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Cost Inefficiencies and Rankings of Ivy Universities: Stochastic Panel Estimates

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Abstract

This paper employs stochastic frontier analysis in providing estimates of the operating cost inefficiencies of private non-profit and public ivy universities in the U.S. Panel data for academic years 2005-09 is used to estimate cost frontiers under two alternative specifications that lead to estimated gross and net inefficiencies. Time varying inefficiencies are reported for each academic year and used to calculate university inefficiency rankings by sector. The results suggest that private ivy universities are less inefficient or more efficient than their public counterparts. However, public ivies appear to have made significant inefficiency adjustments perhaps in response to the global financial crisis. Absent those adjustments among the private ivies, the inefficiency gap between the two sectors is found to have substantially narrowed.

Keywords: Cost inefficiency, Stochastic cost frontier, Ivy universities

1. Introduction

This paper provides operating cost inefficiency estimates for ivy universities in the United States. These universities include the prestigious private ivies and the public flagship universities that have been similarly crowned (Greene and Greene, 2001) on the basis of academic quality. Although these universities individually carry different academic strengths, as a group they comprise, but also omit, some of the most elite universities in the U.S. Many are world renowned and attract students, faculty, and research and other financial support from an international market and produce some of the world's leading scientists, historians, and business leaders. Regardless of their private or public ownership status, they are financed by private and public dollars through tuition charges, research support, and philanthropy. At one time or another, financial donors from all camps have been critical of the university management of these funds. Since the global financial crisis, accelerated interest in managerial reforms, especially in the public deficit ridden sector, has brought new criticism and pressure to bear on these institutions. From a number of perspectives these institutions are increasingly expected to be managed in a cost efficient manner. Moreover, with the growing interest in public management reform, there is expectation that there should not exist significantly detectable cost inefficiency differences between institutions in the private non-profit vs. publicly owned sectors.

Stochastic frontier analysis offers a robust methodological approach to the estimation of institutional and managerial cost efficiencies or, rather, inefficiencies. Based on certain distributional assumptions, the analysis is used to measure the extent to which universities, or more generally firms, operate at or above their minimum potential cost. The greater that deviation, the greater is the cost inefficiency. Using panel data for the four academic years, 2005-09, stochastic cost frontiers and inefficiencies are estimated for both private non-profit and public ivy universities. Using the distinction between gross and net inefficiencies, tests are conducted to determine the appropriateness of university characteristics entering as inefficiency determinants or as cost determinants. In addition to the estimation of aggregate private-public inefficiency differences, the dynamics associated with the time varying inefficiencies are reported for each academic year. In a final analysis, university mean inefficiencies are calculated and used to provide overall rankings and a comparison to individual academic year rankings in an attempt to derive conclusions

concerning the stability of rank exchanges. The time frame included in the analysis offers the potential of uncovering possible university managerial responses to the effects of the global financial crisis.

2. Literature Overview

The large body of literature focused on stochastic frontier analysis begins with the pioneering works of Aigner, Lovell, and Schmidt (1977) and Meeusen and van den Broech (1977). Since then, there have been many theoretical contributions that are beyond the purpose of the present paper but are comprehensively documented in Kumbhakar and Lovell (2003), Coelli, et al. (2005), and Fried, et al. (2008). There seems no reason to duplicate those documentations in terms of reviewing the methodological and data issues that have been resolved in order to bring empirical frontier applications to the forefront of efficiency evaluations. Rather, it should suffice to acknowledge that empirical applications of frontier analysis have been successful in the estimation of both production and cost inefficiencies in an international context for a wide array of industries. This includes, for example, U.S. dairies (Kumbhakar, et al., 1991), U.S. airlines (Kumbhakar, 1991), India paddy farms (Battese and Coelli, 1992 and 1995), the U.S. insurance industry (Cummins and Weiss, 1992), international airlines (Coelli, et al., 1999), U.S. hospital care (Bradford, et al., 2001), Japanese hospitals (Fujii, 2001), Taiwan banking (Huang and Wang, 2001), Greek olive growing (Giannakas, et al., 2003), Switzerland nursing homes (Farsi and Filippini, 2004), British railways (Mulatu and Crafts, 2005), Lisbon crime prevention (Barros and Alves, 2005) and English football (Barros and Leach, 2007), among many others.

In contrast, stochastic frontier analysis as applied to higher education has only recently surfaced. At the time of the present undertaking, literature searches uncovered but five applications, the first of which was introduced in 2002. For convenience, these studies are briefly summarized in Table 1. Two of the five are cross sectional rather than panel data studies and three of the five employ university data from the 1990's and a fourth straddles the 1990'a and 2000's. The point of those observations is not criticism, but instead the offering that data availability can be a factor to contend with in higher education studies. Any detailed attempt to review these studies in terms of the differences in methodological approaches, data sources, variable construction, and empirical results would involve a lengthy treatise. The only common ground among the studies is the recognition of the multi product nature of universities and the subsequent empirical implementation of a cost frontier rather than a more limited production frontier. Beyond that, there is wide variation in the specification of cost frontiers and the modeling of university efficiencies.

Other than using some measure of student enrollments and research revenue as output proxies, the inclusion of additional cost or efficiency determinants vary widely across these studies (from a total of 4 to more than 50 variables). Overall, the differences are too vast to make study to study comparisons. However, Stevens (2005) analysis of British and Welsh universities is the closest representation to the modeling assumptions employed in the current study. Yet, there are several hoped for contributions of this paper that are absent from the current literature, including (1) a more contemporary panel data that could potentially disclose some effects due to the global financial crisis, (2) an inquiry into U.S. higher education, and (3) an evaluation of efficiency differentials existing under private non-profit compared to public university organizational structures.

3. Methodology

The methodology hinges on the specification of a multiple product stochastic cost frontier as applied to panel data. Total cost (C) in the tth academic year for the ith university can be generalized as follows;

$$C_{it} = C(Y_{j,it}, P_{k,it}) + \varepsilon_{it} \tag{1}$$

where the $Y_{j,it}$ represent the j=1,…, J university outputs and $P_{k,\mathrm{it}}$ are the k=1,…, K input prices. Depending upon data availability, empirical measures of outputs usually include some form of education and research while the inclusion of a faculty wage measure has been used as an input price. Data specific to the present study will be introduced in the next section of the paper.

The error term, ε, is a composed error such that

$$\varepsilon_{it} = u_{it} + v_{it} \tag{2}$$

Where v_{it} is the two-sided, normal random component independently and identically distributed as $N(0,\Phi_v^2)$. These random shocks to university costs can occur in various forms, including natural and man-made disasters such as tsunamis and labor strikes, but are generated external to the university. The remaining component, u_{it}, captures the cost inefficiency in production and is assumed to be a one-sided independently distributed variable. Following Coelli, et al. (1999), it is a truncation at zero of the normal distribution with variance Φ_u^2 and mean inefficiency of m_{it}, i.e., $N(m_{it},\Phi_u^{2,})$. This non-negative, $u_{it}\geq 0$, cost inefficiency can be caused by university administrative decisions as well as characteristics and influences associated with the inputs entering the university production processes. This

set of so called university characteristics has also been dubbed "environmental" factors by Coelli, et al. (1999) but were also employed in the earlier work of Battese and Coelli (1995). The mean inefficiency, m_{it}, can be determined by these university characteristics. However, how these characteristics are accounted for in the stochastic model and their effect on cost inefficiencies depends upon the explicit formulation of the inefficiency model.

Following Coelli et al. (1999), if these environmental factors or university characteristics, say $z_{r,it}$, directly affect university operating cost inefficiencies, then the time varying model developed by Battese and Coelli (1995) is an appealing extension as follows:

$$u_{it} = \delta_0 + \sum_r \delta_r z_{r,it} + \psi_{it} \tag{3}$$

Where P_{it} is the random component with mean zero and variance Φ^2 and u_{it}have the truncated distribution with mean

$$m_{it} = \delta_0 + \sum_r \delta_r z_{r,it} \tag{4}$$

This approach produces measures of university inefficiencies that are considered to be gross measures in the sense that all universities operate under the same production technologies and cost structures while environmental factors directly determine cost inefficiencies. Inefficiency in the *t*th operating period is defined by

$$IE_{it} = \exp(u_{it}) = \exp(\delta_0 + \sum_r \delta_r z_{r,it} + \psi_{it}) \tag{5}$$

In contrast, if environmental factors alter university production and cost structures, then the $z_{r,it}$ directly enter the cost frontier (1). With this modified cost frontier, the mean of the u_{it} in (4) becomes m_{it}=*$_0$. In this case, the inefficiencies, IE_{it}, are said to be net efficiencies, i.e., net of any environmental influences. In both cases, an inefficiency ranking of universities across time periods can and will likely result in different rank orderings.

The method of maximum likelihood estimation is used to acquire the parameter estimates of the full model. Under the Battese and Corra (1977) reparameterization of $\sigma^2=\sigma_v^2+\sigma_u^2$, an estimate of (=$\sigma_u^2/\sigma^2$ is obtained. As a measure of the proportion of inefficiency in the overall variance, (must lie between zero and one and can be used to test the significance of inefficiency in university costs. At the end point, (=0 suggests that u_{it} is zero and ordinary least squares is appropriate for the cost estimation. A value of one indicates that the random error should be removed from the cost frontier and all cost deviations are due to university operating inefficiencies.

Empirical frontier studies have commonly employed the translog or its nested Cobb-Douglas specification. In preliminary tests for the present study, the differences in the log-likelihoods for the net inefficiency models were not statistically significant and, therefore, the Cobb-Douglas could not be rejected in favor of the translog. For the gross efficiency models, maximum likelihoods failed to converge under the translog specification. Thus, for the net inefficiency model, the following becomes the Cobb-Douglas specification with institutional (*i*) and time (*t*) subscripts omitted for illustrative convenience:

$$C = \alpha_0 + \sum_j \alpha_j \ln Y_j + \sum_k \beta_k \ln P_k + \sum_r \delta_r \ln z_r + (v+u) \tag{6}$$

Under the gross inefficiency model, the$z_{r,it}$ are removed and placed in the inefficiency component(3). Both gross and net inefficiencies will be estimated for private and public university ivies.

4. Data

Data for individual universities are supplied through the annual surveys undertaken by the U.S. Department of Education, National Center for Education Statistics and housed in the Integrated Postsecondary Education Data System (IPEDS). Culling the data from IPEDS, it was possible to construct a panel data set covering academic years 2005-06 through 2008-09. In a few cases, missing observations were replaced using the method of neighboring values. While it was possible to include all eight private ivy universities, two of the thirty public ivy universities (Delaware and Penn State) had to be omitted due to the lack of data.

The variables used in the cost and inefficiency models are listed in Table 2 along with their brief definitions, means, and standard deviations. The total cost (C), three output measures, including undergraduate (UNGRAD), graduate (GRAD) and research (RESCH), and the faculty wage (WAGE) as an input price, represent the basic building blocks of the higher education cost structures that have been employed in numerous higher education studies. Those studies include both the larger body of literature related to higher education scale and scope estimates (e.g., Cohn, et al., (1989), Koshal and Koshal (1999), Sav (2004), and Lenton (2008), among others) and the new arrivals on higher education stochastic cost frontiers previously noted in Table 1. A medical school dummy (MED) variable (also used in Sav (2004)) is included to account for the potentially higher cost effect of that output. The remaining outputs and

faculty wage would also be expected to carry positive effects on university costs. However, the manner in which research output is proxied and used in previous studies, it is possible that administrative cost sharing components of research grants could produce overall cost saving effects. Although a possibility, previous findings point to cost increasing effects.

Similar to the cost frontier study by Stevens (2005) and a primary-secondary level school study by Chakraborty and Poggio (2008), the environmental variables are constructed so as to represent some aspects of the overall university character and characteristics related to students and faculty. As usual, data availability is the hindrance. As indicated in Table 2, three measures are included in the present analysis. However, at this juncture one cannot have confidence in their expected effects on costs or inefficiency. For example, the student-faculty (STUFAC) ratio is included as an overall institutional characteristic and could be cost and inefficiency increasing as more university resources are allocated to individual student attention or small class sizes. On the other hand, lower ratios could improve educational quality, maybe attract higher quality students, and perhaps increase student retention, all of which can potentially reduce university costs and result in efficiency gains.

These ivies presumably attract the best and brightest students from abroad but the effects of the September 11 attacks on the U.S. created a mound of new administrative requirements for foreign student admissions. As a result, one would expect increased proportions of foreign/international student enrollments to be cost increasing. Although it is difficult to predict an efficiency effect, it does seem more likely that the additional administrative burdens would entail greater inefficiency. In attempting to measure this effect, it was not possible to determine the exact percentage of university foreign students enrolled so the substitute measure presented in Table 2 is based on the percent of non-white student enrollments less the percent of black student enrollments. Thus, it does include native non-black minorities. We label it STUMIN for student minority but with the assumption that foreign students comprise a substantial portion thereof and that universities do create special programs and services for other student groups that can be allocatively costly and potentially create inefficiencies.

University faculty employment can be comprised of non-tenure track, tenure track, and tenured faculty.The latter have attained that status through scholarly productivity but relative to other colleagues also command greater compensation. Increased proportions of tenured faculty (FACTEN) among the ranks would be expected to be cost increasing. However, if the continued scholarship produces increased grant revenues, then through the above effects it is possible that increased tenure could be cost saving and possibly inefficiency reducing. Hopefully, the empirical results will help in sorting out these issues.

As indicated in Table 2, private ivy universities operate under significantly higher cost, higher faculty salaries, lower student-faculty ratios, and board a greater proportion of medical schools. The public institutions are by far the larger producers of undergraduate education and lay claim to somewhat greater research output. Graduate education is not substantially different in the two sectors and the percent of tenured faculty among the ranks is nearly identical.

5. Results

Maximum likelihood estimates are presented in Table 3 for both private and public ivy universities and for both gross and net inefficiency models. Based on the statistical significance of individual coefficients and a comparison of the log-likelihoods, a fairly clear conclusion emerges. The gross inefficiency model with university characteristics determining inefficiency appears to be preferred over the net inefficiency model with university characteristics acting as cost determinants. Likelihood ratios for the gross inefficiency model in both ivy sectors indicate the superiority of the frontier specification over ordinary least squares. Unfortunately, the non-nesting of the two models precludes a gross vs. net model evaluation based on a likelihood ratio test. But in the public ivy sector the likelihood ratio for the net inefficiency model is statistically insignificant, thereby indicating that ordinary least squares would be applicable. In the private sector, the net inefficiency compared to the gross inefficiency model carries both a smaller log-likelihood and smaller likelihood ratio test. Submitting to that as a reasonable guide, the gross inefficiency model also appears to be preferred in application to the private ivy sector. In sum, the effort in taking the alternative models to task proves to be a useful one. That is, the findings suggest that it is preferable to retain the purity of the cost function in modeling the underlying cost structure of both university sectors. For these elite universities, there is reasonable confidence in concluding that university characteristics do not alter the cost structures but do affect operating cost inefficiencies.

With the remaining focus of the paper on the gross inefficiency model, the estimate of λ further supports the notion that inefficiency is a significant consideration for both types of ivy universities. However, it is somewhat greater in the cost deviations among private ivies (0.921) compared to public ivies (0.829). More noteworthy are the differences in the effects of university characteristics on inefficiency. For private universities, all three university inefficiency effects are positive and, therefore, inefficiency increasing; all are statistically significant. In the public

sector, all three are negative, thereby yielding efficiency improvements; although the tenure effect does not reach any reasonable level of significance. Turning back to the Table 2 inter-sector means, these differential inefficiency results are not unreasonable. With regard to student-faculty ratios, the already low ratios common to private universities suggest that attempts at the margin to produce even lower ratios would be managerially cost inefficient. For the public ivies, the efficiency improvements to be gained by reducing their relatively higher student-faculty ratios suggests that administrative undertakings to better, but not completely, emulate private ivies could be productive. Moreover, public ivy improvements (decreases) in student-faculty ratios offer the largest efficiency gains among the three inefficiency effects. Similarly, with the comparatively lower average foreign or minority student bodies, public universities apparently could realize efficiency improvements with additional minority enrollments. Among private universities, additional minority enrollments beyond their already high achievements are estimated to be institutionally cost inefficient.

The effect of faculty tenure on cost inefficiency also differs between the two ivy sectors. For advocates of the tenure system, the public ivy efficiency improving effect (negative coefficient) would be a welcomed finding. However, its statistical insignificance cannot support either tenure advocates or opponents, at least not as it pertains to public ivy universities. Yet, at private ivies, putting more tenured faculty among the faculty ranks is estimated to be cost inefficiency increasing. Given that the two sectors have nearly identical proportions of tenured faculty (Table 2), the inefficiency differences seem to be somewhat at odds with the other two results for inefficiency effects. Yet, given the large public vs. private faculty salary differences (also Table2),it is possible that there is interaction between tenure and the high faculty salaries prevailing in the private sector that is not being accounted for in the inefficiency model.

As with other stochastic frontier studies the interest lies with the inefficiency estimates rather than the specifics of the cost parameters. However, it should be noted that among the estimated cost coefficients, which are elasticities, the faculty wage carries the strongest effect among both private and public ivies. Being greater than one suggests that a percentage wage increase requires additional benefit compensation and, perhaps, the additional allocation of real university resources. With the exception of undergraduate education in the private sector, the output coefficients are all positive and statistically significant. The negative undergraduate enrollment coefficient in the private sector is odd but is not of any passable statistical significance. Among the outputs, the largest cost elasticity is associated with research. That holds in both sectors, but the same percentage increase in research output creates nearly twice the cost increase in the private compared to the public sector. It would be interesting to model and be able to compare the mix of research output between the ivies but the present data do not permit that level of disaggregation. Running medical schools is more costly in the public ivy sector. However, among the private universities, only Princeton does not have a medical school. Thus, the negative MED result indicates that for some reason, ceteris paribus, Princeton incurs higher operating costs.

Table 4 presents a summary of the time variation in cost inefficiencies as calculated from the gross inefficiency models. The overall mean inefficiency across the 2005-09 academic years is 1.103 vs. 1.201 for the private compared to the public university ivies. That is, private ivies are estimated to be operating at 10.3% above their cost frontiers while public ivies are at a level of 20.1%. Thus, on average, public ivies are basically ten percentage points more cost inefficient. The estimated median inefficiencies place public ivies at a fivefold difference. But as indicated by the standard deviations and skewness measures, greater variability exists among public institutions. When the time variations are examined over academic years, one observes consecutive annual mean inefficiency increases in the private ivy sector. In contrast, in the public sector, efficiency gains are achieved in 2006-07 with a 0.5% inefficiency decrease and again in 2008-09 with a 2.5% decrease. As a result, the public-private inefficiency differential narrows in each academic year and falls over time from a difference of 12.3% in 2005-06 to 5% in 2008-09.

Individual university inefficiency results and rankings are presented in Table 5. The overall rankings are based on the individual university's four year mean inefficiencies as reported in column 2. In addition, using the time varying attributes of the stochastic model, each university's rank is reported for each academic year. In both sectors there are the high inefficiency outliers that are now visible: one in the private sector and two in the public sector. Such outliers are not usual and were also found in the inefficiency results presented by Stevens (2005) for English and Welsh universities. Obviously, there is no advantage in introducing the bias that would result in a re-estimation of the model with outliers omitted. But if one momentarily disregards the U. of Pennsylvania in the private sector, then there are seven or twenty five percent of the public ivies that have inefficiencies below the highest private ivy inefficiency of 1.07 existing at Dartmouth. Beyond that, all the remaining seventy five percent of public ivies are individually more cost inefficient than the private ivies.

In Table 5, the rank orders presented for each academic year also offer an indication of the stability of individual university inefficiency estimates over time. In this sense, the private sector appears to reveal more instability as individual universities tend to exhibit greater rank shuffling. Fourth ranked Brown University, for example, ranks first in 2005-06 and then drops to next to last in 2007-08 with some recovery noted as moving to fifth in 2008-09. Cornell, on the other hand, continuously improves in moving from seventh to third ranked. In the public sector, tenth ranked Rutgers tends to bounce around in the annual rankings and moves from thirteenth to seventh and then back to thirteenth. Both SUNY as sixth ranked overall and Minnesota as thirteenth overall, improve from second to eighth and eighth to fifteenth, respectively. The rank movements do tend to be generally confined to the middle of the inefficiency distributions. In the tails of the distributions, the most inefficient and the most efficient universities tend to continue their rank dominance. The Pearson rank order correlations for the private universities vary between 0.48 and 0.88 with the lowest correlation occurring between the 2005-06 and 2008-09 academic year rankings. For the public ivies, the greater stability is evident in that the rank correlations show little to no variation being in the range of 0.94 to 0.97 over the four academic years.

Based on the maximum likelihood estimates of the cost and inefficiency coefficients, the results presented in Table 3 suggest that the gross inefficiency model performs about equally well in both private and public ivy sectors. It can be said that one variable performs better in meeting expectations in one sector compared to another, but on balance it would be unreasonable to reject the results. In fact, as guidance by Greene (2012) suggests, the inefficiencies, not the model parameters, are the principal focus of stochastic frontier analysis. But based on estimates of gamma and the likelihood ratios, there is some justification, albeit weak, to conclude that the frontier model performs better in capturing the private compared to the public sector costs and inefficiencies. Nevertheless, upon examination of the time varying changes in individual university inefficiency rankings (Table 5), one might be inclined to conclude that the greater instability of estimates exhibited in the private ivy sector are of some concern. Reconciling the marginally better stochastic model results with those concerns is beyond the scope of the present inquiry and must remain a future agenda item potentially to be resolved with more precise and higher quality data. Perhaps more importantly would be the acquisition of more academic years of observations to test the stability of the private ivy inefficiency increases and the sustainability of the public ivy efficiency gains.

6. Conclusions

This paper investigated operating cost inefficiencies among the elite ivy universities in the U.S. system of higher education. These included the private non-profit ivy league universities and the similarly crowned but publicly owned ivy institutions. Separate private-public sector cost inefficiencies were estimated using stochastic cost frontier analysis and panel data covering four academic years, 2005-09. Both gross and net inefficiency models were estimated. That proved useful in rejecting the latter and concluding that it is more likely that university characteristics determine inefficiencies rather than modifying institutional cost structures.

Results suggest that public compared to private ivies operate at higher cost inefficiencies. Both incur cost inefficiencies, but based on sector wide average scores, private ivies operate at about 10% above their cost frontier while public ivies are 20% above that efficiency mark. When examined by academic year, the evidence suggests that private ivies consecutively experienced inefficiency increases but public ivies had two years of efficiency gains. Hence, the inefficiency difference between the sectors fell from 12% to 5%. The decline was primarily due to a major public sector efficiency improvement in the 2008-09 academic year that might be the beginning of adjustments induced by the public budget cuts driven by the financial crisis. In the final piece of analysis, inefficiency rankings were presented based on calculated inefficiency scores for individual universities. Overall, the rank ordering over academic years appears more stable in the public relative to private ivy sector, i.e., the individual public ivies tend to experience less shuffling in their rank standings. However, in both sectors that occurs in the middle of the ranks, while the more efficient and more inefficient ivy universities tend to consistently maintain their rank positions over time.

From a managerial and public policy perspective it seems crucial to assess the sustainability of the public ivy university efficiency gains and the narrowing of the cost inefficiencies between those institutions and private ivies. Given the continuing declines in higher education funding and the growing interest in public management reforms brought about by the financial crisis, that research should be conducted as more academic year data becomes available.

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Table 1. Stochastic Frontier Studies of Universities

Study	Universities	Sample Size	Type	Academic Year
Izadi, et al. (2002)	British	99	Cross	1994
Stevens (2005)	English & Welsh	80	Panel	1995-99
McMillan & Chan (2006)	Canadian	45	Cross	1992
Johnes&Johnes (2009)	English	121	Panel	2000-03
Abbott &Doucouliagos (2009)	Australian & New Zealand	36 & 7	Panel	1995-03

Table 2. Ivy University Variables, Means and Standard Deviations

	Private		Public	
Variable	Mean	S.D.	Mean	S.D.
Total Costs, C ($)	2.11E+09	1.35E+09	1.86E+09	1.07E+09
Undergraduate FTE, UNGRAD	8,357	3,753	24,662	7,621
Graduate FTE, GRAD	6,550	4,892	7,099	3,955
Research, RESCH ($)	3.80E+08	2.16E+08	4.36E+08	2.62E+08
Faculty Salary, WAGE ($)	121,300	13,911	96,723	10,011
Medical School, MED (0,1)	0.88	0.34	0.65	0.48
Student Faculty Ratio, STUFAC (%)	7.95	2.41	19.34	4.03
Student Minority, STUMIN (%)	48.32	6.17	35.47	17.32
Faculty Tenure, FACTEN (%)	55.93	9.00	54.11	8.94
N	32		112	

Table 3. Gross and Net Stochastic Cost and Inefficiency Estimates

	Gross Inefficiency Model				Net Inefficiency Model			
	Private		Public		Private		Public	
	Estimate	t value	Estimate	t value	Estimate	t value	Estimate	t value
$\forall_0$	-10.258	-8.94*	-9.401	-2.95*	-16.313	-10.09*	-4.498	-4.52*
UNGRAD	-0.029	-0.80	0.318	2.07*	-0.172	-2.93*	0.358	0.51
GRAD	0.101	3.74*	0.135	1.92*	0.146	3.33*	0.146	0.38
RESCH	0.691	19.09*	0.355	5.51*	0.770	15.70*	0.309	2.27*
WAGE	1.485	14.37*	1.646	6.01*	1.773	11.92*	1.266	2.25*
MED	-0.086	-2.22*	0.285	4.70*	-0.121	-2.15*	0.327	1.34
Gross: University Environment Determining Efficiency								
$*_0$	-11.106	-3.61*	12.500	1.90*	-	-	-	-
STUFAC	0.946	4.32*	-2.660	-2.13*	-	-	-	-
STUMIN	1.613	2.40*	-1.551	-1.82*	-	-	-	-
FACTEN	0.672	2.71*	-0.150	-0.40	-	-	-	-
Net: University Environment Determining Costs								
STUFAC	-	-	-	-	0.380	3.99*	-0.345	-0.46
STUMIN	-	-	-	-	0.120	0.96	-0.047	-0.39
FACTEN	-	-	-	-	0.219	1.84*	0.210	0.32
$*_0$	-	-	-	-	-4.093	-0.95	0.255	0.30
Φ^2	0.013	3.80*	0.197	2.46*	0.252	0.99	0.100	1.99*
(	0.921	22.18*	0.829	9.00*	0.996	193.11*	0.929	1.60
LL	50.60		6.05		44.00		3.28	
LL Ratio	59.51		18.13		11.54		2.85	

Note: LL is log likelihood and "*" denotes significance at ≥ 10%.

Table 4. Time Varying Gross Inefficiency Estimates

Private	2005-06	2006-07	2007-08	2008-09	2005-09
Mean	1.076	1.082	1.113	1.140	1.103
Median	1.018	1.023	1.038	1.049	1.027
Minimum	1.011	1.013	1.009	1.010	1.009
Maximum	1.434	1.447	1.663	1.724	1.724
S.D.	0.146	0.149	0.223	0.239	0.186

Public	2005-06	2006-07	2007-08	2008-09	2005-09
Mean	1.199	1.193	1.220	1.190	1.201
Median	1.106	1.109	1.116	1.104	1.109
Minimum	1.043	1.040	1.040	1.040	1.040
Maximum	2.328	2.372	2.346	2.186	2.372
S.D.	0.254	0.268	0.310	0.241	0.266

Table 5. Efficiency Rankings by Mean Score and Academic Year

Rank	Mean Score	University	Rank 05-06	Rank 06-07	Rank 07-08	Rank 08-09
Private Ivies						
1	1.013	Yale	2	1	1	2
2	1.018	Columbia	4	4	3	1
3	1.020	Princeton	3	2	2	4
4	1.033	Brown	1	5	7	5
5	1.037	Harvard	5	3	4	6
6	1.048	Cornell	7	6	6	3
7	1.070	Dartmouth	6	7	5	7
8	1.540	Pennsylvania	8	8	8	8
Public Ivies						
1	1.041	Maryland	1	1	1	1
2	1.049	California-Santa Barbara	3	2	2	2
3	1.054	Florida	4	3	3	6
4	1.055	California-San Diego	5	4	4	3
5	1.057	California-Berkeley	7	6	5	5
6	1.058	SUNY-Binghamton	2	5	8	7
7	1.058	California-Irvine	6	7	6	4
8	1.077	Arizona	9	8	10	9
9	1.083	California-Davis	10	13	9	8
10	1.087	Rutgers	13	9	7	13
11	1.097	Illinois-Urbana	14	10	11	10
12	1.099	Washington-Seattle	11	16	13	14
13	1.100	Minnesota	8	15	15	15
14	1.103	California-Los Angeles	15	12	12	11
15	1.108	Colorado	12	11	16	17
16	1.109	Michigan State	16	14	14	12
17	1.136	Georgia	17	17	17	16
18	1.167	Wisconsin	19	19	18	18
19	1.175	Virginia	18	18	21	22
20	1.178	North Carolina	20	21	19	19
21	1.201	Texas- Austin	21	20	20	23
22	1.219	Ohio State	23	23	22	20
23	1.237	Indiana	22	22	25	21
24	1.296	Connecticut	24	25	24	24
25	1.302	Iowa	26	26	23	25
26	1.395	William and Mary	25	24	26	26
27	1.752	Michigan	27	27	27	27
28	2.312	Miami -Oxford	28	28	28	28

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The Current Account, the Spot Exchange Rate and the Demand for Money

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Abstract

We derive a theoretical balance of payments current account model from a framework that assumes a monetary model of exchange rates as a first state of the world, but then presumes the existence of deviations from purchasing power parity. In such a model there is slow price adjustment where short-run exchange rates deviate from long-run equilibrium exchange rates. Under these conditions there are accumulations of net foreign assets due to current account imbalances. A nonlinear model results where there is dependence between exchange rate deviations from equilibrium and the current account, as well as a concurrent dependence of the current account on exchange rate deviations. Furthermore, the current account is also shown to depend on the demand for money. Thus the theoretical explanation of the current account is concomitant on the short-run exchange rate and the determinants of money demand.

Keywords: Current account, Net foreign assets, Exchange rate deviation, Nonlinear monetary model, Money demand

JEL Classification: E41; F31; F32.

1. Current Account Analysis

Current account analysis has progressed from the elasticities and absorption approaches to the Mundell-Fleming framework, then to the Monetary, Intertemporal and Portfolio approaches. Our brief summary below will discuss the monetary model last, since it is used as a platform on which we build our own model. Current account models can be said to have begun with the trade analytics of elasticities and absorption approaches, followed by the expanded scope of the Mundell-Fleming model which included international capital flows and allowed monetary and fiscal policy analysis. Improving on both the short-term horizon and depth of the Mundell-Fleming model, the intertemporal approach assumes that the behavior of the current account reflects the intertemporal choices of economic agents. Basically the current account depends on intertemporal consumption which determines savings, and on the world-wide equality of the marginal product of capital which determines investment.

1.1 The Intertemporal Approach

Intertemporal models focus on expected discounted changes in net output which are dependent on the long-run saving and investment decisions of economic agents. The approach considers optimizing economic agents with forward looking decision rules, where international borrowing and lending are used to finance intertemporal substitution that enables consumption smoothing. The ultimate determinant of the current account is the savings-investment gap: countries with higher savings will experience current account surpluses, and countries with lower savings will have deficits and import capital. Intertemporal models have solid microeconomic foundations which Ju and Wei (2007) assert can be connected to Friedman's permanent income hypothesis. Going beyond the workhorse single risk-free security models, many of them featured in Obstfeld and Rogoff's (2002) survey, there are also multiple security models. These are known as complete market models and use the Arrow-Debreau securities construct to incorporate a full variety of financial instruments such as stocks, bonds, derivatives and other securities. As Knight and Scacciavillani (1998) point out, an advantage of the Arrow-Debreau framework is that consumption smoothing can be done both between time periods as well as states of the world.

1.2 Portfolio-Balance Models

Compared to the forward looking optimizing agent intertemporal approach, portfolio balance theory posits that the capital flows of the current account are the consequence of portfolio decisions reflecting the demand for portfolio assets. In a study evaluating a variety of portfolio models Guo and Jin (2009) develop a non-structural accounting framework of the current account. This framework breaks down the current account into two basic components: a composition effect and a growth effect. An overview of this framework provides a good description of the new portfolio balance approach to the current account. Consider:

$$w_T = w_D + A \tag{1}$$

Where (w_T) is total wealth, (w_D) is the domestic capital stock and A are net foreign assets which are defined as

$$A = \theta\, w_T \tag{2}$$

where (θ) is the share of net foreign assets (A) in total wealth. The differentiation of Equation (2) results in

$$\Delta A = a = \Delta\theta\, w_T + \theta\, \Delta w_T \tag{3}$$

ΔA is the change in net foreign assets. ΔA is also by definition the current account of the balance of payments which we now label (a). $\Delta\theta$ is the change in the foreign asset's share of the wealth portfolio; and (Δw_T) depicts the change in total wealth. Finally (Δw_T) is period savings (S). Thus we can write:

$$a = \Delta\theta\, w_T + \theta S \tag{4}$$

where the current account (a) is the consequence of two effects: the composition or reallocation effect shown by the term ($\Delta\theta w_T$), and the portfolio growth effect represented by the term (θS). The research arguments then center on whether the composition effect does or does not outweigh the growth effect, or whether both are relevant forces in current account determination. This framework accommodates models developed by Kray and Ventura (2000, 2003), Lane and Milesi-Ferreti (2006) and Gourinchas and Rey (2007), among others.

1.3 The Monetary Model of the Current Account

The monetary model (MM) assumes purchasing power parity (PPP) holds, that money demand is stable, and that there exists flexible wages and prices. The (MM) is a long-run equilibrium model that can be applied to both fixed and floating exchange rate regimes. The applications are similar in that the changes in money demand and supply that bring about current account surpluses and deficits under fixed exchange rates are very much the same forces that bring about currency appreciations and depreciations under floating exchange rates. A detailed analysis of the fundamentals of the current account model is found in Humphrey (1981), who describes that at its most basic -- when actual cash balances diverge from desired balances and there is current account disequilibria -- the (MM) assumes agents will adjust this divergence. They do so by changing the exports/imports of domestic goods and securities for imports/exports of money, with international reserves flowing to restore monetary equilibrium in the balance of payments. Kemp (1975) submits the (MM) model treats the transactions in the balance of payments as reflecting aggregate portfolio decisions by domestic and foreign agents, but acknowledges the adjustment behavior is incomplete in the short-run as it takes time for actual money balances to reach their desired level.

For the purposes of this paper, however, it will be shown that the true value of the monetary approach lies much more in the monetary exchange rate model than in the monetary current account model. This is because we use the (MM) exchange rate model in the following section as a platform from which we derive a new behavioral relationship to describe changes in net foreign assets. That is, we transform the exchange rate model into a far more

flexible and richer current account approach than the original monetary model of the current account. We therefore begin our modeling process by briefly describing the fundamentals of the monetary exchange rate model below.

1.4 The Monetary Model of Exchange Rates

Two different formulations of the (MM) have been used in the literature. One derives the (MM) from the quantity theory of money, where the exchange rate is made dependent on relative money supplies, velocities and real incomes. A second version substitutes relative velocities with relative interest rates. Empirical studies have used both forms, though Dornbusch (1980), among others, shows the velocity model easily converts into the more widely used interest rate version. There could be some modern relevance, however, to the velocity approach as Sargent and Surico (2011), referencing Luca's (1980) article, point out that developments over 2007-2010 have reignited interest in the quantity theory of money, due to the strong growth in the balance sheets of central banks.

The basic version of the monetary model assumes prices are flexible and that purchasing power parity holds. The long-run exchange rate, (e^*) is a function of the relative prices of any two countries (i) and (j). Expressed in natural logarithms we have

$$e_{ij}^* = p_i - p_j \tag{5}$$

The money demand functions are identical in both countries and are:

$$m_i = p_i + \alpha\, y_i - \delta\, r_i \tag{6}$$

$$m_j = p_j + \alpha\, y_j - \delta\, r_j \tag{7}$$

Where (m) is nominal money, (p) is the price level, (y) is real income, (r) is the nominal interest rate, and (α) *and* (δ) represent parameters. From (5), (6) and (7) we can write:

$$e_{ij}^* = p_i - p_j = (m_i - m_j) - \alpha\,(y_i - y_j) + \delta\,(r_i - r_j) \tag{8}$$

Thus the long-run exchange rate (e^*) depends on relative money supplies, real incomes and nominal interest rates. The MM approach also assumes that local and foreign bonds are perfect substitutes, so that uncovered interest rate parity holds. In this case bond supplies do not affect either exchange or interest rates. If perfect substitutability is relaxed as an assumption interest rate parity would no longer be in effect. Since a premium is now required on foreign assets, a portfolio approach would then appear to be more appropriate, and the exchange rate would now also depend on relative supplies of domestic and foreign bonds. Therefore the degree of asset substitutability and the degree of usefulness of the monetary model appear to be inversely related.

Tests of the MM have largely used consumer price indices as surrogates for PPP measures. The empirical outcomes have been controversial, with results reported as poor from the 1970's to the mid 1990's, to statistically acceptable in the recent past and present. Mostly negative results have been reported in a comprehensive survey by Rogoff (1996). More recent research by Chowdry et al (2005) contends Rogoff's surveyed literature has used inadequate PPP measures, and criticizes the widespread use of the CPI in computing PPP. Chowdry's contribution is to replace the CPI with a price measure extracted from nominal equity returns, since this new measure is found to be a better proxy for unobservable pure price inflation. Subsequent empirical tests show the recalculated PPP and exchange rate differentials to be of the same order of magnitude, thus lending strong support to the MM. A variety of other recent work also finds empirical validity for the monetary model and is referenced in Larrain (2003).

2. Developing a Current Account Model from the Monetary Exchange Rate Model

2.1 Modifying the MM's Money Demand Function

In addition to its use of CPI measures, some of the failings of the monetary model have also been attributed to its use of a simplistic money demand function. For example Dornbusch (1980) acknowledges that the demand for money in the versions of the traditional monetary model employed by Mussa (1976), Frenkel (1976), Bilson (1978) and Hodrick (1978) is poorly specified, since it does not include adjustment lags or long-term interest rates to measure the alternative cost of holding money as compared to long term assets. By modifying the money demand function Dornbusch (1980) obtains substantial improvement in statistical testing. Wilson's (2009) modifications go further, in that the demand for money is also assumed to be a function of future income and interest rates and of the risk associated with holding domestic currency. Wilson (2009) uses the money demand equation developed by Kia (2006) where, among other variables, the risk associated with holding domestic currency is also made a function of (*i*) government deficits as a share of GDP; (*ii*) total government debt as a share of GDP; and (*iii*) foreign financed debt as a share of GDP. Tests of this expanded money demand function also provide empirical support for the monetary model. Other variables incorporated into money demand functions include earnings projections which would reveal changes in the perceived opportunity cost of holding money (Carpenter and Lange, 2002);

unemployment which can represent precautionary demand (De Bondt, 2009); and returns on stocks and bonds (Mankiw, 2003).

We also consider the MM's money demand function to be limited in scope and assume a slightly more complex demand structure which follows Ericsson's (1998) commonly used money demand specification. This results in the functional relationship shown below

$$m - p = \alpha\, y + \beta_1 w_D \quad + \quad \beta_2\, \theta\, w_T \quad - \gamma\, R \quad - \quad \delta\, r \quad - \quad \epsilon\, \pi \tag{9}$$

where $(m - p)$ is real money, (y) is real income, and (α), (β), (γ), (δ), and (ϵ) are parameters. The wealth term (w) is decomposed here into a domestic component (w_D) and a foreign component $(\theta\, w_T)$, where (θ) is the share of net foreign assets (A) in total wealth. The $(\theta\, w_T)$ term in equation (9) can be recognized as the same net foreign assets term differentiated by Guo and Jin (2009) to obtain the composition and growth components of the portfolio current account approach. The opportunity costs of holding money are (R), (r) and (π), which represent long and short term nominal interest rates and the inflation rate, respectively. These opportunity costs are in theory negatively related to narrowly defined real money. However, for broader measures such as M2 and M3, Fase and Winder (1998) maintain that while (R) would still be negatively related, a positive relationship to (r) is plausible.

Substituting the money demand function of equation (9) for countries (i and j) into Equation (5) the resulting long-run exchange rate is now:

$$e_{ij}^* = p_i - p_j = m_{ij} - \alpha\, y_{ij} + \beta_1\, w_{Dij} + \quad \beta_2\, \theta\, w_{Tij} \quad + \gamma\, R_{ij} + \delta\, r_{ij} + \epsilon \quad \pi_{ij} \tag{10}$$

where terms for the independent variables represented in the form (x_{ij}) indicate an abbreviation for $(x_i - x_j)$.

2.2 A Model of the Current Account under PPP Deviations

Under freely floating purchasing power parity long-run equilibrium exchange rates (e^*), product and asset markets are in equilibrium, and there is perfect capital mobility. Consequently there would be no deficits or surpluses on the current/capital accounts. However, a balance of payments disequilibrium will be experienced if market imperfections become present and lead to a short-run non-equilibrium exchange rate (e) such that there is a nonzero deviation ($e - e^*$). Given a nonlinear response by changes in net foreign assets (a) to this discrepancy a joint interaction between the current account and exchange rates can be explicitly developed. To derive this relationship we utilize the same set of nonlinear functions used by Larrain (2003) in analyzing central bank intervention parameters. We differ however in (i) that the degree of reversion towards equilibrium need not increase with the size of the deviation from PPP, (ii) our more complex definition of the money demand function, and (iii) our focus on the current account instead of market intervention by the monetary authorities.

Assume that goods prices are slow to adjust, such that there exists a deviation of a short-run exchange rate (e) from the long-run equilibrium PPP exchange rate (e^*). There would then be an accumulation of net foreign assets through a current account imbalance (a). Furthermore we assume this imbalance is represented by the nonlinear function

$$a_{ij} = \varphi(e_{ij} - e_{ij}^*)^{\nu} \tag{11}$$

where (φ) is a parameter and $(\nu)$is an exponent.

Although it is at times presumed that a return to equilibrium is rapid, it is also plausible to consider that deviations from PPP as shown above may be long lasting. In an extension to international pricing models by Krugman (1987) and Dornbusch (1976, 1987), a recent study by Atkeson and Burstein (2008) shows persistent deviations from PPP can come about from firms pricing-to-market in an environment of persistent changes in the relative cost of production across countries.

Dividing (11) by (φ) we have (see Mathematical Appendix for detailed steps):

$$\frac{a_{ij}}{\varphi} = (e_{ij} - e_{ij}^*)^{\nu} \tag{12}$$

from where

$$e_{ij} - e_{ij}^* = \frac{(a_{ij})^{1/\nu}}{\varphi^{1/\nu}} = \varphi^{-1/\nu}\left(a_{ij}\right)^{1/\nu} \tag{13}$$

and

$$e_{ij} = e_{ij}^* + \varphi^{-1/\nu}\left(a_{ij}\right)^{1/\nu} \tag{14}$$

Further rearrangements yield

$$(a_{ij})^{1/v} = \varphi^{1/v} e_{ij} - \varphi^{1/v} m_{ij} + (\varphi^{1/v}\alpha) y_{ij} + (\varphi^{1/v}\beta_1) w_{D_{ij}} +$$

$$+ (\varphi^{1/v}\beta_2)\theta w_{T_{ij}} - (\varphi^{1/v}\gamma) R_{ij} - (\varphi^{1/v}\delta) r_{ij} - (\varphi^{1/v}\epsilon)\pi_{ij} \quad (15)$$

Thus the short-run exchange rate (e_{ij}) is shown in Equation (14) to depend on the current account as well as the long run purchasing power parity exchange rate. In turn, Equation (15) shows the current account to depend on the short-run exchange rate as well as the variables defined above as determinants of prices in the money demand functions, as represented by (e_{ij}*) and discussed in Equations (9) and (10) above.

Equation (15) can be expressed more simply. Since $\varphi, \alpha, \beta, \delta, \epsilon$ are parameters, let $\alpha_0 = \varphi^{1/v}$, $\alpha_1 = (\varphi^{1/v}\alpha), \alpha_2 = (\varphi^{1/v}\beta_1), \alpha_3 = (\varphi^{1/v}\beta_2), \alpha_4 = (\varphi^{1/v}\gamma), \alpha_5 (\varphi^{1/v}\delta)$, and $\alpha_6 = (\varphi^{1/v}\epsilon)$ So we can write:

$$(a_{ij})^{1/v} = \alpha_0(e_{ij} - m_{ij}) + \alpha_1 y_{ij} + \alpha_2 w_{D_{ij}} + \alpha_3 \theta w_{T_{ij}} - \alpha_4 R_{ij} - \alpha_5 r_{ij} - \alpha_6 \pi_{ij} \quad (16)$$

In Equation (16), the current account depends on relative short-term exchange rates (e_{ij}), nominal money supplies (m_{ij}), real income (y_{ij}), domestic wealth (w_{Dij}), the stock of net foreign assets ($\theta\ w_{Tij}$), long and short-term interest rates (R_{ij}) and (r_{ij}), and inflationary expectations (π_{ij}). When the variables of Equation (16) are interpreted as growth rates instead of levels, the first right-hand side term normalizes the growth in the exchange rate by the growth in the relative money supplies.

3. Characteristics of the Deviation Models

There are several features to the current account deviation model. (i) It is a short-run horizon model; (ii) it is a nonlinear construct based on imperfect market adjustments; (iii) there is interdependence between the current account and short-run exchange rates and vice versa; (iv) the current account is a direct function of the short-run exchange rate and the determinants of money demand; (v) the model is amenable to policy analysis.

Our current account model is derived from a nonlinear iterative system which in generic form can be described by two general functions as shown in Equations (17) and (18)

$$a = h\,(e,\ e^*) \quad (17)$$

and

$$e = f\,(a,\ e^*) \quad (18)$$

The current account relationships are based on deviations from purchasing power parity within the framework of a monetary model of exchange rates. In this model short-run exchange rates deviate from long-run equilibrium exchange rates because of slow price adjustment. Under these conditions there are accumulations of net foreign assets due to current account imbalances. We have shown that there is a joint interdependence between exchange rate deviations and the current account, as well as a concurrent dependence of the current account on exchange rate deviations. That is, the current account is a function of the deviation of short-run rates from their long-run equilibrium, and in turn, deviations of short-run rates depend on the existence of a nonzero current account. From this premise we derive a behavioral equation for the current account. This behavior is related to the desire for holding money as compared to other assets. A relevant point is that the current account in equation (17) is shown to depend directly, among other variables, on the short-run exchange rate. In comparison neither the intertemporal nor the portfolio models have been designed to assign a direct role to the exchange rate, nor is their construct intended to consider the possibility of feedbacks between exchange rates and the current account.

Exchange rates are of consequence for a short-run model because they generate two effects in the international adjustment process. One effect is through (i) a trade-weighted exchange rate influencing net exports. This is the type of exchange rate our model is designed to cope with. The other effect comes from (ii) a financially weighted exchange rate operating through a valuation channel which impacts capital gains and losses. The valuation effect depends on the size and currency composition of foreign assets and liabilities. Lane and Shambaugh (2010) point out its quantitative significance has developed markedly in importance over the past decade with the rapid growth of international financial holdings among countries. They further suggest modeling the dual role of exchange rates in analyzing international adjustment, and our model could be so adapted. Since their research has found substantial

heterogeneity in the co-movement of these two rates it is likely the addition of a financial exchange rate should not present statistical issues in future testing.

In this deviation model, the direct determinants of the current account/net foreign assets, in addition to the short-run exchange rate, are the determinants of the money demand function. We cannot a priori state that the Ericcson (1998) money demand function used in this study is the "appropriate" demand function to be used in current account analysis. This is both a theoretical and an empirical question beyond the scope of the present paper. As discussed above, at least eight additional economic variables beyond Ericsson's seven basic choices shown in Equation (9) have been used in specifying money demand functions. The purpose of this paper, however, is not to favor a specific demand function. It is instead to point out the analytical usefulness of a monetary approach to current account analysis.

The research on money demand is ongoing, extensive, deep, rich, and has a long and intellectually rewarding history. This indicates that the nature and number of the constituent variables in explaining the current account in future deviation models will be linked to the degree of theoretical sophistication and empirical stability of the statistical results of modern research on money demand functions. This paper points to the fact that the powerful analytical tradition and insights of monetary research can be used as a tool which may in turn bring additional perspectives to the analysis of the current account/net foreign assets of the international balance of payments.

4. Conclusion

This paper extends the basic monetary model of exchange rates into a nonlinear model of the current account under imperfect capital mobility and slow price adjustment. In our extended current account model short-run exchange rates are assumed to deviate from long-run purchasing power exchange rates and this divergence generates accumulations of net foreign assets through current account imbalances. These imbalances in turn affect exchange rates, so the model shows a two-way causality, whereby exchange rates influence the current account which then helps determine exchange rates. In comparison neither the intertemporal nor the portfolio models of the current account assign a direct role to the exchange rate. Of equal import, the current account is also shown to depend on the demand for money and therefore on the variables that determine this demand. The study of money demand is well established and the literature has a rich variety of sophisticated models which have undergone empirical tests and could be used in advancing the type of model presented in this paper. The approach of the deviation model to current account determination is relatively straightforward and behavioral. It simply states the current account depends on movements in short-run exchange rates and the desire to hold cash balances. This compares with the more complex analytical structure and empirical difficulties of the intertemporal approach, as well as the accounting framework of the portfolio models.

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Mathematical Appendix

This appendix shows the steps beginning in Equation (11) and ending in Equation (16) that were not shown in the development of the mathematical argument of Section 2.2 of this paper. Equation (1) in this appendix corresponds to Equation (11) in the text.

A current account imbalance is represented by the nonlinear function shown in Equation (1).

$$a_{ij} = \varphi(e_{ij} - e_{ij}^{*})^{v} \quad (1)$$

Dividing Equation (1) by (φ), we have

$$\frac{a_{ij}}{\varphi} = (e_{ij} - e_{ij}^{*})^{v} \tag{2}$$

Raising to the power of $(1/v)$leads to

$$\left(\frac{a_{ij}}{\varphi}\right)^{1/v} = e_{ij} - e_{ij}^{*} \tag{3}$$

$$e_{ij} - e_{ij}^{*} = \frac{(a_{ij})^{1/v}}{\varphi^{1/v}} = \varphi^{-1/v}\left(a_{ij}\right)^{1/v} \tag{4}$$

Equation (4) shows the exchange rate deviation to be dependent on the current account. The current account is now expressed as

$$(a_{ij})^{1/v} = \varphi^{1/v}\,(e_{ij} - e_{ij}^{*}) \tag{5}$$

$$(a_{ij})^{1/v} = \varphi^{1/v} e_{ij} - \varphi^{1/v}\, e_{ij}^{*} \tag{6}$$

Since e_{ij}^{*} is defined as ($p_i - p_j$) we now substitute the determinants of p_i and p_j from our money demand function into Equation (6) to obtain

$$(a_{ij})^{1/v} = \varphi^{1/v} e_{ij} - \varphi^{1/v}\left[m_{ij} - \alpha y_{ij} - \beta_1 w_{D\,ij} - \beta_2 \theta w_{T\,ij} + \gamma R_{ij} + \delta r_{ij} + \epsilon \pi_{ij}\right] \tag{7}$$

From which

$$\left(a_{ij}\right)^{1/v} = \varphi^{1/v} e_{ij} - \varphi^{1/v}\, m_{ij} + (\varphi^{1/v}\alpha) y_{ij} + (\varphi^{1/v}\beta_1) w_{D\,ij} + (\varphi^{1/v}\beta_2)\theta w_{T\,ij} - \\ - (\varphi^{1/v}\gamma) R_{ij} - (\varphi^{1/v}\delta) r_{ij} - (\varphi^{1/v}\epsilon)\pi_{ij} \tag{8}$$

Since $\varphi, \alpha, \beta, \gamma, \delta, \epsilon$ are parameters, let $\alpha_0 = \varphi^{1/v}, \alpha_1 = (\varphi^{1/v}\alpha), \alpha_2 = (\varphi^{1/v}\beta_1),\ \alpha_3 = (\varphi^{1/v}\beta_2),\ \alpha_4 = (\varphi^{1/v}\gamma), \alpha_5 = (\varphi^{1/v}\delta)$, and $\alpha_6 = (\varphi^{1/v}\epsilon)$ so that we can rewrite (8) more simply as

$$(a_{ij})^{1/v} = \alpha_0\left(e_{ij} - m_{ij}\right) + \alpha_1 y_{ij} + \alpha_2 w_{D\,ij} + \alpha_3 \theta w_{T\,ij} - \alpha_4 R_{ij} - \alpha_5 r_{ij} - \alpha_6 \pi_{ij} \tag{9}$$

where the short-run exchange rate is normalized by the demand for money. Equation (9) can also be expressed as

$$a_{ij} = \left[\alpha_0\left(e_{ij} - m_{ij}\right) + \alpha_1 y_{ij} + \alpha_2 w_{D\,ij} + \alpha_3 \theta w_{T\,ij} - \alpha_4 R_{ij} - \alpha_5 r_{ij} - \alpha_6 \pi_{ij}\right]^{v} \tag{10}$$

Foreign Exchange Reserves in Asia and Its Impact on Import Demand

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Abstract

Some Asian countries have experienced increases in the level of their foreign exchange reserves as well as increases in their import volume. Theory suggests that as the level of exchange reserves increases, it may affect the demand for imports since more funds will be available for imports. In this paper, we employ quarterly data of five Asian countries and test the null hypothesis that the import demand behavior in India, Japan, Korea, Singapore and Thailand are not determined by real income, relative import price and foreign exchange reserves. The empirical analysis of import demand behavior is presented using the dynamic error-correction model, which allows an explicit parameterized division of effects into long-run influences, short-term adjustment and error-correction term. It uses econometric techniques organized around Johansen, Harris-Inder, and Hansen Lccointegration analyses; fully modified OLS, dynamic OLS and ARDL to estimate long-and-short run demand elasticities.

Keyword: Import demand, Foreign exchange reserves, Cointegration

JEL: D53, E44

1. Introduction

Over the past one and half decades, Asian economies have exhibited the most noticeable increase in foreign exchange reserves as well as increases in their import volume. For example, besides China, Japan leads the world in foreign reserve ranking with over $1 trillion in 2010. The foreign reserves (rank) for India, Korea, Singapore and Thailand are $287 billion (8th), $295 billion (6th), $226 billion (11th) and $176 billion (13th), respectively.[1]The sources of these reserves have been export earnings, remittances of Asians residing abroad, and in few cases, foreign assistance. As a consequence, in the period 1973 - 2010, imports by these countries grew at a higher rate. Imports averaged 18.88, 4.83, 12.20, 7.15 and 14.25 percent per year in India, Japan, Korea, Singapore and Thailand, respectively, and the variation in imports has been large and wide with the coefficient of variation ranging from a high of 1.64 in India to a low of 0.44 in Japan.

Foreign reserves play an important role in the design and evaluation of current and future macro policies aimed at achieving the trade balance. In countries with fixed or partially flexible exchange rates, the reserves are mainly used to maintain competitiveness of the tradable sectors. They achieve this by preventing the appreciation of their currencies and by keeping the exchange rate at or close to the official target level. Beyond exchange rate stabilization, foreign reserves are generally viewed as indicators of the strength of an economy, especially in particular itsexporting industries. From a policy perspective, foreign reserves influence trade policies. A high level

of foreign exchange reserves is associated with less restrictive policies. With regard to international trade, foreign currency is often anindispensablerequirement to finance imports of goods and services.In this sense, anecdotal evidence suggests that foreign reserves play therole of an international liquidity constraint and any increase in reserves should thus have apositive impact on import demand. The degree to which this hypothesis, among others, is 'genuine' for Asiais what this study will attempt to test empirically using data from five Asian countries (ACs): India, Japan Korea, Singapore and Thailand.

Empirical estimation of import-demand function has generally related the quantity of imports to real domestic income and relative import prices(see, for example, Thursby and Thursby, 1984; Bahamani-Oskooee, 1986; Arize and Afifi, 1987;Arize and Ndubizu, 1992; Gafar, 1995; Senhadji, 1998; Masih and Masih,2000 and Chen, 2008). Following the literature, we thus include a measure of domestic income as well as the relative price of imports in our empirical model, in addition to holdings of foreign exchange reserves. A number of studies have identified real foreign exchange reserves as an additional variable influencing import demand (see, for example, Moran, 1989; Faini et al. (1992); Dutta and Ahmed, 1999; and Arize et al., 2004; Arize and Osang, 2007; Sultan, 2011). Thus, omission of exchange reserves may bias a model's empirical estimates towards overstating the influence of the included variables, in particular domestic income and relative prices.

Given the time-series nature of the data, we are interested in differentiating between the long-run and the short-run impact of reserves, income and relative import prices on real imports provided there exists a long-run equilibrium relationship among real imports, real income, relative import prices and real foreign exchange reserves for each ACs in our sample. Previous studies for India by Dutta (1964), Kantu (1972) and Pani (1977) conclude that a positive relationship exists between real imports and real foreign exchange reserves; however, these studies assumed data stationarity, and recent developments in econometrics suggest that macroeconomic data are non-stationary; hence, their findings need to be reexamined. For a more detailed discussion of these issues, see Arize, Osang and Slottje (2000), Dutta and Ahmed (1999), who examine the demand for imports in Bangladesh, confirm the existence of a long-run equilibrium relationship between real imports, real import prices, real GDP and real foreign exchange reserves. Arize et al. (2004), who investigate import demand for Pakistan, also find that real imports, real income, relative price and real foreign reserves share a long-term relationship. Furthermore, they find a significant positive long-run relation between import demand and foreign exchange reserves, but conclude that in the short run the impact of foreign reserves on import demand is statistically insignificant. Arize and Osang (2007) show that the real foreign reserves coefficient is positive and statistically significant with an elasticity of about one fourth and their results also suggest that real foreign reserves have long and short term effects on import volume in the case of seven Latin American countries. Further empirical support for the effect of real foreign exchange reserves on real imports has also come from the work of Sultan (2011). His estimates show a fairly large response of real imports to changes in real foreign exchange reserves using India's annual data. Further, he presents evidence that real foreign reserves exert both a significantly positive effect on real imports in both the short-run as well as in the long-run.

The purpose of this paper is fourfold. The first is to check the data for unit roots. Second, we examine whether a long-run relationship exists among real imports, real domestic income, relative import priceand real foreign exchange, reserves for each country and whether this relationship is unique. Third, provided the long-run equilibrium exists, we determine the sign, magnitude and statistical significance of the long-run effects of real income, relative price and real foreign exchange reserves on import demand. Fourth, we investigate the short-run dynamics of the import demand function for each country. We use data for quarterly period 1973:2 through 2005:3, (i.e., 130 observations) for estimation, and forecasting isperformed employing data for period, 2006:1 through 2008:4 (12 observations). Finally, we draw policy conclusions.[2]

The rest of this paper is as follows. Section 2 describes the empirical import demand model. Section 3 reports the empirical results. Section 4 contains the major conclusions and policy implications of the paper.

2. Methodology

2.1 Model Specification and Theoretical Considerations

Drawing on the empirical literature in this area (Arize, Malindretos and Grivoyannis, 2004) and the implications for dynamic specificationof thepossible existence of error-correcting mechanisms in the data-generating process, we estimate a simple, conventional model (see Thursby and Thursby, 1984; Arize and Afifi, 1987), augmented with real exchange reserves as the long-run equilibrium (equation 1) and the short-run relationships (equation 2) for the (desired) real imports:

$$m_t^* - \delta_0 - \delta_1 y_t - \delta_2 p_t - \delta_3 IR_t = \varepsilon_t \quad (1)$$

$$\Delta m_t - \alpha - \beta L(\Delta X_t) - \gamma \varepsilon_{t-1} = \psi_t \quad (2)$$

where m_t^* is the logarithm of (desired) real imports; y_t is the logarithm of real domestic income (i.e. real GDP); p_t is the logarithm of the relative price of imports, defined as the ratio of the import price index (P_t^m) to the domestic wholesale price index (P_t^d); IR_t is the logarithm of the real foreign exchange reserves, defined as foreign exchange reserves deflated by the wholesale price index; and ε_t is a stochastic disturbance term.

Equation (1) embodies the hypothesis that the demand for imports with respect to real domestic income would be positive. Real imports would be expected to increase with real income for two reasons. First, if an increase in real income leads to an increase in real consumption, with an unchanged distribution of income, more foreign goods will be purchased. Second, if an increase in income also leads to an increase in real investment, then investment goods not domestically produced must be bought from abroad.[2] On the other hand, the effect of the relative price on the demand for imports is expected to be negative, as consumers substitute domestic products for imports when the price of imports increases. Inasmuch as foreign reserves constitute a limit on the size of excess import demand, an increase in real foreign exchange reserves is expected to have a positive on the demand for imports.

Before presentation of the empirical results, two technical notes regarding equation (1) and the method of estimation are in order. The first issue is whether import demand function should be specified in log-linear or linear terms. Following the 'best practice' in most of the empirical literature, we estimate the import equations in log-linear format.

The second issue is that equation (1) assumes that the import market is in a (long-term) equilibrium so that it may be viewed as a cointegrating model. The basic idea of cointegration is that two or more non-stationary time series may be regarded as defining a long-run equilibrium relationship if a liner combination of the variables in the model is stationary (converges to an equilibrium over time). Thus, if the import demand function describes a stationary long-run relationship among the variables in these equations, this can be interpreted to mean that the stochastic trends in real imports are related to the stochastic trends in the real income, real foreign exchange reserves and relative prices. In other words, even if deviations from the equilibrium should occur, they are mean reverting, which means that the variable will revert back to its (long-term) equilibrium level over time (Arize, Osang and Slottje, 2000).

3. Empirical Results

3.1 Data Issues

The Empirical analysis uses quarterly frequency data for India, Japan, Korea, Singapore, and Thailand. The data are taken from the International Monetary Fund's *International Financial Statistics* (IFS) latest CD-ROM (2009). The data used are the logarithmic value of real import, real GDP, the relative import price (import prices divided consumer prices) and real foreign exchange reserves (exchange reserves divided by wholesale prices). The observations covering the period 1973:2 through 2005:4 were used as the estimation period whereas the data from 2006:1 to 2008:4 were used as the forecast period. While the plots of the level of the logs of all variables are available from the authors, forspace considerations, we only present those of the log of real exchange reserves for each country. This is shown in Figure 1 where real exchange reserves trend upwards in each case.

Insert Figure1 Here

A prerequisite for testing the existence of a long-term equilibrium (cointegration) among the four variables is to test for stochastic trends in the autoregressive representation. The common practice is to usethe augmented Dickey-Fuller (ADF) to investigate this issue. The ADF test statistics – in levels and in differences- for the null hypothesis of non-stationary (including a constant and time trend in the regression equation) for m_t, y_t, P_t and IR_t are given in Table1.

Insert Table 1 Here

The critical value is -3.41 at the five per cent level. For the ADF test statistics in levels, this implies that if the value of the test statistic is smaller than -3.41, we would reject the null hypothesis on non-stationarity for the variables in levels. Since none of the values in Table 1 happens to meet this threshold, we conclude that all variables are non-stationary in all countries. This conclusion is supported by the test statistics in differences. This time, all test statistics for the differenced variables are smaller than -2.86, so the null hypothesis of nonstationary can be rejected.[4]

Having established the non-stationarity of variables in all countries, the next step is to test for the presence of absence of a long-run equilibrium among the four variables. This so-called cointegration test can be performed in various ways, forms and shapes -- see the results in Table 2. Here, we have performed four of these tests since we do

not wish to rely on only one. The four cointegration tests are the Johansen test, the Harris and Inder test, the Shin's test and the Hansen Lc test.

Insert Table 2 Here

The Johansen procedure employs two likelihood ratio (LR) test statistics, the maximal eigenvalue (λ-max), and trace (Tr) to test the presence or absence of long-run equilibria between the variables in Eq. (2). For λ-maxand Tr statistics, the hypotheses are Ho: rk(II) = r against H1: rk(II) = r + 1 and Ho: rk(II) = r against H1: rk(II) = r + 1, respectively. Note that rk is rank, II is a matrix of long-run responses, and the matrix II has rank r, rk(II) = r. If the data cointegrate, II must be of reduced rank, r < N, where N is the number of variables.

For the implementation of the Johansen cointegration test, we determine the optimal number of included lags in each cointegreation equation by employing several information criteria tests.[5] For the four-variable system, we employ the lag order of two for India and Japan, three for Korea and four for Thailand and Singapore, respectively. Without discussing each of the remaining test statistics in detail, we also examined whether any variables can be considered weakly exogenous using procedures discussed in Arize, Osang and Slottje (2000).

Table 2 presents the cointegration test results, where *r* denotes the number of cointegrating vectors.[6] The Johansen cointegration test procedure gives answer to two questions: whether a long-run equilibrium relationship exists and whether it is unique. To this end, it uses two related test statistics: the maximum eigenvalue and the trace statistics. For both statistics, the null hypothesis is that there are (at most) *r* cointegrating vectors, whereas under the alternative hypothesis there are (at least) *r* + 1 cointegrating vectors. The test procedure is thus a nested sequence of test for various levels of *r*, where each level of *r* is associated with a different critical value of the test statistic.

Focusing first on the maximum eigenvalue test result, the null hypothesis tested is that there is no cointegrating vector ($r = 0$) against the alternative of cointegration of order one ($r = 1$). Since all test values in column 1 of Table 2 are significantly largest than the critical value of 27.42 at the five per cent level, we easily reject the null hypothesis (r = 0) of no cointegration. For space reasons, we do not report the data for comparing the null hypothesis of cointegration with $r \leq 1$ to the alternative of cointegration with $r = 2$ because none of the test statistics exceeds the critical value for this test (20.97 at the five per cent level) so we accept the null of cointegration with a single cointegrating vector.

A similar procedure applies to the trace test statistic. We first test the null hypothesis of $r = 0$ against the alternative hypothesis of $r \geq 1$ in each country.Since all empirical test statistics exceed the critical value of 47.21 for the trace statistic, we reject the null of $r = 0$ for all countries. Next, we test $r \leq 1$ against the $r \geq 2$ alternative hypothesis. This time, none of test statistic exceeds the critical value of 29.68 and we thus accept the null of cointegration with a single cointegrating vector.

Concerning the three remaining tests in Table 2, we note that the Harris-Inder test as well as the Shin's test is conducted with three, six and eight lags, and the overall results suggest that the null hypothesis of stationarity (or cointegration) is not rejected at all lag lengths in the case of Singapore for these tests. However, as the authors suggest some degree of augmentation in the tests is needed for better results. As the data show in all cases at higher lags, the null hypothesis of cointegration is retained. In other words, our findings indicate the existence of a unique long-run equilibrium relationship among real imports, real income, relative import prices and real foreign exchange reserves for each ACs in our sample.

3.2 Long-run Dynamics

Next, we are interested in the long-run impact of the three explanatory variables (real income, relative import price and reserves) on import demand. In particular, we want to know whetherthe signs of the estimated coefficients are in line with their predicted values, whether these estimates are statistically significant, and how the explanatory variables perform in relative terms. Due to our log-log specification of the estimation model (see equation (1)), the resulting values for real income, relative import price and real foreign exchange reserves are long-run elasticities.In Table 3, we show the empirical results of Equation (1) using three different approaches, the fully modified least squares (FMLS) estimator of Phillips and Hansen, the dynamic least squares (DLS) estimator of Stock and Watson and the Autoregressive-distributed lag (ARDL) estimator.[8]

Insert Table 3 Here

Focusing on the results obtained from the FMLS estimator[9], we gather that the demand relation is estimated to be positive for real income (y) and real foreign exchange reserve (IR), but negative for the relative price of imports (p). This holds for all ACs in the sample. Furthermore, all coefficient estimates are statistically significant at the conventional levels. These results provide strong support for the theoretical predictions regarding the impact of income, relative prices and foreign reserves on imports. As far as relative strength of the various determinants is

concerned, we find that the magnitude of the foreign exchange effect is substantially smaller than the income effect and the relative price effect. The average income elasticity across all ACs is 1.03 and the average price elasticity is -0.302. Both averages exceed (in absolute terms) the average of 0.152 obtained for foreign reserve elasticity. This implies that the economic importance of both income levels and relative price effects far outweighs the importance of foreign reserve variations for import demand.

As a cross-check, we also obtained long-run estimates by using two alternative estimation procedures, namely the dynamic OLS estimator of Stock and Watson and the autoregressive distributed lag estimator. The obtained elasticities are consistent with those of FMLS also reported in reported in Table 3. From these estimates, we gather that our conclusions are not particularly influenced by the method of estimation.

Table 4 summarizes elasticities from previous studies of Asian countries. In general, the elasticity estimates obtained in this study accords well with some previous studies. For example, the income elasticties in Table 4 reported in Bahmani-OsKooee and Niroomand (1998) for Korea and the results in Senhadji (1998) including Tang (2006) for Singapore support at least in spirit the findings of our study. However, they differ markedly from the two vectors obtained by Bahmani-Oskooee and Niroomand (1998) for Japan and Bahmani-Oskooee (1998) for Korea and Singapore, respectively. Since all our income elasticities are positive, they differ markedly from the negative one (-1.032) obtained by Sinha (1997). Our real foreign exchange reserves elasticity estimates are less than 0.3 for all countries and are thus similar to the ones reported by Khan and Knight (1988), Dutta and Ahmed (1999), Arizeet al. (2004) and Sultan (2011).

Insert Table 4 Here

3.3 Error-correction Model

The Granger representation theorem (GRT) proves that, if a congregating relationship exists among a set of nonstationary series, them a dynamic error-correction representation of the data also exists. The existence of GRT involves two doctrines by Engle and Granger (1987) and Johansen (1991).[10]The methodology used to find this representation follows the "general-to-specific" paradigm (see Hendry and Doornik, 1994). For this purpose;the following error-correction model (ECM) exists for the variable in equation (1):

$$\Delta m_t = \mu + \lambda EC^*_{t-1} + \omega D_t + \sum_{j=1}^{5}\left(\delta_j \Delta y_{t-j} + \delta_{5+j}\Delta p_{t-j} + \delta_{10+j}\Delta IR_{t-j}\right) + \sum_{j=0}^{5}\beta_j \Delta m_{t-j-1}, \quad (3)$$

where EC_{t-1} is the error-correction (one-lagged error) term generated from the FMLS cointegrating estimates, μ is a constant, and D_t are country-specific time dummies that account for observable import demand shocks otherwise not included in the model. The presence of the error-correction term (EC_{t-1}) in equation (3) reflects the presumption that actual real imports do not adjust instantaneously to their long-run determinants. Therefore, the equation gives the short-run determinants of import demand and embodies both the short-run dynamics and the long-run relation of the series. In the short run, adjustments are made to correct any disequilibrium in the long-run import demand.

The parameter λ is the error-correction coefficient and measures the response of the real imports in each period to departures form equilibrium conditions. The ECM therefore reflects how the system converges to the long-run equilibrium implied by equation (1), with convergence being assured when λ is between zero and minus one.In addition, the value of λ depends on the normalization of the cointegrating vector.

Table 5 presents the results for the change in real imports as the dependent variable. We conclude that the short-run impact of any explanatory variable on import demand is positive (negative) if the sum of the statistically significant point estimates of the covariate in question in equation (3) is positive (negative).

Insert Table 5 Here

For each country, a parsimonious and statistically acceptable model is obtained through the simplification of a fifth-order ECM. The simplification process involves deleting successively the first-differenced variable with the lowest t-ratios. Our findings are reported in Table 5.

Considering that each regressand in Table 5 is cast in the first difference, the empirical results suggest that the statistical fit of the each model to the data is satisfactory, as indicated by the value of adjusted coefficient of determination, which ranges from 0.372 (Thailand) to 0.636 (India). The statistical appropriateness of the models is further supported by a number of diagnostic tests. In particular, we report the Durbin-Watson and the Breusch-Godfrey test to test for non-independence of the error distribution. Based on these two statistics, we can reject the null of non-independence for all countries. Furthermore, Ramsey's RESET test reveals no serious omission of variables or violations of the linearity assumption in the structure of the model.

Having provided evidence supporting the adequacy of the estimated equations, we can make the following observations regarding the obtained estimates:

First and foremost, since the sum of the estimates on current and lagged values of (ΔIR_t) is positive for all countries, we conclude that exchange reserves has a positive short-run effect on real imports in addition to its long-run effect established earlier. Second, concerning the short-run dynamics of the relevant variables they are consistent with the theory and in line with their long term effects.

Third, it is worthwhile to interpret the finding with respect to the error-correction coefficient's term. From the data in Table 5, this coefficient term is statistical significant in each of the five cases and is always negative.The average coefficient is -0.2278 per quarter.For example, only about twenty-three percent occurs in one quarter. In addition, since the coefficient estimates range from -0.128 to -0.320 and are thus within the unit interval, convergence to the long-run equilibrium is assured for each country.These findings support the validity of an equilibrium relationship among the variables in each cointegrating equation. In economic terms, this means that when real imports exceed their long-run relationship with real income, relative import prices and real foreign exchange reserves, they adjust downwards at a rate of 13 to 32 percent in each quarter.

Insert Table 6 Here

In sum, our findings imply (a) that overlooking the cointegration of the variables would have introduced a misspecification in the underlying dynamic structure; (b) that there exist market forces in the imports market sector that operate to restore long-run equilibrium after a short-run deviation; (c) that it takes less than a year for 50 per cent of the deviations for long-run equilibrium (the cointegration equation) to be corrected, but a little above one year in Singapore (see Table 6); (d)that the mean time lags suggest that imports react faster to changes in in domestic income than to changes in exchange reserves, therefore, ignoring exchange reserves can produce biased results due to misspecification; and (e) that the full adjustment of real imports to changes in the regressors may take between two and five quarters, depending on the country.

To provide the reader with some insight into the behavior of real imports over time, we first use the Chow test and treat the break date as known. We chose the breakpoint to keep each subsample roughly the same size. The test was implemented using intercept and slope dummies (see Gujarati, 2002, for details). Our results suggest that only the model for Singapore is unstable at the 10 percent level though not at the 5 percent level. Tests suggested by Nyblom (1989) and Hansen (1992) also find instability in Singapore at the ten percent level. To examine the forecasting ability of the error-correction models, we split our data into estimation and forecast periods. The start of the sampleuntil 2005:4 is treated as the estimation period, whereas the forecast period (out-of-sample period) starts from the sample period 2005:4 through 2008:4. The Theil U test results are as follows: the Theil U coefficients are 0.011, 0.003, 0.021, 0.33, and 0.01 for India, Japan, Korea, Singapore, and Thailand, respectively.A Theil U statistic value between zero and one ($0<U< 1$) would suggest that the model yields more accurate prediction than would be a naïve model.

4. Conclusions and Policy Implications

This paper explores empirically the long-run and short-run impact of domestic income, relative import prices and foreign reserves on real imports of selected Asian economies. After examiningthis relationship, previous research, and nonstationarity of data, we use several techniques to explore empirically this possible relationship. Our result indicates that an increase in foreign reserves may have a positive effect on the demand for imports since it relaxes the excess demand liquidity restriction, at least in theory. It tends to influence trade policies, especially those associated with trade liberalization. The paper examines whether this hypothesis holds over both the long and short term using quarterly data over the 1973:2 – 2005:4 period. Forecasting was conducted using data from 2006:1-2008:4.

Our empirical results suggest the following conclusions. First, the evidence points to the nonstationarity of all variables involved in the model. Therefore, the treatment of this nonstationarity is vital for meaningful subsequent results. In addition, further test results suggest that there is a unique, statistically significant long- term equilibrium relationship among real imports, real income, relative price and real foreign exchange reserves.

Second, we find that foreign exchange reserves matter for import demand both in the long and in the short run. In addition, the sign of the estimated coefficient of reserves is positive, as expected. While the statistical impact is significant, the economic impact of foreign reserves on import demand is small, in particular in comparison to the size of the estimated elasticities for real income and relative prices. Nevertheless, policies which focus on increasing foreign exchange reserves should be pursued, as they are likely to influence import behavior. For instance, policies would have to be oriented towards export promotion. Exports are likely to increase reserves and can thereby provide

greater access to international markets (Esfahani, 1991). Trade policy measures also should discourage efforts aimed at borrowing given that reserves are available. Also, had we neglected foreign exchange reserves, our estimated model would have overstated – in absolute terms – the elasticity estimate of the income variable and the relative price variable.

Third, our empirical estimates show that real income is a significant variable in explaining the demand for imports, and that income elasticity is highly elastic in India, Korea and Thailand, whereas, it is inelastic in Japan and Singapore. The high income elasticity in India, Korea and Thailand implies that increases in real income are likely to lead to rising imports and ultimately tolarge trade imbalances. The relevant policy implication is that actions are needed in these countries to bring the income coefficient to less than or equal to unity.It is important that the management of import demand has to be viewed as part of a comprehensive stabilization plan. As part of this effort, imports should be targeted to offset shortfalls in domestic production or to change its nature and composition. Further, income growth could be cut by strategies that reduce government expenditure or those that raise taxes. For Japan and Singapore, our results indicate that import demand is inelastic with respect to real income and thus submits that a growth income may not lead to the expectation of trade deficits. Also, taken together, the estimates for the timing of import responses to changes in income are similar across most of the countries. The overall mean time-lag is 3.14quarters so that a strong domestic growth in these five countries is likely to stimulate the export activities of their respective trading partners.

For the relative price variable, the evidence suggests that they play a vital role in the determination of imports. The long-run elasticity is less than one (in absolute terms) in each country and would tend not to enhance an expansionary policy even if such a policy is accompanied by depreciating exchange rate. Further, the evidence indicates that it would take a little above a year (4.93 quarters) for a change in relative price to influence the quantity imported in these countries. To the extent that price lags provide information about the shape of the "J-curve" these findings suggest that currency depreciation will be reflected with a significant delay in import volumes.

Finally, the significance of relative prices in the our import demand equations has an important implication for the effectiveness of exchange rate policy or commercial policy aimed at correcting trade imbalances and promoting export growth. A fall in the quantity of imports will largely compensate for the increase in price of imported items. This implies that the Marshall-Lerner (M-L) condition is very likely achieved, if the demand price elasticity for exports is substantially large as expected.

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Notes

Note 1. See also The World Factbook, CIA, especially http://www.cia.gov/library/publications/the-world-factbook/rankorder/2188rank.html and World Economic Outlook (various issues, especially 2003)

Note 2. This section draws on Arize and Nippani (2010).

Note 3. Alternatively, we could have tested for the appropriate functional from of the import demand using the following tests: (i) Box-Cox (B-C) procedure as discussed in Zarembka (1974), (ii) Bera and McAleer (BM) as discussed in McAleer(1987) and (iii) the MacKinnon, White and Davidson (MWD)procedure as discussed in Gujarati (2002:281)

Note 4. The results from Table 1 represent strong evidence that all four variables from equation (1) are not only non-stationary, but are likely to be integration of order one occurs if a variable in levels is found to be nonstationary, while the same variable in differences is found to be stationary.

Note 5. To be precise, we use the Sims likelihood ratio test (SLR), the Akaike Information Criterion (AIC), the Schwarz Bayesian criterion (SBC) and the Ljung-Box test.

Note 6. Following Johansen (1995), we also include an (unrestricted) constant term in the model.

Note 7. To provide complementary evidence and check the robustness of the Johansen results, we employ three other tests.

Note 8. Recent specification suggestions have shown that it is much better to employ single equation estimator once r=1(cointegration) has been confirmed. We report the estimated long-run elasticities obtained after normalizing them on real imports.

Note 9. Following the specification suggestion in Funke (2001) we base our coefficient analysis on FMLS estimator. As Funke (2001) points out "one of the key advantages of this approved over alternative estimators, such as Johansen (1988) and Stock and Watson (1988), is that it facilitates a complete analysis of the inclusion of deterministic trends in the cointegration set. An additional benefit of the above framework is that it facilitates a test of cointegration, where cointegration is taken to be the null hypothesis. In the statistics literature this would be the natural way to test for cointegration…"

Note 10. See Hansen (2005) for further description.

Table 1. Augmented Dickey-Fuller Unit Root Tests

Country	Levels				Differences			
	m	y	p	IR	m	y	p	IR
India	-2.75	-2.16	-3.65	-2.72	-5.12	-6.97	-4.38	-4.38
Japan	-2.39	-1.57	-2.47	-2.43	-5.59	-3.59	-4.59	-4.47
Korea	-2.84	-0.90	-2.36	-2.02	-4.65	-4.52	-5.58	-5.81
Singapore	-2.19	-2.14	-1.63	-0.84	-4.33	-4.59	-3.96	-3.45
Thailand	-1.96	-1.35	-1.31	-2.48	-3.59	-3.58	-5.74	-4.93

Note: The critical value of the ADF statistic at the 5 per cent level is -3.41.

Table 2. Test for Cointegration among Import Demand, Domestic Income, Relative Prices and Foreign Exchange Reserves

Country	Johansen		Harris-Inder			Shin's Test			Hansen's Lc
	H0: r=0 Ha: r=1	H0: r=0 Ha: r>=1	H0: Cointegration Ha: No Cointegration			H0: Cointegration Ha: No Cointegration			H0:Cointegration Ha:No Cointegration
	λ-Max	Trace	3	6	8	3	6	8	Lc
India	46.01	65.18	0.11	0.08	0.07	0.13	0.09	0.08	0.55(0.11)
Japan	35.58	61.40	0.21	0.16	0.14	0.15	0.12	0.11	0.49(0.19)
Korea	77.58	92.84	0.28	0.2	0.17	0.14	0.11	0.10	0.52(0.16)
Singapore	51.75	79.73	0.18	0.12	0.1	0.12	0.09	0.08	0.33(0.18)
Thailand	44.17	52.96	0.09	0.06	0.06	0.09	0.07	0.06	0.45(0.20)

Notes**:** The critical values for p-r = 4 in the case of Johansen are 27.07 for λ_{max} and 47.21 for the Trace test. Since we test for one cointegration vector; hence p, the number of variables, is 4, and r, the number of cointegrating vector is zero. The critical values are from Osterwald-Lenum (1992, Table 1.1*). For the Harris-Inder test, the critical value is 0.32 at the 5 percent level. In the case of the Shin test, it is 0.159. The p-values for Hansen's test are in parentheses beside the Lc test statistic

Table 3. Long-run Elasticities and Hypothesis tests

Country	Phillips-Hansen Estimator (FMOLS)			Stock-Watson Estimator (DOLS)			Autoregressive Distributed Lag (ARDL)		
	y	*p*	*IR*	*y*	*p*	*IR*	*y*	*p*	*IR*
India	1.45	-0.39	0.09	1.44	-0.38	0.11	1.44	-0.46	0.10
	(43.48)	(4.97)	(4.83)	(43.03)	(4.70)	(6.43)	(28.70)	(3.56)	(3.60)
Japan	0.74	-0.16	0.19	0.77	-0.14	0.19	0.78	-0.20	0.18
	(10.94)	(3.95)	(11.27)	(14.53)	(3.87)	(15.35)	(6.31)	(2.38)	(6.12)
Korea	1.20	-0.45	0.05	1.02	-0.81	0.06	1.19	-0.43	0.06
	(26.58)	(3.27)	(2.28)	(20.46)	(3.35)	(1.62)	(16.62)	(2.16)	(2.23)
Singapore	0.73	-0.27	0.22	0.84	-0.23	0.15	0.88	-0.23	0.12
	(7.42)	(1.94)	(3.20)	(9.08)	(1.99)	(2.31)	(12.06)	(1.91)	(2.04)
Thailand	1.02	-0.24	0.21	1.06	-0.29	0.20	1.13	-0.70	0.19
	(15.74)	(2.21)	(6.35)	(17.71)	(3.40)	(6.38)	(6.47)	(2.14)	(2.25)

Notes:The numbers in parentheses report absolute t-statistics. The critical value at 10 percent is 1.3 and 1.67 at 5 percent level.

Table 4. Comparison of long-run import elasticities.

Study	Data period	Country	Income	Price
Bahmani-Oskooee and Niroomand (1998)	73:80	Korea	1.83	-0.13
	73:80	Japan	0.46	-0.97
	73:80	Japan	1.17	-0.09
Bahamani-Oskooee (1998)	73:1-80:4	Korea	2.17	-1.37
	73:1-80:4	Korea	0.402	-1.91
	73:1-80:4	Singapore	1.26	-0.15
	73:1-80:4	Singapore	1.054	-0.3
Senhadji (1998)	60:93	India	1.33	-0.12
	60:93	Korea	1.32	-0.84
	60:93	Japan	1.04	-0.52
		Thailand	1.67	-0.43
Tang (2006)	74-02	Singapore	1.077	-0.463
		Thailand	0.917	-0.78
Sinha (2006)	53-90	Thailand	2.147	-0.768
Sinha (2010)	51-96	Japan	0.841	-0.908
	53-95	Thailand	0.902	-0.199
	50-96	India	-0.1134	-0.5142

Table 5. Short-run Dynamics: Error Correction Model

India

$$\Delta m_t = \underset{(3.14)}{0.024} - \underset{(3.52)}{0.296}EC_{t-1} - \underset{(2.35)}{0.213}\Delta m_{t-1} - \underset{(1.85)}{0.131}\Delta m_{t-2} + \underset{(2.29)}{0.137}\Delta m_{t-4} + \underset{(2.30)}{0.401}\Delta^2 y_{t-1} + \underset{(2.27)}{0.346}\Delta^2 y_{t-2} + \underset{(1.94)}{0.360}\Delta^2 y_{t-3} - \underset{(8.17)}{0.670}\Delta p_t - \underset{(2.76)}{0.289}\Delta p_{t-1} + \underset{(1.73)}{0.048}\Delta^2 IR_{t-3}$$

$$R^2 = 0.667, \overline{R}^2 = 0.636, F(10,109) = 21.79, DW = 2.07, BG - F = 1.12(0.35), RESET - F = 0.004(0.95)$$

Japan

$$\Delta m_t = \underset{(8.05)}{0.043} - \underset{(3.91)}{0.186}EC_{t-1} + \underset{(2.73)}{0.126}\Delta^2 y_t - \underset{(2.35)}{0.121}\Delta p_t - \underset{(3.39)}{0.154}\Delta p_{t-4} - \underset{(1.62)}{0.032}\Delta^2 IR_t + \underset{(1.37)}{0.046}\Delta IR_t - \underset{(7.22)}{0.057}S_1 - \underset{(4.18)}{0.031}S_2 - \underset{(5.55)}{0.041}S_3$$

$$R^2 = 0.595, \overline{R}^2 = 0.563, F(9,115) = 18.74, DW = 1.98, BG - F = 0.30(0.87), RESET - F = 5.10(0.03)$$

Korea

$$\Delta m_t = \underset{(1.81)}{0.011} - \underset{(4.63)}{0.320}EC_{t-1} - \underset{(2.43)}{0.178}\Delta m_{t-1} + \underset{(7.06)}{0.482}\Delta y_t + \underset{(6.05)}{0.254}\Delta y_{t-2} + \underset{(4.39)}{0.257}\Delta y_{t-3} - \underset{(2.27)}{0.226}\Delta p_t - \underset{(2.49)}{0.277}\Delta p_{t-2} - \underset{(2.40)}{0.085}\Delta IR_{t-3} + \underset{(2.87)}{0.095}\Delta IR_{t-4}$$

$$R^2 = 0.645, \overline{R}^2 = 0.617, F(9,115) = 23.22, DW = 1.94, BG - F = 1.16(0.34), RESET - F = 1.73(0.19)$$

Singapore

$$\Delta m_t = \underset{(0.30)}{-0.002} - \underset{(2.81)}{0.128}EC_{t-1} + \underset{(8.84)}{0.895}\Delta y_t - \underset{(2.50)}{0.243}\Delta y_{t-2} + \underset{(4.64)}{0.501}\Delta p_{t-4} + \underset{(1.95)}{0.159}\Delta IR_{t-3}$$

$$R^2 = 0.459, \overline{R}^2 = 0.436, F(5,115) = 19.52, DW = 2.09, BG - F = 0.62(0.65), RESET - F = 0.09(0.77)$$

Thailand

$$\Delta m_t = \underset{(0.65)}{-0.005} - \underset{(3.96)}{0.209}EC_{t-1} + \underset{(2.03)}{0.153}\Delta m_{t-4} - \underset{(3.02)}{0.623}\Delta y_{t-1} + \underset{(3.77)}{0.775}\Delta y_{t-3} - \underset{(4.90)}{0.477}\Delta p_t - \underset{(1.94)}{0.182}\Delta p_{t-1} + \underset{(2.31)}{0.128}\Delta IR_{t-4}$$

$$R^2 = 0.408, \overline{R}^2 = 0.372, F(7,118) = 11.60, DW = 1.98, BG - F = 0.17(0.95), RESET - F = 2.45(0.12)$$

Notes: The number in parentheses report absolute t-statisyics. The critical value at 10 per cent is 1.67 and 1.96 at 5 per cent level.
Tests: DW=Durbin-Watson test statistic, BG=Breusch-Godfrey test, RESET=Ramsey RESET normality test.
Variable names: EC=error correction term, m=desired real imports, y=real domestic income, p=domestic wholesale price, IR=real foreign exchange reserves.

Table 6. Speed of adjustments and mean time lags for adjustments of desired real imports

Countries	Speed of adjustments	Response of desired real imports to each regressor			
	Desired real imports	Half-life adjustment	Mean time lag		
	m	*Ψ*	*y*	*p*	*IR*
India	-0.296 (0.08)	1.97	0.34	5.05	3.92
Japan	-0.186 (0.05)	3.38	4.71	6.22	5.56
Korea	-0.320 (0.07)	1.80	2.08	4.54	3.65
Singapore	-0.128 (0.05)	5.08	5.94	3.92	6.59
Thailand	-0.209 (0.05)	2.96	2.64	4.93	3.44
Average		3.04	3.14	4.93	4.63

Notes: The values in parentheses beside the speed of adjustments are the standard errors. Both the half-life and the mean time lag are in absolute terms and in quarters.

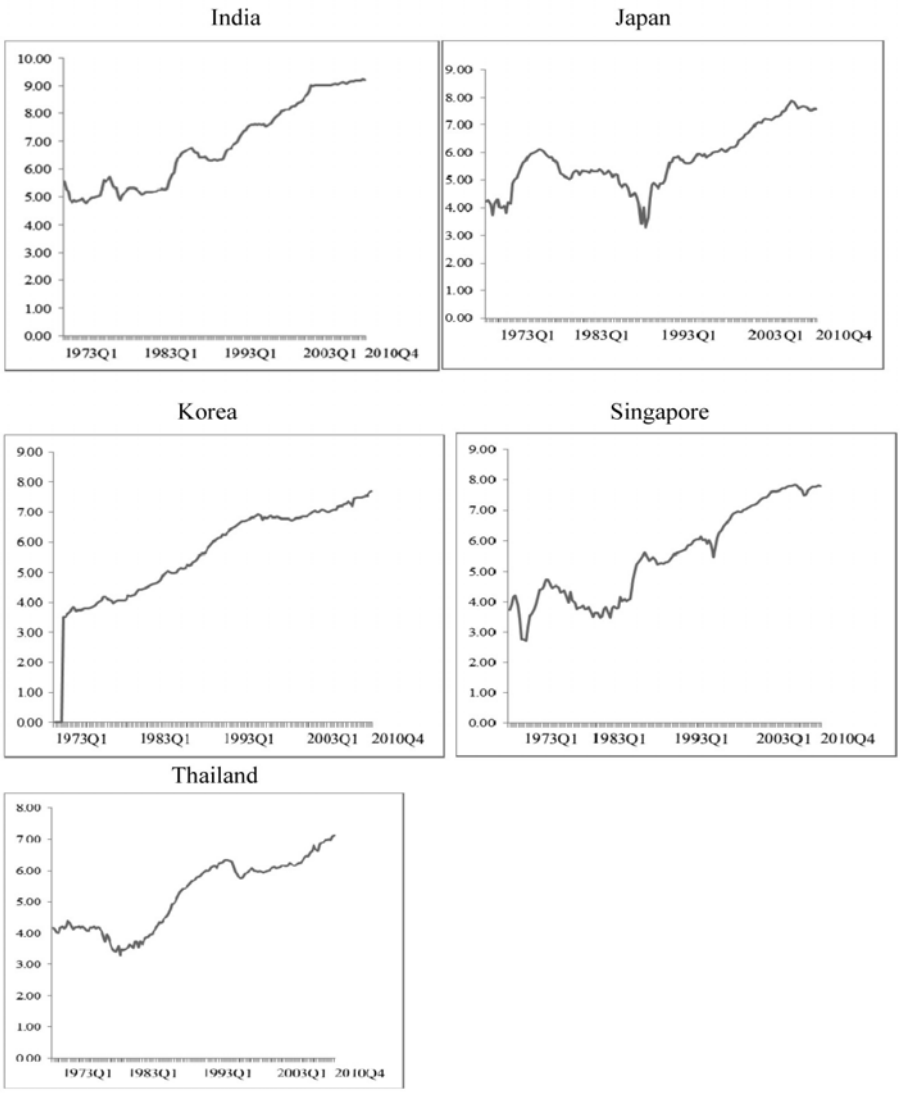

Figure 1. Plots of Real Foreign Exchange Reserves

Factors that Influence Financial Leverage of Small Business Firms in India

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Abstract

The purpose of this study is to examine the factors that influence financial leverage of small business firms in India. This study also seeks to extend the findings of Michaelas *et al.* (1999). Small business owners from Punjab area of India were surveyed in order to gather information. Subjects were asked about their perceptions, beliefs, and feelings regarding the factors that influence financial leverage of their firms. This study utilized survey research (a non-experimental field study design). The findings of this paper show that small business growth, small business performance, total assets, sales, tax, and family have positive influence on the financial leverage of small business firms in India. This study contributes to the literature on the factors that influence financial leverage of small business firms. The findings may be useful for the financial managers, investors, and financial management consultants.

Keywords: Financial leverage, Small business growth, Small business performance, Tax

1. Introduction

The purpose of this study is to examine the factors that influence financial leverage of small business firms in India. One of the tough challenges that business firms face is the choice of capital structure. Capital structure decision is important because it affects the financial performance of the small business firms. Abor (2005) defines capital structure as specific mix of debt and equity that a firm uses to finance its operations. Although small business firms have options to choose among many alternative capital structures, they tend to rely on borrowings from financial institutions such as banks. The decision to finance with debt rather than equity may be driven by necessity instead of choice because small business firms do not have the same access to capital that larger public firms do. Small

business firms cannot issue publicly-held debt or equity because of their small size and the high cost of issuing securities. As a result, small business firms tend to rely on bank financing and trade credits (Petersen & Rajan, 1994). In addition, small business firms that are relatively new and lack a consistent track record of profitability face difficulties in demonstrating their capacity to repay a loan and to provide collateral. Asymmetric and/or incomplete information between the borrower and the lender also represents a potential financing problem for small privately-held firms (Ang, 1992; Petersen & Rajan, 1994).

Modigliani and Miller (1958) were the first authors who developed capital structure theory. Since then, many researcher followed Modigliani and Miller's path to develop new theory on debt policy of firms. While in some theories, the existence of taxes and bankruptcy costs makes debt relevant (DeAngelo & Masulis, 1980), in other theories the relevance is due to information asymmetry; that is, managers have information that investors do not have (Myers, 1984; Ross, 1977). A third relevant theory is agency theory advanced by Jensen and Meckling (1976), which is derived from the conflict between corporate managers, outside stockholders, and bondholders. However, the empirical evidence regarding the alternative theories is still inconclusive (Rajan & Zingales, 1995).

The general result from the various capital structure studies is that the combination of leverage related costs and the tax advantage of debt, produces an optimal capital structure below 100% debt financing, as the tax advantage is traded against the likelihood of incurring bankruptcy costs (Michaelas *et al.,* 1999, p. 113). The determinants of capital structure have been debated for many years and still represent one of the main unsolved issues in the corporate finance literature. Many theoretical studies and much empirical research have addressed these issues, but there is not yet a fully supported and unanimously accepted theory (Morri & Beretta, 2008). Indeed, what makes the capital structure debate so exciting is that only a few of the developed theories have been tested by empirical studies and the theories themselves lead to different, not mutually exclusive and sometimes opposed, results and conclusions (Gill *et al.,* 2009, p. 48).

Small business firms face different issues from larger publically traded firms because of different complexities such as shorter expected life, presence of estate tax, intergenerational transfer problems, and prevalence of implicit contracts. The problems like agency and asymmetric information are more complex in the small business industry (Ang, 1992). Nevertheless, there has not been much research conducted on small, growing, entrepreneurial companies, and the factors affecting the financial leverage of these firms. The capital structure of small business firms is a major area of policy concern, and much of the work, particularly on the failure of small firms, has identified financial leverage as a major cause of decline (Lowe *et al.,* 1991; Michaelas *et al.,* 1999, p. 114).

Most other empirical studies on the debt policy of the firm were conducted on publically traded industrial firms. Therefore, this study examines the factors that influence financial leverage of small business firms that are not listed on the stock exchanges. A variety of variables that are potentially responsible for determining financial leverage of the firm can be found in the literature. In this study, the selection of exploratory variables is based on the alternative capital structure theories and previous empirical work. The choice is sometimes limited, however, because of lack of relevant data. As a result, the final set of proxy variables includes 10 factors: small business growth, small business performance, long-term assets, current assets, total assets, sales, tax, family, industry, and financial leverage.

2. Literature Review

The capital structure theory of Modigliani and Miller (1958) indicates that firms select the mix of debt and equity to minimize weighted average cost of capital (WACC). Because interest expense is tax deductible, debt is less costly than equity as a source of capital. Therefore, firms maintain a certain level of debt in the capital structure to minimize cost of capital, which in turn, helps to maximize the value of the firm. Other researchers, however, have suggested alternatives to Modigiliani and Miller's theory of capital structure. For example, Timmons (1994) observed that capital requirements are different at different stages of firm growth. Small and young firms may draw capital from internal sources such as family and friends. As the successful firm grows, more capital is required to finance growth, and the firm typically needs at some point to turn to external sources such as banks and the public debt and equity markets (Coleman & Cohn, 1999, p. 3). Myers (1984) refers this to a "pecking order." The peaking order is a theory of finance stating that firms use internally generated funds in the form of retained earnings before turning to external sources. When retained earnings are not enough, firms first seek out sources of debt before they use more costly external equity.

Financial economists have advanced a number of leverage relevance theories by relaxing the perfect capital market assumption of Modigliani and Miller. Now, approximately 55 years later, the theory of capital structure is extensive and can be classified into four categories: i) tax-based theories, ii) agency cost theories, iii) asymmetric information, and iv) signalling theories. These market imperfections have been brought forward as determinants of capital structure, which refer to the costs and benefits associated with financial contracting. However, these theories make

no distinction between small and large firms (Michaelas *et al.,* 1999). Ang (1991) also states that the theory of finance was not developed with the small business firms in mind.

Corporate income tax has an important impact on debt-equity choices. Although, the tax shield proposition of Modigliani and Miller (1958) suggest that the firms facing higher marginal tax rates should use higher debts, Biger *et al. (*2008) argue that tax shield proposition does not apply if firms have interest free liabilities. Biger *et al.* may be correct because small business owners in India sometimes borrow interest free money from family members and friends.

DeAngelo and Masulis (1980) assert that as debt interest shields income from taxation, profitable firms with few non-debt tax shields use more debt than less profitable firms. In practice, however, firms do not follow this policy. Michaelas *et al.* (1999, p. 114) describe that many small firms do not use any debt. This may be because smaller firms make less profit than the larger firms. Another reason for using low debt or no debt is that the potential of bankruptcy is high for the small firms if they increase the level financial leverage. In addition, small firms face lower marginal tax rates than the larger firms and get lower tax benefits.

Myers (1977) describe that short-term debt is in the favor of the firm because it can mitigate agency problem and minimize agency costs which incur from the conflict of interest between shareholders and bondholders. Michaelas *et al.* (1999) also point out that Myers' (1977) proposition is more applicable in the small business context where the trade-off between independence and availability of finance is likely to be highlighted and where much debt is of a short-term nature.

The agency problems can be serious when i) the level of asymmetric information is greater, ii) the agent has the capacity and incentive to affect wealth transfers between parties and the corporate contract, and iii) the agent's partial ownership allows him to consume firm's assets while paying less than the sum of the individual costs to the firm's principals (Barnea *et al.,* 1981). As a result one can expect agency costs to be higher in smaller firms as a small business owner/manager is likely to put his own and his venture's interest first, especially in the early years when survival is at stake (Michaelas *et al.,* 1999). However, availability of collateral for debt minimizes these costs. Banks respond to both adverse selection and moral hazard by seeking collaterals (Stiglitz & Weiss, 1981). It is common for lenders to require collaterals for business loans to mitigate default risk. Therefore, it can be expected that firms which possess fixed assets with a high collateral value will have easier access to external finance and probably a higher level of debt in their capital structure relative to firms with lower levels of collateralizable assets (Michaelas *et al.,* 1999, p. 115).

The debt policy is designed to mitigate inefficiencies in the investment decisions of firms that are caused by the information asymmetry between managers (insiders) and creditors (outsiders) (Myers, 1984). Pettit and Singer (1985) also explain that problems of asymmetric information and agency costs affect the availability of credit for small businesses. Therefore, small business firms that have low level of collateral rely on the profitability of the firm for further financing.

Firm size also influences the financial leverage of the firm. Michaelas *et al.* (1999, p. 116) argue that small businesses carry less debt than the larger firms due to generally i) lower marginal corporate tax rates for very small firms, ii) higher bankruptcy costs, iii) greater agency costs, and iv) greater costs of resolving the larger informational asymmetries.

The empirical studies on the factors that influence the financial leverage of the firm are as follows:

Michaelas *et al.* (1999) gathered data from the Lotus One-Source Database of UK small firms and found positive relationships between i) non-debt tax shield and long-term debt, ii) firm growth and debt, iii) asset structure and debt, and iv) firm size and debt. Authors also found that level of debt is negatively correlated with profitability.

Gordon and Lee (1999) used "US Statistics of Income" balance sheet data on all corporations to compare the debt policies of firms of different sizes and found that taxes have a strong effect on debt levels of small firms.

Esperanca *et al.* (2003) used the Portuguese Central Bank (Banco de Portugal) to collect 995 small manufacturing firms' data between 1992 and 1996. Authors found that leverage is positively correlated with i) firm size, asset composition, and firm growth and ii) negatively correlated with firm's profitability.

Huang and Song (2006) collected data from more than 1000 Chinese listed companies up to the year 2000 and found that leverage increases with firm size, non-debt tax shields and fixed assets, and decreases with profitability.

Sayılgan *et al.* (2006) took a sample of 123 Turkish manufacturing firms listed on the Istanbul Stock Exchange (ISE) from 1993-2002. Their analysis shows that leverage ratio is i) positively correlated with firm size and firm growth and ii) negatively correlated with profitability and non-tax debt shield.

Eldomiaty (2007) used 99 firms from 14 non-financial industries and found a positive relationship between firm growth and debt.

Gill *et al.* (2009) collected data from 158 American service firms. Through regression analysis, Gill *et al.* found that leverage is negatively correlated with collateralized assets and firm's profitability.

Gill and Mathur (2011) took a sample of 166 Canadian firms listed on the Toronto Stock Exchange for a period of 3 years (from 2008-2010). Through regression analysis, they found that financial leverage is i) positively affected by firm size and ii) negatively affected by collateralized assets, effective tax rate, firm performance, and firm growth.

In summary, literature review shows that tax shield, asset structure, firm size, firm growth, firm performance, and collateralized assets influence the financial leverage of the firm.

3. Methods

3.1 Measurement

In order to remain (for comparison and reference reasons) consistent with previous research, the measures were taken from three referent studies, which in turn, are based on previous studies in behavioral finance. All measures pertaining to:

i) Small business growth and small business performance were taken from Zehir *et al.* (2006),

ii) Measures pertaining to financial leverage were taken from Beattie *et al.* (2006), and

iii) Measures pertaining to assets, sales, and tax were taken from Michaelas *et al.* (1999).

All the scale items were be reworded to apply to Indian small business owners and the reliability of these re-worded items was re-tested. Respondents were asked to indicate their agreement with each item, using a five-point Likert scale ranging from "Strongly Disagree" to "Strongly Agree."

Small business growth (SBG) independent variable is operationalized as the extent to which small business owners perceive that the overall growth of their small businesses has improved over the last three years. Zehir *et al.* (2006) used the seven-item tolerance-of-freedom scale which measures the "SBG" variable. Two items were selected to measure the "SBG" variable. Scale items were reworded and the reliability of these re-worded items was re-tested.

The Cronbach alpha on the responses of the 29 small business owners who participated in the pre-test of the above scale items was 0.95. All two items were included in the final questionnaire.

Small business performance (SBP) independent variable is operationalized as the extent to which small business owners perceive that the net profit margin, return on assets, and return on invested capital have improved over the last three years. Zehir *et al.* (2006) used the seven-item tolerance-of-freedom scale which measures the "small business growth" variable. In the present study only three items were selected to measure the "SBP" variable. Scale items were reworded and the reliability of these re-worded items was re-tested.

The Cronbach alpha on the responses of the 29 small business owners who participated in the pre-test of the above scale items was 0.91. All three items were included in the final questionnaire.

Financial leverage (FL) dependent variable is operationalized as the extent to which small business owners perceive that they maintain a level of leverage that i) maximizes tax advantage of interest deductions, ii) improves company performance, iii) maximizes cash inflows, iv) minimizes chances of bankruptcy, v) indicates long-term survival, and vi) prevents takeovers. Beattie *et al.* (2006) used thirteen-items which measures appropriate amount of debt. Six items were selected to measure the "FL" variable. Scale items were reworded and the reliability of these re-worded items was re-tested.

The Cronbach alpha on the responses of the 29 small business owners who participated in the pre-test of the above scale items was 0.94. All six items were included in the final questionnaire.

Long-term assets (LA) control variable was measured by a single item that asked respondents to describe if long-term assets (e.g., building, automobiles, tools, etc.) of their companies increased within last three years. Categorized alternative responses were: 1) Yes and 0) No.

Current assets (CA) control variable was measured by a single item that asked respondents to describe if current assets (e.g., inventory, accounts receivables, cash, etc.) of their companies increased within last three years. Categorized alternative responses were: 1) Yes and 0) No.

Total assets (TA) control variable was measured by a single item that asked respondents to describe if total assets of their companies increased within last three years. Categorized alternative responses were: 1) Yes and 0) No.

Sales (SALES) control variable was measured by a single item that asked respondents to describe if average sales of their companies increased within last three years. Categorized alternative responses were: 1) Yes and 0) No.

Tax (TAX) control variable was measured by a single item that asked respondents to describe if average tax of their companies increased within last three years. Categorized alternative responses were: 1) Yes and 0) No.

Family and industry were also used as control variables.

Family (FAMILY) control variable was measured by a single item that asked respondents to indicate their family characteristics. Categorized alternative responses were: 0) Single Family (1-5 Family Members) and i) Joint Family (6 Family Members and More).

Industry (IND) control variable was measured by a single item that asked respondents to indicate the names of the sectors in which their small businesses operate. Categorized alternative responses were: 0) Service and i) Manufacturing.

3.2 Sampling Frame, Questionnaire Distribution, and Collection

The current study consisted of the population of Indian small business owners. Indian small business owners living in Punjab (Ludhiana, Malerkotla, Raikot, Banga, Hoshiar Pur, Kaputhala, Phagwara, Jalandhar, and Sahid Bhagat Singh Nagar) area of India were chosen as a sampling frame.

3.3 Sampling Method, Sampling Issues, and Possible Planned Solutions

Punjab (Ludhiana, Malerkotla, Raikot, Banga, Hoshiar Pur, Kaputhala, Phagwara, Jalandhar, and Sahid Bhagat Singh Nagar) area of India was chosen as the research site to collect data. Given that the population is "abstract" [e.g., it was not possible to obtain a list of all members of the focal population] (Huck, 2008, p. 101), a non-probability (purposive) sample was obtained. In a purposive sample, participants are screened for inclusion based on criteria associated with members of the focal population. The focal population was comprised of small business owners in the Punjab area of India. The survey did not need to be translated into Punjabi or Hindi for the Indian participants since almost all the small business owners can read and write English. Researchers were also available for translation. The instruction sheet indicated that participants could contact the researchers by telephone and/or email regarding any questions or concerns they might have about the research.

To avoid sampling bias, data collection team was asked to only choose participants that represent the target population. Non-Indian small business owners were excluded.

To achieve a convenience sample, an exhaustive list of Indian small business owners' names and telephone numbers were created to distribute surveys and to conduct telephone interviews. Survey questionnaire bundles coupled with an instruction sheet were provided to the surveyors for distribution.

The sample included approximately 800 research participants encompassing Indian small business owners. A total of 209 surveys were completed over the telephone (approximately 10% of the surveys were completed over the telephone), through personal visits, and received by mail. Two of the surveys were non-usable. The response rate was roughly 26.12%. The remaining cases were assumed to be similar to the selected research participants.

3.4 Issues Related to Confidentiality of the Research Participants

All individuals who were approached were ensured that their names will not be disclosed and confidentiality will be strictly maintained. In addition all subjects were requested NOT to disclose their names on the questionnaire. Since the research was based on the survey questionnaire small business owners were not forced to respond to each specific question.

All subjects were provided with stamped envelopes and confidentiality was ensured. There was no obligation for the subjects to answer our questions over the telephone and in person. Before any telephone interview the person was asked for willingness to participate and of course no one was forced to participate.

Small business owners' Consent Letter specifically indicated that by completing the survey, subjects have consented to participate in the study. Any information that was obtained in connection with this study and that can be identified with subjects will remain confidential and will be disclosed only with subjects' permission or as required by law.

4. Analysis and Results

Table 1 shows descriptive statistics related to this study. The information related to industry control variable is as follows:

Responses from manufacturing industry = 67

Responses from service industry = 140

Measures of central tendency, variance, skewness, and kurtosis were calculated on responses to all of the items. Skewness measures for all of the items were within the range of: -0.776 to -1.382, which is considered to be a good range for most research that requires using statistics appropriate to normal distributions. Therefore, we used statistics that assume scalar values and symmetric distributions to test our hypotheses.

We began our analysis by factor analyzing responses to the 11 items that described the respondents' feelings about their small business growth, small business performance, and financial leverage. The principle components analysis (a cluster analysis tool designed to capture the variance in a dataset in terms of principle components) with number of factors set to 3 and a varimax rotation explained 81.49% of the variance in the original scores (see Table 2). As can be seen in Table 3, all the items loaded on the expected factors.

Cronbach Alpha on the clusters of items: SBG 0.842; SBP 0.907; and FL 0.944.

The question subsets were analyzed in order to enable the calculation of the weighted factor scores. In terms of these weighted factor score items: two SBG, three SBP, and six FL, loaded approximately equally.

Table 4 provides the Pearson correlation for the variables used in the regression model. The findings are as follows:

Overall, financial leverage is positively correlated with small business growth (SBG), small business performance (SBP), long-term assets (LA), total assets (TA), sales (SALES), tax (TAX), and family (FAMILY). The financial leverage is positively correlated with SBG, SBP, LA, current assets (CA), TA, SALES, and TAX in the Indian manufacturing industry. The financial leverage is positively correlated with SBG, SBP, TA, SALES, TAX, and FAMILY in the Indian services industry (see Table 4).

4.1 Testing of Hypotheses

In this section, we present the empirical findings on the relationships between SBG, SBP, LA, CA, TA, SALES, TAX, FAMILY, industry (IND), and financial leverage (FL) of small business firms.

Positive relationships between i) SBG and FL, ii) SBP and FL, iii) TA and FL, iv) SALES and FL, v) TAX and FL, vi) FAMILY and FL, and vii) IND and FL were found (see Table 5); that is, SBG, SBP, TA, SALES, TAX, FAMILY, and IND are the predictors of financial leverage of small business firms in India.

Non-significant relationships between i) LA and FL and ii) CA and FL were found (see Table 5); that is, LA and CA are not the predictors of financial leverage of small business firms in India.

In studying our results, we noted that the size of the sample (with a predominance of small business owners from service industry – 140 responses from service industry and 67 responses from manufacturing industry), might affect the results. We first tested to see if SBG, SBP, LA, CA, TA, SALES, TAX, FAMILY, and FL were significantly different between small business firms from manufacturing and service industries. Using one-way ANOVAs, we found that perceived:

i) SBG did not differ between the 2 types of small business firms (sig. = 0.952),

ii) SBP did not differ between the 2 types of small business firms (sig. = 0.472),

iii) LA did not differ between the 2 types of small business firms (sig. = 0.400),

iv) CA did not differ between the 2 types of small business firms (sig. = 0.595),

v) TA did not differ between the 2 types of small business firms (sig. = 0.403),

vi) SALES characteristics did differ between the 2 types of small business firms (sig. = 0.006),

vii) TAX did not differ between the 2 types of small business firms (sig. = 0.655),

viii) FAMILY did differ between the 2 types of small business firms (sig. = 0.000), and

ix) FL did differ between the 2 types of small business firms (sig. = 0.082).

We re-tested the hypotheses for subsets of the sample.

Positive relationships between i) SBG and FL, ii) SBP and FL, iii) TA and FL, and iv) SALES and FL were found (see Table 5); that is, SBG, SBP, TA, and SALES are the predictors of financial leverage of small business firms in the manufacturing industry of India.

Non-significant relationships between i) LA and FL, ii) CA and FL, iii) TAX and FL, and iv) FAMILY and FL, were found (see Table 5); that is, LA, CA, TAX, and FAMILY are not the predictors of financial leverage of small business firms in the manufacturing industry of India.

Positive relationships between i) SBG and FL and ii) FAMILY and FL were found (see Table 5); that is, SBG and FAMILY are the predictors of financial leverage of small business firms in the service industry of India.

Non-significant relationships between i) SBP and FL, ii) LA and FL, iii) CA and FL, iv) TA and FL, v) SALES and FL, and vi) TAX and FL were found (see Table 5); that is, SBP, LA, CA, TA, SALES, and TAX are not the predictors of financial leverage of small business firms in the service industry of India.

Note that:

● A test for multicollinearity was performed. All the variance inflation factor (VIF) coefficients are less than 4 and tolerance coefficients are greater than 0.27.

● 43.3% (R^2 = 0.433) of the variance in the degree of FL can be explained by the degree of IND, SBG, CA, LA, FAMILY, SALES, TAX, TA, and SBP,

●76.3% (R^2 = 0.763) of the variance in the degree of FL can be explained by the degree of FAMILY, TA, CA, SALES, TAX, LA, SBG, and SBP in the manufacturing industry, and

● 35.1% (R^2 = 0.351) of the variance in the degree of FL can be explained by the degree of FAMILY, CA, SALES, LA, SBG, TAX, TA, and SBP in the service industry.

As shown in Table 5, analysis of variance (ANOVA) tests are also significant at 0.000.

5. Discussion, Implications, and Future Research

5.1 Discussion

The main purpose of this study was to examine the perceived factors that influence financial leverage of small business firms in India. This was done by surveying a sample of small business owner from Punjab area of India.

Overall findings show positive relationships between i) SBG and FL, ii) SBP and FL, iii) TA and FL, iv) SALES and FL, v) TAX and FL, vi) FAMILY and FL, and vii) IND and FL. The results also show positive relationships between i) SBG and FL, ii) SBP and FL, iii) TA and FL, and iv) SALES and FL in the manufacturing industry of India. In addition, the findings show positive relationships between i) SBG and FL and ii) FAMILY and FL in the service industry of India (see Table 5). These results lend some support to the findings of:

i) Michaelas *et al.* (1999) who found positive relationships between i) non-debt tax shield and long-term debt, ii) firm growth and debt, iii) asset structure and debt, and iv) firm size and debt.

ii) Gordon and Lee (1999) who found that taxes have a strong effect on debt levels of small firms.

iii) Esperanca *et al.* (2003) who found that leverage is positively related to firm size, asset composition, and firm growth.

iv) Huang and Song (2006) who found that leverage increases with firm size, non-debt tax shields, and fixed assets.

v) Sayılgan *et al.* (2006) who found that leverage ratio is positively related to firm size and firm growth.

vi) Eldomiaty (2007) who found a positive relationship between firm growth and debt.

vii) Gill and Mathur (2011) who found that financial leverage is positively affected by firm size.

The results of this study contradict with the findings of:

i) Esperanca *et al.* (2003) and Huang and Song (2006) who found that leverage decreases with profitability.

ii) Sayılgan *et al.* (2006) who found that leverage ratio is negatively related to profitability and non-tax debt shield.

iii) Gill *et al.* (2009) who found that leverage is negatively correlated with collateralized assets and firm's profitability.

iv) Gill and Mathur (2011) who found that financial leverage is negatively affected by collateralized assets, effective tax rate, firm performance, and firm growth.

The different results may be because the above studies are related to larger firms from different countries. Table 6 shows the summery of previous authors' findings related to the factors that influence financial leverage of the firm.

Although, financial leverage tends to increase with SBG, SBP, TA, and SALES in the manufacturing industry, this is not the case in the service industry of India. In the service industry, financial leverage tends to increase with the small business growth and family support. This may be because small business firms tend to rely on the family support and small business growth. For example, in the joint family businesses, all the income is kept together. It is important to note that majority of small businesses (service and manufacturing) in India are running as family businesses. Although family business may not show profitability, family members get paid in the form of salary. The financial leverage is different for service and manufacturing industries.

In conclusion, SBG, SBP, LA, CA, TA, SALES, TAX, FAMILY, and IND influence the financial leverage of small business firms in India.

5.2 Limitations

The present study asks for responses from fixed format, set-questions survey tools, which could direct questions to the exclusion of providing additional input. A mail/drop off survey data collection method contributed to a low response rate or response error. Some favorable techniques such as including postage paid mail, sending a cover letter, providing a deadline for returning the survey, and promising anonymity were applied in order to increase the response rate. Maturation of participants can also affect the survey response rate. Maturation of participants, in the context of this research, means that some of the research participants may be on holidays. However, a short study period (four weeks) limited any negative effects from maturation.

5.3 Future Research

The present study is limited to perceptions and intentions. The relations found may suffer from common factor bias, as the questions were parts of the same data collection instrument. Future research is needed to test the relation of financial leverage to actual future growth through longitudinal data. Personal characteristics of the small business owners also need further study in India.

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Table 1.

	Descriptive Statistics			
	Min	Max	$\bar{x}$	σ
SBG				
Sales growth over last three years	1	5	3.85	0.978
Market share growth over three years	1	5	3.60	0.944
SBP				
Net profit margin growth over last three years	1	5	3.92	0.987
Return on assets growth over last three years	1	5	3.74	0.995
Return on invested capital over last three years	1	5	3.67	0.930
FL				
Maintaining a level of financial leverage that:	1	5	3.99	0.900
Maximizes tax advantage of interest deductions	1	5	3.82	0.895
Improves company performance	1	5	3.88	0.917
Maximizes cash inflows	1	5	3.90	0.916
Minimizes chances of bankruptcy	1	5	3.77	0.963
Indicates long-term survival	1	5	3.99	0.900
Prevents takeovers	1	5	3.91	0.863

Min = Minimum Max = Maximum
$\bar{x}$ = Mean σ = Standard Deviation
SBG = Small business growth SBP = Small business performance
FL = Financial leverage

Table 2.

Total Variance Explained – Rotation Sums of Square Loadings			
	Total Variance Explained		
	Rotation Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %
1	4.577	41.611	41.611
2	2.674	24.311	65.921
3	1.713	15.573	81.495

Extraction Method: Principal Component Analysis.

Table 3.

	Rotated Component Matrix [a]		
	Component		
	1	2	3
SBG1) Sales of my company has gone up over the last three years.	0.270	0.397	**0.786**
SBG2) Market share of my company has gone up over the last three years.	0.225	0.329	**0.850**
SBP1) The net profit margin of my company has gone up over the last three years.	0.238	**0.848**	0.259
SBP2) The return on assets of my company has gone up over the last three years.	0.240	**0.846**	0.249
SBP3) The return on invested capital has gone up over the last three years.	0.249	**0.848**	0.270
I maintain a level of leverage that…:			
DF1) … Maximizes tax advantage of interest deductions.	**0.857**	0.223	0.197
DF2) … Improves company performance.	**0.858**	0.183	0.146
DF3) … Maximizes cash inflows.	**0.837**	0.161	0.187
DF4) … Minimizes chances of bankruptcy.	**0.846**	0.215	0.169
DF5) … Indicates long-term survival.	**0.838**	0.225	0.133
DF6) … Prevents takeovers.	**0.830**	0.221	0.170

Notes: [a] Extraction Method: Principal Component Analysis Rotation Method: Varimax with Kaiser Normalization
Rotation converged in 5 iterations

Table 4.

Pearson Bivariate Correlation Analysis

Entire Sample (N = 207)

	FL	SBG	SBP	LA	CA	TA	SALES	TAX	FAMILY	IND
FL	1	0.511**	0.518**	0.233**	0.078	0.406**	0.415**	0.337**	0.257**	0.121
SBG		1	0.678**	0.213**	0.125	0.370**	0.401**	0.302**	0.162*	0.004
SBP			1	0.179**	0.109	0.345**	0.432**	0.314**	0.212**	0.050
LA				1	0.187**	0.230**	0.158*	0.458**	0.171*	0.059
CA					1	0.368**	0.210**	0.286**	-0.016	-0.037
TA						1	0.405**	0.322**	0.078	-0.058
SALES							1	0.212**	0.012	-0.189**
TAX								1	0.088	0.031
FAMILY									1	0.284**
IND										1

Manufacturing Industry (N = 67)

	FL	SBG	SBP	LA	CA	TA	SALES	TAX	FAMILY
FL	1	0.761**	0.803**	0.441**	0.248*	0.750**	0.455**	0.429**	0.111
SBG		1	0.760**	0.413**	0.269*	0.661**	0.386**	0.427**	0.050
SBP			1	0.473**	0.386**	0.728**	0.337**	0.496**	0.111
LA				1	0.188	0.458**	0.177	0.381**	0.192
CA					1	0.213	0.311*	0.397**	-0.107
TA						1	0.347**	0.347**	0.004
SALES							1	0.118	-0.008
TAX								1	-0.008
FAMILY									1

Service Industry (N = 140)

	FL	SBG	SBP	LA	CA	TA	SALES	TAX	FAMILY
FL	1	0.441**	0.433**	0.160	0.019	0.288**	0.471**	0.305**	0.275**
SBG		1	0.654**	0.145	0.067	0.249**	0.440**	0.257**	0.209*
SBP			1	0.078	0.001	0.193*	0.529**	0.246**	0.239**
LA				1	0.192*	0.130	0.175*	0.489**	0.150
CA					1	0.456**	0.137	0.233**	0.040
TA						1	0.445**	0.314**	0.145
SALES							1	0.292**	0.117
TAX								1	0.120
FAMILY									1

**Correlation is significant at the 0.01 level (2-tailed)

*Correlation is significant at the 0.05 level (2-tailed)

SBG = Small business growth

SBP = Small business performance

FL = Financial leverage

LA = Long-term assets

CA = Current assets

TA = Total assets

SALES = Sales

TAX = Tax

FAMILY = Family

IND = Industry

Table 5.

Regression Coefficients [a, b, c]

Entire Sample (N = 207)

R^2 = 0.433; SEE = 0.770; F = 16.70; ANOVA's Test Sig. = 0.000

Regression Equation: FL = -1.096 + 0.196 SBG + 0.171 SBP + 0.056 LA – 0.300 CA + 0.538 TA + 0.524 SALES + 0.282 TAX + 0.244 FAMILY + 0.249 IND

	Unstandardized Coefficients		Standardized Coefficients [c]			Collinearity Statistics	
	B	Std. Error	Beta	t	Sig.	Tolerance	VIF
(Constant)	-1.096	0.230		-4.759	0.000		
SBG	0.196	0.075	0.196	2.602	0.010	0.507	1.973
SBP	0.171	0.077	0.171	2.208	0.028	0.482	2.073
LA	0.056	0.172	0.020	0.325	0.745	0.760	1.316
CA	-0.300	0.161	-0.110	-1.861	0.064	0.820	1.219
TA	0.538	0.189	0.184	2.844	0.005	0.685	1.460
SALES	0.524	0.168	0.201	3.112	0.002	0.688	1.454
TAX	0.282	0.140	0.130	2.010	0.046	0.687	1.455
FAMILY	0.244	0.116	0.122	2.113	0.036	0.859	1.163
IND	0.249	0.122	0.117	2.033	0.043	0.873	1.145

Manufacturing Industry (N = 67)

R^2 = 0.763; SEE = 0.427; F = 23.29; ANOVA's Test Sig. = 0.000

Regression Equation: FL = -0.548 + 0.217 SBG + 0.367 SBP - 0.001 LA – 0.193 CA + 0.570 TA + 0.308 SALES + 0.127 TAX + 0.090 FAMILY

	Unstandardized Coefficients		Standardized Coefficients [c]			Collinearity Statistics	
	B	Std. Error	Beta	t	Sig.	Tolerance	VIF
(Constant)	-0.548	0.291		-1.881	0.065		
SBG	0.217	0.099	0.228	2.181	0.033	0.376	2.659
SBP	0.367	0.117	0.380	3.123	0.003	0.277	3.614
LA	-0.001	0.194	0.000	-0.006	0.995	0.688	1.454
CA	-0.193	0.162	-0.091	-1.193	0.238	0.710	1.408
TA	0.570	0.221	0.259	2.574	0.013	0.406	2.466
SALES	0.308	0.132	0.170	2.341	0.023	0.773	1.294
TAX	0.127	0.143	0.070	0.887	0.379	0.653	1.531
FAMILY	0.090	0.124	0.049	0.725	0.471	0.903	1.108

Service Industry (N = 140)

R^2 = 0.351; SEE = 0.885; F = 8.87; ANOVA's Test Sig. = 0.000

Regression Equation: FL = -1.146 + 0.190 SBG + 0.083 SBP - 0.005 LA – 0.328 CA + 0.304 TA + 0.822 SALES + 0.318 TAX + 0.343 FAMILY

	Unstandardized Coefficients		Standardized Coefficients [c]			Collinearity Statistics	
	B	Std. Error	Beta	t	Sig.	Tolerance	VIF
(Constant)	-1.146	0.320		-3.583	0.000		
SBG	0.190	0.096	0.189	1.981	0.050	0.545	1.834
SBP	0.083	0.103	0.082	0.806	0.422	0.472	2.118
LA	-0.005	0.237	-0.002	-0.022	0.983	0.728	1.375
CA	-0.328	0.241	-0.110	-1.364	0.175	0.758	1.319
TA	0.304	0.293	0.093	1.037	0.302	0.610	1.640
SALES	0.822	0.294	0.259	2.797	0.006	0.579	1.728
TAX	0.318	0.198	0.139	1.610	0.110	0.665	1.504
FAMILY	0.343	0.159	0.160	2.164	0.032	0.909	1.100

[a] Dependent Variable: FL

[b] Independent Variables: SBG, SBP, LA, CA, TA, SALES, TAX, FAMILY, and IND

[c] Linear Regression through the Origin

SEE = Standard Error of the Estimate

SBG = Small business growth

SBP = Small business performance

FL = Financial leverage

LA = Long-term assets

CA = Current assets
TA = Total assets
SALES = Sales
TAX = Tax
FAMILY = Family
IND = Industry

Table 6.

Previous Findings Related to Financial Leverage of the Firm		
Author	**Findings Related to Financial Leverage of the Firm**	**Country**
Michaelas *et al.* (1999)	►Found positive relationships between i) non-debt tax shield and long-term debt, ii) firm growth and debt, iii) asset structure and debt, and iv) firm size and debt. Authors also found that level of debt is negatively correlated with profitability.	UK
Gordon and Lee (1999)	►Found that taxes have a strong effect on debt levels of small firms.	USA
Esperanca *et al.* (2003)	►Found that leverage is positively related to i) firm size, asset composition, and firm growth and ii) negatively related to firm's profitability.	Portugal
Huang and Song (2006)	►Found that leverage increases with firm size, non-debt tax shields and fixed assets, and decreases with profitability.	China
Sayılgan *et al.* (2006)	►Found that leverage ratio is i) positively related to firm size and firm growth and ii) negatively related to profitability and non-tax debt shield.	Turkey
Eldomiaty (2007)	►Found a positive relationship between firm growth and debt.	Egypt
Gill *et al.* (2009)	►Found that leverage is negatively correlated with collateralized assets and firm's profitability.	USA
Gill and Mthur (2011)	►Found that financial leverage is i) positively affected by firm size and ii) negatively affected by collateralized assets, effective tax rate, firm performance, and firm growth.	Canada

Financial and Strategic Factors Associated with the Profitability and Growth of SME in Portugal

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Abstract

Drawing on literature from finance and strategic management, eight likely factors associated with the profitability and growth of unquoted, small and medium-sized enterprises (SMEs) are identified and evaluated. These factors are: leverage, liquidity, education, industry performance, low cost, differentiation, product focus and customer focus. The sample comprises 134 unquoted SMEs aged five years or more, operating in different sectors throughout the main districts of Portugal. Data are collected through face-to-face interviews and these are supplemented with secondary sources. Twenty-one independent variables are identified and LISREL is used to produce measurement equations relating the variables to factors. Hypotheses concerning the factors' impact on profit and growth are tested through structural equation modelling using LISREL. The results show that low debt, effective liquidity management, operation in a profitable sector, differentiation, the avoidance of low cost and customer focus favour SMEs' profitability. For high growth, although effective liquidity management and differentiation remain as key factors, they are joined by a product focus. These results carry a number of important implications for SME strategy most notably that there may not be one set of strategies that maximise both profitability and growth.

Keywords: Profitability, Growth, SMEs, Performance

1. Introduction

After lagging behind Europe for nearly one century, particularly in the 1920s, Portugal started a slow process of convergence to the average levels of the EU, especially between the 1950s and the 1990s, abandoning the qualification of undeveloped country in light of the international organisations' criteria. Major changes have taken place since the freedom-based regime set up with the 25 April 1974 Revolution. The Portuguese economy has become more open, especially after accession to the EU. Despite the success of its past economic growth, the convergence process of Portugal is far from complete. To reduce the gap and to give rise to the challenges posed by globalisation and the Euro, efforts are being directed to promote the growth, productivity, and competitiveness of national firms.

That many countries have directed increasing attention to the development of their domestic SMEs to propel economic growth is a phenomenon especially evident in the developing and newly industrialised economies, which traditionally have been mostly powered by foreign investments. The purpose of this paper is to contribute to the understanding of the Portuguese SME sector by reporting on a study of the factors associated with their growth and profitability focussing on financial and strategic factors, and is structured as follows: the next section presents a literature review on the main issues analyzed, such as, capital structure/leverage; liquidity; education; industry performance; low cost strategy; differentiation; product focus; customer focus. Section three describes the variables,

hypotheses and sample. Section four explains the structural equation modeling. Section five reports the results of the empirical analysis and Section six concludes.

2. Literature Review

2.1 Capital Structure/Leverage

One of the most debatable issues in the theory of finance has been the theory of capital structure (leverage) since the celebrated work of Modigliani & Miller (1958, 1963). Thereafter, a number of theories have been put forth by bringing forward a number of frictions omitted in the original work of Modigliani & Miller so as to explain firms' optimal capital structure, should this exist, as a function of the various costs and benefits from debt and equity financing. Most celebrated are the Static Trade-off Theory; Agency Theory (Jensen & Meckling, 1976; Myers, 1977); Signalling Theory (Ross, 1977); the Pecking Order Theory (pioneered by Myers (1984), drawing largely on Myers & Majluf (1984)); and the Credit Rationing Theory (Stiglitz & Weiss, 1981).

However, research in the area is mostly confined to the determinants of capital structure, among which there are often performance measures (e.g. Booth, Aivazian *et al.* (2001); Chittenden *et al.* (1996); Hall *et al.* (2000); Jordan *et al.* (1998); Michaelas *et al.* (1999); Titman & Wessels (1988); Toy *et al.* (1974); Mira (2003); Solano & Teruel (2006); Caballero *et al.* (2010)). The Pecking Order Theory holds up well for SMEs suggesting that there is a negative relationship between leverage and debt with the more profitable firms needing to borrow less. The results for growth have been mixed but generally show a positive if not always significant relationship.

2.2 Liquidity

Liquidity, understood in terms of the availability of cash or near cash resources to meet short-term obligations, is a theme associated with the problems posed by asymmetry of information, agency relationships and credit rationing, all hinting at liquidity being a major problem for the smaller firms. This issue is an extension of the capital structure one. That smaller firms live under tight liquidity constraints is basically a matter of consensus (e.g. Chittenden *et al*. (1996); Chow & Fung (2000); Gopinath (1995); Berger & Udell (2005); Klapper *et al.* (2006); Teruel & Solano (2008, 2010)). Mechanisms through which banks restrain firms from engaging in risk-shifting behaviour (besides strict covenants and collateral) include short maturities, especially for the very small firms that do not have audited financial statements and to whom effective covenants, typically attached to medium and long-term debt, cannot therefore be imposed (Berger & Udell, 1998). Financial restrictions are largely centred on long-term loans because while debt contracts with long maturity provide the borrower with greater opportunity to shift to riskier investments and suffer financial distress, on the other hand, through a sequence of short-term credits the lender can force renegotiation frequently. For example, while collateral for long-term debt is fixed assets, collateral for short-term loans is typically accounts receivable or, as a second choice, inventory/work-in-progress (Duryee, 1994). For all of these, small firms are induced to resemble long-term finance with continuing renewal of short-term finance, not only from banks (including credit cards and overdrafts) but also from suppliers, which have relatively high cost, increase financial risk (Kotey, 1999), and damage liquidity (Chittenden *et al*., 1996). However, under the stress of credit-rationing and limited access to outside capital markets, unlisted SMEs might not find a better option than to take advantage of whatever short-term credit is available irrespective of cost. Good liquidity management should reduce impediments to growth and lead to higher profitability.

2.3 Education

Due to the emerging prominence of the Resource-Based View of competitive advantage, in the 1990s strategic management research underwent a major shift in focus from the role of industry structure and strategic positioning of firms to their bundle of resources and capabilities (Hawawini *et al*., 2003; Hoskisson *et al*., 1999; Spanos *et al*., 2004), thereby the firm being re-established as the critical unit of analysis (Hoopes *et al*., 2003; Lockett & Thompson, 2001; Spanos & Lioukas, 2001).

When Penrose (1959) argues that the firm-specific tacit knowledge of managers is the major inducement and deterrent of their firms' growth rate, she implies the more tacit knowledge a manager holds the better he/she will interpret environmental stimuli to perceive and pursue emerging opportunities for growth, and consequently, he/she will improve the odds of making the right decisions under limited information conditions, i.e., profit-maximising decisions. Penrose (1959) maintains that managers with higher entrepreneurial ability (which Johnson *et al*., 1999, argue may be enhanced by education) should perceive and pursue more and better growth opportunities in the environment as well as recombine resources efficiently and effectively, thereby sustaining superior returns. A positive relationship is thus expected between the education level and both growth and profitability.

2.4 Industry Performance

From the 1960s through the late 1980s the Market-Based View dominated analysis of variance in performance (Hawawini *et al*., 2003; Hoskisson *et al*., 1999; Lockett & Thompson, 2001; McGahan & Porter, 2002). It draws

from Industrial Organisation economics, whose basic model follows from the Structure (environment) - Conduct (strategy)- Performance paradigm which culminated in Porter's (1980) now classical formulation of the competitive strategy framework (Lockett & Thompson, 2001; Makhija, 2003; Rugman & Verbeke, 2002; Spanos & Lioukas, 2001; Spanos *et al*., 2004; Foreman-Peck *et al.,* 2006).

Through his "Five Forces Model", Porter (1980) predicts industry profitability, which is assumed to be a major determinant of firms' profitability. Consistently, most research evaluating industry effects on profitability incorporates several industry variables among the predictors' set (e.g. Pelham, 2000; Spanos & Lioukas, 2001; Van Caneghem *et al.* 2009, Daskalakis *et al.* (2009)).

Industry profitability itself can be taken as a surrogate for the industry structural forces and for the industry efficient scale. Furthermore, the sector/markets in which the firm operates is one of the six elements comprised by the component "The Firm", which is the second of three components identified by Storey (1994) to make up the key determinants that when appropriately combined would allow the small firms to achieve fast growth. Based on a survey of 14 empirical studies of small firm growth, the author (1994) concludes the bulk of studies indicate significant differences between sectors in terms of the typical growth rates of firms. It could, therefore, be expected that there is a positive relationship between the profitability of the firm and its industry and also between the growth of the firm and its industry.

2.5 Low Cost Strategy

Porter's (1980, 1985) theory of generic competitive strategy can be applied to SMEs. Porter's theory is composed of two major elements. In this study, Porter describes competitive strategies in terms of their market scope (focused *versus* broad) and contends there are two sources of competitive advantage: overall cost leadership and differentiation. It is questionable whether a low cost strategy can be successfully achieved by SMEs. Low cost hinges essentially on the economies of scale and experience arising from large volumes of sales, which are unlikely events for SMEs operating under conditions of monopolistic competition and whose shallow pockets are not able to keep up with a swift expansion of production capacity or other means to achieve large volume. Thus, regardless of how much SMEs may economise they are likely to remain too cost disadvantaged to become cost leaders and respond in kind to pressures on price from their large counterparts. Lending support of this view, Clark *et al*. (2001) based on in-depth interviews with 44 SMEs' owner-managers, identified price competition as a major constraint to growth since it imposes low costs. It is unlikely, therefore, that there would be a positive relationship between a low cost approach and growth and profitability.

2.6 Differentiation

Although differentiation may require a firm's engagement in some costly activities, it is possible that the SME can position itself as a differentiator without facing unaffordable expenditures. A distinctive service is a competitive differentiation strategy strongly supported by extant research and on which SMEs may concentrate to position themselves as differentiators. Dess & Davis (1984) report the case of one CEO belonging to the differentiation cluster arguing his firm's enjoyable high profit margins emerging from premium prices hinged more upon the *firm's* differentiation than upon the product differentiation, namely upon a reputation for superior service and quick response to buyer needs.

Horn & Harvey (1998) underline the importance of fast response for firms to survive and grow in a century where the key words are competition, dynamism, and globalisation. Sulek *et al*. (1995) note service is an important differentiating factor among otherwise similar competitors, and they further argue one way to improve service quality consists of fine tuning the service delivery system. David *et al*. (2002) argue a differentiation strategy is supported by, among other things, a high level of service, responsiveness to customer requests, and manufacturing flexibility. SMEs, being in principle less bureaucratic, with a simpler structure, greater flexibility and closer contact between senior managers and customers than their larger counterparts, should be in a better position to develop personal relationships with customers and to serve them on time, thereby providing better service to meet particular needs and avoiding delivery delays that upset customers so much. An order that is due at the client today may be useless tomorrow and even imply costs to the firm. A differentiation strategy should lead to higher growth and profitability.

2.7 Product Focus

Porter (1980) argues unless a focus strategy is used to target a neglected market, it usually involves a trade-off between profitability and sales volume, i.e., focus may limit expansion opportunities thereby constraining the overall market share achievable. Dess & Davis (1984) challenge this commonly acknowledged trade-off. Furthermore, Porter was focused on giant firms organised on a multinational basis whereas for the average SME the overall

market share achievable is small anyway. Thus, we postulate focus should also promote growth not only because it economises and optimises resources usage but also because of the opportunity focusers may have to serve the targeted segments better than broadly-targeted competitors since these latter serve others at the same time. Furthermore, despite the major argument in the literature that product diversity allows economies of scope across different product lines, oftentimes there is a trade-off between cost reduction from a configuration exploiting commonality across product lines (technological and/or market characteristics) and the differentiation premium because commonality dilutes differentiation across products; thus, the firm may have to forego a premium price for the better products causing overall profits to decline (Desai *et al*., 2001). Clearly, this applies where firms pursue a differentiation strategy to command premium prices and higher margins, which is likely to be adequate and necessary for SMEs. A product focus should lead to higher growth and profitability.

2.8 Customer Focus

Customer concentration is one of the elements of the component "Strategy", the third of three components identified by Storey (1994) to make up the key determinants that when appropriately combined would allow the small firms to achieve fast growth. Although it is widely acknowledged that reliance on a small number of customers confers them great bargaining power and represents additional risk, on the other hand, the holding of a narrow customer base allows reducing the costs of marketing and the general overheads, and it promotes customer loyalty through a closer customer-relationship. Thus, as reasoned in Birley & Westhead (1990), customer focus should be one of the most important sources of competitive advantage and thus, of above average performance for SMEs both in terms of growth and profitability.

3. Variables, Hypothesis and Sample

The variables were ratios, dummies or absolute values, averaged for the years 2007 to 2009 as appropriate. The two dependent variables were:

ROA: The SME's return on investment = net profit before interest and tax/ total assets and

GROWTH: The SME's turnover growth = (Turnover 2009 – Turnover 2007)/Turnover 2007

Twenty-one independent variables were classified and measured as described below with the relevant hypotheses (H 1-8).

H1: Leverage

There is a negative relationship between the degree of leverage and SMEs' profitability and a positive one with their growth.

AVDER1: debt to equity ratio = Total Debt/Total Equity

AVAF: financial autonomy ratio = Total Equity/Total Assets

H2: Liquidity

There is a positive relationship between effective liquidity management and SMEs' profitability and growth.

AVASTURN: assets turnover ratio = Net Sales/Total Assets

AVWORKCA: net working capital ratio = (Current Assets-Current Liabilities)/Total assets

LIQCRISI: whether the firm has experienced a severe liquidity crisis over the past 5 years, 1= Yes, 0=No

SUPHONE: whether the firm frequently pays suppliers late, 1= Frequently, 0=Not Frequently

SUPDISC: whether the firm frequently uses early payment discounts, 1= Frequently, 0=Not Frequently

H3: Education

There is a positive relationship between the years of formal education of the most influential manager in the SME and its profitability and growth.

EDU1: number of years of education of the most influential manager in the firm.

H4: Industry performance

There is a positive relationship between the profitability or growth of the industry in which an SME operates and its own profitability or growth. For profitability,

CROA: sector ROA = Sector EBIT/Total Assets, averages for 2007, 2008 and 2009

Alternatively, for growth,

CTURNGRW: sector turnover growth = (Sector Turnover 2009 – 2007)/ Sector Turnover 2007.

H5: Low cost

There is no relationship or a negative relationship between a low cost approach and SMEs' profitability and growth.

BUDGET: whether the firm prepares budgets at least on a yearly basis, 1=Yes, 0=No

LOWCOST: importance attached to continuing, overriding concern for the lowest cost per unit = percentage importance attached

OWNSTOR: whether the firm has its own stores, 1=Yes, 0=No

MPLIST: whether the firm is able to extract a reliable and computerised list of stocks of raw materials at any time, 1=Yes, 0=No

TRUEACC: whether the firm has a true cost accounting system in place, 1=Yes, 0=No.

H6: Differentiation

There is a positive relationship between differentiation and SMEs' profitability and growth.

OWNPROD: percentage of turnover that is own-product.

BRANPRIC: whether brand name, product prestige, or firm reputation is important for the firm's pricing, 1=Yes to any, otherwise =0

PRODCERT: whether major product has a quality stamp on it, 1=Yes, 0=No

PRODELAY: whether deliveries delays occur at least twice a year, 1=Yes, 0=No

H7: Product focus

There is a positive relationship between a product focus and SMEs' profitability and growth.

PRODFOCU: percentage of total turnover contributed by the major product

H8: Customer focus

There is a positive relationship between a customer focus and SMEs' profitability and growth.

CUSFOCUS: percentage of total turnover contributed by the most important customer type.

The sample comprises 134 unquoted SMEs aged five years or more, operating in different sectors throughout the main districts of Portugal. Data were mostly collected through face-to-face interviews and were supplemented with secondary data.

4. Structural Equations Modelling and Lisrel

Structural Equation Modelling (SEM) is a collection of statistical techniques to define, fit and test structural relationships between a number of predictors and one or more dependent variables (Jöreskog & Sörbom, 1993; Ullman, 2001). The term 'structural' is employed because relationships in SEM account for variation among variables that are subject to measurement error or uncontrolled variation, which is the case for every research field where controlled experimentation is not feasible and the scope of the problem goes beyond simple empirical prediction. A structural equation model is a set of sub-models each one represented by a mathematical equation with the dependent variable as a function of the direct 'causes'; thus, it is a system of linear equations that represent the hypothesised cause and effect structural relationships among quantitative variables (Jöreskog & Sörbom, 1993; Tacq, 1997). The problem in SEM is that of estimating the coefficients of such linear structural equations (Jöreskog & Sörbom, 1993).

Historically SEM has been referred to as 'causal modelling'. However, just like in regression, causality in SEM remains a design issue: there is nothing causal about SEM in the statistical sense as many wrongly believe (Shook *et al*., 2004; Ullman, 2001). In every uncontrolled observational study the change in the dependent variable that accompanies a unit change in any one predictor does include not only the effect of that predictor but also the effect of any confounding variables that might be changing simultaneously (Field, 2000; Wonnacott & Wonnacott, 1990), from what follows causality can only be established out of experimental settings (Tabachnik & Fidell, 2001), out of strong theoretical underpinnings for cross-sectional research (Shook *et al.*, 2004), or in longitudinal research, where the temporal ordering of variables is demonstrated (Kelloway, 1995).

Although the concept of SEM was firstly introduced by Sewell Wright (a population biologist at the University of Chicago) more than 80 years ago, it was only over the past 30 years that it became a prominent form of data analysis, thanks to the LISREL programme which has meanwhile become synonymous with SEM (Jöreskog & Sörbom, 1993; Toit & Toit, 2001). The LISREL methodology development started in 1970 with Prof. Karl Jöreskog and five years later the first LISREL programme (version 3) was being published (Toit & Toit, 2001). LISREL stands for 'Linear

Structural Relations', though its current version is also capable of handling non-linear relationships (Toit & Toit, 2001).

5. Results

5.1 Measurement Equations

LISREL was used to reduce the above 21 variables to nine which were named: nodebt, lackliq, educatio, roapot, growpot, lowcost, different, prodfocu and cusfocus. The measurement equations are presented in Table 1 (see appendix 1 for parameter details).

Insert Table 1 Here

The equations reported in Table 1 resulted in four that combined variables and five that comprised the original single variable and can be summarized as follows in Table 2:

Insert Table 2 Here

5.2 Structural Equations

The nine variables were then subject to structural equation modelling in LISREL. Seven of the variables were common to the two dependent variables and two were used alternatively for ROA (roapot) and growth (growpot). The results are shown in Table 3.

Insert Table 3 Here

Since high levels of correlation were found between some factors, orthogonal rotations were performed to deal with this. For example, for "nodebt" and "lackliq" the correlation was -0.682, $p<0.001$, so the syntax line "Set covariance of "nodebt" and "lackliq" to 0" was added and the analysis rerun to check for any effects on sign and significance. This resulted in a change in sign and, or, significance for some factors in relation to profitability and, or, growth. The results for the t-tests after rotation are shown in Table 4 below.

Insert Table 4 Here

The results shown in Exhibit 4 confirm many of the hypothesised relationships. For "nodebt" and ROA, because it was hypothesised that there would be a negative relationship between debt and profitability, a positive relationship would be expected for "nodebt". This is the case and is significant confirming the hypothesis. For growth, it was hypothesised that there would be a positive relationship with debt and so a negative one with "nodebt". This is the case but it is not significant.

The results for "lackliq" are in the hypothesised direction for both profitability and growth. As with "nodebt" the expected sign is the reverse of that hypothesised which was positive for liquidity so negative for a lack of liquidity. Both results are significant suggesting that this is a key factor for both profitability and growth.

Years of education are positively associated with profitability and growth, as hypothesised but are not significant. This does not disprove the popular notion that good management is learnt from experience not formal education.

The profitability of the sector in which an SME operates has a significant positive effect on its own profitability as hypothesised but there is no significant effect of sector growth on the individual SME's growth.

As hypothesised, there is a negative link between "lowcost" and profitability and growth but this is only significant for profitability.

Lastly, differentiation is, as expected, positively and significantly related to profitability and growth.

Interestingly, although both product focus and customer focus were expected to positively affect profitability and growth, the results show that they are both positively related to growth (significantly for prodfocu) and both negatively related to profitability (significantly for cusfocus).

6. Conclusions

The results show that low debt, effective liquidity management, operation in a profitable sector, the avoidance of a low cost approach, the use of differentiation and the avoidance of a customer focus are associated with SMEs' profitability. For high growth, effective liquidity management and differentiation remain important but a product focus is also required. These results carry a number of important implications for SME strategy.

Of immediate concern is the finding that there may not be one set of strategies that maximise both profitability and growth. Indeed of the nine factors only two, effective liquidity management and differentiation, seem to pay off for both. From then on a trade-off may be required or a decision to pursue one or the other of profitability or growth.

Secondly, the result for the relationship between leverage and profitability is less useful than might appear as far as strategic implications are concerned. As was confirmed, there is a significant negative relationship between leverage and profitability for SMEs and this is explained by the Pecking Order Theory (POT). In turn, the POT reflects agency-type problems and information asymmetry in lending to, and borrowing by, SMEs rather than strategic choices by SMEs. Highly profitable SMEs need to borrow less than less profitable ones. Not borrowing to achieve profit confuses the direction of causation and is not a feasible strategy.

Thirdly, the results show the importance of liquidity management and differentiation. Whilst liquidity management may be a relatively unglamorous aspect of management, its inclusion as a strategy is likely to reap rewards both in terms of profitability and growth as is a strategy of differentiation.

Finally, the results show that SMEs could adopt different strategies depending on whether their aim is high profitability or high growth. It is conceivable that, whilst profitability should be the key concern, SMEs may want to grow rapidly at certain times in order to, for example, penetrate a market, increase market share or achieve a stock market flotation. Consequently, profitable periods may be preceded and, or, followed by growth maximising periods. In either case, strategy should emphasise liquidity management and differentiation but a growth strategy should emphasise a product focus and a profitability strategy should emphasise seeking out a profitable sector and avoidance of a customer focus.

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Table 1. Measurement equations

AVAF = 0.94 nodebt	Error var.= 0.12	$R^2 = 0.88$
AVDER1 = - 0.82 nodebt	Error var.= 0.33	$R^2 = 0.67$
AVASTURN = - 0.39 differen - 0.34 lackliq	Error var.= 0.87	$R^2 = 0.13$
AVWORKCA = - 0.59 lackliq	Error var.= 0.65	$R^2 = 0.35$
LIQCRISI = 0.83 lackliq	Error var.= 0.31	$R^2 = 0.69$
SUPHONE = 0.51 lackliq	Error var.= 0.74	$R^2 = 0.26$
SUPDISC = - 0.67 lackliq	Error var.= 0.55	$R^2 = 0.45$
EDU1 = 1.00 educatio		$R^2 = 1.00$
CROA = 1.00 roapot		$R^2 = 1.00$
CTURNGRW = 1.00 growpot		$R^2 = 1.00$
BUDGET = 0.35 differen + 0.69 lowcost	Error var.= 0.45	$R^2 = 0.55$
LOWCOST = 0.20 lowcost	Error var.= 0.96	$R^2 = 0.040$
OWNSTOR = - 0.76 lowcost	Error var.= 0.43	$R^2 = 0.57$
MPLIST = 0.38 lowcost	Error var.= 0.85	$R^2 = 0.15$
TRUEACC = 0.70 lowcost	Error var.= 0.51	$R^2 = 0.49$
OWNPROD = 0.57 differen	Error var.= 0.67	$R^2 = 0.33$
BRANPRIC = 0.58 differen	Error var.= 0.66	$R^2 = 0.34$
PRODCERT = 0.52 differen	Error var.= 0.73	$R^2 = 0.27$
PRODELAY = - 0.47 differen	Error var.= 0.78	$R^2 = 0.22$
PRODFOCU = 1.00 prodfocu		$R^2 = 1.00$
CUSFOCUS = 1.00 cusfocus		$R^2 = 1.00$

Table 2. Composition of variables

*nodebt***:** low leverage or financial slack factor including debt to equity ratio (AVDER1) and financial autonomy ratio (AVAF).
lackliq: lack of liquidity/bad liquidity management factor including assets turnover ratio (AVASTURN), net working capital ratio (AVWORKCA), liquidity crisis dummy (LIQCRISI), frequent late payment to suppliers dummy (SUPHONE) and frequent use of early payments discount dummy (SUPDISC)..
*educatio***:** years of education (EDU1)
roapot: sector ROA ratio (CROA)
growpot; sector growth ratio (same as (CTURNGRW)
lowcost: low cost strategy factor including: preparation of annual budget dummy (BUDGET), overriding concern for lowest cost per unit ratio (LOWCOST), whether the firm had its own stores dummy (OWNSTOR), ability to extract stock information dummy (MPLIST) and true cost accounting system in place dummy (TRUEACC).
differen: differentiation factor including: extent to which firm is own product based ratio (OWNPROD), importance of brand name/product prestige/firm reputation for pricing dummy (BRANPIC), whether major product has quality stamp dummy (PRODCERT) and whether deliveries delays occur at least twice a year dummy (PRODELAY). The asset turnover ratio (AVASTURN) and preparation of annual budget dummy (BUDGET) also load on to this factor.
prodfocu: product focus strategy (PRODFOCU)
cusfocus: customer focus strategy (CUSFOCU).

Table 3. Structural Equations *(before rotation for highly correlated factors)*

ROA =	
-0.79 nodebt (0.15)	t = -5.22*
-1.34 lackliq (0.14)	t = -9.30*
+0.12 educatio (0.16)	t = 0.77
+0.43 roapot (0.095)	t = 4.55*
-0.027 lowcost (0.18)	t = -0.16
-0.47 differen (0.13)	t = -3.70*
-0.064 prodfocu (0.045)	t = -1.42
-0.084 cusfocus (0.049)	t = -1.73*
Errorvar.= 0.38 (0.11)	t = 3.57*
R^2 = 0.62	

GROWTH =	
-0.50nodebt (0.19)	t = -2.56*
-0.38lackliq (0.15)	t = -2.63*
+0.19educatio (0.18)	t = 1.06
+0.016growpot (0.050)	t = 0.32
+0.047lowcost (0.091)	t = 0.52
+0.089differen (0.058)	t = 1.55
+0.15prodfocu (0.033)	t = 4.66*
+0.059cusfocus (0.038)	t = 1.55
Errorvar.= 0.81 (0.100)	t = 8.16*
R^2= 0.19	

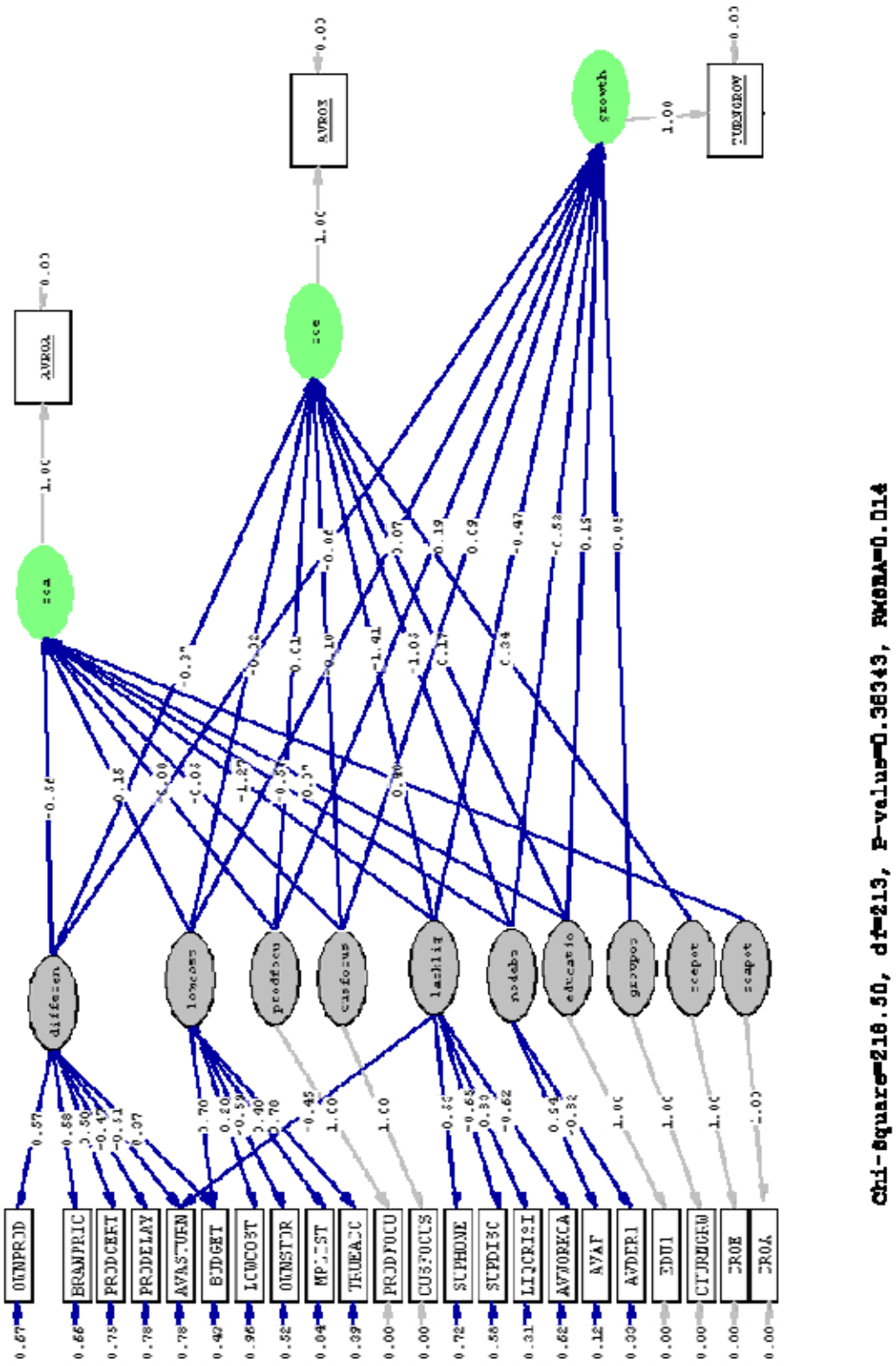
** significant at the 5% level*

Table 4. t-statistics for structural equations after rotation

Factor	ROA	Growth
nodebt	+ 5.51*	-0.64
lackliq	-7.77*	-1.99*
eductio	+0.77	+1.06
roapot	+4.55*	--
growpot	--	+0.32
lowcost	-3.67*	-1.31
different	+2.80*	+5.59*
prodfocu	-1.42	+4.66*
cusfocus	-1.73*	+1.55

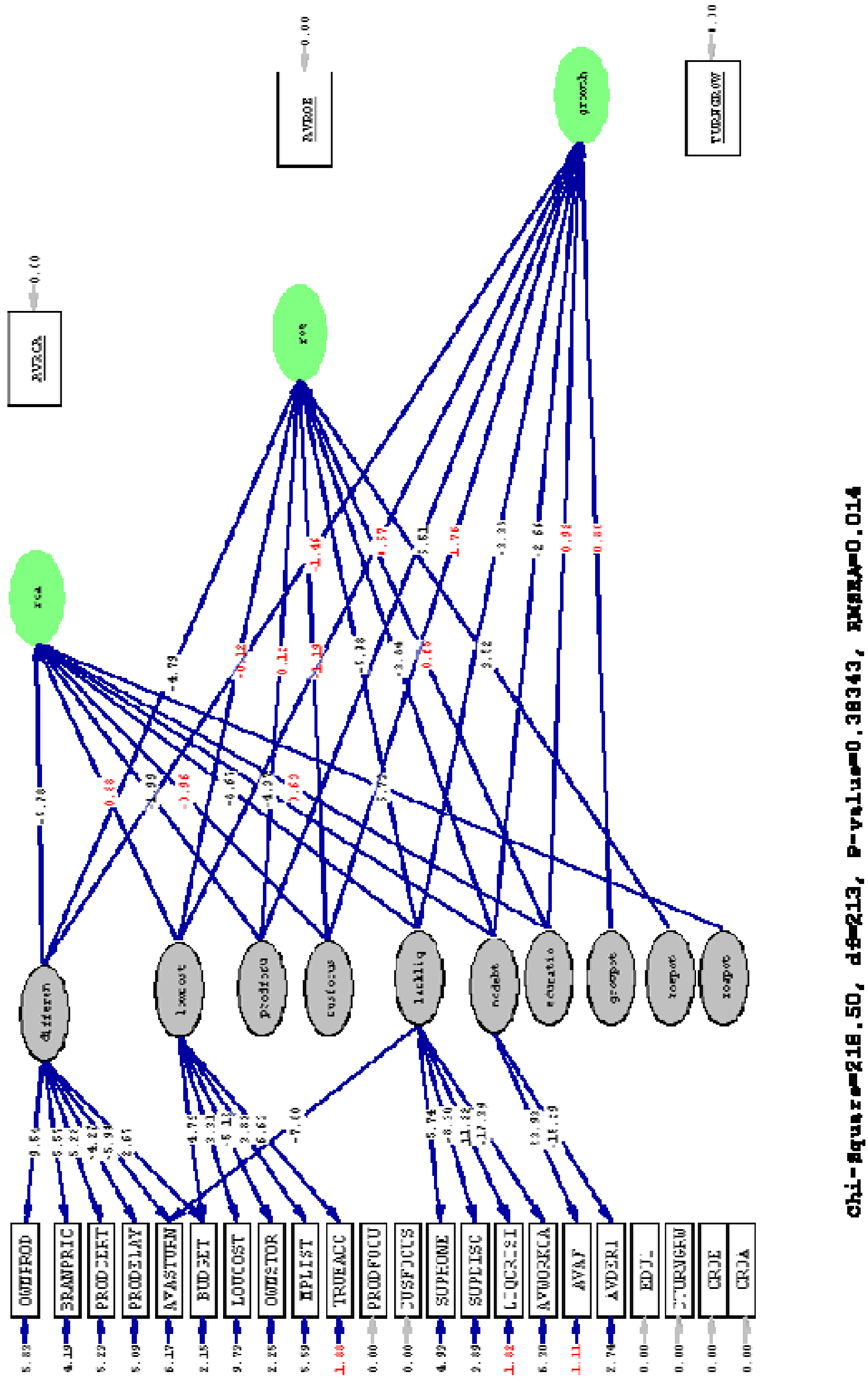
Appendix 1. Database 1 (A1B1C1): Parameter Estimates

A1: No transformations performed; B1: Retention of univariate outliers with alteration; C1: Imputation of missing values on SECTOR TURNOVER GROWTH



Appendix 1 (cont). Database 1 (A1B1C1): LISREL Model T-Values

A1: No transformations performed; B1: Retention of univariate outliers with alteration; C1: Imputation of missing values on SECTOR TURNOVER GROWTH


roa
roe
growth
AVRCA
AVROE
TURNGROW
Chi-Square=218.50, df=213, P-value=0.38343, RMSEA=0.014

Appendix 1 (cont). Database 1 (A1B1C1): LISREL Model in Equation Form

A1: No transformations performed; B1: Retention of univariate outliers with alteration; C1: Imputation of missing values on SECTOR TURNOVER GROWTH

Measurement Equations	Structural Equations
OWNPROD = 0.57*differen, Errorvar.= 0.67 , R^2 = 0.33 (0.060) (0.12) 9.54 5.83	**roa**= -0.56*differen +0.15*lowcost -0.083*prodfocu -0.053*cusfocus (0.098) (0.17) (0.041) (0.055) -5.78 0.88 -1.99 -0.96
BRANPRIC = 0.58*differen, Errorvar.= 0.66 , R^2 = 0.34 (0.10) (0.16) 5.57 4.19	- 1.27*lackliq - 0.57*nodebt +0.074*educatio + 0.48*roapot (0.15) (0.13) (0.12) (0.085) -8.67 -4.37 0.63 5.73
PRODCERT = 0.50*differen, Errorvar.= 0.75 , R^2 = 0.25 (0.095) (0.14) 5.28 5.23	Errorvar.= 0.33, **R^2= 0.67** (0.13) 2.62
PRODELAY = - 0.47*differen, Errorvar.= 0.78 , R^2 = 0.22 (0.11) (0.15) -4.27 5.09	**roe**= -0.37*differen -0.024*lowcost +0.0061*prodfocu -0.097*cusfocus (0.078) (0.20) (0.050) (0.082) -4.79 -0.12 0.12 -1.19
AVASTURN = - 0.51*differen - 0.45*lackliq, Errorvar.= 0.78 , R^2 = 0.22 (0.086) (0.058) (0.13) -5.94 -7.80 6.17	-1.41*lackliq -1.05*nodebt +0.17*educatio +0.34*roepot (0.24) (0.27) (0.26) (0.095) -5.98 -3.84 0.65 3.52
BUDGET = 0.37*differen + 0.70*lowcost, Errorvar.= 0.43 , R^2 = 0.57 (0.14) (0.15) (0.20) 2.67 4.79 2.15	Errorvar.=0.36, **R^2= 0.64** (0.11) 3.31
LOWCOST = 0.20*lowcost, Errorvar.= 0.96 , R^2 = 0.039 (0.060) (0.099) 3.31 9.73	**growth**= - 0.059*differen +0.074*lowcost +0.19*prodfocu +0.090*cusfocus (0.040) (0.11) (0.029) (0.051) -1.46 0.67 6.51 1.76
OWNSTOR = - 0.69*lowcost, Errorvar.= 0.52 , R^2 = 0.48 (0.14) (0.23) -5.12 2.25	- 0.47*lackliq -0.53*nodebt +0.19*educatio +0.048*growpot (0.14) (0.20) (0.21) (0.060) -3.38 -2.66 0.92 0.80
MPLIST = 0.40*lowcost, Errorvar.= 0.84 , R^2 = 0.16 (0.11) (0.15) 3.82 5.59	Errorvar.= 0.78, **R^2= 0.22** (0.10) 7.67
TRUEACC = 0.78*lowcost, Errorvar.= 0.39 , R^2 = 0.61 (0.12) (0.21) 6.63 1.88	
PRODFOCU = 1.00*prodfocu, R^2 = 1.00	
CUSFOCUS = 1.00*cusfocus, R^2 = 1.00	
SUPHONE = 0.53*lackliq, Errorvar.= 0.72 , R^2 = 0.28 (0.093) (0.15) 5.74 4.93	
SUPDISC = - 0.65*lackliq, Errorvar.= 0.58 , R^2 = 0.42 (0.078) (0.15) -8.30 3.89	
LIQCRISI = 0.83*lackliq, Errorvar.= 0.31 , R^2 = 0.69 (0.074) (0.17) 11.22 1.82	
AVWORKCA = - 0.62*lackliq, Errorvar.= 0.62 , R^2 = 0.38 (0.035) (0.099) -17.39 6.30	
AVAF = 0.94*nodebt, Errorvar.= 0.12 , R^2 = 0.88 (0.039) (0.11) 23.93 1.11	
AVDER1 = - 0.82*nodebt, Errorvar.= 0.33 , R^2 = 0.67 (0.053) (0.12) -15.29 2.74	
EDU1 = 1.00*educatio, R^2 = 1.00	
CTURNGRW = 1.00*growpot, R^2 = 1.00	
CROE = 1.00*roepot, R^2 = 1.00	
CROA = 1.00*roapot, R^2 = 1.00	
AVROA = 1.00*roa, R^2 = 1.00	
AVROE = 1.00*roe, R^2 = 1.00	
TURNGROW = 1.00*growth, R^2 = 1.00	

Legend for Appendix 1

OWNPROD: extent to which the firm is own-product based.

BRANPRIC: whether brand name, product prestige, or firm reputation is important for the firm's pricing.

PRODCERT: whether major product has a quality stamp on it.

PRODELAY: whether deliveries delays occur at least twice a year.

AVASTURN: assets turnover ratio.

BUDGET: whether the firm prepares budgets at least on a yearly basis.

LOWCOST: importance attached to continuing, overriding concern for the lowest cost per unit.

OWNSTOR: whether the firm has its own stores.

MPLIST: whether the firm is able to extract a reliable and computerised list of stocks of raw materials at any time.

TRUEACC: whether the firm has a true cost accounting system in place.

PRODFOCU: percentage of total turnover contributed by major product.

CUSFOCUS: percentage of total turnover contributed by the most important customer type.

SUPHONE: whether the firm frequently pays suppliers late.

SUPDISC: whether the firm frequently uses early payment discounts.

LIQCRISI: whether the firm has experienced a severe liquidity crisis over the past 5 years.

AVWORKCA: net working capital ratio.

AVAF: financial autonomy ratio.

AVDER1: debt to equity ratio.

EDU1: years of education of the most influential manager in the firm.

CROA: sector ROA.

CROE: sector ROE.

CTURNGRW: sector turnover growth.

differen: differentiation strategy.

lowcost: low cost strategy.

prodfocu: product focus strategy.

cusfocus: customer focus strategy.

lackliq: lack of liquidity/bad liquidity management.

nodebt: low leverage or financial slack.

educatio: years of education of the most influential manager in the firm.

roapot: sector ROA.

roepot: sector ROE.

growpot: sector turnover growth.

AVROA: firm ROA.

AVROE: firm ROE.

TURNGROW: firm turnover growth.

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The Determinants of Health Expenditure in Italian Regions

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Abstract

The health care expenditure in Italian regions is examined, applying the model selection procedure and panel methodologies to identify the determinants of health expenditure at the state level. After a brief introduction and a survey of the economic literature on this issue, we discuss the data and briefly introduce the methodologies. Empirical results suggest that the real Gross State Product, the unemployment rate, the number of beds in community hospitals, the urbanization degree and the percentage of the population with at least the junior high school degree had a direct impact on the real health care outlay. Furthermore, the income elasticity is below the unity (0.83-0.88 according to the static panel estimates, 0.43-0.48 for the dynamic methods), implying that health expenditure is a necessity rather than a luxury good at the state level.

Keywords: Health policies, Households' expenditure, GSP, Panel data, Italian regions

1. Introduction

Health is one of essential factors for any country's economic development and therefore plays an important role in economy activities.

Over the past three decades, a lot of studies – using the concepts of cointegration and Granger causality – focused on several countries and time periods. Since the pioneering studies by Kleiman (1974), Newhouse (1977) and Cullis and West (1979), empirical findings are mixed and, for some countries, controversial (Devlin and Hansen, 2001). The results differ even on the direction of causality and the short-term versus long-term effects on health policies. Depending upon what kind of causal relationship exists, its policy implications may be significant.

Moreover, multiple causality studies have been done for many countries in the world; however, few studies have been devoted to the analysis of this nexus for the Italian case (Piperno and Di Orio, 1990; Devlin and Hansen, 2001; Giannoni and Hitiris, 2002; Erdil and Yetkiner, 2009; Romagnoli, 2009; Magazzino, 2011b; Magazzino and Mele, 2011).

This study examines the determinants of health care households' expenditure in Italian regions for the period 1980-2009, using panel methodologies, at a time when the country is intensely re-examining the structure of its health care system. The results might help to define and implement the appropriate health development policies in these regions. The data used are obtained by ISTAT.

Besides the Introduction, the outline of this paper is organized as follows. Section 2 discusses the determinants of health care expenditure. In section 3 we illustrate the empirical methodology and the data; afterwards, we show and comment the empirical findings. The last section concludes with some interpretation of our main findings.

2. The Determinants of Health Expenditure

In Italy, starting from 1992, a set of reforms was specifically designed to increase the autonomy of Regional Health Authorities in both the financing and delivery of health care. Regions have thus carried out differentiated policies. Therefore we should expect some strategic interaction, especially after the decentralization process was deepened

during the last decade in order to appoint regions with exclusive health care responsibilities.

The impact of health expenditure on public finance is becoming a usual topic of recent comments and analysis. Textbook economic theory suggests that demand for a good/service by a utility-maximizing consumer depends on two factors: income and relative price. Most of the studies report an income elasticity exceeding unit, implying that health care is a luxury good. (In contrast, Wang (2009) found a cross-section income elasticity of health care around 0.7, implying that health care is a necessity rather than a luxury good at the state level.)

A point of debate among economists is whether the public sector should intervene or not in the short-term fluctuations in economic activity. If classical economists have always opposed such a kind of public action, the Keynesian school of thought invoked fiscal policies to support the economy during recessions. In fact, the classical economists believed that market forces were able to quickly bring economies to a long-run equilibrium, through adjustments in the labor market. Instead, the Keynesians took the fallibility of such self-regulatory mechanisms, precisely because of rigidities in the labor market. To this end, the school has prescribed Keynesian expansionary fiscal policies in order to avoid long slumps.

The first model on the determinants of public expenditure is "Wagner's Law" (Wagner, 1883). According this theory, public expenditure is essentially explained with the evolution of GDP. As confirmed by CEIS analyses (CEIS, 2009), GDP remains the most "important" determinant of health expenditure, as a proxy of earned economic conditions (for analyses and discussions on Wagner's Law in the Italian and European cases see Magazzino (2009a, 2009b, 2011a)).

Newhouse (1977) found a positive effect of income on health expenditures at the national level, assuming no price effect. Gerdtham and Jönsson (1991a, 1991b, 2000) found a strong negative effect of relative prices on quantity demanded, with a price elasticity of -0.84; and Milne and Molana (1991) reached about a similar empirical results. So, as has been shown in Blomqvist and Carter (1997), Di Matteo and Di Matteo (1998), Freeman (2003), omitting relative price in regressors' set when its effect is significant clearly will carry out to biased estimations.

Hall and Jones (2007) argued that the optimal share of spending on health increases as incomes rise, since spending money on life extension allows individuals to escape diminishing marginal utility of consumption within a period.

Spinks and Hollingsworth (2009) has analyzed a number of theoretical questions in order to make some international comparisons of the technical efficiency of health production, enlarging their study to all social policy, and not just health policies.

Wang (2009) has examined the determinants of health expenditure using a homogeneous panel of data for the US states. As a result, gross state product, the proportion of the population over the age of 65 years, the degree of urbanization and the number of hospital beds are the four key determining factors.

Erdil and Yetkiner (2009) have investigated the Granger-causality relationship between real per-capita Gross Domestic Product and real per-capita health care expenditure. Their findings show that the relevant type of Granger-causality is the bidirectional one. The results show that one-way causality generally runs from income to health in low and middle-income countries, whereas the reverse holds for high-income countries.

Lin (2009) has studied the relationship between economic cycle and health expenditures. By using data obtained from eight Asia-Pacific countries over the period 1976 to 2003 and fixed-effects regression model, his results indicates that unemployment rate is negatively and significantly correlated with total mortality and mortality rates from cardiovascular diseases, motor vehicle accidents and infant mortality. According to this empirical evidence, health might improve during economic downturns. In addition, suicide is found to move counter-cyclically. The results also show that unemployment affected mortality rates in an immediate and contemporaneous way.

Narayan (2009) has examined the behaviour of per-capita health expenditures and per-capita GDP for 11 OECD countries, using a non-parametric test for two forms of asymmetries (deepness and steepness). The empirical evidence underlines as, for six out of the 11 countries (the USA, the UK, Japan, Spain, Finland and Iceland), either per-capita health expenditures or per-capita GDP are characterized by asymmetric behaviour.

As regards the relationship between aggregate income and health care for Italian regions, Magazzino (2011b) found the presence of a long-run relationship in fifteen out of twenty regions. Moreover, dividing the sample into three more homogeneous macro-regions (North, Centre and South), a long-run relationship between health expenditure and aggregate income has been found in two areas. Furthermore, the income elasticity is below the unity, implying that health expenditure is not a luxury good.

A lot of study – Kleiman (1974), Newhouse (1977), Leu (1986), Parkin *et al.* (1987), Posnett and Hitiris (1992), Gerdtham (1992), Pritchett and Summers (1996), Hansen and King (1996), Blomqvist and Carter (1997), Barros (1998), Roberts (1999), and Narayan (2009) – have shown that a significant percentage of variation in per capita

health care expenditure (across countries and in time) could be explained by variations in per capita GDP. This is often dubbed "direct causation".

Yet, health expenditure also has an explanatory power on GDP, and this is dubbed "reverse causation" (Rivera and Currais, 1999).

Moreover, health determines school participation and learning and hence human capital accumulation (Galor and Mayer-Faulkes, 2003). Another crucial assumption is that health care expenditures must have positive effects on labour productivity (according to the "efficiency wages" hypothesis) (Barlow, 1979; Srinivasan, 1992; Strauss, 1993; Behrman and Deolalikar, 1988; Muysken *et al.*, 2003; Schultz and Tansel, 1997; Glick and Sahn, 1998; Rivera and Currais, 2005).

However, misspecification problem occurs if causality is simultaneous in both directions. Doing so, OLS estimation will produce biased and inconsistent estimates of the structural parameters given that there is an endogenous relationship between GDP and health care spending. Therefore, it is important to determine the direction of the causality relationship between health care expenditures and GDP.

Furthermore, there is the possibility that the economy may respond asymmetrically to positive shocks than to negative shocks (Beaudry and Koop, 1993).

Brenner conducted a series of studies (1971, 1975, 1979 and 1987) and found that recessions and economic instability have a potentially adverse effect on health, while subsequent studies wasn't able to find an analogous empirical evidence (Wagstaff, 1985; Cook and Zarkin, 1986; McAvinchey, 1988; Joyce and Mocan, 1993).

Certain other studies supported the view that recessions are often accompanied by a higher unemployment rate, increased psychosocial stress, declining income, reduced psychological well-being: these effects lead to deterioration in both mental and physical health. As a result, suicide was strongly associated with labour market conditions (Yang and Lester, 1995; Viren, 1996; Lewis and Sloggett, 1998).

Some recent works underline as the total mortality rates were pro-cyclical, showing the trade-off between unemployment rates and mortality rates. The main the findings of these researches provided evidence that health improves during economic downturns (Ruhm, 2000; Laporte, 2004; Neumayer, 2004; Ruhm, 2004; Tapia Granados, 2005a, 2005b; Gerdtham and Ruhm, 2006).

On the contrary, Gerdtham and Johannesson (2003) found that recessions increase the mortality rate for men, but don't have any effect in relation to women.

3. Data and Empirical Results

We consider the following nine variables in explaining real health expenditures (*HE*): real Gross State Product (*GSP*), unemployment rate (*U*), % of households who complains air pollution (*URBAN*), mortality rate (*M*), birth rate (*B*), the number of beds in community hospitals (*HPBED*), the resident population for generic physicians (*PHYSN*), % of the population with at least the junior high school degree (*EDUCATION*) and the ageing index (*AGEING*). In particular, the causal relationship between health care and aggregate income could be interpreted in two different ways: viewing the former as a cost or as a social-economic investment (CEIS, 2009). The fact that most other OECD countries have also experienced substantial growth in their health sector over the last half century makes the secular rise in incomes a natural candidate to explain the rise in the health share of GDP in Italy. As regards the nature of demographic variables, the model considers the ageing index (Note 1), as well as the general rate of mortality (the latter inserted as proxy of the so-called "cost of death"). The educational degree has been included in the model to capture the impact of social characteristics; while the number of public beds is introduced in the model in an attempt to analyze the impact of possible phenomena of supply induced demand, as an inappropriate spending generated on the supply side. Moreover, the resident/physicians ratio should be regarded as a proxy of the regional (in)efficiency. Finally, we expect that as industrialization goes up, environmental externalities increase, pushing up the health care expenditure.

Due to data availability, we focus on the sample period 1980-2009. We derived the data from *Health for All-Italy* database – a geographic information system on sanity and health – provided by ISTAT (Note 2) (Figure 1).

The empirical methodology used in this paper refers to the basic panel data models. In formal hypothesis testing, a variable is (not) included as an explanatory variable in the model if its coefficient is (not) significantly different from 0 by a *t*-test. More problematically, in large dimension problems two variables may be insignificant only because they are highly correlated. If insignificant variables are excluded sequentially (another practice in empirical studies), there is a problem of which one to exclude first. An alternative to the formal hypothesis testing is the model selection approach, which, based on information criteria, is more objective as it weighs in both model fit and

complexity (relative to the sample size). Throughout the article, we focus on the application of Schwarz's (1978) Bayesian Information Criterion (BIC). In application, we minimize BIC over a domain of models with all possible combinations of explanatory variables. The model with the smallest loss is selected.

In this paper, static panel-type analyses were conducted through GLS-FE (Generalized Least Squares-Fixed Effects), while for the dynamic estimates we applied the GMM (Generalized Method of Moments) estimators (Note 3).

Following Buchanan (1965), Fraser (1978), Leu (1986), Cromwell and Mitchell (1986), Fuchs (1990), Karatzas (2000), CEIS (2009) and Wang (2009), we consider the following explanatory variables in explaining health expenditures (HCE):

$$HE_{i,t} = \beta_0 + \beta_1 GSP_{i,t} + \beta_2 U_{i,t} + \beta_3 URBAN_{i,t} + \beta_4 M_{i,t} + \beta_5 B_{i,t} + \beta_6 HPBED_{i,t} + \beta_7 PHYSN_{i,t} + \beta_8 EDUCATION_{i,t} + \beta_9 AGEING + \varepsilon_{i,t} \quad [1]$$

It is hypothesized that, of these variables, changes in the real GSP, in the unemployment, in the urbanization degree, in the birth rate, in the number of hospital beds, in the ratio of physicians and in the ageing will be positively associated with the dependent variable (*HE*); whereas a negative association between the mortality rate, or the educational level and the real health care expenditure would exist. We derived the logarithmic series of some independent variables (*HE*, *GSP*, *URBAN*, *HPBED*, *PHYSN*, *EDUCATION* and *AGEING*), causing the coefficients to be elasticities. Also, the logarithmic linear form reduces heteroskedasticity.

Correlation coefficients summarized in Table 1 below indicate, especially, a high positive correlation between health expenditure and aggregate income (r=0.98); moreover, the correlation between health expenditure and the number of beds in community hospitals, as well as that between the latter and *GSP* is very high (r=0.94).

Furthermore, it's relevant to underline the strong correlation between health expenditure and urbanization degree (r=0.71), *GSP* and *URBAN* (r=0.78), unemployment and the ageing index (r=-0.70), mortality and birth rates (r=-0.74), mortality and *AGEING* (r=0.86), and birth rate and *AGEING* (r=-0.79).

The results in Table 2 are consistent with the maintained hypotheses. In fact, the model provides a good of fit to the data, since R^2=0.98: therefore, about 98% of the variance of the real health expenditure is collectively explained by the regressors. More specifically, our empirical results suggest that real health care expenditure is income elastic. Further, the urbanization degree is positively elastic, mirroring the effect of different kinds of pollution. Moreover, the dependent variable is also positively related to the hospital beds, while negatively to the educational indicator, as hypothesized. For the sample period, the mortality rate, the birth rate and the resident population for generic physicians are all insignificant.

Since each of the 9 candidate variables may be either included in or excluded from model *[1]*, there are a total of 2^9=512 possible model specifications (a constant is always included). For each specification, we compute a loss function BIC, and which one with the smallest value of BIC has been selected (Note 4).

As shown in Table 3, income has the largest effect on *HE*, ranging from 0.62 to 0.83. It is noteworthy that a significant percentage of variation in health care expenditure (across countries and in time) could be explained by variations in GDP. The magnitude of the elasticity also appears to be reasonable. In fact, it is comparable to Di Matteo and Di Matteo's (1998) estimate of 0.77 based on Canada's provincial data, as well as to Wang (2009) of 0.71. Moreover, our income elasticity estimates are quite similar to that of Freeman (2003) estimates (from 0.82 to 0.84). It is widely observed that Italian health expenditure growth rate turned up in the 1990s. *URBAN* has the expected (positive) sign, since negative externalities due to urbanization degree push up health expenditures. The stock of hospital beds has a small but statistically significant positive effect on *HE*, consistent with the supply-induced demand theory, as shown in Evans (1984). The elasticity of *AGEING* is positive (0.34), meaning that older people tend to use more health care than the working age population. Finally, in contrast to the previous estimates in Table 2, the mortality rate seems to be highly significant and has the expected (negative) sign, even if its coefficient is close to zero.

Table 4 contains the results for the dynamic panel data estimates. In the second column, we applied the Arellano and Bond (1991) Difference GMM estimator, which treats the model as a system of equations, one for each time period; the equation differs only in their instrument/moment condition sets. The predetermined and endogenous variables in first differences are instrumented with suitable lags of their own levels. While, in the third column the GMM-System estimates are shown. GMM-Sys is the augmented version of GMM outlined in Arellano and Bover (1995) and fully developed in Blundell and Bond (1998). Since lagged levels are often poor instruments for first differences, the original equations in levels can be added to the system, so that the additional moment conditions could increase efficiency. In these equations, predetermined and endogenous variables in levels are instrumented with suitable lags of their own first differences.

The GMM-Sys estimator produces some intriguing results. In fact, what clearly emerges from these estimates is that the lags of dependent variable are significant. Moreover, past values of urbanization degree, birth rate, community hospitals' beds, educational degree, and ageing index affect the health expenditures; while current values of GSP, resident/physicians ratio and ageing index are statistically significant. In particular, an increase in GSP is associated with an average in health expenditure of 0.43 to 0.48 percent.

The elasticity of *AGEING* is positive, a result consistent with findings in earlier studies.

Regarding the diagnostic checks, as shown in Arellano and Bond (1991), only for a homoskedastic error term the Sargan test has an asymptotic chi-squared distribution. Here, we cannot reject the null hypothesis that the over-identifying restrictions are valid (at a 1% significance level). When the idiosyncratic errors are independently and identically distributed (i.i.d.), the first-differenced errors are first-order serially correlated. So, as expected, the output below presents strong evidence against the null hypothesis of zero autocorrelation in the first-differenced errors at order 1. Serial correlation in the first-differenced errors at an order higher than 1 implies that the moment conditions used by GMM are not valid. Yet, the Arellano and Bond test for second order serial correlation doesn't reject H_0.

4. Conclusions

In this paper, we used panel methodologies to estimate the determinants of health expenditure in Italian regions during the years 1980-2009, using state-level data. Empirical results show that a relatively simple model focusing on a key group of variables can explain the dynamic of real health expenditure. With the static panel data methods, it was found that the real Gross State Product, the unemployment rate, the number of beds in community hospitals, the urbanization degree, and the % of the population with at least the junior high school degree had a direct impact on the real health care outlay. On the contrary, the ageing index, the mortality rate, the birth rate and the resident population for generic physicians are insignificant.

The income elasticity is about 0.83 according to the static panel estimates, while it is of 0.43 to 0.48 as for the dynamic models, implying that health care can be characterized as a necessity at the state level. Yet, the dynamic estimates' elasticity is lower than 0.77 calculated by Di Matteo and Di Matteo (1998), 0.7 in Wang (2009), or from 0.817 to 0.844 found by Freeman (2003).

5. Suggestions for Future Researches

Further analysis may be conducted studying the nexus between different items of health care expenditure and aggregate income in Italy, both at central and at regional level.

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Notes

Note 1. The ageing index is constructed as a ratio between the percentage of the population in the elderly (65 years and over) and the population at a young age (less than 15 years).

Note 2. See, for more details: http://www.istat.it/dati/db_siti/.

Note 3. For an analysis dealing with panel stationarity, cointegration and Granger-causality on the relationship

between health expenditure and GSP in Italian regions, see Magazzino (2011b).

Note 4. The endogeneity problem may arise in the estimated model, since HCE and GSP may cause each other contemporaneously. To address this issue, we used one-year lagged GSP as the instrument variable for the current GSP. The basic results reported in the paper still hold, which suggests that the endogeneity bias is likely to be small.

Table 1. Correlation matrix.

	1	2	3	4	5	6	7	8	9	10
1	1									
2	0.98	1								
3	0.02	-0.12	1							
4	0.71	0.78	-0.33	1						
5	-0.19	-0.11	-0.50	0.11	1					
6	0.15	-0.13	0.37	0.15	-0.74	1				
7	0.94	0.94	0.13	0.67	-0.24	0.21	1			
8	0.15	0.16	-0.09	0.12	-0.45	0.60	0.10	1		
9	0.24	0.22	-0.47	0.27	0.02	0.05	0.03	0.18	1	
10	-0.03	0.24	-0.70	0.14	0.86	-0.79	-0.19	-0.40	0.25	1

Notes: 1: HE, 2: GSP, 3: U, 4: URBAN, 5: M, 6: B, 7: HPBED, 8: PHYSN, 9: EDUCATION, 10: AGEING. Bonferroni adjustment applied.
Source: our calculations on ISTAT data.

Table 2. Determinants of the real health care expenditure in the Italian regions: 1980-2009 (static panel estimation results).

Dependent variable: HE	***POLS***	***C-S T-S FGLS***	***POLS Driscoll-Kraay SEs***
Constant	-7.7962 ***	-3.8015 ***	-7.7962 ***
	(1.4493)	(1.0872)	(2.0673)
GSP	0.8761 ***	0.8722 ***	0.8761 ***
	(0.0414)	(0.0402)	(0.0377)
U	0.0352 ***	0.0147 ***	0.0352 ***
	(0.0032)	(0.0024)	(0.0037)
URBAN	0.1495 *	0.0027	0.1495 **
	(0.0813)	(0.0285)	(0.0562)
M	-0.0034	-0.0028 **	-0.0034
	(0.0024)	(0.0012)	(0.0044)
B	0.0218	0.0232 **	0.0218
	(0.0289)	(0.0099)	(0.0238)
HPBED	0.1031 *	0.1244 ***	0.1031 *
	(0.0561)	(0.0438)	(0.0527)
PHYSN	0.0791	-0.0616	0.0791
	(0.1503)	(0.1413)	(0.1397)
EDUCATION	-0.7901 ***	-0.5810 ***	-0.7901 **
	(0.1338)	(0.1008)	(0.2797)
AGEING	0.3350 *	-0.0586	0.3350
	(0.1981)	(0.1057)	(0.3660)
Number of obs.	200	200	200
Number of groups	20	20	20
F/Wald χ^2	1143.08	15673.46	1.89e+07
	(0.0000)	(0.0000)	(0.0000)
RMSE	0.1362	-	0.1362
R^2	0.9840	-	0.9840

Notes: Numbers in parentheses are heteroskedasticity-consistent SEs. *, ** and *** indicate significance at the 10, 5 and 1% levels, respectively.
Source: our calculations on ISTAT data.

Table 3. Determinants of the real health care expenditure in the Italian regions: 1980-2009 (static panel estimation results, models selected via BIC).

Dependent variable: HE	***2004***	***2005***	***2006***	***Pooled***
Constant	-5.7267 ***	-1.8669 ***	-1.0324	-5.8671 ***
	(1.6935)	(0.1294)	(0.6575)	(0.5099)
GSP	0.6472 ***	0.6232 ***	0.6991 ***	0.8346 ***
	(0.1304)	(0.0790)	(0.1500)	(0.0493)
U	0.0423 ***	0.0334 ***	0.0396 ***	0.0310 ***
	(0.0051)	(0.0033)	(0.0102)	(0.0022)
URBAN	0.2323 **	0.2461 ***	-	0.1945 ***
	(0.0827)	(0.0767)		(0.0536)
M	-0.0047 ***	-0.0031 ***	-0.0083 ***	-
	(0.0011)	(0.0005)	(0.0020)	
B	-	-	-	-
HPBED	0.2393 *	0.5670 ***	0.2698 *	0.1455 ***
	(0.1199)	(0.0689)	(0.1540)	(0.0465)
PHYSN	0.4356 *	-	-	-
	(0.2253)			
EDUCATION	-	-	-	-0.8138 ***
				(0.1274)
AGEING	-	-	0.3711 **	-
			(0.1268)	
Number of obs.	20	20	20	200
F/Wald χ^2	936.72	3808.75	1732.48	1817.31
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
RMSE	0.0608	0.0408	0.0618	0.1360
R^2	0.9977	0.9989	0.9975	0.9837
BIC	-42.9198	-60.3506	-43.7625	-204.7481

Notes: Numbers in parentheses are heteroskedasticity-consistent SEs. *, ** and *** indicate significance at the 10, 5 and 1% levels, respectively.
Source: our calculations on ISTAT data.

Table 4. Dynamic panel data estimates.

Variable	*Econometric Method*	
	GMM-Dif	**GMM-Sys**
Constant		-0.6530 (1.0168)
$HE_{i,t-1}$	0.3960*** (0.0950)	0.4636*** (0.1052)
$HE_{i,t-2}$	0.0066 (0.0992)	0.3003*** (0.0844)
$GSP_{i,t}$	0.4261* (0.2291)	0.4847** (0.2367)
$GSP_{i,t-1}$	-0.1581 (0.2591)	-0.3116 (0.2818)
$GSP_{i,t-2}$	-0.2944 (0.2374)	-0.1101 (0.2933)
$U_{i,t}$	-0.0011 (0.0041)	-0.0021 (0.0046)
$U_{i,t-1}$	-0.0010 (0.0034)	-0.0002 (0.0029)
$U_{i,t-2}$	0.0024 (0.0021)	0.0034 (0.0035)
$URBAN_{i,t}$	0.0416 (0.0286)	0.0239 (0.0274)
$URBAN_{i,t-1}$	-0.0243 (0.0250)	-0.0226 (0.0275)
$URBAN_{i,t-2}$	0.0804*** (0.0307)	0.0469* (0.0273)
$M_{i,t}$	-0.0003 (0.0010)	0.0004 (0.0011)
$M_{i,t-1}$	-0.0001 (0.0014)	0.0012 (0.0013)
$M_{i,t-2}$	-0.0010 (0.0015)	-0.0005 (0.0011)
$B_{i,t}$	-0.0062 (0.0100)	0.0130 (0.0142)
$B_{i,t-1}$	-0.0202 (0.0184)	-0.0081 (0.0128)
$B_{i,t-2}$	0.0278** (0.0130)	0.0223* (0.0121)
$HPBED_{i,t}$	0.0297 (0.0461)	0.0404 (0.0467)
$HPBED_{i,t-1}$	-0.0460 (0.0600)	0.0281 (0.0537)
$HPBED_{i,t-2}$	-0.0008 (0.0472)	0.0870** (0.0410)
$PHYSN_{i,t}$	0.2801*** (0.0792)	0.1147* (0.0641)
$PHYSN_{i,t-1}$	-0.0995 (0.1077)	0.0340 (0.0897)
$PHYSN_{i,t-2}$	0.0207 (0.0985)	0.0701 (0.0898)
$EDUCATION_{i,t}$	-0.1505 (0.2595)	0.0086 (0.3014)
$EDUCATION_{i,t-1}$	0.3611 (0.3747)	0.2367 (0.3657)
$EDUCATION_{i,t-2}$	-0.5536** (0.2483)	-0.3896 (0.2996)
$AGEING_{i,t}$	2.9689*** (0.8201)	-0.8480 (1.4681)
$AGEING_{i,t-1}$	2.6887 (1.8892)	3.6875* (2.0677)
$AGEING_{i,t-2}$	0.2972 (1.4633)	2.7458** (1.1068)
Wald	(0.0000)	(0.0000)
Sargan	(0.958)	(0.827)
A.-Bond AR(2)	(0.070)	(0.728)

Notes: Number of groups=20. Asymptotic standard errors in parentheses. For the diagnostic tests P-Values are shown. Significance levels: * 10%, ** 5%, *** 1%.

Source: our calculations on ISTAT data.

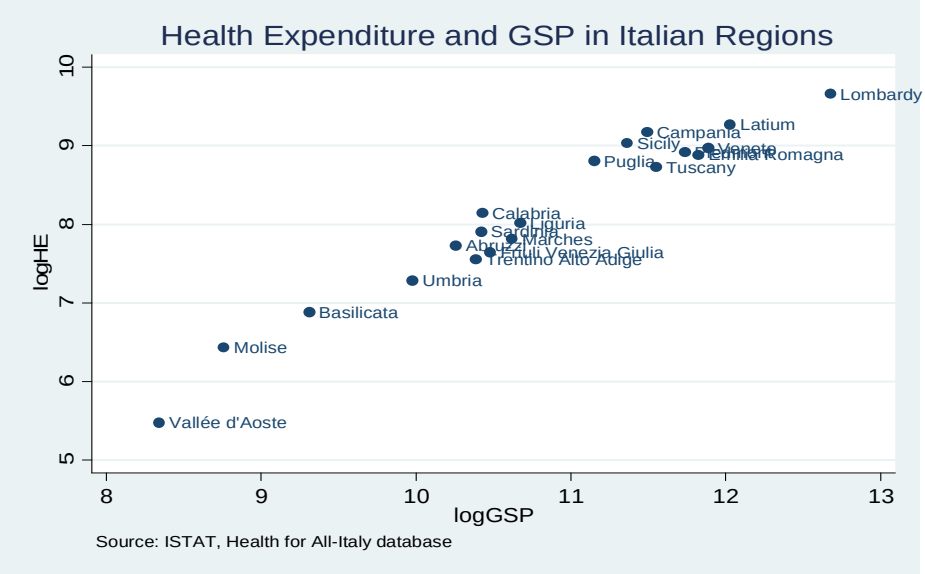

Figure 1. Health Expenditure and Gross State Product in Italian Regions (2007).

Dumping and Antidumping in the United States: A Comprehensive Review of Key Issues

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Abstract

This paper takes a comprehensive look at the issues of dumping and antidumping in the U.S. It discusses key reasons for dumping, sheds light on why domestic firms would file an antidumping suit, traces the evolution of the U.S. antidumping law, assesses the administration of the law, and examines the overall effects of the law on the economy.

Keywords: Antidumping, Dumping, U.S. trade laws, Antidumping law, Trade dispute

1. Introduction

Countries across the globe have increasingly used antidumping laws to punish "illegally" cheap imports (dumping) as away to protect their domestic industries. For better or for worse, the U.S. has historically been one of the world's most frequent users. Antidumping law has become an important component of U.S. trade laws and been a subject of intense debate on both sides of the table. Supporters cite several economic and legal reasons to support the law, while critics do the exact opposite.

There have been many strands of research that focus on different issues related to dumping and antidumping. However, there has not been a paper that brings together the key results of these different research endeavors to shed a comprehensive light on the issues of both dumping and antidumping in theory and practice. This paper fills the gap by (1) discussing various reasons for dumping, (2) tracing the evolution of the U.S. antidumping law, (3) explaining some peculiar motivations for filing an antidumping suit by domestic petitioners, (4) pointing out certain controversial practices adopted by the Department of Commerce (DOC) and the International Trade Commission (ITC) as they administer the U.S. antidumping law, and (5) examining the overall effects of the law on the economy.

2. Reasons for Dumping

Before examining why firms dump their products in export markets, it is essential to first have a clear understanding of what exactly is dumping. Dumping is the practice of selling a product in a foreign market at an "illegally" cheap price. It is usually referred to as selling below the normal value. Here, normal value could either be the cost of producing that product or the selling price of the product in the producer/exporter's home market. So, a producer/exporter is said to sell below normal value when it sells a product to a foreign market at below the cost of production (known as below-cost dumping) or at below the price it normally charges its home-market customers (known as price-discrimination dumping).

How much antidumping duty will be applied to a foreign exporter depends on the dumping margin calculated by the DOC. (Note 1) Basically, the dumping margin is the difference between the price (or cost) in the exporter' home market and the price it sells to U.S. market. For example, if Vietnamese exporters sell shrimp to the U.S. market for $2 a pound but sell to the domestic Vietnamese market for $3 a pound, then the Vietnamese exporters are said to dump shrimp in the U.S. with a dumping margin of $1 (the dumping margin is usually expressed in percentage terms as $1/$2 = 50%). So, if this shrimp dumping causes material injury (or threatens to cause material injury) to the domestic American shrimp producers as determined by the ITC, Vietnamese shrimp exporters will be slapped with a 50% antidumping duty.

To an average consumer, it would be difficult to comprehend the rationale for dumping since s/he would stand to benefit from the cheap prices after all. However, there are at least eight plausible reasons that explain why firms

dump. First, firms sometimes dump just to compensate for the price markups, resulting from transportation costs and normal tariffs, so that they could meet the competitors' prices in the export market. This is considered as unharmful dumping since the purpose is not to undercut competitors (Miranda, 1996).

Second, firms may have a desire to become a monopoly in the export market through the use of predatory pricing. This occurs when the foreign exporters use the abnormal profits from the protected home market to cover the substantial loss due to deep price cuts in the export market with the purpose of driving out the competitors and monopolizing that market. However, this kind of dumping is now considered very rare since the likelihood of success is very small, making it less likely that foreign exporters will choose this method of dumping (Jackson & Vermulst 1989).

Third, government subsidies also lead to dumping. Foreign countries often adopt industrial policy to promote certain key industries, such as steel and semiconductors, where they provide heavy subsidies to have the production lines of these strategic industries running without regard to market conditions. As a result, manufacturers that receive subsidies often dump their products abroad to get rid of the excess capacity at home. This type of dumping is quite damaging and has the potential to wipe out the domestic import-competing industries in the target (importing) country since subsidies are often prolonged, allowing the dumpers to continue their harmful practice for a long time (Mastel, 1998).

Fourth, differences in national cost composition and firms' normal profit-maximizing practices may encourage dumping under certain circumstances. Jackson (2000) points out that differences in national economic characteristics may lead to differences in cost composition among countries, prompting firms from one country to dump into another country during a period of slack demand. In this regard, firms in a country with high fixed costs and low variable costs, when facing a significant fall in demand, would be able to provide a much deeper price cut (in an attempt to maintain sales volumes) than firms in a country with low fixed costs and high variable costs, even though the two countries have exactly the same total costs. More specifically, given its overall low variable-cost structure, firms in the former country will continue to produce and sell at a very low price (at or above its low variable costs) in an attempt to minimize its loss since it has to pay for the high fixed costs anyway, regardless of whether it produces or not.

Fifth, dumping may occur due to the existence of high start-up costs. In competitive industries, where prices are competitive, new entrants to the market must sell their products at this price level. However, the costs of producing the initial batches of products to these new entrants are quite high since the costs themselves are spread over a relatively small volume. So, when these new entrants export their products during the start-up phase at the prevailing competitive prices, these prices are usually below the cost of production, resulting in dumping in the form of below-cost sales. Here, if the market is quite competitive, there is nothing particularly damaging with this form of dumping in the short-run. Supposedly, the below-cost dumping margins in this regard would be eliminated when the once-new entrants have a foothold in the market and begin to spread their costs over a much larger volume, making the costs themselves become significantly lower (Hindley & Messerlin, 1996).

Sixth, dumping may also be related to the cost structure of certain industries. In some industries, such as cement, fixed costs are very high while variable costs are relatively low. Therefore, once the producers in these industries cover their fixed costs with certain volumes, they can sell additional units at very low prices (as long as they can cover their marginal costs on these sales) to maximize sales and profits since anything above marginal costs will contribute to total profits. Usually, these sales are below average total costs, making them fit the definition of below-cost dumping. (This is because the DOC uses average total costs, instead of marginal costs, to determine below-cost dumping).

Seventh, another potential reason for dumping is due to the desire of state trading firms to earn hard currency (e.g., the U.S. dollar) through dumping. When a foreign government is in desperate need for hard currency (for instance, to finance external debts) it can instruct its state-owned firms to dump certain products abroad to get foreign exchange through a significant increase in sales. However, it is very difficult to predict when, how long, and at what magnitude this kind of dumping takes place since the state dumpers do not follow normal business practices like other profit-maximizing businesses (Jackson, Davey & Sykes, 1995).

Finally, dumping may occur due to the existence of a sanctuary market in the exporters' home market. (This is now widely considered by both sides of the antidumping debate as one of the most likely causes of dumping). A sanctuary market is the one that is protected from foreign competition through the use of various trade barriers, allowing the exporters to charge excessively high prices in their home market. It can be built by erecting formal barriers to trade with the help of governments and/or by engaging in informal private-sector collusion. With the decline of formal trade barriers due to the global efforts in reducing and eliminating them, informal private-sector

barriers have become increasingly important. In this regard, private firms, especially those under monopolistic and oligopolistic market structures, can collude with one another to effectively restrict the access of foreign goods. They then use the profits generated from the sanctuary market to subsidize their exports in other markets abroad in the form of low prices for the purposes of expanding internationally, enjoying the benefits of economies of scales, and depressing competitors' profit margins (Mastel, 1998).

3. The Evolution of U.S. Antidumping

Given the various reasons for dumping discussed above, it can be seen that some of them are more malign than the others. Therefore, it is no surprise that domestic firms are fervently asking the government to take action against dumping on the ground of fairness. Antidumping, in its simplest terms, is the practice of countering the selling of products at unfairly low prices by foreign producers/exporters to the U.S. market. The overall rationale for antidumping is that dumping is an unfair trade practice, which results from market distortions abroad, that puts the U.S. domestic producers at a disadvantage when competing against the dumped imports. Therefore, in order to ensure the level playing field for the domestic producers, as they compete directly against foreign producers in the U.S. market, harmful dumping must be condemned by the law.

The history of the U.S. antidumping law is one of the oldest in the world. It is much longer than the history of the GATT (the predecessor of the WTO). However, since the U.S. was a contracting party to the GATT and is now a member of the WTO, much of the latter history of the U.S. antidumping law has been influenced by the GATT/WTO developments. Actually, U.S. law has been changed in several respects in order to incorporate changes resulting from GATT/WTO antidumping negotiations.

Dumping was first recognized as a problem in U.S. laws in 1916. In the Antidumping Act of that year, Congress made predation (predatory pricing) an offense subject to imprisonment, fine and triple damages (Finger, 1993). It was a legal remedy instead of an administrative one. According to this law, dumping was defined as selling below actual market value "with the *intent* [emphasis added] of destroying or injuring an industry in the United States, or of preventing the establishment of an industry in the United States, or of restraining or monopolizing any part of trade and commerce in such articles in the United States." (Note 2) This definition of dumping was restrictive since it required specifically the proving of predatory intent. Consequently, this first antidumping law was not a success in dealing with dumping, because it was very hard for the law enforcers to establish the predatory intent of the foreign exporters so that dumping charges could be made (Mastel, 1998).

The shortcomings associated with the 1916 Act gave rise to the Antidumping Act of 1921, which set the foundation for the present-day antidumping law. This act made antidumping an administrative process, allowed the levy of antidumping duties to counter dumping, and dropped the criterion of proving predatory intent. Under this law, dumping was defined primarily in terms of price discrimination among international markets (i.e., charging different prices in different markets). Here, selling below cost was not considered as dumping. Essentially, price discrimination was the primary definition of dumping for much of the antidumping history. The below-cost-sales addition to the legal definition of dumping was made in 1974 when the influential chairman of the Senate Finance Committee at the time (Senator Russell Long) added an amendment to the 1974 trade bill "to require that sales below cost be considered dumping" (Finger, 1993).

The 1921 Act served as a model for the GATT antidumping provision (Article VI) in 1947. During the Tokyo Round of GATT, the contracting parties further negotiated the 1979 GATT Antidumping Agreement to better streamline the application of antidumping laws. The U.S. Congress implemented this new GATT Antidumping Agreement into law by the 1979 Trade Agreement Act, which "repealed the 1921 [Antidumping] Act and added a new title VII to the Tariff Act of 1930" (ITC, 1995). So, the Antidumping Act of 1921 was in effect with only some changes until 1979, and then became the predecessor of the current U.S. antidumping law, which is "set out in Title VII of the Tariff Act of 1930, as amended, and codified in Title 19 of the United States Code (USC), Sections 1673 to 1677k" (Palmeter in Steele, 1996).

Besides making changes to the U.S. antidumping law in 1979, the U.S. also transferred the authority of making dumping determination from the Treasury Department to the DOC in the same year. This important administrative change was a result of the general feeling that the Treasury had not progressively enforced the antidumping law due to some political and institutional constraints (Mastel, 1998).

From 1979 to the present, the U.S. antidumping law has also been further amended by the Trade and Tariff Act of 1984, the Omnibus Trade and Competitiveness Act of 1988, and the Uruguay Round Agreements Act of 1994, which implemented the Uruguay Round Antidumping Agreement into U.S. law. The Uruguay Round Antidumping Agreement (also referred to as the WTO Antidumping Agreement) sets out various detailed antidumping rules that member countries have to honor. The changes in global antidumping rules made under the WTO Antidumping

Agreement are still in effect today; therefore, the current U.S. antidumping law has to be in conformity with the rules specified in this agreement.

4. Motivations for Filing an Antidumping Suit

Given the long existence of the antidumping law and the relatively advanced legal system of the U.S., American domestic firms have been able to take advantage of it in a significant way. Antidumping duties have been applied to a wide range of foreign imports, ranging from Vietnamese basa fish to Chinese steel products, allowing American firms to maintain their survival in the face of harsh international competition. In this regard, determining whether or when to file an antidumping suit against foreign competitors can be a significant strategic decision that has the potential to materially affect the well-being of domestic firms.

Besides the main reason of asking the government to punish the unfairly-traded imports to actually level the playing field, there are some other peculiar reasons that motivate domestic firms to file an antidumping petition. First, firms sometimes log their complaints with the DOC and ITC just to send off a warning sign to aggressive foreign competitors and give them a hard time. These are referred to as process filers, who file antidumping petition just to get the trade effects resulting "from the investigation process itself" (Krueger, 1996). These process filers typically do not expect their petitions to result in an actual imposition of antidumping duties since they generally do not have a strong case. (On the other hand, firms that file petition for the sole purpose of seeking antidumping duties imposed on their foreign competitors are referred to as outcome filers).

According to their study, Staiger and Wolak (1994) find that around 3 to 4 percent of the antidumping cases in the 1980-1985 period was of process filings. Extending this basic finding, these two authors, in another study, empirically show that Mexico and Canada specifically are the two most likely targets for process filings by U.S. firms, while Western European countries, the East Asian newly industrialized countries, and Japan are the most likely targets of outcome filings (Staiger & Wolak in Krueger, 1996).

Second, the filing pattern of the domestic firms is also related to the changes in the exchange rate and GDP growth rate. This connection can be seen as follows. In one respect, when the economy is not doing well (i.e., falling or stagnant GDP growth rate), demands falls, prompting foreign exporters to reduce prices in the U.S. market to retain market share. This situation makes it more likely for the DOC to find dumping, so it is expected that antidumping petitions would increase. (The reverse is true when the economy is doing well with good GDP growth rate). In another respect, when the dollar appreciates, import prices will be lower, leading to more import competition. This situation makes it easier to find injury by the ITC, prompting the domestic petitioners to increase petitions to take advantage of it.

Feinberg (2003) empirically shows that an appreciation of the dollar leads to an increase in petitions while a growth in GDP leads to a decrease in petitions. In so doing, he examines quarterly data on antidumping petitions of U.S. firms against 15 countries for the period of 72 quarters, from 1981 to 1998. He finds that a 100% real appreciation of the dollar would lead to a 129% increase in petitions (according to estimate based on the "one-year lagged real exchange rate") and that one percentage-point increase in the three-year rate of real GDP growth would lead to a 2% reduction in petitions. Accordingly, he argues that since the mid-1980s, U.S. petitioners have learned about the influence of macroeconomic phenomena (i.e. changes in the GDP growth rate and the exchange rate) on antidumping outcomes and have made good use of the fluctuations in these macroeconomic factors.

The result found by Feinberg supports the result from a more comprehensive study done by Knetter and Prusa (2003). In this study, Knetter and Prusa use the data for antidumping cases from the major users, namely the U.S., Australia, Canada, and the EU, during the period of 1980-1998 to estimate the influences of exchange rate and GDP growth on antidumping filings. These two authors find that a 33% increase in antidumping filings occurs if the currency in the importing country appreciates by one standard deviation from the mean, and that " a one standard deviation fall in domestic real GDP growth [of the importing country] leads to a 23% increase in [antidumping] filings."

The above two results together help to reject a conflicting previous result established by Feinberg (1989). Based on the data for U.S. antidumping (and countervailing) cases for the period of 1982-1987, Feinberg finds that dollar depreciation, instead of dollar appreciation, leads to an increase in antidumping filings. This finding does not seem to stand anymore due to the strong, recent evidences discussed above. A possible explanation for the current positive relationship between dollar appreciation and filing increase is that domestic petitioners now recognize that passing the injury test is more important than finding dumping. As a result, when the dollar appreciates, which means that it is easier for the ITC to find injury, domestic petitioners would take this opportunity to lodge complains since their chance of winning is higher.

5. The Administration of the U.S. Antidumping Law

Although it is in the strategic calculation of domestic firms to decide when and under what circumstances to file an antidumping petition, the final determination of whether the petitioners qualify for protection depend on the actions of the DOC and ITC. These two agencies have broad power since the U.S. antidumping law affords them certain level of discretion in implementing it in practice.

Some studies have tried to document the DOC's discretionary practices and calculation methodologies. Lindsey (1999), based on the data of 49 antidumping cases for the period of 1995-1998, shows that the way in which the DOC determines dumping margins is not consistent with the objectives of countering price-discrimination and below-cost dumping preached by the supporters of the antidumping law.

Specifically, Lindsey identifies and criticizes five methodologies that the DOC uses to calculate the dumping margin, including price-to-price comparison, third-country-price comparison, constructed value, non-market economy procedures, and best information available. (Note 3) Of these five methodologies, he argues that only the price-to-price comparison methodology is relevant to identifying price-discrimination dumping due to a market sanctuary. However, the various arbitrary adjustments to the prices made by the DOC make this approach less than credible. The other four methodologies have nothing to do with price discrimination since actual home-market price data are not used for comparison.

In terms of below-cost dumping, Lindsey also argues that all five methodologies have nothing to do with proving dumping as a result of actual selling below the cost of production. According to him, only the constructed value approach has some connection with below-cost dumping. However, this approach still does not establish that the foreign producer is actually selling below the cost of production per se. This is because the constructed value is the sum of the total cost of production and some amount of profit, instead of cost exclusively. As a result, it is possible that a foreign producer is charged with below-cost dumping even if this producer sells above the cost of production but enjoy little or no profits (Lindsey, 1999).

In a somewhat similar vein to the above study, Lindsey and Ikenson (2002) walk specifically through the process of dumping-margin determination to show how the DOC can create "phantom" and inflated dumping margins through its various biased procedures. For example, the authors show that the DOC can make a series of arbitrary price adjustments to derive positive and high dumping margins in price-discrimination dumping cases. Also, they particularly emphasize the inherent bias against foreign producers associated with the so-called "cost of production test". In this regard, before comparing home-market prices with U.S. export prices, the DOC performs the cost test to identify those home-market sales below the cost of production. If more than 20% of home-market sales is below the cost of production, these below-cost sales will be eliminated, leaving only those home-market sales above cost for comparison with export prices. This practice of excluding a big portion of below-cost sales in the home market, while not doing the same for export sales, inflates the home-market prices and in turn inflates the dumping margin as these inflated home-market prices are compared with export prices.

Speaking of high dumping margins, Blonigen (2006) shows that dumping margins have increased significantly since the early 1980s primarily as a result of the increasing use (extensive use) of discretionary practices and the changing in the implementation (intensive use) of these practices over time. His econometric analysis shows that the three variables of *facts available*, *adverse facts available* and *non-market economy procedures* have statistically significant impact on the calculation of dumping margins as a result of their extensive use. With respect to the intensive use, Blonigen finds that the variables of *adverse facts available*, *non-market economy procedures*, and *constructed value* have statistically significant impact on the increase of dumping margins. He concludes that the extensive and intensive uses of the mentioned discretionary practices are mostly responsible for the increase in the average dumping margin in the U.S. to over 60% by the year 2000 from around 15% in the early 1980s.

In addition to the discretionary practices and their implementation identified above, the DOC has also been criticized by its approach to the so-called sunset review process. Sunset review is a product of antidumping reforms under the Uruguay Round, where WTO-member countries agreed to reform their antidumping laws in such a way that antidumping orders would be automatically terminated (i.e., putting an end to existing antidumping duties) after five years in effect unless there is substantial evidence from the sunset review indicating that the revocation of such orders would lead to the continuation or recurrence of dumping and material injury. Therefore, after five years, if the domestic firms that originally file the antidumping petition have no interest in keeping the antidumping order in place, the order is automatically terminated. On the hand, if the domestic firms still want to keep the order in place, the DOC and the ITC must initiate a sunset review process, where the DOC would determine the *likelihood* of continuation or recurrence of dumping (if the antidumping order was to be revoked) and then the ITC would

determine material injury (after receiving the affirmative ruling and the reported likely dumping margin from the DOC).

Moore (2002), based on the data of 315 cases that occur after 1980 and are later subject to sunset reviews, empirically shows that the DOC *always* rules affirmative (i.e., dumping would likely to continue or recur) to help keep the antidumping orders remained in effect. He also finds that the DOC "almost always" report the original dumping margins, which were calculated during the original investigations, as the likely dumping margins if the antidumping orders were to be revoked. According to him, this "mechanistic" approach is a flaw since there would have been many possible changes, particularly the pricing decisions of the foreign exporters, that make it unreasonable for the DOC to report the original dumping margins. Moore concludes by arguing that the implementation of the sunset review procedures by the DOC supports the doubt of whether the U.S. has lived up to the commitment that it made during the Uruguay Round in regard to antidumping reforms.

With respect to the ITC's practices of material injury determination, Kaplan (in Tharakan, 1991) specifically documents five alternative approaches that the ITC uses in determining material injury, including the weak-201 approach, trend analysis, margins analysis, comparative approach, and five-factor analysis. (Note 4) He argues that most of these approaches employ methods that are not aligned with the purpose of the antidumping statute. For instance, with respect to the weak-201 approach, Kaplan argues that the causal connection between the ill health of the domestic industry and imports is not clearly identified and qualified, because commonsense would dictate that imports would always at least be one of the normal causes of domestic injury anyway. So, conditioning the causal connection simply on the significant presence of imports is pretty much a foregone conclusion. Also, in regard to the trend analysis, Kaplan points out that the trends cannot establish a sound causal relationship between material injury and imports, because they themselves can be influenced by domestic factors that have nothing to do with unfair imports. The only approach that Kaplan considers relatively valid in connecting injury to dumping is the comparative approach. But even this approach is not highly suitable in addressing other types of dumping besides price-discrimination dumping. So, the conclusion to be drawn here is that in order to enhance the validity of its findings, the ITC must improve its methodologies to effectively address the various complex issues associated with material injury determination in antidumping investigations.

In terms of the ITC's approach to the sunset review process, it seems that bias does play some role. Liebman (2001), based on the actual examination of 201 sunset-review cases from July 1998 to December 1999, finds that the ITC rules affirmative in 71% of the cases. He empirically shows that although the ITC largely follows the economic criterion (which includes such variables as import penetration, capacity utilization and total production capacity) mandated by Congress in making its determination in sunset reviews, the Commission's voting behavior is also influenced by some political factors, which fall outside the legally mandated considerations. Specifically, the ITC is biased against Chinese exporters (which face a 96 % affirmative rate) and less developed countries in general. Also, domestic industries that are located in the districts of Senate Finance Committee members tend to get more affirmative rulings than other industries. This suggests that these senators do have some influence on the voting behavior of the ITC.

However, Liebman does not find any statistical significance with respect to the influence of the size of the domestic industry on the Commission's voting behavior. (This rejects the hypothesis that if a particular industry is big and employs a lot of workers, the ITC would rule in favor of it). Finally, Liebman notes that the criteria used by the ITC in making its sunset-review determination are quite different from those employed to make the material injury determination in the original investigation. For instance, a low level of import penetration highly influences the ITC in making affirmative determination during the sunset review, while the reverse (a high level of import penetration) was necessary in determining material injury during the original investigation.

Despite all of the above criticisms against the DOC and ITC, some other experts argue that the administration of the U.S. antidumping law is relatively transparent and gives foreign respondents many opportunities to counter the claims made by the domestic petitioners. Moreover, the decisions of the DOC and ITC can be appealed for review by U.S. federal courts and international dispute settlement panels of the WTO and NAFTA. With respect to some of the discretionary practices mentioned before, Mastel (1998) argues that there are no better alternatives. For example, when foreign respondents refuse to cooperate, there is no way the DOC can force these respondents to participate. So, the only feasible way to go is to use facts available. Overall, Mastel points out that, according to statistics, during the period from 1980 to 1997, there are a total of 732 cases filed by the domestic petitioners, but only 44% (315 cases) of them ended with affirmative rulings by both the DOC and the ITC. This figure seems to reasonably suggest that it is an overstatement to say that the U.S. administrative agencies are grossly biased against foreign respondents. If they were grossly biased, we would have seen a much higher figure for affirmative cases.

6. The Overall Effects of Antidumping Law

Given the controversial nature of the implementation of the U.S. antidumping law, it is important to examine the overall effects that the law has on the economy. Interestingly, experts also have different opinions on this issue as well.

First of all, there seems to be an "academic consensus" that a standard economic welfare analysis would generally shows that the application of antidumping law is welfare reducing (Sykes, 1999). The theory-based evidence for this is that antidumping duties are similar to import tariffs, which in most cases create a loss in consumer surplus that is greater than the benefits enjoyed by the domestic import-competing producers. In an attempt to give a number on the economic welfare cost of unfair-trade remedy orders, the ITC (1995), based on the analysis of 239 outstanding antidumping and countervailing orders in 1991, estimates that these orders together cost the U.S. economy $1.59 billion (or 0.03% of GDP) in 1991. In a similar vein, Gallaway, Blonigen and Flynn (1999), based on the 306 outstanding antidumping and countervailing orders in 1993, estimate that the welfare cost associated with these orders is $4 billion in 1993.

Besides the economic welfare cost, Blonigen and Prusa (2003), based on their review of some papers in this area, point out several other costs of antidumping that are not accounted for in the standard economic welfare analysis. There are three important points. First, because of the administrative review process, exporters can increase their prices to reduce the dumping margins. As a result, antidumping-duty revenues are shifted from the government's treasury of the importing country to the exporters, suggesting that welfare loss associated with antidumping duties would increase as exporters seek to adjust prices to minimize the dumping margins. Second, imposing antidumping duties on foreign exporters can trigger retaliations against American exports on the part of the foreign exporters' governments, making American exports vulnerable abroad. Third, the authors emphasize the additional costs, which cannot be measured directly, associated with the *prospect of protection*. The reasoning behind this is that, given the prospect of protection in the form of the imposition of antidumping duties, domestic firms and foreign exporters will seek to alter their normal profit-maximizing practices to influence the results of potential antidumping investigations. For example, domestic firms may unnecessarily reduce employment in an attempt to show material injury. Accordingly, these two authors argue that the additional costs associated with the prospect of protection could be greater than the readily measurable costs of the imposition of antidumping duties.

On the other hand, proponents of antidumping law put forth a series of arguments to point out the various positive roles that the law plays. To begin with, the presence of antidumping law and the credible threat of antidumping duties can significantly prevent long-term damage to U.S. industries in two ways. First, it may prevent disinvestments due to the existence dumping. The reasoning here is that when there are no antidumping duties to counter foreign dumping, domestic investors will have a negative incentive not to invest in those industries that are exposed to dumping since they are afraid that they will not be able to recoup their investments. (And this potential lack of meaningful investments will make these domestic industries less competitive and potentially disappear). But this problem will be significantly prevented when investors know that harmful foreign dumping will not be tolerated. Second, antidumping may prevent inefficient foreign firms from damaging efficient domestic firms on the basis of capacity utilization. If there was no deterrence, dumping would afford the foreign dumpers the ability to run at higher utilization rates in comparison to the domestic firms. High capacity utilization leads to reduction in costs in capital-intensive industries, giving the dumpers an unfair advantage. This of course puts the domestic firms at a competitively disadvantage that is not of their fault. So, the presence of antidumping law would prevent such problem from happening (Feketekuty & Stokes, 1998).

Mastel (1998), in addition to acknowledging the above two points, also goes further to analyze in-depth the importance of having the antidumping law in place. First, he argues that critics of the law often base their economic analysis on static models, where the short-run costs associated with antidumping duties are quite obvious, so they fail to capture the long-run competitive impact on domestic industries. To prove this point, he uses a simulation model to calculate the negative economic impact on the economy if antidumping actions were not taken to protect the U.S. memory-chip firms from foreign dumping for the period of 1984-1996. Even after taking into account the benefits of low prices (due to dumping) to domestic consumers, Mastel finds that the negative economic impact of memory-chip dumping on the economy "would range between $323 million and $35.6 billion, depending upon how much U.S. production was replaced by dumped imports." These figures suggest that the higher and more prolonged levels of dumping would lead to much greater economic loss as domestic production is increasingly replaced by dumped imports over time. So, the presence of antidumping law would prevent such a long-run competitive loss from happening.

Second, Mastel also points out that having the antidumping law in place would prevent foreign dumping from damaging domestic *strategic* industries. According to him, strategic domestic industries produce various positive externalities that benefit the economy as a whole. For example, advanced developments in the semiconductor industry (a strategic industry) can lead to other advanced developments in such industries as consumer electronics and defense. Here, if dumping was allowed, foreign exporters that are assisted by their governments' mercantilistic trade strategies would dump in the U.S. market and damage its strategic industries, putting American national competitiveness at risk. Therefore, the existence of the antidumping law is necessary to prevent this unfair scenario from taking place or developing fully.

7. Conclusion

From what has been discussed, a rather comprehensive picture on the issues of dumping and antidumping has emerged. There are five main points drawn from the literature. First, there are various reasons that explain why foreign exporters dump their products in the U.S. market (or any other market), ranging from normal profit-maximizing practices to intentional behaviors encouraged by foreign governments to unfairly penetrate the U.S. market and gain an artificial advantage over the domestic import-competing American producers.

Second, the U.S. antidumping law has evolved over time to better address the changing nature of dumping. This evolution initially highlights a change of antidumping from a legal remedy to an administrative one and later develops to include both types of dumping (price-discrimination dumping and below-cost dumping). It also reflects a significant interaction between the American development and that of the GATT/WTO.

Third, the decision to file an antidumping petition of domestic American producers is a carefully calculated one. It is sometimes used simply for the sake of punishing aggressive foreign exporters and sending off warning sign instead of aiming for an actual imposition of antidumping duties. More importantly, American petitioners' filing behavior is increasingly influenced by macroeconomic factors such as GDP growth rate and exchange rate.

Fourth, the administration of the antidumping law by the DOC and the ITC is controversial. Critics point out that the discretionary practices employed by these two agencies are grossly biased against foreign exporter. However, supporters argue that those discretionary practices are necessary since there are no better alternatives, and that the law is implemented in a relatively transparent manner, affording foreign exporters plenty of chances to make their cases.

Finally, the overall effects of the antidumping law on the economy are debatable. Critics point out the immediate welfare reducing effect (in terms of the loss in consumer surplus) of the law and its potential to invite retaliations against American exports as good reasons to use less antidumping actions. But proponents of the law are quick to argue that antidumping is vital in countering the negative long-term effects of dumping on the economy that the standard static analysis fails to capture. It seems that this debate will not end or reach a consensus any time soon. Dumping and antidumping are here to stay. Therefore, having a good understanding about them is the first essential step for joining the debate thoughtfully.

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Notes

Note 1. The law requires that for antidumping duties to be levied against foreign producers/exporters, two conditions must be met: (1) the DOC must find dumping and (2) the ITC must determine that this dumping has caused (or threaten to cause) material injury on the domestic producers.

Note 2. See the United States Code, Title 15, Section 72 (15 USC 72).

Note 3. For detailed and official definitions of these terms, see the Import Administration Antidumping Manual available at: http://ia.ita.doc.gov/admanual/

Note 4. Under the weak-201 approach, which is similar to the approach used to determine material injury in section-201 cases but at a much less stringent standard, the ITC will rule affirmative if (a) the domestic industry is in poor health (the material injury test) and (b) if this declining in health is due to, *among other things*, the significant presence of imports (the cause test).

The trend analysis approach is similar to the weak-201 approach, it also first seeks to determine material injury to the domestic industry and then seeks to connect this injury to imports. However, in the trend analysis, there is explicit effort to directly link the trends caused by imports to injury. Among these trends include import penetration, decrease in import prices, increase in import market share, decrease in domestic sales, etc.

The margins analysis directly measures the effect of dumping on material injury. In so doing, it seeks to compare the dumping margin (the difference between exporter's home market price and exporter's export price) and the underselling margin (the difference between the U.S. domestic price and the import price in the U.S. market). If the dumping margin (e.g., $10) is bigger than the underselling margin (e.g., $5), then dumping does indeed cause material injury, because if there were no dumping, the import price would have been $5 more expensive than the domestic price. Since the $10 dumping margin makes the import price become less expensive than the domestic

price, it causes material injury to the domestic industry. And the reverse is true if the dumping margin is smaller than the underselling margin.

The comparative approach approach seeks to determine injury by comparing the price and quantity effects under dumping with those under no dumping. In so doing, the ITC first tries to come up with an economic model to capture the reality in which there are no dumped imports, and then uses it to estimate the negative effects on domestic price and quantity when dumping is introduced. If these negative effects are significant, the ITC will rule in the affirmative.

Under the five-factor analysis approach, the ITC will rule affirmatively if there are indications (based on five factors such as high dumping margin and significant decrease in price) showing that material injury is due to predatory behavior committed by the foreign exporters.

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Relationship between Cost of Equity Capital and Voluntary Corporate Disclosures

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Abstract

The relationship between disclosure and cost of equity capital has always been interesting not only for managers, but for investors as well. Economic theory suggests that by increasing the level of corporate reporting firms not only increase their stock market liquidity, but they also decrease the investors' estimation risk, arising from uncertainty about future returns and payout distributions. Utilizing the Residual Income Valuation Model, the implied cost of capital is estimated for a sample of 121 Swiss listed, non-financial companies adopting a finite horizon version of the residual income valuation model. The results show that firms on the Swiss market can reduce their cost of equity capital by increasing the level of their voluntary corporate disclosures. The results persist even after controlling for various firm specific risks, such as firm size or financial leverage and regardless of company's reporting strategy (conservative or aggressive).

Keywords: Equity capital, Corporate disclosure, Swiss companies, Residual income valuation model, Accounting policy

1. Introduction

Understanding the relationship between the level of voluntary corporate disclosures and the cost of equity capital has always been interesting not only for managers, but also for investors. Prior theoretical work on asset pricing (Botosan, 1997) suggests that disclosure policy is negatively associated to a firm's cost of equity capital. In general, two literature streams support the negative relationship of increased disclosures to cost of equity financing. One is based on the improved stock market liquidity (Demsetz, 1968; Copeland & Galai, 1983; Glosten & Milgrom, 1985; Amihud & Mendelson, 1986; Diamond & Verrecchia, 1991); the other relies on the reduced non-diversifiable estimation risk (Botosan, 2006; Barry & Brown, 1985; Coles & Loewenstein, 1988; Handa & Linn 1993)

The former stream argues that if companies disclose more corporate information, they would also attract more long-term investors. This in turn will positively influence the market price and the marketability of the firm's stock, thus reducing company's cost of equity financing. The latter strand focuses on investors' estimations of future cash flows. When determining the present value of their investments, investors focus on disclosed information to forecast

future cash flows. More information results in less uncertainty about future cash flows and consequently less estimation risk, thereby lowering firm's cost of equity financing.

Furthermore, empirical evidence suggests that a negative and significant association between cost of equity capital and voluntary disclosures exists. However, as neither disclosure policy nor cost of equity capital can be directly observed and are highly subjective, empirical work on this relationship has documented somewhat confusing results so far. For example, Botosan & Plumlee (2002) found a positive association between cost of capital and voluntary timely disclosures, while Gietzmann & Ireland (2005) argued that a negative relationship exists for the particular variables. Botosan (1997) finds evidence that in the US market voluntary disclosure actions reduce cost of equity financing, but only for firms with low analyst following. Hail (2002) argues that the number of analysts is not that influential on the cost of equity capital and both firms with high and low analyst following can reduce their cost of equity financing by increasing the level of disclosure. In line with Healy et al. (1999) and Leuz & Verrecchia (2000), he suggests that concentrating on specific occasions and reporting environments, where one can observe significant changes in firms' disclosure actions, makes the subtle effect of voluntary disclosure more easily detectable.

Conforming to this latter perspective we focus on a low disclosure environment, as in the case of Switzerland, in an attempt to further explore the relationship between disclosures and cost of equity financing. In our paper we try to establish a relationship between ex ante costs of equity capital and voluntary corporate disclosures. In this light our paper proceeds as follow: In the next section we briefly discuss the theoretical and empirical literature review in relation to disclosure and the cost of equity capital. We then present our research hypotheses, methodology and data sample. This is followed by our research results. Our paper concludes with a discussion of our findings, limitations of our work and areas for future research.

2. Literature Review of Disclosure and Cost of Equity Capital

The impact of voluntary disclosure actions on the cost of equity financing has always been an interesting topic in the financial-accounting literature, which can be classified to theoretical and empirical. From a theoretical point of view, a negative association between quality of corporate reporting and cost of equity financing is observed, particularly emphasizing on disclosure's ability to influence stock market liquidity and estimation risk. Empirical support for the suggested association is also presented by a growing body of studies, trying to quantify the relationship between cost of equity capital and quality of corporate disclosures.

2.1 Theoretical Literature

From a theoretical perspective, there are two separate approaches of research, sustaining the generally accepted negative association between quality of corporate disclosure and cost of equity capital (Botosan, 1997). The basic assumption, underlying both approaches of theoretical literature, is that companies which provide more corporate information reduce the information asymmetries on the capital markets. The first approach investigates the impact of increased disclosure on stock market liquidity and the second one links firm's reporting level to estimation risk. The idea behind the first approach is that firms voluntarily provide more corporate information in their attempt to overcome investors' unwillingness to hold shares in illiquid markets, and consequently lower their cost of equity financing. The other theoretical approach implies that firms try to reduce investors' estimation risk by greater disclosure of corporate information.

Demsetz (1968), one of the pioneers in this field, argued that greater disclosure lowers the transaction costs and enhances stock market liquidity, thus leading to lower cost of equity financing for firms on the New York Stock Exchange. Copeland & Galai (1983), Glosten & Milgrom (1985), Amihud & Mendelson (1986) concluded that higher disclosure decreases the adverse selection component of the bid-ask spread, thus reducing the transaction costs. This increases the liquidity of the particular stock, which reduces firm's cost of equity financing.

Diamond & Verrecchia (1991) suggest that disclosure improves future liquidity of firm's securities by reducing the information asymmetry for investors and motivating them to demand larger portions in firm's stock. This in turn, reduces the company's costs of equity financing, with large companies benefiting the most. These findings complement the results reported by Diamond (1985), who showed that in fully liquid and perfectly competitive markets, shareholder's welfare is improved by increasing the level of corporate disclosure. Baiman & Verrecchia (1996) established a link between the optimal level of disclosure quality and capital market's liquidity needs. They argued that increased voluntary reporting enables better monitoring of managers and reduces insider-trading opportunities. This in turn, increases investors' demands for firm's securities, and consequently reduces its cost of equity capital. This stem of research is also supported by Bloomfield & Wilks (2000).

The other theoretical strand hypothesizes that increased levels of corporate disclosure reduce the estimation risk of an asset's future return or payoff distribution, thus lowering the cost of equity capital (Botosan, 2006). The

reasoning is that because investors base their estimates of return parameters only on publicly available information, an increase in the voluntary disclosure actions would help them to better estimate share returns. Therefore, studies following this doctrine of research, also investigate whether parameters of a security's payoff distribution can be estimated based only on firm's return history and/or other publicly available information. Barry and Brown (1985), for instance, concentrated on asset returns and considered the existence of unobservable estimation risk. They suggested that due to this unobservable estimation risk, firms with poor disclosure quality have higher average rates of return per unit of estimated beta than large companies with higher level of voluntary reporting. Coles & Loewenstein (1988) further analyzed estimation risk in an equilibrium framework under uncertainty about assets' payoff distribution.

Prior theoretical research also suggests that at least part of the estimation risk is non diversifiable, as investors have different degree of information for separate securities and this is respectively priced by the market. For example, Handa and Linn (1993) showed, using the Arbitrage Pricing Model, that investors attribute more systematic risk to an asset with low information (e.g. poor disclosure quality) than to an asset with high information, leading to lower demand and prices for these shares. They also supported Barry and Brown's (1985) perspective that investors' estimation risk, reflected in future expected returns, is often unobservable.

In general, the related research suggests that higher disclosure levels reduce the estimation risk, arising from investors' efforts to estimate assets' expected return and payoff distribution. This stream of research is also supported by the relatively recent study of Lambert et al (2007), who suggest that higher corporate disclosure quality influences not only investor's perception of future expected returns; it also enables them to affect firm's future decisions and cash flows.

2.2 Empirical Literature

Based on the above theoretical background, a number of studies have empirically investigated the relationship between cost of equity capital and different types of voluntary disclosure actions. Botosan (1997) and Hail (2002) concentrated on aggregate disclosures based on self-developed indices, while Botosan & Plumlee (2002) and Gietzmann & Ireland (2005) were more interested in timely disclosure actions and Richardson & Welker (2001) distinguished between financial and social disclosures.

Botosan (1997) documented negative and significant association between cost of capital and level of corporate disclosure for companies with low analyst following. Her empirical analysis indicated that firms with higher disclosure scores can reduce their cost of equity capital by approximately 2.8% relative to firms with lower disclosure scores. She argued that, in the rich US disclosure environment, voluntary reporting actions are not influential on the cost of equity financing for firms that attract high analyst following.

Hail (2002) suggested that the subtle effect of increased reporting on cost of capital is more easily detected when the mandated level of disclosure is low and firms have considerable reporting discretion. Using a sample of 73 Swiss (low disclosure environment) listed companies, he also found a negative association between cost of capital and disclosure actions, and reported that high-disclosing companies enjoy about 1.8 % to 2.4% lower cost of equity financing compared to low-disclosing companies.

Francis et al. (2005), using a sample of companies from 34 emerging and developed countries, also confirmed the expected negative association and provided empirical evidence that firms with higher external financial needs generally disclose more information and this leads to reduction of their cost of equity capital.

Richardson & Welker (2001) examined the impact of social and financial disclosure actions on firm's cost of equity financing. For a sample of Canadian firms, they found out that the cost of equity financing is negatively associated with voluntary financial disclosures and positively related to social reporting actions. These results imply that companies, which disclose more social information, are penalized by the market by charging them higher cost of equity capital.

Botosan & Plumlee (2002) investigated the relationship between cost of capital and annual report disclosures, timely disclosures (quarterly or other published reports) and investor relations disclosures. While confirming the expected negative association for the annual report disclosures, their research showed that cost of capital is positively related to timely reporting actions, which could be attributed to the fact that timely disclosures increase the volatility of share prices by attracting transient investors who trade aggressively on short-term earnings. Moreover, they did not find association between cost of equity financing and investor relations disclosures.

Gietzmann & Ireland (2005) criticized Botosan & Plumlee's (2002) outcomes, claiming that the positive relationship between quarterly reporting and cost of capital is a result of inappropriate measurement of timely disclosures. They found that cost of equity capital is negatively related to the quality of timely disclosures for firms

with aggressive accounting policy choice on the UK market. Their findings were further supported by Espinosa & Trombetta (2007) who studied firms with aggressive accounting policy choice on the Spanish market.

Other studies used more indirect measures for the cost of equity capital and the quality of voluntary disclosure. Welker (1995) used analysts' ratings of overall disclosure policy and confirmed that companies with higher ratings (and respectively higher disclosure) have generally lower bid-ask spreads (costs of capital). This is also supported by Leuz and Verrecchia (2000), who considered the switching from the local (German) GAAP to IFRS or US GAAP as a sign for increased voluntary disclosure, and proved that this change decreased the bid-ask spreads for firms on the German market. Cuijpers and Buijink (2005) also confirmed the expected association, but only for firms with high analyst following, while Daske (2006) found no empirical evidence that German firms, adopting higher disclosure standards, reduce their cost of equity financing.

3. Hypotheses Development

As prior research suggests, incorporating higher levels of disclosure helps to reduce the information asymmetries. This should lead to improving investors' capabilities in forecasting future growth rate, and consequently, decrease the estimation risk and information asymmetry components of a firm's cost of equity capital. Thus, the following hypothesis emerges:

H_1: There is a negative relationship between the expected cost of equity capital and the quality of corporate disclosure

As Hail (2002) concludes, there are four major problems when documenting the above stated hypothesis empirically. First of all, the quality of corporate disclosure relies heavily on the individual perception of the researcher, so it contains an important degree of subjectivity. Furthermore, companies might not select their level of disclosure independently, and this makes the variable subject of self-selection bias. The firm's cost of capital and its components cannot be directly observed and they also have a certain degree of subjectivity. Finally, the relationship of disclosure level and market's profitability expectations might be subject to different factors so that no considerable association is observed. Thus, our study aims to deal with each of the above mentioned concerns.

However, previous empirical work fails to fully clarify the relationship between cost of equity capital and voluntary corporate disclosures. Botosan (1997) and Botosan & Plumlee (2001), for example, found a significantly negative relationship only for firms with low analyst following, but not for their entire sample. Thus, in line with Espinosa & Trombetta (2007) this study aims to investigate if aggressive firms have more incentives to differentiate themselves by increasing the level of disclosure than companies with conservative accounting policy. Therefore, the following hypothesis is tested:

H_2: The relationship between cost of equity capital and disclosure depends on the firm's accounting policy.

which splits to:

H_{2A}: There is a significant negative relationship between cost of equity capital and disclosure for firms with aggressive accounting policy, and

H_{2B}: no relationship exists between cost of capital and disclosure for companies choosing a conservative reporting strategy.

4. Methodology and Data Selection

4.1 Measurement of Implied Cost of Equity Capital

The Residual Income Valuation Model is adopted in order to compute the implied cost of capital. The model applied here was first suggested by Hail (2002) and further used in Espinosa & Trombetta (2007). The intrinsic value of each firm is measured by a three-stage, originally described by Lee et al (1999) and Gebhardt et al (2001). First, the explicit earnings forecasts are collected for the next three years; then, the earnings forecasts are calculated by linearly fading year t+3 Return on Investment (ROE) to the median Swiss market ROE by the year t+T; and finally, the terminal value is estimated by assuming the latest Residual Income (RI) as perpetuity. This approach deals with the Residual Income Model's (RIM) most significant problem- the requirement of forecasted future earnings and book values of equity to infinity- and leads to the following finite time specification:

$$P_t = bv_t + \sum_{k=1}^{n} \frac{(x_{k+1} - r_e \bullet bv_{t+k-1})}{(1+r_e)^k} + \sum_{k=n+1}^{T} \frac{(x_{k+1} - r_e \bullet bv_{t+k-1})}{(1+r_e)^k} + \frac{(x_{t+13} - r_e \bullet bv_{t+k-1})}{r_e(1+r_e)^{12}} \quad (1)$$

where:

P_t = market price of company's stock at date t

bv_t = accounting book value per share at the beginning of the year

x_{t+k} = expected future accounting earning per share for period (t+k-1, t+k), explicitly forecasted, acquired by linear fading rate or assumed constant (Hail, 2002)

r_e = the implied cost of equity capital, which solves equation (1)

bv_{t+k} = expected future accounting BVE. It is assumed that the clean-surplus relationship holds and the $bv_{t+k} = bv_{t+k-1} + x_{t+k} - Dividends_{t+k}$

In this particular approach, the market price of firm's stock is set equal to the current Book Value of Equity (BVE) plus RI over short-term period of analysts' forecasts, medium-term fading period and long-term perpetuity. In order to implement it, several proxies are used for current and future accounting numbers. June 30, 2008, is set as our observation date, because by this point all companies were supposed to have released their annual reports for fiscal 2007, with analysis being based only on publicly available information (Hail, 2002).

In our paper, in accordance to Gebhardt et al (2001), the current stock price is set equal to the intrinsic value of the company. For this reasons particular care is taken when choosing this.. Prior empirical work suggests that choosing an equally weighted average stock price for the observation month delivers a better proxy for the intrinsic value of the firm, than arbitrary choosing the closing price of a single day (Gebhardt et al, 2001). However, Hail (2002) estimates the cost of equity capital using both types of proxies and concludes that results are insensitive to alternative price specifications. Therefore, the closing price for June, 2008, is chosen as proxy for the intrinsic value of each company. Thus, the valuation formula (1) takes the following format, which is applied to each company:

$$P_{June} = bv_t + \sum_{k=1}^{3} \frac{(x_{k+1} - r_e \bullet bv_{t+k-1})}{(1+r_e)^k} + \sum_{k=4}^{12} \frac{(x_{k+1} - r_e \bullet bv_{t+k-1})}{(1+r_e)^k} + \frac{(x_{t+13} - r_e \bullet bv_{t+12})}{r_e(1+r_e)^{12}} \quad (2)$$

The following methodology is used to estimate future accounting earnings,: (1) analysts' consensus forecasts as accounting earnings for fiscal 2008 and 2009 are selected; (2) for fiscal 2010 expected accounting earnings are estimated by multiplying one plus analysts' consensus long term growth forecast with last year's forecasted earnings per share; (3) for years 2011 up to 2019 expected accounting earnings are calculated by multiplying the last year's book value per share with the effective ROE. The effective ROE is the ratio between current earnings per share (EPS) and last year's BVE. (4) The 2019 year's earnings per share are finally used as EPS proxy for perpetuity.

The book value of equity for each year is calculated by solely assuming that the clean-surplus relationship holds. The clean-surplus relationship states that all gains and losses are included in the net income (earnings per share in this case), and the book value per share is only subject to last year's book value, earnings and dividends. As book value per share for 2008 we use the common shareholder equity for the beginning of the year, divided by the number of outstanding shares, downloaded from DataStream. The dividends are computed as a fraction of the earnings per share for the particular year. For each firm, we calculate a dividend payout ratio, based on the company's average dividend payout over the last five years. We use the following estimation formula:

$$DividentPayoutRatio = \frac{1}{5} \bullet \sum_{k=1}^{5} \frac{DPS_k}{EPS_k} \quad (3)$$

For the implementation of the RIM we use explicit fixed forecast horizon, consisting of twelve future periods. The target accounting return on equity is 9.59% and is estimated as the median of past returns from all companies, listed on the Swiss Exchange, over the last five years. Each company's effective ROE fades linearly to the target Swiss market ROE. The same approach has been applied when estimating the ex ante cost of equity capital for all 121 companies. Equity prices and accounting numbers have been collected though DataStream. Earnings forecasts and analyst data are collected from I/B/E/S International database on DataStream or Wharton Research Data Services.

4.2 Measurement of Quality of Corporate Disclosure

The measurement of a firm's disclosure quality is based on the amount of voluntary disclosure provided in the annual report to shareholders. Among all channels of corporate communication, the annual report was selected because it should serve as best estimate for overall quality of voluntary disclosures provided by a firm. This is partly due to the fact that annual report disclosure levels are positively correlated with the amount of disclosure, communicated though other media (Lang & Lundholm, 1993), suggesting that companies coordinate their overall

disclosure policy. Furthermore, the annual report is generally considered as the most important source of corporate information (Knutson, 1992). Moreover, it is the one communication channel, over which the management has complete control and is not subject to distortions by other media (Guthrie & Parker, 1989). However, results from disclosure measures, based solely on annual reports, should be interpreted with caution. Despite the positive correlation of disclosure means, the marginal effect of voluntary reporting in the annual report could be overstated. The outcomes are likely to reflect the effect of all means of voluntary disclosures and not the annual report alone (Botosan, 1997).

Our disclosure measure, referred here as DPNTS, is based on questionnaire and is developed in a similar way as in Botosan (1997). The issues included in the questionnaire rely on a study conducted by the Swiss Banking Institute (SBI) at the University of Zurich. DPNTS is based on the voluntary information companies publish with respect to Swiss accounting law and Swiss GAAP in their 2008 annual report to shareholders. This leaves management with considerable discretion in determining the firm's disclosure policy. The authors' original goal was to identify all information items, voluntarily provided in the annual report to shareholders, and to differentiate them from those, whose disclosure is compulsory by the SWISS GAAP. However, this procedure proved to be rather unrealistic and, therefore, this research focus only on aspects discussed by the SBI in their survey. These items are considered as most informative for financial-statement users in their decision-making process.

DPNTS consists of three types of voluntary disclosures (see Appendix): (1) Background and key non-financial disclosure (DPNTS_1); (2) trend analysis and management discussion (DPNTS_2); (3) risk, value-based and forecasted information (DPNTS_3). Two points are assigned to each of the 27 items if the management provides a detailed representation, including quantitative information and qualitative discussion, one point if it is only briefly mentioned in the annual report and zero otherwise. The total absolute score is computed by the following formula:

$$DPNTS_t = \sum_{t=1}^{3} SCORE_t \tag{4}$$

In order to make the regression coefficients easier to interpret, the fractional rank of a company's disclosure is used (DISCL), which is also less sensitive to outliers. The fractional rank is estimated as the disclosure score DPNTS divided by the number of firms 121 and increases with the disclosure quality. Using absolute disclosure values DPNTS does not qualitatively change the results.

4.3 Other Independent Variables

The ex ante cost of equity capital is simply a theoretical measure and its relevance needs to be additionally justified. One reasonable way to do this is to investigate its relationship with other measures that reflect companies' various risk factors. Numerous prior studies in this field, such as Botosan (1997), Botosan & Plumlee (2002), Hail (2002), Leuz & Hail (2006), employ different accounting and market-based risk proxies to justify the relevance of the ex ante cost of equity capital. Based on their research and taking into consideration their results, three additional risk factor measures were included in our empirical research: the firm's leverage, its size and market beta.

4.3.1 Leverage

The firm's leverage serves as a proxy for the firm's financial risk. Prior research indicates that the amount of debt and its capital structure is an increasing function of the company's cost of equity capital and higher debt is, therefore, associated with higher volatility of future earnings (Gebhardt et al, 2001; Hail, 2002). Numerous other studies have also investigated this link and also observed a positive relation between the ex ante cost of capital and the firm's leverage (Leuz & Hail, 2006; Guay et al, 2005). However, due to information asymmetries, it is still unclear if higher debt announcements are a good or bad news for the investors.

As a proxy for firm's financial leverage, the ratio of total debt to market value of outstanding equity at the beginning of 2008 (LEV) is used.

4.3.2 Beta

The stock's market beta serves as a proxy of the firm's systematic or market risk. The Capital Asset Pricing Model (CAPM) suggests that the beta should be positively correlated with the cost of equity capital. Some studies, such as the one of Hail (2002), confirm the relation for Switzerland or other countries (Leuz & Hail, 2006). However, other studies, such as of Gebhardt et al (2001), fail to consistently show the expected relationship.

In order to estimate the market beta (BETA) a Market Model regression is applied, requiring at least 24 weekly return observations in a two year period ended June 30, 2008. As a benchmark the Swiss Market Index is employed.

4.3.3 Size

As prior research indicates, firm size serves as a proxy for information availability. Bigger firms provide generally more information than the smaller firms which leads to lower risk, regarding future earnings, and also implies lower cost of equity capital. As a proxy for the firm's size the market value of outstanding equity at the beginning of 2008 (MARKET, in CHF millions) is selected. For the final regression, the natural logarithm of the outstanding equity is employed because the results are less sensitive to influence of outliers and the coefficients are easier to interpret.

4.3.4 Accounting Policy

A measure of firm's accounting policy choice, either aggressive or conservative, is necessary in order to test hypothesis H_2. The classification is based on companies' annual reports for 2008 according to the following criteria: bad debt, bad investment, inventory and general risk provisions; which, after thorough research, were considered as the most suitable (Espinosa & Trombetta, 2007).

Then, four ratios were determined for each company by dividing the above provisions by total receivables, total financial assets, total inventory, and total liabilities, respectively. The median of these ratios serves as a criterion to determine the type of accounting policy. If more than two ratios were below their median value for a particular firm then this firm was considered to follow an aggressive accounting policy. A dummy variable was created (D^{AGG}) whose value is one in this case and zero otherwise. The reasoning behind our measure is that companies, whose provision ratios are lower, may have incentives to increase their annual earnings more than companies with higher provision ratios, which can be indicative of a more aggressive accounting policy (Espinosa & Trombetta, 2007).

4.4 Data Collection

Our paper focuses on a low disclosure environment. Switzerland appears particularly appropriate for such kind of analysis, since Swiss companies have considerable reporting discretion and ther mandated level of disclosures is notably low. The only requirement for companies to be listed on the local exchange is compliance with Swiss GAAP, which leaves firms with significant freedom in choosing their voluntary disclosure policy. Furthermore, a number of prior studies also focus on Switzerland, or include it in a more international sample, as the local stock market displays many common features of a typical market in continental Europe and management relies heavily on shareholders' value in their attempt to improve firm's overall financial situation. Therefore, this specific research environment should make the subtle effect of increased voluntary disclosures on firms' cost of equity capital more easily detectable.

Totally, there are 334 companies listed on the Swiss Stock Exchange. The list of firms includes highest capitalized Swiss companies, along with some small publicly held companies, trading on the local exchange. This sample of firms implies that a positive bias in a potential disclosure score may exist, because disclosure quality is positively correlated with company's market value (Lang & Lundholm, 1993). Disclosure quality is negatively related with the firm size and large companies are generally assumed to have a richer information environment in terms of media and analyst coverage. However, if there is a sufficient cross-sectional variation in the disclosure score, this should not cause problems for the empirical research.

Our original sample consisted of all 334 companies listed on the Swiss Stock Exchange SWX. Out of them, 150 were dropped because no proper stock or forecasted information is available on DataStream and I/B/E/S International. Another 10 firms were excluded because their fiscal year does not end on December 31, 2007 or within the first quarter of 2008. For 35 companies a full annual report online could not be found, so it was requested via e-mail. However, 31 failed to reply on time or at all and, therefore, they were also excluded from the sample. In line with Hail (2002), our sample includes companies from various industries. Contrary to Botosan (1997), who restricts her sample on companies from a particular industry, we believe that a cross-sectional sample delivers more consistent and reasonable results. However, 22 companies were excluded from banking, investment and insurance sector, because their disclosure practices are heavily influenced by regulatory requirements and their business differs significantly from other industries. As illustrated on Table 1, the sample selection procedure yields a total of 121 non-financial companies listed on the Swiss Stock Exchange SWX. Finally, Table 2 provides descriptive statistics for the sample.

5. Empirical Analysis

The cost of equity capital and quality of corporate disclosure are both highly subjective variables, relying heavily of researcher's individual perception rather than actual use. Therefore, the validity of these proxies, of the disclosure measure and of the cost of capital was initially assessed and confirmed, before testing the hypotheses.

5.1 Assessment of Validity of the Disclosure Score

Prior studies such as of Marston & Shrives (1991), Lang & Lundholm (1993), Botosan (1997), Botosan & Plumlee (2001), and Hail (2002), confirm that disclosure indices are a useful research tool and usually lead to reasonable and

significant results. However, they suffer from subjectivity. Thus, the validity of the disclosure measure DPNTS was assessed in three different ways.

First positive and highly significant correlation coefficients between DPNTS and its three components were found (see Table 3). However, the coefficients among the components themselves were considerably lower than the ones including DPNTS, which implies that the three categories may reflect different aspects of disclosure.

Second, the relationship between DPNTS and the following variables was estimated: MARKET, market value of outstanding equity (in CHF millions); RETURN, average realized ROE for the sample of firms over last several years; CR_LIST, dummy variable equal to one if company's shares are multiple listed or zero otherwise; LEV, financial leverage measured as the ratio of total debt to market value of outstanding equity at the beginning of 2008; and AUDIT, dummy variable equal to one if a firm is audited by a "BIG SIX" audit company or zero otherwise. To diminish the influence of outliers, the log transformations of the market value of outstanding equity were used instead of absolute values. MARKET, RETURN and AUDIT show a positive and highly significant correlation with the disclosure variable DPNTS (Table 3). However, CR_LIST and LEV do not show a significant relationship with DPNTS, which it implies that the highly levered Swiss companies do not seem to look for options to reduce their monitoring costs by disclosing more information.

Finally, the multivariate analysis of the relationship between firm's fractional disclosure score DISCL and the other firm specific characteristics showed that, while RETURN and AUDIT variables remain positive and statistically significant, MARKET loses its explanatory power. Approximately 53% of the variation in the disclosure score is explained by variables included in the regression model (Table 4). Thus, the validity of the disclosure measure is confirmed.

5.2 Assessment of Validity of Ex ante Cost of Equity Capital Estimate

A valid cost of capital estimate should be an increasing function of the risk, as measured by market beta and financial leverage, and it should also display a well known "size effect" (Botosan, 1997; Botosan and Plumlee 2002; Hail, 2002). The validity of the ex-ante cost of equity capital estimate is assessed by the OLS regression analysis (Table 5). ROE, the proxy of future expected cost of equity capital, is the dependent variable and BETA, LEV and MARKET are the independent or explanatory variables. To diminish the influence of outliers, the log transformations of the market value of outstanding equity were used instead of absolute values.

All coefficients confirmed the expected relationship, documented by prior studies (Botosan, 1997; Gebhardt et al, 2001; Botosan and Plumee, 2001; Hail, 2002). Market beta and financial leverage are positively related to the cost of equity capital, while firm's size shows a negative association. With one exception, all coefficients are significant at least at 10%. These results together confirm the validity of our cost of capital proxy. However, as indicated on panel B, the maximum adjusted R^2 is 34.3%, which means that considerable variation in the cost of capital still remains unexplained.

5.3 Empirical Analysis of Hypothesis One

Prior studies confirm the expected negative relationship between cost of equity capital and quality of corporate disclosure (e.g. Botosan, 1997; Botosan and Plumlee, 2001; Hail, 2002; Leuz and Hail, 2006).

Table 6 provides Pearson correlation coefficients between our cost of capital estimate and firm-specific characteristics, including market and financial risk BETA and LEV, fractional disclosure scores DISCL and firm size MARKET. The correlation between our proxy of future expected cost of capital and the quality of corporate disclosure DISCL is -0.480 and highly significant at all levels according to the two-tail test of statistical significance. This result is consistent with the statement that cost of equity capital decreases as the quality of corporate disclosure increases. As prior studies document, cost of equity capital should correlate positively with market beta and financial leverage and negatively with firm's size (Botosan, 1997; Botosan and Plumlee, 2001; Leuz and Hail, 2006). Our correlation coefficients confirm the expected association and are all statistically significant, except for the LEV variable, which does not show any explanatory power at all. All of the correlation coefficients are less than 0.5, which indicates that multicollinearity should not be a problem, if including all variables in the same model.

Therefore, hypothesis one is tested by taking all variables into consideration and using the following regression model:

$$\text{Cost of Capital}_i = \alpha + \beta_1 \text{MarketRisk}_i + \beta_2 \text{FirmRisk}_i + \beta_3 \text{Disclosure}_i + \beta_4 \text{Size}_i + \varepsilon_i \quad (5a)$$

Or more specifically:

$$\text{ROE}_i = \alpha + \beta_1 \text{BETA}_i + \beta_2 \text{LEV}_i + \beta_3 \text{DISCL}_i + \beta_4 \ln(\text{MARKET}_i) + \varepsilon_i \quad (5b)$$

Table 7 provides the results from a simple OLS regression of the equation illustrated above. All coefficients confirm the expected signs. BETA and LEV are positively related to the ROE and confirm Hail's (2002) conclusion that cost of equity capital is positively related to systematic and financial risk in the Swiss market. The coefficients are economically relevant and statistically significant according to the two-tail test employed in this study. As expected, the firm's size is negatively associated to the cost of equity capital, implying that the particular variable might also capture some other not closely defined influences. Eventually, the voluntary disclosure quality, DISCL, is negatively related to our cost of capital measure. All coefficients are relevant at all levels of statistical significance using two-tail tests. These results confirm that by improving their disclosure quality, firms can reduce their cost of equity capital. The claim holds even after controlling for cross-sectional variation in market beta, financial leverage and company size. The coefficients on DISCL range from -0.115 to -0.148, implying that companies in the sample, with higher fractional disclosure score, enjoy cost reduction somewhere between 11.5% and 14.8% compared to companies that choose lower levels of voluntary corporate disclosure.

The particular regression model is also estimated using absolute disclosure score, DPNTS, instead of the fractional score DISCL. This analysis indicates that one unit increase in the absolute disclosure score DPNTS results in a reduction in cost of equity capital of 0.1%. In order to illustrate the magnitude of these results, we consider the following example. SIKA AG, operating in the construction and materials industry, receives a total of 37 points, which is the highest score, awarded in the sample. In its 2008 annual report, the company provides extensive qualitative and quantitative information on background, non-financial and value-based information. One interpretation of these results would imply that by providing this information, holding all else equal, SIKA AG has reduced its cost of equity capital by approximately 3.7% (i.e. 37 * 0.1%) relative to a company that provided poor background and non-financial information and no value-based discussion. The results are not only statistically significant, but also economically relevant.

However, these findings should be interpreted with caution for two different reasons. First, including disclosure quality proxy in the model increases the adjusted R^2 to a maximum of 43.8%. This means that significant variation in the cost of capital still remains to be explained otherwise. And second, given the self-selection of disclosure policy is an issue, simple OLS analysis would overestimate the effect of corporate reporting quality on company's cost of equity capital.

5.4 Empirical Analysis of Hypothesis Two

According to hypothesis two the influence of voluntary disclosure actions on cost of equity capital depends on firm's accounting policy choice. More specifically, H_{2A} states that companies, adopting aggressive corporate reporting, might look unreliable to potential investors and are likely to have higher cost of equity capital. They would, therefore, voluntarily provide more information in an attempt to reduce this effect. On the other hand, according to H_{2B} companies choosing conservative accounting policy generally engage in higher disclosure levels and additional voluntary reporting might not be that influential on their cost of equity capital.

In order to test H_2, two different regression models were used. The first one investigated the impact of voluntary disclosure actions on cost of equity capital for firms with aggressive accounting policy choice (H_{2A}):

$$ROE_i = \alpha + \beta_1 BETA_i + \beta_2 LEV_i + \beta_3 D_i^{AGG} DISCL_i + \beta_4 \ln(MARKET_i) + \varepsilon_i \quad (6)$$

To distinguish between firms with different accounting policy, the dummy variable D_i^{AGG} is employed which equals one if the company has aggressive reporting strategy and zero otherwise. The interaction term is also included alone to determine whether aggressive firms try to counteract the potentially negative effect of their reporting choice by adopting higher levels of disclosure quality. All coefficients confirm the expected signs (Table 8). It seems that aggressive firms reduce their cost of equity capital by improving the quality of their voluntarily disclosed information. However, the coefficient before the interaction term, despite positive, is statistically insignificant, which indicates that aggressive companies do not necessarily provide this information to compensate for the effects of their accounting policy choice.

In order to further investigate the validity of H_{2B}, the relationship between cost of equity capital and quality of corporate disclosure is examined for companies with conservative accounting policy, using the following regression model:

$$ROE_i = \alpha + \beta_1 BETA_i + \beta_2 LEV_i + \beta_3 DISCL_i + \beta_4 D_i^{CONS} DISCL_i + \beta_5 \ln(MARKET_i) + \varepsilon_i \quad (7)$$

In order to distinguish between aggressive and conservative firms, we reverse the value of the dummy variable from the previous specification and use D^{CONS} with value of one for conservative companies and zero otherwise. The results show that disclosure quality, despite insignificant for conservative firms, is statistically relevant at a general level (Table 9). Thus, it could be concluded that firms on the Swiss market can reduce their cost of equity capital by

increasing the level of voluntary disclosures, regardless of their accounting policy choice. Therefore, hypothesis two is rejected.

6. Discussion and Conclusions

In this study we document negative and highly significant relationship between our proxy of future expected cost of capital ROE and DISCL, companies' fractional disclosure score. The results hold even after adjusting for systematic risk, financial risk and firm size. This statistically strong association may be partially explained by the different institutional factors between capital markets with divergent disclosure requirements. Our findings support the opinion of Leuz and Verrecchia (2000), that the economic consequences of increased voluntary reporting are easier to detect in a low disclosure environment.

Our results also confirmed the expected negative relationship between disclosure quality and cost of equity capital for firms with aggressive reporting choice, but the insignificant coefficient before the interaction term implies that this effect might not be result of company's effort to compensate for the potentially negative effect of its reporting strategy. Our analysis also revealed that this negative relationship between disclosure quality and cost of equity capital exists as well for conservative firms. Thus, it could be concluded that the accounting policy choice does not influence the relationship between cost of equity capital and quality of corporate disclosure, at least on the Swiss market.

7. Study Limitations and Recommendations

This study provides some important insights to financial executives and regulators, revealing that increased levels of disclosure result in inferior cost of equity capital, regardless of firm's accounting policy choice. Furthermore, this study introduces a procedure of constructing a cost of capital proxy, increasing in market beta and decreasing in firms' size. This procedure may be further used in future studies, in which firm-specific cost of equity capital estimates are required and analyst forecast data is available.

The analysis and results reported here are limited to a relatively small sample of 121 companies in a single market during one-year period. Therefore, all conclusions should be interpreted with caution and the results should not be generalized to other markets or other time horizons. To reduce potential distortions due to endogenous bias, future work should focus on better understanding of the determinants of firm's voluntary reporting behavior. By increasing the time horizon, for instance, one can investigate the change of disclosure level over time and its influence on firm's risk situation. To diminish distortions from sample selection bias, similar approach may be employed to study the particular relationship from a more international point of view, by including companies form different countries and different corporate reporting environments.

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Table 1. Summary of Sample Selection Procedure

	Number	Percent
Firms listed on the Swiss Stock Exchange	334	100%
Firms not followed by I/B/E/S International (no financial analysts' forecast data available)	-150	-44.9%
Firms with fiscal year end not on December 31, 2007, or not within the first quarter of 2008	-10	-2.9%
Firms for with no full annual report was found	-31	-9.3%
Firms available for analysis	143	42.8%
Financial institutions (banking, investments and insurance companies)	-22	-6.4%
Total number of sample firms	121	36.2%

Table 2. Descriptive Statistics for sample Firms

Variable	N	Minimum	Maximum	Mean	Std. Deviation
Size (in CHF millions)					
MARKET	121	12	153,046	6,180	16,735
TOTAL ASSETS	121	28	293,055	8,902	33,154
TOTAL SALES	121	21	46,133	4,214	8,891
Risk					
BETA	121	-0.46	3.19	1.18	0.66
LEV	121	0.00	2.10	0.49	0.49
Disclosure					
DPNTS	121	8	37	18.2	7.2
Ex ante Cost of Capital					
ROE	121	4.29%	18.02%	8.02%	2.18%

Table 3. Pearson Correlation Coefficients (two-tailed) for Disclosure Scores and Firm Characteristics

	DPNTS	**DPNTS_1**	**DPNTS_2**	**DPNTS_3**	**MARKET**	**RETURN**	**CR_LIST**	**LEV**
DPNTS_1	0.735							
	(0.000)							
DPNTS_2	0.819	0.336						
	(0.000)	(0.000)						
DPNTS_3	0.756	0.302	0.571					
	(0.000)	(0.001)	(0.000)					
MARKET	0.284	0.180	0.147	0.374				
	(0.002)	(0.048)	(0.107)	(0.000)				
RETURN	0.658	0.485	0.524	0.500	0.099			
	(0.000)	(0.000)	(0.000)	(0.000)	(0.280)			
CR_LIST	0.143	0.053	0.125	0.173	0.338	0.089		
	(0.117)	(0.563)	(0.170)	(0.058)	(0.000)	(0.331)		
LEV	0.005	-0.039	0.052	0.008	- 0.027	- 0.044	0.132	
	(0.958)	(0.674)	(0.573)	(0.928)	(0.766)	(0.631)	(0.150)	
AUDIT	0.554	0.441	0.457	0.397	0.141	0.395	0.033	- 0.139
	(0.000)	(0.000)	0.000	(0.000)	(0.124)	(0.000)	(0.718)	(0.129)

Table 4. Regression of absolute disclosure DISCL on firm specific variables MARKET, RETURN, CR_LIST, LEV and AUDIT

$DISCL_i = \alpha + \beta_1 ln(MARKET_i) + \beta_2 RETURN_i + \beta_3 CR\_LIST_i + \beta_4 LEV_i + \beta_5 AUDIT_i$

	Intercept	MARKET	RETURN	CR_LIST	LEV	AUDIT	Adj. R^2
Coefficient	-0.96	0.115	0.514	0.018	0.052	0.351	53.4%
P-Value (2-tail)	(0.018)	(0.117)	(0.000)	(0.806)	(0.421)	(0.000)	(0.000)

Table 5. Regression of Ex ante Cost of Capital on Beta, Leverage and Market Value

$ROE_i = \alpha + \beta_1 BETA_i + \beta_2 LEV_i + \beta_3 ln(MARKET_i) + \varepsilon_i$

	Intercept	BETA (+)	LEV (+)	MARKET (-)	Adj. R^2
Panel A: Simple Regressions (OLS)					
Coefficient	0.66	0.012			11.9%
P-Value (2-tail)	(0.000)	(0.000)			(0.000)
Coefficient	0.077		0.006		0.9%
P-Value (2-tail)	(0.000)		(0.156)		(0.156)
Coefficient	0.138			-0.005	22.4%
P-Value (2-tail)	(0.000)			(0.000)	(0.000)
Panel B: Multiple Regressions (OLS)					
Coefficient	0.123	0.011		-0.0039	33.2%
P-Value (2-tail)	(0.000)	(0.000)		(0.000)	(0.000)
Coefficient	0.136		0.007	-0.0047	24.3%
P-Value (2-tail)	(0.000)		(0.048)	(0.000)	(0.000)
Coefficient	0.122	0.011	0.006	-0.004	34.3%
P-Value (2-tail)	(0.000)	(0.000)	(0.085)	(0.000)	(0.000)

Table 6. Pearson Correlation Coefficients (2-tail) for ex ante Cost of Capital and Firm Characteristics

Variable	ROE	BETA	LEV	DISCL
BETA	0.356			
	(0.000)			
LEV	0.130	0.089		
	(0.156)	(0.331)		
DISCL	-0.450	-0.233	-0.003	
	(0.000)	(0.010)	(0.976)	
MARKET	-0.480	-0.041	0.060	0.115
	(0.000)	(0.625)	(0.510)	(0.211)

Table 7. Regression of Ex ante Cost of Capital on BETA, Leverage, Disclosure Score and Market Value

$ROE_i = \alpha + \beta_1 BETA_i + \beta_2 LEV_i + \beta_3 DISCL_i + \beta_4 ln(MARKET_i) + \varepsilon_i$

	Intercept	BETA (+)	LEV (+)	DISCL (-)	MARKET (-)	Adj. R^2
Panel A: Simple Regressions (OLS)						
Coefficient	0.103			-0.148		15.6%
P-Value (2-tail)	(0.000)			(0.000)		(0.000)
Panel B: Multiple Regressions (OLS)						
Coefficient	0.140	0.009		-0.115	-0.0038	42.4%
P-Value (2-tail)	(0.000)	(0.000)		(0.000)	(0.000)	(0.000)
Coefficient	0.153		0.007	- 0.135	-0.004	37.5%
P-Value (2-tail)	(0.000)		(0.031)	(0.000)	(0.000)	(0.000)
Coefficient	0.139	0.008	0.006	-0.116	-0.004	43.8%
P-Value (2-tail)	(0.000)	(0.001)	(0.052)	(0.000)	(0.000)	(0.000)

Table 8. Interaction Regression: Firms with Aggressive Accounting Policy

$ROE_i = \alpha + \beta_1 BETA_i + \beta_2 LEV_i + \beta_3 D_i^{AGG} DISCL_i + \beta_4 D_i^{AGG} + \beta_5 ln(MARKET_i) + \varepsilon_i$

	Intercept	BETA	LEV	D^{AGG}DISCL	D^{AGG}	ln(MARKET)	Adj. R^2
Coefficient	0.126	0.010	0.006	-0.082	0.007	-0.004	38.6%
P-Value (2-tail)	(0.000)	(0.000)	(0.074)	(0.047)	(0.379)	(0.000)	(0.000)

Table 9. Interaction Regression: Firms with Conservative Accounting Policy

$ROE_i = \alpha + \beta_1 BETA_i + \beta_2 LEV_i + \beta_3 D_i^{CONS} DISCL_i + \beta_4 DISCL_i + \beta_5 ln(MARKET_i) + \varepsilon_i$

	Intercept	BETA	LEV	D^{CONS}DISCL	DISCL	ln(MARKET)	Adj. R^2
Coefficient	0.140	0.009	0.006	-0.006	-0.118	-0.004	43.3%
P-Value (2-tail)	(0.000)	(0.000)	(0.074)	(0.785)	(0.000)	(0.000)	(0.000)

APPENDIX

Summary of the Components of Disclosure Score DPNTS

Part 1: Background and key non-financial Information (DPNTS_1)

1. Primary products
2. Primary markets and market shares
3. Business environment and crucial success factors
4. Corporate governance and organizational structure
5. Client satisfaction
6. Employee satisfaction
7. Investment in human resources and management development
8. Investment in research and development and other intangible assets
9. Product life cycle and innovation
10. Operational efficiency

Part 2: Trend analysis and management discussion (DPNTS_2)

1. Trend in sales over the last five years
2. Detailed sales information by region and business segment
3. Trend in operation income over the last five years
4. Detailed information about the operating income by region and segment
5. Capital expenditures trend over the last five years
6. Capital expenditures by region and business segment
7. Trend in stock prices and total shareholders return
8. Qualitative discussion in sales and market shares
9. Qualitative discussion in operating income
10. Discussion of changes in capital expenditures / research and development

Part 3: Risk, value-based and forecasted information (DPNTS_3)

1. Qualitative discussion of the risk management technique
2. Quantitative risk exposure measures
3. Implementation of value-based management
4. Qualitative measures of shareholder value creation
5. Management compensation
6. Profit forecast
7. Sales and growth forecasts

Examining the Effect of Selective Macroeconomic Variables on The Stock Exchange's Depth and Breadth (Case Study: Tehran Stock Exchange)

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Abstract

One of the features of developed countries is the existence of effective financial markets, which not only play an important role in the economy, but also facilitate economic growth and a country's development. Stock exchangedevelopment is affected by many macroeconomic variables. In this survey, we mainly attempt to examine the effect of macroeconomic variables on the development of the Tehran Stock Exchange. To do so, national income, investment rate, financial intermediary development and macroeconomic instability are considered as macroeconomic variables, and depth and breadth are considered as indices of the stock exchange development. Necessary data were collected seasonally during 1998-2007. For statistical analysis, we first examined stationary of the variables by augmenting the Dickey-Fuller Unit Root Test. Then, the Johansen co-integration Test was used to estimate co-integration vectors. Finally, we used the Vector Error Correction Model to test the research model. Findings suggest that national income and investment rates have a positive, significant effect on the depth and breadth of the stock exchange. Also, financial intermediary development and macroeconomic instability have a negative, significant effect on the depth and breadth of the stock exchange.

Keywords: Capital market, Stock exchange development, Stock exchange depth, Stock exchange breadth, Macroeconomic variables

JEL: E20, G11, F31

1. Introduction

More and more investigations on stock exchange seem necessary with due attention to the important and vital role of

stock exchange in capital construction and facilitation of the economic development (Khodaee, 2001). Depth and breadth are two major measures of stock exchange development. Depth of the market refers to size and liquidity of the stock exchange, and breadth means variety of the market in terms of participation of large and small corporations, various kinds of corporations from different sectors of industry and international companies (Fathi and Asgarnezhad Nouri, 2010; Miller, 2002). Based on the literature, determining the factors affecting stock exchange development is important for managing the whole economic system. These factors could be placed in one of three groups of internal factors of the organization, external economic factors and external non-economic factors (Khalili and Ramezan Pour, 2002; Boubakri and Olfa, 2007; Cajueiro, Periklis et al., 2009; Demirguc – Kunt and Ross, 1995; Fischer, 1996).

Abdul Rahman, et al., (2009) have studied mutual relationships between selected macroeconomic variables and stock prices in the stock exchange in Malaysia. They showed that monetary policy variables (i.e. money supply, currency rate, resources and interest rate) and internal supply factor (introduced with industrial production) have considerable long-term effects on the Malaysian stock exchange. Solman and Tei (2008) have studied the manner of the effect of macroeconomic indices on the performance of the stock exchange in Ghana. Results reveal that the lending rate of banking savings has a negative effect on stock exchange performance. Also, negative effect of the inflation rate on stock exchange development is obtained with a time period delay, and also investors are benefited from reduction of the currency rate as a result of internal currency rate drop. Miller (2002) has studied the relation between stock exchange development and privatization of corporations owned by the government in Brazil, Argentina and Chile. In this research, stock exchange development has been specified with the three features of depth, breadth and sophistication. Miller (2002) has considered a three-step process in order to test the effect of privatization on stock exchange development. In the first step, Perron Test for Structural Gap Point has been executed by means of measurement criterion of stock exchange development, which is depth of the market. In the second step, the relationships between structural gap and privatization activity is studied, and in the third step, the possible effect of the other factors except privatization on structural gap are studied. Finally, it is concluded that structural gap in the market's capital is in relation to increasing privatization activities. Garcia and Liu (1999) have studied the effect of macroeconomic variables on stock exchange development and especially on the market's capital. Data related to fifteen countries have been collected in the time period from 1980 to 1995. Market capital is the dependent variable of research. Real income, saving rate, investment rate, financial intermediary development, liquidity of stock exchange and macroeconomic stability are descriptive variables. Garcia and Liu (1999) believe that national income, saving rate, investment rate and liquidity of stock exchange have a positive effect on market's capital. Also, they concluded that stock exchange and banking sector are complement, and they are not substitute.

Our purpose is to study whether or not macroeconomic variables affect the development of the Tehran Stock Exchange. In this research, the features of depth and breadth are used to measure stock exchange development. Moreover, national income, investment rate, financial intermediary development and macroeconomic instability are selected as independent variables based on data limitation and the literature.

In section 2, Stock Exchange Development**,** we present definitions and different indices of stock exchange development. Section 3, Factors Affecting Stock Exchange Development, includes the effective factors on development of stock exchange. In section 4, Research Methodology, we introduce the research variables and hypotheses and discus the used statistical methods. Section 5, Findings**,** tries to focus on the results. Finally, in section 6 and 7, conclusions, limitations, and suggestions of the research are described.

2. Stock Exchange Development

According to studies, financial development is a multimodal concept. Since financial structure of a country is made up of various markets and financial products, some limited criteria could not include all necessary aspects of financial developments. It is possible to define financial development from six different aspects including banking sector development, non-banking financial sector development, monetary sector and monetary policy-making development, banking rules and supervision, openness of financial sector, and institutional environment (Creane et al., 2004; Gelbard and Sergio, 1999; Jbili et al., 1997; Khan and Abdelhak, 2000).

We can describe stock exchange development through three major features of depth, breadth and sophistication. Depth refers to size and liquidity of stock exchange and breadth means variety of market in terms of participation of large and small companies, various kinds of companies from different sectors of industry and foreigners. Breadth reduces risk of the total market and encourages extensive ownership, which leads to an increase in capital and enables small corporations to have more access to financial resources. Sophistication refers to management and administration of the market. When there are more firms in the market, the average amount of complicated transactional technologies would be reduced, and corporations and investors show more sensitivity towards investing in the market. Corruption that is special in some small markets could be reduced by more supervision or,

conversely, could be increased because of insufficient execution of privatization programs and as a result of freehold of few shareholders (Fathi and Asgarnezhad Nouri, 2010; Demirguc – Kunt and Ross, 1995; Miller, 2002).

3. Factors Affecting Stock Exchange Development

Generally, the factors affecting stock exchange development could be classified into three groups, namely internal factors of corporations, external non-economic factors and external macroeconomic factors (Pearce and Richard, 2002).

Earnings per share, capital structure of the corporation, demand for the corporation's product, dividend policies, reward and decomposition of stock, capital increase, ownership structure, etc. are some intra-organizational factors affecting stock exchange development (Pearce and Richard, 2002). External non-economic factors affecting the stock exchange development are classified as political, legal, social, cultural, and technological factors (Osulian, 2006; Black, 2001; Boubakri and Olfa, 2007; Torre et al., 2006). These internal and external studies conclude that national income, saving rate, investment rate, financial intermediary development, liquidity of stock exchange, liberalization of stock exchange, privatization, macroeconomic instability, tax rate, interest rate, inflation rate and currency rate are among the most important, effective macroeconomic variables on stock exchange development (Osulian, 2006; Black, 2001; Boubakri and Olfa, 2007; Naceur et al., 2007; Torre et al., 2006). In this research, four variables including national income, investment rate, financial intermediary development, and macroeconomic instability have been selected according to Garcia and Liu (1999). It is predicted that higher income has a positive effect on stock exchange development. Higher income means better education, better commercial environment and wealthier citizens (Naceur et al., 2007). Incomes of individuals are divided into two parts of consumption and saving. Whenever economic conditions of a country allow a high rate of saving i.e., people save part of their income in addition to paying daily expenses, we can say investment in that country will be strengthened. On one hand, it is possible to guess that investment is one of the important factors determining stock exchange capital since investment rate depends on saving rate (Naceur et al., 2007). On the other hand, stock exchange could not be developed without the existence of an efficient system of financial intermediaries including underwriters, dealers, etc. Because banks and stock markets act as intermediaries in directing individuals' savings towards investment projects, they could complement or substitute each other (Black, 2001). Boyd and Smith (2001) and Demirguc-Kunt and Levin (1995) believe that banks and stock exchange institutions act as each other's complement, not substitute. In contrast, Garcia (1986) understood that the central bank could cause a reverse correlation between banking system growth and stock exchange development (Garcia, 1986). The last macroeconomic variable of research is macroeconomic instability: the more the economic instability (for example, the permanent change of inflation rate) the less the motivation of corporations and investors to invest in the stock exchange, and consequently, the fewer opportunities for stock exchange development (Khalili and Ramezan Pour, 2002; Fischer, 1996; Naceur et al., 2007; World Bank, 1996; World Bank Staff, 1993).

4. Research Methodology

As we show in the following equations, according to Garcia and Liu (1999) and Miller (2002)**,** national income, investment rate**,** financial intermediary development and macroeconomic instability are selected as independent variables, and since depth and breadth of stock exchange are selected as dependent variables, we will obtain the following two new multiple regression equations:

$$MD= \alpha_0+\beta_1 RI_t+\beta_2 IR_t+\beta_3 FID_t+\beta_4 MI_t+e$$

$$MB= \alpha_0+\beta_1 RI_t+\beta_2 IR_t+\beta_3 FID_t+\beta_4 MI_t+e$$

In these equations, MD is market depth, MB is market breadth, RI is real income, IR is investment rate, FID is financial intermediary development and MI is macroeconomic instability. It is noteworthy to say that saving rate in Garcia and Liu (1999) and sophistication of market among dimensions of stock exchange development in Miller's research (2002) have been omitted because of limitations. Measures of research variables are shown in Table 1. It should be mentioned that because of different criteria used to measure each of the four variables of market depth, market breadth, financial intermediary development and macroeconomic instability, the TOPSIS method has been used to combine these polymorphous measurement criteria and to obtain a unit number for the above variables in seasonal time period (Azar and Rajabzade, 2009).

The required data have been obtained from information archives of the Tehran Stock Exchange, web sites of Central Bank of the Islamic Republic of Iran, Iran Statistics Center and Tadbir Pardaz financial software. The Vector Error Correction Model has been used to test hypotheses of the research. In the Vector Error Correction Model, a combination of long-term data with short-term adjustment mechanism is used. In other words, short-term fluctuations of a variable are related to its long-term value. In this model, the residual terms of convergence equation

can be used as a variable, and its coefficient is considered as a ratio of short-term balance. The correlation value is between minus one and zero, and it shows the relation between short-term fluctuations and long-term value of a variable (Nofresti, 2000). Totally, the first condition for econometrics relying on macro variables is that all used variables should be stationary. Otherwise, it is necessary to convert non-stationary variables into stationary variables before the estimation of the model. The first step towards determining the reliability of a variable is observing its time series graph. However, we cannot explicitly judge the recognition of reliability using charts in some cases. Therefore, the reliability of variables is examined statistically. In econometrics, time series with a unit root is called a random walk process and is an example of a non-stationary time series (Nofresti, 2000). The Dickey-Fuller Generalized Test will be applied to study the stationary of variables. On the other hand, it is necessary to be sure about the existence of long-term relation among variables to determine optimal interruption length and to execute the Johansen co-integration Test before using the Vector Error Correction Model. So, optimal interruption length was determined in the next step, and the Johansen Co-integration Test has been executed. Finally, the Vector Error Correction Model has been applied to estimate research models in the third step because of the existence of co-integration vector and long-term relations among variables (Noferesti, 2000).

5. Findings

In Table 2, we show the results of the Dickey-Fuller Unit Root Test, which conclude that two variables of MI and FDI are stationary and four variables of MD, MB, GDP and IR are non-stationary by comparing, augmented the Dickey-Fuller test statistic with the test critical values on significance level of 5%. Therefore, the first difference is used to make the above four variables stationary. In Table 3, augmented the Dickey-Fuller Unit Root Test is shown in the first difference of variables. The results are shown in Table 3.

Briefly, results show that four variables of MD, MB, GDP and IR are stationary at first difference, and two variables of MI and FDI are stationary. In Table 4, amounts of the Schwarz Bayesian Criterion and the Akaike Information Criterion are shown in order to determine the order of VAR for depth index of the stock exchange and macroeconomic variables.

In Table 4, the lowest amount of the Schwarz Bayesian Criterion and the Akaike Information Criterion area bout zero, but it is impossible to select zero for optimal order of VAR. Therefore, the number one will be selected as the optimal order of VAR since the lowest amount of the Schwarz Bayesian Criterion and the Akaike Information Criterion are related to number one without considering zero. In Table 5, amounts of the Schwarz Bayesian Criterion and the Akaike Information Criterion are shown in order to determine optimal order of VAR, for the breadth index of the stock exchange and macroeconomic variables.

Conditions of Table 5 are the same as for those of Table 4. Thus, number one is selected as the optimal order of VAR also. It is necessary to perform theco-integration test after determining optimal order of VAR in order to comment about the existence or non-existence of long-term relationship among the variables. Therefore, the co-integration test used by Johansen for the first time in 1998 is applied. The Number of co-integrating vectors is determined by means of trace and maximal eigenvalue of the stochastic matrix (Noferesti, 2000). Results of this test are shown for the depth index of the stock exchange and macroeconomic variables in Table 6.

According to the trace test and the maximal eigenvalue test, the existence of three equilibrium co-integration vectors is confirmed among the variables. This means that there are long-term equilibrium relationships among variables of model, and variables are convergent, and the relationship among variables is reliable. Co-integration vectors in normalized form are as follows:

$$MD=0.0001GDP+37.91IR-3.33FID-3.07MI$$

$$MD=0.0037GDP-35.14IR-279.34FID+320.61MI$$

$$MD=-0.0002GDP-51.37IR-9.52FID-36.88MI$$

In Table 7, the result of the co-integration test is shown for the breadth index of the stock exchange and macroeconomic variables.

According to the trace test and the maximal eigenvalue test, the existence of three equilibrium co-integration vectors is confirmed for the variables. This means that there are long-term equilibrium relationships among variables of the model, and variables are convergent, and the relationship among the variables is reliable. Co-integration vectors in normalized form are as follows:

$$MB= 0.0001GDP+4.33IR-1.21FID-1.04MI$$

$$MB=0.00018GDP-13.38IR-17.45FID+15.48MI$$

MB=0.0001GDP+5.47IR-1.48FID+3.05MI

6. Discussion

Through a general conclusion, and with due attention to the existence of three co-integration vectors among macroeconomic variables and depth index of the stock exchange, we can say that national income, investment rate, financial intermediary development and macroeconomic instability affect stock exchange depth. Moreover, a glance at co-integration vectors shows that the first vector in comparison to the second and the third vector reveal relationships among research variables in a better form. Thus, the first co-integration vector must be studied in order to determine the relation among macroeconomic variables and the depth index. Co-efficients of research variables in the above vector show a positive relationship between independent variables of gross domestic production and investment rate with dependent variable of the stock exchange depth. Also, there is a negative relationship between independent variables of financial intermediary development and macroeconomic instability with dependent variables of stock exchange depth.

Moreover, due to attention to the three co-integration vectors between macroeconomic variables and breadth index of the stock exchange, we can say generally that national income, investment rate, financial intermediary development and macroeconomic instability affect stock exchange breadth. Moreover, a glance at co-integration vectors shows that the first vector in comparison to the second and the third vectors reveal relationships among research variables in a better form. Therefore, the first vector must be used in order to study relationships between macroeconomic variables and breadth index of the stock exchange. Co-efficients of the above variables in this vector demonstrate that there is a positive relationship between independent variables of gross domestic product and investment rate with dependent variables of stock exchange breadth. Also, there is a negative relationship between independent variables of financial intermediary development and macroeconomic instability with dependent variables of stock exchange breadth.

7. Conclusions

In this study, we mainly attempt to examine the effect of macroeconomic variables on the development of the Tehran Stock Exchange. So, national income, investment rate, financial intermediary development and macroeconomic instability were considered as macroeconomic variables. The most important feature of this research is that depth and breadth are considered as indices of the stock exchange development, while in most previous researches, stock index is used as the only variable to determine stock exchange development.

Results show that national income and investment rate have a positive effect on depth and breadth of stock exchange. In other words, we expect the depth and breadth of stock exchange (e.g. market capital, transactions value, turnover ration, the number of accepted companies, the average size of accepted companies composition and concentration rate of top ten market companies) to increase with the increase in national income. These results are consistent with Abdul Rahman, et al. (2009), Yartey (2008), Naceur et al. (2007), Hump and Macmillam (2006), Ibrahim (2003) and Garcia and Liu (1999). By justifying these results, we expect that a higher percentage of people's savings is invested in financial assets resulting in development of financial markets. About the investment rate, it can be said that by increasing the capital, the volume of capital flows will be enhanced through the stock exchange. On the other hand, and based on research results, financial intermediary development and macroeconomic instability have negative effects on depth and breadth of the stock exchange, i.e. with the increase in the development level of financial intermediaries and instability of macroeconomic, we expect depth and breadth of the stock exchange to increase. These results are consistent with Coleman and Tetty (2008), Chen, et al. (2005), Lili and Zuliu (1998), and Garcia (1986). To conclude, we can say that the banking sector is an important competitor for the stock exchange in attracting investment funds. In fact, the stock exchange in Iran is in its primary developmental phase unlike institutions such as governmental and private banks. In relation to the macroeconomic instability variable, it could be said that stable conditions on the macroeconomic level will provide greater motivation for corporations and investors to participate in the stock exchange.

Considering a special time period and limitations in access to seasonal data are the main limitations of this research. The results of this study indicate that government should pave the way for stock exchange development by adopting appropriate policies in order to accelerate national income growth, create double motivation in people for investment and provide stable conditions in macro level. Future researchers are recommended to follow this research by separating each industry with a longer time period and an international scope. Researching about the effect of other macroeconomic variables and non-economic factors such as cultural, political, social and technological factors on stock exchange development, performing meta-analysis tests in order to provide various results obtained from previous researches, and having access to comprehensive results about the research subject are other recommendations for future researches.

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Table 1. Variables of Research and Their Measures

Type	Variable	Abbreviation Sign	Measurement Criteria
Dependent	Market Depth	MD	Market Capitalization
			Traded Value
			Turnover Ratio
			Number of Listed Firms
	Market Breadth	MB	Average Size of Listed Companies
			Sectoral Concentration
			Ten Firm Market Concentration Ratio
Independent	National Income	INC	Gross Domestic Production to Base Price of 1998
	Investment Rate	IR	Ratio of Gross Fixed Capital Formation to Gross Domestic Production
	Financial Intermediary Development	FID	Ratio of Liquidity to Gross Domestic Production
			Ratio of Monetary Base (M2) to Gross Domestic Production
			Monetary Increasing Coefficient
	Macroeconomic Instability	MI	Changes of Inflation Rate
			Changes of Parity Ratio of U.S. Dollar to Iranian Rials
			Changes of Ratio of Budget Deficit (Surplus) to Gross Domestic Production

Table 2. Conclusions of Augmented Dickey-Fuller Unit Root Teston
MD, MB, GDP, IR, FID, MI

Variables	Augmented Dickey-Fuller Test Statistic	Test Critical Values on Significance Level of:		
		1%	5%	10%
MD	-2.31	-3.61	-2.93	-2.6
MB	-2.27	-4.21	-3.52	-3.19
GDP	-2.35	-4.23	-3.54	-3.2
IR	-1.49	-3.62	-2.94	-2.61
FID	7.15	-2.63	-1.95	-1.61
MI	-8.87	-4.21	-3.52	-3.19

Table 3. Conclusions of Augmented Dickey-Fuller Unit Root Teston D(MD), D(MB), D(GDP), D(IR), D(FID), D(MI)

		Test Critical Values on Significance Level of:		
Variables	Augmented Dickey-Fuller Test Statistic	1%	5%	10%
D(MD)	-7.83	-3.61	-2.94	-2.6
D(MB)	-5.64	-4.21	-3.53	-3.19
D(GDP)	-42.49	-4.23	-3.54	-3.2
D(IR)	-24.46	-3.62	-2.94	-2.61

Table 4. Test Statistics and Choice Criteria for Selecting the Order of the VAR Model (MD, GDP, IR, FID, MI)

Criterion Order of Var	Schwarz Bayesian Criterion (SBC)	Akaike Information Criterion (AIC)
0	-170.5852	-163.1027
1	-110.1745	-83.9856
2	-95.5097	-50.6145
3	-80.3735	-16.7720
4	-57.5460	24.7619

Table 5. Test Statistics and Choice Criteria for Selecting the Order of the VAR Model (MB, GDP, IR, FID, MI)

Criterion Order of Var	Schwarz Bayesian Criterion (SBC)	Akaike Information Criterion (AIC)
0	-197.7788	-190.2963
1	-152.3222	-126.1333
2	-137.27	-92.3748
3	-148.0519	-84.4504
4	-139.0696	-56.7617

Table 6. Results of Johansen Co-integration Test for Depth Index of the Stock Exchange and Macroeconomic Variables

Trace test			Maximal Eigenvalue test			
95% Critical Value	Statistic	Contrary Hypothesis	95% Critical Value	Statistic	Alternative Hypothesis	Null Hypothesis
82.23	179.03	r>=1	37.07	83.47	r=1	r=0
58.93	95.56	r>=2	31.00	48.16	r=2	r<=1
39.33	47.39	r>=3	24.35	38.25	r=3	r<=2
23.83	9.14	r>=4	18.33	8.17	r=4	r<=3
11.54	0.96	r=5	11.54	0.96	r=5	r<=4

Table 7. Results of Johansen Co-integration Test for Breadth Index of the Stock Exchange and Macroeconomic Variables

Trace test			Maximal Eigenvalue Test			
95% Critical Value	Statistic	95% Critical Value	95% Critical Value	Statistic	95% Critical Value	
70.49	173.03	r>=1	37.07	97.88	r=1	r=0
47.88	91.7	r>=2	31	47.55	r=2	r<=1
31.54	41.46	r>=3	24.35	34.91	r=3	r<=2
17.86	12.81*	r>=4	18.33	7.5*	r=4	r<=3
8.07	1.79	r=5	11.54	1.14	r=5	r<=4

The Influences of Service Personalization, Customer Satisfaction and Switching Costs on E-Loyalty

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Abstract

This research investigates the interrelationship amongst the variables of service personalization, customer satisfaction and e-loyalty and the moderating effect of switching costs on the said relationships in the Internet banking segment in Hong Kong. Findings from 306 respondents confirm the significant positive effect of service personalization on customer satisfaction and e-loyalty, and customer satisfaction is found to have a positive effect on e-loyalty. However, evidence of switching costs as a moderator does not exist, suggesting that the effects of switching costs on the relationship between customer satisfaction and e-loyalty, and between service personalization and e-loyalty may be more complex than originally hypothesized. This research contributes to consumer marketing research in banking by adding empirical evidence of the positive role that service personalization plays on e-loyalty in the Internet banking sector.

Keywords: Service personalization, Switching costs, Customer satisfaction, Customer loyalty, E-loyalty, Internet banking, Hong Kong

1. Introduction

Customer loyalty is an essential ingredient of almost all kinds of businesses. Studies have found that it is expensive to acquire new customers and new customers usually buy less. Retaining existing customers, however, is much cheaper and easier (Ahmad and Buttle, 2002). To most banks, these customers represent a stable source of income and growth. Prior research has revealed that there is a strong association between customer satisfaction and brand loyalty (Anderson and Sullivan, 1993; Leverin and Liljander, 2006; Ribbink, Allard, Veronica and Sandra, 2004). Having a large pool of loyal customers is generally regarded as a major source of sustainable competitive advantage (Anderson and Mittal, 2000). In the banking industry, customer retention has been found to be a key determinant for long-term profitability, as selling products to existing customers costs much less than selling to new customers (Lam, Burton and Lo, 2009).

In the past thirty years, the use of the Internet has dramatically revolutionized how businesses are conducted in the banking sector (Methlie and Nysveen, 1999). The very nature of Internet banking brings banking services to the personal space of individual account owners. With the aid of a computer or any Internet-equipped devices, one can access his bank accounts and perform banking transactions virtually any time any where. This disintegration of the geographical and time barriers have brought great convenience to customers. From the banks' perspective, however,

Internet banking not only brings about additional costs but also pushes the battle line of customer retention beyond the traditional service counter to the personal spaces of individual customers. The new competitive landscape demands a firm grasp of the needs of their existing customers and practical ingenuity that enables banks to keep their customers from switching by a simple 'click-and-go' (Friedman, 1999).

1.1 The Challenges of the Banking Segment in Hong Kong and the Research Gap

A saturated market with cyclic upheavals in the past few years has induced banks in Hong Kong to compete fiercely both locally and internationally. And, in addition to successive reductions of interest rate spread (Wong, Fong, Wong and Choi, 2007) and rising wages (Tsang, 2010), high property rents have significantly eroded potential profits of the banks in Hong Kong as many of these banks are headquartered or having their main branches set up in prime locations. To increase profit as well as to meet many other challenges they are facing, Internet banking has become their strategy of choice.

To the banks that have chosen Internet banking, the Internet provides them with a low-cost option for serving their customers. It helps them to streamline operating costs and improve efficiency. It reduces the costs of paperwork related to transactions and offers ample opportunities for banks to retain existing customers and attract new ones. Customers find that Internet banking adds value to their lives as it gives them access to banking and financial services 24 hours a day, 7 days a week (24/7).

Nothing breeds customer loyalty and satisfaction more than quality customer service. Quality customer service in Internet banking refers to a bank's ability to create a secure and convenient online platform that not only provides what competitors are providing but also what customers are expecting. The importance of customer loyalty in marketing is well acknowledged by researchers (Reichheld and Schefter, 2000), the influence of some antecedents to customer loyalty, however, remains unclear. Although prior research has identified customer satisfaction, service personalization, and switching costs as key drivers of customer loyalty, findings regarding the effect of switching costs on customer loyalty have been contradictory (e.g. Johnson, Sivadas and Garbarino, 2008; He, Cheung and Tse, 2009). This study examined the direct and indirect influences of service personalization on customer loyalty in Internet banking (e-loyalty). The study used Anderson and Srinivasan's (2003) definition of e-loyalty as an Internet banking user's favorable attitude toward an Internet banking service; a favorable attitude is demonstrated by a patron's continued and repeated use of a particular Internet banking service.

On the other hand, research to date has largely neglected the moderating influences of switching costs on the relationship between service personalization and e-loyalty and on that between customer satisfaction and e-loyalty. This study developed a conceptual model that tested all these variables and examined the direct and indirect relationships among the pivotal components to the breeding of loyal customers, namely switching costs, customer satisfaction and service personalization using samples drawn from Hong Kong Internet banking users. The study contributes to consumer marketing research in banking by adding empirical evidence of the positive role that service personalization plays on e-loyalty in the Internet banking sector.

2. Theoretical Framework

2.1 Service Personalization

The rapid growth of information technology (IT) has not only changed the ways that information is collected and used, but also the ways in which businesses are conducted. With the Internet serving as a conduit and with the growing abundance of IT-based products, such as faster and cheaper computers, the increasing popularity and availability of smartphones and tablet computers, companies are now able to provide services to customers that they have never been possible to provide before. Being a key enabler of service personalization, IT has made one-to-one marketing in banking a reality. The next step in this trend will be to use customer relationship management infrastructure to find out what customers value and tailor the service to their particular needs (Montgomery and Smith, 2009; Peppers and Rogers, 1997) with the aim of further enhancing their loyalty.

A bank which is capable of providing truly personalized service differentiates itself from other banks as each of its customers is provided with sets of banking services catering to their unique needs (Hanson, 2000). With high service differentiation, the bank can then compete in the blue ocean instead of the red sea and earn higher profit than its competitors (Kim and Mauborgne, 2005). Therefore, our first hypothesis was:

Hypothesis 1: Service personalization has a positive influence on e-loyalty of Internet banking users in Hong Kong.

2.2 Customer Satisfaction

Studies have found that customer satisfaction is an ex-post evaluation of service experience and is a key factor in

retaining customers and improving customer loyalty (Mak, Wong and Tong, 2012). Satisfied customers are more likely to stay and continue to use a bank's services, while unsatisfied customers will walk away and find a different service provider (Methlie and Nysveen, 1999; Leverin and Liljander, 2006). Keeping customers loyal is a challenge for banks as it is becoming common for bank customers to maintain more than one bank account with more than one bank. The challenge in Hong Kong is particularly big as the Hong Kong Deposit Protection Board provides full guarantee to account holders with a deposit not exceeding HK$500,000 (around US$64,000) in case of a bank default (Lui, 2010). To depositors who have assets exceeding HK$500,000, putting their money in multiple accounts across a number of banks in order to qualify for the guarantee is a matter worthy of serious consideration.

To the banks, a customer with multiple bank accounts in different banks is more likely to switch one or all of his accounts to another bank if he is not satisfied with the service provided (Lam et al., 2009). In this study, customer satisfaction was considered as contentment with the overall experience gained from using banking services over time (Oliver, 1980; Anderson and Srinivasan, 2003). If a bank can provide personalized services to its customers and make its customers feel that the newly provided personalized services are useful and user-friendly, their level of satisfaction increases (Davis 1989; Davis, Bagozzi and Warshaw, 1989). Therefore, our second hypothesis was:

Hypothesis 2: Service personalization has a positive influence on customer satisfaction of Internet banking users in Hong Kong.

Loyal customers may not be satisfied customers, but satisfied customers tend to be loyal customers (Fornell, 1992). Previous studies in various settings have revealed that customer satisfaction has a positive influence on customer loyalty (e.g. Leverin and Liljander, 2006; Anderson and Sullivan, 1993). As it is more difficult for a competitor to attract satisfied customers than unsatisfied customers (Methlie and Nysveeen, 1999), our third hypothesis, therefore, was:

Hypothesis 3: Customer satisfaction has a positive influence on e-loyalty of Internet banking users in Hong Kong.

2.3 Switching Costs

Switching costs play an important role in customer retention. When switching costs are perceived to be high, customers are reluctant to switch to a competing service provider, whereas when the costs of switching are perceived to be low, customers are more likely to switch to a different provider (Colgate and Lang, 2001). In the old days, large banks in Hong Kong could easily differentiate themselves from the smaller ones because the former were generally perceived as more stable and therefore reliable. This brand image served as a significant switching barrier to depositors and explained why depositors were willing to accept a lower interest rate for deposits with larger banks such as HSBC and Citicorp. But competition has changed after Hong Kong Deposit Protection Board launched the bank deposit guarantee scheme in 2006 (Lui, 2010). The scheme has made it more difficult for a bank in Hong Kong to differentiate itself from competitors, especially on the traditional deposit and lending front.

Customers who hold multiple bank accounts are generally perceived as having lower switching costs as they can easily switch from one bank to another (Lam and Burton, 2006). As switching costs can be one of the antecedents to customer loyalty in the banking industry, it is important for banks to find ways to increase customer switching costs (Beerli, Martin and Quintana, 2004). One way to achieve this is to provide highly personalized services to meet the needs of individual customers. In the context of Internet banking, service personalization can be done through customized interface, targeted banner, etc.. Our fourth hypothesis, therefore, was:

Hypothesis 4: Switching costs have a positive influence on customer loyalty of Internet banking users in Hong Kong.

2.4 Moderating Effects of Switching Costs

Switching costs have often been regarded as one of the reasons of why dissatisfied customers do not switch to another service provider (Beerli et al., 2004; Caruana, 2004; Burnham, Frels and Mahajan, 2003; Colgate and Lang, 2001). But the level of influence of switching costs varies depending on the industry involved (Burnham et al., 2003; Jones, Mothersbaugh and Beatty, 2002). In the banking sector, trust plays an important role and costs associated with risk and uncertainty may have a big influence on customer behavior (Singh and Sirdeshumukh, 2000; Gronghaug and Gilly, 1991). Customers who perceive a high level of switching costs may behave differently from those who only perceive a low level of switching costs. To test this, the following two pairs of hypotheses were proposed:

Hypothesis 5a: Switching costs moderate the influence of service personalization on e-loyalty of Internet banking users in Hong Kong.

Hypothesis 5b: Switching costs do not moderate the influence of service personalization on e-loyalty of Internet banking users in Hong Kong.

Hypothesis 6a: Switching costs moderate the influence of customer satisfaction on e-loyalty of Internet banking users in Hong Kong.

Hypothesis 6b: Switching costs do not moderate the influence of customer satisfaction on e-loyalty of Internet banking users in Hong Kong.

2.5 Research Framework

Insert Figure 1 Here

Based on the above hypotheses, a research framework with four variables outlined in Figure 1 was developed.

3. Methodology

Quantitative research method using an online questionnaire was adopted to examine the direct and indirect influences of service personalization on e-loyalty as well as the moderating role of switching costs on the above relationships. A total of 2,500 email invitations were sent to randomly selected potential participants.

3.1 Measurement Instrument

In order to fully capture the essential features and multidimensional aspects of the above variables, every single variable was measured by way of multi-item scales adapted from prior studies. Service personalization was the only independent variable. The three questionnaire items for service personalization were adapted from Srinivasan, Anderson and Ponnavolu (2002). E-loyalty was the dependent variable. The 6 questionnaire items of e-loyalty were adapted from Anderson and Srinivasan (2003). Switching costs were featured as the moderating variable. The 4 questionnaire items of switching costs were adapted from Ping (1993). Customer satisfaction was hypothesized as an intermediate variable on the causal pathway between service personalization and e-loyalty. The five questionnaire items of customer satisfaction were adapted from Anderson and Srinivasan (2003).

As the content and construct validity of each variable had already been evaluated by the original authors, it was reasonable to assume that both content and construct validities of the multidimensional-item scales should accurately represent the variables concerned (Wong and Tong, 2012).

3.2 Samples and Sampling Technique

For this study, a simple random sampling technique was chosen to obtain a sample size of 2,500 potential respondents. The email addresses of the potential respondents were randomly selected from email address databases collected from public domain websites. As the focus of this study was Internet banking users, only responses from those who used Internet banking services were taken into account. Out of the 2,500 email invitations sent, a total of 306 responses were received, representing a response rate of approximately 12%.

4. Data Analysis

The responses collected were processed to look for both direct and moderating effects using the Statistical Package for the Social Sciences (SPSS) for Windows Version 14.

4.1 Reliability

Cronbach's alpha was used to measure the internal consistency or reliability of the items in each variable of the questionnaire (Verbeke and Bagozzi, 2000). As a general rule, variables with a Cronbach's alpha coefficient higher than 0.7 are considered as having a good internal consistency among items (Nunnally and Bernstein, 1994; Shin, Collier and Wilson, 2000). Table 1 summarizes the Cronbach's alpha coefficients with respect to each of the four variables. All four variables had a Cronbach's alpha coefficient between 0.795 and 0.897 and were therefore considered acceptable for further analysis.

Insert Table 1 Here

4.2 Factor Analysis for Reliability Testing

Principle component analysis with Varimax rotation was conducted using SPSS on all items of the four variables in the questionnaire. Items with factor loading less than 0.5 were deleted (Hair, Black, Babin, Anderson and Tatham, 2006).

Bartlett's test of sphericity and the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy are the two most common tests performed to see whether the basic assumptions for factor analysis are met (Coakes, Steed and Price, 2008; Hair et al., 2006). The results showed in Table 1 indicate that Bartlett's test was significant (sig. = .000) and the KMO values were in the range between 0.653 and 0.868, which were all higher than 0.6 (Coakes et al., 2008),

indicating that the performance items were suitable for factor analysis.

4.3 Data Analysis

Linear regression was used to test the positive association of hypotheses H1 to H4. Multiple linear regression was conducted to test hypotheses H5a, H5b, H6a and H6b to investigate the possible moderating effects of switching costs on the causal pathway between service personalization and e-loyalty and between customer satisfaction and e-loyalty using the method proposed by Baron and Kenny (1986).

5. Results

The linear regression test results in Table 2 confirm that the service personalization had a significant positive impact on both e-loyalty (= 0.487, $p < 0.05$) and customer satisfaction (= 0.330, $p < 0.05$). Service personalization explained 23.7% of variance in e-loyalty of Internet banking users in Hong Kong ($R^2 = 0.237$) and 10.9% of variance in customer satisfaction of Internet banking users in Hong Kong ($R^2 = 0.109$), giving support to both hypotheses 1 and 2.

It was also confirmed that customer satisfaction and switching costs had a significant positive impact on e-loyalty (= 0.623 and 0.288 respectively, $p < 0.05$). Customer satisfaction explained 38.8% of variance in e-loyalty of Internet banking users in Hong Kong ($R^2 = 0.388$) and switching costs explained 8.3% of variance in e-loyalty of Internet banking users in Hong Kong ($R^2 = 0.083$), giving support to hypotheses 3 and 4.

Insert Table 2 Here

Table 3 shows the multiple regression analysis results using the approach proposed by Baron and Kenny (1986) for the test of the moderating effects of switching costs on the respective influences of service personalization (H5a and H5b) and customer satisfaction (H6a and H6b) on e-loyalty.

Insert Table 3 Here

Insert Table 4 Here

From the three models in Table 3, Model 1 indicates significant total effects of service personalization on e-loyalty ($R^2 = 0.237$, = 0.418, $p < 0.05$); and Model 2 shows a significant increase in R^2 value from 0.237 to 0.262. When the moderator of switching costs was added, the explanation power of the model increased slightly by 2.5% to 26.2% ($R^2 = 0.262$, $p < 0.05$). When the interaction item of "Pers X sCost" was added to Model 3, the explanation power of the Model increased slightly by 0.2% to 26.4% ($R^2 = 0.264$). The increase in explanation power was not only small, but also insignificant (=-0.049, p= 0.375). In other words, there exists no significant moderating effects of switching costs on the relationship between service personalization and e-loyalty. Therefore, Hypothesis 5a was rejected and Hypothesis 5b was supported.

From the three models in Table 5, Model 1 indicates a significant total effect of customer satisfaction on e-loyalty ($R^2 = 0.388$, = 0.623, $p < 0.05$); and Model 2 shows a significant increase of R^2 value from 0.388 to 0.434. When the moderator of switching costs was added, the explanation power of the Model increased by 4.6% to 43.4% ($R^2 = 0.434$, $p < 0.05$). When the interaction item of "Sat X sCost" was added to Model 3, the explanation power of the Model increased slightly by 0.3% to 43.7% ($R^2 = 0.437$). The increase in explanation power was small and insignificant (= 0.059, p= 0.192). In other words, there exists no significant moderating effect of switching costs on the relationship between customer satisfaction and e-loyalty. Therefore, Hypothesis 6a was rejected and Hypothesis 6b was supported.

6. Discussion

This study contributes to consumer marketing research in banking in multiple ways. Firstly, it addressed a gap by adding empirical evidence of the positive role that service personalization plays on e-loyalty in the Internet banking sector in Hong Kong. The study found that service personalization has a significant effect on customer satisfaction and customer satisfaction has a significant influence on e-loyalty in the Internet banking sector in Hong Kong.

Most previous studies were on the direct relationships among customer satisfaction, switching costs and customer loyalty. In addition to direct relationships, this study further explored the indirect relationships among the variables featured. Findings of the study revealed that the moderating effect of switching costs on the relationship between service personalization and e-loyalty and that between customer satisfaction and e-loyalty is insignificant. The finding contrasted with prior studies (e.g. Colgate and Lang, 2001; Lee and Cunningham, 2001) which asserted that switching costs has a significant moderating effect on the relationship between customer satisfaction and customer loyalty. The contradictory result indicates that switching costs may probably be a more complicated concept than originally hypothesized (Jones et al., 2002; Burnham et al., 2003). One of the possible explanation is that most of the prior studies were conducted in the traditional transaction settings, and people may perform differently in the

Internet world. Further studies are recommended to verify this.

Lastly, the lack of moderating effects of switching costs on the association between customer satisfaction and e-loyalty and on that between service personalization and e-loyalty, may also underline the complexity of the interrelationships hypothesized. It is possible that switching costs play a mediating role instead of a moderating role on such relationships. In other words, service personalization may accustom Internet banking users to the personalized services provided. Getting used to personalized services creates inertia for customers to continue using these services. The same inertia may then keep these users from switching to other banks. On the other hand, being accustomed to the personalized services and customized webpage of a bank may also make it more difficult for customers to learn and ultimately be satisfied with the services provided by competing banks. This in turn increases customer loyalty.

In practical terms, the confirmation that the perception of service personalization has a significant positive impact on the level of satisfaction an Internet banking user may have toward the services provided suggests that, despite the common view that Internet banking is nothing more than a supplement to traditional over-the-counter banking services, service personalization is an important driver of customer satisfaction. As such, to satisfy customers and to ensure the long-term profitability of banks, banking practitioners in Hong Kong need to enhance service personalization in order to increase the satisfaction level of their Internet banking customers.

Furthermore, this study found that both perceptions of service personalization and customer satisfaction have a very strong and significant positive impact on the level of e-loyalty an Internet banking user may have toward an Internet banking service provider (= 0.487 and 0.623 respectively, $p<0.05$). The finding suggests that the provision of more personalized services to Internet banking users not only increases their satisfaction toward a bank's services, but also considerably increases their loyalty toward the bank. As such, to retain customers and to capture a greater share of the market, banking practitioners in Hong Kong should enhance their efforts in providing personalized service as these efforts would lead to an increase in customer loyalty.

There are many ways for banks to provide personalized services. Personalization of Internet banking services can be done by simply allowing individual customers to customize the layout of the webpage so that every customer can have his or her unique Internet banking webpage after logging onto the Internet banking server. Service personalization can also be done by the creation of a new service that meets a specific need of an individual customer. For example, banks can provide online personalized financial advice to individual customers based on their transaction history and their personal preferences.

Online banking is branded for its low cost (Gilmore and Pine, 2000) and low cost is a major enabler for mass customization. Through mass customization, a bank can divide its services into different service modules and components, and each service module can be a combination of different service components. For example, a bank can divide its online security trading services into different service components covering stock price quotation, stock purchase, sales of stock, and advice. Each module, say, stock price quotation, may offer different components as options, e.g., real time quotation, delayed quotation with varying time lags (5 minutes, 15 minutes, etc.), and daily transaction history of each stock with different levels of details (from a hourly transaction volume report to a full report listing out the transaction time, volume, price, and security agencies used for each and every stock traded). The bank can charge different customers at different levels of costs basing on, for example, the type of service a particular customer selected, the transaction history of the customer or any other customer parameters. As most of the personalized services cited can be provided by computer-based mass customization, personalized service can be provided to individual customers at low cost.

Another management implication that stems from this study is the confirmation of the significant positive impact that customer satisfaction exerts on the e-loyalty of Internet banking users. The finding suggests that loyalty of a user toward an Internet banking provider increases with growing levels of service satisfaction. If a customer is satisfied with the Internet banking services provided, he will use more of the services from the same vendor. To retain customers and to increase their share of the market, banks in Hong Kong should find ways to leverage on the factor of customer satisfaction as satisfaction breeds loyalty.

7. Limitations

While the study is expected to contribute to both academic research and management practice in the Internet banking segment in Hong Kong, its findings may be limited in several ways. The use of positivist ontology, the deductive and confirmatory nature of the study and the adoption of quantitative methodology impose the first limitation. Though quantitative methods were used to ascertain the relationships among the variables featured in the model, it is still unclear whether the hypothesized relationships truly represent the linkages among the variables and whether there exist other antecedents to e-loyalty that may affect the behavior of customers of Internet banking in

Hong Kong.

The cross-sectional nature of this study imposes the second limitation. Similar to all other cross-sectional studies, this study captured and analyzed a snapshot of a phenomenon only (Sriram and Stump, 2004), without examining its changes over time. The third limitation is that this study only focused on investigating the links among service personalization, customer satisfaction, switching costs and e-loyalty, despite the possibility that e-loyalty may also depend on other antecedents such as demographic factors (i.e. gender, age, monthly income and so on) and previous experiences. The possible existence of other antecedents may impose limitations on the generalizability of the findings.

Finally, although the sample size of this study (n = 306) was larger than other similar studies (e.g. Cheng, Lam and Yeung, 2006), the findings which emanated from Internet banking users in Hong Kong may only be valid to the banking industry in Hong Kong and hence may not be generalized to other industries in Hong Kong or the banking industry in other places.

8. Further Research

There are several opportunities for further study to overcome the limitations identified and discussed in the previous section. First, it is suggested that a further study using a mixed-method approach should be conducted by combining both quantitative and qualitative methods to leverage the advantages of triangulation (Bryman, 2008). Qualitative tools, for example in-depth interviews, can be used to identify additional antecedents to loyalty in the Internet banking industry. The antecedents identified can then be used for the development of a more comprehensive framework before being empirically tested by quantitative methods with a wider population.

The second research opportunity is to take into account the time lag between cause and effect and conduct a longitudinal study by capturing the dynamic interplay of relationships among the constructs in the research framework (Bryman, 2008). This approach will allow the researcher to trace and track the changes in the perception of the sampled population over time and enable the researcher to gain a better understanding of the patterns, determinants and dynamics of change in e-loyalty.

Finally, contrary to findings from mainstream research, this study revealed that switching costs do not moderate the relationship between service personalization and e-loyalty or that between customer satisfaction and e-loyalty. This indicates that the relationships among the variables of service personalization, customer satisfaction, switching costs and e-loyalty may be more complicated than that was hypothesized in the study. Further research to find out the true behavior of switching costs would give more insights in both theory and practice for future applications.

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Table 1. Cronbach's Alpha and KMO Statistics

Variables	Cronbach's Alpha	KMO Values
Customer Satisfaction	0.795	0.653
Service Personalization	0.761	0.674
e-loyalty	0.897	0.868
Switching Costs	0.871	0.781

Table 2. Coefficients for H1, H2, H3 and H4

Hypotheses	Independent Variables	Dependent Variables	Standardized beta (.	t	Sig.	R square
H1	Service Personalization	e-loyalty	0.487	9.725	0.000	0.237
H2	Service Personalization	Customer Satisfaction	0.330	6.087	0.000	0.109
H3	Customer Satisfaction	e-loyalty	0.623	13.881	0.000	0.388
H4	Switching Costs	e-loyalty	0.288	5.250	0.000	0.083

Table 3. Model Coefficients for H5a and H5b

Model		Standardized Beta	t	Sig.	R	R square
1	(Constant)		0.000	1.000	0.487	0.237
	Service Personalization	0.487	9.725	0.000		
2	(Constant)		0.000	1.000	0.512	0.262
	Service Personalization	0.441	8.580	0.000		
	Switching Costs	0.165	3.209	0.001		
3	(Constant)		0.242	0.809	0.514	0.264
	Service Personalization	0.418	7.228	0.000		
	Switching Costs	0.174	3.322	0.001		
	Pers X SwCost	-0.049	-0.889	0.375		

a Dependent Variable: e-loyalty

Table 4. Model Coefficients for H6a and H6b

Model		Standardized Beta	t	Sig.	R	R square
1	(Constant)		0.000	1.000	0.623	0.388
	Customer Satisfaction	0.623	13.881	0.000		
2	(Constant)		0.000	1.000	0.659	0.434
	Customer Satisfaction	0.597	13.693	0.000		
	Switching Costs	0.215	4.943	0.000		
3	(Constant)		-0.164	0.870	0.661	0.437
	Customer Satisfaction	0.602	13.771	0.000		
	Switching Costs	0.230	5.119	0.000		
	Sat X SwCost	0.059	1.309	0.192		

a Dependent Variable: e-loyalty

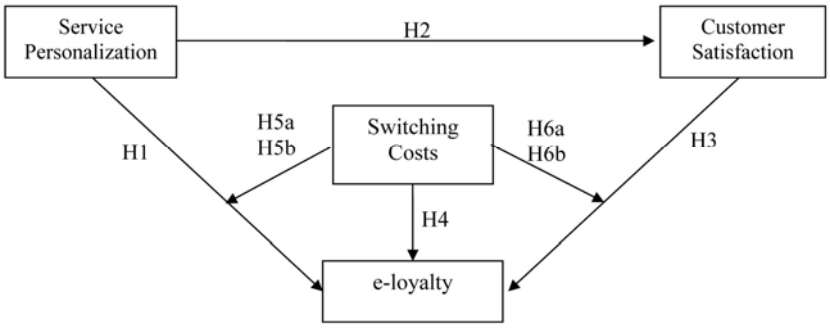

Figure 1. The Research Framework

Enhancement of the Bond Duration-Convexity Approximation

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Abstract

Hedging bond positions under the assumption of a parallel shift of the interest rate curve is well-known and used for a long date in finance. The approximation duration-convexity introduced by L. Fisher and R. Weil is the corresponding main tool. However this last is inaccurately formulated since: the time-passage is neglected, the shift size is assumed to be infinitesimal and the error approximation is out of the control. Our main purpose here is to present how to enhance this classical approximation such that these simultaneous inconveniences may be overcome. Not only our modified approximation leads to a perfect fit of the bond change, but a shift of any arbitrary size is also allowed and a deterministic and explicit estimates of the approximation error becomes available. Though the parallel shift of the interest rate curve is a strong and unrealistic assumption, it remains a standard reference among practitioners and academics. The analysis performed here finds a valuable implication in stress-testing, hedging and managing interest rate risks under more realistic models.

Keywords: Bonds, Duration, Convexity, Interest rate risks

JEL Classification: G11, G12.

1. Introduction

The 2007-08 crisis has put in surface malfunctioning of some glorified financial models and misuses of the existing models by various people (financial engineering, quants, risk managers, . . .), see Triana (2010). Revisiting and improving the foundations of some financial and technical models are among the issues considered by leading academic searchers and supervisory organizations, see Derman (2010) and Jarrow (2010). As a little contribution on this effort of clarification, we consider here the classical duration-convexity approximation initiated by L. Fisher and R. Weil (1971), which is useful when hedging a bond position with respect to a parallel shift of the interest rate curve. Though such an approximation is well-known and becomes among the standard tools in interest risk management, the situation is really inaccurately formulated such that the obtained result is very questionable. Among the inconveniences which may be raised are the following: 1) the time-passage is neglected; 2) the shift is assumed to be infinitesimal but the sense of this last is not clear; 3) the approximation error remains unknown.

Our main purpose here is to present how this classical Fisher-Weil bond duration-convexity approximation can be enhanced, such that we are able to solve simultaneously all of these three inconveniences. The parallel shift assumption underlying the duration-convexity approximation is well-known to be a too strong, not realistic assumption and not consistent with the no-arbitrage assumption, which is the basic assumption for valuation, see for instance Hegde & Nunn (1988) and Nawalka & Sotto (2009). However there are at least four reasons why the Fisher-Weil approach still deserves our consideration here. Indeed

• Parallel shift assumption is historically well-known and used as a benchmark approach of interest rate risk measure among practitioners and academics Our contribution here is to provide a consistent analysis and enhancement for this standard.

• A parallel positive shift (as 100 basis points) remains also a standard and easily tractable approach in the perspective of stress-testing. The result we obtain in this paper enables the user to consider any large shifts lying inside a given range. This is particularly useful to grasp turmoil situations as we are faced frequently since the 2007 financial crisis. Moreover any non-parallel shift of the interest rate term structure may be seen as including in some range corresponding to suitable high and low parallel shifts.

• A correct approach and understanding of the situation related to the parallel shift is a main step to provide a good risk management analysis for the case where the interest rate curve term structure moves in a non-parallel fashion. We will develop in a next project that the ideas underlying this work lead to new and practical results related to bond risk management in the setting of a one-factor model of short interest rate.

• Though it is restrictive, considering a parallel shift of the interest rate has also the advantage to avoid the consideration of the shift distribution nature and consequently gives a fast and clear vision of the core of the interest risk issue.

The parallel shift hypothesis is not consistent with the no-arbitrage assumption. Though alternative consistent models do exist, each of them remains a metaphor of the reality, see Derman (2010), and has its limitation and usefulness depending on the user's perspective (seller or buyer). However once a given model is chosen it becomes a crucial point to provide a correct and coherent approach, as we hope to provide in this paper for the case of Fisher-Weil bond duration-convexity approximation.

The results derived in this work are devoted to present the essential ideas we have launched in our previous working paper Lajili & Rakotondratsimba (2008). They are not based on specific historical or simulated data. It means that their scope are only limited by the underlying assumptions used (as the parallel shift of the interest rate curve). For convenience, non-technical summary of the ideas underlying this present work is given in the next Section 2. Full statments of results are displayed in Section 3. We first recall in Subsections 3.1 and 3.2, the sensitivities and classical duration-convexity approximation. Then we present our contribution in Subsection 3.2. For shortness, very few numerical examples are given in Section 4 to illustrate the analytical formulas we have derived here. However the reader may consult Lajili & Rakotondratsimba (2008) for the proofs and further details. We conclude in Section 5.

2. Non-technical Presentation of Our Results

It is common in financial practice and theory to measure bond price changes, under a parallel shift of the interest rate curve, by means of sensitivities tools as the duration and convexity These last (whose the precise definitions are given in (4) and (6)) are then used by people to immunize a portfolio of assets and liabilities.

Therefore the price relative change of a bond position is seen as given approximately by the sum of two terms (see the full statement in (8)). The first term is the opposite of duration times the parallel shift value of the interest rates. The second term is the product of convexity and the square of this shift value. In the sequel, we refer such an approximation as the classical Fisher-Weil duration-convexity approximation. Actually the idea of approximation of bond change comes back to various authors as F. Macaulay (1938), F. Redington (1952)and L. Fisher and R.Weil (1971).

Such a key approximation is very often mentioned in finance text books (see for instance Hull (2009)) to be valid for small change values of the interest rates. However there is no available references which precise the exact meaning of the term *small* change. Moreover the accuracy of the given approximation remains also unclear. Another important deficiency of the classical duration-convexity approximation is the lack of consideration of the time-passage. Indeed with a zero shift for the interest rate, the duration-convexity approximation leads to a zero relative change for the bond. However in reality the bond value changes, though the interest rate curve remains the same due to the passage of time (see for instance the examples in Section 4). All of these three inconveniences (disregard of the time-passage, indistinctness on the shift size to use, approximation error out-of-the control) lead to a frustrating situation when using the classical Fisher-Weil approximation in the bond portfolio hedging. Apparently a rough approximation approach may lead to an economic loss which goes in the opposite of the initial hedge intention.

Our purpose in this paper is to enhance this *classical duration-convexity approximation* approach so as to overcome the three inconveniences mentioned above. Therefore we will show in (26) of Theorem 6 that the bond relative change may be seen as the sum of three terms. The first (deterministic) term represents the value of the passage of time not present in the classical approximation. The second term is the sum of two other terms. There is first the opposite of a *modified-duration* times the parallel shift value of the interest rates. The next term is the product of a *modified-convexity* by the square of this shift value. The third term is the remainder error term when using the

approximation as a replacement of the initial bond change. The modified-duration and modified-convexity (see (23) and (24)) are defined similarly as the classical duration and convexity. The only change is just the incorporation of the time-passage, and the classical duration and convexity are recovered when the time passage is reduced to zero. We refer our new approximation as the *modified duration-convexity approximation*. In our approach, any arbitrary parallel shift of the interest rate is allowed to be used. But in return, we have to grant an attention on the size of the corresponding remainder approximation error. This last term is of course unknown, however we are able here to derive (see for instance (29) and (30)) an explicit bounds under the assumption that the shift is bounded below. This is a very minimal assumption and no hypothesis on the shift distribution is required. In other terms, we obtain a pointwise estimate of the approximation error. This is an interesting point in bond hedging for example, since a pointwise estimate leads immediately to an economical meaning (as maximum loss or gain level). In contrast the hedging error in term of variance, very often used by many authors, leaves a level of uncertainty and a lack of economical interpretation. Moreover the variance requires in priori the knowledge of the distribution associated to the interest rate shift.

3. The Results

3.1 Fixed Income Value and Their Sensibilities

In this paper we will focus on fixed income products of any kind, assuming that all future cash flows of the respective investments are known and not subject to default risk. For doing let us introduce the cash flows payment dates t_k, $k \in \{1,\dots,n\}$, with $0 \le t \le t_1 < \dots < t_k < \dots < t_n = T$. Denoting by t the present time, then let us set by $\tau_k(t) = t_k - t$ the time elapsed until the k-th cash flow C_k is due.

Standard par-bond products are given by the particular cash flows $C_1 = \dots = C_{n-1} = 100cN$ and $C_n = 100(1+c)N$, where $100N$ is the principal (or face value) and c is the coupon rate.

No-arbitrage considerations lead us to define the price P_t of the stream of positive cash flows $C_1,\dots,C_k,\dots,C_n$ by

$$P_t = \sum_{k=1}^{n} C_k D(t,t_k) \tag{1}$$

where $D(t,t_k)$ is a discount factor. We will work with the continuous compounding setting for which $D(t,t+\tau)$, with $0 < \tau$, is given by

$$D(t,t+\tau) = \exp[-r_{t,\tau}\tau] \tag{2}$$

where $0 \le r_{t,\tau}$. With (1) and (2), it appears that the current price P_t depends both on the tenor $\tau_1(t),\dots,\tau_k(t),\dots,\tau_n(t)$ and the zero interest rates $r_{t,\tau_1(t)},\dots,r_{t,\tau_k(t)},\dots,r_{t,\tau_n(t)}$ at this time t. These last are defined by the interest rates curve $u \in [0,\infty[\mapsto r_{t,u}$.

Usually, people try to grasp the consequence of a parallel shift of the current zero interest rates by considering the quantity

$$\sum_{k=1}^{n} C_k \exp[-(r_{t,\tau_k(t)} + \varepsilon)\tau_k(t)] \equiv P_{t,0;\varepsilon}. \tag{3}$$

The concern task is then to analyze the price absolute change $P_{t,0;\varepsilon} - P_t$ or the corresponding relative change $\frac{P_{t,0;\varepsilon} - P_t}{P_t}$. The common approach of this relative change is to make use of the concept of duration and convexity.

The (Macaulay) duration, of any fixed income product whose the price is as considered in (1) and (2) is defined by

$$\mathrm{D}ur(t) = \frac{1}{P_t}\sum_{k=1}^{n} \tau_k(t) C_k \exp[-r_{t,\tau_k(t)}\tau_k(t)]. \tag{4}$$

The duration can be interpreted as a weighted arithmetic average of the $\tau_k(t)$'s with the weights $\omega_k(t) = \frac{1}{P_t} C_k \exp[-r_{t,\tau_k(t)}\tau_k(t)]$. As a consequence one has

$$\mathrm{D}ur(t) \leq (T-t). \tag{5}$$

To take into account the convexity, we need to introduce

$$\mathrm{C}onv(t) = \frac{1}{2P_t}\sum_{k=1}^{n}\tau_k^2(t)C_k \exp[-r_{t,\tau_k(t)}\tau_k(t)]. \tag{6}$$

Similarly to (5) it can be easily seen that

$$\mathrm{C}onv(t) \leq \frac{1}{2}(T-t)^2. \tag{7}$$

3.2 Classical Duration-Convexity Approximation

From the finance literature (pioneered by the papers of F. Macaulay (1938), F. Redington (1952) and L. Fisher and R. Weil (1971) the following approximation

$$\frac{P_{t,0;\varepsilon}-P_t}{P_t} \approx -\mathrm{D}ur(t)\times\varepsilon + \mathrm{C}onv(t)\times\varepsilon^2, \tag{8}$$

is refered here as the classical (Fisher-Weil) bond duration-convexity approximation. It expresses the relationship between parallel spot rate curve shift and relative price changes of the fixed income security, and consequently plays a role in hedging risks associates to the interest rates.

In textbooks as in Hull (2009), it is often stated that (8) can be used for small values of ε, but there is no clear available analyses and references indicating the size of ε for which it remains reasonable to make use of the approximation (8). Actually it is a consequence of the Taylor expansion for which the derivatives of order more than 3 are ignored, so that some accuracy is consequently lost. Among our contributions in this Section is to clarify the quality of such approximation (8) with respect to the size of ε.

Actually the strength of (8) relies on the information brought about this relative variation when the value of ε is uncertain. Indeed if there is uncertainty about the value of ε, then $\frac{P_{t,0;\varepsilon}-P_t}{P_t}$ remains also uncertain. However in most of the cases, the investor may have a more and less view about the range of values possibly taken by ε. For instance she/he may suspect a parallel shift of the rate curve by ε, with $0<\varepsilon<\varepsilon_0$ for some given ε_0. Therefore if the size of the remainder term related to approximation (8) is available, then we may assert that $\frac{P_{t,0;\varepsilon}-P_t}{P_t} \approx -\mathrm{D}ur(t)\times\varepsilon_1 + \mathrm{C}onv(t)\times\varepsilon_1^2$ for any suitable ε_1. The fact that ε_1 or other values is taken has few importance since in any case the real value of ε at the future time cannot be determined at the present time t. It just gives to the investor the magnitude order of things. The main point here is rather on the error size knowledge of such an approximation. It becomes a valuable tool informing the investor on the possible economic consequences of her/his anticipation in spite of the interest rates uncertainty change.

We first state the exact value of the price relative change $\frac{P_{t,0;\varepsilon}-P_t}{P_t}$.

Proposition 1: *Let* ε *with* $\varepsilon \neq 0$. *Then there is some real number* ρ *such that:*

$$\frac{P_{t,0;\varepsilon}-P_t}{P_t} = -\mathrm{D}ur(t)\times\varepsilon + \mathrm{C}onv(t)\times\varepsilon^2$$

$$-\frac{1}{6P_t}\Big(\sum_{k=1}^{n}\tau_k^3(t)C_k \exp[-(r_{t,\tau_k(t)}+\rho)\tau_k(t)]\Big)\varepsilon^3. \tag{9}$$

Explicit value of ρ *is not known here, but the only information available we have is that* $0<\rho<\varepsilon$ *or* $\varepsilon<\rho<0$ *depending on the sign of* ε.

The restriction to $\varepsilon \neq 0$ is considered since $P_{t,0;0}$ is trivially reduced to P_t. The identity (9) can be just obtained using the Taylor formula with remainder term written in Lagrange form (see Lajili & Y. Rakotondratsimba (2008)for details). As a consequence the shift ε has any arbitrage size, in contrast with the Fisher-Weil (8) approximation which is rather obtained from a second order Taylor expansion for which ε is assumed to be infinitesimal.

In accordance with the financial standard basic use, we limit here our analysis on the second order approximation. Though (9) may lead to an acceptable approximation of $\frac{P_{t,0;\varepsilon}-P_t}{P_t}$ for small values of ε, it should be very insufficient when considering the absolute difference $P_{t,0;\varepsilon}-P_t$. For instance if the precision of the relative value is about 10^{-3} and P_t has a magnitude of order 10^7 (as in the case of bonds with face value 100 and nominal 10000) then the approximation by (8) may suffer of an error of order 10^4. This paper is focused on the relative change $\frac{P_{t,0;\varepsilon}-P_t}{P_t}$ but for the bond hedging purpose, there is the need to consider the absolute change $P_{t,0;\varepsilon}-P_t$ and to analyze the corresponding error approximation. The size of the estimate of this last should be acceptable in the perspective of the user and consequently a restriction on just the duration and convexity may be insufficient. Therefore introducing high order sensitivities (as can be seen in Lajili&Rakotondratsimba (2008)) becomes useful, but here we do not pursue in such a direction.

In this Subsection we derive explicit bounds of the unknown remainder term

$$\frac{1}{6P_t}\sum_{k=1}^{n}\tau_k^3 C_k \exp[-(r_{t,\tau_k(t)}+\rho)\tau_k(t)].$$

Therefore for an upward shift of the interest term structure we can state the following.

Proposition 2: *Let* $\varepsilon>0$. *Then we have*

$$\left|\frac{P_{t,0;\varepsilon}-P_t}{P_t}-\{-\mathrm{D}ur(t)\times\varepsilon+\mathrm{C}onv(t)\times\varepsilon^2\}\right|$$

$$\leq\frac{1}{6P_t}\left(\sum_{k=1}^{n}\tau_k^3(t)C_k\exp[-r_{t,\tau_k(t)}\tau_k(t)]\right)\varepsilon^3. \tag{10}$$

Observe that for $\varepsilon>0$ then $P_{t,0;\varepsilon}<P_t$. It means that the price decreases as ε increases. As in (5) and (7), it is clear that

$$\frac{1}{P_t}\left(\sum_{k=1}^{n}\tau_k^3(t)C_k\exp[-r_{t,\tau_k(t)}\tau_k(t)]\right)\leq(T-t)^3. \tag{11}$$

This last inequality with the second member of (10) leads to

$$\left|\frac{P_{t,0;\varepsilon}-P_t}{P_t}-\{-\mathrm{D}ur(t)\times\varepsilon+\mathrm{C}onv(t)\times\varepsilon^2\}\right|\leq\frac{1}{6}(T-t)^3\varepsilon^3. \tag{12}$$

This estimates yields a practical quality control of the approximation of $\frac{P_{t,0;\varepsilon}-P_t}{P_t}$ by $-\mathrm{D}ur(t)\times\varepsilon+\mathrm{C}onv(t)\times\varepsilon^2$.

In other terms our estimate (12) says the following:

Corollary 3: *When the spot rate curve moves in a parallel shift of size* ε, *with* $0<\varepsilon$, *then the error in using the classical approximation (8) does not exceed* $\frac{1}{6}(T-t)^3\varepsilon^3$.

It may be noted that the maximal size error

$$\rho_{max}(\tau,\varepsilon)\equiv\frac{1}{6}\tau^3\varepsilon^3 \qquad with\ \tau=T-t$$

does not depend on the bond face value. To fix the idea about the magnitude of this quantity we have the following Table. **Some values of** $\rho_{max}(\tau,\varepsilon)$

ε	$\tau = 5 years$	$\tau = 10 years$	$\tau = 15 years$
0.01%	2.08×10^{-11}	1.67×10^{-10}	5.63×10^{-10}
0.1%	2.08×10^{-11}	1.67×10^{-10}	5.63×10^{-7}
0.5%	2.60×10^{-11}	2.08×10^{-5}	7.03×10^{-5}
0.75%	8.78×10^{-6}	7.03×10^{-5}	2.37×10^{-4}
1%	2.08×10^{-5}	1.67×10^{-4}	5.63×10^{-5}
1.5%	2.08×10^{-5}	5.63×10^{-4}	1.90×10^{-3}
2%	2.08×10^{-5}	1.33×10^{-3}	4.50×10^{-3}

It appears here that for fixed income products whose the maturity is five years, then approximation (8) can be used up to $\varepsilon \le 2\%$. For a ten years maturity, it seems that the approximation is fully significant for $\varepsilon \le 0.75\%$. The case $0 < \varepsilon$, which corresponds to a loss, deserves particular attention for the risk management point of view.

For $\varepsilon < 0$, the price appreciates since $P_t < P_{t,0;\varepsilon}$ and holding the position leads to some profit. We also would like to be able to get a similar estimate as (10) when the size of ε is not too big, in the sense that

$$|\varepsilon| = -\varepsilon < \min\{r_{t,\tau_k(t)} | \quad k \in \{1,\ldots,n\}\}. \tag{13}$$

This ensures that $0 < (r_{t,\tau_k} + \varepsilon)$ for all $k \in \{1,\ldots,n\}$. Condition (13) is consistent with the assumption that if the interest rate depreciates, then it cannot reach the zero level.

Precise statement for the analogous of Proposition 2 is as follows.

Proposition 4: *Let us consider* η *satisfying*

$$\eta < \min\{r_{t,\tau_k(t)} | \qquad \text{for all } k \text{ with } k \in \{1,\ldots,n\}\} \tag{14}$$

Then for any parallel shift ε *satisfying*

$$-\eta \le \varepsilon < 0 \tag{15}$$

we have the estimates

$$\left|\frac{P_{t,0;\varepsilon} - P_t}{P_t} - \{-\mathrm{D}ur(t)\times\varepsilon + \mathrm{C}onv(t)\times\varepsilon^2\}\right|$$

$$\le \frac{1}{6P_t}\left(\sum_{k=1}^{n}\tau_k^3(t)C_k \exp[-(r_{t,\tau_k(t)} - \eta)\tau_k(t)]\right)|\varepsilon|^3. \tag{16}$$

In contrast with Proposition 2, devoted to the case $\varepsilon > 0$, here the estimate accuracy is only stated under condition (15), which is justified by (13).

To get a simple bound for the approximation size error as in Corollary 3, we observe that

$$\frac{1}{P_t}\left(\sum_{k=1}^{n}\tau_k^3(t)C_k \exp[-(r_{t,\tau_k(t)} - \eta_k)\tau_k(t)]\right) \le \exp[\eta(T-t)](T-t)^3. \tag{17}$$

This last inequality with the second member of (16) leads to

$$\left|\frac{P_{t,0;\varepsilon} - P_t}{P_t} - \{-\mathrm{D}ur(t)\times\varepsilon + \mathrm{C}onv(t)\times\varepsilon^2\}\right| \le \frac{1}{6}\exp[\eta(T-t)](T-t)^3|\varepsilon|^3. \tag{18}$$

Corollary 5: *When the spot rate curve moves in a parallel shift of size* ε*, with* $\varepsilon < 0$ *satisfying assumptions (15) and (14), then the error in using the classical approximation (8) does not exceed* $\frac{1}{6}\exp[\eta(T-t)](T-t)^3|\varepsilon|^3$.

Therefore the accuracy of approximation (8) can be quickly seen from the smallness of $\frac{1}{6}\exp[\eta(T-t)](T-t)^3|\varepsilon|^3$ when $-\eta \le \varepsilon < 0$, or $\frac{1}{6}(T-t)^3\varepsilon^3$ when $0 < \varepsilon$. The values of $\rho_{max}(\tau,\varepsilon)$ as described in the above Table may be useful to appreciate the accuracy of the error estimates.

3.3 Enhanced Duration-Convexity Approximation

Let us consider again a fixed-income instrument whose the value P_t at the current time t is defined by (1) and (2). For clearness, we make a little change in our notations. Therefore the value P_t may be considered as given by some function P such that

$$P_t = P(\tau_1(t),\ldots\ldots,\tau_n(t);r(t,\tau_1(t)),\ldots\ldots,r(t,\tau_n(t))) \tag{19}$$

where $\tau_k(t) = t_k - t$ and

$$r(t,\tau_1(t)) = r_{t,\tau_1(t)},\ldots\ldots,r(t,\tau_n(t)) = r_{t,\tau_n(t)}.$$

For the future time $t+s$, with $0<s$, the interest rates curve evolves to $u \mapsto r(t+s,u)$. At the current time t, the value of $r(t+s,u)$ is unknown and can be viewed as given by some random variable. Usually people talk about a parallel shift of the zero interest rates curve whenever for some real number ε

$$r(t+s,u) = r(t,u) + \varepsilon \qquad for\ all\ maturities u \geq 0 \tag{20}$$

To simplify, we assume that the elapsed time s is no more than the distance between the present time t and the next cash-flow payment, i.e.

$$t < t+s \leq t_1 < \ldots\ldots < t_n.$$

This means that no cash-flow is paid until the future time $t+s$. At time t, the investor is willing to grasp the fixed-income future value P_{t+s} which is the random variable given by:

$$P_{t+s} =$$

$$P(\tau_1(t+s),\ldots\ldots,\tau_n(t+s);r(t+s,\tau_1(t+s)),\ldots\ldots,r(t+s,\tau_n(t+s))).$$

Assuming a parallel shift of the interest rates curve as in (20) and using the fact that

$$\tau_i(t+s) = \tau_i(t) - s \qquad for\ all\ i \in \{1,\ldots,n\},$$

then P_{t+s} takes the form

$$P(\tau_1(t)-s,\ldots\ldots,\tau_n(t)-s;r(t,\tau_1(t)-s)+\varepsilon,\ldots\ldots,r(t,\tau_n(t)-s)+\varepsilon)$$

$$\equiv P_{t,s;\varepsilon}. \tag{21}$$

It should be emphasized that $P_{t,s;\varepsilon}$ represents the fixed-income value at the future time $t+s$ when the time t all the points of the zero interest rates curve is shifted by ε.

Let us recall that the investor main concern is to get an accurate idea (preferably at the current time t) of the difference $P_{t+s} - P_t$ or the corresponding relative change $\frac{P_{t+s} - P_t}{P_t}$. Therefore the main issue remains now to control the difference $P_{t,s;\varepsilon} - P_t$ or the relative change $\frac{P_{t,s;\varepsilon} - P_t}{P_t}$ whenever $s>0$. The classical approach, as we have analyzed in the previous subsection, is just focused on $P_{t,0;\varepsilon} - P_t$ and $\frac{P_{t,0;\varepsilon} - P_t}{P_t}$, i.e. just for the case $s=0$. Here the zero interest rate curve movement is taken into consideration but the time passage is not taken into consideration. It means that the classical approach, as described in the previous Subsection, is not satisfactory the investor would like to grasp the fixed-income instrument value at a future time $t+s$ for which s satisfies always $s>0$. In this paper, we would like to put in evidence that taking into account the time passage leads to enhance the approximation of the price change. Having an accurate approximation is valuable to get a good hedging and risk management. Applications of the results, we obtain here, on stress-testing and bond hedging is developed in our recent working paper Jaffal&Rakotondratsimba (2011).

From now, we will deal with:

$$P_{t,s;\varepsilon} = \sum_{k=1}^{n} C_k \exp[-(r_{t,\tau_k(t)-s} + \varepsilon)(\tau_k(t) - s)] \tag{22}$$

which should be understood as the future price at time $t+s$ under a parallel shift ε of the zero interest rates curve.

Variants of the duration and convexity introduced in (4) and (6), taking into account the passage of time, are defined by

$$\mathrm{D}ur(t,s) = \frac{1}{P_{t,s;0}} \sum_{k=1}^{n} (\tau_k(t) - s) C_k \exp[-r_{t,\tau_k(t)-s}(\tau_k(t) - s)] \tag{23}$$

and

$$\mathrm{C}onv(t,s) = \frac{1}{2P_{t,s;0}} \sum_{k=1}^{n} (\tau_k(t) - s)^2 C_k \exp[-r_{t,\tau_k(t)-s}(\tau_k(t) - s)] \tag{24}$$

where

$$P_{t,s;0} = \sum_{j=1}^{n} C_j \exp[-r_{t,\tau_j(t)-s}(\tau_j(t) - s)]. \tag{25}$$

Observe that $P_{t,s;0}$ is reduced to P_t whenever s is allowed to be equal to 0. Similarly to (5) and (7) we also have:

$$\mathrm{D}ur(t,s) \le (T - (t+s)) \qquad \textit{and} \qquad \mathrm{C}onv(t,s) \le \frac{1}{2}(T - (t+s))^2.$$

We can now state our result about the estimate of the ratio $\frac{P_{t,s;\varepsilon} - P_t}{P_t}$ under a parallel shift of the curve of interest rates as described in (20).

Theorem 6: *Let s, with $0 < s \le t_1 - t$. Assume that for the future time $t+s$, the term structure of the interest rates has done a parallel shift of ε, as described in (20). Then for all ε, with $\varepsilon > 0$, we have the approximation*

$$\frac{P_{t,s;\varepsilon} - P_t}{P_t} \approx \frac{1}{P_t}\{\sum_{k=1}^{n} C_k(\exp[-r_{t,\tau_k(t)-s}(\tau_k(t) - s)] - \exp[-r_{t,\tau_k(t)}\tau_k(t)])\}$$

$$+ (\frac{P_{t,s;0}}{P_t})\{-\mathrm{D}ur(t,s) \times \varepsilon + \mathrm{C}onv(t,s) \times \varepsilon^2\}. \tag{26}$$

The size of the remainder term

$$Rem(t,s,\varepsilon) \equiv \frac{P_{t,s;\varepsilon} - P_t}{P_t}$$

$$- \frac{1}{P_t}\{\sum_{k=1}^{n} C_k(\exp[-r_{t,\tau_k(t)-s}(\tau_k(t) - s)] - \exp[-r_{t,\tau_k(t)}\tau_k(t)])\}$$

$$- (\frac{P_{t,s;0}}{P_t})\{-\mathrm{D}ur(t,s) \times \varepsilon + \mathrm{C}onv(t,s) \times \varepsilon^2\} \tag{27}$$

is given by the following estimates

$$|\, Rem(t,s,\varepsilon)| \le \frac{1}{6P_t}(\sum_{k=1}^{n} (\tau_k(t) - s)^3 C_k \exp[-r_{t,\tau_k(t)-s}(\tau_k(t) - s)])\varepsilon^3. \tag{28}$$

As in (11) we also get :

$$\frac{1}{P_t}(\sum_{k=1}^{n}(\tau_k(t)-s)^3 C_k \exp[-r_{t,\tau_k(t)-s}(\tau_k(t)-s)]) \le (\frac{P_{t,s;0}}{P_t})(T-(t+s))^3 \tag{29}$$

which, combined with (28), leads to the more practical error estimates

$$|Rem(t,s,\varepsilon)| \le \frac{1}{6}(\frac{P_{t,s;0}}{P_t})(T-(t+s))^3 \varepsilon^3. \tag{30}$$

Our result in Theorem 6 deals with the upward shift of the zero interest rates curve. For the downward movement we get the following statement.

Theorem 7: *Let* s *, with* $0 < s \le t_1 - t$ *. Let us consider* η *satisfying*

$$\eta < \min\{r_{t,\tau_k(t)-s} \mid \quad \text{for all } k \text{ with } k \in \{1,\ldots,n\}\}. \tag{31}$$

Assume that for the future time $t+s$ *, the term structure of the interest rates has done a parallel shift of* ε *, as described in* (20)*. Then for all* ε *satisfying*

$$-\eta \le \varepsilon < 0 \tag{32}$$

the approximation (26) *remains true. The size of the remainder term is governed by the following estimates*

$$|Rem(t,s,\varepsilon)| \le \frac{1}{6P_t}(\sum_{k=1}^{n}(\tau_k(t)-s)^3 C_k \exp[-\{r_{t,\tau_k(t)-s}-\eta\}(\tau_k(t)-s)])\,|\varepsilon|^3 . \tag{33}$$

Under (32) we also have

$$|Rem(t,s,\varepsilon)| \le \frac{1}{6}(\frac{P_{t,s;0}}{P_t})\exp[\eta(T-(t+s))](T-(t+s))^3\,|\varepsilon|^3 . \tag{34}$$

In Theorems 6 and 7, the future date $t+s$ precedes the time t_1, where the first cash flow C_1 takes place. In Lajili & Y. Rakotondratsimba (2008) we have also considered the case where some cash-flows are paid before the considered future time $t+s$ by using the same line of ideas we have used here.

For shortness we have limited our analysis to an approximation limited to the second order. Details for high level approximation may be seen in our recent working paper Jaffal&Rakotondratsimba (2011). The proofs of our results in Proposition 1 to Theorem 7 are also essentially contained in Lajili&Rakotondratsimba (2008), so we do not report here the details. It may be just useful to note that Proposition 1 and the first parts of Theorem 6 and 7 are based on Taylor formula with remainder term written in Lagrange form. All the error estimates use elementary inequalities involving exponentials.

4. Numerical Illustrations

For our illustration, we deal with a coupon-bond with annual payment and a remaining maturity of 5 years. The face value is 100 (Euros for instance) and the coupon rate is 5%. The interest rate curve is assumed to be given by the following

maturity τ(*year*)	1	2	3	4	5
$r(t,\tau)(\%)$	2.16	2.51	2.87	3.21	3.54

To simplify we make use of linear interpolation to define $r(t,\tau)$ for any τ which is not among the pillars $1y,\ldots,5y$. To fully appreciate the efficiency of the modified duration-convexity introduced in this paper, we consider parallel shifts of the interest rate with large sizes as

$$\varepsilon \in \{-2\%,-1.5\%,\ldots,0\%,\ldots,2.5\%,3\%\}$$

in coherence with the shocks we meet frequently on the market since the 2007 financial crisis. We are interested on analyzing the bond relative change after $s=30$ days and $s=90$ days. Observe that some investment manager regularly revise the allocation of their portfolio on a quarterly basis.

What we would like to put in evidence in this illustrative Section is that, our modified duration-convexity approximation fits well the bond change when compared to the classical duration-convexity approximation.

All numbers in Table1 are given in percentage. The interest rate shifts under consideration are displayed in the first

column. In the second column we present the exact value of the bond relative change which is given by $\frac{P_{t,s;\varepsilon} - P_t}{P_t}$, where P_t is computed from (1) by directly using the interest rate curve mentioned above. The quantity $P_{t,s;\varepsilon}$ is obtained by using (22) and the interpolation of the interest rate curve. In the third column of this Table we make use of the classical duration-convexity approximation as recalled in (8). The last fourth column is computed from our modified duration-convexity approximation (26).

Similarly, the result after a delay of $s = 90$ days is summarized in Table2. Focusing on this last Table, we see that for $\varepsilon = 0\%$ the bond relative change is exactly 1.2272%. This case shows the inappropriateness of using the classical duration-convexity, as it lacks to take into account the time passage. It is also apparent from the other cases $\varepsilon \neq 0$ that the classical approximation (described in the third column) is far from the reality (described in the second column) and should not be used. In contrast, the modified duration-convexity approach (described in the fourth column) fits well practically the bond (relative) change since the difference between the modified approximated value and the bond change varies here from -1.26 to 4.04 basis points.

Further examples and error analyses are performed in Lajili & Rakotondratsimba (2008) and Jaffal & Rakotondratsimba (2011). Particularly the implication of the modified duration-convexity on hedging and managing interest rate risks is developed in this last working paper.

5. Conclusion

The Fisher-Weil duration-convexity approximation is inaccurately formulated since the time-passage is neglected, the shift size is assumed to be infinitesimal and the error approximation is out of the control. In this paper we have presented how to enhance this classical approximation such that these simultaneous inconveniences may be overcome. Our modified approximation leads to a perfect fit of the bond change. Indeed a shift of any arbitrary size is now allowed and a deterministic and explicit estimates of the approximation error becomes available.

Though the parallel shift of the interest rate curve is a strong and unrealistic assumption it remains a standard reference among practitioners and academics. The analysis performed here finds a valuable implication in stress-testing, hedging and managing interest rate risks as recently performed in Jaffal & Rakotondratsimba (2011). Moreover the ideas underlying the present work lead to new and practical results related to bond risk management in the framework of a one-uncertainty factor model of short interest rate, as we have been developed recently in Rakotondratsimba (2011).

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Table 1. Result for s=30 days

ε	exact change	classical approx	modified approx.
-2	9.8336	9.5485	9.8196
-1.5	7.3942	7.0793	7.3883
-1	5.0119	4.6648	5.0102
-0.5	2.6854	2.3050	2.6852
0	0.4132	0	0.4132
0.5	-1.8059	-2.2502	-1.8057
1	-3.9731	-4.4457	-3.9714
1.5	-6.0897	-6.5865	-6.0841
2	-8.1569	-8.6725	-8.1436
2.5	-10.1759	-10.7037	-10.1501
3	-12.1479	-12.6802	-12.1034

Table 2. Result for s=90 days

ε	exact change	classical approx	modified approx.
-2	10.3575	9.5485	10.3449
-1.5	7.9960	7.0793	7.9907
-1	5.6879	4.6648	5.6864
-0.5	3.4321	2.3050	3.4319
0	1.2272	0	1.2272
0.5	-0.9278	-2.2502	-0.9276
1	-3.0341	-4.4457	-3.0325
1.5	-5.0928	-6.5865	-5.0877
2	-7.1050	-8.6725	-7.0929
2.5	-9.0719	-10.7037	-9.0484
3	-10.9944	-12.6802	-10.9540

The Determinants of the Demand for Imports in GCC Countries

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Abstract

This study empirically estimates the critical parameters of import demand determinants for GCC countries (Bahrain, United Arab Emirates, Kuwait, Oman Qatar and Saudi Arabia) by using annual time series-cross section data (1994-2008) and by applying panel Seemingly Unrelated Regression (SUR) model. The empirical results confirm that, in both long run and short run, there are positive and significant relationships between the demand for imports and real income, private consumption, international reserves and gross capital formation. On the other hand, there are negative and significant relationships between the demand for imports and the relative price of imports to domestic price and government consumption in the long run, but negative and insignificant relationships in the short run.

Keywords: Import demand, Trade policy, SUR Model, Gulf Cooperation Council (GCC)

1. Introduction

The Gulf Cooperation Council (GCC) is considered one of the most open economies in the world, While in the GCC countries the share of total external trade to GDP (almost 100 percent in 1992-94) is probably among the highest in the world, and per capita exports (US$4,000 in 1994) reach the levels of industrial countries, these measures of openness are heavily influenced by oil trade (http://www.imf.org/external/pubs/ft/policy/3oilmkt.htm). As it shown in Table 1, foreign trade (in 2000 constant prices) increased from $ 201.49 billion in 1994 to $ 930.36 billion in 2008 according a yearly average growth rate of approximately 11.55%. So, the high level contribution of foreign trade in the economic structure of the GCC countries motivated economists to study the demand for imports determinants in each country. So, this study concentrates on studying the import demand determinants of the GCC economies.

Insert Table 1 Here

2. Imports Structure in GCC Countries

Table 2 indicates that the imports of GCC countries increased from $ 89.7 billion in 1994 to $ 349.66 billion in 2008 at constant prices (2000=100), with yearly average growth rate about 10.21 percent This rate is considered of one of the highest growth rates of imports in the world, these growth rates are accompanied by increases in foreign exchange revenues from oil exports and intermediate and capital goods that have been demanded for development process during that period.

Insert Table 2 Here

Figure 1 illustrates the changes of the structure of GCC's imports by country during the period 1994-2008. What can be seen in the figure is that the shares of most countries did not witness obvious changes over the period of review. Figure 1 also illustrates that, total sum of import shares in Saudi Arabia and the United Arab Emirates form the highest share of GCC's imports for 1994 and 2008, with ratios of 74 percent and 78 percent respectively.

Insert Figure 1 Here

Table 3 presents the structure of imports by sector in 1997 and 2007; it showed that, although the shares of merchandize imports decreased slightly from 78 percent to 76 percent respectively, its value increased from 85.09 billion dollars to 226.09 billion dollars with average yearly growth rate about 10.27 percent.

Inset Table 3 Here

Table 4 and figure 2 illustrate the GCC's merchandise import structure by sector. The data indicates that, the total sum of machinery & transport sector and manufacturers sector form 67.96 percent of total merchandise imports in 1997. This percent did not change a lot in 2007, however as shown in Table 5 and Figure 2, it had reached 69 percent. machinery & transports imports represented 40 percent of GCC's merchandise imports. The high share of this sector due basically to the development process requirements in GCC's countries. Food & beverages imports also represented the third highest sector share of merchandise imports, although it decreased from 13.14 percent in 1997 to 9 percent in 2007. The high share of food & beverages imports dues to the lack of agricultural land in the GCC countries and the high levels of reclamation cost to expand it; which make the domestic prices of food & beverages sector are relatively higher than imports prices. Besides that, many exporting countries especially European countries introduce a subsidy to its food exports which makes it cheaper than domestic products in the GCC countries.

Insert Table 4 Here

Insert Figure 2 Here

3. Economic Literature

Imports play an important role in developing economies. However, through it countries can safe goods and services that can't be produced domestically. There are has many applied empirical studies estimating import demand functions for advanced countries and developing countries in order to determine economic variables that affect the behavior of import demand over time.

There are few studies estimated the import demand function in GCC countries. However Doroodian et al. (1994) estimated the import demand function for Saudi Arabia based on annual data for the period 1963-90. The results suggested a number of aspects that characterize the Saudi Arabia import demand function. First, econometric evidence showed that, for standard specifications of the import demand function, the log-linear formulation was more appropriate than the linear one. Secondly, empirical result showed that, in the case of Saudi Arabia, the relative price formulation of the traditional import demand function is inappropriate for estimating elasticities of import demand. Aldakhil K. and Al-Yousef N. (2002) analyzed Saudi Arabia's aggregate demand for imports during the period 1968-98 by using Cointegration analysis and Error Correction approach. They found that, domestic price, import price, and income are important in determining the import demand. Metwally (2004) examined the impact of the fluctuations in oil exports on GCC spending on imports and analyzed the long-run relationship between the imports of each GCC member and the macroeconomic components of final expenditure (exports, government consumption, investment and private consumption) using the Johansen multivariate cointegration analysis. He found that the demand for imports was highly elastic with respect to GDP in all GCC countries studied (with the exception of Oman) during the last three decades.

On the other hand, many authors estimated the import demand function in developing countries. For Turkey, Erlat and Erlat (1991) study on Turkish export and import performance used annual data for the period 1967-87. Export supply, export demand and import demand functions were estimated by ordinary least squares (OLS) first, and then three equations were estimated as a set of seemingly unrelated regressions (SURs). The total volume of imports was regressed on domestic real income, price of imports (including tariffs) divided by domestic prices, real international reserves and one period lagged value of the dependent variable. Two dummies were introduced for the years 1978 and 1979 to explain structural shifts. International reserves were found to be the most important variable in explaining import demand. Relative prices, however, had no significant explanatory power on import demand. Kotan and Saygili (1999) estimate an import demand function for Turkey. They incorporated two different model specifications to estimate the import demand function for Turkey. The estimation performance of the two models was compared and contrasted for the period 1987:Q1-1999:Q1 by using quarterly data. The significance of variables that affect import demand was individually and jointly tested. Also, the short run elasticities of the two models were compared. The first model estimated imports using the Engle-Granger approach. It was found that in the long run, income level, nominal depreciation rate, inflation rate and international reserves insignificantly affect imports. The second approach models import demand using the Bernanke-Sims structural vector autoregressive (VAR) method. The findings indicated that anticipated changes in the real depreciation rate and unanticipated changes in the income

growth and real depreciation rate have significant effects on import demand growth.

For Malaysia, Alias and Tang (2000) examined the long-run relationship between Malaysian aggregate imports and the components of final demand expenditure and relative prices using the Johansen multivariate cointegration analysis. An error correction model is proposed to model the short-run response of imports to its determinants. Annual data for the period 1970 to 1998 are used. The long-run relationship between aggregate imports and the macroeconomic components of final demand expenditure namely public and private consumption expenditure, investment expenditure and exports, is investigated because the different components of final demand might have different import contents. The results of the analysis showed that the components of final demand expenditure and relative prices are all important in determining aggregate demand for imports in both the long-run and the short-run.

Mohammed and Tang (2000), used the Johansen and Juselius cointegration technique and estimated the determinants of aggregate import demand for Malaysia, over the period 1970-1998. The results indicated that while all expenditure components had an inelastic effect on import demand in the long run, investment expenditure had the highest correlation (0.78) with imports followed by final consumption expenditure (0.72). Expenditure on exports was found to have the smallest correlation with imports (0.385). They also found a negative (-0.69) and inelastic relationship between relative prices and import demand. All results were found to be statistically significant at the 1 per cent level.

For India, Dutta et al. (2006) investigate the behavior of Indian aggregate imports during the period 1971-1995. In their empirical analysis of the aggregate import demand function for India, cointegration and error correction modeling approaches were used. In the aggregate import demand function for India, import volume is found to be cointegrated with relative import price and real GDP. The aggregate import volume is found to be price-inelastic, the coefficient estimate being -0.47. The value of income elasticity of demand for imports lagged two years is greater than unity (1.48 in the model), implying that the demand for imports increases more than proportionately to the increase in real GDP.

Sinha's (2001) study illustrated that the price and income demand elasticities are inelastic in India, Japan, the Philippines, Sri Lanka and Thailand.

Bahmani-Oskooee et al. (1998), investigated demand import function for 30 countries durig the period 1970-1992. They found that both price and income elasticities of import demand were high in the most cases.

For, developed countries, Carone et al (1996) tested the American demand for imports using quarterly data 1970 to 1992 based on the cointegration and error correction approaches. They found a statistically significant long-run relationship between the import demand function and real income and relative prices. Stirbock (2006) presented a single error-correction analysis of German total, euro-area (intra) and non-euro-area (extra) import demand for the 1980-2004 period and found that, German import demand is driven largely by domestic and foreign demand and less by changes in relative prices.

4. The Model and the Methods

We estimate a SUR model to explain the demand for imports in GCC countries by using data from the six GCC countries.

Accordingly, the estimated demand function for imports in GCC countries involves the following variables;

$$\log RM_{i,t} = \alpha_i + \beta_1 \log RGDP_{i,t} + \beta_2 \log RFR_{i,t} + \beta_3 \log RINV_{i,t} + \beta_4 \log RPC_{i,t} + \beta_5 \log RGC_{i,t} + \beta_6 \log PMPD_{i,t} + \xi_{i,t} \quad (1)$$

Where RMi,t is the real value of imports of the GCC member country i during year t, RGDPi,t is the real gross domestic product i of GCC member country i during year t; RFRi,t is the value of international reserves of GCC member country i during year t; $RINV_{i,t}$ is the real value of gross capital formation of GCC member country i during year t; $RPC_{i,t}$ is the real value of private consumption expenditure of GCC member country i during year t; $RGC_{i,t}$ is the real value of public consumption expenditure of GCC member country i during year t; The relative price variable $PMPD_{i,t}$ is given by the indicative ratio of foreign country import price index (proxied by consumer price index of United States) to consumer price index of the GCC member country i during year t.

$$PMPD_{i,t} = (CPI_{USA,t} / CPI_{i,t}) \quad (2)$$

Where, CPIUSA,t is the consumer price index of USA in year t, CPIi,t is the consumer price index of GCC member country i in year t.

We expect β1, β2, β3, β4 and β5 to be positive, only β6 expected to be negative. The log linear form is chosen, since it is found to be the most appropriate function form for demand functions in many empirical studies (Doroodian et al.

(1994), Bahmani-Oskooee et al. (1998), Alias and Tang (2000), Aldakhil K. and Al-Yousef N. (2002)). It also has the added advantage of reducing hetroskedasticity (Maddala 1992).

5. Data and Variables

This study will use the annual data from 1994 to 2008 for GCC countries. All data in this study was obtained from World Bank Development Indicator (http://data.worldbank.org/indicator/), the data has been converted to real values (2000 constant prices) by using consumer price indices (2000=100).

6. Empirical Results

6.1 Panel Unit Root Tests

Recent advances in panel data analysis have focused attention on unit root and cointegration properties of variables observed over a relatively long span of time across a large number of cross-section units of countries. In this study, we adopt Maddala and Wu (1999); Levin, Lin, and Chu (2002) panel unit root and stationarity tests. The null hypothesis of these tests is that the panel series has a unit root (non-stationary).

Insert Table 5 Here

As can be shown in Table 5, the null hypothesis can't be rejected for levels of all variables in all tests, but the null hypothesis is rejected at least on one of the significance levels (1%, 5% or 10%) in every test for the first differences of all variables. Thus, it can be said that all variables are integrated of the first order.

6.2 Panel Cointegration Test

Having established that all variables are integrated of the first order, we proceed to test whether there is a long run relationship of the system in panel data. From the Pedroni panel cointegration test results in Table 6, we find evidence to reject the null hypothesis of no cointegration for 4 out of the 7 statistics provided by Pedroni (1999). So, there was no clear cointegration between the series in the long run. Therefore, executed another panel cointegration test to confirm the results of the cointegration analysis. The Kao's panel cointegration test is employed. The results of Kao's panel cointegration test illustrated in Table 7.

Insert Table 6 Here

Insert Table 7 Here

6.3 Panel Cointegration Estimation

Having found that the existence of the cointegrating relationship is supported, we estimate the import demand function (equation 1) by using the E-views econometric software to obtain the panel estimates of the model by the SUR Method.

In Table 8, we see the results of the long run panel SUR estimates. The explanatory power is very high (Adjusted R^2=0.998). The explanatory variables are significant at 1% level with expected sign (Log(RGDP), Log(RFR), Log(RINV), Log(RPC) and Log(PMPD), with the exception of real government expenditure "Log(RGC)" which has a negative unexpected sign. This is because governments do not spend on imports if it has a substitute effect on domestic goods and services.

On the other hand, the elasticity coefficient of real government consumption is negative, that is because an important part of real government consumption expenditure is directed basically to subsidizing domestic goods and services, which makes it cheaper than imports. The elasticity coefficient of relative import price to domestic price ln(PMPD) is negative and significant and almost equal to unity.

In the short run, we estimate equation 3. As shown in Table 8, the elasticity coefficients of real income, gross capital formation and private consumption expenditure are positive and significant while the coefficient for international reserves is positive but insignificant. On the other hand, the import elasticity of government consumption expenditure is negative but insignificant. Finally, the elasticity coefficient of relative import price to domestic price is negative but insignificant, plausibly due to the high income levelss in GCC countries, which make consumers don't pay attention to goods and services prices in the short run. The error correction is correctly negatively signed and highly significant but has a small magnitude (-0.097) suggesting a slow adjustment process, which means that, if import demand is 1 percent out of equilibrium, a 9.7 percent adjustment towards equilibrium will take place within the first year.

$$\log \Delta RM_{i,t} = \alpha_i + \beta_1 \Delta \log RGDP_{i,t} + \beta_2 \Delta \log RFR_{i,t} + \beta_3 \Delta \log RINV_{i,t} + \beta_4 \Delta \log RPC_{i,t} + \beta_5 \Delta \log RGC_{i,t} + \beta_6 \Delta \log PMPD_{i,t} + \beta_7 EC(-1) + \xi_{i,t} \quad (3)$$

Insert Table 8 Here

7. Concluding Remarks and Policy Implications

The primary objective of this study has been to estimate the critical parameters of the GCC's import demand function. The empirical results obtained show that, in both long run and short run, there are a positive and significant relationships between the demand for imports and real income, private consumption, international reserves, gross capital formation. On the other hand, there are negative and significant relationships between the demand for imports and the relative price of imports to domestic price and government consumption in the long run, but a negative and insignificant relationship in the short run.

The anticipated gradual reduction in food subsidies in the world especially the European countries is expected to raise the cost of food imports. However, the impact on the GCC countries would be relatively small as some countries are becoming increasingly self-sufficient in basic foodstuffs, or rely to increase agricultural land in the region. So, GCC countries must support the international efforts that concentrate on decreasing food subsidies in world Trade Organization (WTO). The high share of machinery & transports sector in merchandise imports which reached 40 percent in 2007 as shown in Table 4, may represent positive factor for achieving higher growth rates of development levels. That because the increases of these imports means increases of domestic capital formation which may increase economic growth by the effect of investment multiplier in the future.

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Table 1. Total foreign trade (2000 constant prices) and growth rates of trade in GCC countries

	Foreign Trade (Billion Dollar)			Growth Rate (%)*		
	1994	2001	2008	1994-2001	2001-2008	1994-2008
Bahrain	8.84	11.64	32.79	3.78	16.2	9.82
Emirates	62.11	89.47	264.24	5.35	16.73	10.9
Kuwait	26.21	29.91	104.21	1.9	19.52	10.36
Oman	9.92	18.79	46.83	9.55	13.93	11.72
Qatar	6.86	15.91	39.97	12.77	14.06	13.42
Saudi Arabia	87.55	122.56	442.32	4.92	20.12	12.27
GCC (Total)	201.49	288.1	930.36	5.24	18.23	11.55

Source: http://data.worldbank.org/indicator/

* calculated by the authors.

Table 2. Imports (2000 constant prices) and growth rates of imports in GCC countries

	Imports value (Billion Dollar)			Growth Rate (%)*		
	1994	2001	2008	1994-2001	2001-2008	1994-2008
Bahrain	4.21	4.85	14.23	2.04	16.62	9.09
Emirates	30.07	40.91	121.92	4.5	16.88	10.52
Kuwait	11.9	12.24	29.02	0.4	13.12	6.57
Oman	4.44	7.27	18.28	7.3	14.08	10.64
Qatar	2.85	4.52	16.21	6.82	20.02	13.23
Saudi Arabia	36.23	44,57	150	3	18.93	10.68
GCC (Total)	89.7	114.36	349.66	3.53	17.31	10.21

Source: http://data.worldbank.org/indicator/

* calculated by the authors.

Table 3. Total imports structure (2000 constant prices) in GCC countries (1997-2007)

	1997		2007		Growth Rate (%)*
	(billion dollars)	share (%)	(billion dollars)	share (%)	
Merchandise imports	85.09	78	226.09	76	10.27
Services imports	24.28	22	73.03	24	11.64
Total	109.37	100	299.12	100	10.58

Source: Arab monetary Fund (AMF), http://www.amf.org.ae/ctrylisten/54/Foreign%20Trade.

Note: The data converted to 2000 constant prices by using CPI's of GCC countries.
There are more detailed data at the Table (A-1) in the Appendix.

Table 4. Merchandise imports structure (2000 constant prices) in GCC countries (1997-2007)

	1997		2007	
	(billion dollars)	share (%)*	(billion dollars)	share (%)*
Food & Beverages	11.19	0.13	20.52	0.09
Crude materials	3.96	0.05	5.78	0.03
Mineral fuels	2.45	0.02	6.80	0.03
Chemicals	5.80	0.07	15.73	0.07
Machinery & Transports	31.73	0.37	89.85	0.40
Manufacturers	26.10	0.31	66.74	0.29
Unclassified	3.87	0.05	20.66	0.09
Total	85.09	100	226.09	100

Source: Arab monetary Fund (AMF), http://www.amf.org.ae/ctrylisten/54/Foreign%20Trade.
* Calculated by the authors.
Note: The data converted to 2000 constant prices by using CPI's of GCC countries.
There are more detailed data at the Tables (A-2) and (A-3) in the Appendix.

Table 5. Panel unit root tests

Series	K	LLC	ADF - Fisher Chi-square	PP - Fisher Chi-square
ln(RM)	level	5.49632	0.18956	0.08647
	First diff.	-5.10814***	43.8563***	42.3976***
ln(RGDP)	level	8.47614	0.00651	0.00791
	First diff.	-1.51846***	15.0767**	31.9888***
ln(RFR)	level	3.34253	0.73528	0.29999
	First diff.	-4.66543***	32.9203***	64.9998***
ln(RINV)	level	2.57173	0.70501	0.31433
	First diff.	-4.14723***	41.0165***	40.1561***
ln(RPC)	level	6.18530	0.19192	0.03916
	First diff.	-1.57948*	11.7686	23.2658**
ln(RGC)	level	3.61193	0.58033	0.15715
	First diff.	-2.97861***	23.6230**	28.9228***
ln(PMPD)	level	-0.84954	8.30095	6.98183
	First diff.	-1.59262*	13.0152	14.4498

Notes: LLC indicated Levin et al. (2002) panel unit root and stationary tests. Fisher-ADF and Fisher-PP tests denote Maddala and Wu (1999) panel unit root and stationary tests. The LLC, Fisher-ADF and Fisher-PP examine the null hypothesis of non-stationary. ***,** and* denotes 1%, 5% and 10% significance levels respectively.

Table 6. Pedroni panel cointegration test results

	Statistic	Prob.
Panel v-Statistic	-0.559091	0.7120
Panel rho-Statistic	1.568816	0.9417
Panel PP-Statistic	-4.680368	0.0000
Panel ADF-Statistic	-4.044875	0.0000
Alternative hypothesis: individual AR coefs. (between-dimension)		
Group rho-Statistic	3.184003	0.9993
Group PP-Statistic	-6.077508	0.0000
Group ADF-Statistic	-3.706903	0.0001

Source: The table has been extracted from table (A-4) in the appendix

Table 7. Kao panel cointegration test results

ADF	t-Statistic	Prob.
	-4.285755	0.0000
Residual variance	0.011792	
HAC variance	0.006521	

Source: The table has been extracted from table (A-5) in the appendix

Table 8. Estimation results for SUR model in the long run and short run (1994-2008)

Variable	Coefficient	
	Long Run	Short Run
C	-0.888876***	-0.013817
ln(RGDP)	0.983331***	0.217392***
ln(RINV)	0.245008***	0.192504***
ln(RFR)	0.112251***	-0.038492
ln(RGC)	-1.008486***	-0.032454
ln(RPC)	0.558550***	0.834956***
ln(PMPD)	-1.053413***	0.269971
Ec(-1)	-	-0.096701***
	R2 = 0.998 Durbin-Watson: 1.19	R2 = 0.69 Durbin-Watson: 1.88

Source: Table (A-6) and table (A-7) in Appendix.

- ***,** and * denotes significance level at 1%, 5% and 10% respectively.

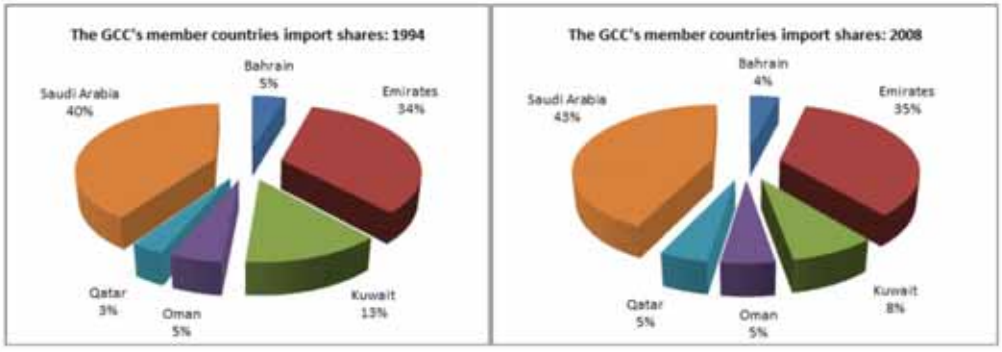

Figure 1. The GCC's member countries imports shares 1994-2008 (in %)

Source: Drawn by the authors from Table 2.

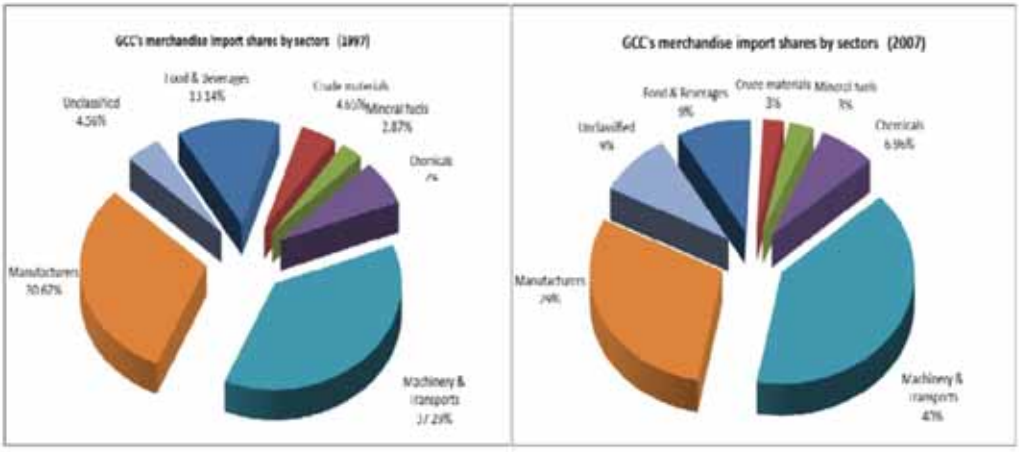

Figure 2. The GCC's merchandise imports shares by sector 1997-2007 (in %)

Source: Drawn by the authors from Table 4.

Appendix:

Table (A-1). Total imports structure (2000 constant prices) by country in GCC countries (billion dollars) (1997-2007)

	1997			2007		
	Merchandise	Services	Total	Merchandise	services	Total
Bahrain	3.93	0.38	4.31	10.42	1.01	11.43
Emirates	35.97	3.97	39.94	81.94	7.72	8.96
Kuwait	8.68	4.02	12.70	19.93	7.53	27.46
Oman	5.012	1.08	6.10	10.89	0.07	10.96
Qatar	3.55	0.78	4.33	18.84	5.32	24.16
Saudi Arabia	27.94	14.05	41.99	84.07	51.38	135.45
GCC	85.09	24.28	109.37	226.09	73.03	299.12

Source: Arab monetary Fund (AMF), http://www.amf.org.ae/ctrylisten/54/Foreign%20Trade.

Note: The data converted to 2000 constant prices by using CPI's of GCC countries.

Table (A-2). Merchandise imports structure (2000 constant prices) in GCC countries (1997) (billion dollars)

	Bahrain	Kuwait	Oman	Qatar	Saudi Arabia	Emirates	GCC
Food & Beverages	0.42	1.28	0.93	0.34	4.63	3.58	11.18
Crude materials	0.28	0.16	0.11	0.10	0.67	2.64	3.96
Mineral fuels	1.43	0.05	0.41	0.02	0.05	0.48	2.44
Chemicals	0.21	0.73	0.27	0.19	2.55	1.85	5.80
Machinery & Transports	0.74	3.35	1.29	1.80	9.71	14.84	31.73
Manufacturers	0.84	2.97	1.64	1.09	8.16	11.40	26.10
Unclassified	0.01	0.15	0.36	0.01	2.17	1.18	3.88
Total	3.93	8.69	5.01	3.55	27.94	35.97	85.09

Source: Arab monetary Fund (AMF), http://www.amf.org.ae/ctrylisten/54/Foreign%20Trade.

Note: The data converted to 2000 constant prices by using CPI's of GCC countries.

Table (A-3). Merchandise imports structure (2000 constant prices) in GCC countries (2007) (billion dollars)

	Bahrain	Kuwait	Oman	Qatar	Saudi Arabia	Emirates	GCC
Food & Beverages	0.52	2.56	0.97	0.87	10.46	5.13	20.51
Crude materials	0.75	0.50	0.28	0.52	1.97	1.76	5.78
Mineral fuels	5.42	0.11	0.38	0.10	0.18	0.61	6.80
Chemicals	0.39	1.68	0.70	0.90	7.49	4.58	15.74
Machinery & Transports	1.94	8.26	5.60	10.00	39.44	24.61	89.85
Manufacturers	1.40	6.73	2.86	6.38	23.89	25.48	66.74
Unclassified	0.01	0.10	0.10	0.06	0.64	19.76	20.67
Total	10.43	19.94	10.89	18.83	84.07	81.93	226.09

Source: Arab monetary Fund (AMF), http://www.amf.org.ae/ctrylisten/54/Foreign%20Trade.

Note: The data converted to 2000 constant prices by using CPI's of GCC countries.

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Table (A-4). Pedroni panel cointegration test results (1994-2008)

Pedroni Residual Cointegration Test					
Series: ln(RM) ln(RGDP) ln(RINV) ln(RFR)ln(RGC) ln(RPC) ln(PMPD)					
Date: 12/01/11 Time: 14:10					
Sample: 1994 2008					
Included observations: 15					
Cross-sections included: 6					
Null Hypothesis: No cointegration					
Trend assumption: No deterministic intercept or trend					
Automatic lag length selection based on SIC with a max lag of 1					
Newey-West automatic bandwidth selection and Bartlett kernel					
Alternative hypothesis: common AR coefs. (within-dimension)					
		Statistic	Prob.	Weighted statistic	Prob.
Panel v-Statistic		-0.559091	0.7120	-2.343878	0.9905
Panel rho-Statistic		1.568816	0.9417	2.173441	0.9851
Panel PP-Statistic		-4.680368	0.0000	-5.639966	0.0000
Panel ADF-Statistic		-4.044875	0.0000	-3.127791	0.0009
Alternative hypothesis: individual AR coefs. (between-dimension)					
		Statistic	Prob.		
Group rho-Statistic		3.184003	0.9993		
Group PP-Statistic		-6.077508	0.0000		
Group ADF-Statistic		-3.706903	0.0001		
Cross section specific results					
Phillips-Peron results (non-parametric)					
Cross ID	AR(1)	Variance	HAC	Bandwidth	Obs
BA	-0.029	0.002201	0.000877	5.00	14
EM	0.130	0.002205	0.000840	5.00	14
KU	-0.288	0.001054	0.000203	11.00	14
OM	-0.108	0.002798	0.000370	13.00	14
QA	-0.315	0.005566	0.006237	1.00	14
SA	-0.165	0.003793	0.001915	7.00	14
Augmented Dickey-Fuller results (parametric)					
Cross ID	AR(1)	Variance	Lag	Max lag	Obs
BA	-0.029	0.002201	0	1	14
EM	0.130	0.002205	0	1	14
KU	-0.288	0.001054	0	1	14
OM	-0.757	0.001947	1	1	13
QA	-0.315	0.005566	0	1	14
SA	-0.165	0.003793	0	1	14

Table (A-5). Kao panel cointegration test results (1994-2008)

Kao Residual Cointegration Test				
Series: ln(RM) ln(RGDP) ln(RINV) ln(RFR) ln(RGC) ln(RPC) ln(PMPD)				
Date: 12/01/11 Time: 14:05				
Sample: 1994 2008				
Included observations: 15				
Null Hypothesis: No cointegration				
Trend assumption: No deterministic trend				
User-specified lag length: 1				
Newey-West automatic bandwidth selection and Bartlett kernel				
ADF.			t-statistic	Prob.
			-4.285755	0.0000
Residual variance			0.011792	
HAC variance			0.006521	
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(RESID01?)				
Method: Panel Least Squares				
Date: 12/01/11 Time: 14:05				
Sample (adjusted): 1996 2008				
Included observations: 13 after adjustments				
Cross-sections included: 6				
Total pool (balanced) observations: 78				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
RESID01?(-1)	-0.760328	0.143324	-5.304945	0.0000
D(RESID01?(-1))	0.074531	0.124404	0.599101	0.5509
R-squared	0.343024		Mean dependent var	-0.000874
Adjusted R-squared	0.334379		S.D. dependent var	0.123894
S.E. of regression	0.101080		Akaike info criterion	-1.720508
Sum squared resid	0.776501		Schwarz criterion	-1.660079
Log likelihood	69.09980		Hannan-Quinn criter.	-1.696317
Durbin-Watson stat	1.821500			

Table (A-6). Demand for imports regression results in the long run 1994-2008

Dependent Variable: ln(RM)				
Method: Pooled EGLS (Cross-section SUR)				
Date: 12/01/11 Time: 11:41				
Sample: 1994 2008				
Included observations: 15				
Cross-sections included: 6				
Total pool (balanced) observations: 90				
Iterate weights to convergence				
Convergence achieved after 210 weight iterations				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.888876	0.087062	-10.20964	0.0000
ln(RGDP)	0.983331	0.058687	16.75544	0.0000
ln(RINV)	0.245008	0.020034	12.22943	0.0000
ln(RFR)	0.112251	0.013955	8.043939	0.0000
ln(RGC)	-1.008486	0.032862	-30.68826	0.0000
ln(RPC)	0.558550	0.041003	13.62222	0.0000
ln(PMPD)	-1.053413	0.083100	-12.67644	0.0000
Weighted Statistics				
R-squared	0.998468	Mean dependent var	67.99049	
Adjusted R-squared	0.998357	S.D. dependent var	118.7347	
S.E. of regression	1.041315	Akaike info criterion	-1.291370	
Sum squared resid	89.99998	Schwarz criterion	-1.096940	
Log likelihood	65.11166	Hannan-Quinn criter.	-1.212965	
F-statistic	9017.077	Durbin-Watson stat	1.189562	
Unweighted Statistics				
R-squared	0.929592	Mean dependent var	2.734682	
Sum squared resid	6.887696	Durbin-Watson stat	0.314082	

Table (A-7). Demand for imports regression results in the short run 1994-2008

Dependent Variable: D(RM)				
Method: Pooled EGLS (Cross-section SUR)				
Date: 12/01/11 Time: 01:16				
Sample (adjusted): 1995 2008				
Included observations: 14 after adjustments				
Cross-sections included: 6				
Total pool (balanced) observations: 84				
Linear estimation after one-step weighting matrix				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.013817	0.011590	-1.192130	0.2369
D((RGDP)	0.217392	0.081667	2.661923	0.0095
D(RINV)	0.192504	0.039625	4.858158	0.0000
D(RFR)	-0.038492	0.024759	-1.554685	0.1242
D(RGC)	-0.032454	0.098451	-0.329648	0.7426
D(RPC))	0.834956	0.094383	8.846477	0.0000
D(PMPD)	0.269971	0.290522	0.929262	0.3557
EC(-1)	-0.096701	0.031376	-3.081986	0.0029
Weighted Statistics				
R-squared	0.690342	Mean dependent var	0.932794	
Adjusted R-squared	0.661821	S.D. dependent var	1.947923	
S.E. of regression	1.034607	Sum squared resid	81.35129	
F-statistic	24.20460	Durbin-Watson stat	1.881687	
Prob(F-statistic)	0.000000			
Unweighted Statistics				
R-squared	0.521536	Mean dependent var	0.100358	
Sum squared resid	0.954603	Durbin-Watson stat	2.065592	

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Examining the Yahoo! Sponsored Search Auctions: A Regression Discontinuity Design Approach

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Abstract

The sponsored search auction is a successful pricing mechanism which helps search engine companies sell navigation service to advertisers and generate multibillion dollar revenue. For the two popular sponsored search auctions—the Generalized First Price (GFP) auction and the Generalized Second Price (GSP) auction—current consensus in both the industry and academia is that the GSP auction is more stable than the GFP auction. Specifically, in the GSP auction, bidders are less likely to "game the system", meaning that an individual bidder will change his bid less frequently and his bid range will be smaller. This paper examines this prevailing belief using a Regression Discontinuity Design (RDD) approach and finds that after bidders switch to the GSP auction, they actually change their bid 19% more frequently and increase their daily bid range by 46%. The paper suggests that the prevailing automated bidding strategies should not be ignored in explaining bidders' behavior.

Keywords: Keyword auction, Sponsored search, Yahoo! Business Model, Regression discontinuity

1. Introduction

The sponsored search auction has played an indispensable role in the success of search engine giants like Yahoo! and Google. For example, Yahoo!'s first half-year revenue in 2008 was $3.62 billion, and at least 50% of that revenue came from the sponsored search auction. For Google, its first half-year revenue in 2008 was $10.55 billion, with 97% of this revenue generated by the sponsored search auctions. Actually, the sponsored search auction is not only crucial to search engine companies, but it is also "vital to the success of many other small businesses" such as bid management software firms, bidding campaign consulting firms, and key word selecting firms, etc. (See Jansen and Mullen, 2008).

The sponsored search auction is a pricing mechanism which helps search engine companies sell navigation services to advertisers. When addressing search requests, search engines display both the search results and advertisers' web links, which are called sponsored links. These sponsored links attempt to navigate potential customers to specific product web sites. Because this targeting of potential costumers has proven effective, advertisers are willing to pay in order to obtain an ideal placement for their web link on a search result page. Search engine companies invented the sponsored search auction to sell these sponsored link placements.

The sponsored search auction was first introduced in 1998 by Goto for Yahoo!. Since then, search engine designers have upgraded the mechanism several times. The purpose of replacing an old sponsored search auction with a new one is "to bring more stability to the auction bidding, increase profits, and help reduce strategic bidding" (Jansen and Mullen, 2008). For search engines, the best scenario is that each of the bidders truthfully spends his maximum willingness to pay on purchasing the links. However, as pointed out by Edelman et al. (2007), bidders have incentive to game the auction system to reduce their costs. In theory, McAdams and Schwarz (2007) argue that the costs that buyers incur while trying to "game" an auction mechanism are fully passed through to the seller. Therefore, search engines may be sensitive to the stability of their sponsored search auction mechanisms.

Correctly understanding how sponsored search auctions work will not only affect the multibillion dollar revenue of search engine companies, but it will also help develop superior sponsored search auctions in the future. In their seminal and influential work, Edelman et al. (2007) and Varian (2007) propose a Generalized Second Price (GSP) auction framework to understand the sponsored search auctions from 2002 through 2007. Edelman et al. (2007) and Varian (2007) argue that this game framework "describes the basic properties of the prices observed in Google's ad auction reasonably accurately." However, Borgers et al. (2007) suggest that "this static GSP auction model actually

may have a very poor explanation power on the real data collected from the Yahoo! sponsored search auction". Actually, the GSP auction approach ignores many important aspects of the actual bidding, such as the dynamic bidding nature or the fact that, in practice, bidders often employ automated bidding software to manage their bidding. Therefore, to what extent this GSP framework can explain the actual bidding behaviors still needs careful empirical examination.

This paper reinvestigates this issue by exploiting a natural experiment which took place on June 26, 2002. On that day, Yahoo! switched its sponsored search auction from the Generalized First Price (GFP) auction to the Generalized Second Price (GSP) auction. Auction theory claims that "superior designs" have replaced the "inefficient market institutions" (Edelman et al., 2007 and Jansen and Mullen, 2008). The GSP game framework predicts that, in the new auction, bidders will be less likely to "game the system". This means that an individual bidder will change his bid less frequently and that his bid range will be smaller. This paper tests these hypotheses using bid data collected from Yahoo! sponsored search auctions in 812 keyword markets from June 15, 2002 through June 14, 2003.

The econometric method adopted in the test is the Regression Discontinuity Design (RDD) approach. Yahoo!'s auction rule change on June 26, 2002 provides a treatment effect framework. Specifically, all the bidders after June 26, 2002 would face the treatment of the GSP auction. Thus, estimating the bidding behavior difference in these two auction systems will be turned into identifying the average treatment effect. However, in the standard treatment effect framework, identification usually depends on strong assumptions. For instance, for the identification of OLS regression, one has to assume that the error terms of the regression satisfy certain ad hoc statistical relationships such as the i.i.d. assumption. This paper avoids this challenge by using a Regression Discontinuity Design (RDD) approach, which enables us to make relatively simple and reasonable assumptions to obtain identification.

The estimation results show that the bidding behavior under the new auction system was less stable than the GSP auction framework predicted. The daily frequency with which an individual bidder changed his bid increased by 3.7 times, representing a 19% increase. In addition, the daily bid range of each bidder increased by $0.71, representing a 46% increase. All the above findings contradict the prediction made by the GSP auction framework which stated that in the new auction bidding behaviors would be more stable.

These findings are important in two aspects. First, in practice, the stability of the sponsored search auction system is an important property. In theory, McAdams and Schwarz (2007) argue that the costs that buyers incur while trying to "game" an auction mechanism are fully passed through to the seller. Therefore, search engines may be sensitive to the stability of their sponsored search auction mechanisms. Actually, in practice, stability has become an important concern. One of the reasons why Yahoo! switched to the GSP auction system was that Yahoo! believed that the GSP auction was more stable and the "second-price structure makes the market less susceptible to gaming" (Edelman et al., 2007).

Second, the findings above have important implications for the current sponsored search auction theory literature. Recent theories on the sponsored search auction, including Edelman et al. (2007), Varian (2007) and Athey and Ellison (2007), are basically based on a static game theory structure. One salient fact these theories miss is that bidders often adopt automated bidding robots to manage their bidding. Yuan (2009) suggests that over 40% of bids may be submitted by these bidding robots following certain technical bidding rules, such as Position Targeting, Cost-per-Purchase Bidding, ROI Bidding, and so on.

It should be noted that this paper is not the first empirical work which provides evidence and suggests that the GSP auction framework may have trouble explaining the actual bidding data. Borgers et al. (2007) suggest that "this static GSP auction model actually may have a very poor explanation power on the real data collected from the Yahoo! sponsored search auction". The difference between this paper and Borgers et al. (2007) is that the latter adopt a structural estimation approach. Plus, to obtain identification, they have to make relatively strong assumptions. Besides, their data set is relatively small. However, this paper exploits the institutional variation and conducts a reduced form regression by employing a RDD approach. This approach enables the author to make relatively simple and clean assumptions. Another advantage this paper has is the huge data set. This paper uses over 1 million bids collected from 812 keyword markets to conduct the RDD estimation, as opposed to the roughly 60,000 bids collected from 5 keyword searches used by Borgers et al. (2007).

The paper is organized as follows. Section 2 introduces the Yahoo! sponsored search auction. Section 3 briefly surveys the sponsored search auction theory literature and proposes the hypothesis to test. Section 4 introduces the data and presents the simple statistics and OLS regression results. Section 5 sets up the RDD framework for the test and discusses the estimation methods. Section 6 presents the RDD estimation results. Section 7 concludes.

2. Yahoo! Sponsored Search Auction

In the search engine industry, there are three key players: the advertisers, the search engines, and the potential customers. Search engines navigate potential customers to advertisers' product web sites by displaying their web

links when potential customers conduct keyword search requests. Advertisers' links are called sponsored links. Sponsored links distinguish themselves from the organic (non-sponsored) web search results by whether or not a fee is paid to the search engine company.

Figure 1 shows an example of sponsored links for the key word "refinance". When someone uses Yahoo! to search for information about "refinance", the search engine will display search results along with sponsored links, which are circled in Figure 1. Usually around 10 sponsored links, located on the top and on the right of each page, will be displayed. Advertisers are interested in buying these link slots for their product web sites because they may target the potential customers more efficiently. In 1998, Goto first introduced the sponsored search auction in the search engine industry to sell these link slots.

The sponsored search auction is a multi-object dynamic auction in which each individual advertiser bids for the ideal slot for his web site. Sponsored search auctions usually have the following common features. First, all the link slots are auctioned at the same time. As shown in Figure 1, there were at least 12 sponsored link slots being auctioned at that time. Second, the auction is dynamic with an infinite time horizon. Each bidder can change or withdraw his bid at any time, which will be immediately reflected in his slot placement. Third, all search engines share a common payment rule: pay per click (PPC), which means that whenever there is a click on the sponsored link, the bidder will pay Yahoo! once. And lastly, in Yahoo!'s sponsored search auction, all the information, including bids and slot placement, is public information, which can be observed by all the bidders directly.

In keeping with the keyword search for "Refinance", Figure 2 shows all bidders' bids and slot allocation information as it was captured by a free public web site. This free bid check website is http://keyword.secretstohighpro_t.com/default.aspx. Actually, Figure 1 and Figure 2 were captured at the same time on March 28, 2007. Figure 2 shows that the bid range is from $16.13 to $7.49 and each bidder's position is determined solely by his bid. As can been seen, "Lending Tree" had the highest bid; therefore, this advertisement was placed at the highest slot as shown in Figure 1.

Designing efficient auction rules regarding how advertisers pay a search engine and how a search engine allocates the link slots among its advertisers is a key challenge faced by search engine designers because the decision to adopt different forms of sponsored search auctions has an important impact on the success of search engine companies. In the past six years, Yahoo! upgraded its sponsored search auction several times hoping to find a better auction mechanism to bring more stable bidding behaviors and higher auction revenue.

Before June 26, 2002, a bidder in the Yahoo! sponsored search auction paid Yahoo! his bid multiplied by the number of the clicks on his web site. For example, if a bidder bid $3 and his web site received 3,000 clicks, the bidder would have to pay Yahoo! $9,000. The literature calls this type of sponsored search auction "Generalized First Price (GFP) Auction" to distinguish it from the standard first price auction.

On June 26, 2002, Yahoo! upgraded its Generalized First Price (GFP) Auction to a Generalized Second Price (GSP) Auction. In this new auction system, the web site placement was still determined solely by a bidder's bid, but each bidder, instead of paying his own bid per click, only had to pay 0.01 more than the next highest bid below his. For example, if two bidders bid $0.4 and $0.6, respectively, in the old bidding system, the winner would pay $0.6 per click received; however, in the GSP auction system, he would be charged at a rate of $0.41.

3. Literature

Recently, economists have been interested in providing a theoretical game foundation for the sponsored search auction between 2002 and 2007. Edelman et al. (2007) first introduced equilibrium concepts for the GSP auctions based on the idea of "envy-free", which assumes that in the equilibrium no bidder would like to place a bid that would cause retaliation. Varian (2007) independently discovered "envy-free" equilibrium and named it "Symmetric Nash Equilibrium" (See Edelman et al. 2007). Many papers follow these two papers and expand the theory framework. In a similar setup, Athey and Ellison (2007) further introduce consumer search behavior into the model and analyze the implications for reserve prices, product variety, and etc. Borgers et al. (2007) make more general assumptions on bidding behaviors and find the multiplicity of Nash Equilibrium.

Edelman et al. (2007) and Varian (2007) argue that this game framework "describes the basic properties of the prices observed in Google's ad auction reasonably accurately," Yet Borgers et al. (2007) suggest that "it actually may have a very poor explanation power on the real data collected from the Yahoo! sponsored search auction." This debate suggests that we still need to carefully conduct empirical examinations on the issue.

In the following subsection, this paper will examine the current GSP auction theory and construct testable hypotheses.

3.1 The Prediction of the GSP Auction Framework

If the current static GSP auction accurately describes bidders' bidding behavior, the actual bidding should follow the

predictions of the theory when it comes to the comparison between the GSP auction and the GFP auction. Currently, theories mainly focus on the GSP auction. In contrast, hardly any formal theoretical analysis has been done on the GFP auction. To compare these two auctions, Edelman et al. (2007) proposed a simple but influential example, which the following literature frequently cited (See Edelman and Ostrovsky, 2006; Jansen and Mullen, 2008). In this subsection, this research also follows this example and constructs the hypothesis.

Example 1 (Edelman et al., 2007): *There are two slots for the links. The first slot receives 400 clicks per hour, and the second slot receives 100 clicks per hour. There are three advertisers bidding to place their product. The value per click for the bidders is \$5, \$4 and \$2. Call these three bidders A, B, and C respectively.*

Edelman et al. (2007) use this example to illustrate the superiority of the GSP auction over the GFP auction in terms of stability. They show that in the GSP auction, the equilibrium bids of A, B, and C will be \$5, \$4 and \$2 and that with these bids, efficient allocation is achieved. In the GFP auction, however, the equilibrium will not be stable. B will bid \$2.01 instead of \$4 and A will bid \$2.02 instead of \$5. B will outbid A at \$2.03 and the bids will escalate until \$4. B will pull his bid back to \$2.01 and the bid escalation will go on again. These bidding behaviors will result in the sawtooth pattern of a bidding war, which is well documented in the literature (Edelman and Ostrovsky, 2006) and (Zhang, 2005). Based on this example, they argue that this second price auction structure makes the GSP auction more stable than the GFP auction.

In the following research, this paper will test the above prediction by estimating how much more stable are the bidding behaviors in the GSP auction. To be specific, if the static GSP auction framework works as the theories claim, the following hypotheses can be tested:

Hypothesis 1 On average, an individual bidder in the GSP auction will change his bid less frequently than in the GFP auction.

Hypothesis 2 On average, in the GSP auction an individual bidder's bid range will be smaller than in the GFP auction.

4. Data

Yahoo!'s research department provides a data set which records all of the bids for the top 812 keyword search by volume and all of the associated accounts for the time period from June 15, 2002 through June 14, 2003.

Each observation in the data contains the following information: bidder ID, his bid, the time when the bid was submitted, and the keyword ID. Both advertisers and keyword phrases are represented as meaningless anonymous numbers so that no identifying information is revealed. The system only records the bid change for 15 minute increments. Therefore, within the 15 minute window, any ordering information cannot be interpreted as chronological.

Table 1 shows several market statistics: the max bid, the mean bid, the minimum bid, and the standard deviation for the top ten most clicked markets. Five cents is the minimum requirement for bidding. One striking observation is the value of the maximum bid. According to this data set, one bidder is paying Yahoo! \$9,170 for just one click through the sponsored search.

Table 2 presents the possible evidence of automated bidding behaviors. The first row of the table shows the simple statistics of the number of times each bidder changed his bid each day. On average, among all bidders and all markets, each bidder changed his bid 15 times each day. The maximum number of times a bid changed in one day is 17,867, which is definitely the result of automated bidding. The lower part of the table gives some ideas about the portion of bids submitted by automated bidding software. First, it shows that more than 53% of bidders update bids 40 times each day. In other words, if updating bids 40 times each day implies the employment of automated bidding, around 53% of bids are submitted by bidding robots. Moreover, the table shows that more than 44% of bidders update bids 100 times each day and more than 28% of bidders change their bids over 500 times each day, which is probably the case of automated bidding. To summarize, Table 2 reveals that a significant portion of bids are submitted through automated bidding software.

The prevailing employment of automated bidding software has important implications because the software usually follows certain mechanical rules instead of solving optimization problems. This will raise questions about how accurately the current theories can describe the actual bidding behaviors in the sponsored search auctions.

I also present the individual bidding statistics from June 15, 2002 through July 15, 2002 in Table 3. Table 3 provides the maximum value, the mean value, the minimum value, and the standard deviation for the following daily statistics:

Bid frequency: the number of times that an individual bidder changes his bid each day.

Bid range: the difference between the maximum bid and the minimum bid of each bidder on each day.

The maximum bid, 75th percentile bid, mean bid, median bid, and 25th percentile bid of each bidder on each day.

Bid frequency and bid range measure the bidding stability of the auction system. The maximum bid, 75th percentile bid, median bid, mean bid and 25th percentile bid measure the impact on the bid distribution of an individual bidder.

Table 3 shows how the mean values of the above statistics change after the launch of the new auction. The mean values of both the daily bid frequency and the daily bid range increase, which suggests that the new auction system is more unstable. The mean values of the max bid and the 75th percentile bid increase while the mean value of the 25th percentile bid decreases, which suggests that the bids are more dispersed.

It is impossible to plot the statistics because of the huge size of the data. To further show a bigger picture of how the change of auction systems affects bidding behaviors, we run a simple OLS regression. In the OLS regression, we control for the market fixed effect and weekday effect. We also control for the entry and exit of bidders by focusing on bidders who submit bids both before and after the auction rule change.

The OLS regression examines the percentage change of the variable $y_{i,m,t}$ in the following three months from July 2002 to September 2002.

$$log(y_{i,m,t}) = \mu_m + \sum_{j=1}^{3} \alpha_j \cdot I_j(t) + \sum_{d\in\{T,W,Th,F,Sa,Su\}} \beta_d \cdot I(t=d) + u_{i,m,t}$$

$y_{i,m,t}$is the statistic of interest for bidder i, market m, at time t. μ is the market fixed effect. $I_j(t)$is an indicator function, showing whether the time t is in the j^{th} month after the policy change. Therefore, $\alpha_1$measures the impact of the new auction system on the market in the first month after the policy change. α_2 measures the impact in the second month after the policy change, and so on. $\beta_d$is the weekday dummy for Tuesday through Sunday.

Table 4 provides the estimation results, showing the bidding behavior change after June 26, 2002. First, both the daily bidding frequency and the daily bid range increase after the auction rule change. This result shows that the bidding behavior is more unstable under the GSP auction in contrast to the predictions which suggest the opposite result.

Second, the individual daily bid distribution expends as the percentage changes of the daily maximum bid, mean bid and median bid are bigger than that of the daily 25th percentile bid.

It may be too ambitious to claim the rejection of the hypotheses based only on the OLS regression results. The unobserved heterogeneities will make these OLS estimations biased, even misleading. First, the OLS regression does not control for the competition brought by the entry and exit of bidders in each market, which is also impossible to do. Fewer numbers of bidders might make the bidding behavior less aggressive. This may bring bias to the estimation of the average daily bidding frequency and the daily bidding range.

Second, the OLS regression cannot control for the competition among search engine markets. During that time period, around 2002, Google's popularity was beginning to rise, becoming more and more popular and grabbing more and more sponsored search market shares. Bidders often had accounts in both search engines. The implication, thus, would be that bidders might have been transferring more resources to Google accounts and paying less attention to their Yahoo! searches. This might also have caused bidders to bid less aggressively, which would affect our OLS estimation.

Moreover, the OLS regression cannot control for many unobserved variables which play an important role in the bidding strategies, such as the bidders' budgets, the conversion rate of purchases, and so on.

The bottom line here is that although the above regressions present a bigger picture of the bidding behavior change and suggest that the GSP auction does not bring stability to the system, the story is not convincing as there are so many unobserved variables which might plague the estimation. Therefore, to identify the true average effect, at least to reveal the sign of it, in the following section we use a RDD approach to avoid the above impacts of the unobserved heterogeneities.

5. Model

The basic idea behind the estimation is to exploit the natural experiment to identify the treatment effect of the GSP auction, which is the performance difference between the two auction systems.

Let $y_i(x_i, t)$denote the statistics of interest for individual i at time t. $X_i$is a variable vector including all other

characteristics such as market dummy and weekday dummy.

After June 26, 2002, Yahoo! launched a new auction system. Let $\bar{t}$be the critical time when this new auction started. Then the statistics y_i can further be rewritten as

$$y_i(x_i,t) = \beta_i(x_i,t) + \alpha_i(x_i,t)\cdot I_i(t \geq \bar{t}) + u_i(x_i,t) \quad (1)$$

and $\alpha_i(x_i,t)$captures the impact the new auction rule has on bidders' bidding behavior. $I_i(t \geq \bar{t})$is the indicator function of whether the bids were submitted after$\bar{t}$. There is no restriction on the form of $\beta_i(x_i,t)$ except continuity at $\bar{t}$. $E[\alpha_i(x_i,t)]$is the average treatment effect, which is what we want to estimate.

If the hypothesis is valid, $E[\alpha_i(x_i,t)]$ should be negative. The challenge is the identification of $E[\alpha_i(x_i,t)]$ as discussed in section 4. The unobserved heterogeneities will make OLS estimations biased, even misleading. However, the RDD approach can obtain identification with more relatively simple and clean assumptions.

5.1 The Identification by RDD

Following Imbens and Angrist (1994) and Cameron and Trivedi (2005), it is easy to show the following:

$$E[\alpha_i(x_i,t)|t=\bar{t}] = \lim_{t\downarrow\bar{t}} E[y_i(x_i,t)|t] - \lim_{t\uparrow\bar{t}} E[y_i(x_i,t)|t]$$

RDD approach assumes that the bidding statistics under the GFP auction system near the critical value $\bar{t}$are continuous although we cannot observe these statistics after $\bar{t}$ as the GFP auction was replaced. In other words, bidders would have continued to behave as they would have before the auction rule change as if there had been no auction switch. Therefore, any bidding behavior change will be attributed to the treatment, or the launch of the new auction. Instead of making ad hoc assumptions about the bidding behaviors long before and after $\bar{t}$ and running regressions across all the observations as the OLS method does, the RDD estimation uses nonparametric regressions to only estimate the bidding behaviors shortly before and after $\bar{t}$, and then compares the behavior difference around $\bar{t}$ to achieve identification.

Because the above continuity assumption is addressing local properties, the estimated result also only reveals the local properties. It is worthwhile pointing out that Regression Discontinuity approach does not identify the average treatment effect $E[\alpha_i(x_i,t)]$ of the whole population. Instead, it identifies the local average $E[\alpha_i(x_i,t)]$at $\bar{t}$, which is $E[\alpha_i(x_i,t)|t=\bar{t}]$.

5.2 RDD Estimator

Imbens and Lemieux (2007) and Van der Klaauw (2007) have very good surveys for the literature of RDD, especially the estimation methods used in RDD. The asymptotical boundary properties of the standard kernel estimator are not ideal because of the poor convergence rate, as pointed out by Hahn et al. (2001) and Porter (2003). Therefore, we consider the local linear regression method proposed by Fan and Gijbels (1996).

Let α_y and β_y solve the following minimization problems for the numerator:

$$\min_{\alpha_{yl},\beta_{yl},\alpha_{yr},\beta_{yr}} \sum_{i|\bar{t}-h<t_i<\bar{t}} (y_i - \alpha_{yl} - \beta_{yl}\cdot(t_i-\bar{t}) - \delta\cdot X_i)^2 + \sum_{i|\bar{t}<t_i<\bar{t}+h} (y_i - \alpha_{yr} - \beta_{yr}\cdot(t_i-\bar{t}) - \delta\cdot X_i)^2$$

Here h is the bandwidth on either side of the discontinuity point. $X_i$is the covariate vector in which the estimation includes the market dummy variable and the weekday dummy variable.

Then the estimator for the average treatment effect will be$\hat{\tau} = \hat{\alpha}_{yr} - \hat{\alpha}_{yl}$.

6. Results

To estimate the bidding behavior difference, we try two different bandwidths on 11 days and 6 days around the discontinuity point on June 26, 2002. In the literature, there are some well-known methods for choosing this bandwidth optimally. Imbens and Lemieux (2007) have very good surveys on the optimal bandwidth selection. Due to the length of data for RDD, which is around 15 days before and after the cutoff point, we pick these two bandwidths. And readers should be noted that the results are not affected by the picks of the bandwidths. The bidding statistics examined here include the daily bid changing frequency, the daily bid range, the daily maximum bid, the 75th percentile bid, the mean bid, the median bid, the 25th percentile bid, and the daily individual bidder payment. For the last statistic, because we cannot observe the click-through-rate of each bidder's link, we simply assume every bidder received one unit of clicks every 15 minutes.

Table 5 shows the RDD estimation results, which are consistent with the OLS regression results shown in Table 4. Column 1 shows the frequency of individual daily bidding increased 3.7 times, which represents a 19% increase. For each individual bidder, bid range also increased by 71 cents, or 46% in relative value. All reject the hypothesis made by the static GSP auction framework

The estimation results also present how an individual bidder's payment changed each day after the new auction was launched. Table 5 shows that each bidder's average daily payment decreased by about 11.7%. One of the reasons that this number is so big might be that we cannot observe the actually click through rates on each slot and have to calibrate the numbers from Brooks (2005). This might bring bias to the magnitude of the estimation.

Table 5 also presents how an individual bidder's bid distribution changed after the launch of the GSP auction. Column 2 shows that the maximum bid and the 75th percentile bid tended to increase and the mean bid, median bid and the 25th percentile bid tended to decrease, which is also consistent with the increase of bid range.

Lastly, Figure 3 plots how each of the statistics evolves before and after June 26, 2002. We fit the estimation results with a smooth function.

When Yahoo! launched the new auction mechanism, it named the new bid "maximum willingness to pay", hoping bidders would simply bid their highest possible payment. Yahoo! hoped this would reduce the instability of the system and increase its revenue. But the above results suggest these goals were not achieved. Instead of reducing the strategic behaviors, bidders submitted their bids in a bigger range and changed their bids at a higher frequency.

6.1 Robustness Check

The above estimation provides the average effect across the markets. We also conduct the RDD estimation of the individual daily bidding frequency change and daily bid range for each market m. Figure 4 provides the histograms of the RDD estimation results. Most of daily bidding frequency increase resides between 0 and 10 times. The mean and median are also between 0 and 10. Meanwhile, the histogram of the daily bid range increase shows that in most of the markets bidders' increase their daily bid ranges and the mean and median value are around $1. All these results reject the hypothesis and suggest the robustness of the above RDD estimation regarding the daily bidding frequency increase and the daily bid range increase.

6.2 Learning

One possible factor, which might have an impact on the above estimation, is the learning curve. If bidders were testing and learning the new auction system, the estimation of the bidding frequency difference may have biases.

There is no good control for learning because of the limitation of the data, especially to what extent learning may affect estimation. However, one important fact is that, before Yahoo! launched the GSP auction in June, Google had already started a similar GSP auction in April (Jansen and Mullen, 2008). Serious advertisers would have usually had accounts with both of the search engines' sponsored search auctions. Therefore, ideally, the bidding behaviors under the Google GSP auction would be a perfect control group for the current RDD analysis. Unfortunately, it is even harder to obtain keyword auction data from both of these two search engines. However, as keyword advertising is a serious business that deals with a serious amount of money, it is reasonable to assume that most of the bidders in the Yahoo! GSP auction had already experienced and learned the GSP auction bidding under Google. Therefore, when they faced the GSP auction under Yahoo!, learning might not play an important role.

7. Conclusion

The sponsored search auction is an important and interesting mechanism worth great attention. Edelman et al. (2007) and Varian (2007) provide a foundation to understand it. However, the actual bidding in the real sponsored search auction is much more complicated, especially when a significant portion of bids are submitted by automated bidding robots following certain mechanical bidding rules. When one bidder can change his bid over 10 000 times in one a day, an immediate question should be whether the current theory has fully captured the main features of the actual auction and is able to give accurate predictions about bidding behavior.

Fortunately, the institutional variation of the Yahoo! sponsored search auction rule provides an opportunity to examine the theory using a huge data set with over 1 million observations. This paper provides solid evidence suggesting that the GSP auction framework may provide biased predictions on the actual bidding.

Due to the limitations of the data set, it is not the goal of this paper to interpret why the actual bidding does not match the current GSP auction framework predictions. But, we conjecture that the automated bidding in the sponsored search auction may affect the explaining power of the current theory framework. An interesting topic would be to examine what role automated bidding behaviors play in the actual bidding process. This will be left for future research.

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Table 1. Bid Statistics of the Top 10 Most Clicked Markets

Market	Observations	mean	stddev	min	Max
All 812 Markets	18,634,347	5.7	9.1	0.05	9,170
1	1,455,161	16.73	6.52	0.05	60
2	2,041,397	12.24	5.27	0.05	50
3	58,269	7.07	2.41	0.05	22.01
4	14,467	18.86	9.88	0.05	50
5	294,538	14.86	4.06	0.05	50
6	22,884	4.92	2.95	0.05	50
7	20,659	17.98	6.88	0.05	50
8	21,136	14.34	7.06	0.05	50
9	28,695	5.06	3.82	0.05	50
10	17,850	18.63	8.91	0.05	50

Table 2.The Average Bidding Frequency on Each Day

	Mean	Sd.	Max	Min
	14.9	128	17.867	1
Threshold	Portion of Automated Bids			
> 40	53.30%			
> 100	44.60%			
> 200	38.80%			
> 500	28.10%			

Note: N = 18,634,347.

Table 3. Summary Statistics from June 15th to July 5th

Before June 25th	Mean	Stv	Min	Max
Bid Frequency	20.9	108	1	4,934
Bid Range	0.617	1.55	0	48.99
Max Bid	2.66	3.69	0.05	100
75 percentile bid	2.74	3.89	0.05	100
Median Bid	2.54	3.59	0.05	100
Mean Bid	2.52	3.55	0.05	100
25 Percentile bid	2.38	3.48	0.05	100
After June 25th	Mean	Stv	Min	Max
Bid Frequency	23.3	143	1	6,011
Bid Range	0.983	3.33	0	49.95
Max Bid	3.02	4.64	0.05	100
75 percentile bid	2.82	4.1	0.05	50
Median Bid	2.59	3.75	0.05	50
Mean Bid	2.56	3.62	0.05	42.8
25 Percentile bid	2.3	3.42	0.05	50

Table 4. The Change of the Statistics in Three Months by OLS Regression

	α1	α2	α3	R2
Bid Frequency	14.50%	28%	18.80%	0.28
	(-0.008)	(-0.009)	(-0.01)	
Bid Range	14.00%	14.40%	15.20%	0.26
	(-1.3%)	(-1.3%)	(-1.4%)	
Max Bid	10.30%	12.70%	15.10%	0.45
	(-0.7%)	(-0.7%)	(-0.8%)	
75 percentile Bid	9.70%	12.10%	14.60%	0.45
	(-0.7%)	(-0.7%)	(-0.8%)	
Mean Bid	9.10%	11%	13.60%	0.46
	(-0.007)	(-0.007)	(-0.008)	
Median Bid	8.80%	10.80%	13.70%	0.45
	(-0.007)	(-0.007)	(-0.008)	
25 percentile Bid	6.70%	8.20%	11.10%	0.42
	(-0.007)	(-0.008)	(-0.008)	

Table 5. RDD Estimation Results

	h=11		h=6	
	Absolute	Relative	Absolute	Relative
Bid Frequency	3.671	19.40%	3.11	26%
	(-2.031)	(-0.021)	(-2.284)	(-0.024)
Bid Range	0.709	46.00%	0.91	54%
	(-0.006)	(-0.006)	(-0.053)	(-0.039)
Daily Payment	-5.4	-11.70%	-11.28	-12.9%
	(-0.62)	(-1.42)	(-0.25)	(-0.03)
Max Bid	0.298	3.30%	0.43	9%
	(-0.051)	(-0.017)	(-0.066)	(-0.022)
75 percentile bid	0.049	0.00%	0.119	5%
	(-0.046)	(-0.017)	(-0.061)	(-0.019)
Median Bid	-0.113	-3.30%	-0.084	0.5%
	(-0.042)	(-0.017)	(-0.048)	(-0.02)
Mean Bid	-0.106	-2.20%	-0.078	-1.9%
	(-0.04)	(-0.017)	(-0.047)	(-0.019)
25 Percentile bid	-0.287	-9.70%	-0.309	-7.1%
	(-0.039)	(-0.019)	(-0.05)	(-0.021)

Notes: There are 1,099,781 bids collected from 812 keyword markets. "Absolute" measures the absolute value change; "relative" measures the percentage change. h is the bandwidth, taking values of 11 days and 6 days respectively. To analyze payment, we normalize the click on the first slot to one. The click declining rate follows Brooks (2005). Therefore, the relative change for the daily payment is more meaningful.

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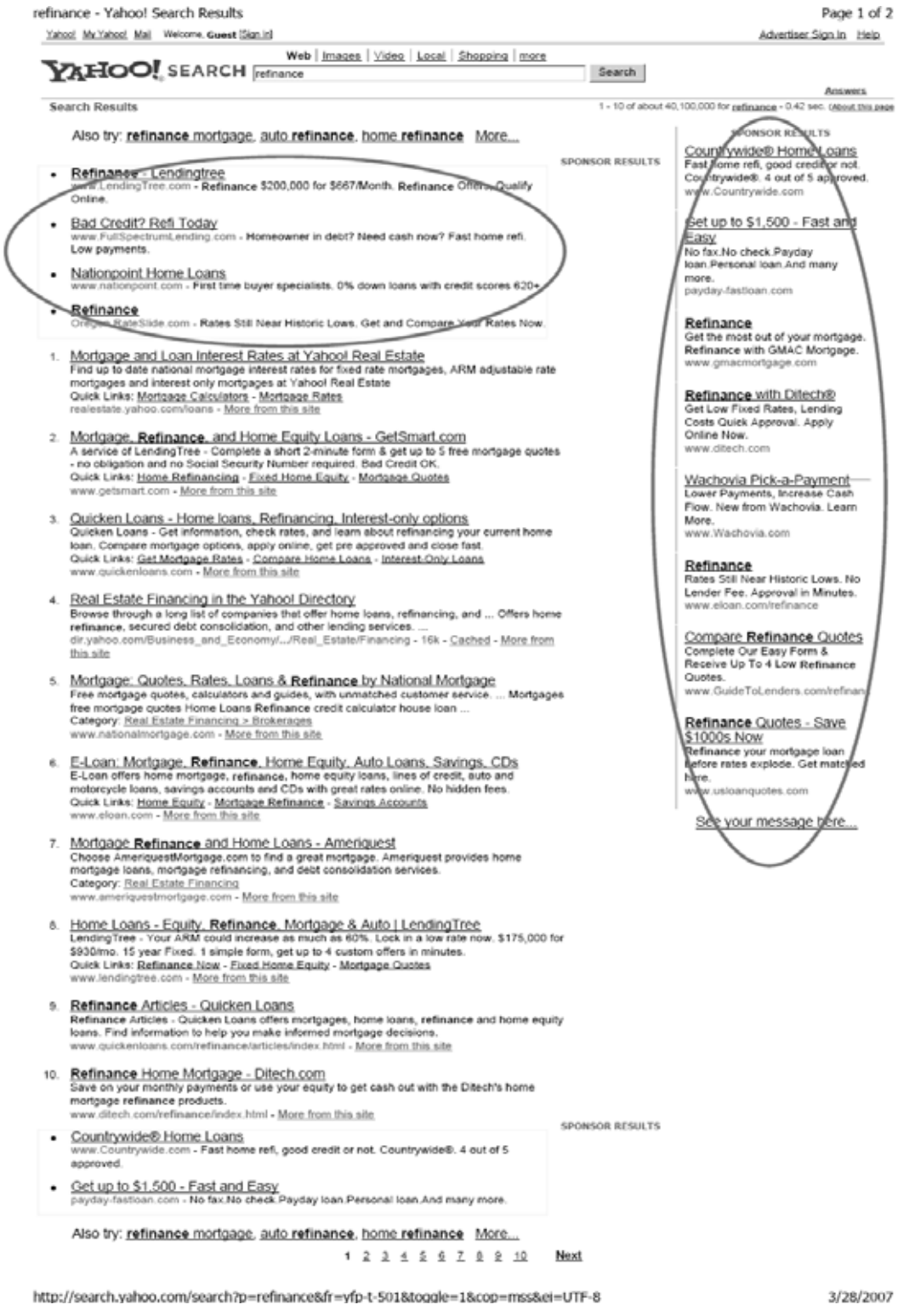

Figure 1.Sponsored Links for the Keyword "Refinance"

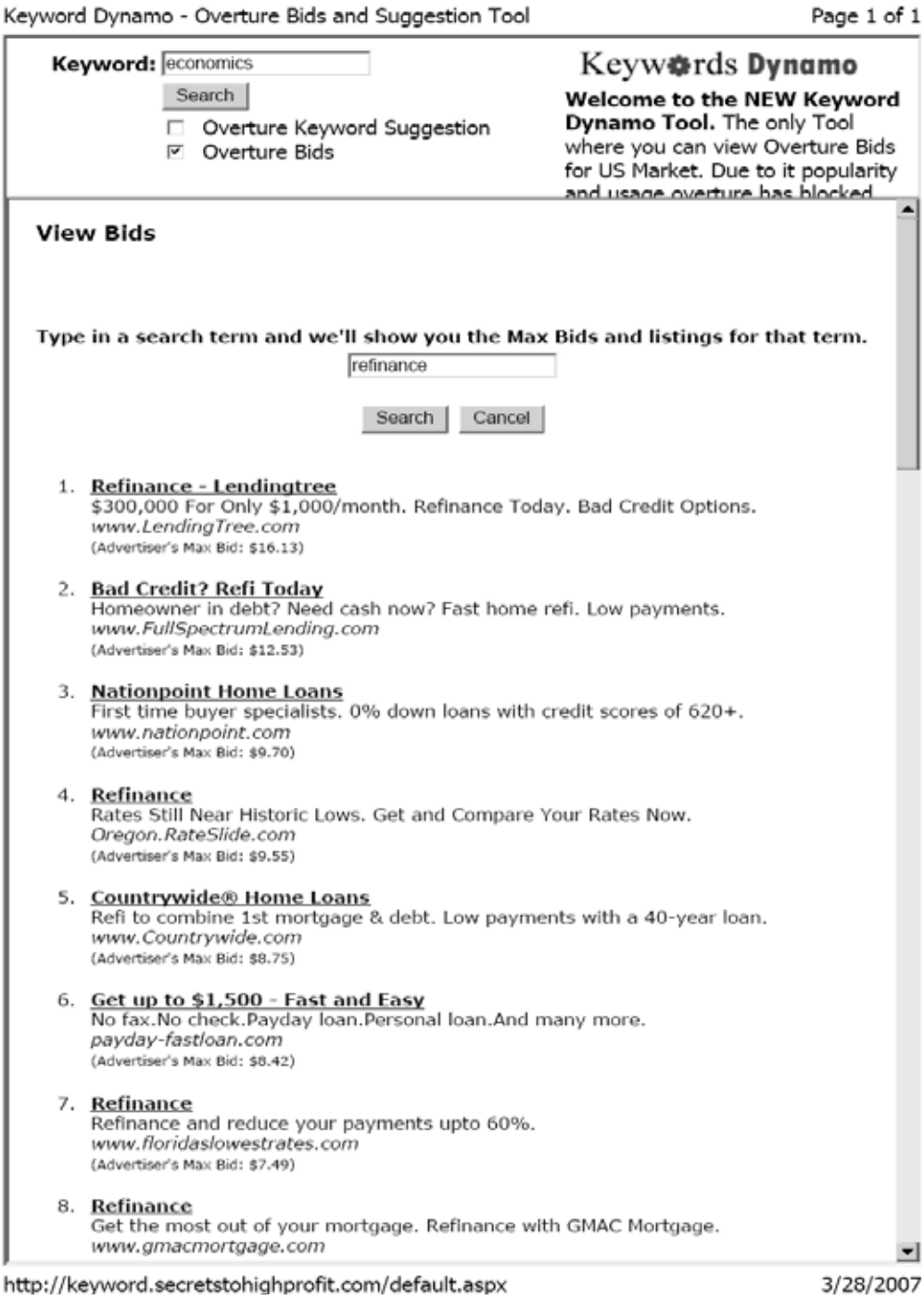

Figure 2.Bids and Placements

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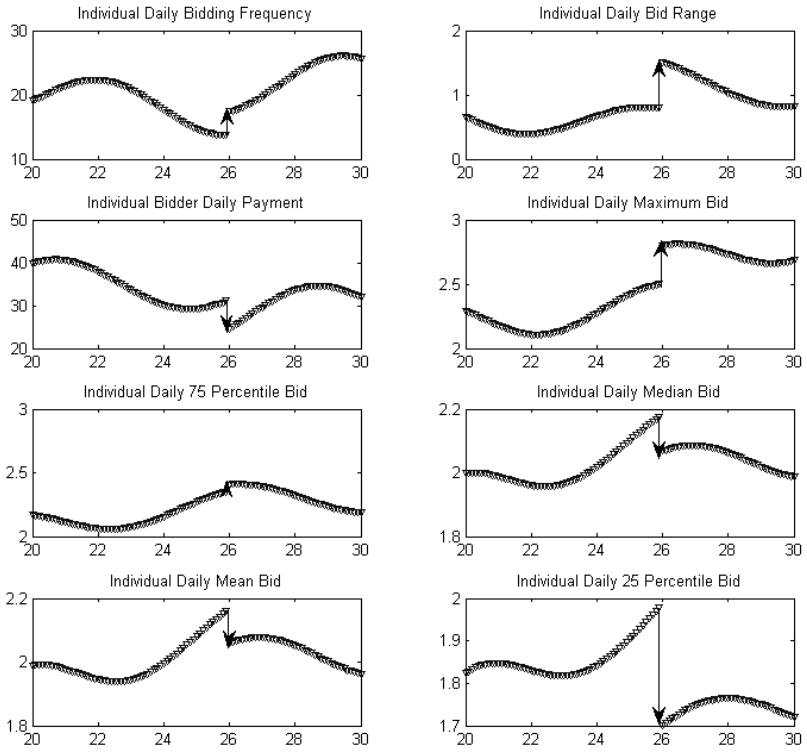

Figure 3.The Impact of GSP Auction on Bidders' Behavior

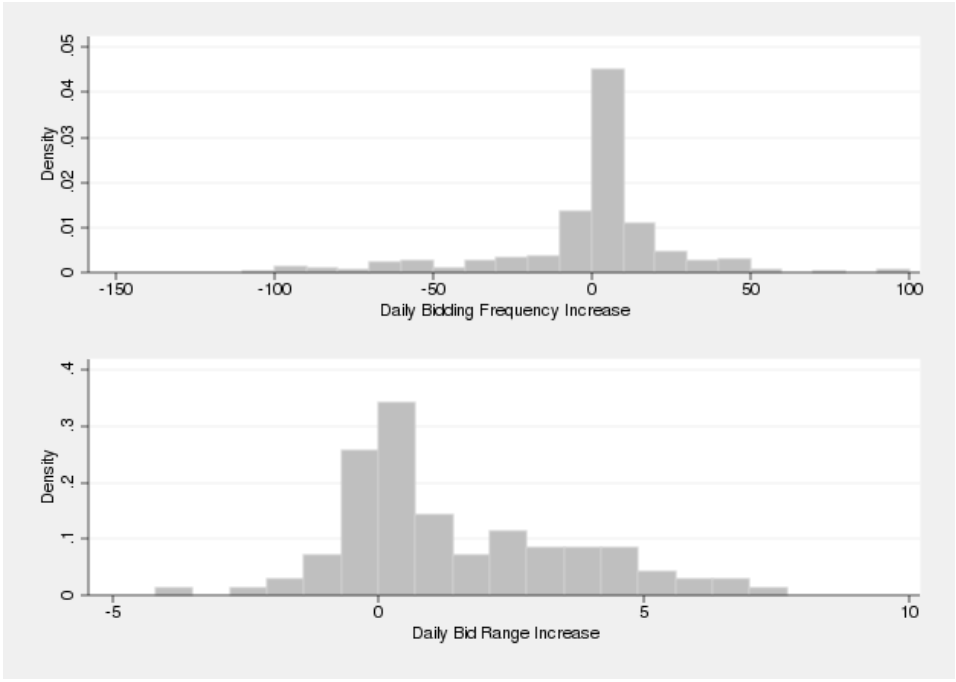

Figure 4. Robustness Check on the Histograms of the Daily Biding Frequency Increase and the Daily Bid Range Increase across Markets

The Application of International Accounting Standard's Requirements No. (20) in Jordanian Chemical Detergents Industry Companies

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Abstract

The study aimed at identifying the extent to which Jordanian chemical detergents industry companies applying the requirements of international accounting standard No. (20). A questionnaire has been designed for this purpose and distributed to the external auditors of these companies of (50) auditors / questionnaire, (30) questionnaires were recovered and were suitable for analysis, with recovery rate reached to (60%). Resolution data was analyzed using (SPSS), and a number of statistical techniques through descriptive statistics, arithmetic means, standard deviations and percentages. The results of the study showed that Jordanian chemical detergents industry companies do not apply the requirements of international accounting standard No. (20), and there are difficulties that limit the application of the mentioned standard in a high degree. The study recommended urging Jordanian chemical detergents industry companies to implement the requirements of international accounting standard No. (20), in addition to helping Jordanian chemical detergents industry companies to reduce the difficulties of application of international accounting standard No, (20) and treated them radically.

Keywords: International accounting standards, Chemical detergents, Jordanian companies, Detergents industry, High degree

1. Introduction

Governments had contributed in the rapid developments that have taken place in the world and occur recently in most fields in our industrial and economic lives, through their support represented in grants and government assistance to support development sectors including the industrial sector which considered the most important, this matter required that industrial companies will include the balance and the values of these grants in their financial statements by generally accepted accounting treatments, which brought by international accounting standards, where International Accounting System allocated number (20) for this purpose.

In spite of the different accounting systems in the industrial sectors from other sectors and the existence of financial and accounting legislations governing in each country, there must be a role for the International Accounting Standards (IAS) in the treatment and implementation.

And here comes this study to shed light on the Jordanian chemical detergents industry companies and their application of Accounting Standard No. (20), that consists of accounting, government grants and disclosure of government assistance, which is given either in the form of cash to protect the environment, for example, or that the government gives the company a land in a remote area to revive it in the future.

2. Study Problem

The problem of the study represents in the need to know the extent to which Jordanian chemical detergents industry companies implement the International Accounting Standard No. (20), the international accounting standard is

specified by the developed countries to comply with legislations, by-laws and laws in these countries, it is easy to apply them in those developed countries, but on the local level, they can have a conflict with local legislations and laws. The problem of the study can be formulated through the following main question: *Are Jordanian chemical detergents industry companies implement International Accounting Standard No. (20)***,** the following questions come out from this question:

1. Do Jordanian chemical detergents industry companies recognize the government grants?

2. Do the government grants display in the financial statements of the Jordanian chemical detergents industry companies?

3. Do Jordanian chemical detergents industry companies re-pay the government grants?

4. Do Jordanian chemical detergents industry companies recognize the government assistance?

5. Do Jordanian chemical detergents industry companies disclose according to the requirements of Accounting Standard No. (20)?

6. Are there difficulties that limit the application of International Accounting Standard No. (20) in the Jordanian chemical detergents industry companies?

3. Study Objectives

The study aims at identifying the extent of the application of Jordanian chemical detergents industry companies to the requirements of International Accounting Standard No. (20), through the following objectives:

1. Recognition of the extent of Jordanian chemical detergents industry companies of the government grants.

2. Showing the extent of government grants in financial statements of Jordanian chemical detergents industry companies.

3. Recognition of the extent of re-payment of government grants by Jordanian chemical detergents industry companies.

4. Recognition of the extent of Jordanian chemical detergents industry companies of government assistance.

5. The extent of disclosure of Jordanian chemical detergents industry companies in accordance with Accounting Standard No. (20).

6. Indicating the difficulties that limit the application of the requirements of International Accounting Standard (20) in Jordanian chemical detergents industry companies.

4. Significance of The Study

The significance of the study came in the importance of the application of Jordanian industry companies to the requirements of International Accounting Standard No. (20) in general, and Jordanian chemical detergents industry companies in particular, the fact that the government often supports the industrial sectors, including chemical companies in the form of grants and assistance, for the difficulty of working in them and the negative impacts of this industry, where it is assumed by these companies to deal with these grants and government assistance in accounting way, either under the local financial legislations or under International Accounting Standard No. (20). The importance of this study that it is the first study talks about the International Accounting Standard No. (20) at the local and Arab level to the knowledge of the researcher.

5. Hypotheses of The Study

5.1 First Hypothesis: Jordanian Chemical Detergents Industry Companies do not Apply International Accounting Standard No. (20).

The following sub-hypotheses ramify from the first hypothesis:

1. Jordanian chemical detergents industry companies do not recognize government grants.
2. Government grants do not display in financial lists of Jordanian chemical detergents industry companies.
3. Government grants do not re-pay in Jordanian chemical detergents industry companies.
4. Jordanian chemical detergents industry companies do not recognize government assistance.
5. Accounting disclosure for government grants is not disclosed in accordance with International Accounting Standard No. (20).

5.2 Second Hypothesis: There are no Difficulties that Limit the Application of the International Accounting Standard No. (20) Requirements in Jordanian Chemical Detergents Industry Companies.

6. Previous Studies

The study of (Al-Otaibi, 2010) aimed at identifying the extent to which Kuwaiti contribution companies meet the requirements of: measurement, disclosure provisions assets and potential liabilities under International Accounting Standard No. (37). In order to achieve the objectives of the study, a questionnaire was designed for this purpose and distributed to financial managers and their assistants, questionnaires which were subject to analysis were (162). The study found commitment of Kuwaiti companies with the requirements of disclosure and measurement, with percentages of 73%, 72.8%, and 58.6%, respectively, for provisions and contingent liabilities and possible assets. The study recommended the need to increase compliance with the requirements of measurement and disclosure of the listed items, as well as the need for rehabilitation and training of financial managers and encourage them to obtain professional, local and international certification.

The study of (Al-Sriheen, 2009) aimed at identifying the extent of the commitment of the Jordanian public shareholding companies with the disclosure's requirements for inventories under IAS No. (2) from the point of view of the external auditor. A questionnaire was designed for this purpose and distributed to (112) external auditors. The study showed that there is a commitment to a fair degree phase to disclose the value of the stock and the disclosure of accounting policies adopted in measuring inventories, the study recommended to provide adequate information and more disclosure for the goods in the road and to be placed in a separate item.

The study of (Al-Alimat, 2007) aimed at identifying the extent of the respondents' support in the Jordanian petrochemical industry contribution companies to factors that influencing accounting disclosure of the costs of social responsibility in the financial statements of their companies and the disclosure of that in accounting. The study showed that the petrochemical companies of Jordan contribute highly in many social fields such as disclosure of the costs of providing public safety conditions for their workers, health insurance for workers, reduce pollution, get rid of it safely, companies' possession of the establishment licenses that consistent with environmental matters, disclosure of contributions and grants provided to members of the community and the recycling of production's output to reduce the environmental damage because of their interest in the long run with their reputation. The study recommended the necessity for petrochemical companies of Jordan to focus on the establishment of educational, recreational and health centers so that the members of the society can reach to the public welfare and improve their living conditions.

The study of (Bamzahm, 2003) aimed at analyzing and test the impact of accounting disclosure of social environmental of Jordanian public shareholding companies that are trading shares on Amman financial market on the investment decisions by recognizing the importance of information disclosure provided by the social environment in the companies to take investment decisions, the results showed the following: The disclosure of social environmental performance disclosure was not satisfactory, what is disclosed is not more than a qualitative and descriptive disclosure. An accounting disclosure of the social environmental performance still needs a lot of development.

The study of (Al-Khatib, 2002) aimed at collecting necessary information and data regarding the basis of presentation of financial statements in Jordanian public shareholding companies on the principle of disclosure for public purposes and to ensure comparability of the private financial statements concerning the facilities for the previous years, and by what this principle required explanation that the users of financial statements interest in for the decision-making process, especially when the disclosure of financial data is sufficient in the attached financial statements. Where the study relied on the deductive approach, which is based on the study of financial reports of the Jordanian Industrial Corporations in 1999, and to study the level of disclosure of the information in the financial statements in the specified period, and its variability from year to year, and the factors affecting the level of disclosure of the company under study.

7. Materials and Methods

Analytical approach was used in this study depending on primary and secondary data for the statistical analysis, they were collected through a questionnaire, which is designed according to the nature of the study problem. T-Test was used for testing hypotheses results using simple and multiple regressions**.** the researchers extracted the arithmetic means and standard deviations for ratings on the questionnaire paragraphs

7.1 Study Determinants

This study was conducted on Jordanian chemical detergents industry companies within the Greater Amman Municipality, which Jordanian government do not have any shares in these companies, as noted by the International Accounting Standard No. (20) "does not apply to: government participation in ownership of the entity" (IASB, 2007)

(IFRS, 2011), and thus companies owned by the Jordanian government, whether in whole or in possession of a partial contribution were excluded. There are also no studies on this subject about Jordan to the knowledge of the researcher.

7.2 Population and Sample of the Study

The population of the study consists of Jordanians Chartered Accountants (external auditors) certified and practitioners of the auditing profession, they have been counted and numbered to (255) auditors. The authors selected of them all auditors who audit in Jordanian chemical detergents industry companies as a study sample, there number were (50) auditors, where the questionnaire was distributed to the entire sample. The distributed questionnaires were (50) and the recovered were (30) questionnaires that are valid for analysis, with a percentage recovery of (60%) as shown in Table (1) .

8. Statistical Analysis

A field for answers has been identified, giving five options for responses to each question to know the opinion of respondents about the application of the Standard requirements No. (20), its levels were set through the use of five Likert scale as shown in the table (2).

Based on this, the arithmetic means of the study, will be dealt with to interpret the data as follows:

(1 -2.49) means low degree, (2.50 -3.49) implies a medium degree and (3.5-5) means a high degree as shown in Table (3) .

Central tendency measures were used as arithmetic mean, standard deviation, frequencies and percentages for the purposes of description of study data and analysis it, in addition to statistical tests for a (T) test.

For the purposes of analysis, the following statistical methods were used:

8.1 Descriptive Analysis

This analysis adopted the arithmetic mean, standard deviation and percentages.

- To test the study tool and its reliability in testing hypotheses and to achieve the objectives of the study, an internal consistency measure Cronbach's Alpha was used; to measure the credibility of the sample of the study answers on the questions from the questionnaire and (Sekaran, 2003) explains the internal coefficient reliability of the responses that the statistically significant accepted value for this measure are **(%)** or more.

The results of calculation of this factor showed that consistency in the paragraphs were very high, which confirms the reliability of the questionnaire to test hypotheses, as illustrated in the table (4),

the values of reliability coefficient (internal consistency) reached for the tool (0.825), which is high and suitable value for the purposes of the study, it is noted that Cronbach's alpha value for the recognition of government grants field amounted to (0.740), for the presentation of government grants the value was (0.861), the re-payment of government grants (0.727), the recognition of government assistance (0.815) and the disclosure requirements for government assistance (0.846) and the difficulties of applying the standard "20" (0.766) where all values reflect the high persistence and sufficient for the purposes of this study.

8.2 Data Analysis Related to Demographic Characteristics of Respondents

Distribution of respondents by demographic characteristics of the study sample is shown in the table (5):

* It is noted from the table that the majority of the study sample in the Gender variable are males, as it accounted for (80%) of the members of the study sample, while the percentage of females were (20%) of the members of the study sample, this reflects the nature of profession or job.

* It is noted from the table that more members of the study sample were within the age group of (35-45) reaching percentage of (40%) followed by age group of (25-35 years) with a percentage of (30%), the age group category (45 and over) occupied the last rank with a percentage of (10%) which showed of the presence of an inconsistency between the age and experience of members of the study sample.

* It is noted from the mentioned previously table that more members of the study sample between those who experience (10-5 years) accounted for (40%), then those with experience of (15-10 years) were (30%), which indicates the presence of consistency between the age and years of job experience, which is a positive indication, thus enhancing the scientific capacity to understand questions and answer of the questionnaire properly, which help in strengthening for the judgment of the study hypotheses.

8.3 Data Analysis Related to The Study Fields

In order to describe the application requirements of the IAS No. (20), the researchers extracted the arithmetic means and standard deviations for the members of the sample estimations on the questionnaire paragraphs.

The arithmetic mean, standard deviations and percentages values for each paragraph of the recognition of government grants as shown in Table(6). Paragraphs (1, 9, 11) occupied the first rank, with an arithmetic mean of (3.27), which was the highest means, while paragraph (4), occupied the second rank, with an arithmetic mean of (3.10), paragraphs (2) and (3) came last, with an arithmetic mean of each reached (2.83), the overall field of the arithmetic mean / recognition of government grants were (3.03), the mean value of this shows that the government grants have achieved fair degree according to the used scale.

For each paragraph of presenting government grants shown in Table(7), paragraph (12) has occupied the first rank, with an arithmetic mean of (3.27), which is the highest means, paragraph (13) has occupied the second rank, with an arithmetic mean of (3.23), paragraph (19) came last, with an arithmetic mean of (2.97). The total field of the arithmetic mean / **Presenting Government Grants** reached (3.08) the value of this mean shows that presenting the government grants had achieved at medium degree.

For each paragraph of the re-payment of government grants which illustrated in Table(8), paragraph (20) has occupied the first rank**,** with arithmetic mean of (3.30), which is the highest means, paragraph (21) occupied the second rank**,** with arithmetic mean of (3.03), paragraph (23) came last**,** with arithmetic mean of (2.93). The total field of the arithmetic mean /re-payment of government grants reached (3.04) the average value shows that the repayment of government grants have been achieved in a medium degree.

The recognition of government assistance shown in Table(9), paragraph (26) has occupied the first rank, with an arithmetic mean of (3.73), which is the highest means, paragraph (32) occupied the second rank, with an arithmetic mean of (3.23), paragraph (28) came last, with an arithmetic mean of (3.03). The total field of the arithmetic mean / Recognition of government assistance reached (3.18); the average value shows that recognition of government assistance has achieved a medium degree.

The accounting disclosure for government grants shown in Table (10), paragraph (33) has occupied the first rank, with an arithmetic mean of (3.37), which is the highest means, paragraph (35) occupied the second rank, with an arithmetic mean of (3.23), paragraph (34) came last, with an arithmetic mean of (3.13). The total field of the arithmetic mean / Disclosure of the accounting for government grants reached (3.24), the average value shows that the accounting disclosure for government grants has achieved a medium degree.

The difficulties of applying the standard (20), paragraph (39) has occupied the first rank, with an arithmetic mean of (4.40), which is the highest means, paragraph (40) occupied the second rank, with an arithmetic mean of (4.37), paragraph (36) came last, with an arithmetic mean of (4.20). The total field of the arithmetic mean / Difficulties in the application of criterion (20) reached (4.31), the value of this mean shows that the difficulties of applying the standard (20) has achieved in a high degree as shown in Table(11).

8.4 The Results and Testing Hypotheses of the Study Using Multiple Regressions

For the purpose of testing hypotheses of the study which were verified and accepted or rejected by a (T) test, the default center was adopted (3) for this purpose, table no. (12) shows the results of multiple linear regression test for the extent of the application of IAS (20).

We can note from table no. (12) the following:

1. Calculated (T) value related to the sub-hypothesis (1) amounted to (0.50) with the significance level of (0.614), which is less than indexed (T) that amounted of (2.04), the null hypothesis are accepted if the calculated (T) value is less than indexed (T), null is refused if the calculated (T) is greater than indexed (T), based on the above sub-hypothesis (1) is accepted, which states: " Jordanian chemical detergents industry companies do not recognize government grants".

2. The value of calculated (T) for the sub-hypothesis no. (2) amounted to (1.13) with a significance level of (0.268), which is less than indexed value of (2.04), and through this comparison we accept the hypothesis which states that: " Government grants do not display lists in financial companies in Jordanian chemical detergents industry companies".

3. It was found that the calculated (T) value for sub-hypothesis no. (3) amounted to (0.79) with a significance level of (0.433), which is less than its indexed value which is (2.04). Therefore, and based on the basis of acceptance of previous hypotheses, sub-hypothesis no. (3) are accepted, which states that: " Government grants do not be re-paid off in Jordanian chemical detergents industry companies".

4. Also it has shown that the calculated (T) value for sub-hypothesis no. (4) amounted to (2.81) with a significance level of (0.009) which is greater than its indexed value which is amounted (2.04). Therefore, and based on the basis of acceptance of previous hypotheses, hypothesis no. (4) are rejected, which states that: " Jordanian chemical detergents industry companies do not recognize government assistances".

5. As the calculated (T) value for sub-hypothesis no. (5) has reached (2.58) with a significance level of (0.015), which is less than indexed value which is amounted (2.04). Therefore, and based on a rejection of the previous hypotheses, hypothesis no. (5) are accepted, which states that: "It does not make an accounting disclose for government grants in accordance with International Accounting Standard No. (20)".

As for the calculated (T) value for the main hypothesis, this refers to "Jordanian chemical detergents industry companies do not apply International Accounting Standard No. (20)" has reached (7.84) with a significance level of (0.000), which is larger than the indexed (T) value which amounted (2.04), this means a rejection of this hypothesis and thus conclude that Jordanian chemical detergents industry companies do not apply the requirements of international Accounting Standard no. (20).

Table no. (13) shows that the value of calculated (T) related to the difficulties in the application of International Accounting Standard No. (20) in Jordanian chemical detergents industry companies amounted to (30.11) with a significance level of (0.000), which is greater than indexed value (2.04) and where calculated (T) value is larger than the indexed, so the second hypothesis is rejected, which states that: There are no difficulties that limit the application of International Accounting Standard No. (20), in the sense that there are difficulties that limit the application of the requirements of International Accounting Standard No. (20) in Jordanian chemical detergents industry companies and that is confirmed by the value of high arithmetic mean which amounted (4.31), which represents a high degree of difficulty.

9. Discussions

By analyzing the data and testing hypotheses and discussed it in the previous chapter, the study found:

Firstly: Although there is a limited application to the requirements of Accounting Standard No. (20) However, Jordanian chemical detergents industry companies in general do not apply the requirements of International Accounting Standard No. (20), this is indicated by the statistical results and as follows in descending order in terms of lack of application:

- The recognition of government grants are the least applied in Jordanian chemical detergents industry companies.
- Then the re-payment of government grants, as it also does not apply in Jordanian chemical detergents industry companies which higher a little bet.
- Followed by government grants in the financial statements, where there is not also application to this requirement.
- The requirement to recognize government assistance, where it is applied in a medium degree.
- Finally, accounting disclosure requirement for government grants which is the most applied, but in a medium degree.

Secondly: With regard to the difficulties that limit Jordanian chemical detergents industry companies from applying IAS, there is a high degree of difficulty, which is arranged as follows in terms of higher difficulty:

There is no support from the administration for the application of International Accounting Standard No. (20) in those companies.

- The nature of the activity in Jordanian chemical detergents industry companies has a significant role in the non-implementation.
- Lack of qualified personnel that limit at the high degree of application of standard no. (20).
- The lack of obligation to apply the standard has a big role in reducing the application.
- Finally, understanding and awareness difficulties of the requirements of International Accounting Standard No. (20) that limit the application.

10 . Conclusions

Through the findings of the study, the study recommends the following:

Jordanian chemical detergents industry companies urged to implement the requirements of International Accounting Standard No. (20) and more particularly the following:

- The need for applying the recognition requirement of government grants
- The need for applying the re-pay of government grants requirement
- The need for applying presenting government grants requirement
- The need for increasing the application of the recognition of government assistance requirement

- The need for increasing the application of accounting disclosure requirement

Helping Jordanian chemical detergents industry companies to find out the difficulties of reducing the application of International Accounting Standard no. (20) and treated it radically, by the following:

- The need for adequate support by the administration to apply the international standard no. (20)
- Work to provide a suitable environment between the nature of chemical detergents companies' activity and the process of applying the standard no. (20)
- The obligation to provide by the concerned parties and those on the application of international accounting standards.
- Increase the provision of qualified accountants and auditors in Jordanian chemical detergents industry companies.
- Work on training and rehabilitation, held an introduction courses about the International Accounting Standards in general, international accounting no. (20) In particular, for the most understanding and awareness of the international accounting standards.

The need for greater focusing by accounting departments in the Jordanian universities to expand into the details of the International Accounting Standards in the study plans.

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Appendices

Table 1. Number of questionnaires distributed, recovered and approved in the analysis

Statement	Number	Percentage
Distributed Questionnaires	50	100%
Recovered Questionnaires Appropriate for Analysis	30	60%

Table 2. Answers of the Study Sample Degrees According to Five Likert Scale

Strongly Agree	Agree	Moderately Agree	Disagree	Strongly Disagree
5	4	3	2	1

Table 3. Data Interpretation into Three Degrees

Highly Applied	Moderately Applied	Low Applied
3.5 and above	2.5-3.49	1-2.49

Table 4. Consistency Factors in Cronbach's Alpha Manner for the Internal Consistency of the Study Fields

Field	Number of Questions	Coefficient Alpha Value
Government Grants' Recognition	11	0.740
Presentation of Government Grants	8	0.861
Repayment of Government Grants	6	0.727
Recognition of Government Assistance	7	0.815
Accounting Disclosure for Government Grants	3	0.846
Difficulties in Applying the Standard No. (20)	5	0.766
Overall Field	40	0.825

Table 5. Demographic characteristics of study sample

Variable	Category	Repetitions	Percentage
Gender	Male	24	80%
	Female	6	20%
Total		30	100%
Age	Less than 25 years	6	20%
	From 25 years to less than 35 years	9	30%
	From 35 years to less than 45 years	12	40%
	45 years and over	3	10%
Total		30	100%
Experiences	Less than 5 years	3	10%
	From 5 years and less than 10 years	12	40%
	From 10 years and less than 15 years	9	30%
	From 15 years and above	6	20%
Total		30	100%

Table 6. Arithmetic means and standard deviations for each paragraph of the first field: Recognition of government grants (N=30)

No.	Recognition of government grants	Mean	Standard Deviation	Percentages%	Sort
1	The company applies the recognition of government grants conditions, including non-monetary grants at fair and assessed value, so that the two conditions were available together, namely: the entity will meet the requirements for the grant and a reasonable assurance for the actual receipt of the grant.	3.27	0.69	65.33	1
2	Actual receipt of the grant does not necessarily mean that the entity will meet the special conditions of the grant.	2.83	0.79	56.67	10
3	Recognition treatment is not affected by how to receive the value of the grant, which the treatment is not different weather it was received in cash or the value of the grant is deducted from governmental obligations owed by the entity.	2.83	0.65	56.67	10
4	Government grants are recognized as income during the time period necessary to match them with the costs of fulfilling the terms of the grant, on a regular basis, and the grants should not be added directly to shareholders.	3.07	0.64	61.33	5
5	The grant is recognized as an income through the distribution of the value of the grant on periods of time necessary to fulfill the terms of the grant, as to use the costs incurred by the entity to meet the terms of the grant as the basis for distribution to the time periods for implementation in the event that the government grant does not involve the provision of assets which is not depreciated, such as cash grants or reduce the government's commitment to the enterprise.	2.97	0.81	59.33	7
6	In the event that the grant is already capable of depreciation, in that case the grant is recognized as income during the period of time consumed by those assets with a depreciation of asset rates in each period. For example, a private hospital has an ambulance donated by the government entity; in this case the value of the car is distributed on the estimated useful life of the asset according to the used depreciation method.	2.90	0.76	58.00	8
7	The grants that include the presence of more than one condition that the entity must achieved are recognized, some of these conditions may require special costs and specific period of time to fulfill, which requires in this case the analysis of the value of the grant to parts and to link the recognition of each part of the costs which will be incurred to meet the related requirement.	2.87	0.57	57.33	9
8	Received government grants are recognized as compensation for the entity for actually suffered expenses or losses or when the purpose of the grant is to provide immediate financial support for the entity without incurring future costs related to implement the grant conditions, in this case, the value of the grant is recognized as an income for the period which becomes receivable.	3.10	0.61	62.00	4
9	The grants provided by the government for some of the entities are recognized as compensation for losses incurred in the past because of the work within a remote area or as a result that these entities are negatively affected by the decisions of government.	3.27	0.83	65.33	1
10	The accounting treatment for non-monetary grants such as the government give a land or building in a remote area, register it at fair value for the asset is cash	3.00	0.53	60.00	6
11	The accounting treatment for non-monetary grants such as the government give a land or building in a remote area, both the asset and the grant is fixed "nominal amount" symbolic, the amount of one dinars for example.	3.27	0.52	65.33	1
	Overall field / Recognition of Government Grants	3.03	0.36	60.67	

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Table 7. Arithmetic means and standard deviations for each paragraph of the second /field: Presenting government grants (N=30)

No.	Presenting Government Grants	Mean	Standard Deviation	Percentages %	Sort
12	Government grants related to assets, including non-monetary grants at fair value that are installed in the general budget are presented as deferred income, then being recognized later as income in a specific way according to the costs incurred in fulfilling the terms of the grant.	3.27	0.69	65.33	1
13	Government grants related to assets, including non-monetary grants at fair value that are installed in the general budget are presented in deducting the amount of the related grant value of assets to reach to the carrying value (net) of the asset.	3.23	0.73	64.67	2
14	Government grants related to income as credited in the income statement are presented either separately or under the general heading "like other income".	3.07	0.74	61.33	4
15	Government grants related to income are presented in subtracting the grant of the associated expenses.	2.90	0.61	58.00	8
16	Government grants related to assets are presented in the statement of cash flows when the receipt of grants related to assets in cash.	3.10	0.61	62.00	3
17	Received cash flows are shown within the department of investment activities in the statement of cash flows, in addition to that there will also be a result of external cash flows resulted in purchasing the asset stipulating in terms of the grant.	3.07	0.64	61.33	4
18	Received flows and foreign payments are shown separately and not shown in net by offsetting.	3.00	0.59	60.00	6
19	Receipts are shown separately from payments, regardless whether the devaluation of the original grant or not when viewed in the budget.	2.97	0.72	59.33	7
Overall field / Presenting Government Grants		3.08	0.36	61.50	

Table 8. Arithmetic means and standard deviations for each paragraph of the third field: Repayment of government grants (N= 30)

No.	Repayment of government grants	Mean	Standard Deviation	Percentages %	Sort
20	Breaching the terms of the grant so that the grant becomes available for re-payment, it shall be treated as a change in accounting estimates under IAS No. (8) and is accountable prospectively through the income statement.	3.30	0.47	66.00	1
21	A grant related to income is re-paid, in this case, the use of the balance amount of the unamortized grant is followed (deferred income grant which its balance is credited), if any, to cover the re-paid amounts.	3.03	0.67	60.67	2
22	A grant related to income is re-paid, in this case if the required re-paid amount exceeds the balance of deferred income grant, it must recognize the amounts remaining from the re-paid grant as an expense. In case there was no credit balance of deferred grant income, the full re-paid amounts of the grant are recognized as an expense.	2.97	0.49	59.33	5
23	Re-paid grants to the donors related to assets are being treated by increasing the book value (registered) of the asset related to the grant, this method is used in presenting the grant when obtained as a reduction of the asset value.	2.93	0.78	58.67	6
24	Re-paid grants to the donors related to assets are being treated by reducing the balance of the re-paid deferred income, this method is used in case of selection of presenting the grant as deferred income.	3.00	0.59	60.00	4
25	It is directly recognized as an expense the aggregate additional accumulated depreciation, which will be recognized to date as an expense in the absence of the grant.	3.03	0.56	60.67	2
Total field / Re-payment of Government Grants		3.04	0.31	60.89	

Table 9. Arithmetic means and standard deviations for each paragraph of the fourth field: Recognition of government assistance (N=30)

No.	Recognition of government assistance	Mean	Standard Deviation	Percentages %	Sort
26	We can distinct between government grants and government assistances in the company.	3.73	0.64	74.67	1
27	Technical free or almost free consultancy or processes with the government are recognized and cannot be distinguished from normal business operations of the entity, such as allocating a portion of the state purchases of some goods and services to the entity.	3.10	0.61	62.00	4
28	Technical free or almost free advice are disclosed or an operations with the government that cannot be distinguished from normal business operations of the entity, such as allocating a portion of the state purchases of some goods and services to the entity.	3.03	0.67	60.67	6
29	Interest-free loans or low interest rates that the government donates as assistances are recognized.	3.07	0.58	61.33	5
30	Interest-free loans or low interest rates for that the government donates as assistances are disclosed.	3.13	0.57	62.67	3
31	Companies recognize the indirect assistances representing in the government's provision of infrastructure through the improvement of transport networks, telecommunications and water.	2.97	0.72	59.33	7
32	Companies disclose the indirect assistances representing in the government's provision of infrastructure through the improvement of transport networks, telecommunications and water.	3.23	0.68	64.67	2
Total field / Recognition of Government Assistance		3.18	0.35	63.62	

Table 10. Arithmetic means and standard deviations for each paragraph of the fifth field: Accounting disclosure of government grants (N=30)

No.	Accounting disclosure of government grants	Mean	Standard Deviation	Percentages %	Sort
33	The adopted accounting policy for government grants are disclosed, including the view of government grants that have been followed in the financial statements.	3.37	0.72	67.33	1
34	The nature and extent of government grants that have been obtained and recognized and government assistance that benefited from established are being disclosed.	3.13	0.57	62.67	3
35	Conditions that the entity do not met and other emergency events related to government assistance that have been recognized are being disclosed.	3.23	0.73	64.67	2
Total field / Accounting Disclosure for Government Grants		3.24	0.52	64.89	

Table 11. Arithmetic means and standard deviations for each paragraph of the fifth field: Difficulties in applying the standard (20) (N=30)

No.	Difficulties in the Application of Accounting Standard No. (20)	Mean	Standard deviation	Percentages %	Sort
36	Difficulties in understanding and awareness of the IAS (20).	4.20	0.41	84.00	5
37	Lack of qualified personnel will limit the application of Accounting Standard No. (20).	4.30	0.53	86.00	3
38	Non-compulsory application of IAS (20).	4.30	0.53	86.00	3
39	Lack of support from management for the application of Accounting Standard No. (20).	4.40	0.62	88.00	1
40	The difficulty of applying International Accounting Standard No. (20) due to the nature of the company's activity.	4.37	0.61	87.33	2
Total field / Difficulties Applying the Standard (20)		4.31	0.24	86.27	

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Table 12. The results of T-test to test the hypothesis of the major study and their sub-hypotheses

Hypothesis Field	Mean	Standard Deviation	Calculated T	Tabulated T	Sig	Null Hypothesis Result
Sub-hypothesis no. (1): Recognition of government grants.	3.03	0.36	0.50	2.04	0.614	Acceptance
Sub-hypothesis no. (2): Presenting the government grants in financial statements.	3.08	0.36	1.13	2.04	0.268	Acceptance
Sub-hypothesis no. (3): Re-payment of government grants.	3.04	0.31	0.79	2.04	0.433	Acceptance
Sub-hypothesis no. (4): Recognition of government assistances.	3.18	0.35	2.81	2.04	*0.009	Rejection
Sub-hypothesis no. (5): Accounting disclosure for government grants.	3.24	0.52	2.58	2.04	*0.015	Rejection
The first major hypothesis: Application of International Accounting Standard No. (20).	3.32	0.22	7.84	2.04	*0.000	Rejection

Table 13. T-test results to examine the second major hypothesis of the study

Hypothesis Field	Mean	Standard Deviation	Calculated T	Indexed T	Sig	Null Hypothesis Result
The second major hypothesis: Difficulties in the application of Accounting Standard No. (20).	4.31	0.24	30.11	2.04	*0.000	Rejection

Strategical Behavior of Firms and Excise Tax Payment (Revenue Maximization, Profit Maximization, Love, Respect and Trust)

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Abstract

In this paper, we analyze the effect on price and quantity traded of a commodity of an excise tax payment under different conditions. First, we analyze the effect of the tax payment as in traditional analysis, where the firm considers tax as a "bad" to be avoided. Next, we propose a new approach for sharing the payment for the firm. Finally, we develop a new philosphical and psychological analysis wehere tax payment may be considered as a "good" to be happily provided by the firm rather than a "bad" that needs totally to be avoided.

Keywords: Market equilibrium, Excise tax, Firm strategy, Cost minimization, Revenue maximization, Profit maximization.

1. Introduction

In traditional microeconomic analysis, the excise tax payment is considered as a "bad" to be avoided, and therefore producers are assumed to transfer all of the tax payment to the consumers. This would mean an upward shift of the supply function by the amount of the excise tax, resulting in an increase in the equilibrium price of the good as well as a decrease in equilibrium quantity traded. The resulting situation is worse than the initial condition for consumers since the price has increased, and also bad for the producers since declining quantity at an elastic portion of the demand curve would also mean decreasing total revenues.

In this paper, we analyze different strategies that the firm may apply faced with the excise tax payment. The first of these alternative strategies is to consider the excise tax as a "good" to be provided, rather than a "bad" to be avoided. This can only happen if the owners of the firm are benevolent citizens, who by means of paying higher taxes believe that the government will spend the tax proceeds for the benefit of the citizens (rather than for partisan reasons) and therefore, will increase the welfare of all the citizens of the country. Nevertheless, this strategy should at least be as good as the initial strategy for the firm for it to be feasible to begin with.

Another strategy is to keep the supply function as it was before the application of the excise tax. In other words, the firm behaves as if the excise tax has not been applied and keep producing as it would without the tax. This strategy would be a better profit maximizing strategy for the firm if the resulting outcome is higher than those obtained from the initial strategy of transferring all of the excise tax payment to the consumers.

Actually, the firm may choose any combination of these strategies by means of a simple linear weighted average rule (according to the objective function chosen), thereby partially transferring the tax payment on the consumers, or partially considering the tax as a "good" to be provided.

Since the analysis involves the knowledge of basic microeconomics, our essential references are an introductory economics book, Parkin (2005), and a managerial economics book, Baye (2009). Throughout the analysis we assume that the firm has enough market power (for example by differentiating its product) so that it faces a downward sloping demand curve for its product.

Furthermore, the strategic behavior of firms towards excise tax payment may be analyzed in the framework of whether the firm is a revenue maximizer or profit maximizer. Moro (2008) summarizes the previous work done in comparing these two strategies in his paper. In the paper, he argues that manager motives may be more inclined towards revenue maximization with separation of ownership and control of the firm. He mentions that strategic choice variable also depends on the corporate culture. For example, Japanese firms are principally growth and market-share oriented, which means they are revenue maximizers, whereas US corporations which rely more on short run investment returns and capital gains, are profit maximizers. Even though in the paper he concentrates more on the technical aspects of revenue maximization, like the capital labor ratio declining in a revenue maximizing firm, compared to a profit maximizer and a static revenue maximizing firm sets the average product of labor equal to the wage rate, its importance for our purposes lies in summarizing the previous literature about revenue maximization as a valid strategic alternative for firms. As an example of another work in this area we give Miller and Pazgal's paper (2002), which focuses on strategic choice of manager type if the competitive environment of the firm necessitates a more aggressive stance towards rivals including revenue maximization. Whereas revenue maximization and profit maximization are two points at the extreme, a firm may as well choose any strategy between the two in a linear weighted average rule framework. Revenue maximization may also be chosen as strategic variable subject to a profit constraint such that the profits are equal to zero, or a specific positive value.

Even though it is not comprehensive, and is not intended to be so, we give two further works done in this area as examples, one of which is Tabeta, N., Ruifang, W.'s 1996 working paper ""Relative" Revenue Maximizing Strategy Under Duopolistic Competition: The Case of US-Japan Bilateral Auto Trade", where they argue that the success of Japanese auto manufacturers against US counterparts in bilateral trade is as a result of their use of a revenue maximizing strategy rather than profit maximization. In another working paper. Zitzewitz, E., 2002, "A Strategic Rationale for Imperfect Profit Measures" the author argues that the use of imperfect profit measures by the owners may encourage the managers towards the use of a more aggressive competitive strategy of revenue maximization rather than that of profit maximization. "Aggressive" here is a relative term, which refers to the increasing competition for the rivals, but which may be beneficial for the consumers and the society as a whole.

Apart from the existing literature about revenue or profit maximization, we want to stress **a new dimension in our paper that there may be a paradigm shift from "maximizing own benefit" to "maximizing the benefit of all".** In this regard, we have a series of papers which stresses the application of the paradigm shift to different problems, and interested readers may have a look at them. For example, Seber (2011b) tries to find a solution to the Global Warming problem by a change in production processes considering the environmental impacts as well, as a result of which the supply and demand functions coincide. Seber (2011c) uses this paradigm in an educational problem in an organizational setting and the way to increase efficiency and enable the students to reach their potential is teamwork rather than a hierarchical structure. Similarly, Seber and Kaya (2011a) looks at how decisions created at early childhood upbringing or in an educational setting may be corrected with an absolute-potential oriented performance measure use, rather than a relative-comparative downgrading performance measure. Also, Seber (2011d) looks at how information technology may be used in place of transportation in an educational setting for efficiency purposes and prevention of Global Warming. All these papers stress the mentioned paradigm shift as a result of which individuals, societies, and the world may benefit in the long-run.

Public choice literature is also important for our analysis for the use of tax payments in provision of public goods, which are nonrival and nonexclusionary by nature, entail free riding problem (that is people may want to benefit from public goods without paying for them); and on the spending side there is the principle-agent problem which means the government may use tax proceeds for partisan benefits rather than for the benefit of the society at large. We give Rowley and Schneider's work (2004) as a reference for issues related with public choice. Related with the paradigm shift we mentioned above, **the taxpaying corporations and the government officials may also accept the "maximizing the benefit of all" paradigm with possible welfare maximizing consequences for the citizens of a country**.

2. Model and Results for Revenue Maximization

The problem we intend to analyze for the paper is a simple question given in regular economics courses. It suffices for our purposes to analyze demand and supply as specific rather than general functions in order to illustrate different firm strategies and their consequences for the firm and the society. In solving this problem, we first want to find the solution of the equilibrium price and quantity and consider implementation of different alternative strategies for sharing of the excise tax payment afterwards:

Problem

Suppose demand and supply functions are given by the following linear equations:

$$Q_x^d = 7 - \frac{1}{2}P_x \quad (1a)$$

$$Q_x^s = \frac{1}{4}P_x - \frac{1}{2} \quad (1b)$$

Find the equilibrium price and quantity as well as the effect on these variables of a \$6 excise tax and the resulting total tax payment.

Answer

First, based on equations (1a) and (1b), we can find the inverse demand and supply functions where the dependent and independent variables are interchanged so that:

$$P_x = 14 - 2Q_x^d \quad (2a)$$

$$P_x = 2 + 4Q_x^s \quad (2b)$$

If we solve either equations (1a)-(1b) or (2a)-(2b), we find that equilibrium price, $P_x^e = \$10$, and equilibrium quantity $Q_x^e = 2$. This part of the problem has a straightforward solution with 2 equations and 2 unknowns.

2.1 Strategy 1 – When Tax is Considered as Bad to be Avoided

In order to analyze the effect of the excise tax on the price and quantity of x traded in the market, let's assume as in traditional analysis that all the payment of the excise tax is transferred to the consumers. Therefore, the new supply function will be:

$$P_x = 8 + 4Q_x^s \quad (2c)$$

The solution to equations (2a) and (2c) is the new equilibrium price of $P_x^e = \$12$, and equilibrium quantity $Q_x^e = 1$. In other words, the price of commodity x increases and quantity traded decreases. The total tax paid to the government will be $T = \$6 \times 1 = \$6$, and total revenue of the firm will be $TR = \$12 \times 1 = \$12$, with an after-tax revenue of \$6.

2.2 Strategy 2 – Neutralizing the Effect of the Tax Payment

It might also be possible for the firm to implement a strategy where it neutralizes the effect of applied excise tax. In this case the relevant demand and supply equations are equations (1a) and (1b) with the resulting equilibrium price and quantity as $P_x^e = \$10$, $Q_x^e = 2$. In this case total revenue for the firm is \$20 out of which \$12 is paid to the government as tax whereas the firm remains with after-tax revenues of \$8. This condition is best for the firm assuming a revenue maximization strategy. Both the consumers and the government are better off than strategy 1, nevertheless, worse off than strategy 3, as described below.

2.3 Strategy 3 – When Tax is Considered as Good to be Provided

On the other hand, let's assume that the firm wants to bear all the tax payment by itself and wants to maximize tax payments to the government (as a hypothetical example). In this case, instead of modeling the problem based on the inverse demand and supply functions, let's use the demand and supply functions as given in equations 1. The new supply function will be:

$$Q_x^s = \frac{1}{4}(P_x + 6) - \frac{1}{2} \quad (1c)$$

Solving equations (1a) and (1c), we find the new equilibrium price to be $P_x^e = \$8$, and equilibrium quantity to be $Q_x^e = 3$. When the firm considers it as good to pay taxes to the government, the resulting price is lower and quantity higher than that without paying taxes. The total tax payment and total revenue will be $T = \$6 \times 3 = \$18$, and $TR = \$8 \times 3 = \$24$, with an after-tax revenue of \$6 for the firm.

In this case, the firm operates by considering tax payments as a "good" to be provided rather than as a "bad" to be avoided. It gives \$18 to the government as taxes. Earnings of the firm are the same as its earnings of strategy 1 of \$6. In other words, it doesn't matter whether the firm considers tax payments as "good" or "bad" since its after-tax earnings are the same in both of the cases. Even though the firm is indifferent between the two states, both the government and the consumers are better off in strategy 3 compared to strategy 1. Put differently, strategy 3 Pareto dominates strategy 1, since at least one of the parties are better off without making anyone worse off. The situation can be better visualized in Figure 1.

An interesting feature of the analysis is the resulting price elasticity of demand for the two strategies. Let's define the price elasticity of demand as follows:

$$E_P^D = \frac{dQ}{dP} \times \frac{P}{Q} \tag{3}$$

Since the slope of the demand curve is -2, the price elasticity of demand is 6, 2.5, and 1.33 at the point of equilibrium for strategies 1, 2 and 3 respectively, all of which are greater than 1 and therefore in the elastic portion of the demand curve. In traditional microeconomic analysis, we know that when price elasticity of demand is greater than 1, increasing quantity (by means of decreasing price) increases total revenue.

The situation also holds in our example, where total revenue increases for the firm in strategy 3 compared to strategy 1. Consumers are better off in strategy 3 since they buy each quantity at a lower price of $8, rather than as in strategy 1 of $12. Producers are better off in strategy 3 since their total revenue is $24 rather than $12 as in strategy 1. The remaining amount of revenues to the firm after tax payments is unchanged, however, that is $6 in both of the strategies 1 and 3. Table 1 summarizes the returns analysis examined so far.

3. Results for Profit Maximization

We want to analyze the profit function of the firm in this section for different cost functions.

3.1 Assuming that the Firm has $MC = 0$

Given that the firm has MC = 0 (assuming that the supply function and marginal cost are unrelated), the revenue maximizing quantity choice would also represent the profit maximizing choice. In order to have a better grasp of the condition, it is possible to define the equations for total revenue, tax and profit as a function of quantity as follows:

$$TR = P.Q = 14Q - 2Q^2 \tag{4a}$$

$$MR = 14 - 4Q \tag{4b}$$

$$Tax = 6Q \tag{4c}$$

$$\pi = Q(8 - 2Q) \tag{4d}$$

The profit function (4d) may also be plotted as in Figure 2. As can be observed from Figure 2, regardless of the firm type, **strategy 2 of keeping the status quo after the announcement of the excise tax payment appears to be the best strategy for profit maximization. This is contrary to classical economic analysis, which recommends strategy 1 of tax avoidance as best strategy for dealing with an excise tax payment.**

Another interesting point in Figure 2 is that, normally we would expect the marginal revenue (MR) to become zero when Q equals 3.5, indicating that for the range of $Q\epsilon[0, 3.5]$, profits will be increasing. On the other hand, the introduction of the excise tax of $6, decreases this range to $Q\epsilon[0, 2]$.

3.2 Assuming that MC equals the Supply Function

In case the MC equals the supply function and with negligible fixed costs (such that $TC = 2Q + 2Q^2$ and $MC = 2 + 4Q$), the profit maximizing quantities and the resulting tax payments and profits are found as in Table 2 (in the calculations, tax payment is considered as cost, neutral and revenue, respectively, so that -6Q, 0, +6Q is added to the MC function and MR is equated to MC to find the profit maximizing quantity):

One interesting aspect of the analysis is **that in traditional economics, taxes are not considered at all in profit maximization decisions** (when equating MR to MC) even though they may have significance in the strategic decisions of the firm. The different strategies available for the firm as analyzed here, introduces a more correct view of approaching the problem in case of excise tax payments.

The results, which are summarized in Table 2, indicate that in a **static profit maximizing environment**, strategy 1 of cost avoidance appears to be the best strategy. In a **dynamic profit maximization environment**, however, where the demand function shifts to the right or left with entry and exit of firms and competitive price advantage, strategy 2 and 3 are equally viable strategies. In a dynamic environment, long-run profits of the firm would be zero, like in a heterogeneous product, many firm, monopolistically competitive market structure.

4. Analysis of the Results

There is a very important necessary condition, however, for the firm to retain any of the tax burden with the firm as in any of the alternative strategies proposed in the paper: **The necessary condition is that all the citizens of the country love, respect and trust each other.** Therefore, the owners of the firms should love their citizens (so much as to produce a commodity at a cheaper price and pay a lot of taxes which will be spent for the benefit of the citizens of the country). Also, the people forming the government, who are chosen by the citizens of the country, love their citizen (more than their own personal or partisan benefits), and will spend the tax proceeds (without any discrimination among the citizens) for the best alternatives for serving all the citizens of the country.

The simple example examined in this paper may also lead to the argument that, (without regard to the efficiency or technological domains) **public ownership of companies may be better for social welfare than private ownership in the case of distrust equilibrium,** and (without regard to the technological domain) **domestic private ownership may be better than foreign ownership of companies in the case of trust equilibrium**.

In any case, keeping the "status quo" after the application of the excise tax may be better for both types of private firms (domestic, foreign) if revenue maximization is the motive, contrary to the transfer of the excise tax to the consumer as in the case of the profit maximizing firm of traditional economic analysis. In more trustable environments, considering excise tax as "good" to be provided is a possible welfare improving strategy for both revenue maximizing and profit maximizing firms. Considering the excise tax payment as a "good" to be provided, rather than a "bad" to be avoided makes both the consumers and government better off as far as revenue maximization, and dynamic profit maximization is concerned, whereas the firm is indifferent between these two states. **This actually is the definition of a Pareto improving strategy.**

5. Conclusion

If individual - joint benefits of the firm, consumer and the government are assumed, different strategies may be considered as better strategies for different types of firms. For the revenue maximizing firm (which is also the profit maximizing firm when costs are negligible), the "status quo" is the best strategy, rather than assuming taxes to be as "good" to be provided or "bad" to be avoided. When costs are included, the result is that excise tax payment as "bad" is the best strategy for static profit maximization, whereas as "bad", "status quo", or "good" may all be equally viable strategies for dynamic profit maximization. For both revenue maximizing and dynamic profit maximizing firms, a more trustable environment makes excise tax payment as "good" to be provided strategy Pareto superior to excise tax payment as "bad" to be avoided strategy.

As far as the ownership of the firms is concerned, the analysis in this paper also indicates that having a more trustable environment favors "public" and "private domestic" firms in place of "private foreign" firms. Implementation of custom taxes on the import side of goods or provision of incentive mechanisms for the encouragement of domestic production and technological improvement may also be necessary needed supplementary measures in this regard. **These arguments are in conflict with the current trend of foreign ownership of companies, multinational corporations and free trade aspects of globalization**.

We may also state, for example, that the analysis carried out in the paper may have policy implications for the European sovereign debt problem, which may be considered as a result of the global financial crisis as stated in Arestis, Sobreira, and Oreiro (2011) and Posta and Talani (2011). The paradigm shift we proposed in the paper, a positive attitude of taxpayers for tax payments and a responsible government who deserves the trust of taxpayers may help to prevent a possible worst-case scenario of EU public finance and social problems.

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Table 1. TR of the Firm and Tax Payments

	(P; Q)	TR of the firm ($)	Tax payment ($)	After-tax revenue ($)
Strategy 1 **Tax Avoidance**	12; 1	12	6	6
Strategy 2 **Status Quo**	10; 2	20	12	8
Strategy 3 **Tax Provision**	8; 3	24	18	6

Table 2. Profit of the Firm with MR = MC Rule

	(P; Q)	TR of the firm ($)	TC of the firm ($)	Profit ($)	Tax payment ($)	After-tax profit ($)
Strategy 1 **Tax Avoidance**	12.5; 0.75	9.375	2.625	6.75	4.5	2.25
Strategy 2 **Status Quo**	11; 1.5	16.5	7.5	9	9	0
Strategy 3 **Tax Provision**	9.5; 2.25	21.375	14.625	6.75	13.5	-6.75

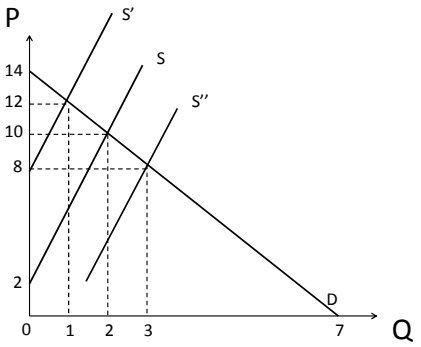

Figure 1. The demand and supply functions as given in equations 1 and 2. Line S is the initial supply function, S' the supply function when the firm considers the excise tax as "bad", and S'' the supply function when it considers the excise tax as "good".

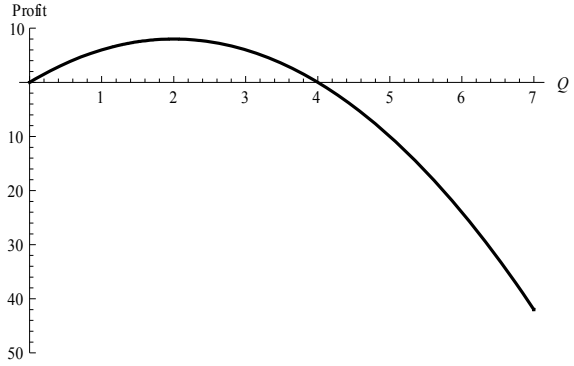

Figure 2. The profit function as a function of Q after tax payments when both fixed and variable costs are assumed to be zero.

Financial Institutions and Firm Efficiency in the Gulf Cooperation Council Countries

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Abstract

The aim of this study is to estimate the level of firm efficiency in the Gulf Cooperation Council countries including Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates. The paper also identifies the relationship of individual firm-specific characteristics with firm efficiency in these countries. The result exhibits that the level of firm efficiency ranges from 62% to 69% in the region. However, the magnitude of this efficiency varies across different industries and among individual countries. The result also suggests that financial institutions play an insignificant role in improving firm efficiency in the region. In contrast, the level of efficiency increases as a result of improving firm's own financial performance. These findings are indeed useful for potential investors in their portfolio investment decisions, and for policymakers in initiating necessary measures to strengthen the contribution of financial institutions in the region.

Keywords: Firm efficiency, Financial institutions, The Gulf Cooperation Council Countries, Stochastic frontier approach

1. Introduction

There are several papers in extant literature that examine the efficiency of banks and financial institutions in the Gulf Cooperation Council (GCC) countries (See Marie et al. 2009; Rao, 2005). However, none of the studies determines the efficiency level of non-financial firms of the region. This study bridges such gap in the literature by addressing the following four questions: Are GCC firms efficient? Is there any trend of improvement in firm efficiency throughout the region? Which industry in the GCC countries is the most/least efficient? Does firm-level efficiency vary across six GCC countries? Further, earlier studies in corporate finance determine several significant roles of financial institutions in enhancing firm's operating efficiency. For instance, an efficient financial institution can produce information *ex ante* about possible investments, as well as monitor investments and exert corporate governance after providing finance (see Stulz, 2000; Walsh and Ryan, 1997). In addition, a high level of debt outstanding reduces managerial cash flow waste through the threat of liquidation (see Grossman and Hart, 1986) or through pressure to generate cash flows to service debt (see Jensen, 1986). Therefore, the disciplinary and monitoring roles of financial institutions create an external pressure on managers to become more competent and transparent, and thus can help firms to outperform. The question remains whether financial institutions in the GCC countries perform such roles successfully in order to improve firm efficiency in this region. The paper addresses this question by examining the effectiveness of financial institutions in accelerating firm efficiency in six GCC countries including Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates. Finally, the paper identifies the key determinants of firm's operating efficiency by examining the relationship between firm efficiency and several firm-specific factors including operating cash flows, profitability, growth, firm size, future investment opportunity, and asset turnover.

The level of firm efficiency is estimated by using the Stochastic Frontier Model (SFM), introduced by Aigner et al. (1977). Three different functional forms of SFM including fixed-effects, translog, and flexible-fourier specifications are used to calculate such efficiency. In my knowledge, there is no paper in extant literature that considers all three functional forms to estimate firm efficiency particularly for GCC companies. This study is also the first research on the GCC countries that considers a large panel dataset over the period 2001-2010.

The result exhibits that the publicly-listed GCC firms are quite inefficient.[1] In particular, the level of firm efficiency varies from 62% to 69%. Further, the result shows that there were no significant changes in efficiency of GCC firms over the last ten years. Among individual industries, the construction industry is relatively less efficient among all other sectors of the region. Among the GCC countries, firms located in Kuwait and Qatar are comparatively more inefficient than individual companies in the remaining four countries. Further analysis reveals that high amount of debt and large interest payments by individual firms do not have any significant effect on firm efficiency, suggesting that an increase in external borrowing from banks and other financial institutions do not necessarily force GCC firms to become more efficient. In other words, the disciplinary and monitoring roles of financial institutions are not sufficient to improve firm efficiency in the case of GCC firms. This evidence is not unlikely given that financial institutions in the GCC countries are still inefficient (refer to Section 3). In contrast, the result suggests that an increase in firm efficiency is mainly driven by an improvement in operating cash flows, net margin, asset turnover, and future investment opportunity of individual firms. Therefore, managers' active participation and their competency in managing internally generated resources result in high firm efficiency in the GCC countries.

The rest of the paper is organized as follows. Section 2 mentions the recent emerging activities of the GCC countries. Section 3 discusses the key hypothesis based on the findings in extant literature. Section 4 describes sample data, theoretical models and econometric methodology. Section 5 analyzes the estimated results, and section 6 concludes the paper.

2. Background about the GCC Countries

The GCC countries are highly comparable because of their geographical proximity and the similarity of regulations, economic and social conditions. Over the past one decade, the GCC countries changed their priority from oil-based economic system to market-driven and production-oriented economic model. By constant reforms and infrastructural development, this region is now one of the fastest growing and highly competitive markets in the world. As IMF (International Monetary Fund) record shows, the GCC countries achieved an average growth of 6.6 percent a year during the period 2003-2008 (see Khamis and Senhadji, 2010). Further, the annual growth of non-oil sector increased from 4.8 percent in 1997-2002 to 7.3 percent in 2003-2008. Additionally, the size of total fixed investments in the GCC countries increased by more than eight times from $300 billion in 2004 to $2.5 trillion in 2008. At the same time, total bank credit to the private sector of six GCC countries, particularly in Qatar and the United Arab Emirates (UAE), grew at roughly 23 percent a year during the period 2004-2008. Because of this rapid growth in the credit market, the fraction of private sector credit to non-oil GDP increased to almost 122 percent by the end of 2008. Subsequent changes in economic and social infrastructures finally converted this region into a business-friendly environment by the end of 2010.

3. Literature Review and Hypothesis

Earlier studies analyzed both credit and stock market efficiencies in the Gulf countries. Mostafa (2007), for example, examines the operating efficiency of several commercial banks in six GCC countries, and find that the performance of many banks in the region is sub-optimal, suggesting the potential for significant improvement in the banking industry in the GCC. By applying non-parametric frontier approach, Ariss et al. (2007) find that while banks in Oman are on average the most efficient, banks in Saudi Arabia are the least efficient in the GCC countries. They also find that low efficient banking environment is continuing for several years in Qatar and the UAE. They determine that such variations in bank performance across the GCC countries are mainly resulted from significant differences in productivity and scale inefficiencies among banks. Finally, Srairi (2010) finds that banks in the Gulf region are relatively more efficient in generating profits than in controlling costs.

Several other studies examine stock market efficiency in the GCC. For instance, Abdmoulah (2010) argues that the equity markets in the GCC countries are weak-form efficient with no significant changes until the first quarter of 2009. Likewise, Asiri (2008) measures the behavior of stock prices in the Bahrain Stock Exchange, and finds random walk with no drift and trend for all daily stock prices. Similarly, Hassan et al. (2003) find that the Kuwait Stock Exchange is also weak-form efficient because of low market liquidity, lack of high quality information, and restriction on institutional trading. Using more recent data, Smith (2007) and Squalli (2006) also find similar evidence in the case of Oman and the UAE stock markets, respectively.

In summary, the extant literature highlights that banks and stock markets in the GCC are less efficient in retrieving inside information, ensuring credit quality, and enforcing good corporate governance due to their own allocation and technical inefficiencies. This eventually increases the chance of misusing firm's internal resources by managers, and thereby adversely affects on firm performance. I therefore assume that banks and other financial institutions of the region play an insignificant role in improving firm efficiency in the GCC countries.

4. Data, Empirical Models and Estimation Method

In the paper, the empirical model includes two steps of regression analysis. The first stage regression model estimates the magnitude of firm inefficiency in the GCC countries. In the second stage regression model, I use such inefficiency measures to determine whether and how a firm's external source of financing and other firm-specific determinants influence the existing level of firm inefficiency.

4.1 Data

To estimate the coefficients of both first- and second-stage regression models, I use an unbalanced panel dataset, clustered by firm. The dataset consists of financial data of all publicly-listed non-financial and non-utility GCC firms. Accordingly, there are 15 companies from Bahrain, 131 companies from Kuwait, 96 companies from Oman, 15 companies from Qatar, 90 companies from Saudi Arabia, and 38 companies from the UAE in the dataset. All these 385 companies mainly belong to six major industries of the GCC countries including construction, energy, food, manufacturing, services, and tourism. In this paper, I cover a sample period from 2001 to 2010. Because of missing data of several firms in certain years, the magnitude of firm inefficiency is finally estimated from total 2 219 firm-year observations. I collect the data from *Zawya*, an electronic database that consists of financial and non-financial information about all publicly-listed companies in the GCC stock markets.

4.2 First Stage Regression Model

I measure the level of firm inefficiency by conducting the stochastic frontier analysis (SFA), developed by Meeusen and Broeck (1977) and Aigner et al. (1977). The general expression of the stochastic frontier model is:

$$Y = \beta' X + v - u \tag{1}$$

In the model, Y is the observed outcome, and X's are the set of exogenous variables that affect firm's output variable. The optimal frontier goal is expressed by $(\beta' X + v)$ in which $\beta' X$ is the deterministic part of the frontier, and v is a systematic error component that allows random variation of the frontier across firms and captures the effects of measurement error, individual statistical noises and random shocks beyond firm's control. The last term in the model, u, is an error component that captures the effects of both technical and allocative inefficiencies of individual firms relative to their best-practice level. SFA allows four different distributions of the inefficiency term (u), such as half-normal, exponential, truncated and gamma distributions. This paper reports the estimated parameters of stochastic frontier model based on the exponential distribution of u.[2]

To specify the SFA revenue function of Model (1), I employ three alternative functional forms including (i) fixed-effects; (ii) translog, and (iii) flexible fourier specifications.

4.2.1 Fixed-effects Specification

The frontier regression model under this functional form is specified as follows:

$$\text{Ln}\,(Y_{it}) = \alpha + \beta.\text{Ln}(W_{it}) + \gamma.\,\text{Ln}\,(Q_{it}) + \delta.\,D_i + \eta.\,T_t + \varepsilon_{it} \tag{2-1}$$

Here, Y_{it} is the observed output variable of firm i at year t. W_{it} are two separate input variables, and Q_{it} includes a vector of control variables. D_i is a set of industry- and country-specific dummy variables, and T is a vector of year-specific dummy variables. β, γ, δ and η are estimated coefficients of corresponding variables, and ε is the error term, which is equal to $(v - u)$.

4.2.2 Translog Specification

The translog function usually consists of both linear and quadratic terms. The function can be approximated by second order Taylor series. Accordingly, the translog revenue function is specified as follows:

$$\begin{aligned}\text{Ln}\,(Y_{it}) = {} & \alpha_0 + \textstyle\sum_i \beta_i.\text{Ln}\,(Q_{it}) + \sum_i \gamma_i.\text{Ln}(W_{it}) + \sum_j \delta_j.D_j + \eta_t.T_t + \\ & 0.5\textstyle\sum_i \alpha_i (\text{Ln}Q_{it})^2 + 0.5\sum_i \omega_i (\text{Ln}W_{it})^2 \\ & + \\ & \textstyle\sum_i \sum_j \beta_j.\,(\text{Ln}Q_{it})\,(\text{Ln}Q_{jt}) + \sum_i \xi_i.\,(\text{Ln}Q_{it})\,(\text{Ln}W_{it}) + \varepsilon_{it}\end{aligned} \tag{2-2}$$

In addition to individual terms of equation (2-1), the above specification includes two separate square terms of input (W_{it}) and output variables (Q_{it}), cross-product terms between Q_{it} and W_{it}, and between Q_{it} and Q_{jt}. Therefore, the estimated results include nine additional terms in translog specification compared to that in the fixed-effects model. All variables are expressed in natural logs.

4.2.3 Flexible Fourier Specification

The flexible fourier specification represents a semi-non-parametric approach to the problem of using the data to infer interrelationships among the variables when the true functional form of the relationships is unknown (Mitchell and Onvural, 1996). Though the functional form requires an indefinite number of trigonometric terms, I consider a

limited number of terms in the revenue function because of a finite number of observations of individual variables. Gallant (1981) finds that a fourier series representation of an unknown function can achieve a given level of approximation error with fewer trigonometric terms when it includes a second-order polynomial in the explanatory variables. Accordingly, the flexible fourier specification of the revenue function is expressed as follows:

$$\begin{aligned}\text{Ln}\,(Y_{it}) = {} & \alpha_0 + \sum_i \beta_i.\ \text{Ln}(Q_{it}) + \sum_i \gamma_i.\ \text{Ln}(W_{it}) + \sum_j \delta_j.D_j + \eta_t.T_t + 0.5\sum_i \alpha_i(\text{Ln}Q_{it})^2 + 0.5\sum_i \omega_i(\text{Ln}W_{it})^2 \\ & + \sum_i\sum_j \beta_j.\ (\text{Ln}Q_{it})\,(\text{Ln}Q_{jt}) + \sum_i \xi_i.\ (\text{Ln}Q_{it})\,(\text{Ln}W_{it}) + \sum_{j=1}^{2}\left[\varphi_j cosQ_j + \vartheta_j sinQ_j\right] + \\ & \sum_{j=1}^{2}\sum_{k=1}^{2}[\varphi_{jk}\cos(Q_j + Q_k) + \vartheta_{jk}\sin(Q_j + Q_k)] + \varepsilon_{it} \qquad (2\text{-}3)\end{aligned}$$

The definition of each variable is the same as in the previous two specifications (2-1 and 2-2). While the first eight terms of equation (2-3) represent the translog series of the flexible fourier revenue function, the last two terms consist of sine and cosine expressions of output variables to identify the truncated fourier series.

4.2.4 Estimation Method

The unknown parameters of Model (1) are estimated using the maximum likelihood (ML) method. The idea behind the ML estimation is to determine the value of a parameter that maximizes the probability (likelihood) of the sample data. There are several other parameters, estimated from Model (1), that have important implications for the analysis. First, the parameter θ is defined as $1/\sigma_u$ in the normal-exponential model. In general, $\theta \to 0$ implies that there are no operational inefficiency effects and all deviations from the frontier are mainly due to statistical noise. Therefore, I conduct a hypothesis test, such as H_0: $\theta = 0$ against H_1: $\theta > 0$, to examine the significance of θ. Second, total variance of the combined error term can be expressed as $(\sigma_v^2 + \sigma_u^2)$. Between these two terms, σ_u^2 denotes the volatility of error component in the stochastic frontier model that is associated with operational inefficiency, and therefore can be manageable by reallocating internal resources of firms, while σ_v^2 captures the remaining fraction of volatility in error term that is uncontrollable by individual firms. Therefore, in the case of $\sigma_u^2 > \sigma_v^2$, the GCC companies should be able to reduce their operating inefficiencies by further improving the allocation of internal resources (i.e., labor, capital and other resources). The parameters of log-likelihood function is usually estimated by taking the first order derivatives of the function with respect to unknown parameters and setting them equal to zero. However, since these first order conditions are highly nonlinear and cannot be solved analytically for σ and θ, the likelihood function is usually maximized using an iterative optimization procedure. This involves selecting starting values for the unknown parameters and systematically updating them until the values that maximize the log-likelihood function are found. In this study, I use the econometric software, called LIMDEP, to estimate all these parameters. The stochastic frontier model in LIMDEP can be expressed as follows:

$$\text{Ln}\ Y_{it} = X_{it}.\beta + v_{it} - u_{it},\ i = 1, 2, 3, \ldots\ldots, \text{N and } t = 2001, 2002, \ldots.., 2010 \qquad (3\text{-}1)$$

where, $v_{it} \sim \text{iidN}(0,\ \sigma_v^2)$ and $u_{it} \sim \theta.\exp(-\theta u)$ as described in Meeusen and Broeck (1977). Based on the estimated parameters of (3-1), the expected firm inefficiency, $E[u|v\text{-}u]$, is finally calculated in LIMDEP by the following equation (see Jondrow et al., 1982):

$$\hat{E}(u|v\text{-}u) = \sigma_v.[\emptyset(z)/(1 - \Phi(z))] - z, \text{ where } z = (\varepsilon/\sigma_v) + \theta.\sigma_v \text{ and } \varepsilon = v - u \qquad (3\text{-}2)$$

Consistent with Leibenstein (1966) and Kozmetsky and Yue (1998), I consider that a firm is efficient if the manager of that firm spends lesser amount of resources in production and administrative expenses while simultaneously generates a greater amount of sales revenue. I therefore calculate firm inefficiency by estimating a revenue frontier model. As such, the output variable in the model is firm's sales revenue. Further, I describe $X_i = (W_i, Q_i, Z_i)$ as a set of firm-specific exogenous variables that affect firm's total revenue. Among them, W_i, expressed in natural logs, are two input variables including the cost of goods sold (*COGS*), and selling, general and administrative expenses (*SGA*) of individual firms.[3] By definition, *COGS* is total cost of labors and raw materials associated with the production of goods and/or services, and *SGA* includes total cost related to advertising, sales, distributions and promotions as well as officers' payrolls and bonuses, directors' remuneration and fringe benefits. Q_i includes two additional output quantities, expressed in natural logs, including firm's total assets (*TA*) and plants, property and equipments (*FA*). *TA* is the sum of current assets (i.e., cash and marketable securities, accounts receivables, inventories) and fixed assets (i.e., lands, buildings, machineries and equipments plus other long term investments). Additionally, *FA* is total physical assets net off annual depreciation of assets. In the model, *TA* and *FA* are considered as two separate control variables. Finally, Z_i includes three different dummy variables (0, 1) indicating (a) the sample year, (b) the industry in which a sample firm belongs to, and (c) the country where a firm is incorporated. In the analysis, I consider 2001 as a base year, the energy sector as a base industry, and the UAE as a base country.[4]

4.3 Second Stage Regression Model

In the paper, the second-stage regression model is specified as follows:

$$u_{it} = Constant + \alpha_1(Firm's\ Exposure\ to\ Banks)_{it} + \sum_{k=1}^{6} \beta_k(Firm\ Characteristics)_{it} + \delta_i.T_i + \gamma_i.IND_i + \varphi_i.C_i + \zeta_{it} \quad (4)$$

Here, u_{it} is the level of firm inefficiency at year t, estimated from equations (2-1) – (2-3). To measure a firm's dependence on banks and other financial institutions, I consider two alternative measures: (a) firm's leverage (*LEV*) and (b) total interest payments (*INT*). High financial leverage mitigates the conflict between shareholders and managers concerning the choice of investment (e.g., Myers, 1977), the amount of risk to undertake (e.g., Jensen and Meckling, 1976; Williams, 1987), the conditions under which the firm is liquidated (e.g., Harris and Raviv, 1990), and the problem associated with dividend policy (e.g., Stulz, 1990). In addition, managers remain under pressure to generate sufficient cash flows to pay interests in the presence of high leverage (e.g., Jensen, 1986). I therefore posit that managers' high commitment to fulfill debt related obligations motivates them to make more effective decisions. In the paper, I define *LEV* as a ratio of total long-term debt to total assets, and *INT* as a ratio of total interest payments to total assets of individual firms.

To measure firm's own financial performance, I consider firm's (a) operating cash flows (*OCF*), a ratio of cash-flows from operating activities to total assets, (b) asset turnover (*TA*), a ratio of sales revenue to total assets of a firm, (c) net margin (*NM*), a ratio of net profit to total sales, (d) sales growth (*GR*), a change in current sales revenue, (e) future investment opportunity (*INVOPP*), a ratio of firm's market value of equity to book value of total assets less total liabilities, and (f) firm size (*SIZE*), logarithm of total assets, in Model (4). I include year dummy variables (*T*) to observe whether firm-level inefficiency had been changed over time during the sample period. Likewise, I include country- (*C*) and industry-specific (*IND*) dummy variables to observe whether the level of firm inefficiency vary across individual countries and different industries in the GCC region. I finally estimate the coefficients of Model (4) by using the fixed-effect panel regression method.

5. Empirical Results and Analysis

5.1 Characteristics of GCC Firms

Table 1 reports the summary statistics of individual key variables that have been used in the first- (Panel A) and the second-stage (Panel B) regression models. Since different functional forms of the first stage regression model include the logarithm of input and output variables, the table summarizes the mean, standard deviation and skewness of log values of each indicator in Panel A. Column I of Panel A, for example, reports the estimated statistics of logarithm of sales revenue (*lnREV*). I find that average *lnREV*, *lnCOGS*, and *lnSGA* range from 16.55 to 18.54, from 16.15 to 18.03, and from 14.47 to 16.24, respectively. Therefore, the average sales revenue, cost of production, and SGA expenses of GCC firms vary in between $15 million and $113 million, between $10 million and $68 million, and between $2 million and $11 million, respectively. In addition, the average total assets (fixed assets) range from $31 million to $569 million (from $11 million to $102 million) among the GCC firms.

Panel B includes two key variables of the second stage regression model. The result exhibits that the publicly-listed firms in Oman (Bahrain) are highly (less) borrowed firms compared to others located in the remaining five countries. Similarly, the mean *INT* is also the highest (lowest) in the case of Omani (Bahraini) firms. Further, the standard deviation of *LEV* of Omani (Bahraini) firms is 33.22 (8.61), indicating that there are highly (less) dispersed group of business entities in Oman (Bahrain) that are relying heavily on bank financing.

Insert Table 1 Here

5.2 Estimated Results of the First Stage Regression Model

Table 2 includes the estimated coefficients of the first stage regression model under different functional forms, and the corresponding measures of firm efficiency in the region. Both log-likelihood and Akaike Information Criteria (AIC) under each functional form of the revenue frontier model exhibit that all three model specifications are statistically significant and equally comparable to each another. Therefore, the choice among different model specifications does not significantly alter the efficiency measure. Among three functional forms, it is difficult to interpret the coefficients of independent variables under translog and flexible fourier revenue functions because of the presence of combined effects of several second order, interaction and/or trigonometric variables in those specifications. In the case of the fixed-effects functional form, both production and administrative expenses of individual firms are positively correlated with sales revenues, suggesting that firms with high operating expenses are usually high revenue generating firms in the GCC countries. As is evident in Model Specification (1), the coefficients of *lnCOGS* and *lnSGA* are 0.64 and 0.18, respectively, significant at the 1% level. Likewise, the coefficient of *lnTA* is 0.20, significant at the 1% level, implying that large GCC firms are able to earn high amount of revenues. The result also shows that firm's revenues vary across different industries and countries of the region.

Panel B of the table reports that the average level of efficiency of GCC firms is 69% in the fixed-effects model specification, and 62% in both translog and flexible fourier specifications, significant at the 1% level. Further, the coefficient of θ under different revenue functional forms ranges from 2.66 to 3.28, significant at the 1% level, suggesting that a significant difference in firm inefficiency exists among individual GCC firms. The result also shows that σ_u^2 ranges from 9% in the fixed-effects functional form to 14% in both translog and flexible fourier revenue functional forms. In contrast, σ_v^2 lies in between 3% under both translog and flexible fourier functional forms and 9% under the fixed-effects revenue frontier functional form. Therefore, the manageable fraction of firm inefficiency outweighs the uncontrollable and random portion of inefficiency of GCC firms. This suggests that the current level of operating inefficiency of publicly-listed GCC firms can be reduced further by efficient allocation and utilization of their own internal resources.

Insert Table 2 Here

5.3 Analysis of Firm Inefficiency in the Region

Table 3 reports the magnitude of firm inefficiency, derived from all three functional forms, by year, industry, and country. Panel A, for example, includes the distribution of firm inefficiency by year. The estimates reveal that there had been no significant changes in firm inefficiency over the last ten years. Among different sectors, the construction industry is relatively less efficient than other industries in the GCC countries. The average range of firm inefficiency in the construction industry is 47%-66% under both translog and flexible fourier functional forms followed by 30%-49% in the tourism sector, and 32%-39% in the service sector. In contrast, the energy, food, and manufacturing industries are relatively less inefficient than other industries in the region. In particular, the level of firm inefficiency in these industries lies in between 27% and 31%, on average. Finally, the result shows that the publicly-listed firms in Kuwait and Qatar are relatively less efficient than those in other four GCC countries. Notably, the magnitude of firm inefficiency ranges from 30% to 31% in Bahrain, from 29% to 36% in Oman, from 27% to 33% in Saudi Arabia, and from 28% to 33% in the UAE.

Insert Table 3 Here

5.4 Determinants of Firm Inefficiency of GCC Firms

Table 4 reports the estimated coefficients of the second stage regression model. The dependent variable in each model specification is the measure of firm inefficiency obtained from the first stage regression model. For example, Model Specification (1) includes the inefficiency estimates of individual firms that have been derived from the fixed-effects functional form. Likewise, the inefficiency estimates derived from the translog and flexible-fourier frontier model are considered in Model Specification (2) and (3), respectively. As can be seen in the regression diagnostics including the R^2, *F*-values and chi-square values, the Model Specification (1) outperforms the other two models. However, the estimated results across three model specifications remain consistent.

First of all, the estimated results exhibit that there is an insignificant effect of debt financing on firm inefficiency. In particular, the coefficients of *LEV* and *INT* are economically and statistically insignificant across three model specifications. For example, the coefficient of *INT* varies from -0.001 in Model Specification (2) to 0.001 in Model Specification (1) with a very low *t*-statistics ranging from -0.31 to 0.65. This evidence exhibits that an obligation of repaying high amount of principal and interest to lenders does not necessarily create an external pressure on managers to run their firms more efficiently. This finding is not unlikely given that financial institutions are inefficient in the GCC countries, as discussed in Section 3. Therefore, the financial institutions play an insignificant role in improving firm efficiency in the region, which satisfies the initial hypothesis that the external monitoring and disciplinary roles of banks and other financial institutions is not sufficient enough to improve firm efficiency in the GCC countries.

In contrast, the result shows that the coefficient of operating cash flows is negative and statistically significant at the 1% level, indicating that an increase in firm's internal cash flows reduces firm inefficiency in the GCC countries. For instance, the coefficient of *OCF* varies from -0.23 in Model Specification (1) to -0.43 in Model Specification (2) and (3). The result also exhibits that an increase in asset turnover reduces firm inefficiency. As an example, the estimated coefficient of *AT* lies in between -0.07 in Model Specification (1) and -0.11 in both model specifications (2) and (3), significant at the 1% level. Likewise, there is a significant negative effect of net margin on firm inefficiency, suggesting that an increase in profitability improves operating efficiency of GCC firms. The above findings therefore recommend that the GCC firms can achieve high level of efficiency by improving their own financial performance. Similarly, large companies and firms with high future investment opportunities are less inefficient in the GCC countries. These firms are, in general, well-reputed and well-established business entities in the GCC. Additionally, managers of individual firms with good future investment opportunities operate their

companies more cautiously so that they can raise their required funds from the financial market at a reasonable cost in future. This in turn increases the current level of firm efficiency.

The estimated results also highlight that there had been no significant changes in firm efficiency over the past ten years in the GCC countries. Further, it exhibits that the publicly-listed firms in Kuwait and Qatar are relatively more inefficient than those in the UAE. Consistent with the previous findings, it is also found that the construction industry is relatively more inefficient than the energy sector in the region. In contrast, the food, manufacturing, and tourism sectors are less inefficient than the energy sector in the GCC countries. Such evidence suggests that the difference in firm inefficiency exists across different industries and countries in the GCC region. Future research can therefore be directed to determine the underlying reasons for such differences in efficiency across industries and individual countries in the GCC.

Insert Table 4 Here

6. Conclusion

While several papers examine the efficiency level of financial institutions and stock markets in the Gulf region, this paper aims to investigate firm efficiency for the first time by using a unique data set of a large number of GCC firms over the period 2001-2010. By using stochastic frontier approach, I find that the efficiency level of the publicly-listed GCC firms varies within a range of 62% - 69%, on average. I further notice that firm efficiency remained the same in the GCC countries over the last ten years. Instead, a significant difference in firm inefficiency exists across individual industries and different countries of the region. In particular, I find that the construction industry is relatively less efficient sector than all other industries in the GCC countries. Further, firms that are located in Kuwait and Qatar are comparatively less efficient than firms operating in other four countries. The result also exhibits that the fraction of manageable firm inefficiency is greater than that of uncontrollable inefficiency (i.e., 9%-12% versus 3%-9%) among GCC firms. Therefore, a further improvement in firm efficiency is possible across six GCC countries.

In the second stage of the analysis, I examine whether the disciplinary and monitoring roles of financial institutions can improve firm efficiency. To measure a firm's degree of dependence on banks and other financial institutions, I use firm's leverage and annual interest payments as two separate proxy variables. I posit that firms are required to be more transparent and accountable to outside investors at a high level of external financing, which in turn encourage managers to perform well. I indeed find that high level of bank borrowing does not have any significant impact on improving firm efficiency in the GCC countries. Therefore, the existing roles of financial institutions are not sufficient to improve firm efficiency in the region. In contrast, an improvement in firm's operating cash flows, net margin, and asset turnover decreases the level of firm inefficiency in the GCC countries, suggesting that managing firm's internal resources in an effective manner drives in an increase in efficiency of GCC companies. Likewise, large firms and individual companies with high future investment opportunities are usually more efficient business entities in the region. This evidence has two critical implications in the real world. First, potential investors should choose stocks from the GCC equity markets for their investment after examining firm's financial and operating performances more carefully, and second, policy makers and regulators should take immediate steps in strengthening the roles of banks and financial institutions in the region.

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Notes

Note 1. In the rest of the paper, GCC firms include firms that are listed in individual stock markets of the GCC countries. The findings are therefore solely based on publicly-listed firms of the region.

Note 2. The choice of distributional specification is sometimes a matter of computational convenience since the estimation of some frontier models is automated in some statistical software. In this study, the results using half-normal, truncated normal and gamma models are also qualitatively similar. To conserve the space, I do not report the results of the latter three specifications.

Note 3. Kozmetsky and Yue (1998), and Tseng et al. (2009) also use *SALES* as output, and *COGS* and *SGA* as input variables to estimate firm inefficiency.

Note 4. For example, in the case of a country-dummy variable, *UAE*, I assign 1 to those particular firms that are located in the UAE, and 0 for the remaining non-UAE firms.

Table 1. Characteristics of key variables of GCC Firms

Panel A. First stage regression model variables

Country	(I) Output: *lnREV*			(II) Input 1: *lnCOGS*			(III) Input 2: *lnSGA*		
	Mean	S. D.	Skewness	Mean	S. D.	Skewness	Mean	S. D.	Skewness
BAH	16.83	1.27	-0.54	16.31	1.77	-1.56	14.68	1.26	0.44
KUW	17.40	1.66	-0.26	16.77	2.00	-0.44	15.44	1.22	0.56
OMN	16.55	1.74	-0.09	16.15	1.75	0.05	14.47	1.29	0.44
QTR	18.50	2.18	-1.60	17.95	2.15	-1.42	16.24	1.37	-0.13
SAU	18.54	1.74	-0.25	18.03	1.78	-0.10	16.14	1.60	0.40
UAE	18.40	1.71	-0.80	17.95	1.66	-0.65	16.22	1.51	0.33

Country	(IV) Control variable 1: *lnTA*			(V) Control variable 2: *lnFA*		
	Mean	S. D.	Skewness	Mean	S. D.	Skewness
BAH	17.79	0.69	-0.48	16.20	1.24	0.16
KUW	18.82	1.25	-0.05	16.39	2.31	-1.54
OMN	17.25	1.45	0.50	16.26	1.71	-0.29
QTR	20.16	1.39	-0.28	18.32	2.08	-0.33
SAU	19.55	1.53	0.97	18.44	2.00	-0.60
UAE	19.37	1.67	0.44	17.68	2.05	-0.48

Panel B. Second stage regression model variables

Country	(I) *LEV*			(II) *INT*		
	Mean	S. D.	Skewness	Mean	S. D.	Skewness
BAH	11.50	8.61	0.45	0.001	0.003	2.68
KUW	21.58	15.71	0.54	0.01	0.01	1.25
OMN	40.53	33.22	1.91	0.02	0.05	14.37
QTR	18.85	15.50	1.83	0.01	0.01	1.53
SAU	15.31	14.44	1.10	0.01	0.01	2.55
UAE	19.91	18.56	1.08	0.01	0.01	1.95

In the table, S.D. stands for standard deviation. Since we consider logarithm of each variable in the first stage regression model, we calculate summary statistics of log values of respective variables in Panel A. *LEV* and *INT* are two separate proxy measures, indicating firm's dependence on banks and other financial institutions. Countries include: *BAH* (Bahrain), *KUW* (Kuwait), *OMN* (Oman), *QTR* (Qatar), *SAU* (Saudi Arabia), and UAE (the United Arab Emirates).

Table 2. Estimating firm inefficiency

Panel A: First-stage regression

Independent variables	Model Specification 1: Fixed-effects		Model Specification 2: Translog		Model Specification 3: Flexible Fourier	
	Coefficient	*t*-stat	Coefficient	*t*-stat	Coefficient	*t*-stat
Intercept	0.64***	4.09	0.48	0.77	0.46	0.73
ln*COGS*	0.64***	65.82	0.34***	5.06	0.35***	5.13
ln*SGA*	0.18***	18.09	0.75***	8.09	0.74***	8.04
ln*TA*	0.20***	14.40	0.01	0.12	0.02	0.15
ln*FA*	-0.001	-0.22	-0.03	-0.46	-0.03	-0.49
$0.5(\ln COGS)^2$	-	-	0.03***	21.01	0.03***	20.89
$0.5(\ln SGA)^2$	-	-	0.01***	5.11	0.01***	5.05
$0.5(\ln TA)^2$	-	-	0.04***	10.19	0.04***	10.16
$0.5(\ln FA)^2$	-	-	0.01***	7.19	0.01***	7.18
$\ln COGS \times \ln TA$	-	-	-0.09***	-14.06	-0.09***	-13.99
$\ln COGS \times \ln FA$	-	-	-0.003	-1.08	-0.003	-1.13
$\ln SGA \times \ln TA$	-	-	-0.06***	-6.17	-0.06***	-6.15
$\ln SGA \times \ln FA$	-	-	-0.01*	-1.74	-0.01	-1.62
$\ln TA \times \ln FA$	-	-	-0.01*	-1.61	-0.01*	-1.67
Cos*TA*	-	-	-	-	0.01	0.79
Cos*FA*	-	-	-	-	0.01	1.06
Sin*TA*	-	-	-	-	0.01	0.88
Sin*FA*	-	-	-	-	-0.004	-0.39
$\cos(TA + FA)$	-	-	-	-	0.001	0.11
$\sin(TA + FA)$	-	-	-	-	0.002	0.23
YR2	0.05	0.53	0.07	0.92	0.07	0.96
YR3	0.11	1.47	0.13**	2.07	0.13**	2.11
YR4	0.12	1.61	0.13**	2.19	0.13**	2.23
YR5	0.16**	2.07	0.15***	2.54	0.15***	2.57
YR6	0.18**	2.35	0.16***	2.73	0.17***	2.75
YR7	0.16**	2.06	0.15***	2.56	0.16***	2.61
YR8	0.16**	2.08	0.14**	2.41	0.15***	2.46
YR9	0.10	1.35	0.10*	1.71	0.10*	1.74
YR10	0.26	1.45	0.10	0.80	0.10	0.80
CONS	0.15**	2.03	0.07	1.51	0.07	1.51
FOOD	-0.30	-1.06	-0.16***	-5.54	-0.16***	-5.54
MNG	-0.10**	2.39	0.03	1.12	0.03	1.09
SERV	-0.14	0.12	-0.03	-1.22	-0.03	-1.25
TOUR	-0.17	0.99	-0.07*	-1.92	-0.07*	-1.91
BAH	0.12***	-2.99	0.05	1.16	0.05	1.17
KUW	0.004***	-4.09	0.00	0.10	0.001	0.05
OMN	0.03***	-3.59	0.00	0.07	0.002	0.07
QTR	-0.05***	-7.87	-0.05	-1.29	-0.05	-1.32
SAU	0.06***	2.92	0.01	0.59	0.01	0.58

Panel B: Summary statistics

Indicators	Model Specification 1: Fixed-effects		Model Specification 2: Translog		Model Specification 3: Flexible Fourier	
	Estimate	*t*-stat	Estimate	*t*-stat	Estimate	*t*-stat
Mean firm efficiency	0.69***	24.93	0.62***	24.36	0.62***	24.35
σ_u^2	0.09	-	0.14	-	0.14	-
σ_v^2	0.09	-	0.03	-	0.03	-
Θ	3.28***	23.32	2.66***	31.26	2.66***	31.20
N	2219	-	2219	-	2219	-
Log-likelihood	-1198.08	-	-946.42	-	-945.06	-
AIC	1.10	-	0.89	-	0.89	-

Panel A includes the estimated coefficients of Stochastic Frontier Model (SFM). Panel B reports the estimated firm efficiency in the GCC, and other relevant statistics. In panel A, 2001 is the base year, energy is the base industry, and the United Arab Emirates is the base country. Individual sample years from 2002 to 2010 are defined as *YR2*, *YR3* and so forth. Industry dummy variables include: *CONS* (Construction), *FOOD* (Food), *MNG* (Manufacturing), *SERV* (Services) and *TOUR* (Tourism). Country dummy variables are: *BAH* (Bahrain), *KUW* (Kuwait), *OMN* (Oman), *QTR* (Qatar) and *SAU* (Saudi Arabia). ***, ** and * imply the significance of each coefficient/statistic at the 1%, 5% and 10% level, respectively.

Table 3. Distribution of firm inefficiency

Panel A: Distribution by year

Year	Specification 1: Fixed-effects		Specification 2: Translog		Specification 3: Flexible Fourier	
	Mean (u_t)	Mean Difference ($u_t - u_{t-1}$)	Mean (u_t)	Mean Difference ($u_t - u_{t-1}$)	Mean (u_t)	Mean Difference ($u_t - u_{t-1}$)
2001	0.40	-	0.54	-	0.54	-
2002	0.33	-0.07	0.41	-0.13	0.41	-0.13
2003	0.28	-0.05	0.34	-0.07	0.34	-0.07
2004	0.31	0.03	0.39	0.05	0.39	0.05
2005	0.28	-0.03	0.34	-0.05	0.34	-0.05
2006	0.31	0.03	0.38	0.04	0.38	0.04
2007	0.30	-0.01	0.37	-0.01	0.37	-0.01
2008	0.33	0.03	0.40	0.03	0.40	0.03
2009	0.31	-0.02	0.39	-0.01	0.39	-0.01
2010	0.28	-0.03	0.21	-0.18***	0.22	-0.17***

Panel B: Distribution by industry

Industries	Specification 1: Fixed-effects	Specification 2: Translog	Specification 3: Flexible Fourier
Construction (*CONS*)	0.47	0.66	0.66
Energy (*ENG*)	0.27	0.31	0.31
Food (*FOOD*)	0.27	0.31	0.31
Manufacturing (*MNG*)	0.27	0.31	0.31
Services (*SERV*)	0.32	0.39	0.39
Tourism (*TOUR*)	0.30	0.49	0.49
Mean differences in firm inefficiency between industries			
ENG – CONS	-0.20***	-0.35***	-0.35***
ENG – FOOD	0.00	0.00	0.00
ENG – MNG	0.00	0.00	0.00
ENG – SERV	-0.05**	-0.08**	-0.08**
ENG – TOUR	-0.03	-0.18**	-0.18**
FOOD – CONS	-0.20***	-0.35***	-0.35***
FOOD – MNG	0.00	0.00	0.00
FOOD – SERV	-0.05**	-0.08**	-0.08**
FOOD – TOUR	-0.03	-0.18**	-0.18**
MNG – CONS	-0.20***	-0.35***	-0.35***
MNG – SERV	-0.05**	-0.08***	-0.08***
MNG – TOUR	-0.03	-0.18**	-0.18**
CONS – SERV	0.15***	0.27***	0.27***
CONS – TOUR	0.17***	0.17*	0.17*
SERV – TOUR	0.02	-0.10	-0.10

Panel C: Distribution by country

Gulf countries	Specification 1: Fixed-effects	Specification 2: Translog	Specification 3: Flexible Fourier
	Average u_t		
Bahrain (*BAH*)	0.30	0.31	0.31
Kuwait (*KUW*)	0.34	0.45	0.45
Oman (*OMN*)	0.29	0.36	0.36
Qatar (*QTR*)	0.34	0.45	0.45
Saudi Arabia (*SAU*)	0.27	0.33	0.33
The United Arab Emirates (*UAE*)	0.28	0.33	0.33
Mean differences in firm inefficiency between two GCC countries			
BAH – KUW	-0.05*	-0.14***	-0.14***
BAH – OMN	0.01	-0.05	-0.05
BAH – QTR	-0.04	-0.14	-0.14
BAH – SAU	0.03	-0.02	-0.02
BAH – UAE	0.02	-0.02	-0.02

KUW – OMN	0.05**	0.09***	0.09***
KUW – QTR	0.00	0.00	0.00
KUW – SAU	0.07***	0.12***	0.12***
KUW – UAE	0.06**	0.12**	0.12**
OMN – QTR	-0.05	-0.09	-0.09
OMN – SAU	0.02	0.03	0.03
OMN – UAE	0.01	0.03	0.03
QTR – SAU	0.07	0.12	0.12
QTR – UAE	0.06	0.12	0.12
SAU – UAE	-0.01	0.00	0.00

Table 4. Determinants of firm inefficiency

Independent variables	Model Specification 1: Fixed-effects		Model Specification 2: Translog		Model Specification 3: Flexible Fourier	
Intercept	0.49***	0.40***	0.41*	0.41*	0.58***	0.41*
LEV	-0.001	-	0.00	-	0.00	-
INT	-	0.001	-	-0.001	-	-0.00
OCF	-0.23***	-0.25***	-0.39***	-0.43***	-0.39***	-0.43***
AT	-0.09***	-0.07***	-0.11***	-0.08***	-0.11***	-0.08***
NM	-0.01***	-0.01**	-0.01*	-0.002	-0.01*	-0.002
GR	0.01	0.002	0.01	0.004	0.01	0.004
INVOPP	-0.03***	-0.04***	-0.06***	-0.06***	-0.06***	-0.06***
SIZE	-0.01**	-0.01*	-0.02***	-0.010	-0.02***	-0.01
YR2	0.06	0.07	0.09	0.10	0.10	0.11
YR3	0.06	0.07	0.09	0.09	0.10	0.10
YR4	0.03	0.04	0.07	0.07	0.07	0.07
YR5	0.04	0.05	0.06	0.07	0.07	0.07
YR6	0.04	0.06	0.07	0.08	0.07	0.09
YR7	0.04	0.04	0.04	0.04	0.04	0.04
YR8	0.03	0.04	0.03	0.04	0.03	0.04
YR9	0.03	0.04	0.04	0.06	0.05	0.06
YR10	0.14	0.11	-0.08	-0.01	-0.07	-0.01
CONS	0.08***	0.05**	0.11***	0.10***	0.11***	0.10***
FOOD	-0.07***	-0.05***	-0.09***	-0.06*	-0.10***	-0.06*
MNG	-0.04**	-0.04**	-0.07**	-0.04	-0.06**	-0.04
SERV	-0.01	0.003	-0.01	0.03	-0.004	0.03
TOUR	-0.11***	-0.09***	-0.11**	-0.05	-0.11**	-0.06
BAH	0.11**	0.04*	0.11	0.02	0.11	0.02
KUW	0.02	0.02	0.08**	0.09***	0.08***	0.09***
OMN	-0.003	0.01	0.02	0.04	0.02	0.04
QTR	0.02	0.02	0.10**	0.09**	0.10**	0.09**
SAU	0.03	0.02	0.10***	0.08***	0.10***	0.07***
N	1410	1810	1410	1810	1410	1810
R^2	0.22	0.20	0.21	0.18	0.21	0.18
F-stat	15.41***	17.50***	14.06***	15.34***	14.07***	15.33***
Chi-sq	358.63***	411.40***	330.75***	365.39***	330.81***	365.09***

The coefficients are obtained from the panel regression estimation method. The dependent variable is firm inefficiency estimated from the first stage regression model. The extent to which firms are involved with financial institutions is measured by firms' leverage (*LEV*) and interest payments (*INT*). Other independent variables include: firm's operating cash flows (*OCF*), asset turnover (*AT*), net margin (*NM*), sales growth (*GR*), future investment opportunity (*INVOPP*), and firm size (*SIZE*). 2001 is the base year, energy is the base industry, and the United Arab Emirates is the base country. Individual sample years from 2002 to 2010 are defined as *YR2*, *YR3* and so forth. Industry dummy variables include: *CONS* (Construction), *FOOD* (Food), *MNG* (Manufacturing), *SERV* (Services) and *TOUR* (Tourism). Country dummy variables are: *BAH* (Bahrain), *KUW* (Kuwait), *OMN* (Oman), *QTR* (Qatar) and *SAU* (Saudi Arabia). ***, ** and * imply the significance of each coefficient/statistic at the 1%, 5%, and 10% level, respectively.

Assessing the Impact of Private Sector Credit on Economic Performance: Evidence from Sectoral Panel Data for Kenya

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Abstract

Despite the growing literature on financial development-economic growth nexus, there is paucity of empirical studies that explore the impact of access to credit and economic performance at the sectoral country level, as an increasing number of studies largely focus on cross-country analyses. This paper investigates the impact of access to bank credit on the economic performance of key economic sectors using sectoral panel data for Kenya. We find a positive and significant impact of credit on sectoral gross domestic product measured as real value added. However, the magnitude of the impact is smaller once factors such as the labour employed and past economic performance of the sectors are taken into account. Policies aimed at financial sector deepening and increasing access to credit are of essence to enhancing economic performance. Such policies should, however, be complemented with strategies that enhance efficiency of the key sectors of economy.

Keywords: Credit, Economic performance, Economic sectors, Finance, Growth

1. Introduction

The role of financial sector in promoting economic growth is well acknowledged, dating back to the early economists like Schumpeter (1911) who strongly argued in support of finance-led growth. Financial sector plays a key role in channelling savings into productive investment, especially in the formal sectors of the economy. The banking sector in particular is well recognised as a key conduit for financial intermediation in the economy. Access to credit enhances the productive capacity of businesses. Businesses and enterprises with adequate financial access have greater potential to grow. Studies have shown that a number of business enterprises in Africa, particularly the small and medium manufacturing firms are credit-constrained (Bigsten et al., 2000; Loening et al., 2008; Soderbom, 2000).

Although the literature regarding the role of financial development on economic growth has grown rapidly in recent times, studies that examine bank credit or access to private sector credit and how it impacts on the economic

performance of industries or economic sectors (Note 1) have been overshadowed by the increasing number of empirical studies that largely focus on financial development and growth at the cross-country levels. In a survey of recent literature on finance and growth, Ang (2008) observes that although these studies have contributed to the understanding of finance-growth nexus, the results are subject to a number of criticisms, such as failure to account for the significant differences among countries and hence, points to the need for country-specific studies to inform the policy debate. Moreover, whereas broad measures such as broad money (to Gross Domestic Product (GDP)) are often used as a proxy of financial development, they can conceal the real effects of finance on growth since not all the money is channelled or used for investment. That notwithstanding, most studies provide evidence of a positive effect of finance or financial market development on economic growth (Jayaratne and Strahan 1996; Rajan and Zingales 1998; Guiso et al., 2004; King and Levin 1993). King and Levin (1993) for example, find a positive effect of finance on economic growth based on cross country growth regressions using data for 77 countries. However, a re-examination by Favara (2003) of the analysis by Levine, Loayza and Beck (2000) indicate a weak effect at best. Using time series analysis, Hondroyiannis et al (2005) find a bilateral causal relationship between financial development and economic growth for Greece. The recent work of Demirguc-Kunt and Levin (2008) in a review of the various analytical methods used in finance literature found strong evidence that financial development is important for growth. Lately, empirical work linking banking sector developments to real activity using indicators such as bank credit has started growing out of the broad literature documenting the relationship between financial development and economic growth (see Beck and Levine (2001) for instance). In attempt to improve upon measurements used in cross-country studies on finance and growth, Beck and Levine (2001) measure bank development as bank credit to private sector divided by GDP. For a detailed review of literature on finance and economic growth, see Trew (2006) and Ang (2008). This paper takes a digression from cross-country studies by using Kenya as a case study to examine the impact of bank credit on the economic performance of key sectors of the economy, i.e. sectoral GDP measured as real value added. The sectors include agriculture, manufacturing, building and construction, transport and communication, wholesale and retail trade and hotels and restaurants. Although Kenya's vision of becoming "a globally competitive and prosperous country" by 2030 is pegged on the economic success of these sectors (Republic of Kenya 2007), one of the constraints to sectoral growth has been hailed to be inadequate access to credit. Credit provision is, thus, expected to play a role as the country forges forward with the realization of its development objectives.

2. An Overview of the Banking Structure and Trends in Bank Credit to Private Sector

2.1 Structure of the Banking Sector

A significant portion of credit in Kenya is extended through the banking system, though there are some other institutions such as savings and credit cooperative societies, finance companies and micro finance institutions that provide credit, mainly targeting small and micro enterprises. However, availability of data for the latter is very limited. The rest of this section explores the developments in Kenya's banking sector.

The banking sector is made up of 44 institutions comprising of 42 commercial banks, 2 mortgage finance companies. In terms of ownership, about 79.5 percent are locally owned while the rest are foreign owned. In 2010, the total net assets for local private institutions constituted 54.7 percent while the local public institutions and foreign institutions constituted 5.3 percent and 40.0 percent of the total assets, respectively.

The banking sector recorded an impressive growth in tandem with improved economic activity after 2003, with return on assets of 3.6 percent in 2010 from 0.5 percent in 2000 (Table I). The improvement in profitability was attributed to an increase in income streams, boosted by the increase in the level of economic activities. This was coupled with the decline in the industry's stock of non-performing loans. The banking sector is one of the few sectors that remained resilient to the effects of the post-December 2007 general election violence and the global financial crisis, registering annualised profit after tax to average asset ratios (profitability ratios) of 2.8 percent, 2.9 percent and 3.6 percent in 2008, 2009 and 2010, respectively. However, the distribution of profits remained skewed with four major banks accounting for over 60 percent of the total pre-tax profits in the industry.

Insert Table 1 Here

On the other hand, growth in private sector credit from the banking sector declined from 26.7 percent in the year to December 2008 to 13.9 percent in 2009 but rose in 2010 to 20.3 percent. Asset quality as measured by the ratio of net non-performing loans to gross loans improved from 9.2 percent in December 2008 to 6.3 percent in 2010.

In terms of capital, the banking sector is well capitalized, mainly on account of fresh capital injection and retention of profits. Capital adequacy in the sector, as well as liquidity has been strong for most of the years. The high liquidity is a reflection of the sector's preference for liquid assets notably risk free government securities. The commercial banks maintained an average liquidity ratio of 51 percent in 2010, way above the minimum requirement

of 20 percent. Holding other factors constant, the banking sector is therefore, well placed to provide sufficient credit to spur economic growth.

2.2 Trends in Bank Credit to the Private Sector

There has been a significant rise in bank credit to the private sector relative to public sector credit, particularly since 2003 (see Figure I). The proportion of private sector credit relative to public sector credit increased particularly since 2003. For instance, private sector accounted for 80 percent and 76.5 percent of total credit in 2008 and 2009, respectively. A further decomposition of private sector credit into credit for businesses (private enterprises) and private households shows that the later has increased rapidly (from 3 percent in 1997-1999 to 13 percent of total private sector credit in 2009), mainly on account of stiff competition within the industry that saw an expansion of a range of credit products including personal unsecured loans. That notwithstanding, at 27 percent of GDP, bank credit to the private sector still remain relatively low by international standards. Holding other factors constant, there is still potential for credit growth.

Insert Figure 1 Here

In terms of sectoral allocations, manufacturing sector and the service sector (wholesale and retail trade, restaurants and hotels) accounts for the highest proportion of credit as a percentage of bank credit to the overall private sector, respectively. On the average, the two sectors accounted for a third of the private sector credit in the period 2000-2003 before declining to about 26 percent in 2007- 2009. The share of private sector credit to agriculture declined significantly in 2008 following the effects of the post general election violence that adversely affected the agricultural sector. Credit to transport and communication sector has been on the rise mainly on the account of increased infrastructure and construction activities.

3. Theoretical Framework and Model Specification

The endogenous growth literature underscores the role of finance in promoting long run economic growth and hence, provides a good starting ground for analysing and understanding the impact of credit on economic performance. The usual two factor neoclassical growth model developed by Solow (1956, 1957) and others is extended by incorporating the role of credit. In the finance-growth literature, financial sector services such as credit availability influence economic growth through their impact on capital accumulation and technological innovation (see Levine 1997, Trew 2006). Mackinnon (1973) long argued that whereas a farmer could provide own savings to increase the usage of commercial fertilizer, it was a virtual impossibility of a poor farmer financing from current savings, the total amount needed for investment in order to adopt the new technology. Greenwood and Jovanovich (1990) observe that financial institutions produce better information, improve resource allocation (through financing firms with the best technology) and thereby induce growth. It has also been argued that financial institutions like the banking sector are much better placed to evaluate prospective entrepreneurs and hence, likely to finance the promising ones thereby increasing the probability of successful innovation which accelerate economic growth (King and Levine, 1993).

Assuming a Cobb-Douglas production function

$$Q_{it} = A^{\lambda} K_{it}^{\alpha} L_{it}^{\beta} \tag{1}$$

where Q_{it} =real output for industry i at time t; K_{it} = capital stock for industry i, time t ; L_{it} = units of labour utilized by industry i at time t; α, β represent the factor share coefficients whereas λ allows for factors changing the efficiency of the production process. We assume that the technical efficiency of the production process is correlated with availability of credit, implying that the parameter A in the production function varies with credit access. Access to credit help boost the rate of technological innovation and hence output (Trew 2006). In other words, credit constraints limit business expansion and can constrain production processes to economically inefficient scales.

From the foundations of profit-maximization, a firm or industry will employ labour and capital such that the marginal revenue product of labour (MRP_L) equals the wage (w) and the marginal revenue product of capital (MRP_K) equals the user cost (c). Marginal products of labour and capital are derived by differentiating equation (1) with respect to labour and capital respectively. These are then multiplied by unit price (p) to obtain MRP_L and MRP_K as below

$$MRP_L = p\beta A^{\lambda} K^{\alpha} L^{\mathrm{B}-1} = w \tag{2}$$

$$MRP_K = p\alpha A^{\lambda} K^{\alpha-1} L^{\beta} = c \tag{3}$$

Solving this system simultaneously for K allows us to eliminate capital from the expression for output in equation (1). The resultant expression is given below as

$$Q_{it} = A^{\lambda}\left(\frac{\alpha L_{it}}{\beta}\frac{w}{c}\right)^{\alpha} L_{it}^{\beta} \tag{4}$$

By taking logarithms we obtain

$$\ln Q_{it} = \theta_0 + \theta_1 \ln A + \theta_2 \ln L_{it} \tag{5}$$

where $\theta_0 = \alpha\left(\ln\left(\frac{\alpha}{\beta}\right) + \ln\left(\frac{w}{c}\right)\right)$

$$\theta_1 = \lambda$$

$$\theta_2 = \alpha + \beta$$

A is assumed to vary with credit accessed. Letting credit to be denoted by CRDT, the basic estimable equation is specified below (Note 2)

$$\ln Q_{it} = \phi_0 + \phi_1 \ln L_{it} + \phi_2 \ln CRDT + \phi_3 R_t + S_i + \varepsilon_{it} \tag{6}$$

Where Q_{it} = real output measured as value added (real GDP) of sector or industry *i* in year *t,* L_{it} = employment, i.e. labour employed by sector *i,* year *t,* S_i = sector-specific effects capturing the impact of unobservable effects, while R= real interest rate (i.e. lending rate) at time t, which is included to capture constraints to borrowing. It is time-specific but same for all sectors. ε_{it} is the error term. In an empirical analysis of the impact of agriculture credit on economic growth in Nigeria, Enoma (2010) finds credit and interest rate to be some of the important factors in influencing economic growth in Nigeria. We also control for labour as a fundamental factor of production particularly in the Kenyan context where most of the entrepreneurial or production activities such as agricultural production are labour intensive. Credit is measured in real terms. All variables are in natural logarithms except the interest rate. We expect a positive impact of private sector credit and labour on real sectoral GDP and a negative effect with respect to interest rate. The cross sections constitute seven sectors which account for over 60 percent of the GDP, out of which agriculture contributes about 25 percent of the GDP (Note 3). The time series are for the period 1998 to 2010.

4. Methodology

To assess the impact of credit accessed by different economic sectors on their economic performance, we employ panel data estimation methodology. The oft-touted power of panel data derives from their theoretical ability to isolate the effects of specific actions, treatments, or more general policies (Hsiao 2003). Ignoring the time-specific or sector-specific unobserved (omitted) effects that exist among sectors in the conventional time series and cross-sectional studies on financial development and economic growth leads to biased or misleading results. The basic assumption of the fixed and random effects models is that, conditional on the observed explanatory variables, the effects of omitted (excluded) variables are driven by (1) individual time-invariant such as individual-industry management style and ability, efficiency, or other technical differences between sectors; (2) period individual-invariant—variables that are same for all firms at a given time but that vary through time. These are variables that reflect general conditions affecting the productivity of all sectors but that are fluctuating over time (such as weather in agriculture production). The third class is individual time-varying. Ideally, such sector-specific and time-effects variables should be explicitly introduced into the equation or specification.

The central assumption of random effects model is that the sector-specific effects (random effects) are uncorrelated with the explanatory variables. This assumption is tested using Hausman test. The fixed-effects estimates are calculated from differences within each sector across time. We also note that in most economies especially African economies, past or previous performance tends to influence current economic performance. Hence, for robustness, we also estimated a dynamic panel model with lagged dependent variable using Generalised Method of Moments (GMM) albeit keeping in mind the limited size of the sample. GMM is best suited in dealing with the endogeneity issues and is convenient for estimating extensions of the basic unobserved effects model (Wooldridge 2001).

5. Empirical Results and Discussion

To assess the impact of credit, we start with a simple, basic model with credit accessed as the only explanatory variable (model 1). In model 2, we control for labour (employment level) in each sector and in model 3, interest rate is added. One-way error component model regression results for both fixed effects and random effects as well as the GMM results (model 4) are reported in Table 2. In model 3a, we report the results for Seemingly Unrelated Regression (SUR) fixed effects model, which allow for contemporaneous effects between the sectors (i.e. the error terms are assumed to be contemporaneously correlated). This is a more intuitive case since the sectors face more or

else similar shocks. For robustness, the two way error component model results (model 2) are also reported in Table 3. Cross-section heteroskedasticity and correlation among the variables are common problems in panel data. To ensure validity of results, the reported results were obtained by estimating a feasible generalised least squares specification correcting for both cross-section heteroskedasticity and contemporaneous correlation where possible.

Insert Table 2 Here

The empirical results (both random and fixed effects models) indicate that access to credit has a statistically significant and positive impact on sectoral GDP. However, the magnitude of the impact is reduced from 0.30 to 0.19 when we control for labour employed. We further observe that when we control for the influence previous economic performance has on current performance using GMM, the impact of credit is statistically significant but drastically reduced (0.04). Nonetheless, the findings support the positive impact of credit on economic performance often reported in the literature (Abu-Bader and Abu-Qarn 2008; Rajan and Zingales 1998; Guiso et al., 2004 among others), though the impact is smaller. The other variables have the expected signs though the labour variable turned out to be insignificant when real interest rate was added while at the same time controlling for heteroskedasticity. However, the fixed effects SUR model (model 3a) which intuitively captures the effects of correlation between sectors shows all the variables as being highly significant.

Since the cross-sections (sectors) are few, we also reported the fixed effects. In all cases, the results consistently show that there are some unobserved or excluded factors that enhance the effect of credit on economic performance in agriculture, manufacturing, transport and communication and service (wholesale and retail trade, hotels and restaurants) sectors. These could be the quality of managerial or technological skills or other factors that enhance efficiency in those sectors. Agricultural sector accounts for a quarter of the GDP followed by manufacturing sector. The performance of these sectors is thus critical to the performance of the entire economy. On the other hand, there are certain factors associated with building and construction, electricity and water and mining and quarrying that inhibit the economic performance. The F-test statistic for validity of the fixed effects model was found to be highly significant implying the fixed effects model is valid. The Hausman test was also undertaken but was not highly significant—the validity of Hausman test in small samples is however questionable.

The results of the two-way error component model allowing the unobservable effects to vary both across sectors and time period (fixed effects model) or be random across sectors and periods (random effects) as reported in Table 3 corroborate the results reported above. The impact of credit is positive and significant (Note 4). Additionally, period fixed effects shows that there are certain factors or measures undertaken, which consistently enhanced economic performance over time, particularly in the period from 2005 to 2010. This relates to the period that saw a number of policy strategies and reforms in revamping economic growth after the National Rainbow Coalition (NARC) government came into power in 2004. These included economic, institutional and governance reforms aimed at enhancing productivity to spur growth.

Insert Table 3 here

6. Conclusion and Policy Implications

Despite the growing literature on financial development and economic growth, empirical studies that divulge into how access to bank credit impacts economic growth at the country or sectoral level are scant. Using sectoral panel data, the paper makes a contribution by investigating the relationship between access to credit and sectoral economic performance (i.e. sectoral GDP) in Kenya. In particular, we employ panel data estimation, specifically the fixed-effects approach to capture sector-specific effects, which if correlated with the explanatory variables, can lead to inconsistent or misleading estimates. Failure to control for fixed effects in purely time series-based studies can lead to biased or misleading results.

In general, there has been a rise in bank credit to private sector in the recent past. More importantly, the empirical results show a positive impact of credit on sectoral GDP, consistent with other findings in the literature. However, the magnitude of the impact is smaller when other factors such as labour and past economic performance of the sectors are controlled for. The fixed effects model also shows that there some unobserved factors that enhance economic performance of key sectors such as agriculture, manufacturing, transport and communication and service sectors.

Overall, provision of private sector credit to key economic sectors of the economy holds great potential to promoting sectoral economic growth. The banking sector, which is the main source of credit to the private sector, is an important channel of financial intermediation through which financial resources can be mobilised for productive investment needed for the realisation of the high economic growth path envisaged under vision 2030. Consequently, policies towards deepening of the financial sector and reducing the cost of credit which is currently considered to be

high are important (Note 5). Such policies should, however, be accompanied with other complementary strategies that enhance productivity and consequently growth of key sectors of economy such as manufacturing and agriculture.

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Notes

Note 1. 'Industries' and 'sectors' are used interchangeably in the paper

Note 2. Given we are dealing with real output, w/c is eliminated from the estimable equation by assuming the wage/user cost variations across firms can sufficiently be captured by the fixed effects.

Note 3. The sectors considered were those with same classification under GDP activities, credit to private sector and sectoral employment.

Note 4. Estimation with variables in growth rates also indicated a positive impact of credit on real growth (results not reported in the paper).

Note 5. The interest rates charged on bank loans in Kenya are still considered high. According to financial sector deepening study conducted in 2006, 68.2 percent of those who had used formal providers as source of credit considered the interest rate charged on loan to be very high.

Table 1. Banking Sector Statistics

	2000	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Capital adequacy[1]	17.6	17.9	17	17.2	17.1	16.8	16.6	19.3	18.9	19.5	20.8
Asset Quality[2]	38.2	39	37.7	33.4	28	24.8	20.2	10.7	9.2	7.9	6.3
Profitability ratio[3]	0.5	1.7	1	2.2	2.1	2.4	2.8	3	2.8	2.9	3.6
Domestic Credit (%)	-8.7	2.1	9	10.9	16.8	4.8	14.9	15.6	22.8	15.7	25.1
Private sector credit (%)	-9.1	-2.4	4.5	6.7	24.7	9.3	14.3	22.6	26.7	13.9	20.3
Liquidity ratio[4]	43.1	45.1	43.4	48.2	45.5	41.7	41.8	44.8	46.4	46.3	51%

Source: Central Bank of Kenya

(1) Measured as a ratio of total regulatory capital (tier 1 and 2) to total risk weighted assets, (2) Measured as a ratio of total non-performing loans to total loans, (3) Measured as a ratio of annualized profit after tax to average assets, (4) Measured as ratio of total liquid assets to net deposit liabilities.

Table 2. Regression Results for Fixed Effects and Random Effects Models

	Fixed Effects				Random Effects			GMM
	Model1	**Model 2**	**Model 3**	**Model 3a**	**Model 1**	**Model 2**	**Model 3**	**Model 4**
Constant	8.08	9.88	9.45	9.67	7.96	9.92	9.5	
	(16.0)***	(11.4)***	(15.6)***	(39)***	(9.34)***	(9.6)***	(10.9)***	
Credit	0.30	0.19	0.20	0.19	0.31	0.19	0.20	0.04
	(6.32)***	(3.35)***	(5.35)***	(11.4)***	(7.68)***	(3.4)***	(	(3.31)***
							7.14)***	
Labour		0.24	0.12	0.13		0.25	0.14	0.02
		(1.77)*	(1.0)	(4.1)***		(2.17)**	(1.22)	(1.07)
Interest rate			-1.12	-0.81			-1.08	
			(-4.8)***	(-5.8)***			(-5.22)***	
Lagged dependent var.								0.98
								(30.6)***
Fixed Effects:								
Agriculture	1.44	1.07	1.28	1.26				
B&C	-0.59	-0.61	-0.58	-0.58				
E&W	-0.22	0.28	-0.04	-0.05				
Manu.	0.27	0.06	0.22	0.23				
M&Q	-1.92	-1.57	-1.81	-1.81				
T&C	0.61	0.54	0.59	0.59				
WHR	0.40	0.21	0.35	0.36				
Adjusted R-Squared	0.97	0.98	0.99	0.99	0.33	0.48	0.60	
Redundant Fixed Effects F-test stat.	395	338	462	5949				
	(0.00)	(0.00)	(0.00)	(0.00)				
Sargan test (Chi^2	Statistic)							74.3
								(0.251)

*** ** * significant at 1%, 5% and 10% significance levels respectively. t values for the coefficients in brackets. P-values for fixed effects F-test and Sargan test statistics in brackets. B&C = Building and Construction; E&W= Electricity and Water; Manu. = Manufacturing; M&Q = Mining and Quarrying; T&C = Transport and Communication; WHR=Wholesale and Retail Trade and, Hotels and Restaurants.

Table 3. Two way component models (fixed and random)

	Fixed	**Random**
	Model 2	**Model 2**
Constant	10.5	10.3
	(22.1)***	(19.3)***
Credit	0.07	0.10
	(2.3)**	(3.79)***
Labour	0.06	0.11
	(1.8)*	(1.5)*
Fixed Effects (cross section):		
Agriculture	1.44	
B & C	-0.52	
E&W	-0.48	
Manu.	0.48	
M&Q	-2.14	
T&C	0.65	
WHR	0.57	
Fixed Effects period		
1998	-0.18	
1999	-0.17	
2000	-0.18	
2001	-0.12	
2002	-0.10	
2003	-0.05	
2004	-0.01	
2005	0.03	
2006	0.08	
2007	0.14	
2008	0.14	
2009	0.18	
2010	0.24	
Adjusted R-Squared	0.99	0.24

*** ** * significant at 1%, 5% and 10% significance levels respectively. t values for the coefficients in brackets. B&C = Building and Construction; E&W= Electricity and Water; Manu. = Manufacturing; M&Q = Mining and Quarrying; T&C = Transport and Communication; WHR=Wholesale and Retail Trade and, Hotels and Restaurants.

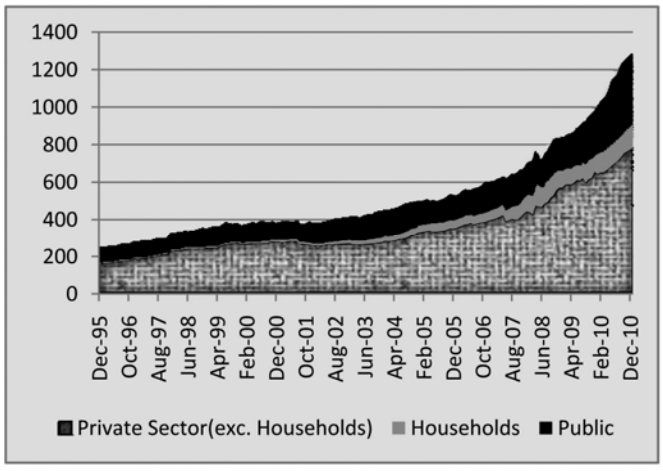

Figure 1. Composition of Credit between public and private sector

Determinants of Capital Structure Empirical Evidence from Financial Services Listed Firms in China

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Abstract

This paper investigates the determinants of capital structure of financial service firms in China. Using a relative regression of accounting data for 36 A-share financial listed companies over the years 2005-2009, an empirical study on determinants of capital structure in financial industry is conducted. The results show that profitability, firm size, non-debt tax shields, earnings volatility and non-circulating shares are significant influence factors in financial sector. Moreover, firm size is positively related to the corporate leverage ratio. It is also found that Chinese institutional characteristic affects the capital choice decision. While it confirmed that capital structure determinant of financial firms are similar to other industry, the largely state ownerships do affect capital structure choices.

Keywords: China, Financial services, Capital structure, Leverage, Financing mix

1. Introduction

Financing and investment are two main activities undertaken by a firm. In the financing decision, the manager is concerned with determining the best financing mix or capital structure for his firm. Capital structure decisions affect a firm in two ways. Firstly, firms of the same risk class could possibly have higher cost of capital with higher leverage. Secondly, capital structure may affect the valuation of the firm, with more leveraged firms, being riskier, being valued lower than less leveraged firms. Thus, capital structure is an important decision for it could lead to an optimal financing mix which could maximize the market price of the firm.

Modigliani and Miller (1958 and 1963) showed that, in theory, without taxes and information asymmetries, capital structure has no impact on firm value. The Modigliani-Miller Theorem proposed that, under perfect market conditions, a firm's financial decisions do not matter. Modigliani and Miller (1958) established the modern theory of capital structure where it stated that a firm's debt-equity ratio does not affect its market value. How a firm choose to finance its investment is irrelevant.

In practice though, capital structure of a firm does matter to the wealth of a firm. Miller (1988) suggested that a firm's value can be affected by financing decisions if (1) different tax regimes exist, (2) information asymmetries between the firm's management and outside investors are present, (3) "real" decisions differ across financing decisions because of agency costs, for example, and/or (4) other frictions, such as costs of financial distress, are introduced. This led to the two famous capital structure theories, the trade-off theory (Scott, 1977) and the pecking order theory (Myers and Majluf, 1984).

Over the years, the gap between theory and practice has narrowed as Rajan and Zingales (1995) concluded "Theory has clearly made some progress on the subject. We now understand the most important departures from the Modigliani and Miller assumptions that make capital structure relevant to a firm's value. The empirical work, Graham and Harvey (2001) echoed this stand, by saying "financial executives are much less likely to follow the academically proscribed factors and theories when determining capital structure".

Most early empirical studies on capital structure focus on firms in the United States and the coverage extended to Europe and Japan in the mid-1980s (Kester, 1986; Rajan and Zingales, 1995; Cornelli et al., 1996). After the Asian financial crisis in 1997, efforts were focused on emerging countries to shed some light on the factors that caused the turmoil in the region. Despite this attempt, there has been limited work done on the Asian region mainly because of the constraints on corporate financial data in the region (Fan and Wong, 2002; Deesomsak et al., 2004; Driffield et al., 2007).

The recent financial crisis of 2008 revealed the importance of capital structure of financial services industry such as banks and financial institutions. Without the optimal capital structure, banks and financial institutions are vulnerable to economic upheavals. During a crisis, fearful clients may withdraw their deposits or capital markets may suddenly become unwilling to roll over an institution's debt and they risk sharp declines in shareholder value or even collapse. This was the fate of Lehman Brothers, Bear Stearns, AIG, Citigroup and Bank of America.

The financial services industry includes firms that deal with the management, investment, transfer and lending of money. Financial institutions actually make money their business; rather than selling a line of physical products, they offer customers their fiscal expertise. The industry itself is very large, encompassing everything from small, local banks to the multinational investment banks regularly featured in news headlines.

This paper investigates the choice of capital structure of financial services companies listed on the two Chinese stock markets. There had been very limited studies performed on this sector especially in China. Most studies focus on the entire firms listed on the stock market or small and medium size enterprises. Since the optimal capital structure mix has been found to differ from industry to industry (Kim, 1997) and also from country to country (Wald, 1999), this paper is motivated to carry out this study on selected financial services firms listed on the Chinese stock exchanges.

This paper is organized as follows: Section 1 describes the modern theories of capital structure; Section 2 provides the literature review of empirical research on capital structure. Section 3 refers to the theoretical framework of capital structure. In Section 4, the current situation of financial industry is discussed. The empirical research and result analysis are presented in Section 5 and 6. Finally, Section 7 concludes the paper with several recommendations.

1.1 Modern Theories of Capital Structure

The MM theory (Modigliani and Miller, 1958) demonstrated that the firm's choice of financing is irrelevant to the determination of its value. They assumed that capital markets are frictionless, individuals can borrow and lend at the risk-free rate, there are no bankruptcy costs, firms issue only two types of claims: risk-free debt and risky equity, all firms are in the same risk class, there is no growth, expectations are homogeneous, there is information symmetry and agency costs are absent.

The trade-off theory (Scott, 1977) claims that a firm's optimal debt ratio is determined by a trade-off between the bankruptcy cost and tax advantage of borrowing. Higher profitability decreases the expected costs of distress and let firms increase their tax benefits by raising leverage. Firms would prefer debt over equity until the point where the probability of financial distress starts to be important. Two versions of the trade-off theories are proposed; static and dynamic trade off.

The static trade-off theory affirms that firms have optimal capital structures which they determine by trading off the costs against the benefits of the use of debt and equity. One of the benefits of the use of debt is the advantage of a debt tax shield. One of the disadvantages of debt is the cost of potential financial distress, especially when the firm relies on too much debt. Already, this leads to a trade-off between the tax benefit and the disadvantage of higher risk of financial distress. But there are more cost and benefits involved with the use of debt and equity. One other major cost factor consists of agency costs. Agency costs stem from conflicts of interest between the different stakeholders of the firm and because of ex post asymmetric information (Jensen and Meckling, 1976 and Jensen, 1986)).

Dynamic trade-off theory states that firms choose their capital structure or leverage ratio by trading off the benefits and costs of debt. In its simplest form, managers of firms are continuously optimizing the leverage ratio as to maximize the value of the firm. Dynamic trade off theory recognized that it is costly to issue and repurchase debt. Firms whose leverage ratios do not coincide with their targets will only adjust their capital structure when the benefits of doing so outweigh the costs of adjustment. In Fischer et al. (1989) and Mauer and Triantis (1994), adjustment costs imply boundaries on leverage beyond which it becomes optimal to adjust capital structure. Both of these models hold investment policy fixed. They assume that the firm's assets are already in place. Subsequent debt issues are motivated by financial policy alone.

In 1984, Myers and Majluf considered the impact of information sources between insiders and outside investors on the corporation investment and financing behaviors. Retained earnings, as the internal funds, dominated the first place in the corporate financing preference, followed by debt financing and equity financing. Pecking Order theory takes account of the asymmetric information and the existence of transaction costs. Since internal funding does not incur any transaction costs, companies prefer internal financing to minimize financing cost. From the asymmetric information perspective, managers, as the insiders, access more relevant and reliable information about firms than the less informed outside investors. With the information advantage, managers, if acting in the best interests of

existing shareholders, tend to have more opportunistic behavior by issuing bonds to avoid adverse signaling information of issuing equity. This theory is usually regarded as a competitor to the Trade-off theory.

Baker and Wurgler (2002) suggested a new theory of capital structure: the "market timing theory of capital structure". This theory argues that firms time their equity issues in the sense that they issue new stock when the stock price is perceived to be overvalued, and buy back own shares when there is undervaluation. Consequently, fluctuations in stock prices affect firms' capital structures. They find that leverage changes are strongly and positively related to their market timing measure so they conclude that the capital structure of a firm is the cumulative outcome of past attempts to time the equity market.

2. Literature Review

Before the celebrated paper of Modigliani and Miller in 1958, traditional view on capital structure lack the theoretical basis for making direct assumptions about the nature of the costs of debt/equity.

The MM theory was revolutionary and it changed market view forever. Although MM theory will not stand in a practical world which is obviously not perfect, it became a foundation for serious development of the currently popular capital structure theories such as Trade-off Theory, Static Trade-Off theory, Dynamic Trade-off Theory, Pecking Order and Market Timing Theory.

Previous studies of capital structure determinants have found that corporate financial leverage is closely related to the business characteristic (Titman and Wessels, 1988; Harris and Raviv, 1991). Bank leverage have positive correlation with fixed assets, non-debt tax shields, future investment opportunities and firm size, but negatively correlated with earnings volatility, profitability, uniqueness, bankruptcy probability and advertising expenditure. The levels of bank capital are much higher than the regulatory minimum (Barth et al. 2005; Berger et al. 2008; Brewer et al. 2008).

Rajan & Zingales (1995) found similar levels of leverage across the G7 group of countries. This is a surprising result because it has been usually asserted that firms in bank oriented countries are more levered than in market-oriented countries. They also show that the determinants of the capital structure that have been previously reported for U.S. data are equally important in other G-7 countries.

The determinants of capital structure choices are such as agency signaling costs (Heinkel, 1982; Poitevin, 1989), bankruptcy (Ross, 1977), taxes (Leland and Toft, 1996), institutional and historical characteristics of national financial systems (La Porta et al., 1997, 2006; Rajan and Zingales, 2003) but the understanding of the determinants of national and international capital structure is still limited and vague (Aggarwal and Jamdee, 2003).

Banks may be optimizing their capital structure, possibly much like non-financial firms, which would relegate capital requirements to second order importance. Flannery (1994), Myers and Rajan (1998), Diamond and Rajan (2000) and Allen et al. (2009) develop theories of optimal bank capital structure, in which capital requirements are not necessarily binding. Non-binding capital requirements are also explored in the market discipline literature. Based on the market view, banks' capital structures are the outcome of pressures emanating from shareholders, debt holders and depositors (Flannery and Sorescu, 1996, Morgan and Stiroh, 2001, Martinez Peria and Schmuckler, 2001, Calomiris and Wilson, 2004, Ashcraft, 2008, and Flannery and Rangan, 2008).

Brunnermeier et al. (2008) also conceptually distinguish between a regulatory and a market based notion of bank capital. When examining the roots of the crisis, Greenlaw et al. (2008) argue that banks' active management of their capital structures in relation to internal value at risk, rather than regulatory constraints, was a key destabilizing factor.

3. Capital Structure Research in China

Capital structure has been the core issue of a large number of corporate finance researches. The majority of the above empirical studies have been restricted on the United States and other developed Western countries. Generally speaking, the history about empirical research on the determinants of capital structure in Western countries is much longer than the domestic. In domestic research arena, Chen (2004) and Huang and Song (2006) are notable studies to assess the capital structure theories in Chinese listed companies. Evaluating the explanatory power of capital structure theories in China is important because China is the largest developing and transitional economy in the world.

Although Booth et al. (2001) have done research in developing countries, those countries using market-based economic models that are similar to developed countries. Chen (2004) provides the first study to examine whether and how the determinants of capital structure investigated in Western countries are also feasible in Chinese economy, where using firm-level panel data of 77 Chinese non-financial listed companies from the year 1995 to 2000. The

methodology and determinants of the research refers to previous studies. Chen (2004) reports that the modern theories of capital structure, such as the trade off theory and the Pecking order hypothesis, are less applicable to the financing choice of Chinese firms. Due to the transitional nature and distinctive institutional features of publicly listed corporations, it seems to appear a new Pecking order for financing in Chinese firms. Internal fund is still the first consideration, then equity financing and lastly long-term debt. Chen (2004) finds that financial leverage in Chinese firms decreases with profitability and it is consistent with existing literature. Additionally, growth opportunities and tangibility are positively related to debt in China.

Huang and Song (2006) exercise a new data set of both market and accounting value to analyze the capital structure models in more than 1000 Chinese listed companies over the period 1994-2000. In their research, they indicate the same findings as Booth et al. (2001) that firms in developing countries tend to have lower long-term debt. Moreover, 'as in other countries, leverage in Chinese firms increases with firm size, non-debt tax shields and fixed assets and decreases with profitability and correlates with industries'. However, results different from others is that debt in Chinese firms have a negative relationship with earnings volatility.

Qian et al. (2007) have examined the six determinants of capital structure for Chinese listed companies over the period of 1999-2004. The static panel-data models showed that firm size, tangibility and state ownership are positively related with firm's leverage ratio. However, factors such as profitability, non-debt tax shields and volatility have a negative relationship with the leverage ratio.

3.1 Determinants of Capital Structure

3.1.1 Profitability

Profitability measures the effectiveness of the business in generating profits. According to the capital structure theory, Myers and Majluf (1984) demonstrated that firms have a pecking order in funding their activities and they prefer internal finance to external finance. This theory predicts that the relationship between profitability and leverage is negative. Generally, firms with higher profitability tend to create more capital flow to enterprises and then the sufficient retained earnings internally generated could be utilized as internal finance. In this process of funding, companies can reduce the amount of debt financing and corresponding decrease the leverage level. In the empirical research, Kester (1986) finds the negative relationship between leverage and profitability in US and Japan. Titman and Wessels (1988) also confirmed the findings from US firms. Rajan and Zingales (1995) studied the G-7 countries, Wald (1999) analyzed the developed countries, Booth et al. (2001) for developing countries and Huang and Song (2006) investigated in China, also find that profitability is negatively related to leverage.

However, the signaling theory predicts the different opinion that profitability and financial leverage is positively correlated. The higher leverage indicates the good performance of business, thus managers and investors are more confident about future operation. Jensen (1986) pointed out that the relationship is likely to be positive and Titman and Wessels (1988) predicted that larger firms may tend to have a higher debt capacity. As the relationship between profitability and leverage is ambiguous, it is better to test the validity between them.

In this study, return on assets (ROA) will be used as the proxy for profitability followed by Titman and Wessels (1988); it is defined as earnings before interest and tax divided by total assets.

3.1.2 Asset Tangibility

Tangible and intangible assets are the main component in enterprise assets. Most of the empirical researches confirm that the tangibility of assets affect the firms' financial leverage. Based on the agency cost theory created by Jensen and Meckling (1976), there is a positive relationship between the fraction of tangible assets and leverage. There is a potential conflict of interests between shareholders and lenders that creditors tend to undertake more risks when shareholders make sub-optimal investment decision. Therefore, lenders have incentives to acquire tangible assets of companies as collateral to diminish their risks (Harris and Raviv, 1991). An enterprise with a high proportion of fixed assets is expected to be associated with high ability to repay their liabilities, thus more opportunities to raise debt financing. Both the theoretical prediction and academic research (Long and Malitz, 1985; Rajan and Zingales, 1995; Wald, 1999; Huang and Song, 2006) have shown that asset tangibility is positively associated with leverage.

The ratio fixed assets over total assets will be the indicator of asset tangibility in this paper. The measurement is same as Rajan and Zingales (1995).

3.1.3 Firm Size

According to the trade-off theory, the relationship between firm size and leverage is expected to be positive. Larger firms turn out to be more diversified than smaller firms; therefore it is less prone to the risk of default. Harris and Ravivs (1991), Rajan and Zingales (1995), Wald (1999), and Booth et al. (2001) provide evidence to support that

large firms are highly leveraged. Moreover, the cost of debt and equity financing is negatively associated with firm size. Large firms are likely to reduce the transaction costs of issuing long-term liabilities (Chen, 2004). Marsh (1982) suggests that large firms usually prefer long-term debt issuance while the small choose the short term. However, Rajan and Zingales (1995) state that if size can be an inverse indicator for the probability of bankruptcy, for countries with low costs of financial distress, the correlation between firm size and leverage is not significantly positive.

Size may also relate to the informational asymmetries between insiders and outside investors. Larger firms tend to disclose more information about their business to the public than smaller companies (Fama and Jensen, 1983; Rajan and Zingales, 1995). Based to the Pecking order hypothesis, the relationship of firm size to total debt is negative. Frank and Goyal (2002) also find that large firms tend to follow the pecking order. Titman and Wessels (1988) confirm the negative link between firm size and the level of gearing.

As with Chen (2004), natural logarithm of total assets will be the proxy for firm size in this paper.

3.1.4 Non-debt Tax Shields

According to Modigliani and Miller (1958), the interest of debt can be treated as expenses to offset the taxation. This interest tax shields give incentives for companies to debt financing. Besides debt, the fixed assets depreciation and investment tax credits are also able to compensate the tax payment. The non-debt tax shields (NDTS) is concerned with the tax deduction for depreciation and investment tax credits. DeAngelo and Masulis (1980) put forward that NDTS could be regard as substitutes for tax benefits of debt financing. As a result, firms with large NDTS are expected to less finance with debt in their capital structure. Wald (1999) confirmed the prediction that leverage is negatively correlated with NDTS. Chen (2004) also found the negative relationship but not statistically significant.

However, Titman and Wessels (1988) do not find any evidence to support the relationship between NDTS and leverage. Huang and Song (2006) conducted the empirical research in China found that non-debt tax shields are positively related to firm leverage, which is consistent with the result of Bradley et al. (1984).

In this study, the ratio of non-debt tax shield will be defined as depreciation divided by total assets.

3.1.5 Growth Opportunities

Theoretically, expected future growth is considered to be negatively associated with leverage. According to the trade-off theory, firms with growth potential of more intangible assets, which cannot be collateralized, are likely to issue fewer debts than firms with more tangible assets (Chen, 2004). In addition, Myers (1977) argued the negative relationship between growth and leverage from the perspective of agency costs. Firms with greater growth potential have more flexibility to have sub-optimal behaviors, thus transferring the wealth from debt holders to shareholders. The conflicts between shareholders and creditors result in high agency costs, for this reason, it also suggests the negative relationship. Furthermore, Myers (1997) illustrated that the agency problem can be mitigated if firms issue short-term debt instead of the long-term bond. The findings of Titman and Wessels (1988), Rajan and Zingales (1995) confirmed that firms with high future growth turn out to use less leverage.

However, the pecking order hypothesis predicts that firms with growth prospects tend to occupy more leverage. Firms with higher growth opportunities indicate the greater demand of capital, thus external fund is preferred through debt financing. The signaling model also suggests the positive prediction. Chen (2004) found growth potential is positively related to debt in China. Titman and Wessels (1988) used the percentage change of total assets as a proxy for growth. In this research, the same indicator for growth opportunities is applied.

3.1.6 Earnings Volatility

Earnings volatility can reflect the corporate business risk. It is generally a proxy for the probability of financial default (Titman and Wessels, 1988). Since leverage increases the risk of financial distress, it is expected that earnings volatility is negatively related with leverage. As Qian et al. (2007) demonstrated, when firms have high volatility, cash will be accumulated during the flourishing period to avoid future underinvestment and thus the negative relationship is advocated from the pecking order hypothesis. Although Hsia (1981) found a positive relationship, Wald (1991) and Booth et al. (2001) showed that business risk is negatively correlated with debt.

In this paper, the standard deviation of return on assets suggested by Booth et al. (2001) is used to measure the earnings volatility.

3.1.7 Ownership Structure

According to the agency theory, Jensen and Meckling (1976) described that total agency costs could be minimized by the optimal structure of leverage and ownership. Though ownership structure is believed to have influence on capital structure, no clear predication is concerned with the relationship related to debt level (Huang and Song,

2006). Leland and Pyle (1977) suggested that 'leverage is positively correlated with the extent of managerial equity ownership' but Friend and Lang (1988) provided opposite results.

Ownership structure is one of the most significant institutional differences between China and the Western countries. After reform of state-owned enterprises (SOE) in China, most of Chinese listed companies are still under the control of the state and intervened by government. This phenomenon directly affects corporate financial leverage.

In China, most shares are non-circulating, including state-owned shares and legal person shares. From the perspective of state-owned shares, firms with more state-owned shares are more likely to obtain support from the state, but the criteria of issuing equity is difficulty for financial listed firms to achieve; therefore, debt financing is employed. The principal of legal person shares usually focus on the long-term development of business. As a result, they have a preference for high leverage (Xu, 2010). Theoretically, firms with more non-circulating shares (NCS) tend to have higher leverage ratio.

In this study, the percentage of non-circulating shares, followed by Qian et al. (2007), is the indicator for the ownership structure of financial listed firms.

4. Methodology

4.1 The Model

Since the 36 Chinese public listed firms from financial industry over the year of 2005-2009 are the sample, the basic regression model can be formulated as follows

$$Y_{it} = a + X_{it}^{'}\beta + \alpha_i + \varepsilon_{it}, i = 1,2,.....,36; t = 1,.....,5$$

In this model, Y_{it} (LEV and LLEV) represent the leverage ratio of firm i in year t, a is the constant term, $X_{it}^{'}$ is a 1×7 vector of observations on seven explanatory indicators. Specifically,

$$X_{it}^{'} = (PROF_{it}, TANG_{it}, SIZE_{it}, NDTS_{it}, GROWTH_{it}, EVOL_{it}, NCS_{it}).$$

In addition, β is a 7×1 vector of parameters, α_i is the unobserved firm specific effect, and ε_{it} is the unobserved zero-mean error term. Definition of variables is found on Table 13.

4.2 Data

In this empirical research, the China Stock Market and Accounting Research Database (CSMAR) are applied as the main data source. CSMAR was developed by the Shenzhen GTA Information Technology Co., Ltd which recorded all the trading and financial information from Shanghai Stock Exchange and Shenzhen Stock Exchange.

4.3 Selection of Sample

Initially, all industries of listed companies classified by China Securities Regulatory Commission (CSRC) should be considered in this project. However, the corporations in financial and non-financial industry have different capital structure. Moreover, due to its particularity as well as few empirical studies of financial sector, this study takes all Chinese listed companies in financial industry as samples. This research analyzes a sample consisting of 36 A-share listed firms in financial sector traded on the Shanghai and Shenzhen Stock Exchange over the period of 2005-2009, including banks, insurance and investment companies. All the accounting data are from the CSMAR database over the period of five years. Based on the firms' financial statements and annual reports, the year-end data will be selected.

5. Empirical Results and Analysis

Using the method of multiple linear regressions, all independent variables are entered into the regression simultaneously. To verify the accuracy of the following obtained results, the method of stepwise is also applied. Similar results are obtained from these two approaches.

5.1 Comparison of Models

Model 1 is to test the relationship between total leverage (LEV) and 7 different explanatory variables. The summary results of Model 1 are reported in Table 7 and Table 8.

It can be seen from the Table 7 that the R Square=0.725 and the Adjusted R Square=0.713. It indicates that the goodness of fit index in model 1 is fairly good and the independent variables have strong explanatory power to the dependent variable (LEV). In the ANOVA table 8, F value is equal to 64.627, which is greater than the critical value and p-value = 0<0.05 implies that the overall model is reasonable. In general, the relationship between financial leverage and independent variables is significantly linear.

Model 2 focuses on the long-term leverage (LLEV) with the same independent variables as in model 1. In Model 2, the R Square is only 0.121 and the Adjusted R Square is 0.085. The R Square is extremely low although the F value (3.378) and p-value (0.002) reveal that the model is significant at a 5% critical value.

5.2 Regression Results

The regression results are reported in following Table 11 for Model 1 and Table 12 for Model 2.

These two models can be rewritten as following equations (only including significant variables) :

$$LEV = -0.060 - 0.349 * PROF + 0.084 * SIZE - 3.945 * NDTS - 0.493 * EVOL - 0.076 * NCS + \varepsilon$$
$$LLEV = 0.187 - 0.013 * SIZE - 1.642 * NDTS + \varepsilon$$

The empirical results obtained suggest that the coefficients of profitability, firm size, non-debt tax shields, earnings volatility and non-circulating shares are significant for total leverage at 5% level (Table 11 and Equation 1). However, the coefficients of firm size and non-debt tax shields are significant through the t-test for long-term leverage regression (Table 12 and Equation 2). These two models offer different results in total and long-term leverage regressions. The most considerable one is that the coefficient of size is negative in long-term debt ration while positive in total leverage estimation. The coefficients of size are both significant in these two models, it can be concluded that large firms prefer short-term finance than long-term one, which is consistent with the results of Chen (2004). Overall, the outstanding difference between capital choices of financial industry in China and the Western countries is that Chinese firms prefer short-term debt financing and have a substantially lower amount of long-term one.

5.3 Results Analysis

Focusing on the significant independent variables, it is discovered the following relationships between explanatory variables and leverage levels.

1. There is a negative relationship between profitability and debt level, but not significant in long-term debt.

2. Firm size is positively associated with financial leverage, but negatively related to long-term debt.

3. The relationship between non-debt tax shields and gearing ratio is significantly negative as well as long-term debt ratio.

4. A negative relationship exists between earnings volatility and debt.

5. Non-circulating share is negatively related to leverage.

The negative relationship between profitability and debt in Chinese financial listed companies is consistent with the implication of the pecking order theory and the results found by most prior research, especially Chen (2004) and Huang and Song (2006). As the profitability of financial listed business increase by 1%, the total liabilities ratio will decline by 34.9%. It implies that profitable financial listed firms are less likely to finance with debt. However, as discussed in Section 4.2, the proportion of internal funds within the overall financial industry is substantially lower than external financing. Although retained earnings is the most convenient source of financing, external financing is occupied a leading position in Chinese financial listed companies.

Size is found to have a significant and positive influence on total leverage in financial listed companies. This positive relationship coincides with the prediction of trade-off theory and suggests that larger firms tend to have higher gearing ratios. However, the coefficient of size is significant and negatively associated with long-term debt. As Chen (2004) explained, this negative relationship 'may not be the result of informational asymmetries suggested by Myers and Majluf (1984) because the market capitalization of equity in China is very high'. Xu (2010) also illustrated that the firm size of financial listed companies cannot be a good indicator to measure the level of informational asymmetries in China. Moreover, large firms do not provide more efficient information to the outside. In general, most listed companies in China are state owned and they are not permitted to go bankrupt. Therefore, the negative relationship could be mainly caused by the low bankruptcy costs and the state controlled nature in China.

Non-debt tax shields (NDTS) are estimated to be significantly negative with debt ratio. This result is in line with Chen (2004) but her result is not statistically significant. As mentioned in Section 3.3.4, NDTS could be regarded as substitutes for tax benefits of debt financing, therefore, firms with high level of NDTS will decrease their gearing ratio. In the perspective of long term, an increase in NDTS can affect leverage negatively. It can be predicted that firms are likely to prefer short-term debt when they have high NDTS.

Volatility is found to have a negative impact on corporate leverage ratio, and the coefficient (-0.493) is statistically significant at 5% level. This finding implies that firms with higher volatility as well as higher probability of default

are more likely to have lower gearing ratio. As stated in Section 3.3.3, size can be perceived as the inverse proxy for financial distress, the positive relationship between size and leverage found in this study exactly support the negative relationship referred to volatility and leverage.

It is found that ownership structure has an impact on corporate leverage in Chinese listed companies as predicted. However, the result of negative relationship (-0.076) is inconsistent with the theoretical analysis. In financial industry, firms with higher non-circulating shares tend to have lower total leverage ratio and lower long-term leverage although it is not significant in the long term. This negative relationship is probably because of the problem in corporate governance structure. Since most of the financial listed companies are controlled by the state, it may result in the owner absence and lack of effective management in business. Therefore, managers are more likely to behave on their own interests to pursue lower leverage level.

6. Conclusion

The empirical results show that leverage ratio increases with firm size and decreases with profitability, non-debt tax shields, earnings volatility and non-circulating shares. Although China is still transforming from a command economy to a market-based economy, the determinants of capital structure found in developed countries also have similar influences on Chinese financial listed companies. This illustrates that publicly listed companies in China have followed the fundamental regulations of the market economy.

The most significant institutional characteristic in China is the state controlling ownership, since most of listed companies are still controlled by the state. China's incomplete and immature institutional structure does have an effect on firms' leverage decision. The results of this study also imply that the trade-off theory has limited robust explanatory power for Chinese listed companies. Moreover, the financial listed companies in China seem to follow a different pecking order that external financing is preferred than internal sources, which means debt financing is the priority.

The model has not considered the macroeconomic factors that may affect leverage, so further explore on capital structure choice should include those variables. This study lacks the thorough analysis of China's institutional environment and corporate governance structure, which should be further discussed. Therefore, future research should be carried out to include these factors.

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Table 1. Summaries of Determinants of Capital Structure

In Table 1, the implications and empirical results of the above determinants of capital structure is summarized.

Determinants	Definitions	Theoretical results	Major empirical results
Profitability	Earnings before interest and tax divided by total assets	+/-	-
Asset tangibility	Fixed assets divided by total assets	+	+
Firm size	Natural logarithm of total assets	+/-	+
Non-debt tax shields	Depreciation divided by total assets	-	-
Growth opportunities	Change of total assets ($TA_t - TA_{t-1}$)	+/-	-
Earnings volatility	Standard deviation of the return on assets	-	-
Non-circulating shares	Non- circulating shares divided by total shares	+	+

Note: "+" means that the relationship between the determinant and leverage is positive.

"_" means that the relationship between the determinant and leverage is negative.

Table 2. Percentage of internal and external financing

	Internal Sources	External Sources	
Year	Retained Earnings	Equity Financing	Debt Financing
2005	0.003149	0.037248	0.959602
2006	0.006099	0.044458	0.949442
2007	0.009816	0.049932	0.940251
2008	0.012374	0.045671	0.941955
2009	0.016368	0.037780	0.945853
Average	0.009561	0.043018	0.947421

Source:Data processing from CSMAR

Table 3. The Asset-Liability Ratio of Financial listed companies

Year	Mean value	Maximum value	Minimum value	Standard deviation
2005	0.7685	1.0054	0.1147	0.2529
2006	0.8012	1.2364	0.1514	0.2470
2007	0.8342	1.1371	0.3117	0.1558
2008	0.7992	0.9682	0.2393	0.1707
2009	0.8073	0.9652	0.2536	0.1731
Average	0.8022			

Source:Shanghai and Shenzhen Stock Exchange

Table 4. The quantity distribution of debt ratio during 2005-2009

Year	2005	2006	2007	2008	2009
10%-30%	3	3	0	1	1
30%-50%	2	1	1	1	2
50%-70%	6	6	5	10	5
70%-90%	8	6	14	9	11
90%-110%	17	19	15	15	17
110%-130%	0	1	1	0	0
Sample number	36	36	36	36	36

Source:Shanghai and Shenzhen Stock Exchange

Table 5. Percentage of non-current liabilities

Year	Long-term liabilities/Total liabilities	Long-term liabilities/Total assets
2005	0.063062	0.045669
2006	0.055089	0.040016
2007	0.056748	0.040255
2008	0.049853	0.037400
2009	0.036079	0.025436
Average	0.052166	0.037755

Table 6a. Percentage of non-circulating shares and state-owned shares

Year	Non-circulating shares	State-owned shares
2009	0.402994	0.406621
2008	0.493801	0.312198
2007	0.669151	0.370012
2006	0.646340	0.268464
2005	0.619558	0.169680
Average	0.566373	0.315642

Table 6b. Ownership concentration

Year	Proportion of first shareholding	Proportion of three biggest shareholding
2009	0.336793	0.538301
2008	0.295463	0.505872
2007	0.292108	0.492872
2006	0.366088	0.517777
2005	0.294426	0.438538
Average	0.316976	0.498672

Table 7. Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.851a	.725	.713	.108643783
a. Predictors: (Constant), NCS, EVOL, GROWTH, SIZE, TANG, PROF, NDTS				

Table 8. ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	5.340	7	.763	64.627	.000a
	Residual	2.030	172	.012		
	Total	7.370	179			
a. Predictors: (Constant), NCS, EVOL, GROWTH, SIZE, TANG, PROF, NDTS						
b. Dependent Variable: LEV						

Table 9. Mode2 Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
2	.348a	.121	.085	.049257037
a. Predictors: (Constant), NCS, EVOL, GROWTH, SIZE, TANG, PROF, NDTS				

Table 10. ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
2	Regression	.057	7	.008	3.378	.002a
	Residual	.417	172	.002		
	Total	.475	179			
a. Predictors: (Constant), NCS, EVOL, GROWTH, SIZE, TANG, PROF, NDTS						
b. Dependent Variable: LLEV						

Table 11. Coefficients a

Model		Unstandardized Coefficients		Co linearity Statistics	
		B	Std. Error	Tolerance	VIF
1	(Constant)	-.060	.086		
	PROF	-.349	.100	.455	2.199
	TANG	-.281	.186	.103	9.671
	SIZE	.084	.007	.708	1.413
	NDTS	-3.945	1.805	.101	9.889
	GROWTH	.005	.013	.844	1.186
	EVOL	-.493	.178	.406	2.462
	NCS	-.076	.026	.910	1.099
a. Dependent Variable: LEV					

Table 12. Coefficients

Model		Unstandardized Coefficients		Co linearity Statistics	
		B	Std. Error	Tolerance	VIF
2	(Constant)	.187	.039		
	PROF	-.055	.045	.455	2.199
	TANG	.138	.084	.103	9.671
	SIZE	-.013	.003	.708	1.413
	NDTS	-1.642	.818	.101	9.889
	GROWTH	-.007	.006	.844	1.186
	EVOL	-.025	.081	.406	2.462
	NCS	-.003	.012	.910	1.099
a. Dependent Variable: LLEV					

Table 13. Definitions of variables

Variables	Definitions
Dependent variables	
Total leverage (LEV)	Total debt divided by total assets (TD/TA)
Long-term leverage (LLEV)	Long-term debt divided by total assets (LD/TA)
Independent variables	
Profitability (PROF)	Earnings before interest and tax divided by total assets (EBIT/TA = ROA)
Asset tangibility (TANG)	Fixed assets divided by total assets (FA/TA)
Firm size (SIZE)	Natural logarithm of total assets (Ln(TA))
Non-debt tax shields (NDTS)	Depreciation divided by total assets (Dep/TA)
Growth opportunities (GROWTH)	Change of total assets
Earnings volatility (EVOL)	Standard deviation of the return on assets
Non-circulating shares	Non-circulating shares divided by total shares

Portfolio Value at Risk Bounds Using Extreme Value Theory

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Abstract

The aim of this paper is to apply a semi-parametric methodology developed by Mesfioui and Quessy (2005) to derive the Value-at-Risk (VaR) bounds for portfolios of possibly dependent financial assets when the marginal return distribution is in the domain of attraction of the generalized extreme value distribution while the dependence structure between financial assets remains unknown. However, These bounds are very sensitive to location changes and depend heavily on the actual location. Modified VaR bounds are derived through an extension of the Vermaat, Does and Steerneman (2005) contribution on quantile estimation of large order to a multivariate setting which enjoy the interesting property of location invariance. Empirical studies for several market indexes are carried out to illustrate our approach.

Keywords: Copulas, Extreme value theory, Location invariance, Portfolio value at risk, Dependent risks

1. Introduction

Portfolio managers have to face questions related to extremal events for handling problems concerning the probable maximal loss of investment strategies. As highlighted by the past turbulences in financial markets such as the Russian financial crisis in 1998, the burst of the speculative information technology bubble in 2001, or recently the subprime crisis, extreme price fluctuations may expose at times portfolio managers to high levels of market risk. In this specific context, funds managers have to pay more attention on the distribution of « large» stock returns values and implement suitable risk management tools to avoid big losses. Some funds managers and other market participants have been driven to adopt such quantitative risk management techniques not only in reaction to their own experience of market turbulence, but also because of regulatory climate. Hence, pension funds and insurance companies portfolio managers are not allowed to take high risks and are constrained in their management by some statutory regulatory restrictions, with the aim to ensure diversification for limiting investment risks. Therefore, given the non-Gaussian character of financial returns distributions and in consequence the limitation of the variance as an indicator for describing the amount of uncertainty in their fluctuations, various risk measures have been proposed, such as VaR (Jorion, 1997; Duffie and Pan, 1997). VaR techniques aim to quantify the worst expected loss of a portfolio over a specific time interval at a given confidence level α. In other words, VaR is the highest α-quantile of potential loss that can occur within a given portfolio during a specified time period. Although VaR is widely adopted by the financial community, it has undesirable mathematical characteristics such as a lack of sub additivity and convexity. So that, VaR is not a coherent measure of risk for non-elliptical portfolios (Artzner, Delbaen, Eber and Heath., 1999). Hence, the risk associated to a given portfolio may be greater than the sum of the risks of the individual assets, when measured by VaR. Besides dependence seems to be particularly pronounced during sock market crises, which emphasizes that financial assets become more dependent in the lower tail during extreme market movements (Longin and Solnik, 2001; Ang and Chen, 2002; Cappiello, Engle, and Sheppard 2006). The key feature of measuring the risk of an aggregate position is to accurately depict the underlying dependence structure between the marginal business lines. In the context of elliptical distributions the correlation matrix is naturally used to describe the dependence structure of the individual risks. However, outside the family of elliptical distributions, correlation only might provide partial or misleading information on the actual underlying dependencies (Embrechts, McNeil and Straumann, 2002). Copulas seem to be an interesting alternative for dependence characterization. In

order to estimate portfolio VaR in a classical way, one have to assume a marginal return distribution and a specific dependence structure between the portfolio components by fitting a parametric copulas to data (Mendes and Souza, 2004; Junker and May, 2005; Miller and Liu, 2006). However, this may lead to a model-dependent view of stochastic dependence. A more flexible and reliable approach consists in assessing portfolio risk when there is no information on the asset's dependence structure but only their marginal distributions are known. It is obvious, in this specific framework, of unknown dependence structure, that an explicit portfolio VaR is unreachable but one is interested in finding lower and upper bounds on VaR**.** Recent contributions include (Denuit, Genest , and Marceau, 1999; Denuit, Dhaene, Goovaerts, and Kaas, 2005; Embrechts, Höing, and Puccetti, 2005; Embrechts and Puccetti, 2006a ; Kaas, Laeven, and Nelsen, 2009; Luciano and Marena, 2002; Mesfioui and Quessy, 2005) and refer to Embrechts and Puccetti (2006b) for an extension to the general case where the marginal distributions of each of the assets are different. In a such case, a numerical procedure is suggested to compute VaR bounds. In this paper, we study VaR bounds for sums of possibly dependent financial assets using the recent contribution by Mesfioui and Quessy (2005) when no information on the dependence between them is available. The underlying dependence involving the portfolio constituents is captured through the empirical copula. The Generalized Extreme Value (GEV) distribution is assumed for marginals, as its ability to replicate the tail behaviour of asset returns (Bali, 2003). Besides, we derive modified bounds for portfolio VaR when a large shift of location is applied to asset returns as a generalization of the quantile estimator suggested by Vermaat et al. (2005) to the multivariate framework. These modified bounds have the advantage of being insensitive with respect to location changes. The outline of the paper is as follows. Section 2 recalls the notion of portfolio VaR and some mathematical background about the concept of copulas and the Fréchet bounds. In section 3, the GEV distribution is introduced for modelling big losses of financial assets. Explicit expressions for the lower and the upper bounds of VaR are then given under the assumption of GEV distribution for marginals when a shift of location is applied to the original data. The relevance of these bounds for describing portfolio risk is discussed through several applications including five international stock market indexes: empirical studies are carried out in section 5 and some concluding remarks are collected in section 6.

2. Copulas and VaR Bounds: Some Basics

In this section we give the basic concepts about copulas and the fundamental results about the problem of bounding VaR for functions of dependent risks, while we refer the interested reader to Nelsen (1999) for a more detailed treatment of copulas as well as their relationship to the different concepts of dependence

Definition *Let* $f:\square \to \square$ *be a non-decreasing function. Its generalized left continuous inverse is the mapping* $f^{-1}:\square \to \square$ *defined by* $f^{-1}(t)=\inf\{s\in\square \mid f(s)\geq t\}$. *The VaR at probability level* $\alpha\in[0,1]$ *for a random variable* X *with (right-continuous) distribution function* F *is defined by*

$$VaR_\alpha = F^{-1}(\alpha)$$

In order to evaluate the risk level of a portfolio of possibly dependent financial assets, one is involved in the dependence structure among the risks. This can be carried out through the use of copulas. The concept of copula was introduced by Sklar (1959), but only recently its potential for applications in finance has become clear. A review of applications of copulas in finance can be found in Embrechts, Höing and Juri (2003) and Cherubini, Luciano and Vecchiato (2004). Let the multivariate distribution function of a random vector $X=(X_1,...,X_d)$ be defined as $H(x_1,...,x_d)=\mathrm{P}(X_1\leq x_1,...,X_d\leq x_d)$ and denote by $F_1,...,F_d$ the set of the associated marginal distributions. The sklar's theorem (Sklar, 1959) states that there exists a multidimensional copula C such that $H(x_1,...,x_d)=C(F_1(x_1),...,F_d(x_d))$ for all $(x_1,...,x_d)\in\square^d$. For continuous marginal distributions C is unique. Therefore, The multivariate distribution function H is linked to the marginal distributions via the copula function $C:[0,1]^d\to[0,1]$.

Let us denote the risky asset losses with $X_1,...,X_d$, where $X_i:\Omega\to\square, i=1,2,...,d$, and consider the portfolio strategy consisting in investing a fixed relative amount $w_i\in[0,1]$ of the capital in the i-th asset (short sales being excluded), so that $\sum_{i=1}^{d} w_i=1$ (the portfolio is fully invested). For given weights, the portfolio loss can be expressed as the sum of the random variable $S_i\overset{d}{=}w_iX_i$ with known continuous marginal distribution functions $F_1,\ldots,F_d$. It is assumed throughout this paper that the underlying dependence structure of $S_1,\cdots,S_d$ described by the copula C is unknown. However, it is supposed that there exist copulas C_L and C_U such that

$C \geq C_L$ and $C^D \geq C_U^D$. Let denote by F_S the distribution function of the portfolio loss, $S = S_1 + \cdots + S_d$. For high dimensional portfolios, $d > 2$, stochastic bounds for F_S, easily obtained from the multivariate version of Makarov (1981) in Cossette, Denuit, and Marceau (2002), are $F_L(s) \leq F_S(s) \leq F_U(s)$, where

$$F_L(s) = \sup_{u_1+\cdots+u_d=s} C_L\{F_1(u_1),\ldots,F_d(u_d)\}$$

and

$$F_U(s) = \inf_{u_1+\cdots+u_d=s} C_U^D\{F_1(u_1),\ldots,F_d(u_d)\}$$

The distribution functions (Note 1), F_L and F_U, known respectively as the lower and the upper Fréchet bounds, provide the best possible bounds of F_S in terms of stochastic dominance (Lehmann, 1966). When no information about the dependence structure of d risks is available and if for each $i \in \{1,\ldots,d\}$ there exist a number s_i^* such that the density $f_i(s)$ is non-increasing for all $s \leq s_i^*$, it is shown in Mesfioui and Quessy (2005) that portfolio VaR for a given confidence level α, denoted by $VaR_\alpha(S)$, is bounded as follows

$$\underline{VaR}(\alpha) \leq VaR_\alpha(S) \leq \overline{VaR}(\alpha)$$

where

$$\overline{VaR}(\alpha) = \inf_{u_1+\cdots+u_d=\alpha+d-1} \sum_{i=1}^{d} F_i^{-1}(\alpha_i) \tag{1}$$

and

$$\underline{VaR}(\alpha) = \max_{1\leq i\leq d}\left\{F_i^{-1}(\alpha) + \sum_{1\leq j\neq i\leq d} F_j^{-1}(0)\right\}, \quad \alpha \leq \min\left\{F_1(s_1^*),\ldots,F_n(s_n^*)\right\} \tag{2}$$

The above result is crucial since it allows to easily compute explicit VaR bounds for possibly dependent risks. One only needs to assume an appropriate distribution function for the marginal asset losses. Explicit, analytical bounds exist when all the S_i r.v.'s belong to the same distribution class.

3. On Portfolio Extreme Loss Distribution and Quantile Estimation

In this section, we focus on the maximal relative loss (Note 2) of weighted financial assets over a large period of time n, that is to say on $M_n = \max_{t=1,\ldots,n} S(t)$, of which fluctuations may be characterized by an asymptotic extreme value distribution. The asymptotic theory for extremes is well developed and univariate modelling basically falls in one of the two categories: modelling standardized maxima through the GEV distribution, or modelling excesses over high thresholds via the generalized Pareto distribution **(**refer to Embrechts, Klüppelberg, and Mikosch, 1997, for further details on extreme value theory). We use GEV to approximate the distribution of suitably normalized extreme asset losses $(M_n - \mu)/\sigma$, where σ and μ are scale and location parameters, respectively. The GEV distribution function is given by

$$F_\gamma(s) = \exp\left\{-(1+\gamma s)^{-1/\gamma}\right\}, 1+\gamma s \geq 0, \gamma \in \square$$

which is interpreted as $\exp\left\{e^{-s}\right\}$ for $\gamma = 0$. The tail index γ characterizes the extreme upper behaviour of an i.i.d. sequence $(S(t))_{1\leq t\leq n}$ drawn from its unknown distribution function F regarding to its maximum value. It is a well-known result in extreme value theory that there are only three types of possible limit distributions for the maximum of i.i.d. r.v.'s under positive affine transformations, depending on the tail behaviour of their common density. The Fisher-Tippet Theorem (Fischer and Tippett, 1928; Gnedenko, 1943) implies that, The limit distribution of the normalized maxima, when $n \to \infty$, must be one of the Gumbel, the Weibull and the Fréchet distribution which are respectively related to $\gamma = 0$, to $\gamma < 0$, and to $\gamma > 0$. The Gumbel distribution is reached for thin-tailed return distributions. The Fréchet distribution is obtained for fat-tailed distributions of returns. Finally, the Weibull distribution is obtained when the distribution of returns has no tail. Therefore, the class of GEV distribution is very flexible with the tail index parameter controlling the shape of the tails of the three different

families of distributions subsumed under it. Let $S_{(1)} < S_{(2)} < \cdots < S_{(n)}$ denote the order statistics of the weighted asset returns sequence $S_1, \ldots, S_n$ and m the number of the largest order statistics. When no assumption being made on the tail index γ, one may use the moment estimator proposed by Dekkers, Einmahl, and Haan (1989) for quantiles of large order defined by

$$\hat{\gamma}_n = M_n^{(1)} + 1 - \frac{1}{2}\left\{1 - \frac{(M_n^{(1)})^2}{M_n^{(2)}}\right\}^{-1}, \tag{3}$$

where

$$M_n^{(r)} = \frac{1}{m}\sum_{j=1}^{m} \log\left(\frac{S_{(n-j+1)}}{S_{(n-m)}}\right)^r, \text{ for } r = 1, 2.$$

Then, $M_n^{(1)}$ is the well known Hill estimator (Hill, 1975). The Hill estimator and the moment estimator have the best performance especially in the case $\gamma > 0$. However, even these estimators are scale invariant, they are not location invariant. The $(1-\alpha)$ – quantile of the distribution function F_γ for $0 < \alpha < 1/2$ is given by

$$F_\gamma^{-1}(1-\alpha) = S_{(n-m)} + \frac{(m/n\alpha)^{\hat{\gamma}_n}}{\hat{\gamma}_n}\left(1 - \min\left(\hat{\gamma}_n, 0\right)\right) S_{(n-m)} M_n^{(1)}.$$

4. Convergence of portfolio VaR bounds

In order to establish explicit bounds for VaR of a portfolio composed by possibly dependent assets, we combine the Dekkers et al. (1989) quantile estimator of large order with VaR bounds obtained by Mesfioui and Quessy (2005) and discussed in section 2. Moreover, following the methodology of Vermaat et al. (2005), we provide location change invariant bounds for quantile estimator of large order. The upper bound of VaR can be interpreted as the "worst possible outcome" at a given confidence level, in the absence of any information on the actual dependence structure between the different sources of risk and only the marginal distributions are known. A straightforward application of VaR bounds defined in (1) and (2) to the special case of a GEV distribution for marginal extreme losses gives

$$\overline{VaR}(\alpha) = \sum_{i=1}^{d} S_{i(n-m_i)} + \frac{\left(m_i / n q_i(\alpha)\right)^{\hat{\gamma}_{in}} - 1}{\hat{\gamma}_{in}}\left(1 - \min\left(0, \hat{\gamma}_{in}\right)\right) S_{i(n-m_i)} M_{in}^{(1)}, \tag{4}$$

and

$$\underline{VaR}(\alpha) = \sum_{i=1}^{d} S_{i(n-m_i)} + \max_{1\le i\le d}\left\{\frac{\left(m_i / n(1-\alpha)\right)^{\hat{\gamma}_{in}} - 1}{\hat{\gamma}_{in}}\left(1 - \min\left(0, \hat{\gamma}_{in}\right)\right) S_{i(n-m_i)} M_{in}^{(1)}\right.$$

$$\left. + \sum_{1\le j\ne i\le d} \frac{\left(m_j / n\right)^{\hat{\gamma}_{jn}} - 1}{\hat{\gamma}_{jn}}\left(1 - \min\left(0, \hat{\gamma}_{jn}\right)\right) S_{j(n-m_i)} M_{jn}^{(1)}\right\}. \tag{5}$$

These bounds will be referred as standards bounds of VaR. Since the quantile estimator based on the Dekkers et al. (1989) work depends heavily on the actual location because of the steepness of the log function, one can easily verify that the standard VaR bounds do not react adequately to a shift of the data. Therefore, we introduce a large shift of location, denoted by K, to the original data and we calculate the quantile bounds for the transformed data. Then, to restore the quantile bounds for the original data, an inverse transformation of the calculated bounds is performed. In our setting, we investigate the limiting values for VaR bounds when the shift goes to infinity. Then, we get the modified upper and lower bounds estimation for the quantile of the sum $S = S_1 + \cdots + S_d$, which are invariant with respect to location change. The results are given in the following proposition. The proof of the proposition as well as standard VaR bounds defined in (4) and (5) are given in the appendix.

Proposition *Define* $(S_i^*)_{1\le i\le d} = (S_i)_{1\le i\le d} + K$ *where* S_i *is a random variable with an absolutely continuous probability distribution function* F_γ^i *and K is a constant. Suppose that* $m_i / n(1-\alpha) \ge 1$. *When no information is*

available about the dependence structure of $(S_1,...,S_d)$ *and if* $K \to \infty$, *then the modified upper and lower VaR bounds denoted respectively by* $\overline{VaR}^*(\alpha)$ *and* $\underline{VaR}^*(\alpha)$ *with* $1/2 < \alpha < 1$ *are given by*

$$\overline{VaR}^*(\alpha) = \sum_{i=1}^{d} \left\{ S_{i(n-m_i)} + D_i\left(\frac{m_i}{nq_i(\alpha)}\right)\frac{1}{m_i}\sum_{j=1}^{m_i}\left(S_{i(n-j+1)} - S_{i(n-m_i)}\right)\right\},$$

and

$$\underline{VaR}^*(\alpha) = \sum_{i=1}^{d} S_{i(n-m_i)} + \max_{1\le i\le d}\left\{ D_i\left(\frac{m_i}{n(1-\alpha)}\right)\frac{1}{m_i}\sum_{l=1}^{m_i}\left(S_{i(n-l+1)} - S_{i(n-m_i)}\right) + \sum_{1\le j\ne i\le d} D_j\left(\frac{m_j}{n}\right)\frac{1}{m_j}\sum_{l=1}^{m_j}\left(S_{j(n-l+1)} - S_{j(n-m_j)}\right)\right\}, \quad (6)$$

where

$$q_i(\alpha) = \frac{(L_i)^{1/G_{in}+1}}{\sum_{i=1}^{d}(L_i)^{1/G_{in}+1}}(1-\alpha),$$

and

$$D_i\left(\frac{m_i}{nq_i(\alpha)}\right) = \frac{(m/nq_i(\alpha))^{G_{in}} - 1}{G_{in}}(1 - \min(0, G_{in})),$$

with

$$G_{in} = 1 - \frac{1}{2(1-Q_{in})}, \quad (7)$$

and

$$Q_{in} = \frac{\left[\frac{1}{m_i}\sum_{j=1}^{m_i}\left(S_{i(n-j+1)} - S_{i(n-m_i)}\right)\right]^2}{\frac{1}{m_i}\sum_{j=1}^{m_i}\left(S_{i(n-j+1)} - S_{i(n-m_i)}\right)^2}.$$

The tail index estimator defined in (7) will be referred as the modified moment estimator since it stands for the limiting value of the moment estimator as the shift goes to infinity. From our experience with several data sets, as a rule of thumb, the modified estimator provides a rather better approximation of the actual tail index than the classical moment estimator. As shown by Figure 1, the modified tail index estimator converges to the true value of the shape parameter of a sample of size T = 5000 generated from a GEV distribution with parameters $\mu = 0.5$, $\sigma = 0.1$ and $\gamma = 0.3$, while the original moment estimator is significantly above the actual value, thus overestimating γ.

5. Applications

In this section we apply our approach to estimate VaR bounds for international equity portfolios. We use daily return series of international stock market indexes over the period running from July-09-1987 to December-17-2007 (the length of the financial time series studied is thus $n = 5333$) listed in Table 1. For comparison purpose, inferential and descriptive statistics concerning the loss distribution of single equity indexes are also given in Table 1. The estimation of the Dekkers et al. (1989) tail index $\hat{\gamma}_n$ and the modified tail index $\hat{G}_n$ requires to choose the number m_i, $1 < i < d$, of upper order statistics for each portfolio component $S_1, \cdots, S_d$. It is well-known that tail index estimators are very sensitive to the choice of the sample fraction m. This problem has been the subject of

intense research in theoretical statistics, still developing. The optimal sample fraction m is selected through the minimization of the asymptotic mean squared error as in Danielsson, De Haan, Peng and De Vries (2001) or Drees and Kaufmann (1998). In a general fashion, by looking at these indicators one can see that the single market indexes loss distributions are skewed and heavy-tailed.

As a first illustration of our approach for measuring risk in the case of $d = 2$, we consider two equally weighted portfolios. The first portfolio (PF1) is composed of the French and the German stock market indexes, the second portfolio (PF2) contains the Japanese and the Chilean stock market indexes. The dependence for the French-German stock market returns in PF1 is persistent for both positive and negative returns, as illustrated by Figure 2a, extreme variations of CAC40 and DAX30 returns occur simultaneously in most cases suggesting strong positive dependence. In contrast, the dependence between the Japanese-Chilean stock market returns is much weaker, which is indicative of a presumably independence between returns in PF2 (see Figure 2b).

The idea behind the construction of portfolios PF1 and PF2 is to illustrate the behaviour of VaR bounds in different (supposed unknown) dependence situations since stock market indexes returns pairs in these two portfolios are characterized by completely different dependence structures. In Figure 3, the upper and the lower VaR bounds for PF1 are displayed under the assumption of GEV distribution for extreme marginal loss of stock market indexes. Given the positive dependence between CAC40 and DAX30 returns, one is interested in the upper bounds of VaR and compare these bounds to the exact $VaR_\alpha(S)$ under the assumption of comonotonicity (the so-called perfect positive dependence). It is important to notice that the worst possible scenario may occur when the portfolio assets have a very special dependence beyond the perfect positive dependence. Indeed,

because of the non-coherence of VaR, $VaR_\alpha(S) = VaR_\alpha(\sum_{i=1}^{d} S_i)$ may be greater than $\sum_{i=1}^{d} VaR_\alpha(S_i)$ when

the marginal distributions of the portfolio components are very skewed or heavy-tailed as illustrated in Table 1. Therefore, the upper bound in particular is interesting, from the point of view of risk management, since it represents the worst possible portfolio loss at a given confidence level, when there is no knowledge of the joint distribution nor of their dependence structure and only the marginal distributions are known. As expected, the upper bounds are closer to $VaR_\alpha(S)$ than the lower bounds. Moreover the modified upper bound provides a rather good approximation to $VaR_\alpha(S)$ than the standard upper bound. One may observe from Figure 3a that VaR estimates under the GEV assumption for marginal losses are close to the empirical quantiles for the different confidence levels between 0.95 and 0.99 suggesting a good fit of the GEV model to data. Besides, the modified upper bound is very close to the empirical quantile under the assumption of comonotonicity at high levels of probability. Given the quasi-independence between the NIKKEI225 and the IGPA returns, Figure 3b shows that the lower bounds are closer to the exact $VaR_\alpha(S)$ under the assumption of independence than the upper bounds. Even if the standard lower bound provides a better approximation of $VaR_\alpha(S)$ than the modified lower bound for the probability level interval $[0.95,0.993]$, the modified lower bound is identical to the empirical quantile for extremely high confidence levels. As a second illustration, we also applied our method to the case of a five dimensional portfolio (PF3) including all the stock market indexes listed in Table 1. Unlike the case of portfolios PF1 and PF2 where the unknown dependence between returns pairs is characterized in Figure 2 and hence one can either look at the upper bound as an approximation of VaR when asset returns are comonotonic or come across the lower bound when portfolio components are independent or countermonotonic, the actual dependency structure of the asset returns in the high dimensional portfolio PF3 could not be illustrated any more for comparison purpose. Therefore, the risk manager have to consider lower and upper bounds as an approximation of the exact portfolio VaR in any scenario of dependence between asset returns. As a matter of fact, the modified upper bound is closer to the comonotonic VaR than the standard upper bound. However, the standard lower bound yields a better approximation of the exact VaR under the assumption of independence (see Figure 4).

6. Conclusion

In this paper explicit VaR bounds for portfolios of possibly dependent financial assets are evaluated. The upper bound in particular is interesting, from the point of view of risk management, since it comes into sight as the worst possible portfolio loss at a given probability level. By exploiting recent contribution of Mesfioui and Quessy (2005) on bounding VaR of the sum of several risks, we provide explicit bounds for portfolio risk when the asymptotic marginal distribution of extreme negative returns belongs to the domain of attraction of GEV distribution. These standard bounds are obtained without imposing a specific assumption on the dependence structure between asset returns. The underlying dependence between the portfolio components is captured throughout the empirical copula. In order to consider possibly location change, the standard bounds are evaluated when a large shift of location is applied to the original data. The reverse translated bounds applied to the shifted data converge to the modified

bounds which enjoy the desirable property of location invariance, as well as scale invariance, a property also common to the classical Dekkers et al. (1989) estimator. Empirical applications are carried out on three international equity portfolios under various dependence scenarios and show that the modified upper bound is closer than the standard one to the exact VaR under the assumption of comonotonicity. However, the modified lower bound outperforms the standard lower bound, when asset risks are independent or countermonotonic, only for extremely high levels of probability.

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Notes

Note 1. For $d = 2$ the upper and lower bounds are themselves copula. However, for higher dimension $d > 2$, the lower bound F_L is not any more a distribution function (Embrechts et al., 2003)

Note 2. Following convention, a loss is treated as a positive number and extreme events take place when losses come from the upper tail of the loss distribution.

Table 1. Extreme value statistics based on daily losses from 5 international equity markets, for the period July 1987 to December 2007. For each market index, m is the number of order statistics used for computing tail index estimates defined in (3) and (7), respectively.

Country (Index)	**Skewness**	**Kurtosis**	m	γ_n	G_n
Germany (DAX30)	0.33	9.09	318	0.18	0.12
France (CAC40)	0.15	7.55	240	0.18	0.13
Japan (Nikkei225)	0.06	9.74	266	0.14	0.19
U.K. (FTSE100)	0.58	12.39	355	0.23	0.21
Chile (IGPA)	0.31	14.28	305	0.15	0.18

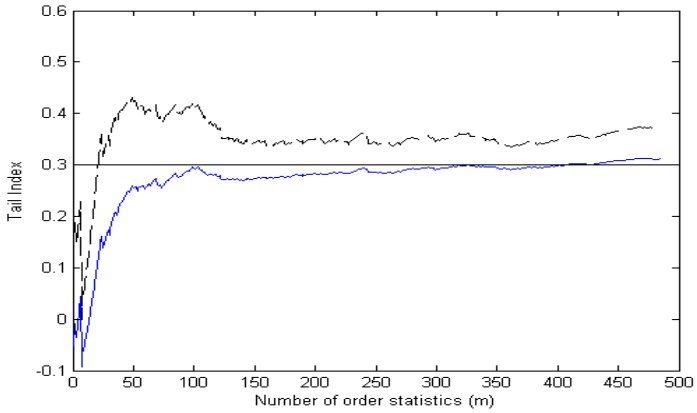

Figure 1. Tail index estimates from simulated data: moment estimator (dashed line) and modified moment estimator (solid line).

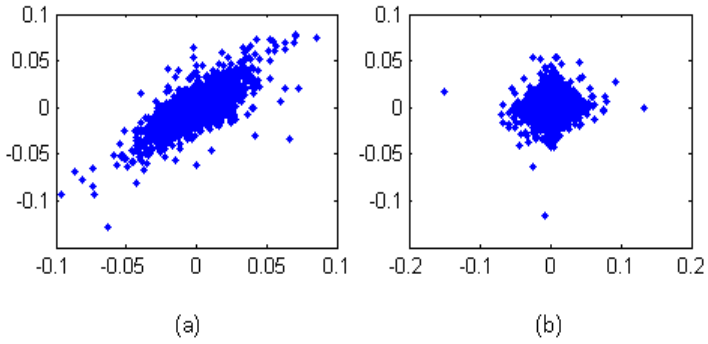

Figure 2. Dependence structure of returns pairs. (a) France (vertical axis) and Germany (horizontal axis) (b) Japan (vertical axis) and Chile (horizontal axis)

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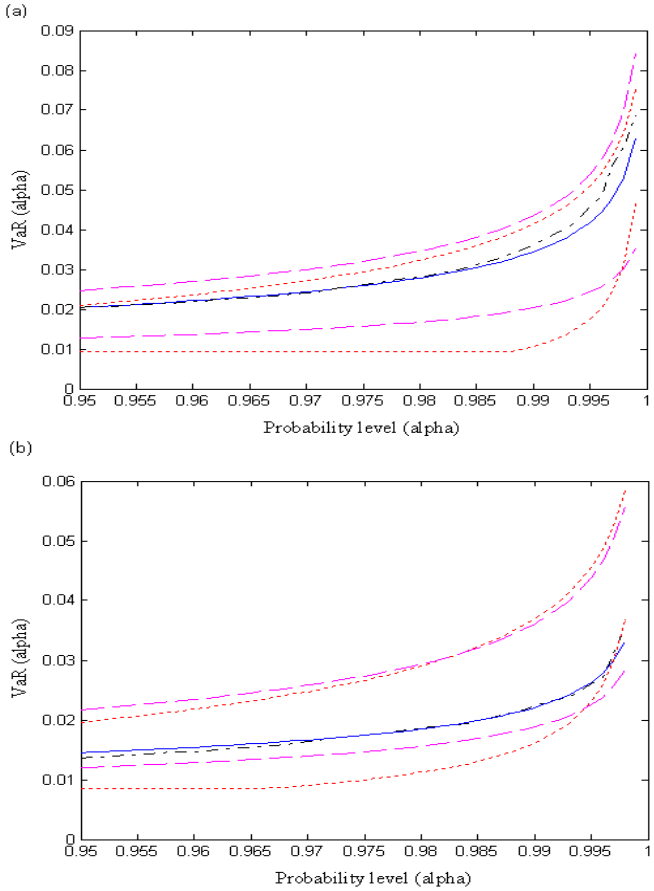

Figure 3. (a) Bounds on VaR of PF1 (dashed lines) and modified bounds (dotted lines) compared to the exact $VaR_\alpha(S)$ when the portfolio components are comonotonic under the assumption of GEV for loss distribution (solid line) and empirical distribution (dash dotted line). (b) Bounds on VaR of PF2 compared to the exact $VaR_\alpha(S)$ when the portfolio components are independent.

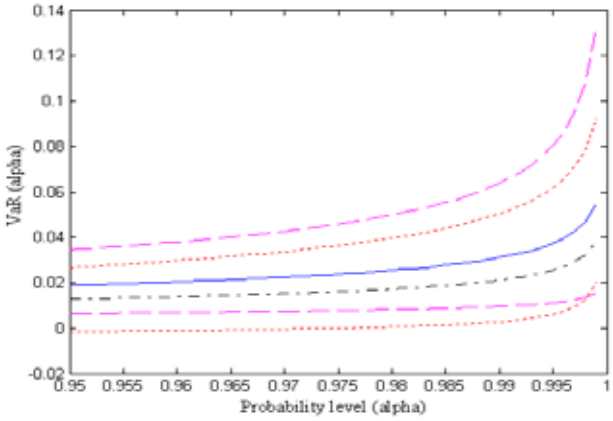

Figure 4. Bounds on VaR of PF3 (dashed lines) and modified bounds (dotted lines) compared to the exact $VaR_\alpha(S)$ when the portfolio components are comonotonic (solid line) and when the portfolio components are independent (dash dotted line).

Appendix. Proof of Proposition

By replacing $(S_i)_{1\le i\le d}$ with $(S_i^*)_{1\le i\le d}$ the definitions of $\hat{\gamma}_{in}$ and $M_{in}^{(r)}$ are modified, respectively, into $\hat{\gamma}_{in}^*$ and $M_{in}^{*(r)}$. The $(1-q_i)$-quantile of the distribution function of $(S_i^*)_{1\le i\le d}$ can be easily obtained from

$$\hat{F}_i^{-1}(q_i,\hat{\gamma}_{in}^\star)=S_{i(n-m_i)}^\star+\frac{(\frac{m_i}{n(1-q_i)})^{\hat{\gamma}_{in}^\star}-1}{\hat{\gamma}_{in}^\star}(1-\min(0,\hat{\gamma}_{in}^\star))S_{i(n-m_i)}^\star M_{in}^{\star(1)}-K,$$

then

$$VaR_\alpha\le\overline{VaR}(\alpha)=\inf_{\sum_{i=1}^d q_i=\alpha+d-1}\sum_{i=1}^d\frac{\left(m_i/n(1-q_i)\right)^{\hat{\gamma}_{in}^*}-1}{\hat{\gamma}_{in}^*}\left(1-\min\left(0,\hat{\gamma}_{in}^*\right)\right)S_{i(n-m_i)}^*M_{in}^{*(1)}+\sum_{i=1}^d S_{i(n-m_i)}. \tag{8}$$

Since the function, defined in (8), to be minimized is convex, the problem can be solved using the Lagrange multiplier method, which gives

$$\left(\frac{m_i}{n}\right)^{\hat{\gamma}_{in}^*}\left(\frac{1}{1-q_i}\right)^{\hat{\gamma}_{in}^*+1}\left(\min\left(0,\hat{\gamma}_{in}^*\right)-1\right)S_{i(n-m_i)}^*M_{in}^{*(1)}=\lambda,\quad\text{and}$$

$$\sum_{i=1}^d(1-q_i)=1-\alpha. \tag{9}$$

Now we write

$$C_i\left(\frac{1}{1-q_i}\right)^{\hat{\gamma}_{in}^*+1}=\lambda,\quad\text{where}\qquad C_i=\left(\frac{m_i}{n}\right)^{\hat{\gamma}_{in}^*}\left(\min\left(0,\hat{\gamma}_{in}^*\right)-1\right)S_{i(n-m_i)}^*M_{in}^{*(1)},$$

and $$\lambda=\left[\frac{\sum_{i=1}^d(C_i)^{1/\hat{\gamma}_{in}^*+1}}{1-\alpha}\right]^{\hat{\gamma}_{in}^*+1}$$

The solution to (9) is given by

$$(1-q_i)=\frac{(C_i)^{1/\hat{\gamma}_{in}^*+1}}{\sum_{i=1}^d(C_i)^{1/\hat{\gamma}_{in}^*+1}}(1-\alpha),=q_i^*(\alpha). \tag{10}$$

Using equation (10) in the objective function (8) we get

$$\overline{VaR}(\alpha)=\sum_{i=1}^d S_{i(n-m_i)}+\frac{\left(m_i/nq_i^*(\alpha)\right)^{\hat{\gamma}_{in}^*}-1}{\hat{\gamma}_{in}^*}\left(1-\min\left(0,\hat{\gamma}_{in}^*\right)\right)S_{i(n-m_i)}^*M_{in}^{*(1)}.$$

Now we calculate the following limits, if $K\to\infty$

$$\lim_{K\to\infty}\hat{\gamma}_{in}^*=1-\frac{1}{2(1-Q_{in})}=G_{in},$$

where

$$\lim_{K\to\infty}\frac{\left(M_{in}^{(1)*}\right)^2}{M_{in}^{(2)*}}=\frac{\left(\frac{1}{m_i}\sum_{j=1}^{m_i}\left(S_{i(n-j+1)}-S_{i(n-m_i)}\right)\right)^2}{\frac{1}{m_i}\sum_{j=1}^{m_i}\left(S_{i(n-j+1)}-S_{i(n-m_i)}\right)^2}=Q_{in},\ \text{with}\ \ 0<Q_{in}<1\ \ \text{and}\ \ G_{in}\in\left(-\infty,\frac{1}{2}\right)\ \ \text{with probability one.}$$

We also have

$$\lim_{K\to\infty}q_i^*(\alpha)=\frac{\left(L_i\right)^{1/G_{in}+1}}{\sum_{i=1}^{d}\left(L_i\right)^{1/G_{in}+1}}\left(1-\alpha\right)=q_i(\alpha) \tag{11}$$

where

$$L_i=\lim_{K\to\infty}C_i=\left(\frac{m_i}{n}\right)^{G_{in}}\left(\min\left(0,G_{in}\right)-1\right)\frac{1}{m_i}\sum_{j=1}^{m_i}\left(S_{i(n-j+1)}-S_{i(n-m_i)}\right),$$

and

$$\lim_{K\to\infty}\frac{\left(m_i/n\right)^{\hat{\gamma}_{in}^*}-1}{\hat{\gamma}_{in}^*}\left(1-\min\left(0,\hat{\gamma}_{in}^*\right)\right)=\frac{\left(m_i/nq_i\left(\alpha\right)\right)^{G_{in}}-1}{G_{in}}\left(1-\min\left(0,G_{in}\right)\right)=D_i\left(m_i/nq_i\left(\alpha\right)\right). \tag{12}$$

Using (11) and (12), we get if $K\to\infty$

$$\overline{VaR}^*\left(\alpha\right)=\sum_{i=1}^{d}\left\{S_{i(n-m_i)}+D_i\left(m_i/nq_i\left(\alpha\right)\right)\frac{1}{m_i}\sum_{j=1}^{m_i}\left(S_{i(n-j+1)}-S_{i(n-m_i)}\right)\right\},$$

and we have $VaR_\alpha(S)\ge\underline{VaR}(\alpha)$ with

$$\underline{VaR}(\alpha)=\max_{1\le i\le d}\left\{S_{i(n-m_i)}+\frac{\left(m_i/n\left(1-\alpha\right)\right)^{\hat{\gamma}_{in}^*}-1}{\hat{\gamma}_{in}^*}\left(1-\min\left(0,\hat{\gamma}_{in}^*\right)\right)S_{i(n-m_i)}^*M_{in}^{*(1)}\right.$$

$$\left.+\sum_{1\le j\ne i\le d}S_{j(n-m_j)}+\frac{\left(m_j/n\right)^{\hat{\gamma}_{jn}^*}-1}{\hat{\gamma}_{jn}^*}\left(1-\min\left(0,\hat{\gamma}_{jn}^*\right)\right)S_{j(n-m_j)}^*M_{jn}^{*(1)}\right\}$$

$$=\sum_{i=1}^{d}S_{i(n-m_i)}+\max_{1\le i\le d}\left\{\frac{\left(m_i/n\left(1-\alpha\right)\right)^{\hat{\gamma}_{in}^*}-1}{\hat{\gamma}_{in}^*}\left(1-\min\left(0,\hat{\gamma}_{in}^*\right)\right)S_{i(n-m_i)}^*M_{in}^{*(1)}\right.$$

$$\left.+\sum_{1\le j\ne i\le d}\frac{\left(m_j/n\right)^{\hat{\gamma}_{jn}^*}-1}{\hat{\gamma}_{jn}^*}\left(1-\min\left(0,\hat{\gamma}_{jn}^*\right)\right)S_{j(n-m_j)}^*M_{jn}^{*(1)}\right\}.$$

If $K\to\infty$, then $\underline{VaR}(\alpha)$ converges to

$$\underline{VaR}^*\left(\alpha\right)=\sum_{i=1}^{d}S_{i(n-m_i)}+\max_{1\le i\le d}\left\{D_i\left(m_i/n\left(1-\alpha\right)\right)\frac{1}{m_i}\sum_{l=1}^{m_i}\left(S_{i(n-l+1)}-S_{i(n-m_i)}\right)+\sum_{1\le j\ne i\le d}D_j\left(m_j/n\right)\frac{1}{m_j}\sum_{l=1}^{m_j}\left(S_{j(n-l+1)}-S_{j(n-m_j)}\right)\right\}.$$

Modelling Exchange Rate Volatility using GARCH Models: Empirical Evidence from Arab Countries

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Abstract

This paper considers the generalized autoregressive conditional heteroscedastic approach in modelling exchange rate volatility in a panel of nineteen of the Arab countries using daily observations over the period of 1st January 2000 to 19th November 2011. The paper applies both symmetric and asymmetric models that capture most common stylized facts about exchange rate returns such as volatility clustering and leverage effect. Based on the GARCH(1,1) model, the results show that for ten out of nineteen currencies the sum of the estimated persistent coefficients exceed one, implying that volatility is an explosive process, in contrast, it is quite persistent for seven currencies, a result which is required to have a mean reverting variance process. Furthermore, the asymmetrical EGARCH (1,1) results provide evidence of leverage effect for majority of currencies, indicating that negative shocks imply a higher next period volatility than positive shocks. Finally, the paper concludes that the exchange rates volatility can be adequately modelled by the class of GARCH models.

Keywords: Exchange rate volatility, Heteroscedasticity, GARCH model, Volatility clustering, Leverage effect

1. Introduction

Over the last few decades, exchange rate movements and fluctuations have become an important subject of macroeconomic analysis and have received a great deal of interest from academics, financial economists and policy makers, particularly after the collapse of the Bretton Woods agreement of fixed exchange rates among major industrial countries. Since then, there has been an extensive debate about the topic of exchange rate volatility and its potential influence on welfare, inflation, international trade and degree of external sector competitiveness of the economy and also its role in security valuation, investment analysis, profitability and risk management. Consequently, a number of models have been developed in empirical finance literature to investigate this volatility across different regions and countries. Well known and frequently applied models to estimate exchange rate volatility are the autoregressive conditional heteroscedastic (ARCH) model advanced by Engle (1982) and generalized (GARCH) model developed independently by Bollerslev (1986) and Taylor (1986).

The issue of modelling exchange rate volatility has gained considerable importance in the research studies since 1973, when many countries shifted towards floating exchange rate from fixed exchange rate regime. Part of these studies were conducted to understand the behavior of exchange rate and to explain the sources of its movements and fluctuations. Although, there is no consensus in the literature regarding the factors that influence exchange rate volatility but, generally, it could be explained largely by macroeconomic variables. Many researches indicate some connection between exchange rate volatility and news or information on other macroeconomic fundamentals (including inflation, interest rates, money supply and GDP), see for example, Hartman (1972), De Grauwe (1988), Asseery and Peel (1991), Choi and Prasad (1995), Andersen and Bollerslev (1998), Arize et al. (2000), McKenzie and Faff (2004), Engel and Kenneth (2005), Evans and Lyons (2005), Laakkonen (2007), Lubik and Frank (2007), Mark (2009) and Pavasuthipaisit (2010).

On the other hand, many empirical studies have risen significantly in recent years to investigate the characteristics of exchange rate volatility in the context of time series analysis of financial returns such as leverage effect and volatility clustering and persistence. For example, Friedman and Stoddard (1982), Meese and Rogoff (1983), Milhoj (1987), Taylor (1987), Hsieh (1989), Lastrapes (1989), Bollerslev (1990), Pesaran and Robinson (1993), Jorion (1995), McKenzie (1997), Tse and Tsui (1997) Brooks and Burke (1998), Longmore and Robinson (2004), Wang (2006), Yoon and Lee (2008), Hamadu and Adeleke (2009), and Fiser and Roman (2010) find evidence of volatility clustering and persistence which mean that large and small values in the log-returns tend to occur in clusters, and

also find evidence of asymmetric effects in exchange rate returns which means downward movements (depreciation) is always followed by higher volatility and come to conclusion that GARCH models and their many extensions were successful in modelling and forecasting exchange rates volatility. (Note 1)

Although there have been an extensive empirical studies focusing on modelling and estimating exchange rate volatility in developed countries by applying different specifications, little attention has been paid in developing countries, and to the best of my knowledge, empirical research on the topic of volatility of exchange rate is fragmented as there is no work that compares the ability of different volatility models in the different Arab countries.

The main objective of this paper is to investigate volatility characteristics of exchange rate in selected Arab countries using daily observations over the period of 1st January 2000 to 19th November 2011. The rest of this paper is organized as follows. Section 2 provides a brief review of exchange rate regimes and stylized facts about exchange rate volatility and section 3 describes the data used for investigation. Section 4 presents the methodology, while section 5 presents the empirical results, and finally section 6 concludes the paper.

2. Exchange Rate Volatility, Regimes and Stylized Facts about Volatility of Exchange Rate

2.1 Exchange Rate Volatility

Exchange rate volatility is a measure of the fluctuations in an exchange rate. It is also known as a measure of risk, whether in asset pricing, portfolio optimization, option pricing, or risk management, and presents a careful example of risk measurement, which could be the input to a variety of economic decisions. It can be measured on an hourly, daily, weekly, monthly or annual basis. Based on the assumption that changes in an exchange rate follow a normal distribution, volatility provides an idea of how much the exchange rate can change within a given period. Volatility of an exchange rate, just like that of other financial assets, is usually calculated from the standard deviation of movements of exchange rates. Clearly, it is unobservable variable and thus its measure is a matter of serious contention. Consequently the literature is not unanimous as to which measure is most appropriate. Recent literature, however, seems to be increasingly adopting the use of Bollerslev's generalized autoregressive conditional heteroscedasticity (GARCH) models

Two measures of volatility are commonly employed in financial calculations; historical and implied volatility. Historical volatility is calculated from the past values of an exchange rate. Given a series of past daily exchange rates, we can calculate the standard deviation of the daily price changes and then the annual volatility of the exchange rate. Historical volatility provides a good assessment of possible future changes when the financial markets and economies have not gone through structural changes. Implied volatility is a forward looking measure of volatility and is calculated from the market participants estimates of what is likely to happen in the future. More precisely, implied volatility is estimated from the quoted price of a currency option when the values of all other determinants of the price of an option are known. The basis for this calculation is the Black Scholes option pricing model, according to which the price of an option is determined by the following: the current price of the asset (the exchange rate or a stock or a commodity), the strike price at which the option can be exercised, the remaining time for the maturity of the option, the risk free interest rate, and the volatility of the asset (or the exchange rate.). Exchange rate volatility, like the volatility of any other financial asset, changes in response to information. Currency traders are sensitive to information that might influence the value of one currency in terms of another. The most important information is that about the macroeconomic performance of the economies behind the two currencies. Changes in the levels of uncertainty about the future of either economy will cause traders to become restless and less willing to hold a particular currency. Uncertainty about the future is the most important reason for the change in the volatility in the currency markets. Changes in the proportions of hedgers versus speculators can also change the volatility of a currency. Central banks can also influence the volatility of their currencies with their announcements of their intentions to either intervene or otherwise in the markets for their currencies. While it is commonly believed that central banks can influence the value of their currency at most in the short run, they can certainly cause a change in the volatility.

2.2 Exchange Rate Regimes

Exchange rate systems are classified on the basis of the flexibility that the monetary authorities show towards fluctuations in the exchange rates and have been traditionally divided into two categories, namely systems with a fixed exchange rate and systems with a flexible exchange rate. In the former system the exchange rate is usually a political decision, in the latter the prices are determined by the market forces, in accordance with demand and supply. These systems are often referred to as Fixed Peg (sometimes also described as "hard peg") and Floating systems. But as usual, between these two extreme positions there exists also an intermediate range of different systems with limited flexibility, usually referred to as "soft pegs". In the following, some of these systems are described in short to show which possibilities exist to choose an exchange rate regime from8.

2.2.1 Fixed Pegs

A fixed peg regime exists when the exchange rate of the home currency is fixed to an anchor currency. This is the case with economies having currency boards or with no separate national currency of their own. Countries do not have a separate national currency, either when they have formally dollarized, or when the country is a member of a currency union, for example Euro. The IMF categorizes these two processes as "Exchange Arrangement with No Separate Le-gal Tender".

2.2.2 Floating Regimes

Floating exchange rate regimes consist of independent floating and managed floating systems. In independent floating systems the exchange rate is market determined and monetary policy usually functions without exchange rate considerations. Foreign exchange interventions are rare and meant to prevent undue fluctuations. But no attempt is undertaken to achieve/maintain a particular rate. Managed floating systems usually let the market take its own course but the monetary authorities intervene in the market to "manage" the exchange rate, if needed, to prevent high volatilities and to stimulate growth, without committing to a particular exchange rate level. The IMF calls this practice a "Managed Floating With No Predetermined Path for the Exchange Rate".

2.2.3 Intermediate Regimes

Intermediate exchange rate regimes consist of an array of differing systems allowing a varying degree of flexibility, such as conventional fixed exchange rate pegs, crawling pegs and exchange rate bands. For more details about exchange rate regimes see Tiwari (2003).

2.3 Stylized Facts about Volatility of Exchange Rates

Financial time series such as, exchange rates, stock returns and other financial series are known to exhibit certain stylized patterns which are crucial for correct model specification, estimation and forecasting (Note 2). Since the early work of Mandelbrot (1963) and Fama (1965), researchers have documented empirical regularities regarding theses series. Due to a large body of empirical evidence, many of the regularities can be considered stylized facts. The most common stylized facts are the following:

2.3.1 Fat Tails

When the distribution of financial time series such as exchange rate returns is compared with the normal distribution, fatter tails are observed. This observation is also referred to as excess kurtosis. The standardized fourth moment for a normal distribution is 3 whereas for many financial time series a value well above 3 is observed (Mandelbrot (1963) and Fama (1963, 1965) are the first studies to report this feature).

2.3.2 Volatility Clustering and Persistence

The second stylized fact is periods of volatility clustering which mean that large and small values in the log-returns tend to occur in clusters. i.e., the large changes tend to be followed by large changes and small changes tend to be followed by small changes. This was first put across by Mandelbrot (1963). When volatility is high it is likely to remain high and when it is low it is likely to remain low. Volatility clustering is nothing but accumulation or clustering of information. This feature reflects on the fact that news is clustered over time (Engle, 2004).

2.3.3 Leverage Effects

In financial markets, it is a stylized fact that a downward movement (depreciation) is always followed by higher volatility. This characteristic exhibited by percentage changes in financial data is termed leverage effects. According to past studies in this field, price movements are negatively correlated with volatility. Volatility is higher after negative shocks than after positive shocks of the same magnitude. This feature was first suggested by Black (1976) for stock returns. He attributed asymmetry to leverage effects. In this context, negative shocks increase predictable volatility in asset markets more than positive shocks. Another explanation of asymmetry is volatility feedback hypothesis. This in case of foreign market, a shock, which increases the volatility of the market, increases the risk of holding the currency (Longmore and Robinson, 2004). Empirical evidence on leverage effects can be found in Nelson (1991), Gallant, Rossi and Tauchen (1992, 1993), Campbell and Kyle (1993) and Engle and Ng (1993).

2.3.4 Long Memory

Especially for high-frequency data like exchange tares, volatility is highly persistent and there exists evidence of near unit root behaviour of the conditional variance process. This observation led to two propositions for modelling persistence: unit root or long memory process. (Longmore and Robinson, 2004).

2.3.5 Co-movements in Volatility

When looking at financial time series across different markets, such as looking at exchange rate returns for different

currencies, we observe big movements in one currency being matched by big movements in another. This suggests the importance of multivariate models in modelling cross-correlations in different markets.

2.3.6 Regular Events

Regular events like holidays and weekends have effects on exchange rate volatility. Studies indicate that volatility of exchange rates returns or percentage changes is lower during weekends and holidays than during the trading week. Many studies attribute this phenomenon to the accumulative effects of information during weekends and holidays (Note 3).

3. Data

The data which will be used in modelling volatility of exchange rate in this paper are the daily returns of exchange rates on the United Arab Emirates dirham (AED), Bahraini Dinar (BHD), Djiboutian Franc (DJF), Algerian Dinar (DZD), Egyptian Pound (EGP), Iraqi Dinar (IQD), Jordanian Dinar (JOD), Kuwaiti Dinar (KWD), Lebanese Pound (LBP), Libyan Dinar (LYD), Moroccan Dirham (MAD), Mauritanian Ouguiya (MRO), Omani Rial (OMR), Qatari Riyal (QAR), Saudi Arabian Riyal (SAR), Somali Shilling (SOS), Syrian Pound (SYP), Tunisian Dinar (TND), and Yemeni Rial (YER), all against the US dollar. The data span from 1st January 2000 to 19th November 2011 resulting in a total of 4341 observation. All the data are sourced from www.oanda.com/currency/realtime series.

As in most of empirical finance literature, the variable to be modelled is percentage daily exchange rate return which is the first difference of the natural logarithm of the exchange rate and is given by the following equation:

$$r_t = 100 * \log\left(\frac{E_t}{E_{t-1}}\right) \tag{1}$$

where r_t is the daily percentage return to the exchange rate and E_t and E_{t-1} denote the exchange rate at the current day and previous day, respectively. Summary statistics of daily exchange rates are provided in Table 1

4. Methodology

This section discusses the competing GARCH models used to investigate volatility characteristics. In presenting these models, there are two distinct specifications, the first for the conditional mean and the other for the conditional variance. The models are estimated using maximum likelihood method under the assumption of Gaussian normal error distribution (Note 4). The log likelihood function is maximized using Marquardt numerical iterative algorithm to search for optimal parameters.

4.1 Volatility Definition and Measurement

It is useful, before starting the description of volatility models to give a brief explanation of the term volatility, at least for the purpose of clarifying the scope of this paper. Volatility refers to the spread of all likely outcomes of an uncertain variable. Typically, in financial markets, we are often concerned with the spread of asset returns. Statistically, volatility is often measured as the sample standard deviation:

$$\hat{\sigma} = \sqrt{\frac{1}{T-1}\sum_{t=1}^{T}(r_t - \mu)^2} \tag{2}$$

where r_t is the return on day t and μ is the average return over the T-day period. Sometimes, variance, σ^2, is used also as a volatility measure. Volatility is related to, but not exactly the same as, risk. Risk is associated with undesirable outcome, whereas volatility as a measure strictly for uncertainty could be due to a positive outcome (Poon, 2005). This paper uses the variance as a measured of volatility.

4.2 Testing for Heteroscedasticity

One of the most important issues before applying the generalized autoregressive conditional heteroscedasticity (GARCH) methodology is to first examine the residuals of the returns series of exchange rate for evidence of heteroscedasticity. To test for this heteroscedasticity, the Lagrange Multiplier (LM) test proposed by Engle (1982) is applied.

In summary, the test procedure is performed by first obtaining the residuals e_t from the ordinary least squares regression of the conditional mean equation which might be an autoregressive (AR) process, moving average (MA) process or a combination of AR and MA processes; i.e. (ARMA) process. For example, in ARMA (1,1) process the conditional mean equation will be:

$$r_t = \phi_1 r_{t-1} + \varepsilon_t + \theta_1 \varepsilon_{t-1} \tag{3}$$

After obtaining the residuals e_t, the next step is to regress the squared residuals on a constant and q lags as in the following equation:

$$e_t^2 = \alpha_0 + \alpha_1 e_{t-1}^2 + \alpha_2 e_{t-2}^2 + ... + \alpha_q e_{t-q}^2 + \nu_t \quad (4)$$

The null hypothesis that there is no ARCH effect up to order q can be formulated as:

$$H_0 : \alpha_1 = \alpha_2 .. = \alpha_q = 0$$

against the alternative: $H_1 : \alpha_i > 0$

for at least one i = 1, 2, …, q.

The test statistic for the joint significance of the q-lagged squared residuals is the number of observations times the R-squared (TR^2) from the regression. TR^2 is evaluated against $\chi^2_{(q)}$ distribution. This is an asymptotically locally most powerful test (Rachev et al., 2007).

In this paper, an autoregressive moving average ARMA (1,1) model for the conditional mean in the returns series is employed as an initial regression, then, test the null hypothesis that there are no ARCH effects in the residual series.

4.3 Volatility Models

4.3.1The Generalized Autoregressive Conditional Heteroscedastic (GARCH) Model

The generalized autoregressive conditional heteroscedastic (GARCH) model is used in this paper to investigate the volatility clustering and persistence. The model has only three parameters that allows for an infinite number of squared errors to influence the current conditional variance (volatility). The conditional variance determined through GARCH model is a weighted average of past squared residuals. However, the weights decline gradually but they never reach zero. Essentially, the GARCH model allows the conditional variance to be dependent upon previous own lags. The general framework of this model, GARCH (p, q), is expressed by allowing the current conditional variance to depend on the first p past conditional variances as well as the q past squared innovations. That is,

$$\sigma_t^2 = \omega + \sum_{j=1}^{q} \alpha_j \varepsilon_{t-1}^2 + \sum_{i=1}^{p} \beta_i \sigma_{t-1}^2 \quad (5)$$

where, p is the number of lagged σ^2 terms and q is the number of lagged ε^2 terms.

In this paper, the following simple specification - GARCH (1,1) - is used:

$$\text{Mean equation} \quad r_t = \mu + \varepsilon_t \quad (6)$$

$$\text{Variance equation} \quad \sigma_t^2 = \omega + \alpha_1 \varepsilon_{t-1}^2 + \beta_1 \sigma_{t-1}^2 \quad (7)$$

where $\omega > 0$ and $\alpha_1 \geq 0$ and $\beta_1 \geq 0$, and.

r_t = return of the asset at time t.

μ = average returns.

ε_t = residual returns, defined as:

$$\varepsilon_t = \sigma_t z_t \quad (8)$$

where z_t is standardized residual returns (i.e. *iid* random variable with zero mean and variance 1), and σ_t^2 is conditional variance.

The constraints $\alpha_1 \geq 0$ and $\beta_1 \geq 0$ are needed to ensure σ_t^2 is strictly positive (Poon, 2005).

In this model, the mean equation is written as a function of constant with an error term. Since σ_t^2 is the one – period ahead forecast variance based on past information, it is called the conditional variance. The conditional variance equation specified as a function of three terms: (i) A constant term: ω; (ii) News about volatility from the previous period, measured as the lag of the squared residuals from the mean equation: ε_{t-1}^2 (the ARCH term); and (iii) Last period forecast variance: σ_{t-1}^2 (the GARCH term).

The conditional variance equation models the time varying nature of volatility of the residuals generated from the mean equation. This specification is often interpreted in a financial context, where an agent or trader predicts this

period's variance by forming a weighted average of a long term average (the constant), the forecast variance from last period (the GARCH term), and information about volatility observed in the previous period (the ARCH term). If the asset return was unexpectedly large in either the upward or the downward direction, then the trader will increase the estimate of the variance for the next period.

4.3.2 The Exponential GARCH (EGARCH) model

Even if the GARCH models successfully capture the thick tail returns, and the volatility clustering, they are poor models if one wishes to capture the leverage effect since the conditional variance is a function only of the magnitudes of the past values and not their sign. In financial time-series, it has been stated that volatility behaves differently depending on if a positive or negative shock occurs. This asymmetric relationship is called leverage effect, and describes how a negative shock causes volatility to rise more than if a positive shock with the same magnitude had occurred. To capture this asymmetry, different models have been developed and the one used in this paper is the EGARCH model. This model captures asymmetric responses of the time-varying variance to shocks and, at the same time, ensures that the variance is always positive. The model was developed by Nelson (1991). In the general form, the conditional variance is written as:

$$Ln(\sigma_t^2) = \omega + \sum_{j=1}^{p} \beta_j Ln(\sigma_{t-j}^2) + \sum_{i=1}^{q} \alpha_i \left\{ \left| \frac{\varepsilon_{t-i}}{\sigma_{t-i}} \right| - \sqrt{\frac{2}{\pi}} \right\} - \gamma_i \frac{\varepsilon_{t-i}}{\sigma_{t-i}} \quad (9)$$

The EGARCH model is asymmetric because the level $|\varepsilon_{t-i}| / \sigma_{t-i}$ is included with coefficient γ_i. Since this coefficient is typically negative, positive returns shocks generate less volatility than negative return shocks assuming other factors remains unchanged.

In macroeconomic analysis, financial markets and corporate finance, a negative shock usually implies bad news, leading to a more uncertain future. Consequently, for example, shareholders would require a higher expected return to compensate for bearing increased risk in their investment (Wang, 2003).

In order to capture asymmetric responses of the time-varying variance to shocks, the paper employs EGARCH(1,1) model, which has the following specification:

Mean equation $$r_t = \mu + \varepsilon_t \quad (10)$$

Variance equation $$Ln(\sigma_t^2) = \omega + \beta_1 Ln(\sigma_{t-1}^2) + \alpha_1 \left\{ \left| \frac{\varepsilon_{t-1}}{\sigma_{t-1}} \right| - \sqrt{\frac{2}{\pi}} \right\} - \gamma \frac{\varepsilon_{t-1}}{\sigma_{t-1}} \quad (11)$$

5. Empirical Results

5.1 Descriptive Statistics of the Daily Returns of the Exchange Rates Series

To specify the distributional properties of the daily returns of the exchange rates series, various descriptive statistics were calculated and reported in Table 2. As we can see from Table 2, Skewness and excess kurtosis are clearly observed for the daily returns for all currencies which indicate departure from normality (Note 5). Likewise, the Jarque-Bera (J-B) statistic, which is a test for normality, also confirms that the null hypothesis of normality for the daily returns should be rejected at the 1% significant level. In summary, all returns series do not conform to normal distribution but display positive skewness (the distribution has a long right tail) for AED, BHD, DJF, DZD, EGP, JOD, KWD, LYD, MAD, MUR, OMR, QAR, SYP and YER, and negative skewness (the distribution has a long left tail) for IQD, LBP, SAR, SOS and TND. In addition to that, a highly leptokurtic distribution is observed for all series. Moreover, Figure 1 presents the pattern of the exchange rate series and its returns for the currencies used.

To investigate whether the daily returns are stationary, the Augmented Dickey –Fuller (ADF) test (Dickey and Fuller, 1981) has been applied. The ADF test results in Table 2 strongly reject the null hypothesis of a unit root for all series.

5.2 Results of Heteroscedasticity Test

The results of examination the residuals for evidence of heteroscedasticity are summarized in Table 3. The ARCH-LM test results provide strong evidence for rejecting the null hypothesis for all series except the case of Iraqi Dinar (IQD) and Libyan Dinar (LYD). Rejecting the null hypothesis indicates the existence of ARCH effects in the residuals series in the mean equation.

5.3 Test of Asymmetry

In order to investigate further the existence of leverage effect, sign and size bias tests for asymmetry in volatility proposed by Engle and Ng (1993) will be conducted (Note 6). These tests are commonly used to differentiate the effect of good and bad news on the predictability of stock returns volatility. In these tests, two sources of asymmetric

response of variance are considered: the sign effect that is past shocks of different sign have a differentiated effect on the present volatility, and the size effect, that is past shocks of the same sign but different magnitudes have different effects on present variance. The following regression is performed:

$$\hat{u}_t^2 = \phi_0 + \phi_1 S_{t-1}^- + \phi_2 S_{t-1}^- u_{t-1} + \phi_3 S_{t-1}^+ u_{t-1} + \upsilon_t \quad (12)$$

where S_{t-1}^- is an indicator dummy that takes the value of 1 if $\hat{u}_{t-1} < 0$ and zero otherwise. The t-ratios for ϕ_1, ϕ_2 and ϕ_3 are the sign bias, the negative size bias, and the positive size bias test statistics, respectively. υ_t is *iid*. Significance of ϕ_1 indicates the presence of sign bias, meaning that the variance of returns is larger after a negative return than after a positive return. On the other hand, the significance of ϕ_2 or ϕ_3 indicate respectively negative and positive size bias, meaning that the variance is higher after a large (positive or negative) return than after a small (positive or negative) return and that the time-series is characterized by variance clustering. Engle and Ng show that a joint test for the size and sign bias, based on the Lagrange multiplier principal, formulated in the standard fashion by calculating TR^2 from equation (12), which will asymptotically follow a χ^2 distribution with 3 degrees of freedom under the null hypothesis of no asymmetric effects ($\phi_1 = \phi_2 = \phi_3 = 0$) . The results of this investigation are presented in Table 6.

As can be seen in Table 6, the results show that ϕ_1, ϕ_2 and ϕ_3 are statistically significant in most cases. Also, the results indicate that both ϕ_2 and ϕ_3 have the expected sign in most cases as ϕ_2 is negative and ϕ_3 positive, meaning that the volatility increases more after a shock of negative sign. However there are different effects according to the sign of past returns as we observe that the size bias coefficients ϕ_2 and ϕ_3 are different of each other. The significant negative size bias indicates that large negative returns induce higher subsequent squared returns, while positive size bias indicates that a positive return has a larger effect than a negative return. These results indicate that returns volatility exhibit asymmetric behavior, suggesting that the asymmetric volatility models are better suited for capturing the dynamics of volatility process in the data series.

5.4 Estimation results of GARCH (1,1) Model

The estimation results of GARCH (1,1) model in Table 4 show that the first three coefficients ω (constant), ARCH term (α) and GARCH term (β) are statistically significant at the 1% level and with expected sign for all returns series. The statistical significance of the coefficient α shows the presence of volatility clustering in GARCH (1,1) model for all cases. Also the significance of both α and β indicates that, lagged conditional variance and lagged squared disturbance have an impact on the conditional variance, in other words this means that news about volatility from the previous periods have an explanatory power on current volatility. Moreover, Table 4 also shows that; the sum of the two estimated ARCH and GARCH coefficients $\alpha + \beta$ (persistence coefficient) for the United Arab Emirates dirham (AED), Djiboutian franc (DJF), Algerian Dinar (DZD), Jordanian Dinar (JOD), Lebanese Pound (LBP), Qatari riyal (QAR), Saudi Arabian Riyal (SAR), Syrian Pound (SYP), Tunisian Dinar (TND), and Yemeni rial (YER) is larger than one, suggesting that the conditional variance is an explosive process. However, for the Bahraini Dinar (BHD), Egyptian Pound (EGP), Kuwaiti Dinar (KWD), Moroccan Dirham (MAD), Mauritanian ouguiya (MUR), Omani Rial (OMR), and Somali Shilling (SOS) returns, the sum of the ARCH and GARCH coefficients is very close to one which is required to have a mean reverting variance process, indicating that volatility shocks are quite persistent. This appears to show that the shocks to volatility are very high and will remain forever as the variances are not stationary under the GARCH model.The ARCH-LM test statistics did not exhibit additional ARCH effect. This shows that the variance equations are well specified.

5.5 Estimation Results of EGARCH (1,1) Model

The asymmetrical EGARCH (1,1) results in Table 5 indicate that all the estimated coefficients are statistically significant at the 1% confidence level. The parameter for the asymmetric volatility response (γ) is negative and significant for all cases- except for the Jordanian Dinar (JOD)- indicating an asymmetric response for positive returns in the conditional variance equation. This result reflects the condition that volatility tends rise in response to positive spikes and fall in response to negative spikes. This lies counter to the usual expectation in stock markets where downward movements (falling returns) are followed by higher volatility than upward movements (increasing returns), that means the existence of leverage effects in the returns series during the study period. According to the ARCH-LM test results, there is no additional ARCH effect left.

6. Conclusions

This paper has examined the daily returns of exchange rates series of nineteen Arab countries. The currencies considered are the United Arab Emirates dirham (AED), Bahraini Dinar (BHD), Djiboutian franc (DJF), Algerian Dinar (DZD), Egyptian Pound (EGP), Iraqi Dinar (IQD), Jordanian Dinar (JOD), Kuwaiti Dinar (KWD), Lebanese Pound (LBP), Libyan Dinar (LYD), Moroccan Dirham (MAD), Mauritanian ouguiya (MRO), Omani Rial (OMR), Qatari riyal (QAR), Saudi Arabian Riyal (SAR), Somali Shilling (SOS), Syrian Pound (SYP), Tunisian Dinar (TND), and Yemeni rial (YER), all against the US dollar. The data span from 1st January 2000 to 19th November 2011. The paper employs two univariate specifications of the generalized autoregressive conditional heteroscedastic (GARCH) model, including both symmetric and asymmetric models that capture most common stylized facts about exchange rate returns such as volatility clustering and leverage effect. The empirical results show that the conditional variance (volatility) is an explosive process for the ten of nineteen currencies, while it is quite persistent for seven currencies which is required to have a mean reverting variance process. Furthermore, the asymmetrical EGARCH (1,1) results find evidence of leverage effects for all currencies - except for the Jordanian Dinar (JOD) - indicating that negative shocks imply a higher next period conditional variance than positive shocks of the same magnitude. Finally, the paper concludes that the exchange rates volatility can be adequately modelled by the class of GARCH models.

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Notes

Note 1. GARCH-M models (Engle et al., 1987), IGARCH model (Engle and Bollerslev 1986), Exponential GARCH model (Nelson, 1991), Threshold GARCH model Zakoian (1994) and (Glosten et al., 1993) and Power ARCH model (Ding et al., 1993), Components ARCH (Engle and Lee 1993).

Note 2. For more detail see for example Tsay 2002 and Poon, 2005.

Note. 3. For further reading on holidays and weekend effects see for example Theobald and Price (1984), Miller (1988), Abraham and Ikenberry (1994), and Cai et al. (2006).

Note 4. Maximum likelihood estimator (MLE) is the most popular method where parameters are chosen such that the probability of occurrence of data under its assumed density function is the maximum. MLE is widely used because it produces an asymptotically normal and efficient parameter estimates.

Note 5. In a normally distributed series, skewness is 0 and kurtosis is 3. Positive or negative skewness indicates asymmetry in the series and less than or greater than 3 kurtosis coefficient suggest flatness and peakedness, respectively, in the data.

Note 6. These tests examine whether we can predict the squared normalized residual by some variables observed in the past which are not included in the volatility model being used. If these variables can predict the squared normalized residual, then the variance model is misspecified.

Table 1. Descriptive Statistics of the exchange rate of the currencies against US dollar

Currencies	Mean	Min.	Max.	S. D.	Currencies	Mean	Min	Max.	S. D.
AED	3.67	3.64	3.6735	0.0010	MAD	9.073	7.140	12.04	1.234
BHD	0.38	0.36	0.3779	0.0026	MUR	256.3	219.6	289.4	12.86
DJF	169.9	143.8	177.720	4.4620	OMR	0.383	0.370	0.387	0.001
DZD	71.31	57.28	80.4162	3.7352	QAR	3.634	3.395	3.664	0.024
EGP	5.283	3.408	6.3513	0.7889	SAR	3.748	3.698	3.765	0.004
IQD	1775	1108	3124.00	757.9814	SOS	2033	1222	3179	637.3
JOD	0.745	0.694	0.7100	0.0021	SYP	47.99	40.95	58.49	2.665
KWD	0.291	0.262	0.3089	0.0117	TND	1.334	1.131	1.522	0.083
LBP	1485	1429	1514.30	19.8358	YER	191.4	164.2	239.2	15.09
LYD	1.116	0.459	1.3338	0.2678					

Table 2. Descriptive Statistics of the exchange rate returns series

	Mean	Min.	Max.	Std. D.	Skewness	Kurtosis	J-B	ADF
AED	-6.96E-06	-0.632	0.724591	0.0225	2.670328	494.4522	35417829*	-46.02*
BHD	-0.00016	-4.924	4.977234	0.8438	0.007990	17.77734	32018.51*	-63.66*
DJF	0.002436	-3.152	9.940499	0.5163	3.945172	74.53601	759467.3*	-37.80*
DZD	-0.001177	-4.405	5.355525	0.8596	0.184042	10.65667	8615.698*	-51.02*
EGP	0.007399	-11.06	15.60286	0.9212	1.953165	51.51488	347347.8*	-46.27*
IQD	-0.026664	-74.19	5.074177	1.3968	-42.55365	2261.854	7.49E+08*	-48.52*
JOD	8.06E-05	-1.392	1.445877	0.2069	0.111681	11.15080	9748.437*	-66.18*
KWD	-0.003065	-2.386	2.907374	0.2332	0.493437	25.18613	72315.21*	-49.83*
LBP	0.000412	-5.001	4.950929	0.8745	-0.137921	11.21966	9917.557*	-60.66*
LYD	-0.001922	-9.884	1.22703	0.5915	1.239034	85.09331	989051.9*	-47.58*
MAD	-0.009803	-4.162	.133995	0.2273	0.152842	6.935277	2284.396*	-43.28*
MUR	0.001398	-11.11	11.50472	0.8087	0.627939	43.92586	245817.3*	-39.59*
OMR	-5.17E-05	-3.504	3.166491	0.3227	0.147625	49.12274	311929.2*	-51.49*
QAR	3.12E-06	-5.143	.076545	0.6672	0.105014	31.81248	121728.5*	-50.46*
SAR	-2.27E-06	-1.386	.137430	0.759	-0.981169	56.91341	426753.0*	-63.18*
SOS	-0.013901	-20.19	8.616237	0.2415	-1.284939	35.02021	151302.1*	-47.19*
SYP	-0.000244	-12.64	20.38335	0.9099	2.431750	118.8036	1969779*	-39.72*
TND	-0.000794	-15.14	14.82751	2.2879	-0.049461	21.15078	48307.14*	-63.17*
YER	0.006093	-11.43	11.53460	0.4232	0.037140	34.58145	146242.9*	-60.58*

Notes: 1- * Indicates that the results are statistically significant at the 1% level.

2- ADF test includes a constant term without trend.

Table 3. ARCH-LM Test for residuals of returns series

Currencies	AED	BHD	DJF	DZD	EGP	IQD	JOD	KWD	LBP	LYD
ARCH-LM test statistic	1532*	1245*	487.9*	408.4*	456.9*	0.022	866.1*	385.3*	1579.7*	0.039
Currencies	MAD	MUR	OMR	QAR	SAR	SOS	SYP	TND	YER	
ARCH-LM test statistic	603.4*	815.9*	116.1*	639.9*	478.0*	77.3*	578.1*	1667.5*	1686.3*	

Notes: H_0 : There are no ARCH effects in the residual series.

* Indicates significant at 1% significant level.

Table 4. Estimation results of GARCH(1,1) model

Currencies	ω	α	β	$\alpha + \beta$	Log likelihood	ARCH-LM Test	
						statistic	Prob.
AED	8.50E-07*	0.111302*	0.904413*	1.015715	13897.79	14.26176	0.505777
BHD	0.000533*	0.022216*	0.977682*	0.999898	-1585.909	16.16764	0.370999
DJF	0.000839*	0.023757*	0.979260*	1.003017	-3329.159	18.74005	0.225756
DZD	0.004040*	0.069104*	0.932407*	1.001511	-5000.586	39.74372	0.000496
EGP	0.022422*	0.068604*	0.902161*	0.970765	-4606.610	0.485958	1.000000
JOD	5.79E-05*	0.188803*	0.874751*	1.063554	3014.051	16.20451	0.368592
KWD	0.000312*	0.053763*	0.943929*	0.997692	1223.468	17.12639	0.311365
LBP	0.002419*	0.061709*	0.940003*	1.001712	-3476.090	4.309008	0.996536
MAD	0.002149*	0.039420*	0.959707*	0.999127	-5223.059	69.59486	0.000000
MUR	0.006964*	0.071859*	0.919355*	0.991214	-3507.733	4.692976	0.994422
OMR	0.001729*	0.080914*	0.916108*	0.997022	202.5211	5.522989	0.986696
QAR	0.002158*	0.051709*	0.952221*	1.00393	-1641.817	0.777535	1.000000
SAR	1.86E-06v	0.142810*	0.888220*	1.03103	11060.68	6.282886	0.974594
SOS	0.025923*	0.071293*	0.900938*	0.972231	-4705.430	0.058244	1.000000
SYP	0.032733v	0.152505*	0.887726*	1.040231	-5987.829	0.486776	1.000000
TND	0.006702*	0.170539*	0.873210*	1.043749	-5706.664	1.487619	0.999996
YER	0.002289*	0.188023*	0.914639v	1.102662	-2259.343	0.135458	1.000000

Note: * Denotes significance at the 1% level.

Table 5. Estimation results of EGARCH(1,1) model

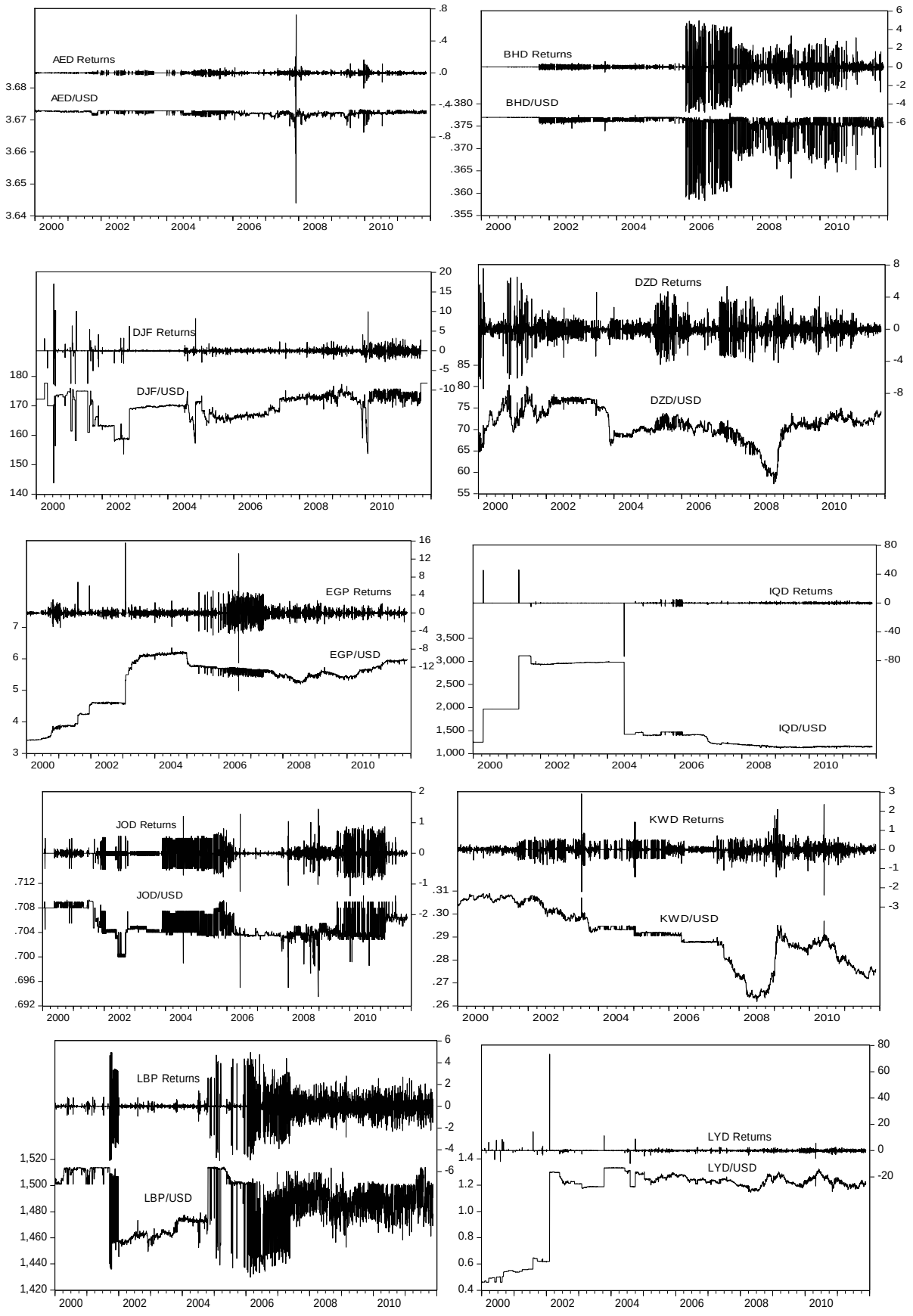
Currencies	ω	α	β	γ	Log likelihood	ARCH-LM Test	
						statistic	Prob.
AED	-13.03336*	0.313838*	-0.519609*	-0.123702*	12258.67	1257.77	0.0000
BHD	-0.078087*	0.101849*	0.988342*	-0.200766*	-740.0006	0.12617	1.0000
DJF	-0.049974*	0.022241*	0.967575*	-3418.323*	-3418.323	5.06858	0.9915
DZD	-0.101055*	0.167210*	0.990183*	-0.031086*	-5066.862	40.2992	0.0000
EGP	-0.100968*	0.132437*	0.954535*	-0.183590*	-4479.508	12.2535	0.6597
JOD	-0.338132*	0.357846*	0.957328*	0.019610*	2773.870	30.4282	0.0104
KWD	-0.106158*	0.094616*	0.983337*	-0.065332*	1101.609	45.9084	0.0000
LBP	-0.045539*	0.050058*	0.988804*	-0.190857*	-3515.859	1.73969	0.9999
MAD	-0.063991*	0.091828*	0.995378*	-0.086207*	-5197.239	127.997	0.0000
MUR	-0.117139*	0.174755*	0.956798*	-0.045725*	-3725.470	26.7005	0.0312
OMR	-0.029562*	-0.008418*	0.992434*	-0.210764*	1119.458	19.2269	0.2036
QAR	-0.025742*	-0.100117*	0.990081*	-0.415596*	-1108.082	0.70049	1.0000
SAR	-0.146521*	0.151156*	0.992861*	-0.206656*	11059.13	8.31246	0.9106
SOS	-0.088910*	0.153635*	0.938346*	-0.074651*	-4943.147	0.03083	1.0000
SYP	0.789230*	0.035457*	-0.658564*	-0.190590	-7202.369	11.8453	0.5643
TND	-0.196725*	0.348268*	1.004092*	-0.130239*	-5784.852	6.50237	0.9700
YER	-0.104012*	0.230964*	0.971554*	-0.088034*	-2292.899	0.70695	1.0000

Note: * Denotes significance at the 1% level.

Table 6. Results of asymmetric test

Currencies	Intercept	Sign bias	Size bias	
	φ_0	φ_1	φ_2	φ_3
AED	1.050**	-0.134*	-1.213***	0.323***
BHD	1.123**	-0.211*	-1.021***	0.229**
DJF	1.032**	0.143	-0.373	0.125*
DZD	1.832	0.311	-0.972*	0.201**
EGP	0.873***	-0.251**	-1.011*	0.314**
JOD	1.921	0.921	0.009	-0.033
KWD	0.832***	-0.397**	-1.072***	0.129***
LBP	1.527*	0.432	-0.032	0.003
MAD	1.493*	0.140*	-0.004	0.192*
MUR	0.932***	-0.137*	-0.629**	0.292**
OMR	0.864***	-0.235*	-1.219*	0.310**
QAR	0.821***	-0.211*	-1.327***	0.352**
SAR	0.759***	-0.241**	-1.038***	0.157***
SOS	1.321*	-0.143	-0.017	0.001
SYP	1.092**	0.129*	-0.782*	0.148*
TND	1.021*	-0.232**	-0.078	0.102*
YER	1.211*	-0.141*	-0.023	0.007

***, **, * indicate that the null hypothesis can be rejected at the 1%, 5% and 10% levels respectively.


AED Returns
AED/USD
BHD Returns
BHD/USD
DJF Returns
DJF/USD
DZD Returns
DZD/USD
EGP Returns
EGP/USD
IQD Returns
IQD/USD
JOD Returns
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KWD Returns
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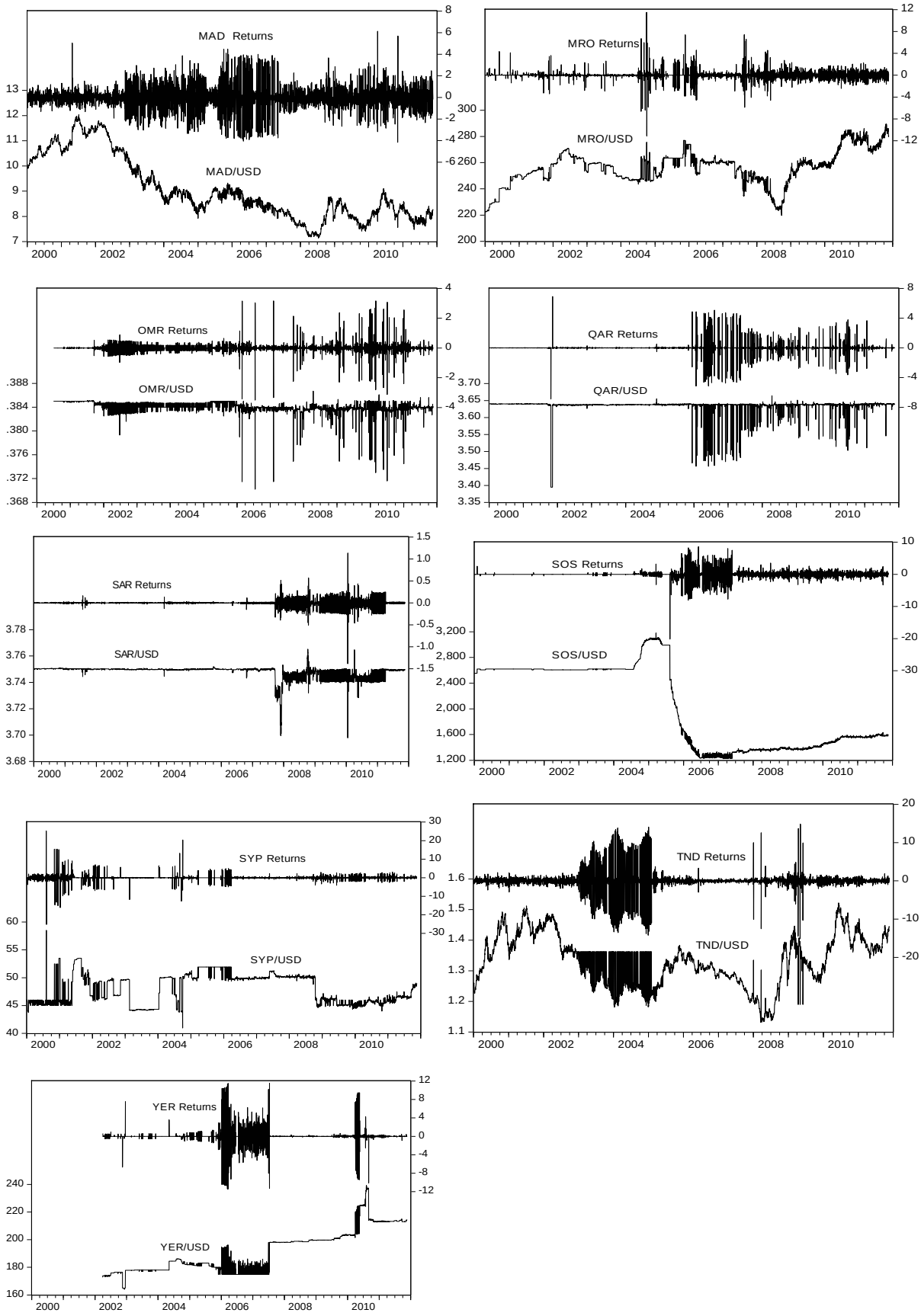

Figure 1. Plots of Exchange Rates and its Returns (2000-2011)

Calendar Anomalies and Turkish Real Estate Investment Trusts (REITs)

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Abstract

This study investigates the presence of calendar anomalies (January Effect; Day of the Week Effect; Turn of the Month Effect) on the daily returns at Istanbul Stock Exchange (ISE) real estate investment trusts (REIT) market. Although there have been numerous studies in the finance literature on the existence of calendar anomalies in common stocks but a few studies of anomalies in the markets for REITs. The research covers the period of January 4, 2000 to December 31, 2010, and the empirical study applies the ordinary least squares (OLS) model with dummy variables to investigate the calendar effects. The results prove that the daily returns of ISE REIT Index in January shows a statistically significant difference from other months. For the day of the week anomalies, statistics indicate that ISE-REIT Index daily returns on Tuesdays, Wednesdays, Thursdays and Fridays are significantly higher than the returns on Monday. This provides evidence of a day of the week effect in the market. On the other hand, the average return in turn of the month trading days is significantly higher than the average return in non turn of the month trading days and that is the existence of the turn of the month effect. In addition, there is no any previous study analyzing the calendar anomalies in REIT market. At this point, this paper is the first academic study that investigates anomalous behavior in REIT returns in Turkey.

Keywords: Real Estate Investment Trusts (REITs), Calendar anomalies, January effect, Day of the week effect, Turn of the month effect

JEL Classification: G12; G23; G29

1. Introduction

Real estate investment trusts (REITs) are closed-end investment companies which are managing portfolios composed of real estates, real estate based projects and capital market instruments based on real estates. They serve as financial intermediaries to facilitate the flow of funds from investors to real estate sector of the economy (Corgel et.al, 1995). The firstly introduction of the REITs in Turkey in 1995 opened the door for making real estate investments more widely available to individual and institutional investors. The main goal of REITs in Turkey is to create a source of financing for the real estate sector, which has been experiencing problems in this area. In order to promote the formation and growth of the industry, authorities have provided REITs with some important tax incentives as well as flexibility in managing their portfolios. On the other hand, Turkish REITs are not required to pay out dividends on an annual basis that is they have freedom to choose their dividend policy (Erol and Tirtiroglu, 2011). As of June, 2011, there are 23 REITs registered with the Capital Markets Board of Turkey and listed on the Istanbul Stock Exchange (ISE) with a total portfolio of US$11,808 billion. However, apart from the ones already on the ISE, this number is expected to rise and the total portfolio to grow with new public offerings in the years ahead. **Table 1** presents the historical consolidated portfolio structure of REITs in Turkey.

The main purpose of this paper is to provide an examination of three calendar anomalies (the January effect, the day of the week effect, and the turn of the month effect) in ISE REIT market. The results of this study would help individual and institutional investors for creating more effective investment strategies. If such calendar anomalies exist, opportunities may arise for earning abnormal returns on REIT stocks. The layout of the remainder of this paper is organized as follows. The literature review discusses the related literature on the calendar anomalies for REITs. The data section describes the sample. The methodology and the empirical results section provide an overview of the methodologies and present the results of the empirical tests. The final section provides some concluding remarks. In addition, there is no any previous study analyzing the calendar anomalies in REIT market. At this point, this paper is the first academic study that investigates anomalous behavior in REIT returns in Turkey.

2. Literature Review

In finance, an efficient capital market suggests that security prices adjust rapidly and accurately to new information and always "fully reflect" all available information (Fama, 1965). The issue of efficiency in the financial markets has been widely investigated by determining the behavioral characteristics of the prices of securities. The unusual behaviors of the prices, anomalies, are divided into subgroups, and one of the subgroups is called calendar anomaly. The literature on calendar anomalies is vast and dates back many decades. Most of the research on anomalies in stock markets has concentrated on the day of the week effect, the turn of the month effect, and the January effect. French (1980), Ariel (1987), and Rozeff and Kinney (1976) were the first researchers who exhaustively investigated these three price irregularities, which contradict the efficient market hypothesis. There have been numerous studies in the finance literature on the existence of calendar anomalies in common stocks but a few studies of anomalies in the markets for real estate investment trusts.

A major finding in most of the existing studies on monthly seasonality in stock markets is the January effect. That is abnormally high stock returns generated in January compared to the rest of the year. The first study on the existence of the January effect in the returns of real estate related stocks was by Colwell and Park (1990), who constructed an equally weighted return index based on monthly Center for Research in Security Prices (CRSP) data for the period from 1964 through 1986 to examine whether the January effect was also present in the REIT market. The main conclusion of their research is that the average rate of return on REITs is highest in January, but this is more apparent among small REITs. Similar research with comparable results was performed by Friday and Peterson (1997) for US REITs over the period 1974 to 1993. In this research, the authors find evidence, which indicates that the January effect is caused by tax-loss selling. Redman et al. (1997) examined the January effect in addition to three calendar anomalies for the period 1986 through 1993. They indicated that trading in January provided greater returns for REITs. More recently, Connors et al. (2002) re-examined the January effect in US REIT market over a period of 6 years, from 1994 through 1999. Contrary to other published researches, they found little or no evidence for the existence of the January effect in REITs. Instead, their results indicated that a December effect with returns significantly higher in Office/ Industrial, Retail and Multifamily Housing sectors. Hardin et al. (2005) re-examined the January effect over the period January 1994 to December 2002 in US REIT equally and value weighted indices. REITs did not evidence a January effect as measured by the REIT value-weighted index. By contrast, the REIT equal-weighted index supported a January effect anomaly.

As mentioned, the market efficiency hypothesis suggests that security prices adjust rapidly and accurately to new information. One of the most important issues is the day of the week anomaly in the market efficiency hypothesis. That is defined as a pattern of relatively low returns for some days of the week (i.e. Mondays) and relatively high returns for some other days of the week (i.e. Fridays). With regard to the literature on the day-of-the-week effect, the returns of REITs were first examined by Redman et al. (1997). For the period 1986 to 1993 they documented both significant negative returns on Mondays and a gradual increase in the returns as the week progresses, with the highest returns occurring on Friday. Although the returns on Mondays for the common stock portfolios are the lowest of the week too, the patterns are different from the REIT returns. Given the similarities between the equally weighted portfolio and the REIT index they conclude that the day of the week effect seems to be most prominent among small firms. Friday and Higgins (2000) examined the behavior of REIT returns around the weekend from 1972 to 1995. They reported that the average returns on Mondays to be positive when returns on Friday were positive and returns on Monday were negative when returns on Friday were negative. The relation between Monday returns of REITs and the changes in REIT structures in the late 1980s is investigated by Chan et al. (2005). They found that the disappearance of the lower and negative returns on Mondays coincided with an increase in the number of institutional investors in the REIT market, that is, no Monday anomaly was found in the case of US REITs. Brounen, and Yair (2009) examined the pattern of REIT returns around the weekend from 1987 to 2007 and found that returns on Thursday and Friday were significantly positive, but that returns on Monday were insignificantly positive in the US REIT market during the period from 1997 to 2007. Finally, in a recent study by Lee and Ou (2010) the day of the week effect is examined by using Value at Risk (VaR). Researchers found that there were positive returns on Tuesday and Friday, and negative returns on Wednesday.

The turn of the month is a market anomaly where stocks appear to earn abnormal returns during the last few days of one month through the first few days of the next. Redman et al. (1997) are the first to document a turn of the month in REIT stocks. In their research the dummy variable, for the turn of the month effect, be covering the last and the first three trading days of the month. They found evidence of a turn of the month effect and investors could earn higher returns by trading at the turn of the month in REIT shares. Connors et al. (2002) verified the continued pattern for REITs to experience positive returns around the turn-of-the-month, and noted that the returns during the rest of the month are insignificantly different from zero. Compton et al. (2006) examined the market returns of five

REIT indices (real estate 50 REIT, all-REIT, equity REIT, hybrid REIT, and mortgage REIT) to determine whether they exhibited a turn of the month (TOM) effect. They found that the six-day TOM period, on average, accounted for over 100 per cent of the monthly return for the three non-mortgage REITs, while the rest of the month (ROM) period generated a negative return. Additionally, the TOM returns were greater than the ROM returns in 75 per cent of the months. The other recent study by Wiley and Zumpano (2009) measured the impact of the level of institutional investment on the turn-of-the-month effect using a sample of 238 REITs over the period 1980 to 2004.

3. Overview of Data

The objective of this study is to provide an examination of the January effect, the day of the week effect, and the turn of the month effect anomalies in ISE-REIT market (Note 1). To achieve this objective, a total of 2,730 daily observations for the whole operation period of ISE-REIT Index (from January 4, 2000 to December 31, 2010) are employed. REIT daily percentage returns in each month are calculated as follows:

$$R_{j,t}=[(l_{j,t}-l_{j,t-1})/\ l_{j,t-1}]*100 \quad (1)$$

where $l_{j,t}$ and $R_{j,t}$ denote index number and return on day t in month j, respectively. **Table 2** shows the descriptive statistics for REIT Index.

4. Methodology and the Empirical Results

This study uses the ordinary least squares (OLS) model with standard errors computed using the Newey-West (1987) autocorrelation and heteroscedasticity to investigate the calendar effects. Following Redman et al. (1997), the OLS model with the January effect is as follows:

$$R_t=a_1+a_2D_{2t}+a_3D_{3t}+ \ldots\ldots\ldots+a_{12}D_{12t}+e_t \quad (2)$$

where, R_t is the return on day t; D_{2t}…. D_{12} are the dummy variables for the months, 1 if the trading day t falls in the months of February through December, and 0 otherwise; e_t is the random error term. In equation (2), the intercept a_1 is the average return in January. If the intercept is positive and significant, this indicates that the average return in January is significantly greater than zero. The coefficients a_2 to a_{12} compare the average return in January with the average return in February through December. A positive and significant a_2 indicates that the returns in February are significantly higher than the returns in January. The coefficients for the remaining dummy variables, from a_3 to a_{12}, are also interpreted similarly. The *F*-value measures the joint significance of the coefficients. In addition to the parametric test, a nonparametric Kruskal-Wallis (KW) test is conducted to test the equality of returns. A significant *F*-value and KW test also supports the presence of a January effect. In addition, the *t*-statistics in a_1 to a_{12} are adjusted for autocorrelation and heteroscedasticity up to 8 lags by using the Newey-West (1987) approach. The January effect results are shown in **Table 3**. Using the REIT index, the average daily return in January, measured by the constant, is positive and statistically significant at the 1% level. That is January behaves differently from the other months of the year, and for individual and institutional investors this generates a premium over the other months.

To analyze the day of the week effect in REIT index returns, equation 3 is utilized:

$$R_t=a_1+a_2D_{2t}+a_3D_{3t}+a_3D_{3t}+a_4D_{4t}+a_5D_{5t}+e_t \quad (3)$$

where, R_t is the return on day t; D_{2t}…. D_{5t} are the day of the week dummies; 1 if the trading day t falls on Tuesday through Friday, and 0 otherwise; e_t is the error term expected to follow regular normal regression assumptions. The intercept, a_1, measures the average daily rate of return on Monday. A positive and significant intercept implies that the average return on Monday is significantly greater than zero. The coefficients a_2 through a_5 are the pair wise comparison between the average return on Monday and the average return on Tuesday through Friday. A positive and significant a_2 indicates that the returns on Tuesday are significantly higher than the returns on Monday. Similar interpretation is also applied to the remaining three dummy variables. A significant *F*-value and KW test also supports the presence of a day of the week effect. In addition, the *t*-statistics in a_1 to a_5 are the Newey-West (1987) *t*-statistics adjusted for autocorrelation and heteroscedasticity up to 8 lags. **Table 4** contains the regression results for the day of the week effect. The constant term shows the average daily return that was earned on Mondays. On the other hand, the variables Tuesday, Wednesday, Thursday, and Friday are the dummy variables for the day of the week anomaly. As seen from the table, the coefficients for dummies are all positive and significant at the 1% level. These positive and significant coefficients imply that these returns are significantly higher than the returns on Monday. This provides evidence of a day of the week effect in REIT market.

To compare turn of the month and non turn of the month returns, the following regression with dummy variables representing the turn of the month trading days (explained in Ogden (1990) as *"the final trading day of the previous month and the first three trading days of the current month"*) is employed in equation 4:

$$R_t=a_1+a_2D_{2t}+e_t \quad (4)$$

where, R_t is the return on day t; D_2 is the dummy variable for turn of the month trading day; 1 if the trading day t is at the turn of the month, and 0 otherwise; e_t is the random error term. The intercept, a_1, is the average return in non turn of the month trading days. If the intercept is positive and significant, this indicates that the average return in non turn of the month trading days is significantly greater than zero. The coefficients a_2 compare the average return in non turn of the month trading days with the average return in turn of the month trading days. If a_2 is positive and significant, this suggests that the average return in on turn of the month trading days is significantly higher than the average return in non turn of the month trading days and that is the presence of the turn of the month effect. A significant F-value and KW test supports the presence of a turn of the month effect. The *t*-statistics in a_1 and a_2 are also adjusted for autocorrelation and heteroscedasticity up to 8 lags by using the Newey-West (1987) approach. The parametric OLS regression model used to identify a turn of the month effect and the empirical test results are all exhibited in **Table 5**. The dummy variable for the turn of the month covers the last and the first three trading days of the month. The constant represents the average return in non turn of the month trading days. As seen from the table, the positive and the significant a_2 suggests that the average return in turn of the month trading days is significantly higher than the average return in non turn of the month trading days and that is the existence of the turn of the month effect during the period from January 4, 2000 to December 31, 2010.

5. Conclusion

Real estate investment trusts are closed-end investment companies which are managing portfolios composed of real estates, real estate based projects and capital market instruments based on real estates. They serve as financial intermediaries to facilitate the flow of funds from investors to real estate sector of the economy. The firstly introduction of the REITs in Turkey in 1995 opened the door for making real estate investments more widely available to individual and institutional investors. There are now 23 REITs registered with the Capital Markets Board of Turkey and listed on the ISE REIT index. This study examines the behavior of ISE REIT market around the three calendar effects (the January effect, the day of the week effect, and the turn of the month effect) from 2000 to 2010. Although there have been numerous studies in the finance literature on the existence of calendar anomalies in common stocks but a few studies of anomalies in the markets for REITs. The empirical results of the OLS model reveal that January behaves differently from the other months of the year, and for individual and institutional investors this generates a premium over the other months. For the day of the week anomalies, statistics indicate that ISE-REIT Index daily returns on Tuesdays, Wednesdays, Thursdays and Fridays are significantly higher than the returns on Monday. This also provides evidence of a day of the week effect in the REIT market. In addition, the parametric OLS regression model finds a turn of the month effect during the period from January 4, 2000 to December 31, 2010. That is, the average return in turn of the month trading days is significantly higher than the average return in non turn of the month trading days.

Investigating these three price irregularities contradicted the efficient market hypothesis in ISE REIT market. The results of this study are also important to individual and portfolio managers for creating more effective investment strategies. That is opportunities may arise for earning abnormal returns on REIT stocks if investors trade in January, trade from Tuesday through Friday, and trade at the final trading day of the previous month and the first three trading days of the current month. On the other hand, for researchers the January effect, the day of the week effect, and the turn of the month effect have implications for asset pricing and performance evaluation.

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Notes

Note 1. Istanbul Stock Exchange (ISE) designs different types of indices so as to enable investors to track the ISE markets. Respectively, 46 and 18 indices are computed for the stock market and the bonds and bills market. Stock market indices calculated include both the price and return indices. While price indices reflect only the change in prices, dividend payments are also taken into account in return indices. The REIT index consists of stocks of real estate investment trusts traded on the ISE market. REIT index series are also set at 21,180.77 at the last trading day of 1999.

Table 1. Historical Consolidated Portfolio Structure of REITs in Turkey

All Real Estate Investment Trusts								
Year	Number of REITs	Portfolio Value Million USD$	R (%)	RP (%)	GB (%)	RR (%)	MM (%)	Other (%)
1997	2	43	45.00	0.00	0.00	55.00	0.00	0.00
1998	5	434	84.71	10.67	2.72	1.90	0.00	0.00
1999	8	796	17.62	65.17	4.39	12.81	0.00	0.00
2000	8	792	47.16	43.87	3.62	4.36	0.99	0.00
2001	8	621	72.97	25.36	1.12	0.36	0.19	0.00
2002	9	661	72.80	23.08	2.37	0.23	1.53	0.00
2003	9	845	72.16	20.09	5.35	0.01	2.39	0.00
2004	9	1,030	90.63	0.00	0.00	0.00	9.37	0.00
2005	9	1,645	84.86	0.00	0.00	0.00	14.71	0.43
2006	11	1,756	93.79	0.21	6.01	0.00	0.00	0.00
2007	13	2,471	82.18	0.14	17.54	0.00	0.00	0.00
2008	14	2,652	86.75	3.43	4.30	0.01	5.51	0.00
2009	14	3,172	69.54	17.44	4.39	0.00	0.00	8.63
2010	21	11,189	58.10	24.30	1.80	0.03	0.00	15.77
2011/ June	23	11,808	61.99	22.29	4.02	0.91	0.00	10.79

Notes: R %: Proportion of "Real Estates" in the Portfolio; RP %: Proportion of Real Estate "Projects" in the Portfolio; GB %: Proportion of "Public Debt Instruments" in the Portfolio; RR %: Proportion of "Reverse Repo" in the Portfolio; MM %: Proportion of "Money Market Instruments" in the Portfolio.

Source: Capital Markets Board of Turkey, www.cmb.gov.tr

Table 2. Descriptive Statistics for REIT Index, from 2000 to 2010

	REIT Index							
Year	Mean	Median	Max.	Min.	Std. Dev.	Skewness	Kurtosis	N
2000	-0.0011	-0.0038	0.1974	-0.1173	0.0391	1.0362	5.5514	245
2001	0.0011	-0.0025	0.1300	-0.1738	0.0388	-0.2064	2.0439	248
2002	-0.0012	-0.0008	0.1195	-0.1003	0.0294	0.5001	2.5456	249
2003	0.0019	0.0011	0.1017	-0.1195	0.0244	-0.7489	5.6430	244
2004	0.0024	0.0036	0.0734	-0.0638	0.0211	-0.0075	0.7650	248
2005	0.0019	0.0027	0.0526	-0.0554	0.0172	-0.2127	0.6852	251
2006	-0.0005	0.0005	0.0680	-0.1088	0.0200	-0.8377	4.2879	250
2007	0.0005	0.0010	0.0627	-0.0836	0.0165	-0.5636	4.4246	249
2008	-0.0041	-0.0035	0.0882	-0.0818	0.0223	-0.1378	1.9746	249
2009	0.0036	0.0043	0.0539	-0.0832	0.0181	-0.6625	2.4762	250
2010	0.0011	0.0011	0.0843	-0.0807	0.0171	0.0015	4.6218	247

Source: Istanbul Stock Exchange, www.ise.org

Table 3. The January Effect in REITs, from 2000 to 2010

$R_t=a_1+a_2D_{2t}+a_3D_{3t}+ \ldots\ldots\ldots+a_{12}D_{12t}+e_t$			
	Coefficients	Value	t-stat
Constant	a_1	0.1163	2.99*
February	a_2	-0.0825	-1.52
March	a_3	-0.1166	-2.14**
April	a_4	-0.0504	-0.92
May	a_5	-0.1333	-2.48
June	a_6	-0.0459	-0.81
July	a_7	-0.0982	-1.89***
August	a_8	-0.1230	-2.29**
September	a_9	-0.0721	-1.32
October	a_{10}	-0.0628	-1.14
November	a_{11}	-0.0677	-1.23
December	a_{12}	-0.0201	-0.35

*, **, and *** indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 4. The Day of the Week Effect in REITs, from 2000 to 2010

$R_t=a_1+a_2D_{2t}+a_3D_{3t}+a_4D_{4t}+a_5D_{5t}+e_t$			
	Coefficients	Value	t-stat
Constant	a_1	-0.1158	-2.92*
Tuesday	a_2	0.0764	0.93
Wednesday	a_3	0.2115	4.17*
Thursday	a_4	0.2396	4.62*
Friday	a_5	0.2756	4.98*

*, **, and *** indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 5. The Turn of the Month Effect in REITs, from 2000 to 2010

$R_t=a_1+a_2D_{2t}+e_t$			
	Coefficients	Value	t-stat
Constant	a_1	0.0134	0.76
Turn of the Month	a_2	0.0351	1.83*

*, **, and *** indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

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The Determinants of Life Insurance Demand in Central and Southeastern Europe

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Abstract

The main purpose of this study is to identify determinants of the demand of life insurance in 14 countries in Central and South- Eastern Europe (CSEE). We use fixed-effects panel model for the period 1998 - 2010 allowing each cross-sectional unit to have a different intercept term serving as an unobserved random variable that is potentially correlated with the observed regressors. We use two measures as a demand for life insurance: life insurance penetration and life insurance density. The research results show that higher, GDP per capita, inflation, health expenditure, level of education and rule of law are the most robust predictors of the use of life insurance. Real interest rates, ratio of quasi-money, young dependency ratio, old dependency ratio control of corruption and government effectiveness do not appear to be robustly associated with life insurance demand.

Keywords: Life insurance, Life insurance demand, Central and South- Eastern Europe countries

1. Introduction

Life insurance demand has experienced a rapid growth over the last few decades, both as provider of financial services to consumers and as a major investor in the capital market. But, the growth of life insurance did not raise on the same level, not only among industrial countries and developing countries, but also there is a difference between developing countries. The large disparity across countries in the use of life insurance raises questions about what causes this variation and thus what determines life insurance consumption. A number of authors have proposed a variety of different socio-economic and institutional factors as possible determinants of life insurance consumption.

This paper contribution resides in a new effort to understand what drives the life insurance consumption within a sample of 14 Central and South- Eastern Europe (Albania, Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Macedonia, Poland, Romania, Slovak Republic, Slovenia and Ukraine) for the period 1998 - 2010. As a measurers of life insurance demand we use: life insurance penetration (life insurance premiums in relation to GDP) and life insurance density (life insurance premiums per capita in constant dollars). We apply linear country specific fixed effects panel data regression model with common coefficients across all cross-section members of the pool. We have chosen fixed effects in each of two models for capturing the effects of unobserved variables that are potentially correlated with observed regressors.

The paper is organized as follows. Section 2 highlights literature on theoretical and empirical findings relevant to the demand for life insurance. Section 3 presents methodology and data, which we incorporate in the analysis. The results of the empirical research are given in section 4. The paper finishes with some concluding remarks and suggestions for the future work that are outlined in section 5.

2. Literature Review

In this section first we present the theoretical research and highlight the most relevant findings in the field of life insurance demand. The theoretical frameworks usually are followed by the empirical investigation of the developed models, so in the first part of literature review we will highlight both the models and the empirical findings, where they are present. Then we proceed to the empirical studies which for the most part evaluate factors' impact on life insurance demand in particular countries and across them.

2.1 Theoretical Studies

Yaari (1965) was the first to develop a theoretical model to explain the demand for life insurance. He developed the

life-cycle utility model of a consumer together with deducing the optimal consumption and optimal saving plans of a consumer. The consumer maximizes lifetime utility subject to a vector of interest rates and a vector of prices including insurance premium rates. This model posits the demand for life insurance to be a function of wealth, expected income over an individual's lifetime, the level of interest rates, the cost of life insurance policies (administrative costs), and the assumed subjective discount rate for current over future consumption.

Lewis (1989) used the life insurance framework developed by Yaari (1965) in his paper extending it in the sense that he included in his model the preferences of other members of the household. While, earlier studies were based on the assumption that life insurance is purchased to maximize the lifetime utility of the individual purchasing the life insurance product, the primary wage earner, Lewis's suggests that life insurance should be purchased to satisfy the needs of survivors. His model does not explicitly rely on the primary wage earner having a bequest motive. However, it does require that the preferences of the beneficiaries be the basis for the amount of life insurance purchased by the household. Deriving utility maximization by both spouse and offspring separately and assuming no bequest by the policyholder and an isoelastic utility function, Lewis shows that total life insurance demand can be written as follows:

$$(1\text{-lp})F=\max\{[\frac{1-1lp}{l(1-p)}]^{1/\delta}\ TC\text{-}W,\} \quad (1)$$

where l is the policy loading factor – the ratio of the costs of the insurance to its actuarial value -, p the probability of the primary wage earner's death, F the face value of all life insurance written on the primary wage earner's life, δ a measure of the beneficiaries' relative risk aversion, TC the present value of consumption of each offspring until he/she leaves the household and of the spouse over his/her predicted remaining life span ands W the household's net wealth.

Life insurance consumption, however, is not only driven by consumer demand. Price, is undoubtedly an important determinant in the consumption of life insurance. Varying levels of urbanization, monetary stability, bureaucratic quality, rule of law, corruption, and banking sector development all impact the insurer's ability to provide cost-effective insurance. Within the Lewis model, described above, these supply-side factors might be represented by the policyloading factor.

In short, the theoretical review yields variables like income, rate of interest, current consumption and accumulated savings in wealth form as variables influencing insurance consumption. Demographic and social variables were also incorporated in theoretical models and their potential impact on an individual's life insurance consumption decision was investigated. Life insurance consumption increases with the breadwinner's probability of death, the present level of family's consumption and the degree of risk aversion. However, there is no concrete evidence as to how many such non-economic or additional economic variables can play a role in theoretical models. In the next section, we explore selected empirical studies to highlight those variables which were significant in affecting insurance demand.

2.2 Review of the Empirical Literature

In this section we present a brief sublimate of empirical literature concerning the relationship between insurance sector and economic growth. When it is noted that often the relationship between insurance sector and economic growth is explored in panel context (studies of groups of countries).

Fortune (1973) was first to focus on the sensitivity relationship between life insurance purchase and financial variables, and linked his implications with the monetary policy and capital markets. He analysed the US insurance market for 1964-1971 and found a high degree of sensitivity between the optimal amount of life insurance, wealth and the real interest rate.

Beenstock et al. (1988) using an international dataset (12 countries over a period of 12 years) to examine the relationship between property liability insurance premiums and income, found out that marginal propensity to insure i.e., increase in insurance spending when income rises by 1$, differs from country to country and premiums vary directly with real rates of interest. Thus, again the decision of consumer and his/her initial wealth status too are significant factors when shortrun or longrun consumption of insurance is considered.

The study by Truett et al. (1990) discussed the growth pattern of life insurance consumption in Mexico and United States in a comparative framework, during the period 1964 to 1984. They assumed that at an abstract level demand depends upon the price of insurance, income level of individual, availability of substitute and other individual and environment specific characteristics. Further, they experimented with demographic variables like age of individual insured and size of population within the age group 25 to 64 and also considered education level to have some bearing on insurance consumption decision. Their results show the existence of higher income inelasticity of

demand for life insurance in Mexico at low income levels. Age, level of education and income were significant factors affecting the demand for life insurance in both the countries.

Starting with a brief review of Lewis's (1989) theoretical study and an assumption that inhabitants of a country are homogeneous relative to those of other countries, the study by Browne et al. (1993) expanded the discussion on life insurance demand by adding newer variables namely, average life expectancy and enrollment ratio of third level education. The study based on 45 countries for two separate time periods (1980 and 1987) concluded that income and social security expenditures are significant determinants of insurance demand, however, inflation has a negative correlation. Dependency ratio, education and life expectancy were not significant but incorporation of religion, a dummy variable, indicates that Muslim countries have negative affinity towards life insurance.

Based on a cross-sectional analysis of 45 developing countries, Outreville (1996) analysed the demand for life insurance for the period 1986. In his study he considered variables such as agricultural status of the country represented by the percentage of agricultural labour force; health status of the country in terms of amenities like percentage of population with access to safe drinking water; percentage of labour force with higher education and the level of financial development as factors explaining insurance demand other than the variables we have discussed above. Two dummy variables were used to reflect the extent of competition in the domestic market and foreign participation in the countries considered. The results show that personal disposable income and level of financial development significantly relates to insurance development.

Beck and Webb (2002) made a research over 68 countries of the world, paying attention to the question what causes the variance in life insurance consumption between different countries. They use four different measures of life insurance consumption and incorporate various economic, demographic and institutional factors in their research. As a result, they find that countries with higher income per capita level, more developed banking sector and lower inflation tend to consume larger amounts of life insurance. In addition, life insurance consumption is observed to be positively influenced by private savings rate and real interest rate. Education, young dependency ratio, life expectancy, and size of social security appear not to have any robust influence on the life insurance consumption.

In contrast to Beck and Webb (2002) results, the study by Ward et al (2002) is indicative of the fact that improved civil rights and political stability leads to an increase in the consumption of life insurance in the Asian region as well in the OECD region. The results of the study are consistent with the S-curve relationship proposed by Enz (2000), because in the countries with initially high income level the insurance consumption is less sensitive to income increase.

Although there are strong empirical explanations for determinants of life insurance, none of them focus on the Central and South- Eastern Europe countries particular. Only Beck and Webb (2002) include some of former socialist countries of CSEE (Bulgaria, Czech Republic, Hungary, Poland and Slovenia). In order to contribute to filling of the gap, the following is new empirical study on selected countries from the Central and Southeastern Europe (Albania, Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Macedonia, Poland, Romania, Slovak Republic, Slovenia and Ukraine).

3. Data and Methodology

For our research we focus on factors that determine demand of life insurance in 14 countries in Central and South-Eastern Europe (Albania, Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Macedonia, Poland, Romania, Slovak Republic, Slovenia and Ukraine)over the period of 1998 - 2010**.** In order to get more observations we used annual panel data. Following similar approach used by Beck and and Webb (2003), we use two measures as a demand for life insurance: life insurance penetration and life insurance density. Factors that we use as control variables, which may explain the demand of life insurance, include the following:

- Economic: GDP per capita, level of financial development, inflation, real interest rate;

- Demographic: dependency ratio, level of education;

- Social Factors: health expenditure to GDP;

- Institutional: rule of law, control of corruption and government effectiveness.

Insert Table 1 Here

Data are obtained from various sources. Life insurance penetration and life insurance density are obtained from Sigma, Swiss Re Economic Research & Consulting, Swiss Re, Zurich and national insurance associations. Education is obtained from EdStats, World Bank. GDP per capita, level of financial development, inflation, real interest rate, dependency ratio and health expenditure to GDP are obtained from World development indicators (WDI) database. Rule of law, control of corruption and government effectiveness is obtained from Worldwide

Governance Indicators. Table 1 presents the descriptive statistics for all the variables used in the regressions.

Life insurance penetration measures the importance of insurance activity relative to the size of the economy. Life insurance penetration, is not a perfect measure of consumption since it is the product of quantity and price. A higher premium volume might therefore reflect a higher quantity, a higher price or a difference in the mix of mortality and savings element purchased. Lack of competition and costly regulation might increase the price of insurance without implying a higher level of insurance consumption.

The second indicator of life insurance consumption is life insurance density. It indicates how much each inhabitant of the country spends on average on insurance in real international dollars. Consumers that purchase life insurance policies to insure their dependents against mortality risk will potentially buy more coverage and thus a higher face value in richer countries, since the death benefit has to replace a larger income. Therefore we expect life insurance density to be more income elastic than life insurance penetration.

3.1 Economic Factors

The significant positive impact of level of income in the economy - GDP was found by all the researchers in the field (e.g Fortune (1973), Campbell (1980), Beenstock, Dickinson, Khajuria (1986), Lewis (1989), Outreville (1996), Beck and Webb (2002), Ward and Zurbruegg (2000) The larger is level of income, the more of life insurance consumer can afford to purchase for several reasons Beck and Webb (2002). First, an individual's consumption and human capital typically increase along with income. This can create a greater demand for insurance (mortality coverage) to safeguard the income potential of the insured and the expected consumption of his/her dependents. Second, life insurance may be a superior good, inasmuch as increasing income may explain an increasing ability to direct a higher share of income towards retirement and investment-related life insurance products. Finally, the overhead costs associated with administrating and marketing insurance make larger size policies less expensive per dollar of insurance in force, which lowers the price of life insurance policies. To measure the income level of countries, we employ real GDP per capita, and we expect to have a positive relationship with life insurance consumption.

Real interest rates are taken in order to reflect the real return of invested money of insurance company. A higher real interest rate increases life insurers' investment returns and thus their profitability, in turn offering greater profitability of financial relative to real investment for potential purchasers of life insurance policies. This is particularly accurate for life savings instruments. Moreover higher real interest rates increase the supply of capital and therefore the ability of life insurance companies to answer to potential demand. On the other, higher interest rates may induce consumers to reduce their life insurance purchases given the anticipation of higher returns. Indeed, the rise in interest rates might reduce the purchase of life insurance as higher returns on alternative assets may switch consumers from savings in life insurance to another type of money accumulation (Lenten and Rulli, 2006).

Real interest rates have not been systematically included in all studies. For example, Browne and Kim (1993) neglect the influence of this variable on life insurance demand. Outreville (1996) finds the correlation of real interest rates with life insurance demand to be almost insignificant. Beck and Webb (2002) appear to detect a positive relationship using average lending rates. However, it can be noted that lending rates contain a credit risk premium that varies from one country to another, depending on its credit default experience. Therefore we expect real interest rates to be ambiguous related to life insurance demand.

Financial development is associated with the widespread securitization of cash flows, which enables households to secure future income through the ownership of financial assets. By offering similar benefits, life insurance is expected to generate higher sales in countries with a high level of financial development. The measurement of financial development is very controversial (Jung, 1986), but two alternative proxies are usually employed. One is the ratio of quasi-money (M2-M1) to the broad definition of money (M2). – shows the complexity of the financial structure (higher ratio indicates higher level of financial development), another is the ratio of M2 to the nominal GDP – financial deepening (demand for money per unit of output). Broad money M2 is often taken as an adequate measure of the financial sector in developing countries in view of the predominance of the banking sector, as well as owing to the lack of data on other financial assets (Hemming and Manson, 1988, and Liu and Woo, 1994). Following mentioned previous studies we use the ratio of quasi-money (M2-M1) as a measure of financial development.We hypothesise positive correlation with life insurance demand.

The next variable used in our research is the inflation rate. It is used to account for monetary discipline. It is expressed by the GDP deflator (annual percentage). As life insurance savings products typically provide monetary benefits over the long term a rise in inflation discourages people's incentives to save, leading to monetary uncertainty, thus making negative impact on the demand for life insurance. The negative impact of inflation had been widely documented in previous researchers (Outreville (1996), Beck and Webb (2002), Ward and Zurbruegg

(2002), Li et al. (2007)). With this variable, we expect a negative correlation with life insurance demand.

3.2 Demographic Factors

Dependency ratio together with education level of a society are key deterministic demographic variables considered in the previous researches. Dependency ratio shows the structure of the household in terms of a number of people, dependent on the main source of income. Campbell (1980) and Burnett and Palmer (1984) argue that the protection of dependents against financial hardships is the major force driving life insurance consumption. As shown in Lewis (1989), the demand for life insurance increases with the expected value of the dependents' lifetime consumption. This expected value obviously increases with the number of dependents. Hence, the greater need to safeguard them against the premature death of the wage earner.

To capture this relationship on aggregate data, most studies use the dependency ratio defined as the ratio of dependents--under 15 and over 64--to the working-age population aged between 15 and 64. Some studies use the median age of the population and the percent of the population between 25 and 64 years of age to depict the age distribution Truett et al. (1990), while others used ratio of young dependents to working population and ratio of old dependents to working population. For the purposes of this paper as a measure of dependency ratio we will use the following ratios: young dependency ratio, and old dependency ratio. With this two variables we expect to be ambiguously correlation with life insurance demand.

The level of education positively affects the demand for life insurance for several reasons. Truett and Truett (1990) argue that a higher level of education is associated with a stronger desire to protect dependents and safeguard their standard of living. Browne and Kim (1993) explain that a higher level of education is a good proxy to measure the risk aversion. An individual's education level is positively related to greater risk aversion. Outreville (1996) also supports the view expressed by Browne and Kim (1993). Additionally, Li et al. (2007) point out that larger duration of education, measured in average years of schooling, leads to a longer pressure of offsprings' dependency, which contributes to a higher demand for life insurance products to protect the dependents. On the other hand, the more people are involved in education process, the less labor force is presented on the market, therefore reducing overall GDP of the country. Therefore, education is hypothesized to be ambiguous related to life insurance demand. As an indicator of the level of education across countries we use tertiary gross enrollment ratio defined by the UNESCO Institute of Statistics as the total enrolment in tertiary education, regardless of age, expressed as a proportion of the eligible school-age population. measure a country's level of education by its.

3.3 Social Factors

Social security programs may affect the demand for life insurance in several different ways. First, social security programs proxy national wealth. Furthermore, given that social security benefits come from taxes, which reduce available income to purchase life insurance, high social security expenditure is hypothesized to reduce the consumption of life insurance. Beenstock, Dickinson, and Khajuria (1986), Browne and Kim (1993), Skipper and Klein (2000), Ward and Zurbruegg (2002) and Beck and Webb (2002) showed that the need for life insurance purchase is reduced when government spending on social security is increased.

However, to the extent that social security pension benefits cease upon the wage earner's death and are not replaced by survivorship benefits, the social security benefits represent a household asset that increases family consumption as long as the wage earner survives. As such, social security expenditures may be positively correlated with life insurance consumption. We use the ratio health expenditure to GDP as a proxy for social security expenditures, and we expect country's social security system to be ambiguous correlated with the demand for life insurance products.

3.4 Institutional Factors

Political and legal stability is important for a vibrant and growing life insurance market. As life insurance is considered to be a long-term relationships between a consumer and a company, the more stable is the legal system and, therefore, a political system in the country the higher is the willingness of contracting parties to initiate the business relationships.

Levine (1997, 1998) showed that a good investor protection will induce a higher economic growth. This situation is particularly applicable to life insurance products where relationship with companies tends to be long term. Moreover, with the increasing complexity of life insurance products, policyholder can suffer from informational asymmetry. The absence of sound legal system may also hamper the efficiency of insurers' investment, decreasing the profitability and increasing the insurance price. Finally, the lack of political stability shortens the economic horizon of both potential buyers and suppliers of life insurance products, dampening the development of a healthy life insurance market. To measure these institutional and political factors, we use two different indicators.

To measure property right protection, we use rule of law index, provided by the The Worldwide Governance

Indicators. This index reflects perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence. Therefore, it is hypothesized a positive relationship with life insurance consumption.

To measure property right protection, we use control of corruption index also provided by the The Worldwide Governance Indicators. This index Reflects perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests.

As a measure of political stability, we use indicator compiled by the The Worldwide Governance Indicators. This indicator is constructed using a large number of enterprise, citizen and expert survey respondents in industrial and developing countries, as reported by a number of survey institutes, think tanks, non-governmental organizations, and international organizations. He reflects perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies.

All three institutional factors are measured in units ranging from about -2.5 to 2.5, with higher values corresponding to better governance outcomes.

Given the cross-sectional and time-series data, we use country specific fixed effects panel data regression model with common coefficients across all cross-section members of the pool. The general equation to be estimated using pooled least squares is:

$$yit = \alpha i + xit\beta + uit\,, \tag{2}$$

where *yit* is a dependent variable, *xit* is a vector of independent variables, *uit* is a scalar disturbance term, *i* indexes country in a cross section, and *t* indexes time measured in years. Since the error terms *uit* are potentially serially correlated and heteroskedastic, we propose an autoregressive process of first order: *uit = puit-1 + eit*, where *eit* is white noise. Model incorporates White's consistent covariance matrix (White, 1980), for dealing with heteroskedasticity.

Given the hypotheses specified above, we construct two separate panel data regression models. The models are different since life insurance demand is represented by two different dependent variables: Insurance penetration and insurance density.

The specifications of the models to be estimated are as under:

Model 1

(life insurance penetration)it = αi + β1(GDP per capita)it + β2 (real interest rates)it+ β3 (QuasiMon/M2)it + β4(Inflation)it + β5 (young dependency ratio)it + β6(old dependency ratio)it + β7(education level)it + β8(Health expenditure to GDP)it + β9(rule of law)it + β10(Control of Corruption)it + β11 (Government Effectiveness)it + uit

(3)

Model 2

(life insurance density)it = αi + β1(GDP per capita)it + β2 (real interest rates)it+ β3 (QuasiMon/M2)it + β4(Inflation)it + β5 (young dependency ratio)it + β6(old dependency ratio)it + β7(education level)it + β8(Health expenditure to GDP)it + β9(rule of law)it + β10(Control of Corruption)it + β11 (Government Effectiveness)it + uit

(4)

Before running the regression an Im, Pesaran and Shin, panel unit-root test, which is based on the Dickey-Fuller procedure was employed to test the stationarity of the variables in order to avoid the spurious regression. Im, Pesaran and Shin denoted IPS proposed a test for the presence of unit roots in panels that combines information from the time series dimension with that from the cross section dimension, such that fewer time observations are required for the test to have power. Since the IPS test has been found to have superior test power by researchers in economics to analyze long-run relationships in panel data, we will also employ this procedure in this study. IPS begins by specifying a separate ADF regression for each cross-section with individual effects and no time trend:

$$\Delta y_{it} = \alpha_i + \rho_i y_{i,t-1} + \sum_{j=1}^{p_i} \beta_{ij} \Delta y_{i,t-j} + \varepsilon_{it} \tag{5}$$

where $i = 1, \ldots, N$ and $t = 1, \ldots, T$

IPS use separate unit root tests for the *N* cross-section units. Their test is based on the Augmented Dickey-fuller

(ADF) statistics averaged across groups. After estimating the separate ADF regressions, the average of the *t*-statistics for p_1 from the individual ADF regressions, $t_{iT_i}(p_i)$:

$$\bar{t}_{NT} = \frac{1}{N}\sum_{i=1}^{N} t_{iT}(p_i\beta_i) \tag{6}$$

The *t*-bar is then standardized and it is shown that the standardized *t-bar* statistic converges to the standard normal distribution as N and $T \to \infty$. Im, Pesaran and Shin (1997) showed that *t-bar* test has better performance when N and T are small. They proposed a cross-sectionally demeaned version of both test to be used in the case where the errors in different regressions contain a common time-specific component.

The results of the unit root test are presented in Table 2. While the null hypothesis of the unit-root was rejected for eight of the thirteen variables, and they are are stationary at their levels I (0); the obtained results indicate that there was a unit root in GDP per capita, young dependency ratio, old dependency ratio, life insurance penetration and life insurance density. To solve the problem of non-stationarity, the series were differenced at first level I(1).

Insert Table 2 Here

5. Empirical Results

The models used in this study have been introduced at the end of previous chapter. In this section, we present original results and interpretations concerning both of the observed models.

Insert Table 3 Here

5.1 Life Insurance Penetration

The results in Table 4 show that the variation of life insurance penetration across countries significantly and positively depends on income level, average years of schooling and health expenditure to GDP. These three variables show significant coefficients to the 1,5 or 10 per cent level in our baseline regression. Whereas the results for real interest rates, quasimon/M2 inflation, young dependency ratio, old dependency ratio, rule of law, control of corruption and government effectiveness are less robust..

As suggested in the previous studies, GDP per capita has a positive and significant influence on life insurance penetration. The results suggest that a 1% increase in GDP per capita is associated with an increase of about 0,0168 percentage points.in life insurance penetration. The results are consistent with the models of Campbell (1980) and Lewis (1989). Truett and Truett (1990), Browne and Kim (1993), Outreville (1996), and Beck and Webb (2002) obtain similar coefficients.

The results underline the importance of a high level of education for life insurance consumption. The coefficient on average years of schooling indicating that the rise in average years of schooling by 1 year improves life insurance penetration by 0.0016 percentage points

Reflecting the conflicting indications of previous studies that have sought to determine its effect, health expenditure expenditure appears to have a positive and significant influence on life insurance penetration. Thus 1% increase in health expenditure expenditure leads to 0.0123 percentage points rise in life insurance penetration. Hence, it would appear as in Browne and Kim (1993) that health expenditure reflects the high level of wealth of a country and should therefore be associated with higher life insurance demand. This result is consistent with Lewis (1989) and confirms the findings of Beenstock, Dickinson, and Khajuria (1986).

Contrary to most previous studies, real interest rates, quasimon/M2, inflation, young dependency ratio, old dependency ratio, rule of law, control of corruption and government effectiveness cannot explain the variation in life insurance density across countries.

As we expected, inflation and real interest rate is inversely related with penetration but are not significant. The relation between inflation and real interest rate with the demand proxies does not corroborate with earlier studies and hence we conclude that current interest rate and real interest rate or price situation does not affect in life insurance penetration.

The value of quasi money to M2 ratio, produces an expected positive sign and can be an important source of growth in the insurance industry but it was found to be insignificant. Although the results of the regression showed that value of quasi money to M2 ratio is statistically insignificant this variable my be a crucial factor in increasing demand for life insurance. This might due to the fact that a more developed financial institutions can increase competition with other financial sectors, especially insurance companies. This assertion is particularly appropriate for banking-type products offered by life insurers. The links between this two sectors, for instance, in Baltic

countries were observed going back to the end of 1990th (several life insurance companies were the bank subsidiaries in Estonia, Lithuania and Latvia), the cooperation between the two sectors in CSEE countries is still in its initial stage. The mentioned cooperation is known as bancassurance – expressed in acquiring the existing life insurance companies by banks or, what is more common, selling of insurance and banking products mutually through bank branches. The upward trend for this kind of services is justified by the positive experience of Western economies. 35% of sales in European life insurance market are accounted for bancassurance, which became a prevailing distribution channel for a number of Western economies including France, Spain, Italy and Belgium (Milliman, 2005).

The negative relationship between young dependency ratio and life insurance demand is not surprising. We expected ambiguous relationship. As young population earns no salary, they are not prompted to buy protection against early death in order to substitute actual salaries. Moreover, they cannot afford savings products. The old dependency ratio has also expected sign but it was found to be insignificant. It suggests that rising old dependency ratio will increase the demand for both the mortality and the savings component of life insurance policies. While the theoretical work focuses mostly on the life insurance policies held by primary wage earners, life insurance policies held by retirees have gained importance in many developed countries. This conclusion was confirmed in our study where we had as a sample of former socialist countries in Central and South- Eastern Europe.

The results in columns 1 indicate that out of our three indicators of institutional quality only the control of corruption is positively correlated with life insurance penetration, although is not significant. The coefficients on both the rule of law and government effectiveness are insignificant and have a negative sign. This can be interpreted as lack of evidence that these supply side deterninants are important.

5.2 Life Insurance Density

Now, proceeding to the density regression, the results indicate the following relationship: income level, average years of schooling, health expenditure to GDP and rule of law have a significant positive impact on the demand for life insurance, inflation influence significant negatively impact. These results are very similar to the ones obtained for life insurance penetration, so that in the following we will concentrate on the differences.

The important advantage of density regression is the significant impact of real personal income, which is highly supported by previous findings and shows that 1US dollars increase in income level of a person pushes life insurance density up by 11.56 US dollar.

The level of education also positively determines the demand for life insurance, indicating that the rise in average years of schooling by 1 year improves life life insurance density by 0.15 percentage points. This is relatively large impact of this socioeconomic factor comparing to other researchers, which emphasizes the importance of education in life insurance demand.

The coefficient of health expenditure is also positively determines the demand for life insurance.The hypothesis of a negative relationship, resulting from life insurance provided by social insurance programs substituting for private life insurance, is not supported by this study, postulates that 1 % increase in health expenditure results in 1,70 percentage points increase in life insurance demand. These results show that there is a greater influence on life insurance density on than was the case with life insurance penetration.

The results from our three indicators of institutional quality only the rule of law is positively correlated and significant with life insurance density. The results do show evidence to support the hypothesis that quality of property right factors is determinants of life insurance consumption in economies. It indicates that uprise in ratio by 1% increase life insurance density by 2.210 percentage points.

Contrary to most previous studies the coefficient on the inflation rate is significantly negative in all specifications. So 1% increase in inflation rate would reduce life insurance density by 1.041 percentage points.

Such economic, demographic and institutional factors as real interest rates, quasimon/M2, young dependency ratio, old dependency ratio, control of corruption and government effectiveness do not explain variation in the demand for life insurance across the CSEE countries.

6. Conclusion

In this paper we have analyzed the determinants of life insurance demand in panel of 14 countries in Central and South- Eastern Europe over the period 1998 - 2010, using two indicators of life insurance demand, life insurance penetration and life insurance density.

Consistent with previous research, we find that life insurance penetration and life insurance density increase with higher per-capita income. The results indicate that, increase in per-capita income level have the robustly impact the

life insurance demand. As overall income level and the share of middle class rises, we can expect demand for life insurance to rise too.

The analysis show that from economic variables QuasiMon/M2 have a positive but not significant effect on life insurance demand. But in our opinion as bancassurance will continue growing in the CSEE and, more important, in the CSEE countries and occupy its share in the life insurance products, the change in this relationship is expected. Although bancassurance is in its initial stage in CSEE countries, the tendency towards its growth is observed due to increase in consumers' crediting activity of the banks

The results also imply that real interest rates do not have robust link on life insurance density. Positive impact of real interest rate on the life insurance penetration in the selected countries may indicate the awareness of potential consumers about the benefits of life insurance and negligence to the mortality risk coverage. Inflation appears to have negative influence on life insurance demand, which is widely supported by previous researchers. Therefore, macroeconomic stability plays an important role in the development of life insurance market.

From the demographic factors we find that higher level of education lead to a higher life insurance penetration and higher life insurance density. This finding suggests a need for elevating the education level of population. It would be useful to enhance the understanding of financial products presented on the market and possible benefits from using them by potential consumers.

The results from the our regressions underline the importance of health expenditure with two indicators of life insurance demand. This result is consistent with the hypothesis that pension benefits represent assets which individuals protect against premature loss.

The results from institutional factors underline the importance of rule of law in life insurance density. Therefore, it is worth noticing that protection and enforcement of property rights will facilitate the demand of life insurance policies.

Whereas other factors, such real interest rates, young dependency ratio, old dependency ratio control of corruption and government effectiveness, do not have robust link to life insurance demand.

The results of this paper that the Central and South- Eastern Europe countries are regarded to be a highly potential region with dynamic and fact-growing insurance markets. Taking into account the impact of insurance development on economic growth (Ward and Zurbruegg, 2000, Webb, Grace and Skipper (2002) Arena (2008) the increase of life insurance sector should be viewed as inevitable part of stable economic development. In the future research when more data become available, would be useful to take a much bigger sample in terms of countries and periods would lead to a greater understanding and knowledge of determinants of life insurance demand.

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Table 1. Descriptive Statistics

Variable	Mean	Median	Minimum	Maximum	Std. Dev.
Life insurance penetration	0,697447	0,500000	0,000500000	3,10000	0,616695
Life insurance density	72,0184	25,3000	0,00800000	465,700	100,462
GDP per capita	7,44053	5,60500	0,313000	26,9110	5,50366
Real interest rates	5,96494	5,70000	-12,6000	37,9000	6,28183
QuasiMon/M2	16,7389	14,1500	-99,4000	145,200	19,2771
Inflation	6,83846	4,40000	-2,30000	55,2000	8,25363
Young dependency ratio	17,1703	16,0000	13,0000	31,0000	3,48614
Old dependency ratio	14,1703	15,0000	7,00000	18,0000	2,53780
Education level	50,3536	50,0000	15,0000	88,0000	18,2792
Health expenditure to GDP	6,79613	6,80000	4,60000	10,1000	1,02569
Rule of Law	0,230672	0,398227	-1,24346	1,22419	0,632538
Control of Corruption	0,0760387	0,171488	-1,15830	1,29689	0,541978
Government Effectiveness	0,352113	0,532759	-0,952360	1,22157	0,583592

Table 2. Panel Unit Root Test – Im, Pesaran and Shin (IPS)

Variable	Im, Pesaran and Shin Test	Order of Integration
Life insurance penetration	- 1,25236	I(1)
Life insurance density	- 0,546255	I(1)
GDP per capita	- 0,557758	I(1)
Real interest rates	-3,21412***	I(0)
QuasiMon/M2	-2,68304***	I(0)
Inflation	-3,50959***	I(0)
Young dependency ratio	-1,64284	I(1)
Old dependency ratio	-1,09956	I(1)
Education level	-2,19729***	I(0)
Health expenditure to GDP	-1,73602***	I(0)
Rule of Law	-3,90002***	I(0)
Control of Corruption	-4,2451***	I(0)
Government Effectiveness	-3,68991***	I(0)

*,**and***indicates test statistic is significant at the 10%, 5% and 1% level.

Table 3. Estimation results

Variable	Dependent variable: Life insurance penetration	Dependent variable: Life insurance density
Const	0,0227057	0,41238
	(0,0152934)	(2,0081)
GDP per capita	0,0168362***	11,5568***
	(0,00949187)	(1,29823)
Real interest rates	-0,00241964	-0,383954
	(0,00283315)	(0,351046)
QuasiMon/M2	6,35491e-05	0,0484918
	(0,000466415)	(0,0472744)
Inflation	-0,00162014	-1,04102*
	(0,00318447)	(0,545763)
Young dependency ratio	-0,0016596	-0,577787
	(0,0243775)	(3,04295)
Old dependency ratio	0,00712641	-1,11683
	(0,0313043)	(3,93174)
Education level	0,0044079*	0,149345*
	(0,00164312)	(0,245234)
Health expenditure to GDP	0,011221*	1,69694*
	(0,0123009)	(1,91384)
Rule of Law	-0,000368588	2,21082*
Control of Corruption	(0,0689616)	(7,5165)
	0,0840193	12,0439
Government Effectiveness	(0,0592414)	(6,82207)
Mean dependent var	-0,0554055	-10,2779
Sum squared resid	(0,0750332)	(6,95669)
R-squared	0,046110	8,760179
F(18, 111)	4,435753	70874,12
Log-likelihood	0,082222	0,424133
Schwarz criterion	0,533799	4,388378
S.D. dependent var	-66,89672	-746,1362
S.E. of regression	5,694335	1620,371
Adjusted R-squared	0,170121	27,14716
P-value(F)	0,176123	22,26260
Akaike criterion	0,071810	0,327484
Hannan-Quinn	0,042829	0,007908
Durbin-Watson	83,79343	1542,272
	52,09702	1573,969
	2,224837	2,385445

Standard errors in parentheses. ***, **, * denote statistical significance at the 1, 5, 10 percent level=

Research on Multi-Classification of Credit Rating of Small and Medium-Sized Enterprises in Growth Enterprises Board Based on Fuzzy Ordinal Regression Support Vector Machine

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Abstract

It is necessary to classify credit rating of small and medium-sized companies in Chinese growth enterprises board. We selected the data of 90 small and medium-sized companies, used fuzzy theory to calculate the qualitative variables, and reformulated support vector machine for ordinal regression method so that different input points can make different contributions to decide hyper plane, to analyze multi-classification of credit rating problem, and divided them into four different categories and demonstrated the good performance. The effectiveness of this improved method is verified in multi-classification of credit rating of small and medium-sized logistical companies; the experiment results show that our method is promising and can be used to other multi-classification problems.

Keywords: Support vector machine for ordinal regression method, Small and medium-sized companies, Growth enterprises board, Credit rating

1. Introduction

Small and medium-size enterprises are a pillar in China's economy. The statistical data demonstrated that small and medium-sized enterprises account for more than 99% of total number of enterprises, the contribution to GDP is more than 60% and the tax contribution is more than 50%, providing nearly 70% of the import and export trade amounts, creating about 80% of urban jobs in China in 2009. The country's long-awaited NASDAQ-style second board – Chinese's growth enterprises board started with 40 listed firms at November 2009. Chinese government and people hope that the growth enterprise board will play an important role in stimulating private investment, advancing industry upgrading, and promoting employment. It will also allow the capital market play its fundamental role in allocating market resources in a better way. Until nowadays, there are more than 200 enterprises in growth enterprises board in Shenzhen stock market. However, during two years, the growth enterprises board once crowned by "high growth potential market" make the investors disappointed, appeared repeatedly declining, a great deal of loss, the managers selling their own stocks to earn profits and financial frauds. Even if patient investors also had the questions, the companies in growth enterprises board highly not only cannot bring undertaking profits, but also induce to a large amount of loss and deficits. The researchers and investors hope delisting provision is brought into effect in companies of growth enterprises board. And China's Securities Regulatory Commission was improving delisting system to contain "shell" speculation and it was started that non-public bonds of SME in growth enterprises board. Thus, it is necessary to research on multi-classification of comprehensive evaluation and credit rating of SME in growth enterprises

Currently, the qualitatively appraised method used in the practice is mainly the artificial expert analytic method, called the classical credit analysis method using 5 fields to analyze the debtor's credit condition (called 5C method): Character, Capacity, Capital, Collateral and Condition. The quantitative assessment method is statistical methods used vary widely, such as Multi-linear Discriminate Analysis, Logistic analysis model, Fisher model analysis and artificial analysis method.

2. Literature Review

2.1 Research on Small and Medium-Sized Enterprises' Credit Rating

Xu Zhi-chun (2008) stochastically selected 12 financial indexes and 11 non-financial indexes (external environment changes, guarantee outside, investment increased, appraised value of mortgages decreased, misbehaviors, negative

news such as tax or environmental pollution, investigated by government authorities, net cash flow decreased, not coordinating to bank, manager changed) of small and medium-sized enterprises' as samples in the CMS database from some provinces ,establishing logistic regression model to forecast the borrowers' default risk. In doing so, early warning ability has been remarkably enhanced and early-warning model classification leads to better results than random classification. Dai Fen (2009) proposed the small and medium-sized enterprise credit rating index system which combined the non-financial indexes with the financial indexes, using ant group neural network to evaluate the samples to five levels, the results of which indicated that the ant group neural network is better than the traditional BP neural network.

The enterprise's credit rating from the view of credit sales in enterprises: Steven Finlay (2010) selected the selling data from a British large-scale catalog retailer and described the customers' default behavior with the binary continually financial behavior forecasting model. Finlay proved that this model is a feasible taxonomic approach and that people can even may also further calculate the profit optimization boundary if using genetic algorithm.

2.2 Support Vector Machines

Support vector machines (SVM) was first proposed by Corinna Cortes and Vapnik in 1995 that has been used very well to solve problems with a few such samples as nonlinear and high-dimensional pattern recognition, and can applies to other machine learning question, just as the function fitting. Support vector machine can solve regression problem (time series analysis) and the pattern recognition problem (classified question analysis), and also is also used in comprehensive evaluation and forecasting problems. Support vector machine is established on statistical learning theory, making up of VC dimension and structural risk minimization, which, based on the limited sample information, seek the balance between complexity of the model (ie, specific learning accuracy of training samples) and learning ability (ie, the ability of error-free identification to any sample) in order to obtain the best generalization ability. The classification process is a machine learning process. In the space of N hyperplane, VC is N +1. These data in VC dimension is n-dimensional space points, these points separated by a n-1 dimensional hyper plane, which is usually referred to as a linear classifier. Training samples of VC dimension in limited circumstances, when the sample size n is fixed, the higher VC dimension of learning machine, the more complicated of learning machine, VC dimension of learning reflects the learning ability of function set. The greater VC dimension is, the more complicated machine learning is (larger capacity is larger). Structural risk minimization is to ensure the classification accuracy (empirical risk), while reducing VC dimension of learning machine, and control expected risk of learning machine on the entire sample set, and then find the best classification plane, which can make the two different types data have the largest interval, also known as the largest interval hyper plane. SVM maps the vectors to a higher dimensional space, in this space to establish a maximum interval of hyper plane, then to build two parallel hyper plane on both sides of hyper plane which separates data each other, and maximize the distance between the two parallel hyper plane which have the right direction. The larger that the distance between these parallel hyper plane is, the smaller the classifier has total errors, support vector refers to the training sample points at edge of the interval. Support vector machine and neural network have the similar learning mechanisms, but SVM differ from neural network to use the mathematical methods and optimization techniques.

Kernel function of SVM is the key. Set of low-dimensional vector space is usually difficult to divide, if mapping them to high-dimensional space, which will increase the computational complexity, citing the concept of kernel function can solve such problems. Choosing the appropriate kernel function, high-dimensional space will be classified by function, using different kernel functions will lead to different SVM algorithms. Zhou Qifeng, et al (2005) , selected more than 1,000 industrial enterprises as samples from a commercial bank in 2003, made the rates of AAA, AA, A and A- as the output. By experiments, several multi-classification strategies assessing performances were compared and directed acyclic graph SVM and embedded space SVM were more suitable for credit risk assessment, which had a faster learning speed and higher forecast accuracy for commercial banks as credit risk assessment modeling. Wun-Hwa Chen et al (2006) used SVM to classify commercial banks which were qualified distributors in Taiwan's capital market, selected the index of stock market information, government financial support, major stockholder financial support and other variables analysis, and got the results which had the ratio higher accuracy than that of neural network. Xiao Wenbing et al (2007) used support vector machines to establish individual credit evaluation model, and compared the results with that of three fully connected BPN methods. The results showed that SVM in identifying potential loan applicants is better than that of neural network. Cheng-Lung Huang (2007) used mixed method combining genetic algorithms with support vector machine to analysis credit data in Australia and Germany, and obtains a more ideal result. Yan Youhao, et al. (2007) proposed an improved FSVM based on vague sets by assigning a truth-membership and a false-membership to each data points and reformulate the improved FSVM so that different input points can make different contributions to decision hyper plane. It is verified that the effectiveness of the improved FSVM in credit rating and the experiment results show that these

method is promising. Cheng-Lung Huang, et al (2007) used support vector machine with mixture of kernel to evaluate credit risk and demonstrate the good performance for the credit dataset from a US commercial bank. Atish P. Sinha, et al (2008) compared the results of Naive Bayes method, logistic regression, decision trees, decision tables, neural networks, K nearest neighbor method, support vector machine method in the borrower's credit evaluation and considered that in the certain fields and data limited it is important that to stress synergy between data mining and professional knowledge. Wu Chong, et al (2008) used integrated fuzzy integral-based support vector machine method to assess customers' credit in e-commerce environment and found good robustness and generalization ability. Shu-Ting Luo, et al (2009) used support vector machines and clustering algorithm to rate German credit data, and received more satisfied results. Wan Fuyong (2009) using Gaussian kernel SVM established the financial risk assessment model for listed companies, selected from 13 key indicators of listed companies, established 42 kinds of financial risk assessment models and compared the prediction accuracy of results. Wan proved support vector machines and statistical methods are better, and that based on numerical simulations Gaussian kernel of support vector machines in financial risk assessment of listed companies is superior. Wen Jingchen (2010) used similar Lp standard support vector machines to analyze 6,000 records of major U.S. credit card banks, solving smoothing problems by conjugate gradient method, and the results showed that this method was effective.

3. Research Methodology

It is necessary to analyze comprehensive evaluation and credit ratings of small and medium-sized companies in growth enterprises board for investors and other stakeholders to make decisions. And it is helpful to early warning and delisting system.

According Law of the People's Republic of China on Promotion of Small and Medium-sized Enterprises and Provisional Regulations on Standards for SMEs, small and medium-sized enterprises of industry, construction, wholesale and retail trade, must meet the following criteria: total number of employees less than 2000, sales revenue less than RMB300 million yuan per year, or total assets of RMB40,000 yuan; Among them, medium-sized enterprises have to meet people and over 300 employees, sales of RMB30 million yuan and above, total assets of RMB40 million yuan and above; the other for small businesses.

From nearly 300 listed companies in growth enterprises board, we selected 90 medium-sized companies according with the law and regulations. (Data collected from: http://quote.eastmoney.com/chuangyeban.html). We collected qualitative variables, including the basic information of companies: companies' name, companies' code, actual controllers, controlling shareholder, information of people in charge (such as age and education); macro environment of company: Industry prospects and industry performance ranking, location of company, Executives annual salary. Moreover, it is necessary to use quantitative variables, including total common stock, outstanding shares, total assets total sales revenue, operating income, net income, liquidity ratios: current ratio, quick ratio, cash ratio, operating cash flow ratio; profitability analysis ratios: return on assets, return on common equity, profit margin, EPS; activity analysis ratios: asset turnover ratio, accounts receivable turnover ratio, inventory turnover ratio; capital structure analysis ratios: debt ratio, interest coverage ratio; capital market analysis ratios: price earnings ratio, market to book ratio, dividend yield, dividend payout ratio

Because some small and medium-sized companies did not have enough information, default data was 0. Since sample data obtained mostly were qualitative variables, we should use the theory of fuzzy sets proposed in 1965 by Zadeh, which has been used for handling fuzzy decision-making problems. The elements of fuzzy sets have degrees of membership.A fuzzy set is a pair (A, m) where A is a set and m : A→[0,1].For each $x \in A$, m(x) is called the grade of membership of x in (A, m). For a finite set $A = \{x_1,..., x_n\}$, the fuzzy set (A, m) is often denoted by $\{m(x_1) / x_1,...,m(x_n) / x_n\}$.Let $x \in A$. Then x is called not included in the fuzzy set (A, m) if m(x) = 0, x is called fully included if m(x) = 1, and x is called a fuzzy member if $0 < m(x) < 1$. The set is $\{ x \in A \mid m(x) > 0 \}$is called the support of (A, m) and the set $\{ x \in A \mid m(x) = 1 \}$ is called its kernel. After calculation, we changed quantitative variables into data [0, 1], and easily used in next calculation.

And the selected indicators will duplicate information, such as total assets, and debt ratio. Therefore, principal component analysis is used to dimension reduction analysis, which obtained variables through computing process.

Because this problem belongs to small sample classification question, it selects support vector machine of multi-classification algorithm on small sample learning. Assigns training set:

$$T = \{(x_1, x_2),...,(x_1, x_2)\} \in (R^n \times y)^l, \qquad x_i \in R^n, y_i \in Y = \{1,-1\}, i = 1,...,l \tag{1}$$

Support vector machine solving multi-classification problem is to construct a series of problems into two classifications, and establish corresponding two classified machines, to determine which category input x belongs to based on two classified machines. One versus one method, one versus the rest method, and Crammer-Singer

multi-classification support vector machines. It is selected ordinal regression support vector machine, consider that M category of input is sequential from 1 to M in space Rn, which has identified adjacent relationship, that is, class j is the adjacent class of j-1, j +1 , and class j-1 and class j +1 are not adjacent class, and space can be separated by M-1 parallel hyper plane.

$$T = \{x_i^j\}_{i=1,2,...,l^j}^{j=1,2,...,M} \tag{2}$$

Here, x_i^j is training input, superscript j expresses the category of corresponding training, li is the number of jth kind training data.

The primitive question is:

$$\min_{w,b} \ \tfrac{1}{2}\|w\|^2 \tag{3}$$

$$s.t. \qquad (w \cdot x_i^j) - b_j \le -1, j = 1,...,M, i = 1,...,l^j \tag{4}$$

$$(w \cdot x_i^j) - b_{j-1} \ge 1, j = 1,...,M, i = 1,...,l^j \tag{5}$$

Here $b = (b_1,...,b_{M-1})^T, b_0 = -\infty, b_M = +\infty$

According to the training regulations and training set, introduce to slack variable $\xi^{(x)} = (\xi_1^1,...,\xi_{l^1}^1,...,\xi_1^M,...,\xi_{l^M}^M,\xi_1^{*1},...,\xi_1^{*M},...,\xi_{l^M}^{*M})^T$ and penalty parameter C>0, primitive question transforms to convex quadratic programming problem:

$$\min_{w,b,\xi^{(*)}} \ \tfrac{1}{2}\|w\|^2 + C\sum_{j=1}^{M}\sum_{i=1}^{l^j}(\xi_i^j + \xi_i^{*j}), \tag{6}$$

s.t.

$$(w \cdot x_i^j) - b_j \le -1 + \xi_i^j, j = 1,...,M, i = 1,...,l^j$$

$$(w \cdot x_i^j) - b_j \ge -1 + \xi_i^{*j}, j = 1,...,M, i = 1,...,l^j$$

$$\xi_i^j \ge 0, \xi_i^{*j} \ge 0, j = 1,...,M, i = 1,...,l^j$$

And

$$b = (b_1,...,b_{M-1})^T, b_0 = -\infty, b_M = +\infty$$

4. Conclusion

Using support vector machine classified credit rating of small and medium sized companies of growth enterprises board into selling(from website the investment rating agencies gave these companies no comments and these companies had losses), holdings, buying three category. According to the experimental results, accuracy rate of training set were: 84.2%, 86.4%, 83.1%, accuracy rate of testing set were: 79.1%, 76.8%, 74.3% The results can be explained that level selling means the enterprises with poor performance and losses of investors in the future, level holdings means the enterprises were not so good, but in the future the profits of them would be increased, level buying means the enterprises operating performance very well. Sometimes, the performance of enterprises will be affected by national industrial policy and macroeconomic environment, such as bank and real estate industry.

For these exceptional phenomena, it is manually adjusted by artificial expert method in practice, and achieves the better results of judgments. Thus, it is certified that we reformulated support vector machine for ordinal regression method so that different input points can make different contributions to decide hyper plane, to analyze multi-classification problems, and divided them into different categories to demonstrate the good performance. The effectiveness of this improved method is verified in multi-classification of credit rating of small and medium-sized companies in growth enterprises board. The experiment results show that our method is promising and can be used to comprehensive evaluation, sequencing problems, and other multi-classification problems. Our future direction of the research will focus on how to improve the accuracy of multi-classification. We believe that more suitable parameters and variables selection will affect and improve the performance of generalization. Extending the multi-class classification to solve other problems is also our future research work.

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Correlation and Volatility Transmission across International Stock Markets: A Bivariate GARCH Analysis

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Abstract

The study empirically examines correlation and volatility transmission across international stock markets by employing Bivariate GARCH model. The study uses weekly data for five major stock indices such as S&P 500(USA), BSE 30 sensex (India), FTSE 100(U.K), Nikkei 225(Japan) and Ordinary Share Price Index (Australia) from 30th January, 1998 to 30th July, 2011. Long run and short run integrations are investigated through Johansen cointegration and vector error correction models respectively. The results of Johansen test show that long run co-integration is found across international stock indices prices. Further, results suggest that the arrival of external news is simultaneously received by US and Japan stock markets and then transmitted to other Asian and European stock markets. The results of bivariate GARCH model reveal that there is a bidirectional volatility spillover between US and Indian stock markets. This is due to fact that these two economies are strongly integrated through international trade and investment. Finally, results show that a unidirectional volatility spillover from Japan and United Kingdom to India.

Keywords: Johansen cointegration test, Vector error correction model, Bivariate GARCH and volatility spillover

1. Introduction

Under globalization, world financial markets and economics are increasingly integrated due to free flow capital and international trade. Further, globalization has increased co-movement in stock prices across international markets. This co-movement stimulates vulnerability to market shocks. Therefore, shocks originating in one market not only affected its own market but are also transmitted to other equity markets. Hence, any information regarding the economic fundamentals of one country gets transmitted to other markets and thus affects the other's stock markets.

There are differing views concerning how correlation of international stock markets changes over a period of time. One view is that correlations across international stock markets are not constant over time due to changes in economics, political and market environments among countries (Baharumshah, Sarmidi, and Tan (2003) Shamsuddin and Kim (2003) Voronkova (2004), Bekaert and Harvey (2003); Bekaert and Harvey (2000) Errunza and Losq,(1985). Corhay, et al (1995) particularly studied the stock markets of Australia, Japan, Hong Kong, New Zealand and Singapore and found no evidence of a correlation among these markets. Nath and Verma (2003) studied the market indices of India, Singapore and Taiwan and found no correlation between these indices. Cheung and Mak (1992) and Masih and Mash 1997 b) found evidence that international stock markets are strongly correlated. They specifically, found that the US is a global factor affecting both the developed and developing markets. Therefore, there is a need to study cross border interrelation among international stock markets.

The study also investigates volatility transmission across international markets. There are studies which have examined this issue. For instance, Theodossiou et al. 1997, Yiuman Tse and Booth, 1999, Mansor and Mahmoodof, 2003, Savva, 2008, Shiun and Hsueh, 1998 have found significant mean and volatility spillovers from the U.S. market to other international markets. Koutmos and Booth (1995) also examine price and volatility spillovers among US, Japanese and British stock markets in a multivariate EGARCH model. They found significant asymmetric volatility spillovers from NY and London to Tokyo, from Tokyo and NY to London and from London and Tokyo and NY.

However, some studies reveal that there are weaker or no volatility spillover effects from U.S. to Asia [Ng, 2000; Baele, 2002, Bae and Karolyi, 1994]. Ng (2000) studied volatility spillovers between Japan and the US stock markets and found that there is no volatility transmission from the US to Japan. Baele (2002) investigated the time-varying nature of the volatility-spillover effects between the US (global effects) and European stock markets and found volatility spillover from European to the US stock markets.

It may however be pertinent to note that most of the studies have generated evidences which are mixed and inconclusive in nature on this issue. Therefore, the present study proposes to re-examine how common news (external news) drive both the Asia and European stock markets including India and also how these news are transmitted from one market to another.

The correlation and volatility transmission between stock markets is important for risk managers and policy makers for the following reasons. The correlation of stock markets is useful to design a well-diversified portfolio for investors. Changes in international correlation patterns call for an adjustment of portfolios. Policy makers are interested in volatility transmission across markets because of its implications for the stability of the global financial system. For instance, if volatility spillovers are significant between markets, a shock originating from one market may have a destabilizing impact on other markets. Hence, it is important for policy makers to understand the inter relations and volatility spillovers between financial markets.

The remainder of the study is organized as follows. Section 2 provides some empirical evidence on interrelation and volatility transmission across international stock markets. Section 3 describes the methodology and the data used. Section 4 the presents results and discussion. Section 5 provides a summary and conclusion of the study.

2. Some Empirical Evidence

There are studies which have examined correlation and volatility transmission across international stock markets. The empirical evidence however was found mixed [Kanas 1998, Shiun Pan and Hsueh 1998, Ng 2000, Ahmad Zubaidi and Boon Tan 2003, Kaur (2004) Gunasekarage and Power 2005, Victor Fang et al 2006, Mukherjee, and Mishra 2008]. Kanas (1998) examined volatility spillovers across the three largest European stock markets namely, London, Frankfurt and Paris by employing the Exponential Generalized Autoregressive Conditional Heteroscedasticity (EGARCH) model. He found that reciprocal spillovers between London and Paris, and between Paris and Frankfurt, and unidirectional spillovers from London to Frankfurt. Finally, his results show that spillovers are asymmetric in the sense that bad news in one market has a greater effect on the volatility of another market than good news. Similarly, Pan and Hsueh (1998) examined the nature of transmission of stock returns and volatility between the U.S. and Japanese futures markets. They used daily opening and closing futures prices on the S&P 500 and Nikkei 225 index from January 3rd, 1989 to December 30th, 1993. Employing the two-step univariate GARCH approach, the results show that there are unidirectional contemporaneous return and volatility spillovers from the U.S. to Japan.

Research studies which have employed the bivariate and multivariate GARCH also found inconclusive results. Ng, (2000) investigated the magnitude and changing nature of the return and volatility spillovers from Japan and the US to the Pacific–Basin markets using bivariate GARCH model. The empirical results show that there are significant volatility spillovers from both the Japanese and US markets to Malaysia, Singapore, Taiwan and Thailand. Kaur (2004) studied the return and volatility spillover between India (Sensex and Nifty) and US (NASDAQ and S&P 500) markets by employing EGARCH models. His results show mixed evidence of return and volatility spillover between the US and the Indian markets. The significant correlation between US and Indian markets was time specific.

Similarly, Gunasekarage and Power (2005) examined return and volatility spillovers from the US and Japanese stock markets to three South Asian capital markets namely, (i) the Bombay Stock Exchange, (ii) the Karachi Stock Exchange and (iii) the Colombo Stock Exchange. Their results show return spillovers in all three markets, and volatility spillovers from the US to the Indian and Sri Lankan markets and from the Japanese to the Pakistani market. Fang et al (2006) investigated the volatility transmission between Stock and Bond Market by using the daily data of stock and bond indices of both the U.S. and Australia during the period from 1998 to 2003. Employing BEKK GARCH (1, 1), they found spillovers between the stock markets of the U.S. and Australia, and the same effects are

present in the bond markets of both the countries. Their evidence support that bidirectional information flows between two markets.

Mukherjee and Mishra, (2008) investigated return and volatility spillover among Indian stock market with 12 other developed and emerging Asian countries by applying the Multivariate GARCH model. The study used both daily opening and closing prices from November 1997 to April 2008. The results show that Hong Kong, Korea, Singapore and Thailand are found to be the four Asian markets from where there is a significant flow of information in India. Similarly, among others, stock markets in Pakistan and Sri Lanka are found to be strongly influenced by movements in Indian market.

Employing bivariate VAR model, Savva (2008) investigated the price, volatility spillovers and correlations between the US and the major European stock markets. The study used daily prices S&P 500 (USA), FTSE-100 (UK), DAX-30 (Germany), CAC-40 (France), MIBTEL-30 (Italy) and IBEX-35 (Spain) from August 3rd, 1990 to April 12th, 2005. The estimated results show there is strong co-integration relationship between US and European stock markets. As far as the volatility spillover effects are concerned, the study revealed effects not only from US to Europe but also from Europe to US.

The above review shows that the findings of the various studies have been inconclusive on this issue. In the light of this observation the present study addresses issues related to correlation and volatility transmission across international stock markets.

3. Data and Methodology

3.1 Data

The study has chosen indices from India's four major trading partners; the United States, the United Kingdom, Japan and Australia. The US is India's largest trading partner among others and plays a dominant role in India's trade, accounting for 22.7 per cent of India's exports and around 7.69 per cent of India's imports. India's exports to the US have more than doubled during the period 2000 -01 to 2008-09. During 2000- 01, India's exports to the US at $ 9,301 million and then increased to $ 20,972.3 million in year of 2008-2009. India's exports to the UK also jumped manifold into $ 6,597 million during 2008 -09 as compared to 2000-01 which was $ 2,298.7 million. India's foreign trade with selected partners is given in figure 1. The figures show that India became increasing integrated with other developed countries through foreign trade.

The weekly data were collected from Yahoo Finance and Bombay Stock Exchange of India. The study mainly has chosen the indices from five major countries namely, the United States, the United Kingdom and Japan, Australia and India, to examine volatility transmission across international stock markets. Each index represents one country, such as BSE 30 sensex (India), S&P 500 (the United States), FTSE 100 (United Kingdom), Nikkei 225 (Japan) and Ordinary Share Price Index (Australia). Our weekly data of five indices cover the period from 30th January**,** 1998 to 30th July, 2011. The weekly indices rather than daily data are used for avoiding representation bias from some thinly traded stocks, i.e., the problems of non-trading and non-synchronous trading and to avoid the serious bid/ask spreads in daily data.

3.2 Methodology

The study employs the ADF and PP unit root tests to confirm the stationarity of the process and Johansan cointegration and vector error correction models to examine the long run relationship across international stock markets. The vector error correction model explains the speed of adjustment of the price deviation from long run equilibrium in relation to different stock price indices. The study finally employed bivariate GARCH model to establish the link between variances and covariance of two stock returns.

The main objective of study is to investigate volatility transmission across international stock markets. The Volatility spillovers are important in the study of information transmission because volatility is also a source of information to which investors react and form new expectations regarding risk and return. Angel Liao (2004) argued, volatility or "news" is transmitted through two channels. The first channel is price changes (an increase in the volatility of the variance of returns) whereas the second channel is noise (an increase in the volatility of the variance of the forecast error). Using GARCH models we can predict the effect that news in one stock market has on returns in other markets the next day and through which channel news is conveyed. A significant interaction is evidence of stock market interdependence or integration.

The study follows a two-step procedure. The first step involves estimation of VECM and the second step bivariate GARCH model. Estimating the two models simultaneously in one step is not practical because of the large number of parameters involved. Moreover, although the study focuses more on volatility spillovers (second moment) than cointegration (first moment), the error correction term must be included in the GARCH conditional variance equation.

Otherwise, the model will be misspecified and the residuals obtained in the first step (and, consequently, the volatility spillover results) will be biased.

To investigate volatility transmissions among two markets, a bivariate - GARCH model is employed. To illustrate, let there be two stock markets say one the US and another India. The bivariate GARCH (1, 1) model can be written as follows.

$$R_{1_t} = \theta_{10} + \theta_{11} R_{1_{t-1}} + \theta_{12} \varepsilon_{2t-1} + \upsilon_{t1} \quad (1)$$

$$R_{2_t} = \theta_{20} + \theta_{21} R_{1_{t-1}} + \theta_{22} \varepsilon_{1t-1} + \upsilon_{t2} \quad (2)$$

where the error terms are distributed as $N(0, H_t)$. The return or mean spillover parameters are θ_{12} and θ_{22}. R_{1t} is the S&P 500 returns depending on its own past values and ϵ_{2t-1}, is residuals from vector error correction model to check mean spillover from US to India. Similarly, R_{2t-1}, is BSE 30 returns depending on its own past values including residuals are derived from vector error correction model.

To capture the volatility spillover between markets, we introduce Error Correction (ECT) terms in conditional variance equations. The expansion of the matrix H_t is structured as:

$$h_{,11t} = c_{11} + \alpha_{11} \varepsilon^2_{1,t-1} + \beta_{11} h_{11,t-1} + \gamma_{11} \varepsilon^2_{1,t-1} \quad (3)$$

$$h_{22t} = c_{22} + \alpha_{22} \varepsilon^2_{2,t-1} + \beta_{22} h_{22,t-1} + \gamma_{22} \varepsilon^2_{2,t-1} \quad (4)$$

$$h_{12t} = c_{12} + \alpha_{12} \varepsilon_{1,t-1} \varepsilon_{2,t-1} + \beta_{12} h_{12,t-1} + \gamma_{12} h_{12,t-1} \quad (5)$$

The Equation (3) is conditional variance for US market which includes a function of past lagged value of residuals from VECM as well as own lagged value of residuals including past conditional variance. In this equation, γ_{11} is the coefficient spillovers from US (market 1) to India (market 2). In Equation (4) is the conditional variance equation for India, γ_{22} is the coefficient of spillovers from India (market 2) to USA (market 1)

The bivariate specification allows the conditional variances (h_{11t} and h_{22t}) and covariance (h_{12t}) of two markets returns to influence each other. The volatility spillover is measured by the parameters of γ_{11} and γ_{22}. The standard square residuals of $\varepsilon^2_{1,t-1}$ and $\varepsilon^2_{2,t-1}$ are obtained from Vector Error Correction (VCEM) Model.

4. Empirical Results

Table 1 presents summary of statistics for S& P 500, FTSE 100 and NIKKEI 225, BSE 30 sensex and Ordinary Share Price Index. The daily mean returns are positive, in case of S& P 500, FTSE 100 and Nikkei 225. But it is negative for BSE 30 sensex and All Ordinaries Shares. The standard deviation of S& P 500 and Nikkei 225 are higher among five stock indices. This shows that there is higher volatility in these two markets as compared to other markets. The measures for skewness and excess kurtosis indicate that the distributions of returns for all five markets are positively skewed and leptokurtic relative to non normal distribution. The Jarque Bera (denoted by JB) statistic rejects normality at 1% level of significance in all cases. The Ljung Box statistic for 16 lags applied on returns (denoted by LB (16))and squared returns (denoted by LB^2 (16)) indicate that significant linear and nonlinear dependencies exist. The LM test statistic shows that there is evidence for ARCH effect and time varying volatility.

The results of correction matrix are presented in table 2. The results reveal that the five stock indices are highly correlated with each other since correlation coefficients are high. Particularly, S & P 500 index is highly correlated with European and Asian stock indices. The weekly stock returns of India (BSE 30 sensex), US (S&P 500), UK (FTSE 100), Japan (Nikkei 225) and Australia (Ordinary Share Price Index) are presented from figures 2 to 6 and their unit root statistics are reported in table 3. The results of ADF show that all series are non-stationary at level since null hypothesis is accepted in all cases. However, all stock prices are stationary at first difference, which are integrated of order one. Similar results are observed in Phillips-Perron test given in the same table.

Table 4 provides results of Johansen cointegration test. All test equations contain two lag for the endogenous variables chosen by Akaike Information Criteria (AIC), Final Prediction Error (FPE) and Schwarz Information Criteria. The Johansen results indicate that there are two cointegrating vectors in the five variables system which cannot reject null hypothesis at 5% level under trace and maximum eigen value. These results suggest there are two cointegrating vectors among five stock indices prices.

The results of vector error correction model are given in table 5. The results show that the coefficients of error correction terms are not statistically significant in case of Nikki 225 and S&P 500, but it is statistically significant for

BSE 30 sensex, FTSE 100 and All Ordinaries Shares. It indicates that whenever stock indices such as Nikki 225 and S&P 500 deviate from equilibrium level, other markets (BSE 30 sensex, FTSE 100 and All Ordinaries Shares) tend to correct back to towards long run equilibrium level during next period. These result shows that stock markets such as the US and Japan lead other markets suggesting that any external news is arrives simultaneously get affected by both stock markets and then transmitted to other Asian and European stock markets.

The results of bivariate GARCH model are reported in tables 6 to 9. The results reveal that there are positive significant volatility spillovers from the US market to Indian market (0.00979) and from the India to US stock market (0.00521). In other words, there is bidirectional volatility spillover between two markets. This is due to the fact that co-movement information flows exist between prices in the two markets. Similarly, there is positive volatility transmission from Japan to India since coefficient of γ11 is found to be significant. However, a negative volatility spillover is found from United Kingdom to India. Further results suggested that there is no reverse volatility spillover from India to Japan and United Kingdom. Finally, the results show that volatility spillovers between Australia and India are not found. The positive spillover coefficients (γ_{11} and γ_{22}) indicate that shocks to one market increase the conditional variance of another in the next period.

The spillover coefficient from the US to India (0.00979) is greater than the spillover coefficient from India to the US (0.00521). Similarly, the coefficient from Japan to India (0.00846) is larger than the coefficient from India to Japan (0.00427). Overall, these results indicate that US and Japan stock markets are exporting their volatility to India, with London exporting volatility which has a comparatively the negative influence.

5. Final Remarks

Interinkages between developed and emerging stock markets has great importance because strong linkage reduces insulation of domestic market from any global shock and creates implications, whereas weak market linkage offers potential gains from international diversifications and affects development of the emerging markets. This study investigates interdependent and volatility spillover across international stock markets using bivariate GARCH model. The weekly closing prices of the S&P500 (US), FTSE 100 (United Kingdom), Nikkei 225 (Japan), Ordinary Share Price Index (Australia) and BSE 30 sensex (India) are used from January 30th, 2000 to July 30th, 2011. Employing Johansan co-integration and vector error correction models, it is found that there is long run relationship across international stock indices prices.

Further, the results reveal that stock markets such as S&P 500 and Nikkei 225 deviate from equilibrium level, but three markets namely, BSE 30 sensex, FSTE 100 and Ordinary Share Price Index tend to make all correction to reestablish equilibrium in the long run. This implies that the US and Japan stock markets lead other markets suggesting that any external news arrival simultaneously received by both markets and then transmitted to other international stock markets. In case of volatility transmission, the study finds a bidirectional volatility spillover between the US and Indian stock markets. This may be because of the fact that these two economies are strongly interrelated through international trade, investment. Finally, the results show that a positive volatility spillover is found from Japan to India.

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Table 1. Descriptive Statistics for Selected Stock Indices Returns

	ASX	BSE 30 Sensex	FTSE 100	Nikkei 225	S&P 500
Mean	-0.0001	-0.0005	0.0001	0.00014	6.86E-05
Median	-0.0004	-0.0012	-0.0002	-7.70E-06	-0.00042
Maximum	0.0855	0.1180	0.0926	0.1211	0.0946
Minimum	-0.0536	-0.1599	-0.0938	-0.1323	-0.1095
Std. Dev.	0.0099	0.0181	0.0214	0.0193	0.0239
Skewness	0.6785	0.0944	0.0920	0.2336	0.1189
Kurtosis	10.643	8.0601	8.4553	8.7506	10.212
Jarque-Bera	7083.8	3013.8	3502.1	3912.83	6121.5
Probability	0.0000	0.0000	0.0000	0.0000	0.0000
Sum	-0.3676	-1.4644	0.2976	0.4067	0.1936
Sum Sq. Dev.	0.2803	0.9312	0.5101	0.7496	0.5472
Results of Residuals Test					
LB-Q (16)	42.61 (0.000)	52.57 (0.000)	94.41 (0.000)	32.536 (0.000)	59.205 (0.000)
LB-Q^2 (16)	311.16 (0.000)	629.2 (0.000)	287.9 (0.000)	345.25 (0.000)	352.50 (0.000)
LM test (6)	28.387 (0.000)	37..21 (0.000)	77.54 (0.000)	16.327 (0.0183)	23.608 (0.001)

Note: LB-Q (k) and LB2-Q (k) are the portmanteau Ljung-Box Q test statistics for testing joint significance of autocorrelation of standardized residuals up to 16 lags. LM is the ARCH effect in the standardized squared residuals up to 12 lags. The figures in parentheses are the p-values.

Table 2. Correlation Matrix for Selected Stock Indices

	ASX	BSE 30 sensex	FTSE 100	NIKKE225	S&P 500
ASX	1	0.68649	0.73889	0.68063	0.68335
BSE 30 sensex	0.68649	1	0.97965	0.92467	0.95356
FTSE 100	0.73889	0.97965	1	0.91697	0.95203
NIKKE225	0.68063	0.92467	0.91697	1	0.89465
S&P 500	0.68335	0.95356	0.95203	0.89465	1

Table 3. Unit Root Statistics

Index	Augmented Dickey-Fuller Test			
	Levels	P. Value	First Differences	P. Value
All Ordinaries Shares	-0.289333	0.9240	39.9971*	0.000
BSE 30 sensex	-1.505365	0.5309	22.00650*	0.0000
FSTE 100 Index	-1.496206	0.5856	45.07651*	0.0000
NIKKEI 225	-1.669398	0.4468	-35.89363*	0.0000
S&P 500 INDEX	-0.8842	0.7893	-48.7841*	0.0000
Phillips-Perron Test				
All Ordinaries Shares	-0.276361	0.9259	40.38646*	0.0000
BSE 30 Sensex	-1.530122	0.5182	-46.92045*	
FSTE 100 Index	-1.617131	0.4736	-48.12292*	0.0000
NIKKEI 225	-1.396802	0.5853	-45.20754*	0.0000
S&P 500 INDEX	-1.728527	0.4167	49.35343*	0.0000

* indicates that unit root rejection of null hypotheses

Table 4. Johansen Cointegration Test

Null Hypothesis	Alternative hypothesis	Trace Test	Critical Value	P.value
H0	H1			
r≤0	r>0	172.5302*	69.81889	0.0000
r≤1	r>1	59.96486*	47.85613	0.0025
r≤2	r>2	27.94328	29.79707	0.0806
r≤3	r>3	12.64363	15.49471	0.1286
r≤4	r>4	1.856646	3.841466	0.1730
Maximum Eigenvalue				
Null Hypothesis	Alternative hypothesis	Eigenvalue	Critical Value	P.value
r≤0	r>0*	112.5654*	33.87687	0.0000
r≤1	r>1*	32.02158*	27.58434	0.0126
r≤2	r>2	15.29965	21.13162	0.2684
r≤3	r>3	10.78698	14.26460	0.1652
r≤4	r>4	1.856646	3.841466	0.1730

Note: * indicates 5% level of significance; lag length is chosen based on AIC and FPE and found to be 2

Table 5. Results of Vector Error Correction Model

Error Correction:	ASX	BSE 30 Sensex	FSTE 100	Nikkei 225	S&P 500
ECT	-0.52005 [-3.16071]*	-0.001794 [-10.8086]*	0.000549 [2.86304]*	0.000470 [0.86380]	0.00006 [1.25797]
ASX (-1)	0.086345 [3.74328]*	0.000685 [0.10601]	-0.019531 [-2.61251*]	0.000271 [0.01259]	-0.003209 [-1.97237]
ASX (-2)	-0.031627 [-1.37686]	-0.009606 [-1.49213]	-0.009361 [-1.25738]	0.068379 [3.19318]	0.001369 [0.84490]
BSE 30 sensex (-1)	0.018058 [0.22419]	-0.054473 [-2.41300]*	-0.045635 [-1.74812]	-0.039890 [-0.53121]	-0.005954 [-1.04796]
BSE 30 sensex (-2)	-0.110465 [-1.43863]	-0.001481 [-0.06882]	-0.016472 [-0.66191]	-0.143890 [-2.01011]	0.006489 [1.19814]
FSTE 100 (-1)	0.025677 [0.33276]	0.139133 [6.43339]*	-0.073031 [-2.92020]*	0.035797 [0.49761]	0.065245 [11.9875]*
FSTE 100 (-2)	0.082030 [1.03610]	-0.075863 [-3.41895]	-0.004330 [-0.16875]	0.051541 [0.69831]	0.027667 [4.95445]
Nikkei 225 (-1)	0.088267 [3.58843*]	-0.001995* [-3.28939]	2.82E-05 [0.00353]	-0.030766 [-1.34165]	-0.002373* [-2.36780]
Nikkei 225 (-2)	-0.021856 [-0.88573]	0.002597 [0.37548]	0.022923 [2.86627]	-0.017520 [-0.76160]	0.001463 [0.84054]
S&P 500 (-1)	0.729057 [2.18808]*	0.609714 [6.52917]*	-0.001092 [-0.01011]	0.523288 [2.68464]*	-0.210487 [-8.95627]
S&P 500 (-2)	0.091201 [0.27782]	0.121265 [1.31806]	-0.016382 [-0.15398]	-0.445557 [-1.45592]	-0.113688 [-4.91001]

Note: ECT represents the lagged error correction term; * indicates 1% level of significance; figures in parentheses are t values; lag length is chosen based on AIC and FPE and found to be 2.

Table 6. Bivariate GARCH Model between BSE 30 sensex and S&P 500 Index

	Coefficients	Z. Value	P. value
θ_{11}	0.7821	3.7891	0.0000
θ_{21}	-0.0814	-3.0174	0.0000
θ_{12}	0.0987	2.2741	0.0156
θ_{22}	-0.0008	-0.9981	0.2786
α_{11}	0.0029	8.4083	0.0000
α_{22}	0.0011	9.8224	0.0000
β_{11}	7.5E-05	1.7792	0.3489
β_{22}	-0.7955	-5.7892	0.0000
γ_{11}	0.00979	2.5891*	0.0178
γ_{22}	0.00521	2.1756*	0.0789
Residual Diagnostics	**Test Statistic**		**P. value**
LBQ (12)	8.7762		0.7791
LBQ^2 (12)	6.9981		0.8951
LM Test	4.7892		0.5786

Note: * indicates 1% level of significance. LB-Q (k) and LB^2-Q (k) are the portmanteau Ljung-Box Q test statistics for testing joint significance of autocorrelation of standardized residuals up to 12 lags. LM is the ARCH effect in the standardized squared residuals up to 6 lags. Estimates of constant and covariance terms are not reported in the table.

Table 7. Bivariate GARCH Model between BSE 30 sensex and Nikkei 225

	Coefficients	Z. Value	P. value
θ_{11}	0.7668	3. 0661	0.0000
θ_{21}	-0.0456	-1.7892	0.2871
θ_{12}	0.5894	2.8794	0.0175
θ_{22}	-0.0079	-1.9482	0.2287
α_{11}	0.0024	7.3702	0.0000
α_{22}	-0.0014	-8.7408	0.0000
β_{11}	0.4177	11.0757	0.0000
β_{22}	-0.31481	-8.0189	0.0000
γ_{11}	0.00860	2.3947*	0.0327
γ_{22}	0.00427	0.7141	0.4789
Residual Diagnostics	**Test Statistic**		**P. value**
LBQ (12)	4.5928		0.5587
LBQ^2 (12)	6.8861		0.7418
LM test	7.9975		0.8567

Note: * indicates 1% level of significance. LB-Q (k) and LB^2-Q (k) are the portmanteau Ljung-Box Q test statistics for testing joint significance of autocorrelation of standardized residuals up to 12 lags. LM is the ARCH effect in the standardized squared residuals up to 6 lags. Estimates of constant and covariance terms are not reported in the table.

Table 8. Bivariate GARCH Model between BSE 30 sensex and FTSE 100 Index

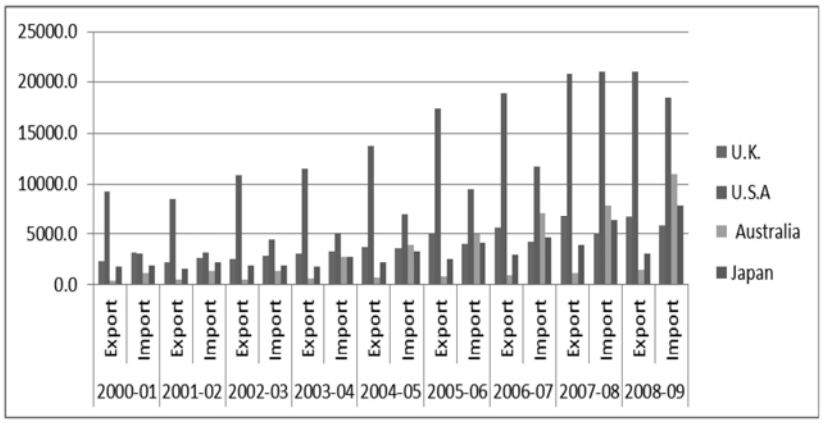
	Coefficients	Z. Value	P. value
θ_{11}	0.3870	2.7892	0.0147
θ_{21}	-0.5111	-4.8992	0.0000
θ_{12}	0.0027	1.2296	0.2339
θ_{22}	0.0489	2.7781	0.0178
α_{11}	0.0048	10.972	0.0000
α_{22}	-0.2276	-5.7790	0.0000
β_{11}	0.99258	7.0371	0.0000
β_{22}	-0.0276	-4.8923	0.0000
γ_{11}	-0.00387	-3.8912*	0.0000
γ_{22}	0.0019	0.7790	0.0122
Residual Diagnostics	**Test Statistic**		**P. value**
LBQ (12)	7.014		0.478
LBQ^2 (12)	9.878		0.571
LM test	5.721		0.479

Note: * indicates 1% level of significance. LB-Q (k) and LB^2-Q (k) are the portmanteau Ljung-Box Q test statistics for testing joint significance of autocorrelation of standardized residuals up to 12 lags. LM is the ARCH effect in the standardized squared residuals up to 6 lags. Estimates of constant and covariance terms are not reported in the table.

Table 9. Bivariate GARCH Model between BSE 30 sensex and Ordinary Share Price Index

Variable	Coefficients	Z. Value	P. value
θ_{11}	0.0234	2.456	0.000
θ_{21}	0.3267	1.562	0.014
θ_{12}	-0.0017	-0.045	0.278
θ_{22}	0.0078	0.478	0.175
α_{11}	0.00010	3.451	0.000
α_{22}	-0.89551	-5.159	0.000
β_{11}	0.69373	2.854	0.000
β_{22}	-0.78958	-4.179	0.000
γ_{11}	-0.0032	-0.018	0.378
γ_{22}	0.00072	0.425	0.744
Residual Diagnostics	**Test Statistic**		**P. value**
LBQ (12)	7.8963		0.6789
LBQ^2 (12)	8.2387		0.7892
LM test	6.7521		0.8974

Note: * indicates 1% level of significance. LB-Q (k) and LB^2-Q (k) are the portmanteau Ljung-Box Q test statistics for testing joint significance of autocorrelation of standardized residuals up to 12 lags. LM is the ARCH effect in the standardized squared residuals up to 6 lags. Estimates of constant and covariance terms are not reported in the table.



Source of Data: Reserve Bank of India website

Figure 1. India's Foreign Trade with Selected Partners Million dollars

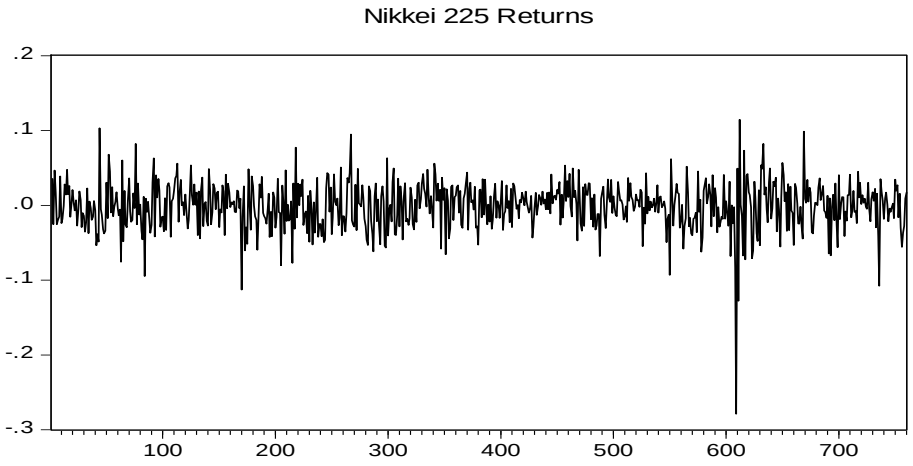


Figure 2. Nikkei 225 Returns

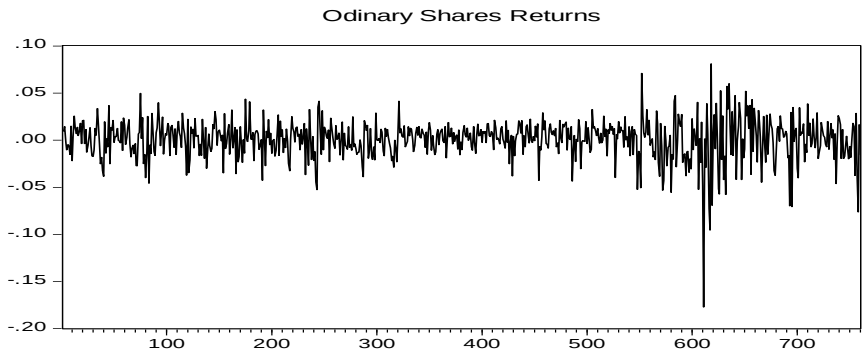


Figure 3. Odinary Shares Returns

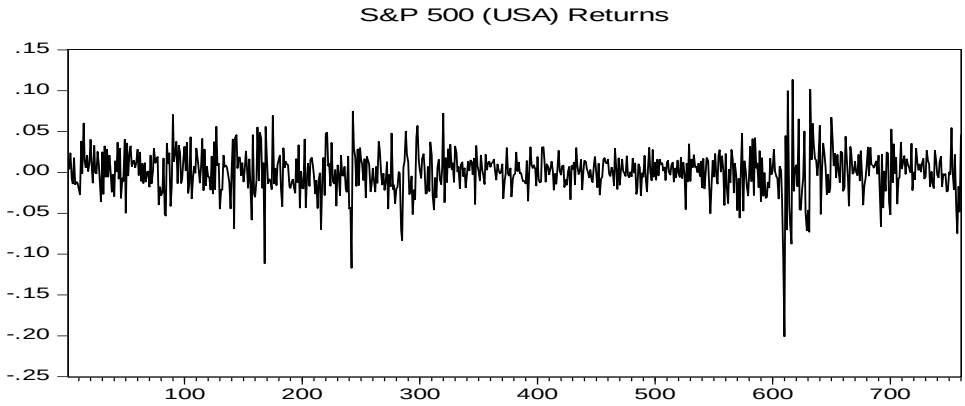


Figure 4. S&P 500 (USA) Reruns

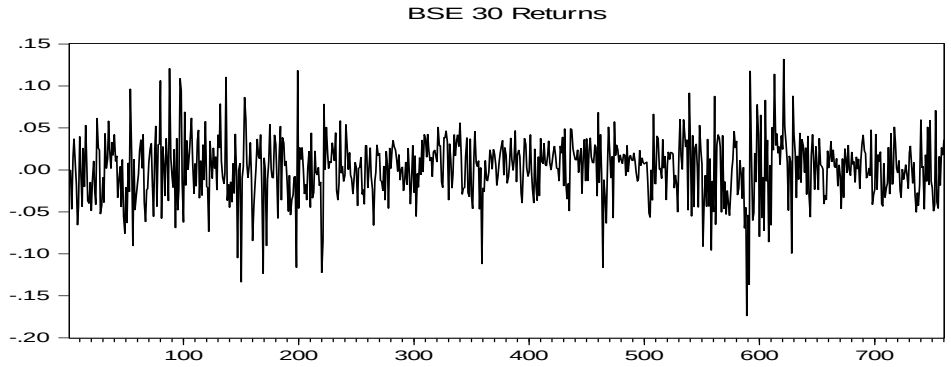


Figure 5. BSE 30 Sensex Returns

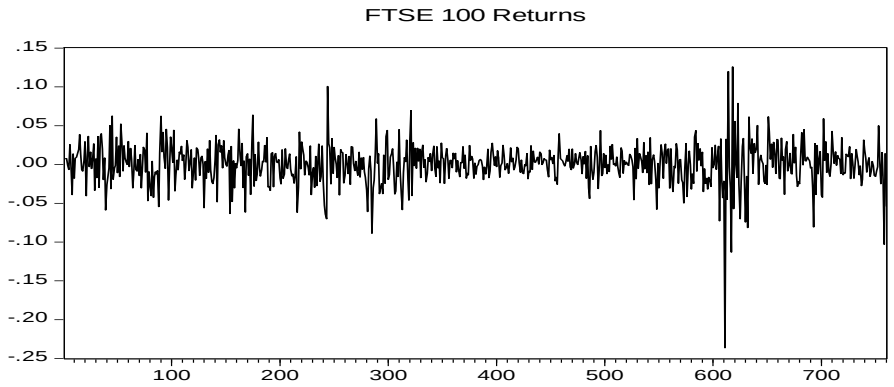


Figure 6. FTSE 100 Returns

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Impact of Small Entrepreneurship on Sustainable Livelihood Assets of Rural Poor Women in Bangladesh

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Abstract

The present study deals with the impact of small scale agricultural entrepreneurship on livelihood assets rural poor women and role of NGOs to developed women living of standard. The sample of the study consisted 300 women entrepreneurs those are involvement with livestock and poultry, fisheries, and vegetables entrepreneurship. Stratified Random sampling technique was used to obtained sample size. The study used the sustainable livelihood analysis framework as an analytical tool to identify ways to advance the livelihood of small entrepreneurship. Tobit and ordered probit regression estimation were used to analyze the result. Livestock and poultry entrepreneurship is significant and positively associated with financial capital, physical and social capital, vegetables entrepreneurship is significant and positively associated with natural capital and physical capital, fisheries entrepreneurship also positive and significantly associated with human capital. Role of NGOs micro credit and institutional support has great impact on women entrepreneurs living of standard. The analysis shows how entrepreneurs can achieve sustainable livelihood through access to a range of livelihood assets. Livestock and poultry entrepreneurs potentially provide higher economic returns, physical and social benefits. However, lack of resources, vulnerability and poor institutional support are identified as constraints to long term sustainability.

Keywords: Small entrepreneurship, Sustainable livelihood assets, Rural women

1. Introduction

A livelihood is environmentally sustainable when it maintains or enhances the local and global assets in which livelihoods depends, and has net beneficial effects on other livelihoods. A livelihood is the set of capabilities, assets and activities that furnish the means for people to meet their basic needs and support their well being. The building of livelihoods reflects and seeks to fulfill both material and experiential needs. Livelihood are not simply a localized phenomenon, but connected by environmental, economic, political and cultural process to wider national, regional and global arenas(Castro,2002).livelihood security has been interpreted in different ways by various scholars. While livelihood has been defined as an adequate flow of resources (both cash and kind) to meet the basic needs of the people, access to social institutions relating to kinship, family and neighborhoods, village and gender bias free property rights required to support and sustain a given standard of living, livelihood security has been understand to encompass ownership of access to resources and assets to offset risks, ease out shocks and meet contingencies (Chamber,1989:Redelift, 1990; Chamber and Convey,1992;long,1997;Complain,1998;Ellis,2000;Huq,2000).A good working definition of livelihoods is provided by Frank Ellis (2000:10): “the assets (natural, physical, human, financial and social capital), the activities, and the access to these (mediated by institutions and social relations) that together determine the living gained by individual or household”.

In Bangladesh, women are playing an effective role in agricultural sector. Most of the housewives in rural and urban areas of Bangladesh contribute to their family income through active participation in crop, livestock, poultry, fisheries, nursery, vegetables cultivations, handicrafts as well as participating in non-farm activities. The success goes far beyond economic success. Especially in terms of women’s participation in economic activities. Entrepreneurship is a dynamic function. Entrepreneurs thrive on changes in the environment that bring useful opportunities for business. Entrepreneurs always need to take different dynamic decisions. Rigid social customs and strong religious constraints are creating difficulties for women entrepreneur in operating their business.

Rural women play a very important part in the highly labor intensive production process, but within the confines of their own front yard. In agrarian and largely subsistence economy of Bangladesh, poultry, dairy, nursery, rice husking, fisheries & handicraft enterprises play a crucial role to supply nutritious food and to generate income and employment. Poultry farming has a great potential for providing additional income to our farming community and

educated unemployed persons, widows of rural areas through creating self employment opportunities (Ahmed and Hamid, 1991).Their participation in development activities is expected to affect their lives in personal, social and economic dimensions by increasing their access to and control over the resources. Sustainable agriculture, rural development and food security cannot be achieved through efforts that ignore or exclude more than half of the rural population- women; women constitute more than half of the agricultural labor force and are responsible for most of the household food production in low income food deficit countries. Poor rural women represent the most vulnerable group in Bangladesh they are isolated and deprived (Schuler & Hashemi, 1995).Although women contribute considerably to rural economic activities, women gain neither recognition nor status from their work (Abdullah & Zeidenstein. 1982).True development means the development in the three categories of a woman. These are individual, social, and economic development (Rodney, 1972).

Understanding female entrepreneurship can also have a significant impact on economic development and poverty alleviation (Kreide 2003). Female entrepreneurship has been identified as a major force for innovation and job creation (Orhan and Scott 2001). Barriers to gender entrepreneurship can have an adverse impact on a country's competitiveness, productivity, and growth potentials (Bardasi et al.2007). However, while economic growth has reduced gender disparity and improved female standards of living, especially in developing countries, such growth although important has not been synonymous with economic equality (Harrison and Bluestone 1988)

As a developing country, Bangladesh places special priority to socio-economic development. In order to accelerate the development process, the Government and Non-Government Organizations (NGOs) have undertaken massive development programs for poverty alleviation through economic activities such as livestock and poultry, fisheries, dairy, vegetables and nursery enterprises, etc. Overall objective of the study is to find out the impact of the small enterprise on livelihood assets of poor women in rural society and find out the NGOs role to developed women standard of living through sustainable livelihood approach.

2. Sustainable Livelihoods Approach (SLA)

Insert Figure 1 Here

A livelihood comprises the capabilities, assets and activities needed for a means of living (Scoones, 1998). A livelihood is sustainable when it can cope with and recover from stresses and shocks, and maintain or enhance its capabilities and assets, both now and in the future, while not undermining the natural resource base (DFID, 1999). According to Scoones (1998), five key indicators are important for assessing sustainable livelihoods: 1) poverty reduction, 2) well-being and capabilities, 3) livelihood adaptation, 4) vulnerability and resilience, and5) natural resource base sustainability.

The SLA is prominent in recent development programs that aim to reduce poverty and vulnerability in communities engaged in small-scale aquaculture and fisheries (Edwards et al., 2002; Neiland and Bene, 2004). It is increasingly being used by many development agencies and NGOs to achieve a better understanding of natural resource management systems (Allison and Horemans, 2006). The livelihoods approach seeks to improve rural development policy and practice by recognizing the seasonal and cyclical complexity of livelihood strategies (Carney, 2002; Allison and Ellis, 2001). It embraces a wider approach to people's livelihoods by looking beyond income generating activities in which people engage (Chambers and Conway, 1992; Farrington et al., 1999; Shankland, 2000).

The sustainable livelihoods framework helps in thinking holistically about the things that poor might be very vulnerable to, the assets and resources that help them thrive and survive, and the policies and institutions that impact on their livelihoods (DFID, 1999). Figure 1 shows the sustainable livelihoods framework and its various factors, which constrain or enhance livelihood opportunities and show how they relate to each other. The framework provides a way of thinking through the different influences (constraints and opportunities) on livelihoods, and ensuring that important factors are not neglected (Ashley and Carney, 1999). The framework shows how, in differing contexts, sustainable livelihoods are achieved through access to a range of livelihood assets which are combined in the pursuit of different livelihood strategies.

3. Methodology

A socioeconomic study usually requires selection of an area for collection of data in accordance with the objectives set for the study. Selection of the study area is an important step in such a study. To achieve the objectives of the present study, a preliminary survey was conducted in three entrepreneurship activities namely livestock and poultry, fish cultivation, vegetable production under the Mymensingh district to understand the broad socio-economic characteristics of the respondents.

Questionnaire Interviews

Questionnaire interviews with entrepreneurs were preceded by preparation and testing of the questionnaire, use of

statistical procedures to determine the sample size and sampling method, and the use of enumerators to fill in questionnaires. The pre-survey activities included reconnaissance for the pilot survey, revision of survey instruments and preparation of the sampling frame. To achieve the objective of the present study the necessary data were collected from 3 sub district (9 villages) from Mymensingh district. Data were collected by the researcher himself through personal interview with the individual women.

Sampling and Analysis Technique

In a sample survey, a subset of population called sampling frame was prepared and required data were collected from the frame. Different groups of women came under the activities. Memory recall method was used to collect data before involvement and after involvement in small enterprise. Entrepreneurs respondent were selected using stratified random sampling based on entrepreneurs production systems, such as vegetable cultivation, livestock and poultry rearing, fish cultivation. Here we can categories extensive cultivation (vegetables) typically employs slightly modified versions of traditional methods called low-density and low-input systems. Semi –intensive operations (livestock and poultry) employ intermediate levels of stocking and other inputs. The intensive production (fish cultivation) system is characterized by relatively high stocking and high inputs (Shang and Tisdell,1997; Shang et al,; 1998). A total of 3000 entrepreneurs, among them 10 per cent sample were collected in each group. 100 samples were selected for each of the groups those were involvement 5-10 years with entrepreneurship activities. The sample frame thus contained 300 women respondents who were randomly selected as a sample unit.

Data were collected during July-September/2010. In order to obtain reliable data, the author first visited the study area. For collecting data, the author stayed in the selected village so that the selected women could respond at their own conveniences. At the time of interview the author asked questions systematically and explained wherever it was found necessary. The author explained the purpose of the study before interviewing and the respondents were assured that the study was purely an academic one, which wasn't likely to have any adverse affect on them. The survey method was followed in the present study. It was argued that the method was comparatively less costly, less time consuming, easier to employ and most appropriate for the enterprise working in our country.

Data from questionnaire interviews were coded and entered into a database system using Microsoft Excel software. Tobit and ordered probit estimation was used to identify the relationship between livelihood assets (financial, natural, physical, human, social) and small scale agricultural entrepreneurship and to changes in the livelihood status of the women entrepreneurs after involvement in small scale-agricultural entrepreneurship.

4. Analytical Framework and Approach

The five capital framework of sustainable rural livelihood is adopted here. These include natural, financial, physical, social and human capital (Carney, 1998; Davies,1996; Soussan et al.,2000). Sustainable rural livelihoods are critically linked to the enhancement of these capitals. Improvement in all these capital could be a function of changes in financial, physical, natural, social and human capital. Improvement in each of these capitals is in turn dependent on various indicators. *Financial* capital is dependent on income, employment and savings; *physical* capital is dependent on household assets, road and transport, market and health care service; *natural* capital dependent on water, land, temperature; *social* capital dependent on social institutional role (early marriage, dowry), decision ability, social prestige, solve conflict and cooperation; and human capital is dependent on health, education, training, knowledge and skills.

In the present context financial capital is measured through changes in income and savings after involvement small scale agricultural entrepreneurship activities. Physical capital is measured in terms of household possession of durable assets such as house, machinery, market, health care facilities and road transport facilities. Natural capital is measured in terms of improvements in land, sources of water and climate. Human capital is measured in terms of improvement of family health, education, knowledge and skills, indigenous knowledge and technology. Social capital is measured in terms of improvements in social prestige, decision making ability, , late marriage, cooperation between neighbors and satisfaction on own entrepreneurship, etc.

5. Result and Discussion

Household livelihood assets frameworks have become useful for community and family assessments and social program design for many reasons. This asset can provide a useful starting point for household livelihood analysis, as it encourages investigators to take into account all the different kinds of assets and resources that are likely to play a role in household livelihood.

Financial Capital

Financial capital includes flows as well as stock of capital and it can contribute to consumption as well as production. However, the financial resources that is available to people(whether savings, supplies of credit or

regular earnings or pension and even in some case other assets that can converted into cash) to enable to pursue different livelihood options. Here, income and saving are the major financial resources of the entrepreneur's household. In this study we will see the relationship between financial capital and others explanatory variables which is related to entrepreneurs livelihood functions.

Insert Table 1 Here

According to the regression result, log likelihood value is 410.4926 which means we can refuse the Zero Test. R^2= maximum the likelihood function.(Table 1) shows tobit regression estimations which reveals the coefficient of dependent (financial) variables and independent variables.

From our analysis the age of the respondents is highly significant in relation to financial capital, from statistical summary the mean age of the entrepreneurs was 39 years which implies they belong to an active age, they are more capable and energetic to engage in their entrepreneurship activities. a similar distribution of age groups is also found in other studies on women entrepreneurs in Turkey (Celebi,1997). This means that younger entrepreneurs with experience tend to participate more in small scale agricultural entrepreneurship. Consequently, the amount of micro credit from NGO is positively significant associated with financial capital. It implies that the micro credit from NGO has great impact on small scale agricultural entrepreneurship profitability and that profits tend to increase amount of financial capital. One group of scholars (Rahman, 1999; Shehabuddin,1992; Mizan,1994, Pit and Khandker 1996, Todd 1996; Hashemi, Schuler, and Riley 1996, Kabeer 1998,2001) is optimistic about sustainable micro-finance programs, and the possibility of women's empowerment through micro-credit programs. In many causes, microcredit has contributed to changes in attitude about women's contribution to and role in economic and social development. Specifically, microcredit has resulted in increased recognition of women's productive role.

Earning our own money allows us to do what we want with it. It also brings us 'izzat'(honor or respect) because the money "proves" our contribution. Otherwise, we work like animals, we are never given credit for our contribution and even our own men say that we don't work. When we have our own money we are no longer mohtaj (dependent to the point of being at the other person's mercy. The word is often used for the physically disabled). (quote from a pakistani entrepreneur, in Nighat Said Khan,1984)

Additionally, formal education in school or college is significant and positively associated with financial capital. Education is very important cognitive factors for women entrepreneurship development in rural areas. Educated entrepreneurs have greater potential to discharge the entrepreneurial responsibilities effectively and efficiently. They are risk takers and have access to information regarding entrepreneurial activities. Educational attainment, a recent study found that education plays different roles in countries at different stages of economic development (Van der Sluis et al. 2005). Tobit estimations further reveals that shared labor (shared labor=1 other=0) is significant and positively associated with financial capital. Shared labor means entrepreneurs combine their work forces to create efficiency and also take advantage of economies of scale. In small scale agricultural entrepreneurship activities rural women share labor with family member and paid workers to run entrepreneurship venture properly, in this way they earn more profit which tends to accumulate more capital to reinvest in to entrepreneurial process.

Lack of credit (yes=1no=0) is significant and negative associated with financial capital, those entrepreneurs are disadvantaged due to lack of capital which means their financial capital base is lower than those have access to sufficient credit. Those entrepreneurs lack sufficient working capital to run their entrepreneurship activities so in this regards their financial assets portfolio is low. Due to Lack of credit they can't run their entrepreneurship activities smooth, this has directly impacted on entrepreneurs programs. A deposit money facility in Bank (good=1 bad=0) and collateral condition (good=1 bad=0) is highly positive and significant with financial capital. Most of them respondent of entrepreneurs noticed that they have a good chance to deposit money in commercial Bank, they are very much interested to deposit in commercial bank due to high interest rate. In this way, financial capital is associated with good deposit facilities. Another very important variable is that collateral condition is more flexible in NGOs micro credit program.

Unpaid loan or credit (yes=1 no=0) is not significant but has negative co-efficient due to ongoing loan servicing process. It means that they pay back the credit on installment basis hence this has the effect of reducing their capital and their general cash flows. Experience on own entrepreneurship (sufficient=1 not sufficient=0) is also positively significant associated with financial capital. Entrepreneurship experience plays a vital role to run enterprise activities such as when, how, where to invest, buying or selling of product and saving of money, especially financial management capacity etc.Attending training on entrepreneurship is significant and positive associated with financial capital. In rural areas different NGOs those are operate micro credit program, besides they arranged training program for entrepreneurs (client) such as micro credit management which is related to financial activities.

From this table1 reveal that livestock and poultry entrepreneurship is positively significant associated financial

capital. Vegetables entrepreneurship is not significant but positive relation with financial capital. In Bangladesh Livestock and poultry sector has got top priority in the recent years, poultry and livestock products have high demand in the markets where rural women are working as a self employed entrepreneurs. Micro credit programs that are accessible to poor households and use of sustainable approaches are essential to minimize the inherently high cost of lending.

Natural Capital

Natural capital is the term used for the natural resources stocks from which resource flows and services (e.g. nutrient cycling, erosion protection) useful for livelihoods are derived. Here we considered the sources of water, types of land, and current condition of climate are natural capital of small scale entrepreneurship. Now we will see the relationship between natural capital and entrepreneurship livelihood variables.

Insert Table.2 Here

Table 2 present the result of the ordered probit estimation used to investigate the relationship natural capital and small scale agricultural entrepreneurships variables where dependent variables ordered score (0, 1 and 2) while 11 explanatory variables were considered in the model.

Land is the major factor of production in agrarian rural area. Access to natural capital like land, fertilizer and rain fall are crucial factors for production in small scale agricultural entrepreneurship. Here we observe that land, fertilizer and rainfall are all highly significant and positively associated with natural capital. We can also observe that the size of land, fertilizer (organic=1 inorganic=0), rain fall (sufficient=1 not sufficient =0) which means land size has direct impact on natural capital in agricultural entrepreneurship, without land we can't imagine agricultural production system. As a natural resource land has direct impact on agricultural production process but it also depend on land quality it means soil type and fertility. Organic fertilizer is pre-requisite to preserve soil fertility and productivity and sufficient rainfall tends to increase high production in agricultural sector. In rural area it is very convenient to make organic fertilizer because of available tree leafs, cow dung and by product of paddy etc. entrepreneurs prefer to use organic fertilizer than inorganic fertilizer because inorganic fertilizer price is high and it's harmful for soil fertility. Rural women can manage organic fertilizer due to availability of raw materials. If they use organic fertilizer then they can reduce cost of production and sustain soil productivity. In rural women especially they are used to apply indigenous knowledge in agricultural cropping pattern. Any technology that makes the most economic use of a country's natural resources and its relative proportions of capital, labor and skills and that furthers national and social goals (Harrison, 1983).

Rainfall has direct impact on agricultural production process but it also depends on requirement of cropping pattern. Over rainfall or insufficient rainfall has negative effects on agricultural production process. In rural area, poor farmer or agricultural crop producers depend on nature, so rural women also depend on sufficient rain. In this study area respondents women noticed that due to sufficient rain their agricultural production didn't hamper especially vegetable cultivation. Women said that whenever they need water for agricultural crop or vegetable cultivation they get it from pond or river because it's very convenient and cost is low. Due to sufficient rainfall water can preserve naturally into the pond and river. Sometimes excess rainfall also harmful for agricultural productions it creates over flooding.

Vegetation (sufficient=1 not sufficient =0) of the area is also highly significant and positively associated with natural capital, vegetations has vital role to maintain conducive climate, it maintains average temperature, humidity and expected rainfalls in any particular region or area. .

Another important variables is that the ground water level (availability=1 non-availability=0) is positive and significant relation with natural capital. Water is very important factor for production purpose especially in agrarian area without water it's impossible to sustain agricultural activities. If ground water level is above the average levels then producers have an easier task to boost their production, they can easily use normal tube well to get sufficient water this way minimizes the higher cost of production. In this model we see the vegetables entrepreneurship is significant and positively associated with natural capital because land size, fertilizer, rainfall and vegetation of the area are highly significant in the model, these kind of factors are very much related with vegetables production process, so this shows that vegetables entrepreneurs needs such kind of natural environment which not too much essentials for fisheries or livestock and poultry entrepreneurship.

Fisheries entrepreneurship is not significant but positive coefficient with natural capital; natural environment is more favor to vegetables entrepreneurs than fisheries entrepreneurs in this study area. Land ownership of women entrepreneur, Knowledge about high yielding variety, Working Experience on own entrepreneurship and Soil preservation is not significant but positively associated with natural capital. These kinds of variables have a positive

impact on natural capital. Land ownership of women is not significant due to land tenure system or land reform system, in rural area women have no direct access to ownership of land, they use the land production purpose for the time being, most of the women entrepreneurs admit that they don't own land, but they have got opportunity for production purpose except for permanent ownership of land.High yielding variety is new terminology for rural women used for local breeding in production system either, vegetables, fisheries or other entrepreneurship activities but they don't have sufficient knowledge about HYV. Working experience has no direct impact on natural capital, and respondents working experience is not so lengthy but just average. Rural women are not well versed with soil preservation technology but they noticed that after every harvest periods they use organic fertilizer and use indigenous technology which is helpful to preserve soil fertility. Rural women are closely associated with local ecological resources and manage biodiversity on a daily basis. Agriculturally, livelihood strategies may include short-term yield enhancing strategies or longer-term soil improvement or conservation strategies (Twomlow, et al., 2002).

Physical Capital

Physical capitals comprise capital that is created by economic production process and the basic infrastructure and producer goods needed to support livelihoods. In this study ,road and transport, market facilities, housing, health care facilities, and machinery equipment are considered as a physical capital of entrepreneurship activities.

Insert Table.3 Here

Table 3 present the result of the ordered probit model used to investigate the relationship physical capital and small scale agricultural entrepreneurships variables where dependent variables ordered score (0 and 1) while 11 explanatory variables were considered in the model. Table 3 shows, the experience on entrepreneurship, women reproductive health, sources of institutional credit and input supply availability are highly significant and positive associated with physical capital. Experience has is fundamental to operate entrepreneurship successfully, experienced entrepreneurs have know how to manage fund, how to collect input, market communication and have clear concept about physical infrastructure of entrepreneurs location. In this study we considered experienced means those are engaged 5-10 years in their own entrepreneurship activities. so we can say after involvement in agricultural entrepreneurship their physical capital has increased. Production and marketing efficiency are important determinants of entrepreneurial success.Women entrepreneurs realized that they have reproductive health care facilities (good=1 not good=0) after involvement in entrepreneurship activities. Health is one of the basic human rights of any nation which is related to physical infrastructure of local community. In this study area women entrepreneurs claimed that after involvement in entrepreneurship program they are well concern about reproductive and others health facilities. Now they have earning source and they are much more caring health issues. They used to seek medical attention from Government hospital, NGOs health clinic and local community clinic.

Institutional credit source is highly significant and positively associated with physical capital. The variable Sources of institutional credit (NGOs=1 Bank =0), has vital influence on women entrepreneurship activities this so because respondents are too much engaged with NGOs as opposed to Banks. Most of the NGOs provide loan without collateral and the terms are more flexible than banks', as a result it has positive impact on physical capital. NGOs microcredit programs have also, in many cases, increased mobility and strengthened networks among women who were previously confined to the home (Carr et al.,1996) borrowers build solidarity through their participation in lending circles and village organizations. There are also studies that suggest even more far-reaching social impact, including decreases in fertility rates, assumed to be linked to increased financial self-reliance (Ruhul, 1994) and more say for women in family matters, including family finances (Hashemi et al., 1996).

Input supply (availability=1 not available=0) is also highly and positively associated with physical capital. Input (seeds, feeds, fertilizer etc) is a major factor of production, without them the production chain would not exist. On the other hand if local infrastructure is well developed and maintained then entrepreneur's mobility is enhanced to facilitate an efficient chain of supply of the products. Availability of input supply enhances market stability in rural area. In rural areas women entrepreneurs are easy to access agricultural input if available.Land size (acre) has significant and positive coefficient with physical capital, it means that those entrepreneurs homestead and cultivable land size is big their physical capital is high. After involvement in small scale agricultural entrepreneurship women are capable to use land for production purpose whether its rent or own land. If they want to build good house they use homestead land. Dwelling facilities protect them from natural disasters and social insecurity. Road and transport facilities also depend on local people's willingness to share their land property to build necessary road that can help to transport agricultural product/input supply on time in local market Sanitation awareness (increased=1 not increased=0) is not significant but it belongs to positive coefficient with physical capital. In study area women are aware about sanitation system due to the fact that NGOs are sensitizing them about personal hygiene and health care

matters.If women earn money and they spend on family requirements such as, food, health and education but if they get knowledge about health care or sanitation then they can prevent some disease by this way they can save money that money they spend before health care purpose. Land rent (high=1 low=0) is negatively associated with physical capital it implies that entrepreneurs are dependent on rented land hence their physical capital is lower than those who own land. Whenever they settle their rental dues, it tends to have negative effects on others activities of entrepreneurs such as input supply, labor cost etc.

Local government support (good=1 not good=0) and training on entrepreneurship are positively associated with physical capital but not significant. In study area most of the respondents agreed that their local government is support in favor of their entrepreneurship activities. Training on entrepreneurship not only the matter of economic activities but also taught them to learn about good health, housing, marketing and other related activities which influence to women proper functioning of own program. We can deduce from table 6 that vegetables entrepneurship is highly and positive associated with physical capital than livestock and poultry entrepreneurship. This confirms that vegetables entrepneurship has more opportunity to produce vegetable and operate their entrepreneurship activities than other entrepreneurships. Their physical infrastructural opportunity is better for vegetables entrepreneurship as compared to that livestock and poultry entrepreneurship.

Human Capital

Human capital represents skills, knowledge, good health and ability to work. Education can help to improve people's capacity to use existing assets better and create new assets and opportunities. Human capital refers to the labor available to the household: its education, skill, and health (Ellis,2000). In small scale agricultural entrepreneurship, education of entrepreneurship, knowledge, family health, experiences has been considered as a human capital.

Insert Table 4 Here

Table 4 present the result of the ordered probit model used to investigate the relationship between human capital and small scale agricultural entrepreneurships variables where dependent variables ordered score (0, 1 and 2)while 10 explanatory variables were considered in the model. Table 4 shows the training with groups, household food nutrition and sanitation, knowledge about agricultural production are highly significant and positively associated with human capital. Group training is common phenomena with NGOs activities. Agricultural entrepreneurial training is required for process, grading, manufacturing, livestock and fisheries, nursery plantation and vegetables production. Such kind of training very important for their personal development as well as entrepreneurship.

Household nutrients from foods and sanitation (very good=2 good=1 bad=0) represent the family status in the society. After involvement in entrepreneurship activities women are offering more support to fulfill their basic needs such as nutritional food and improved personal hygiene. When entrepreneur's family affords nutritional food and good sanitations facilities, definitely the overall family health will improves. Rural Women entrepreneurs facilitate production livestock and poultry product, fish, vegetables, etc and they sell the products in market. They produce nutritious foods but they don't know which foods are more nutritious, through training programs, women entrepreneurs learnt such kind of beneficial information. Knowledge about agricultural production (high=2 medium=1 low=0) activities is a vital factor for agricultural entrepreneurship. In rural areas, women are often used to apply their indigenous knowledge and technology in their agricultural practices such as how to preserve seed for replanting purpose, how to make organic manure from tree leafs, garbage waste, cow dung etc. The idea is; if one woman knows this techniques then it spreads through their practical activities and interaction in productions process. Technology with an sustainable livelihood approach aims to increase productivity of all materials through the life cycle of both the programme and material (Sustainable livelihood unit,1999).

Ages of the entrepreneurs are positive significantly associated with human capital. Age has positive and negative impact on livelihood activities but it depends on which categories of age they belong; naturally children and the old are dependent more than youthful energetic working group all over the world especially if we considered it. From statistical summary we can observe that the women entrepreneurs mean age is 39 years old. It's tentatively a young age so in this age women are more capable to do more risk in entrepreneurship activities. Vigano (1993) noted that with increase in age, it is usually expected that borrowers get more stability and experience. At young age, women are energetic they can actively participate in agricultural activities either it is production process, grading process or marketing activities; additionally are highly mobile for their business purpose. Child and adult education expenses also positively and significant associated with human capital. After involvement in entrepreneurship, women are more conscious about their children and adult education so they spend more money for this purpose, and they believe that they are investing money for their children and adult education because they are aware of the benefits of education. Due to technological advancement and globalization, rural women are more interested to support their

children and adults to get proper education in the long run get good jobs and support their families.. So women entrepreneurs are spending more money to take care of children and adults by enrolling them in good education facilities, they want to exist in society harmoniously and peacefully. By this way sustainable livelihood can be attained.

Visit to reproductive health care centre (yes=1 no=0) is also significant and positively related to human capital of rural women entrepreneurship. As it's with education, good health is also a vital issue of human resource development. In rural areas of Bangladesh, women suffer health problem due social or cultural obstacles. Women are not easily allowed to visit doctors especially on reproductive health matter, one reason is uneducated women feel shy, and secondly due to religious binding they don't like to share about reproductive health issues with male doctors. But now a day's times have changed people have known about their basic human rights, literacy rates are increasing, people are more aware about their life style, dependency ratio has also decreased, especially rural women are now well organized to know about group concepts, meetings, self esteem, self respect etc. rural women entrepreneurs are more conscious about their reproductive health status. Women suffer more than men in this aspect. Women entrepreneurs often visit rural reproductive health centre or health community centre to get proper service from doctors whether the Doctor is male or female. Working experience (year) on entrepreneurship and attitude towards family planning (improved =1 not improved=0) are not significant but positive coefficient with human capital. In this study we see the women are engaged in agricultural entrepreneurship activities not for too long time from and statistical summary shows that's experienced mean year is 7 years. Though experience is not so much, but it has positive relation with human capital.

Attitude towards family planning is also positively coefficient with human capital. Family planning has broad meaning but in this study we considered entrepreneurs' women attitude towards small families; those families with one or two children either daughter or son, and women can understand small family's benefit suppose if they keep the family small then they can spend more time on their own entrepreneurship activities, definitely if family is big then they need to spend more money to take care of their children on needs such as food, educations expenses. Tables 4 reveal that fisheries entrepreneurship is significant and positively associated with human capital. We know that fish cultivation is harder among the three agricultural entrepreneurship; it needs skill based labor, efficient and effective entrepreneurs who are capable of doing it. Though it is a profitable business, it highly depends on entrepreneur's skills and knowledge. So we can conclude that among all entrepreneurs, fisheries entrepreneurs are more efficient than other; it means their

Social Capital

The definition of a reliable and standard measure of social capital is not an easy task. First of all, there is not a consensus on the fact of social capital being a one-dimensional (Burt 1992) or a multidimensional (Koka and Prescott 2002) concept. Moreover, social capital can be defined at different levels and for distinct units of analysis: individuals (micro level), organizations (intermediate level) of the whole society (macro level). Roughly speaking, social capital refers to social relations among persons generating productive results (Szreter 2000;Smallbone et al.2010; Ramirez et al.2010) Social networks are valuable resources since they facilitate economic activity (Nahapiet and Ghoshal 1998; Burt 1992), allow entrepreneurs to be more efficient and access privileged business opportunities (Batjargal 2003; Abreu et al.2010; Baregheh et al. 2009; Melia et al. 2010; Rubalcaba et al.2010; Toivonen and Tuominen 2009) and improve innovation (Shan et al.1994; Powell et al.1996; Ahuja 2000; Alpkan et al.2010; Bonet et al. 2010; Romero-Martinez et al.2010; Sundbo 2009; Un and Montoro-Sanchez 2010; Zhang and Duan 2010). In this study, social prestige, conflict solve capacity, cooperation between neighbors',late marriage, husband cooperation, satisfaction of own works and decision making ability of entrepreneurs are considered for social capital.

Insert Table 5 Here

Table 5 present the result of the ordered probit model used to investigate the relationship between social capital and small scale agricultural entrepreneurships variables where dependent variables ordered score (0, 1 and 2)while 11 explanatory variables were considered in the model. Table 5 shows that , contact with others entrepreneurs, leadership in NGO group meeting, participation in social gathering, water and sanitation , political consciousness and support from family are highly significant and positively associated with social capital.

Contact with others entrepreneurs (increased=1 not increased=0) means they have good networking system i.e if women entrepreneurs organize groups or working networks then they can overcome their obstacles easily. Rural women are very conscious about group concept due to the well known the benefit of this. Whenever any conflicts arise in the local community they can easily solve it by the rules of the NGOs group meeting activities. (Aldrich et al. 1989), too, describe women's networks as networks organized around spheres of work, family and social life.

Similarly, Neider (1987) reports that women owned businesses are more likely to be informally structured.

Leadership (increased=1 not increased=0) is a very important virtue for the human society; everybody can not be a leader in group activities; but by the proper training and guidance, it can help people to achieve such kind of ability. In this research most of the women's respondents are client of micro credit institution and institution provide training to their clients. Leadership in NGOs group meeting can make entrepreneurs more self-esteem, and self respectful by this way woman feel more freedom in patriarchal society. So we can say that leadership enhanced them to take family decision, solve conflict between group member or neighbors' and increased social prestige. There is strong evidence to the effect that women are better at establishing communication and convincing others (Ufuk and Ozgen, 2001), which makes them even better at problem solving and especially in providing solutions for interpersonal problems (Eagley and Johnsn,1990).

Participation in social gathering (increased=1 not increased=0), women entrepreneurs and their family can be benefited by interacting with other family members, to join wedding ceremonies, rural sports programs , school or club annual programs, women cultural or local recreation activities. When women earn money in the family as a financial supporter she deserve well behave from family member and from society. After involvement in small scale agricultural entrepreneurship women feel more freedom in the family so they can enjoy social gathering like visit relatives, follow local cultural festival others social activities which is essential for human life to become more civilized and cultured.In a non-western society, Pakistan, (Shabbir and DiGregorio 1996) found that personal freedom, security and satisfaction are the primary goals of female entrepreneurs.Water and sanitation (well setup=1 not well setup=0) is crucial for human health; it also has remarkable impact on social life in rural areas. Cleanliness and personal hygiene indicates people's social status and level of civilization, in rural areas, most families don't use piped water additionally, and they do not have good sanitation facilities. In this study sample, most of class families are used to pure drinking water and good sanitations system. Respondent women noticed that after engaged with entrepreneurship activities they are more awareness about health and sanitation especially learnt from development organization when they take training or monthly group meeting. In rural area people socially considered prestigious family those are used to good sanitation and pure drinking water from own tube well.

Political consciousness and support from family (increased=1 not increased=0) is a vital issue now a days in rural community especially for women empowerment. In rural Bangladesh, government has established new rural power structure policy whereby any women can participate in local government political system to be elected member or chairman of the local government authority. Respondent women are more aware about their voting rights and to elect eligible person who can solve their problems such as neighbor conflict, family conflict and other social problem easily.Changes in basic needs are also positive and significantly associated with social capital. In this study we considered basic needs such as food which included rice, meat, vegetables, fish, eggs, pulses and milk; cloth; medicine and housing. After fulfilling basic requirement people can cater for additional activities. If people suffer from hunger then they will be mentally disturbed, in this way they will engage any illegal or unlawful activities. After joining own entrepreneurship activities, they are mentally stable on their own activities or enjoying self-employment opportunities because they are fulfilling family's basic requirements. It means self employment creates harmonious environment in family life as well as social life. Women get self recognition and self respect through this process. Working experience on own entrepreneurship is positive and significantly correlate with social capital. In general women entrepreneurs are engaged in entrepreneurship activities (5-10 years).In rural area women entrepreneurs aims is not only economic development but also social recognition. In developing countries' rural area like Bangladesh, women are constrained by social rule, so women entrepreneurs want to come out from that circle. Besides entrepreneurship activities, they organize group on how to make friendship, how to solve conflict with each other and how to help each other. After joining entrepreneurial activities day by day they become more experienced in social aspects or issues. Its means those women are well experienced or engaged with any development activities then their social capital will be high. Formal education and training experiences are positive coefficient but not significant with social capital. In these study women entrepreneurs are not highly educated; most of them are primary and secondary drop outs, so it is sufficient for them to get a remarkable positive impact also study shows that it has positive sign for social capital

Here we can observe that, livestock and poultry entrepreneurship is significant and positively associated with social capital. Livestock and poultry entrepreneurship is semi-intensive type of enterprise, which is an attractable activity for rural women. In the previous two models we have seen that financial and physical capital are also higher, so we can say that financial and physical capital has significant role to increase social capital for livestock and poultry entrepreneurs.

6. Vulnerabilities

The vulnerability concerns refer to: i) shocks, ii) adverse trends and iii) unfavorable seasonal patterns that can affect the livelihood of entrepreneurs (table 5). All these can have major impact on capital assets of households and

individuals, and consequently on their abilities to generate incomes. It is therefore important to identify means by which negative effects can be minimized- including building greater resilience and improving overall livelihood security.

Shocks

Shocks in the form of flood or drought/ natural disaster in farming communities can destroy assets. Other natural disaster (heavy rains and cyclones) can also have significant impacts on natural resources or environmental sustainability on which an entrepreneur's livelihood heavily relies. Illness of entrepreneurs, diseases in livestock and poultry and poor harvest are all shocks and make crop or vegetable cultivation hazardous. Small entrepreneurs are especially vulnerable as shocks can force them to liquidate assets.

Insert Table 6 Here

Trends

Entrepreneurs' livelihoods can be made more or less vulnerable depending on long-term trends. Over population, environmental changes, political unrest, social conflict may aggravate the problem of meager incomes. Over populations within entrepreneurs communities can contribute to a reduction in individual access to natural resources.

Seasonality

Various types of seasonal stress emerge in small scale agricultural entrepreneurship systems. In Rural area small entrepreneurs communities with predominantly natural resource-based livelihoods are subject to seasonal cycles of stress. Seasonal employment opportunities such as trading, harvesting and marketing, and day laboring all affect livelihoods of poor people.

7. Transforming Structures and Processes

Transforming structures and processes are the institutions, organizations, policies and legislation that shape livelihoods. The institutions and their policies have a profound influence on access to assets (DFID, 1999). Understanding institutional processes allows the identification of barriers and opportunities to sustainable livelihoods. The study found several major transforming structures and processes that can facilitate the generation of desirable outcomes from the entrepreneurs activities (Table 7). Appropriate policies, legal instruments and enforcement can remove constraints to the development of women entrepreneurship. Government agencies, NGOs and the private sector can provide technical support to poor women entrepreneurs. Private and public institutions can catalyses and facilitate small entrepreneurship development sector. However, these institutions have not played much of a role in the development of the field in general. Thus, lack of institutional and administrative help, poor infrastructure and inadequate extension services - all have affected livelihoods of women entrepreneurs and associated groups.

Insert Table 7 Here

8. Conclusions

Assets or capacity building models focus attention on developing the underlying resources and capacities needed to escape poverty on a sustainable basis. The study shows the relationship between small scale agricultural entrepreneurship and livelihood assets. The study confirmed that most of the entrepreneurs have improved their socio-economic conditions through small scale entrepreneurship. A livestock and poultry entrepreneurship is significantly associated with financial, physical and social capital. Vegetables entrepreneurship has significant co-efficient with natural and physical capital, fisheries entrepreneurship also significant and positively associated with human capital. Result shows that semi intensive entrepreneurs have benefited the most .results also shows the role of NGOs micro credit and training program has great impact on entrepreneurs livelihood pattern and developed living standard. Moreover, poor livelihood assets, vulnerabilities and weak transforming structures and process are identified as constraints for sustainable livelihoods of entrepreneurs and associated group. It is therefore necessary to provide institutional, organizational, and government support for sustainable small scale agricultural entrepreneurship.

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Table 1.Tobit regression estimation of financial capital

Name of the Variables		Coefficient	Z-Statistic
constant		5.157924	47.12942***
age of the respondents		0.001609	3.177684***
Amount of micro credit from NGOs		0.056749	2.255596**
Formal education in school or college		0.002903	1.653416*
Shared labor		0.026031	2.092855**
Lack of credit		-0.037341	-2.430954**
Deposit facilities in Bank		0.049452	3.058227***
Collateral condition		0.043974	3.175901***
Unpaid loan or credit		-0.010296	-1.128951
Experience on own entrepreneurship		0.013764	1.738345*
Vegetables entrepreneurs hip		0.012906	1.383401
attended training on own entrepreneurship		0.108657	2.020172*
Livestock and poultry entrepreneurship		0.017509	1.903164*
R-squared	0.188178	Mean dependent var	5.516297
Adjusted R-squared	0.129983	S.D.dependent var	0.066812
S.E. of regression	0.063080	Akaike info criterion	-2.643284
Sum squared resid	1.138018	Schwarz criterion	-2.470441
Log likelihood	410.4926	Hannan-quinn criterion	-2.574112
Avg.log livelihood	1.368309		

Source field survey,2010

*****,**** and ***** denotes significance at 1%, 5% and 10% respectively

Table 2. Ordered probit regression estimation of natural capital

Name of the Variables		Coefficient	Z-Statistic
Land ownership of women entrepreneur		0.171851	0.562044
Land		4.131993	9.917155***
Fertilizer		0.909181	2.693695***
Rain fall		1.227186	3.491950***
Vegetables entrepreneurship		0.304947	1.6567740*
Ground water level		0.819718	2.350868**
Fisheries entrepreneurship		0.269593	1.383258
Knowledge about high yielding variety		0.080477	0.497370
Working Experience on own entrepreneurship		0.046214	1.040735
Vegetation of the area		1.699174	4.563784***
Soil preservation		0.276068	0.874135
Akaike info criterion	1.488054	Schwarz criterion	1.673243
Log likelihood	-208.2081	Hannan-quinn criterion	1.562167
R estr.Log likelihood	-387.8192	Avg.log likelihood	-0.694027
LR statistic (11 df)	359.2222	LR index (Pseudo-R2)	0.463131
Probability (LR stat)	0.0000		

Source: field survey,2010

*****,**** and ***** denotes significance at 1%, 5% and 10% respectively.

Table 3. Ordered probit regression estimation of physical capital

Name of the Variables		Coefficient	Z-Statistic
Sanitation awareness		0.149790	0.861976
Land rent		-0.189951	-1.255587
Working experience on entrepreneurship		0.118093	2.969487***
Vegetables entrepreneurship		0.618493	3.734421***
Land size		0.646762	2.008908**
Women reproductive health status		0.612887	2.884450***
Livestock and poultry entrepreneurship		0.402630	2.245419**
Local government support		0.081322	0.546256
attended training on own entrepreneurship		0.023545	1.163434
Source of institutional credit		1.081181	5.311452***
Input supply availability		1.395531	6.113605***
Akaike info criterion	2.145139	Schwarz criterion	2.330328
Log likelihood	-306.7708	Hannan-quinn criterion	2.219252
R estr.Log likelihood	-355.4606	Avg.log likelihood	-1.022569
LR statistic (11 df)	97.37960	LR index (Pseudo-R2	0.221802
Probability (LR stat)	5.55E-16		

Source field survey,2010

*****,**** and ***** denotes significance at 1%, 5% and 10% respectively.

Table 4. Ordered probit regression estimation of human capital

Name of the Variables		Coefficient	Z-Statistic
Training with groups in NGOs on entrepreneurship		0.279890	9.228943***
Age of the entrepreneurs		0.014373	1.739390*
Fisheries entrepreneurship		0.278101	1.693683*
household nutrients food and sanitation		2.728863	11.55003***
Livestock and poultry entrepreneurship		0.297830	1.601819
Knowledge about agricultural production		2.432933	10.61724***
child and adult education		0.962650	1.897046*
Working experience on entrepreneurship		0.059977	1.221768
Attitude towards family planning		0.214277	1.396594
Visit to reproductive health care centre		0.683669	2.060312**
Akaike info criterion	1.432687	Schwarz criterion	1.605530
Log likelihood	-200.9030	Hannan-quinn criterion	1.501859
R estr.Log likelihood	-386.1331	Avg.log likelihood	-0.669677
LR statistic (10 df)	370.4601	LR index (Pseudo-R2)	0.479705
Probability (LR stat)	0.000000		

Source field survey,2010

*****,**** and ***** denotes significance at 1%, 5% and 10% respectively.

Table 5. ordered probit regression estimation of social capital.

Name of the Variables		Coefficient	Z-Statistic
Formal Education in school or college		0.025672	0.891630
Training from NGOs with group on entrepreneurship		0.016848	0.798090
changes in basic needs		0.171846	1.748134*
Working experience on entrepreneurship		0.103464	2.628725**
Contact with others entrepreneurs		1.568266	8.806701***
Fisheries entrepreneurship		0.064372	0.369244
Leadership in NGOs group meeting		1.544197	7.964731***
Participation in social gathering		1.712960	9.630006***
Livestock and poultry entrepreneurship		0.304205	1.792775*
water and sanitation Condition		1.736831	7.460516***
Political consciousness (voting) and support from family		1.628800	6.146266***
Akaike info criterion	1.890617	Schwarz criterion	2.088152
Log likelihood	-267.5925	Hannan-quinn criterion	1.969671
R estr.Log likelihood	-391.5555	Avg.log likelihood	-0.891975
LR statistic (11 df)	247.9260	LR index (Pseudo-R2)	0.316591
Probability (LR stat)	0.000000		

Source field survey,2010

*****,**** and ***** denotes significance at 1%, 5% and 10% respectively.

Table 6. Common shocks, trends and seasonality faced by entrepreneurs'

Vulnerability concerns	Name of entrepreneurship		
	Livestock and poultry	fisheries	vegetables
Shocks:			
Flood	++	+++	+
Drought	+	+	++
Illness of entrepreneurs	+	++	+
Disease of livestock/poultry/fishery/vegetables	++	+	-
Trends:			
Over population	+	++	+
Political unrest	++	+	-
Local government politics	+	+	+
Resource trends through social conflicts	+	++	-
Environmental change	+	+	-
Seasonality:			
Of production	++	+	++
Of prices of product	++	++	+
Of employment opportunities	+	+	+
Shortage of feed supply	+	+	-

+,++,+++: mild to strong impacts

-: no impact

Table 7. Components of transforming structures and processes to the development small scale agricultural entrepreneurship.

components	Example
Policies	i. Pertinent government policies(technical support) ii. Rules and regulations for sustainable agricultural entrepreneurship iii. Environmental protection (control pollution and diseases)
Institutions	i. Roles of government agencies, research institutions and NGOs ii. Roles of private institutions.(feed factory, seed suppliers) iii. Public and private partnership (research initiatives, entrepreneurship development, agricultural product marketing)
Service and facilities	i. Agricultural extension services and training facilities ii. Credit facilities to rural poor women iii. Infrastructure development (communication, road ,markets)
Social issues	i. Conflict prevention(land reform, social stability, dowry, early marriage, women rights) ii. Minimize power relation (patron-client, poor and rich entrepreneurs, money lenders)
Labour market	i. On-farm employment opportunities through agricultural production process and build agri-based industry in rural area. ii. Off-farm employment opportunities (feed industries, agricultural product processing and marketing.

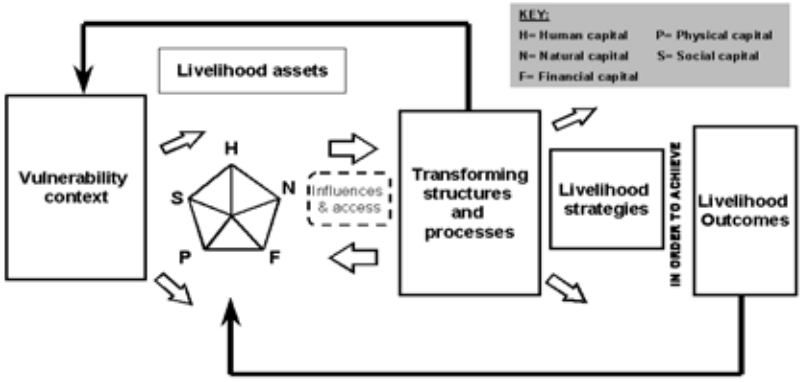

Figure1. Sustainable livelihood Approach

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