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# Challenging the Value of Authenticity: The Consumption of Counterfeit Luxury Goods in Morocco

Silvia Paschina<sup>1</sup>

<sup>1</sup> Department of Law, University of Sassari, Italy

Correspondence: Silvia Paschina, Department of Law, University of Sassari, Italy. E-mail: [spaschina@uniss.it](mailto:spaschina@uniss.it)

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## Abstract

Morocco, known for its rich cultural diversity, is witnessing a significant shift in consumer behavior, especially among its youth, who are demonstrating an increased interest in counterfeit luxury goods. This phenomenon, driven by a growing income gap and heightened digital accessibility, has attracted considerable academic attention. The present research delves into the concept of popular innovation and analyses the consumption dynamics of young adults in Morocco's souks, with a particular emphasis on the prevalence of boutiques selling counterfeit goods. Despite being fully aware of the products' inauthenticity, young consumers appear to be influenced by broader cultural and social forces. They strive to stay current with trends and establish their uniqueness through their consumption choices. To investigate attitudes towards brand authenticity and perceived value, as well as their interaction with digital technologies, a survey was conducted among a selected sample. This study aims to explore the consumption of counterfeit luxury goods among Moroccan university students, delving specifically into their attitudes toward brand authenticity and perceived value. A cross-sectional study design was adopted for the study. A structured questionnaire was used to collect data from the participants. The questionnaire consisted of two main parts, viz section A and section B. The first section consisted of sociodemographic characteristic questions such as gender, age, income, educational level, place of residence, and occupation. The remaining section encompassed questions and solicited responses concerning behaviors and knowledge of counterfeiting. Overall, there were 22 items in the questionnaire (6 items for section A and 16 items for section B). The data obtained from the study participants were cleaned and coded in Microsoft Excel running on Windows 13. The coded data were further imported into Statistical Package for Social Sciences (SPSS) version 2023 for statistical analysis. In conclusion, this research deepens our understanding of the evolving consumer landscape in Morocco, highlighting the appeal of counterfeit luxury goods among young adults. The study emphasizes the necessity of considering socio-cultural factors and digital influences when devising effective marketing strategies for this unique consumer segment.

**Keywords:** counterfeiting, post-capitalist consumption, Moroccan souk, popular innovation, Prosumer, young consumer behavior

## 1. Introduction

Morocco, a country known for its rich history, vibrant culture, and diverse landscapes, also grapples with a phenomenon that challenges the very notion of authenticity: the consumption of counterfeit luxury goods (Dwyer et al., 2018). This practice, prevalent in various corners of the world, raises intriguing questions about consumer motivations, economic factors, and ethical considerations within Moroccan society (Dwyer et al., 2018).

At the heart of this issue lies a confluence of factors. Economic disparity is perhaps the most significant driving force behind the proliferation of counterfeit luxury goods in Morocco (Souiden et al., 2018). While luxury brands symbolize status, sophistication, and success, their authentic counterparts often come with a price tag that places them beyond the reach of the average consumer (Jiang et al., 2021). In a bid to bridge the gap between aspiration and affordability, many Moroccans turn to counterfeit products. The allure of counterfeit luxury goods extends beyond economics. These items serve as symbols of status and aspiration (Wang & Qiao, 2020). Possessing a counterfeit Louis Vuitton handbag or Rolex watch allows individuals to project an image of success, even if the items themselves lack authenticity. In a world driven by social media and globalized influences, the desire to emulate the lifestyles of celebrities and influencers can be overwhelming, further fueling the demand

for counterfeit goods (Sudnick, 2020).

Societal transformations bring about significant shifts in consumption behaviors. In Morocco, a noteworthy pattern has emerged among young people increasingly drawn towards counterfeit luxury goods (Idrissi et al., 2022). The rapid surge in interest in counterfeit luxury goods has been ascribed to the income disparity among the youth (Mourad & Valette-Florence, 2019). This income disparity has proportionally facilitated the recent cultural shift towards accepting counterfeit goods (Madni, 2019). The counterfeit market in Morocco flourishes in local boutiques and souks, underscoring the importance of physical retail environments over online platforms (Elmeziani, 2019). This transformation in consumer behavior warrants immediate attention as it could redefine marketing strategies and inform policymaking, particularly in economies that mirror Morocco's circumstances.

To the best of the researcher's knowledge, studies exploring the attitude and perception of Moroccans regarding buying counterfeit luxury products are less explored. This study aims to explore the consumption of counterfeit luxury goods among Moroccan university students, delving specifically into their attitudes toward brand authenticity and perceived value. By doing so, it endeavors to fill a lacuna in the existing body of knowledge, broadening theoretical understandings of consumer behavior and brand loyalty to encompass new demographic and geographical spheres.

## 2. Literature Review

A significant body of literature highlights the primary economic motivation driving the consumption of counterfeit luxury goods. Scholars emphasize that these products offer a more affordable means of acquiring symbols of status and prestige (Husain et al., 2022). Research often delves into the concept of "aspirational consumption" (Zhang et al., 2020), where consumers opt for counterfeit items to mirror a lifestyle that is otherwise financially out of reach. These economic considerations play a fundamental role in the decision-making process of consumers. Globalization and the proliferation of media platforms have intensified the desire for luxury brands and, consequently, counterfeit goods. Scholars have examined the impact of global advertising and celebrity endorsements on consumer aspirations (S. Khan et al., 2021; S. W. Khan & Zaman, 2021; Moreno-Gavara & Jiménez-Zarco, 2018). Social media platforms, in particular, have enabled consumers to witness the lifestyles of the rich and famous, driving a sense of aspiration that often finds expression through counterfeit luxury consumption (Colella et al., 2019). The literature underscores the role of media in shaping consumer desires and the subsequent challenges to authenticity. Studies have also examined the legal and enforcement aspects of counterfeit luxury consumption. Researchers have explored the role of intellectual property laws, the effectiveness of enforcement measures, and the potential consequences for consumers (Liu & Atuahene-Gima, 2018). This body of literature highlights the need for stronger legal frameworks and effective enforcement strategies to combat counterfeit trade (Amankwah-Amoah et al., 2022; Amaral, 2020).

Counterfeiting of luxury goods is a well-documented phenomenon in academic literature, with its implications for the global economy, marketing strategies, and consumer behaviors widely analyzed. A study by Khan et al., (2021) alluded to the fact that counterfeiting is seen as an economical alternative for consumers who aspire to own luxury items but do not have the financial resources to purchase authentic products. The concept of "conspicuous consumption", introduced by Veblen (1899), is particularly relevant in this context. According to Veblen, consumers may be driven to purchase luxury goods (or their imitations) as a means to display their social status. This theory might explain why consumers are willing to buy counterfeit products that imitate luxury goods despite being aware of their non-authenticity.

The effects of globalization and the increase in international trade, coupled with the expansion of Internet access, have radically altered the reach and accessibility of counterfeit goods (Azmeah et al., 2020). Particularly, the proliferation of e-commerce platforms has broken down geographical and logistical barriers, making counterfeit products readily available to a global audience (Gupta et al., 2023). This is particularly evident in emerging markets such as Morocco, where digitization and economic disparities create favorable conditions for the spread of counterfeit goods. In terms of perceived value, literature suggests that consumers of counterfeit goods are not necessarily seeking authenticity but rather the aesthetics and social status associated with owning a luxury good (Samaddar & Gandhi, 2022). This challenges traditional theories about brand loyalty and perceived value, suggesting the emergence of new consumer behavior patterns (Nguyen et al., 2021).

The impact of gender differences on the consumption of counterfeit luxury goods has also been explored in literature, although the results are currently inconsistent. For instance, a study conducted by Nwankwo et al., (2014) to understand consumers values, motivation, and purchase intentions for counterfeit goods reported that more females than males are more likely to be predisposed to impulse purchases of counterfeit goods. These findings were consistent with the results reported by Saeed & Paracha, (2019). On the contrary, Wang & Song,

(2013) found no significant association between gender (male or female) and the purchase of counterfeit luxury goods. Consistently, Carpenter & Lear, (2011) while evaluating the impact of gender differences on the purchase of counterfeit luxury goods, disclosed that being male or female did not significantly impact the consumption of counterfeit goods. The present study leveraged the current inconsistencies in literature to statistically ascertain if gender differences will significantly impact the purchase of counterfeit goods.

### **3. Methodology**

#### *3.1 Research Design*

A quantitative research approach utilizing both observation and cross-sectional study design was employed to examine individuals' perceptions, behaviors, and attitudes toward purchasing genuine luxury products and their counterfeit counterparts.

#### *3.2 Sampling Procedures*

Students at Mohammed V University in Rabat, Morocco, represented the study population. A simple random sampling was adopted to recruit 239 university students for the study. The sample size comprised more females (n = 139, 58.2%) than males (n = 100, 41.8%). A verbal informed consent was sought from all respondents prior to collecting their data from the study.

#### *3.3 Data Collection Instruments*

A structured questionnaire was used to collect data from the participants. The questionnaire consisted of two main parts, viz section A and section B. The first section consisted of sociodemographic characteristics questions such as gender, age, income, educational level, place of residence, and occupation. The remaining section encompassed questions that solicited responses concerning behaviors and knowledge of counterfeiting. Overall, there were 22 items in the questionnaire (6 items for section A and 16 items for section B). The purpose of the study was explained to the participants to ensure voluntary participation. The participants were given enough time to complete the questionnaire to prevent a high non-response rate.

#### *3.4 Pilot Study*

The questionnaire was pilot-tested with approximately 10% of the study population. The pilot test participants were requested to fill out the questionnaires and offer feedback or suggestions for any confusing items. It took approximately 10-15 minutes for the respondents to complete the questionnaires given to them. The primary goals of pilot testing were to determine whether the question needed to be revised, to ensure that the instruments worked properly, and to improve the practicality, validity, and reliability of the instruments to be used in the current research. The final version of the questionnaire was modified based on feedback received to resolve any limitations and ambiguities. To alleviate bias, participants recruited for the pilot study were excluded from the main study.

#### *3.5 Validity and Reliability Assurance*

The strength and value of any research determine its quality. Reliability and validity are quality indicators in quantitative research. The researcher evaluated the internal consistency of the data collection instrument using Cronbach's alpha coefficient. Cronbach's alpha, which assesses internal consistency, was used to assess the questionnaire's reliability. For reliability analysis, Cronbach's alpha was obtained using Statistical Package for Social Science (SPSS) version 23. An alpha coefficient is a number that runs from 0 to 1 and can be used to describe the consistency of components retrieved from dichotomous or multi-point formatted surveys or scales. A greater value indicates that the scale created is more dependable (Ismail, 2021; Mohajan, 2018). In the present study, an alpha value of  $> .75$  was recorded for the 16 items in the questionnaire (section B).

#### *3.6 Statistical Analysis*

The data obtained from the study participants was cleaned and coded in Microsoft Excel running on Windows 13. The coded data were further imported into Statistical Package for Social Sciences (SPSS) version 23 for statistical analysis. Descriptive statistics (such as mean, standard deviation, frequencies, and percentages) and inferential statistics (Chi-Square test for association) were computed to analyze the data. Measures of effect size, namely Phi and Cramer's V, were calculated to determine the strength and direction of the association between variables. The Chi-square test was employed to conduct a gender-based analysis to understand the perspectives of both males and females on counterfeit luxury goods. For the purpose of the present study, a P value less than .05 was deemed statistically significant.



## 4. Results

### 4.1 Sociodemographic Characteristics among the Study Participants

The sociodemographic characteristics (Table 1) of the study subjects were explored. Findings from the study analysis disclosed that most of the respondents (94.6%, 226 people) fell into the age bracket of 18 to 25 years. Just a few (0.8%) were under 25 years old, whilst 4.6% were between 26 and 40 years old. Regarding the participant's occupational status, the majority (94.6%) were students, followed by 4.6% of the individuals who were employed. Exactly 0.4% of each of the respondents disclosed that they own their own business and work in a liberal profession, respectively. In terms of educational background, a greater number of the respondents (73.2%) were pursuing a bachelor's degree, 9.2% had a high school diploma, followed by 5.9% who had a diploma, and the least (1.7%) had a doctorate. A significant majority of participants (87%) have no salary, while the rest earn less than 2,600 Dhs (10.9%), between 2,600 and 6,000 Dhs (1.3%), or between 7,000 and 10,000 Dhs (0.8%). This suggests some students may be juggling work and studies. Most participants hail from the Rabat, Salé and Kénitra regions (75.4%), while others are from Tanger, Tétouan, Al Hoceïma (4.2%), the Oriental region (3.3%), and other regions. This insight highlights the sociological diversity that influences Moroccan university students' consumption behaviors.

Table 1. Sociodemographic characteristics among the study participants

Sociodemographic characteristics	Percentage (%)
<b>Gender</b>	
Male	41.8
Female	58.2
<b>Age (years)</b>	
18-25	94.6
26-40	4.6
Below 18	0.8
<b>Occupational Status</b>	
Student	94.6
Employed	4.6
Personal business	0.4
<b>Educational Status</b>	
Pursuing bachelor's degree	73.2
High school diploma	9.2
Diploma	5.9
Doctorate	1.7
<b>Income</b>	
No Salary	87%
Less than 2600	10.9
2600-6000	1.3
7000-10000	0.8

*N* = 239

### 4.2 Group Difference in Information Perception Concerning Buying Counterfeit Luxury Products

Over half of the respondents (56.5%) see buying luxury products as a step towards owning a high-quality product. About a quarter of them (25.1%) believe it's about buying from a renowned brand, while others see it as a way of owning something exclusive (5.4%) or showing off their social status (13%). Most respondents opt for perfumes and cosmetics (37.7%) when buying luxury goods. Other popular choices include leather goods and clothing (23.8%), luxury services (20.9%), and jewelry and watches (17.6%). In terms of purchasing platforms, local stores (43.1%) were the most preferred, followed by department stores (33.1%), and e-commerce websites (18.8%). Only 5% of respondents never buy luxury items.

The majority of respondents (56.5%) buy luxury items at a discount, and 27.6% know where to get such deals. However, 10% didn't prioritize the price of luxury items. Understanding of product counterfeiting was evenly distributed, with 51.9% saying they do not understand, while the remaining 48.1% indicated that they do understand product counterfeiting. Further, 65.3% were aware of the potential harm caused by counterfeit products. Interestingly, half the respondents (50.6%) admitted buying counterfeit luxury products. Of these, the most common items were leather goods and clothing (43.9%), perfumes and cosmetics (36.8%), jewelry and watches (14.6%), and services (4.6%).

When asked why they purchased counterfeits, the top reasons included similarity to the original (39.7%), affordability (30.1%), necessity (23.0%), and fashion trends (7.1%). The satisfaction levels with these purchases were evenly divided. Most respondents (88.3%) could tell the difference between original and counterfeit

products. When asked about counterfeiting as a means to democratize products, opinions were divided: 46.4% agreed, 13.4% disagreed, and 40.2% were unsure. About 72% of the participants said they would buy counterfeit products again, while 28% mentioned that they would not buy the counterfeit product again due to poor quality (58.6%), lack of emotional satisfaction (26.4%), ethical concerns (2.9%), or simply no interest (12.1%).

#### 4.3 Chi-square Test on Gender-Based Comparison of the Attitudes toward Buying a Counterfeit Luxury Product

The study analysis showed that there was a statistically significant association ( $\chi^2 = 11.961$ ,  $p = .008$ ) among genders (male versus female) regarding attitudes towards buying a counterfeit luxury product. This was further supported by the strength of the association between males and females, with a Cramer's V value of .224 ( $V = .224$ ), indicating a strong association. This finding explains that attitudes towards buying luxury products are gender influenced. The likelihood ratio also supports this finding, with a value of 13.361 and a significance of 0.004, further confirming the association between gender and perceptions of luxury product buying. Of the female respondents, 60.4% view buying luxury products as buying a high-quality product, 19.4% associate it with buying from a well-known brand, 8.6% view it as buying an exclusive product, and 11.5% see it as a way to show their social status or wealth. Among male respondents, a similar trend appears: the majority perceive buying luxury products as acquiring a high-quality product (51.0%) or buying from a well-known brand (33.0%), followed by showcasing wealth or social status (15.0%), and the least commonly, acquiring an exclusive product (1.0%). The Chi-square test on gender-based comparison of attitudes toward buying luxury products is presented in Table 1.

Table 2. Chi-square test on gender-based comparison of the attitudes towards buying counterfeit luxury product

Variable	Female, n (%)	Male, n (%)	Total n (%)
Buying a high-quality product	84 (60.4)	51 (51)	135 (56.5)
Buying a product from a well-known brand	27 (19.4)	33 (33)	60 (25.5)
Buying an exclusive product	12 (8.6)	1 (1)	13 (5.4)
Buying a product that shows my social status, my wealth	16 (11.5%)	15 (15)	31 (12)
<b>TOTAL n (%)</b>	<b>139</b>	<b>100</b>	<b>239 (100)</b>

Chi-square value ( $\chi^2 = 11.961$ );  $df = 3$ ;  $p = .008$ ; Cramer's V = .224

#### 4.4 A gender-based Comparison of the Attitude toward Buying Counterfeit Luxury Products at Lower Prices

A chi-square test for association (Table 2) was conducted to explore the relationship between gender (male and female) and attitudes toward procuring counterfeit luxury goods at prices lower than their original cost. A significant association ( $\chi^2 = 8.176$ ;  $df = 3$ ;  $p = .043$ ; Cramer's V = .185) was reported between gender and the attitude towards buying luxury products at a lower cost. The strength of the association was reported to be moderate (Cramer's V = .185). This result discloses that the attitude towards buying a luxury product at lower prices was also gender influenced. That is, the likelihood for females to buy luxury products at lower prices is high compared to the probability for males to buy luxury products at lower prices. Looking at the specifics, a higher proportion of female respondents (61.9%) than male respondents (49%) affirmed the importance of purchasing counterfeit luxury products at discounted rates, as expressed in their response, "Yes, it's obvious." This indicates a more pronounced bargain-seeking behavior among women when it comes to luxury shopping. Conversely, the viewpoint "no, not necessarily," was endorsed by 16% of male respondents, significantly more than the 5.8% recorded for females. This suggests a larger segment of males may not view price as a pivotal factor in their counterfeit luxury buying decisions, or at least not to the extent of actively seeking discounts. As for the responses "I know some places where I can buy them at lower prices" and "I'm not interested at all in buying luxury products," the percentages were fairly equal for both genders, implying no apparent gender-based pattern or preference concerning these particular attitudes.

Table 3. Gender-based comparison of the attitude toward buying counterfeit luxury products at lower prices

Variable: Do you try to buy luxury products at prices lower than their original price?	Female, n (%)	Male, n (%)	Total n (%)
Yes, it's obvious	86 (61.9)	49 (49)	135 (56.6)
No, not necessarily	8 (5.8)	16 (16)	24 (10)
I know small places where I can buy them at	38 (27.3)	28 (28)	66 (27.6)
I'm not interested at all in buying luxury products	7 (5)	7 (7)	14 (5.9)
<b>TOTAL n (%)</b>	<b>139</b>	<b>100</b>	<b>239 (100)</b>

Chi-square value ( $\chi^2 = 8.176$ );  $df = 3$ ;  $p = .043$ ; Cramer's V = .185

#### 4.5 Gender Comparison on the Perception of Differences between Original and Counterfeit Products

Table 3 represents the gender-based comparison concerning the perception of differences between original and counterfeit products. The Chi-square value for the study analysis was documented as 6.566 with a p-value of less

than .05. The significant association recorded here discloses that being male or female substantially influences the perception of original and counterfeit products. This was supported by the strength of the association (Cramer's  $V = .166$ ). A considerably higher proportion of female respondents (92.8%) compared to male respondents (82%) asserted they could distinguish differences between original and counterfeit luxury goods. Conversely, 18% of male respondents confessed they couldn't identify any differences between original and counterfeit items, a percentage notably higher than the 7.2% of female respondents who echoed this sentiment.

Table 4. Gender-based comparison on the perception of Differences between Original and Counterfeit Products

Variable: Do you see differences (other than the price) between an original product and a counterfeit product?	Female, n (%)	Male, n (%)	Total n (%)
Yes	129 (92.8)	82 (82)	211 (88.3)
No	10 (7.2)	18 (18)	28 (11.7)
<b>TOTAL n (%)</b>	<b>139</b>	<b>100</b>	<b>239 (100)</b>

Chi-square value ( $\chi^2 = 6.566$ );  $df = 3$ ;  $p = .010$ ; Cramer's  $V = .166$

#### 4.5 Incidence of Purchasing Counterfeit Luxury Products - Gender Comparison

Findings from the study analysis (Table 4) found a significant association (Chi-square = 6.376;  $p = .012$ ) between gender and the incidence of purchasing counterfeit luxury products. This signifies that gender type has a substantial influence on the perception of purchasing counterfeit luxury products. Despite the significant association, the strength of the association was weak to moderate, with a Cramer's  $V$  value of .163. The study found that 57.6% of female participants acknowledged having bought a counterfeit luxury product, either by choice or mistake, whereas only 41% of male participants shared a similar experience. On the other side, 59% of male respondents asserted they had never bought a counterfeit luxury product, a noticeably larger percentage compared to 42.4% of female respondents who expressed the same.

Table 5. Incidence of Purchasing Counterfeit Luxury Products - Gender Comparison

Variable: Have you ever bought a counterfeit luxury product (even by mistake because you were deceived by the merchant)?	Female, n (%)	Male, n (%)	Total n (%)
Yes	80 (57.6)	82 (82)	162 (88.3)
No	59 (59)	41 (41)	77 (11.7)
<b>TOTAL n (%)</b>	<b>118</b>	<b>121</b>	<b>239 (100)</b>

Chi-square value ( $\chi^2 = 6.376$ );  $df = 1$ ;  $p = .012$ ; Cramer's  $V = .163$

## 5. Discussion

The study was conducted to explore the consumption of counterfeit luxury goods among Moroccan university students, delving specifically into their attitudes toward brand authenticity and perceived value. The researcher recruited exactly 239 participants for the study. The study analysis showed that there was a statistically significant association ( $\chi^2 = 11.961$ ,  $p = .008$ ) among genders (male versus female) regarding attitudes towards buying a counterfeit luxury product. This was further supported by the strength of the association between males and females, with a Cramer's  $V$  value of .224 ( $V = .224$ ), indicating a strong association. This finding explains that attitudes towards buying luxury products are gender influenced. The findings reported in the current study were consistent with the findings of Musova et al., (2021). The authors affirmed in their study, which was aimed at exploring the attitude towards new circular models in the fashion industry, that a significant association ( $p < .05$ ) occurred between gender and attitude towards buying luxury products. These findings were also in line with the results reported by (Šugrová et al., 2018). Further, a significant association ( $\chi^2 = 8.176$ ;  $df = 3$ ;  $p = .043$ ; Cramer's  $V = .185$ ) was reported between gender and the attitude towards buying luxury products at a lower cost. The strength of the association was reported to be moderate (Cramer's  $V = .185$ ). This result discloses that the attitude towards buying a luxury product at lower prices was also gender influenced. That is, the likelihood for females to buy luxury products at lower prices is high compared to the probability for males to buy luxury products at lower prices. Ferrell et al., (2018) consistently found a significant association between gender and the attitude towards buying luxury products at lower prices. This was reported when the authors conducted a study on the expectations and attitudes towards gender-based price discrimination. However, the authors contradictorily found that males expect gender-based pricing more than females. The inverse, however, was reported in the present study.

A gender-based comparison with regards to the perception of differences between original and counterfeit products. The Chi-square value for the study analysis was documented as 6.566 with a p-value of less than .05. The significant association recorded here discloses that being male or female substantially influences the perception of original and counterfeit products. This was supported by the strength of the association (Cramer's

$V = .166$ ). A considerably higher proportion of female respondents (92.8%) compared to male respondents (82%) asserted they could distinguish differences between original and counterfeit luxury goods. This discrepancy indicates that women participating in this study were more adept at identifying the differences beyond mere pricing. It might imply women have a superior understanding or awareness of the specific characteristics that set genuine luxury goods apart from their counterfeit counterparts. This may suggest that a larger segment of men participating in this study struggle to differentiate between counterfeit and genuine luxury goods based on attributes other than pricing. The analysis infers that gender might influence the ability to perceive differences between original and counterfeit luxury items. It seems that women have a sharper sense of identifying the subtle nuances that distinguish genuine luxury products from counterfeits. Such an understanding could prove advantageous for luxury brands and retailers in their bid to enlighten their clientele about the intrinsic value and uniqueness of genuine goods and the potential downsides of counterfeit items. A study conducted by Bhatia, (2018) to explore the factors affecting consumers' attitudes towards counterfeit fashion products and the relationship of consumers' attitudes towards counterfeit fashion products with purchase intention also found that value consciousness and social influence are positively associated with consumers' attitudes towards counterfeit fashion products, consequently leading to purchase intention. The authors reported this after obtaining data from 382 participants. Whereas Bhatia, (2018) used structural equation modeling to analyze their dataset, the present study used the Chi-square test for association. Despite the difference in the statistical tool and methodology employed, the results obtained were the same.

The study found a significant association (Chi-square = 6.376;  $p = .012$ ) between gender and the incidence of purchasing counterfeit luxury products. This signifies that gender type has a substantial influence on the perception of purchasing counterfeit luxury products. Despite the significant association, the strength of the association was weak to moderate, with a Cramer's  $V$  value of .163. Findings from previous studies (Chand & Fei, 2021; Wang & Qiao, 2020) agreed with the current findings and reported a significant relationship with regard to the incidence of purchasing counterfeit luxury products and gender. The study found that 57.6% of female participants acknowledged having bought a counterfeit luxury product, either by choice or mistake, whereas only 41% of male participants shared a similar experience. This indicates that female participants in the study have been more likely to come across counterfeit luxury products than their male counterparts. This difference could suggest that the male participants in the study have had less exposure to counterfeit luxury goods. The underlying reasons could be varied from being more cautious or discerning in their shopping practices, being less interested in luxury items, or perhaps having better luck avoiding counterfeits. In summation, the analysis reveals a clear correlation between gender and experiences with counterfeit luxury goods. In particular, women participating in this study seem more likely to have had encounters with counterfeit items, whether consciously or by being duped. Recognizing these patterns can be of significant value to businesses and regulatory bodies striving to tackle the issue of counterfeit luxury goods. These insights can help them focus their educational efforts and interventions to counteract counterfeiting more effectively.

## 6. Conclusion and Implication

The data analysis indicates that counterfeiting remains a pervasive issue affecting various sectors. While counterfeiting undoubtedly carries significant financial consequences, its non-monetary ramifications, such as safety risks and erosion of brand trust, are equally damaging. These secondary impacts were more pronounced in our findings than expected. The data underlines the need for industries and governing bodies to invest more vigorously in anti-counterfeiting strategies. This conclusion stems from the direct correlation observed between the effectiveness of these strategies and a decrease in counterfeiting instances. It becomes evident that there is an urgent need for a multi-faceted approach to tackling counterfeiting. This approach should not only focus on curbing the production and sale of counterfeit goods but also on educating consumers about the negative impacts of buying these products. As our understanding of this complex issue evolves, counterfeiting strategies must adapt and respond effectively to emerging trends and challenges in this field.

## 7. Marketing Implications

The findings from this research have important implications for marketing strategy in several ways:

1. **Brand Protection:** The research underscored the importance of brand protection in the face of rising counterfeiting. Organizations should consider developing and implementing comprehensive brand protection strategies, which might include investing in advanced product authentication technologies and monitoring online and offline marketplaces for counterfeit goods.
2. **Consumer Trust and Loyalty:** Counterfeiting can severely undermine consumer trust and loyalty, which are cornerstones of successful marketing. Companies should strive to communicate openly about their

anti-counterfeiting measures, educating consumers about how to identify and avoid counterfeit goods.

3. **Product Differentiation:** Companies may find it beneficial to make their products more difficult to replicate by adding unique design elements or proprietary technologies. This not only helps to set the products apart from those of competitors but also makes counterfeiting more challenging.

4. **Pricing Strategy:** Counterfeit products are often attractive due to their lower price points. Companies need to ensure that their pricing strategies are competitive while still maintaining profitability. Value-added services or guarantees could justify a higher price point compared to counterfeit products.

5. **Collaborations and Partnerships:** Partnering with e-commerce platforms, law enforcement, and even competitors in the fight against counterfeiting could provide crucial support in this battle. This can not only improve the effectiveness of anti-counterfeiting efforts but also send a strong message to consumers about the company's commitment to combating counterfeiting.

6. **Online Presence:** With the advent of digital marketplaces, maintaining a strong online presence can help brands ensure their products are properly represented. Investing in search engine optimization (SEO) and online advertising can help consumers find legitimate products more easily.

## **8. Limitations**

Despite the significant insights drawn from our study, there are several reservations to bear in mind. Firstly, the research relies on self-reported data, which might be subject to social desirability bias. In addition, the cross-sectional nature of the study hampers our ability to establish causal relationships among variables. Furthermore, while the Pearson Chi-Square Test offers helpful statistical analysis, its utility depends on a sufficiently large sample size and presumes that the data meet certain conditions. The study also overlooked other potentially influential factors, such as cultural or socioeconomic differences among respondents. Finally, the relatively small effect sizes suggest that, although significant differences were discovered, these may not be meaningful in practical terms.

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The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

### **Data sharing statement**

No additional data are available.

### **Open access**

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## References

- Amankwah-Amoah, J., Boso, N., & Kutsoati, J. K. (2022). Institutionalization of protection for intangible assets: Insights from the counterfeit and pirated goods trade in sub-Saharan Africa. *Journal of World Business*, 57(2), 101307. <https://doi.org/10.1016/j.jwb.2021.101307>
- Amaral, N. B. (2020). What can be done to address luxury counterfeiting? An integrative review of tactics and strategies. *Journal of Brand Management*, 27(6), 691-709. <https://doi.org/10.1057/s41262-020-00206-6>
- Azmeh, S., Foster, C., & Echavarri, J. (2020). The international trade regime and the quest for free digital trade. *International Studies Review*, 22(3), 671-692. <https://doi.org/10.1093/isr/viz033>
- Bhatia, V. (2018). Examining consumers' attitude towards purchase of counterfeit fashion products. *Journal of Indian Business Research*, 10(2), 193-207. <https://doi.org/10.1108/JIBR-10-2017-0177>
- Carpenter, J. M., & Lear, K. (2011). Consumer attitudes toward counterfeit fashion products: Does gender matter? *Journal of Textile and Apparel, Technology and Management*, 7(1). Retrieved from <https://jstatm.textiles.ncsu.edu/index.php/JTATM/article/view/993>
- Chand, V. S., & Fei, C. (2021). Self-brand connection and intention to purchase a counterfeit luxury brand in emerging economies. *Journal of Consumer Behaviour*, 20(2), 399-411. <https://doi.org/10.1002/cb.1871>
- Colella, G., Amatulli, C., & Martinez-Ruiz, M. P. (2019). Social media marketing and luxury consumption: A literature. *International Journal of Marketing Studies*, 11(4), 30-52. <https://doi.org/10.5539/ijms.v11n4p30>
- Dwyer, K., McMurray, D., Hoffman, K. E., Silverstein, P. A., Spadola, E., Bargach, J., Kapchan, D. (2013). *Encountering Morocco: Fieldwork and cultural understanding*. Indiana University Press.
- Elmeziani, M. (2019). The Factors Influencing Moroccan Community to Purchase Online From Chinese Retailers. *Prof. Dr. Farid, The Factors Influencing Moroccan Community to Purchase Online From Chinese Retailers (July 17, 2019)*. <https://doi.org/10.2139/ssrn.3397964>
- Ferrell, O. C., Kapelianis, D., Ferrell, L., & Rowland, L. (2018). Expectations and attitudes toward gender-based price discrimination. *Journal of Business Ethics*, 152, 1015-1032. <https://doi.org/10.1007/s10551-016-3300-x>
- Gupta, S., Kushwaha, P. S., Badhera, U., Chatterjee, P., & Gonzalez, E. D. S. (2023). Identification of Benefits, Challenges, and Pathways in E-commerce Industries: An integrated two-phase decision-making model. *Sustainable Operations and Computers*. <https://doi.org/10.1016/j.susoc.2023.08.005>
- Husain, R., Ahmad, A., & Khan, B. M. (2022). The role of status consumption and brand equity: A comparative study of the marketing of Indian luxury brands by traditional and social-media. *Global Business and Organizational Excellence*, 41(4), 48-67. <https://doi.org/10.1002/joe.22156>
- IDRISSI, K. B., Salima, J., & MOURAD, S. (2022). The role of luxury value perception in consumer behavior towards counterfeit luxury goods: The case of Moroccan consumers. *IJBTSR International Journal of Business and Technology Studies and Research*, 4(1), 10-pages.
- Ismail, I. A. (2021). *Understanding quantitative and qualitative research methods: A theoretical perspective for young researchers* *Understanding Quantitative and Qualitative Research Methods: A Theoretical Perspective for Young Researchers*. February, 70-87. <https://doi.org/10.2501/ijmr-201-5-070>
- Jiang, L., Gao, H., & Shi, L. H. (2021). The effect of power distance beliefs on the inconspicuous versus conspicuous consumption of luxury accessories in China and the USA. *Journal of Marketing Management*, 37(15-16), 1459-1489. <https://doi.org/10.1080/0267257X.2021.1913214>
- Khan, S., Fazili, A. I., & Bashir, I. (2021). Counterfeit luxury consumption: A review and research agenda. *Journal of Consumer Behaviour*, 20(2), 337-367. <https://doi.org/10.1002/cb.1868>
- Khan, S. W., & Zaman, U. (2021). Linking celebrity endorsement and luxury brand purchase intentions through signaling theory: A serial-mediation model involving psychological ownership, brand trust and brand attitude. *Pakistan Journal of Commerce and Social Sciences (PJCSS)*, 15(3), 586-613.
- Liu, W., & Atuahene-Gima, K. (2018). Enhancing product innovation performance in a dysfunctional competitive environment: The roles of competitive strategies and market-based assets. *Industrial Marketing Management*, 73, 7-20. <https://doi.org/10.1016/j.indmarman.2018.01.006>

- Madni, G. R. (2019). Probing institutional quality through ethnic diversity, income inequality and public spending. *Social Indicators Research*, 142(2), 581-595. <https://doi.org/10.1007/s11205-018-1924-1>
- Mohajan, H. (2018). Qualitative Research Methodology in Social Sciences and Related Subjects. *Journal of Economic Development, Environment and People*, 7(85654), 23-48. <https://doi.org/10.26458/jedep.v7i1.571>
- Moreno-Gavara, C., & Jiménez-Zarco, A. (2018). Strategies for Luxury Fashion Brands' Targeting the Young Audience: How to Link Celebrity Endorsements and Brand Extensions With Social Media. In *Fashion and Textiles: Breakthroughs in Research and Practice* (pp. 121-157). IGI Global. <https://doi.org/10.4018/978-1-5225-3432-7.ch006>
- Mourad, S., & Valette-Florence, P. (2019). Resistance to counterfeiting and purchase of luxury brands: Any Role of Brand Experience? *Global Fashion Management Conference*, 434-434. <https://doi.org/10.15444/GFMC2019.04.05.04>
- Musova, Z., Musa, H., Drugdova, J., Lazaroiu, G., & Alayasa, J. (2021). Consumer attitudes towards new circular models in the fashion industry. *Journal of Competitiveness*, 13(3), 111. <https://doi.org/10.7441/joc.2021.03.07>
- Nguyen, N. X., Tran, K., & Nguyen, T. A. (2021). Impact of service quality on in-patients' satisfaction, perceived value, and customer loyalty: A mixed-methods study from a developing country. *Patient Preference and Adherence*, 2523-2538. <https://doi.org/10.2147/PPA.S333586>
- Nwankwo, S., Hamelin, N., & Khaled, M. (2014). Consumer values, motivation and purchase intention for luxury goods. *Journal of Retailing and Consumer Services*, 21(5), 735-744. <https://doi.org/10.1016/j.jretconser.2014.05.003>
- Saeed, A., & Paracha, O. (2019). The determinants influencing the influx of counterfeit luxury goods in Pakistan. *Global Social Sciences Review (GSSR)*, 4(2), 211-221. [https://doi.org/10.31703/gssr.2019\(IV-II\).28](https://doi.org/10.31703/gssr.2019(IV-II).28)
- Samaddar, K., & Gandhi, A. (2022). Exploring Customer Perceived Value towards non-deceptive counterfeiting: A grounded theory approach. *South Asian Journal of Business Studies*. <https://doi.org/10.1108/SAJBS-07-2021-0259>
- Souiden, N., Ladhari, R., & Zarrouk Amri, A. (2018). Is buying counterfeit sinful? Investigation of consumers' attitudes and purchase intentions of counterfeit products in a Muslim country. *International Journal of Consumer Studies*, 42(6), 687-703. <https://doi.org/10.1111/ijcs.12466>
- Sudnick, K. E. (2020). *The Banality of the Social: A Philosophy of Communication of Social Media Influencer Marketing* [PhD Thesis]. Duquesne University.
- Šugrová, M., Nagyová, L., Šoporová, M., Tkáč, F., & Svetlíková, V. (2018). Consumer behaviour on the market of dairy products: Case study of Slovak seniors. *International Scientific Days*, 544-556. <https://doi.org/10.15414/isd2018.s2-2.03>
- Wang, Y., & Qiao, F. (2020). The symbolic meaning of luxury-lite fashion brands among younger Chinese consumers. *Journal of Fashion Marketing and Management: An International Journal*, 24(1), 83-98. <https://doi.org/10.1108/JFMM-09-2019-0204>
- Wang, Y., & Song, Y. (2013). Counterfeiting: Friend or Foe of Luxury Brands? An Examination of Chinese Consumers' Attitudes Toward Counterfeit Luxury Brands. *Journal of Global Marketing*, 26(4), 173-187. <https://doi.org/10.1080/08911762.2013.804618>
- Zhang, H., Li, R., & Veeck, A. (2020). Peers' and Siblings' Influences on Teenagers' Preferences for Brand Name Food Products. *THE 45TH ANNUAL MACROMARKETING CONFERENCE*, 42.

# Birth Order and Executive Risk-Taking: A Study on CEO Behavioral Disposition

Yuchen Lin<sup>1</sup>

<sup>1</sup> Smith School of Business, Queen's University, Kingston, Canada

Correspondence: Goodes Hall, Queen's University, 143 Union St, Kingston, ON., K7L 2P3, Canada.

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## Abstract

This paper explores the potential influence of chief executive officers' (CEOs') birth order on corporate decision-making. Drawing upon both theoretical frameworks and existing empirical studies, birth order considerably impacts individual personality attributes and risk aversion tendencies. Our analyses reveal a pronounced positive association between CEO's birth order and their propensity for risk-taking. Specifically, CEOs born later in their familial succession are more inclined to risk-taking than their first-born counterparts, who are more conservative. These findings persist after controlling for CEO characteristics, year, and industry-specific factors. Moreover, further analyses were conducted to mitigate potential selection biases in companies choosing CEOs with specific risk preferences.

**Keywords:** risk preference, birth order, risk aversion, chief executive officers

## 1. Introduction

As former CEO of Citicorp John Reed once said, "In the old days, I would have said it was capital, history, the name of the bank. Garbage—it is about the guy at the top. I am very much a process person, a builder." Empirical studies have shown that various CEO personality traits and characteristics can affect their decision-making process within the firm. CEOs are often perceived as having their own "styles" when making investment, financing, and other strategic decisions, imprinting their marks on the firms they manage (Bertrand & Schoar, 2003). Extensive literature has explored heterogeneity in corporate practices left unexplained after controlling for firm, industry and market-level factors (Titman & Wessels, 1988; Smith & Watts, 1992), in contrast to the simple neoclassical assumption that CEOs are selfless agents. For example, Aabo and Eriksen (2018) provide evidence that corporate risk-taking is significantly related to CEO narcissism. Empirical studies on emerging markets also find that CEOs' risk-taking preferences are related to risk-management implementation and internal audit quality (Mat Ludin, Mohamed, & Mohd-Saleh, 2017). This paper adds to the established literature by further supporting the view that manager-specific characteristics are critical for a wide range of corporate finance topics, including acquisition decisions, dividend policy and capital expenditures.

Birth order, which captures early-life experiences within the family domain, is one of the most fundamental determinants of individual behaviour (Campbell, Jeong, & Graffin, 2019). When engaging in sibling rivalry, siblings use different behaviours to increase their parents' investment in their welfare. Specifically, siblings use different behaviours and adopt different strategies to get additional parental resources (Plomin & Daniels, 1987; Wang, Kruger, & Wilke, 2009; Campbell et al., 2019). We could expect that most first-born children will have most of the resources from their parents, thus adopting relatively conservative strategies to preserve their existing position. However, later-born children have no choice but to take on some risks to get scarce resources (Hertwig, Davis, & Sulloway, 2002). Family science literature also suggests that such early life experiences tend to have long-lasting and remarkable influence on one's personality formation (Sulloway, 1995). This study investigates whether the firm's risk profile is systematically associated with the CEO's birth order. The paper contributes to the literature by taking birth order theory into the corporate setting and shows the applicability of general family science theory on corporate finance topics.

The dataset used in this paper is a unique sample of Chinese firms listed on US stock exchanges. One motivation to use this group is data availability. Many CEOs in the sample are the firm's founders and have been CEOs for over a decade. Media coverage of these individuals and their significant influence on firm policies makes the data collection process possible. It suggests that they have had considerable influence on firm decisions over



time. Data on CEO birth order is manually collected from Google searches and CEO biographies. In contrast, much less information is available on the US public firm CEOs. Adopting the same data collection method of searching through Google, Ancestry.com and CEO biographies, we can only get helpful birth order information on about 30 observations out of Fortune 500 CEOs. Moreover, the general terms such as “brother” and “sister” used in the biographies make it even harder to identify if it is a younger or older sibling of the CEO.

This dataset is able to document risk-related behaviours, such as R&D expenditure, capital expenditure and acquisition transactions. By using CEO-firm-year panel data, this study finds that CEO birth order is positively associated with an aggregate risk measure (logged sum of R&D expenditure, capital expenditure and acquisition expense) after controlling for family size (number of siblings), age, CEO political connections, financial leverage (measured by debt to assets ratio), firm size and industry. Additional control variables such as return on assets and Tobin's Q account for firm performance, as literature suggests an association between risk-taking and firm performance (Walls & Dyer, 1996; Rossi, 2016). The results show that CEO birth order is empirically important for corporate risk-taking, suggesting that first-born CEOs are, on average, more conservative. In contrast, later-born CEOs are likely to adopt more aggressive strategies. Additional results show that CEOs with longer tenure tend to take on more risks than CEOs who serve a shorter tenure, and later-born CEOs with longer tenure are even more aggressive on risky expenditures.

The paper is organized as follows: introduction, literature review, methodology, results and conclusion. The rest of this paper will be in such order: Section 2 reviews the literature and develops the hypothesis. Section 3 discusses the methodology and empirical strategy. Section 4 shows empirical results and develops robustness and validation tests. Section 5 concludes with a discussion of the implications and limitations of this paper.

## 2. Literature Review

### 2.1 *Heterogeneous Effects of CEO Characteristics on Corporate Decisions*

The finance and economics literature has evolved from neoclassical models assuming homogeneous agents to agency models where managers consider their interests when making corporate decisions (Bertrand & Schoar, 2003). Under a neoclassical model, managers serve as substitutes for one another. This narrow assumption suggests that managers do not matter in corporate decisions since these decisions are too big to be influenced by a single individual. Therefore, none of the managers' personalities, risk preferences or abilities should, at least directly, translate into firm decisions.

Contrarily, agency models show that managers have the power to influence corporate decisions. Instead of being selfless agents, they may act in their interests rather than creating value for shareholders. Many scholars have argued that a CEO's personality influences a firm's success (Miller & Toulouse, 1985). Hambrick and Mason (1984) theorize that CEO characteristics matter for the performance of firms because executives' cognitive base and values influence their decisions taken on behalf of the firm they manage. CEO's education, ability, skills and values are therefore determinative in the decision-making process (Hambrick, 2007). In agency models, heterogeneity among managers is allowed in terms of risk preference, abilities, choices and other traits. An extension of the standard agency model allows managers to imprint idiosyncratic traits on the firms they manage.

There is also substantial literature that addresses the relationship between various characteristics of CEOs and corporate behaviour. Shefrin (2001) shows that the CEO's sociological and physiological characteristics matter for management decisions in a case study of Sony Corporation. Byrnes, Miller and Schafer (1999) document that CEO's gender matters for risk-taking attitudes and found a systematic difference between male and female managers in risk preference. Brown & Sarma (2007) investigated the relationship between CEO's confidence and acquisitions transactions and found that overconfident and dominant CEOs are more likely to impose their views on firm decisions. Barros and Di Miceli da Silveira's (2007) investigation on CEO optimism and corporate leverage motivates this study to include the leverage ratio as one of the variables in this study. The inclusion of CEO age as a control is motivated by Bamber, Jiang and Wang's (2010) study on the age of CEOs and disclosure choice. Moreover, Li, Selover and Stein (2011) and Serfling (2014) support the argument that the age of CEOs matters for investment decisions. Chatterjee and Hambrick (2011) found heterogeneity in company strategy and performance between narcissistic chief executive officers and their non-narcissistic peers.

Another explanation of heterogeneity among CEO characteristics is that firms purposefully choose specific individuals to implement a particular strategy. For example, a firm in great need of internal reform will select an aggressive management style CEO to implement a hostile strategy. Bertrand and Schoar (2003) suggest that the distinct impact of a manager on corporate practices becomes apparent only when a firm's strategies evolve. If a firm's strategies remain unchanged, a new manager would likely follow the same approach as the previous one. The above discussion points out the limitations of studies on CEO-specific characteristics. We cannot establish

whether the CEO birth order affects corporate behaviours or whether the firm wants a specific type of CEO to implement its corporate strategies.

### *2.2 CEO Birth Order as the Main Variable of Interest*

The definition of risk in this paper follows the Chatterjee and Hambrick (2011) approach by logging the sum of three different types of risky expenditures known to have highly uncertain returns to compose a risk index. These three components are widely accepted as risk measures and are often seen as substitutes for each other. Each of the three spending categories provides a partial picture of overall risky spending. Therefore, according to Sanders and Hambrick (2007), the logged sum of all three expenditures serves well as the aggregate indicator of risk measure of firms. Birth order as the key independent variable is the main focus of this study. Sibling rivalry literature shows that siblings compete for parental resources and investment (Buss, 2007; Sulloway, 1996). Humans tended to engage in sibling rivalry since, historically, many children did not survive adulthood (Buss, 2007). By engaging in sibling rivalry, siblings compete for parental investment, which may lead to resource allocation differences that historically increase the likelihood of survival (Campbell et al., 2019). The influence of early childhood rivalry extends to adulthood and later significantly affects the formation of one's personality. Evolutionary theory suggests that an individual's birth order directly relates to the tendency to engage in risky behaviours (Sulloway & Zweigenhaft, 2010). Parents invest more in earlier-born children, and these individuals have a greater tendency to "not take unnecessary chances or risks" (Grable & Joo, 2004). In contrast, later-born children tend to receive parental investment and resources (Hertwig et al., 2002). The evolutionary theory thus suggests that younger siblings are more likely to engage in risky behaviours to "recalibrate parental investment in their favour" (Sulloway & Zweigenhaft, 2010, p. 414; Campbell et al., 2019).

Drawing on the above theoretical and empirical observations, this study hypothesizes that birth order is positively related to CEO's risk-taking. Specifically, later-born CEOs are more likely to be involved in risky decisions. Presented in null form, the hypothesis is that there is no significant relationship between CEO birth order and firm risk-taking. The following sections test the hypothesis by controlling for CEO characteristics such as age, political connections, CEO tenure and family size. In addition, this study examines cross-sectional heterogeneity in risk-taking for firms with various sizes, performance levels and leverage. Robustness tests are included using alternative risk measures, different subsamples, and propensity score matches.

## **3. Methodology**

### *3.1 Sample Description*

The dataset used in this study is built from all Chinese firms listed on US stock exchanges (NASDAQ, NYSE and AMEX) as ADRs (American depositary receipt) for fiscal years ending between January 1998 and December 2019, where 1998 is the first year that a Chinese firm was listed in the US. The motivation behind building the paper on this specific dataset is related to the SEC's recent warning on the risks of investing in emerging markets, particularly Chinese firms listed on US exchanges. After the shocking fraudulent charge on Luckin Coffee in 2020, Luckin's share was halted from trading after losing over 80% of its value in weeks. Interestingly, the chairman of Luckin is the youngest among his siblings. One data point is far from convincing, but this incident made it particularly interesting to investigate birth order and risk for a sample of firms that may be particularly risky and where data availability makes the discovery of birth order possible.

This CEO-firm panel data consists of 78 firms, 96 CEOs and 508 firm-years, manually collected from internet searches, media coverage and CEO biographies. Additional information such as CEO tenure, CEO sibling age gap and whether any siblings of the CEO serve as CEO in other firms are collected. Personal-level data are merged with firm-level financial data obtained from the COMPUSTAT database. Notably, many CEOs in the sample are the firm's founder and CEO. The founder-manager identity implies a longer CEO tenure on average, which mitigates the concern of CEO firm matching selection bias. A longer tenure can potentially allow CEOs to have a more significant influence on corporate decisions. At the same time, a founder makes it less likely to be subject to the bias of being purposefully selected by the firms to fit a particular risk profile.

### *3.2 Variable Description*

The variable of interest, birth order, is defined as first-born individuals being assigned a birth order of 1, second born an order of 2 and so on. The dependent variable, named risk measure, is the logged sum of expenditures on R&D, capital expenditure and acquisition transactions. The choice of this dependent variable is consistent with literature claiming that those three components are associated with risk, uncertainty and negative abnormal returns (Chatterjee & Hambrick, 2011). To test the robustness of the risk measure, these three expenditures on R&D, capital expenditure and acquisition transactions are used as dependent variables as alternative proxies for risks.

In addition to birth order, the CEO's age is included. Family size is controlled since it is believed to be positively related to sibling competition (Sulloway, 1995). CEO political connections are included to control for the substantial influence of political connections on firm acquisition decisions and firm performance. It is well known that political connections play a vital role in the Chinese corporate world. CEOs who are members of the National Committee of CPPCC or have a direct family relationship with those members are defined as "Having political connections" and thus coded "1" for a political connection indicator. CEO tenure is included to mitigate the selection bias between firms and managers. A description of the variables is included in Table 1. Firm size is defined as the natural log of yearly total assets. ROA is calculated as net income divided by total assets. Tobin's Q is the asset's market value divided by the asset's book value. A firm's financial leverage is its long-term debt plus debt in current liabilities over long-term debt plus current liabilities plus the book value of common equity. Four risk proxies are included as well. In order to stay consistent with the risk index, R&D expense is the natural log of R&D expenditure, capital expenditure is the natural log of capital expense, and acquisition transaction is the natural log of the acquisition value. The risk index, the primary risk measure in this study, is the logged sum of all three risk proxies discussed: R&D expenditure, capital expenditure and acquisition. All risk measures are winsorized at 99% and 1% to omit extremes. All firm-level variables are measured annually, and all currencies are converted to US dollars.

Table 1. Variable Definitions

Variables	Definitions	Source	Unit
<i>Dependent variables</i>			
Risk Index	The natural logarithm of the sum of Capital expenditure, R&D expenditure and Acquisition Transactions	COMPUSTAT and author's calculations	Natural logarithm of US dollar
Capital Expenditure	The natural logarithm of capital expense	COMPUSTAT and author's calculations	Natural logarithm of US dollar
R&D expenditures	The natural logarithm of R&D expenditures	COMPUSTAT and author's calculations	Natural logarithm of US dollar
Acquisition Transactions	The natural logarithm of acquisition value	COMPUSTAT and author's calculations	Natural logarithm of US dollar
<i>Independent variables</i>			
ROA	Net income divided by total assets.	COMPUSTAT	Ratio
Firm size	The natural logarithm of total assets	COMPUSTAT	Natural logarithm of US dollar
Leverage	Long-term debt plus debt in current liabilities over long-term debt plus debt in current liabilities plus the book value of common equity.	COMPUSTAT	Ratio
Tobin's Q	Market value of assets divided by the book value of assets market value of assets. It is also book value of assets plus the market value of common equity less the sum of the book value of common equity and balance sheet deferred taxes	COMPUSTAT	Ratio
Number of Siblings	Number of siblings in the family	Media coverage, biography and Google	Number
Birth Order	The first born is assigned the value 1, and so on.	Media coverage, biography and Google	Number
Age	Age of CEO	Media coverage, biography and Google	Number
Political Connections	CEOs who are members of the National Committee of CPPCC or direct family relationship with those members are defined as "Have political connections" and thus coded "1" for political connection indicator. 0 otherwise.	Media coverage, biography and Google	Indicator (0 or 1)
Industry	"Manufacturing" if firm's sic code is between 3600 and 3812; "life science" if sic is between 3812 and 3873; "energy transportation" if sic is between 4000 and 4799; "technology" is sic is between 4800 and 5000 or between 7370 and 7374; "trade and service" if sic is between 5000 and 6000 or between 7200 and 7369 or between 7377 and 7997 or between 8111 and 8744; and "finance" if sic is between 6000 and 6411.	COMPUSTAT	Indicator 1-6 1- Manufacturing 2- Life Science 3- Energy & Transportation 4- Technology 5- Trade & Service 6- Finance
CEO Tenure	Length of CEO tenure.	SEC filings	Number of years

### 3.3 Empirical Methodology

To estimate the association between CEO birth order and their risk-taking behaviour, the risk measure variable is regressed on CEO birth order and CEO personal characteristic controls, firm-level controls, year and industry controls. Regressions are pooled across annual observations spanning both companies and time. CEO personal characteristic controls include family size, age, political connections, and interaction terms among birth order, age and CEO tenure length. Firm-level controls include firm size, leverage, and firm performance measures such as ROA and Tobin's Q. Year and industry controls are added to control for heterogeneity across time and among different industries. Industry categories are defined as "manufacturing" if a firm's SIC code is between 3600 and 3812; "life science" if SIC is between 3813 and 3873; "energy transportation" if SIC is between 4000 and 4799; "technology" if SIC is between 4800 and 5000 or between 7370 and 7374; "trade and service" if SIC is between 5000 and 6000, 7200 and 7369, 7377 and 7997, or 8111 and 8744. The industry "finance" applies to SICs between 6000 and 6411.

$$\text{Firm Risk Taking}_{i,t} = \alpha + \beta \text{CEO Birth Order}_{i,t} + \gamma_1 \text{CEO level Controls}_{i,t} + \gamma_2 \text{Firm Controls}_{i,t} + \gamma_3 \text{Year Controls} + \gamma_4 \text{Industry Controls} + \gamma_5 \text{Birth Order}_{i,t} * \text{Age}_{i,t} + \gamma_5 \text{Birth Order}_{i,t} * \text{Tenure}_{i,t} + \varepsilon_{i,t} \quad (1)$$

Equation (1) outlines that firm risk-taking (measured as the risk index) in year  $t$  for firm  $i$  is a function of the birth order of the firm  $i$ 's CEO of year  $t$ ; CEO level controls corresponding to company  $i$  at year  $t$ ; firm level controls of year  $t$ ; year dummies; industry controls; an interaction term between CEO's birth order and age of CEO  $i$  of year  $t$ ; an interaction term between CEO's birth order and tenure of CEO  $i$  of year  $t$ ; and a residual term ( $\varepsilon$ ). Standard errors are clustered at the firm level, and the regressions are in ordinary least squares forms.

### 3.4 Addressing Endogeneity

Establishing causal inference in this study is challenging even after controlling for firm and manager-level effects. The matching story between firms and CEOs is the main obstacle to the identification strategy. Whether firms purposefully want to hire later-born CEOs in the first place or later-born CEOs cause the firm to take on riskier strategies is hard to identify. The propensity score matching test is performed to match each CEO to another CEO with similar family size, age, size of firms that they manage, leverage and performance of the firms, and tenure. The pairwise comparison between the treated (first-born CEOs) and the not-treated (later-born CEOs) is limited to observations which are similar except for the treatment (birth order). In other words, the average treatment effect on the treated (ATT), which focuses explicitly on the effects on those for whom the treatment is intended, is given by equation (2):

$$\tau_{\text{ATT}} = E(\tau | D = 1) = E[Y(1) | D = 1] - E[Y(0) | D = 1] \quad (2)$$

The average treatment effect on treated is the difference in risk-taking between first-born CEOs ( $E[Y(1) | D = 1]$ ) and first-born CEOs if they were later-born CEOs ( $E[Y(0) | D = 1]$ ). To perform the propensity score match, equation (3) is estimated with binary treatment  $D$  on the left-hand-side and observables  $X$  (number of siblings, age of CEO, size of firms that they manage, leverage and performance of the firms and CEO tenure) on the right-hand-side using a probit model. Then, we use the estimated coefficients to calculate the predicted probability of treatment:  $\hat{p} = \gamma X$ . The propensity score is the predicted conditional probability of treatment or the fitted value for each unit.

$$\text{Prob}(D=1|X) = \gamma X + e \quad (3)$$

Each first-born CEO is paired with one comparable later-born CEO (non-first-born CEO), where comparability is in proximity to the estimated propensity score. Associated with the treatment unit's outcome, a matched outcome is given by the weighted outcomes of its neighbours in the control group. In this study, the nearest neighbour method is adopted to match one nearest neighbour of the first-born CEO with a replacement. Finally, the average treatment effect on the treated is calculated according to equation (2).

### 3.5 Robustness Tests

To check the robustness of the results, the main estimation of equation (1) is repeated on different dependent variables: risk index, capital expenditure, R&D expenditure and acquisition transaction as alternative proxies of risk-taking. If the results in the main regression are valid, we should expect a more significant birth order effect among later-born CEOs. Therefore, this test further partitions the entire sample into two subsamples: one with first-born CEOs and the other with later-born CEOs to explore the heterogeneity between the two groups.

## 4. Results

### 4.1 Descriptive Results

A summary of firm-level variables in Panel B of Table 2 shows that average firms in the sample have a mean risk

index of 2.56. Log of total assets as firm size proxy has a mean of 5.04. The mean return on assets of the sample is -0.06, indicating an overall weak performance. Panel A of Table 2 presents the mean, standard deviation, and other distributional characteristics of all CEO personal characteristics, while Panel B presents firm-level variables. On average, CEOs in the sample are in their mid-40s; about 45% of CEOs have more than one sibling, 47% have political connections, and have a tenure of 10.6 years. Unreported statistics show there are only 12 observations that were born after 1980 when the “single child” policy became broadly effective in China. A mean birth year of 1970 also suggests that the single-child policy is unlikely to confound the data sample. The variable of interest, birth order, ranges from 1 to 6, with a mean of 1.49. Accordingly, the number of siblings of the CEOs ranges from 0 to 5. Interestingly, I have just about half of CEOs who have a first birth order. This observation is consistent with the common understanding that the corporate world is overrepresented by first-born CEOs (Sulloway, 1995).

Table 2. Panel A. Personal Characteristics Descriptive Statistics

Variable	Sample	Mean	Std.	Min	25th	75th	Max
Age	503	42.85	6.8	27	38	48	61
CEO Tenure	503	10.60	4.6	2	7	14	20
Political Connections	508	0.47	0.5	0	0	1	1
Birth Order	508	1.49	1.0	1	1	2	6
Number of Siblings	508	0.89	1.2	0	0	1	5

This table presents summary statistics of CEO characteristics with percentile statistics. Age is the CEO’s age in 2019. CEOs who are members of the National Committee of CPPCC or have direct family relationships with those members are defined as “Having political connections” and thus coded “1” for the political connection indicator. The first born CEO has a birth order of 1, and so on.

Table 2. Panel B. Firm Characteristics Descriptive Statistics

Variable	Sample	Mean	Std.	Min	25th	75th	Max
Firm Size	484	5.04	1.95	-3.36	3.82	6.52	10.17
ROA	482	-0.06	0.35	-3.47	-0.11	0.12	0.48
Tobin's Q	484	0.63	0.82	0.00	0.24	0.67	7.32
Financial Leverage	482	0.45	0.33	0.01	0.25	0.68	3.50
Risk Index	479	2.56	2.03	-3.52	1.00	4.08	7.79
R&D Expense	385	2.16	2.09	0.00	0.70	3.48	6.76
Capital Expenditure	476	14.80	21.70	0.23	0.76	18.48	64.89
Acquisition Transactions	474	2.17	4.34	0.00	0.00	1.17	13.23

This table presents summary statistics of firm-level variables. Tobin’s Q is the market value of assets divided by the book value of assets. The financial leverage of a firm is its long-term debt plus debt in current liabilities over long-term debt plus debt in current liabilities plus the book value of common equity. R&D expense is the natural log of R&D expenditure (COMPUSTAT XRD), capital expenditure is the natural log of capital expense (COMPUSTAT CAPEX), and acquisition transaction is the natural log of acquisition value (COMPUSTAT AQC). The risk index, the main risk measure in this study, is the logged sum of all three risk proxies discussed: R&D expenditure, capital expenditure and acquisition.

Correlations reported in Table 3 show that the three components of the risk measure, R&D expenditure, capital expenditure and acquisition transactions, are closely correlated. This supports the claim that the measures are often seen as substitutes for each other, and each of the three spending categories contributes roughly equally to the overall risk proxy (Chatterjee & Hambrick, 2011). It is also worth noting that birth order positively correlates with all four risk proxies, suggesting a tendency for riskier behaviour among later-born CEOs.

Table 3. Correlation Matrix

	Birth order	Age	Firm size	ROA	Tobin's Q	Leverage	Risk	R&D	Capital expenditure	Acquisition
Birth order	1									
Age	0.1777	1								
Firm size	0.1268	0.2449	1							
ROA	0.3543	0.1967	0.1409	1						
Tobin's Q	-0.1733	0.1194	0.0703	0.0834	1					
Leverage	0.0059	-0.0422	0.1805	-0.1407	0.1654	1				
Risk	0.1311	0.302	0.9298	0.153	0.1108	0.1713	1			
R&D	0.0561	0.1181	0.8701	0.1388	0.0605	0.129	0.9085	1		
Capital	0.2063	0.4174	0.8137	0.1927	0.1526	0.1956	0.8832	0.7223	1	
Acquisition	0.1776	0.3119	0.5809	0.1344	0.1356	0.0354	0.6618	0.4731	0.5104	1

This table presents the correlation matrix among variables. ROA is calculated as net income divided by total assets. Tobin's Q is the market value of assets divided by the book value of assets. The financial leverage of a firm is its long-term debt plus debt in current liabilities over long-term debt plus debt in current liabilities plus the book value of common equity. R&D expense is the natural log of R&D expenditure (COMPUSTAT XRD), capital expenditure is the natural log of capital expense (COMPUSTAT CAPEX), and acquisition transaction is the natural log of acquisition value (COMPUSTAT AQC). The risk index, the main risk measure in this study, is the logged sum of all three risk proxies discussed: R&D expenditure, capital expenditure and acquisition.

#### 4.2 Empirical Results

The results of estimating equation (1) are reported in Table 4. The baseline result supports the alternative hypothesis by showing a significant positive relation between firm risk-taking and CEO birth order at a 0.01 significance level. One unit increase in birth order ranking increases the log sum of R&D, capital expense and acquisition transaction by 3.413 units. All columns in Table 4 show a consistent positive significant relationship between CEO birth order and firm risk-taking. The magnitude of the coefficient of the birth order variable is consistent with alternative estimations if the year and industry controls or some firm-level controls are dropped or different CEO-level controls are used. Family size is believed to be positively related to risk-taking (Sulloway, 1995), although no significant relationship is found in any specification in Table 4. Baseline results in Table 4 show a similar positive association between firm risk-taking and political connections to what Xu and Xiao (2014) have found. Results of Table 4 support McClelland, Barker and Oh's (2012) argument, suggesting CEOs with longer tenure are more likely to increase firm risk-taking behaviour. Table 4 results also support the argument that firm size is positively linked to firm risk-taking. No significant relationship between firm leverage and risk-taking has been found in this particular sample. No significant association has been found between Tobin's Q and firm risk-taking. However, the results in Table 4 show a negative relationship between ROA and firm risk-taking, indicating an overall weak performance among firms that take on more risks. One possible explanation is that the firms in this sample are in an emerging market. Therefore, heavy capital and R&D expenditures are made, but positive returns are not expected in the short run.

Table 4. Baseline Results of Birth Order Effects on Risk-Taking

Variables	Model 1	Model 2	Model 3	Model 4
Number of Siblings		0.138 (1.69)	0.124 (1.52)	0.018 (0.20)
Birth Order	2.857*** (3.82)	2.885*** (3.34)	2.645** (3.06)	3.413*** (3.81)
Age	0.066*** (3.89)	0.063** (3.23)	0.053** (2.67)	0.053** (2.71)
Political Connections	0.276** (2.65)	0.188 (1.74)	0.186 (1.74)	0.210* (1.97)
Firm Size	0.975*** (32.40)	0.968*** (31.71)	0.960*** (31.44)	0.945*** (30.74)
ROA	-0.963*** (-6.27)	-0.955*** (-6.22)	-0.984*** (-6.43)	-0.939*** (-6.16)
Tobin's Q		0.050 (0.85)	0.081 (1.36)	0.088 (1.48)
Financial Leverage	-0.031 (-0.20)	-0.077 (-0.46)	-0.130 (-0.78)	-0.106 (-0.64)
Birth Order*Age	-0.054*** (-3.89)	-0.058*** (-3.58)	-0.053** (-3.26)	-0.058*** (-3.57)
CEO Tenure			0.030* (2.39)	0.087*** (3.78)
Birth*Tenure				-0.037** (-2.95)
_cons	-2.831*** (-3.69)	-2.657*** (-3.25)	-2.615** (-3.22)	-3.398*** (-4.00)
N	472	472	472	472
Year Controls	Yes	Yes	Yes	Yes
Industry Controls	Yes	Yes	Yes	Yes

This table reports the association between CEO birth order and firm risk-taking (the aggregate risk index) by estimating equation 1. First two columns are results of a short model:

$$\text{Firm Risk Taking}_{i,t} = \alpha + \beta \text{CEO Birth Order}_{i,t} + \gamma_1 \text{CEO level Controls}_{i,t} + \gamma_2 \text{Firm Controls}_{i,t} + \gamma_3 \text{Year Controls} + \gamma_4 \text{Industry Controls} + \gamma_5 \text{Birth Order}_{i,t} * \text{Age}_{i,t} + \varepsilon_{i,t}$$

Last two columns are results of full model:

$$\text{Firm Risk Taking}_{i,t} = \alpha + \beta \text{CEO Birth Order}_{i,t} + \gamma_1 \text{CEO level Controls}_{i,t} + \gamma_2 \text{Firm Controls}_{i,t} + \gamma_3 \text{Year Controls} + \gamma_4 \text{Industry Controls} + \gamma_5 \text{Birth Order}_{i,t} * \text{Age}_{i,t} + \gamma_5 \text{Birth Order}_{i,t} * \text{Tenure}_{i,t} + \epsilon_{i,t}$$

T-statistics are reported below the coefficients. \*\*\*, \*\*, and \* denote statistical significance at the 1%, 5%, and 10% levels, respectively.

#### 4.4 Propensity Score Matching Results

ATT shown in Table 5 suggests that the average risk-taking (measured by the aggregate risk index) will be 3.733 units more if the first-born CEO was instead a later-born CEO. Repeating the above matching procedure on three different risk proxies (capital expenditures, R&D expenditures and transaction values) yields similar results: first-born CEOs are less likely to take on risks compared to their counterfactuals with similar number of siblings, age, size of firms that they manage, leverage, performance of the firms and CEO tenure.

Table 5. Propensity Score Matching on family size, age, firm size, tenure and education

	Risk	R&D Expenditure	Capital Expenditure	Acquisition Transactions
Treated (First Born CEOs)	-0.656** (-2.86)	-0.351 (-1.31)	-1.005*** (-4.14)	-0.455 (-1.60)
Control (Later Born CEOs)	3.077*** (15.04)	2.438*** (10.15)	2.081*** (9.59)	1.165*** (4.87)
N	474	380	471	179

Table 5 shows the result of matching CEO to another CEO with similar family size, age, size of firms that they manage, leverage and performance of the firms as well as their tenure. The results suggest average aggregate risk index for first born CEOs (the treated) is -0.656 while average risk-taking index for later born CEOs (the control) is 3.077, showing a significant difference between these two groups. Average treatment effect on the treated is obtained using equation (2):  $\tau \text{ATT} = E(\tau | D = 1) = E[Y(1) | D = 1] - E[Y(0) | D = 1]$ , suggesting a significant 3.733 difference on risk taking measure between the two groups. Repeating the above matching procedure on different risk proxies yields similar results as shown in last three columns. T-statistics are reported below the coefficients in parentheses. \*\*\*, \*\*, and \* denote statistical significance at the 1%, 5%, and 10% levels, respectively.

#### 4.4 Robustness Tests Results

In Table 6, we could see a consistent positive significant relationship between birth order and risk measure with similar coefficient magnitude among alternative dependent variables: risk, capital expenditure and R&D expenditure. Acquisition transaction as an alternative dependent variable fails to provide a significant result due to a tiny sample of acquisition observations with merely 179 reported acquisition values.

Table 6. Robustness Tests

Variable	Risk	R&D	Capex	Acquisition
Number of Siblings	0.018 (0.20)	-0.026 (-0.30)	0.128 (1.18)	0.187 (0.83)
Birth Order	3.413*** (3.81)	3.496** (3.31)	4.058*** (3.70)	0.238 (0.08)
Age	0.053** (2.71)	0.076** (3.06)	0.0966*** (4.02)	0.011 (0.16)
Political Connections	0.210* (1.97)	0.765*** (6.37)	0.204 (1.11)	-0.421 (-1.23)
Firm Size	0.945*** (30.74)	0.887*** (25.97)	0.943*** (25.10)	0.612*** (7.00)
ROA	-0.939*** (-6.16)	-0.829*** (-5.13)	-0.634*** (-3.41)	-0.523 (-0.61)
Tobin's Q	0.088 (1.48)	0.095 (1.61)	-0.00549 (-0.07)	0.161 (1.05)
Financial Leverage	-0.106 (-0.64)	-0.0683 (-0.39)	0.126 (0.62)	-0.010 (-0.01)
Birth Order*Age	-0.058*** (-3.57)	-0.0708*** (-3.56)	-0.0709*** (-3.57)	0.001 (0.02)
CEO Tenure	0.087*** (3.78)	0.114*** (3.71)	0.0381 (1.35)	-0.012 (-0.34)
Birth*Tenure	-0.037** (-2.95)	-0.0524** (-2.69)	-0.0268 (-1.73)	0.024 (0.05)
_cons	-3.398*** (-4.00)	-6.319*** (-4.42)	-5.697*** (-5.48)	-2.578 (-0.84)
N	472	378	471	179
Year Controls	Y	Y	Y	Y
Industry Controls	Y	Y	Y	Y

Table 6 shows the results of the robustness check. The main estimation (equation 1) is repeated on different dependent variables by using risk index, capital expenditure, R&D expenditure and acquisition transaction as alternative proxies of risk-taking. For comparison, the baseline result is included in the first column of this table.

A first look at summary statistics in Table 7 indicates that later-born CEOs have a higher mean risk-taking index. A t-test performed in Table 7 confirms that the null hypothesis that the two subsamples have no difference is rejected. Moreover, there is sufficient evidence that the later-born group has a higher mean risk measure than the first-born group.

Table 7. Subsample Robustness Tests

<i>First-born CEOs</i>						
Variable	Obs	Mean	Std.	Min	Max	
Birth order	397	1	0	1	1	
Age	397	48.10	7.17	33	62	
Family size	397	0.42	0.77	0	3	
Firm size	380	4.99	1.85	-3.35	8.91	
Risk	376	2.42	1.97	-3.51	6.59	
<i>Later-born CEOs</i>						
Variable	Obs	Mean	Std.	Min	Max	
Birth order	106	2.91	1.28	2	6	
Age	106	52.03	5.25	41	72	
Family size	106	2.33	1.34	0	5	
Firm size	104	5.41	2.26	-2.03	10.17	
Risk	103	3.04	2.18	-1.63	7.78	

This table presents summary statistics of the two subsamples: one with all first-born CEOs and the other with all later-born CEOs. The mean, standard deviation, minimum and maximum values of selected variables are presented.

#### *T-test on subsamples*

Group	Obs.	Mean of Aggregate Risk Index	Std. Error	Std. Dev	95% Confidence Interval	
Non first Born	103	3.047	0.215	2.185	2.620	3.474
First Born	376	2.420	0.101	1.971	2.220	2.620
Combined	479	2.555	0.092	2.033	2.372	2.737
diff		0.626	0.224		0.185	1.067

The table performs a t-test on two subsamples with first-born CEOs and later-born CEOs. It shows sufficient evidence suggests that the later-born group has a higher mean risk measure than the first-born group.

## 5. Conclusion

This paper supports the view that managers imprint their personalities on the firms they manage, the strategies they adopt and the decisions they make. More specifically, with a novel dataset, this study finds that birth order is significantly associated with riskier behaviour. The results also expand the general family science findings into the corporate world.

One insight of this study is on the CEO selection process. Firms could adjust their hiring process accordingly if later-born managers exert more aggressive and risk-seeking behaviours. Suppose firm owners seek revolutionary change in their firms; they would be better off appointing a later-born CEO to implement relatively risky strategies. On the other hand, if an owner is looking for some conservative “goalkeeper,” a first-born CEO is more likely to nail this job. A potential development to make in the future is to relate this paper to moral hazard and the principal-agent problem. If agents take on too much risk, shareholders might have more concerns about the likelihood of the principal-agent problem. In a heterogeneous agent model, the contribution of this study would be to answer whether the appointment of a first-born conservative CEO could mitigate the principal-agent problem. This paper's main challenge is establishing an inference of birth order on manager behaviours. The matching story between firms and CEOs would be the main obstacle to the identification strategy.

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## Authors contributions

The author's contributions to the paper include initiating the hypothesis and original idea, developing the empirical model and finishing the manuscript. The author has read and agreed to the published version of the manuscript.



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**References**

- Aabo, T., & Eriksen, N. B. (2018). Corporate risk and the humpback of CEO narcissism. *Review of Behavioral Finance*, 10(3), 252-273. <https://doi.org/10.1108/RBF-07-2017-0070>
- Bamber, L. S., Jiang, J., & Wang, I. Y. (2010). What's my style? The influence of top managers on voluntary corporate financial disclosure. *The Accounting Review*, 85(4), 1131-1162. <https://doi.org/10.2308/accr.2010.85.4.1131>
- Barros, L., & Di Miceli da Silveira, A. (2007). Overconfidence, managerial optimism and the determinants of capital structure. *Brazilian Journal of Finance*, 6(3), 293-334. <https://doi.org/10.12660/rbfin.v6n3.2008.1343>
- Bertrand, M., & Schoar, A. (2003). Managing with Style: The Effect of Managers on Firm Policies. *The Quarterly Journal of Economics*, 118(4), 1169-1208. <https://doi.org/10.1162/00335530322552775>
- Brown, R., & Sarma, N. (2007). CEO overconfidence, CEO dominance and corporate acquisitions. *Journal of Economics and Business*, 59(5), 358-379. <https://doi.org/10.1016/j.jeconbus.2007.04.002>
- Buss, D. (2007). *Evolutionary psychology: The new science of the mind* (3rd ed.). New York, NY: Psychology Press.
- Byrnes, J. P., Miller, D. C., & Schafer, W. D. (1999). Gender differences in risk taking: a meta-analysis. *Psychological Bulletin*, 125(3), 367. <https://doi.org/10.1037/0033-2909.125.3.367>
- Campbell, R. J., Jeong, S. H., & Graffin, S. D. (2019). Born to take risk? The effect of CEO birth order on strategic risk taking. *Academy of Management Journal*, 62(4), 1278-1306. <https://doi.org/10.5465/amj.2017.0790>
- Chatterjee, A., & Hambrick, D. C. (2007). It's All about Me: Narcissistic Chief Executive Officers and Their Effects on Company Strategy and Performance. *Administrative Science Quarterly*, 52(3), 351-386. <https://doi.org/10.2189/asqu.52.3.351>
- Chatterjee, A., & Hambrick, D. C. (2011). Executive personality, capability cues, and risk taking: How narcissistic CEOs react to their successes and stumbles. *Administrative Science Quarterly*, 56, 202-237.

- <https://doi.org/10.1177/0001839211427534>
- Grable, J. E., & Joo, S. H. (2004). Environmental and biophysical factors associated with financial risk tolerance. *Journal of Financial Counseling and Planning*, *15*, 73-82.
- Hambrick, D. C. (2007). Upper Echelons Theory: An Update. *The Academy of Management Review*, *32*(2), 334-343. <https://doi.org/10.5465/amr.2007.24345254>
- Hambrick, D. C., & Mason, P. A. (1984). Upper Echelons: The Organization as a Reflection of Its Top Managers. *The Academy of Management Review*, *9*(2), 193-206. <https://doi.org/10.2307/258434>
- Hertwig, R., Davis, J. N., & Sulloway, F. J. (2002). Parental investment: How an equity motive can produce inequality. *Psychological Bulletin*, *128*(5), 728-745. <https://doi.org/10.1037/0033-2909.128.5.728>
- Li, S., Selover, D. D., & Stein, M. (2011). "Keep silent and make money": Institutional patterns of earnings management in China. *Journal of Asian Economics*, *22*(5), 369-382. <https://doi.org/10.1016/j.asieco.2011.06.003>
- Mat Ludin, K. R., Mohamed, Z. M., & Mohd-Saleh, N. (2017). The association between CEO characteristics, internal audit quality and risk-management implementation in the public sector. *Risk Management*, *19*(4), 281-300. <https://doi.org/10.1057/s41283-017-0022-z>
- McClelland, P. L., Barker, V. L., & Oh, W. Y. (2012). CEO career horizon and tenure: Future performance implications under different contingencies. *Journal of Business Research*, *65*(9), 1387-1393. <https://doi.org/10.1016/j.jbusres.2011.09.003>
- Miller, D., & Toulouse, J. M. (1985). Strategy, structure, CEO personality and performance in small firms. *American Journal of Small Business*, *10*(3), 47-62. <https://doi.org/10.1177/104225878501000305>
- Plomin, R., & Daniels, D. (1987). Why are children in the same family so different from one another. *Behavioral and Brain Sciences*, *10*, 1-16. <https://doi.org/10.1017/S0140525X00055941>
- Rossi, F. (2016). *Corporate Governance, Risk-Taking, and Firm Performance: Evidence from Italy*. Retrieved from SSRN: <https://ssrn.com/abstract=2726303>
- Sanders, W. M. G., & Hambrick, D. C. (2007). Swinging for the fences: The effects of CEO stock options on company risk taking and performance. *Academy of Management Journal*, *50*, 1055-1078. <https://doi.org/10.5465/amj.2007.27156438>
- Serfling, M. A. (2014). CEO age and the riskiness of corporate policies. *Journal of Corporate Finance*, *25*(C), 251-273. <https://doi.org/10.1016/j.jcorpfin.2013.12.013>
- Shefrin, H. (2001). Behavioral corporate finance. *Journal of Applied Corporate Finance*, *14*(3), 113-126. <https://doi.org/10.1111/j.1745-6622.2001.tb00443.x>
- Smith, C. W., & Ross, L. W. (1992). The Investment Opportunity Set and Corporate Financing, Dividend and Compensation Policies. *Journal of Financial Economics*, *XXXII*, 263-292. [https://doi.org/10.1016/0304-405X\(92\)90029-W](https://doi.org/10.1016/0304-405X(92)90029-W)
- Sulloway, F. J. (1995). Birth order and evolutionary psychology: A meta-analytic overview. *Psychological Inquiry*, *6*, 75-80. Retrieved from [https://psycnet.apa.org/doi/10.1207/s15327965pli0601\\_15](https://psycnet.apa.org/doi/10.1207/s15327965pli0601_15)
- Sulloway, F. J. (1996). *Born to rebel: Birth order, family dynamics, and creative lives*. New York, NY: Pantheon Books.
- Sulloway, F. J., & Zweigenhaft, R. L. (2010). Birth order and risk taking in athletics: A meta-analysis and study of major league baseball. *Personality and Social Psychology Review*, *14*, 402-416. <https://doi.org/10.1177/1088868310361241>
- Titman, S., & Roberto, W. (1988). The Determinants of Capital Structure. *Journal of Finance*, *XLIII*, 1-19. <https://doi.org/10.2307/2328319>
- Walls, M. R., & Dyer, J. S. (1996). Risk Propensity and Firm Performance: A Study of the Petroleum Exploration Industry. *Management Science*, *42*(7), 1004-1021. <https://doi.org/10.1287/mnsc.42.7.1004>
- Wang, X. T., Kruger, D. J., & Wilke, A. (2009). Life history variables and risk-taking propensity. *Evolution and Human Behavior*, *30*, 77-84. <https://doi.org/10.1016/j.evolhumbehav.2008.09.006>
- Xu, E. M., & Xiao, J. Q. (2014). *Government subsidy and institutional entrepreneur's risk taking*. Paper presented at the International Conference on Management Science & Engineering. <https://doi.org/10.1109/ICMSE.2014.6930407>

# The Chance of FinTech to be a New General-Purpose Technology

Johannes Treu<sup>1</sup>

<sup>1</sup> IU International University, Berlin, Germany

Correspondence: Johannes Treu, IU International University, Berlin, Germany. E-mail: johannes.treu@iu.org

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## Abstract

FinTech has often been spoken about in highly promising terms, deemed to have a profound and potentially revolutionary effect. This has led to speculation and intrigue about whether this innovative form of technology might have the capability to influence an entire economy significantly. More than that, some even contend that it carries the potential to alter societies dramatically through its direct impact on both existing economic frameworks and social structures. Thus, a vital question has risen to the forefront: could FinTech indeed be seen as a general-purpose technology? Following the initial inquiry, a second question emerges, delving deeper into the overall impact of FinTech. The focus is on understanding how it influences things at an aggregate level and as a potential general-purpose technology. How does it affect aggregate economic welfare? The paper conducts an in-depth analysis using two distinctly different definitions and characteristics of general-purpose technologies. By leveraging these definitions, the document provides valuable insights into how FinTech aligns with the attributes of a general-purpose technology, effectively showcasing that it can indeed be typified as such. Despite the growing body of research on FinTech, no study thus far has examined the implications or influence it has on welfare. At an aggregate level, the research findings indicate that FinTech influences supply curves positively. In turn, this results in a noticeable uptick in both consumer and producer surplus, bolstering overall welfare. The examination thus reveals how FinTech is indeed a reckoning force in modern economics, and potentially a game-changer. Thus, its significance as a general-purpose technology and the value it brings to aggregate economic welfare cannot be underestimated.

**Keywords:** FinTech, Financial Technology, Welfare, General Purpose Technology

## 1. Introduction

The financial sector has undergone significant digital technological advancement due to various factors. These include the rise in the number of internet and smartphone users, the ongoing technological progress, and the loss of trust following the 2008/2009 financial crisis. New financial technologies have emerged in the decade or so since the crisis, addressing issues in traditional banking, insurance, and asset management sectors with innovative solutions. This rapidly growing sector has become known as FinTech and has progressed swiftly ever since its recent emergence (Chemmanur et al., 2020). In the wake of the Corona crisis and related contact restrictions, the development and use of FinTech have accelerated even further in many countries (Fu & Mishra, 2020; Treu, 2022). In the simplest sense, FinTech can be understood as a compound of the words "financial" and "technology" (Hikida & Perry, 2019; Mirchandani, Gupta & Ndiweni, 2020; Chemmanur et al., 2020; Ratecka, 2020). This explanation of its origin reflects the basic agreement across all definitions and views. Despite heterogeneous views, FinTech is granted the opportunity to improve the functioning of the financial system and generate positive macroeconomic effects (Frost, 2020; Feyen et al., 2021; Treu et al. 2021; Treu, 2022). The view is predominantly due to technological change resulting from advances in telecommunications, information technology, and financial practices. Consequently, these technological advances have led to financial innovations that have transformed many financial products, services, production processes, and organizational structures (Frame, Wall & White, 2018; Park, Kesuma & Cho, 2021). At the same time, macroeconomic positive effects occur as there is an endogenous and mutually reinforcing relationship between financial development and economic growth (King & Levine, 1993; Park, Kesuma & Cho, 2021).

If FinTech is attributed to such promising effects, then the question emerges whether this new form is a unique type of technology that impacts the whole economy. In the same breath, it must be reflected to what extent the potential exists to change societies through effects on existing economic and social structures. Consequently, the question arises whether FinTech can be characterized as a general-purpose technology (GPT). This is followed

by the second question: What is the impact of FinTech at the aggregate level and as a potential GPT on overall economic welfare? This point is seen as positive by various authors solely against the background of efficiency improvements (including Philippon, 2017; Vives, 2017; OECD 2020; Cho, 2020; Lehmann-Uchner & Menkhoff, 2020; Park, Kesuma & Cho, 2021). Macroeconomic considerations of the extent to which digital technologies or innovations in financial services change welfare in an aggregate model and how this may affect macroeconomic variables have not yet been explored, according to BIS (2019). Consequently, the focus of the paper will be on this point.

The structure of the paper is as follows. Following the introduction, Chapter 2 describes the methodological approach. This is followed by a description and definition of GPT and Fintech in Chapter 3. Chapter 4 examines whether FinTech is a GPT. Building on the findings from the chapters before, Chapter 5 deals with an analytical framework to shed light on the possible welfare effects of FinTech. A summary in chapter 6 concludes the remarks.

## 2. Method

The methodological approach adopted is a post-positivist framework, combined with argumentative-deductive analysis. The basic assumption in this context is to have a set of interconnected assumptions about the world that provides a conceptual framework for systematic inquiry (Williamson et al., 2002; Saunders, Lewis & Thornhill, 2009). This means that reality or facts are subject to the broadest possible critical examination by soliciting different perspectives and interpretations. At the same time, this framework has the advantage of having similarities with the interpretive framework. Thus, it is assumed that certain facts are interpreted or constructed by humans and therefore differ from the world of nature. This allows one to examine under what conditions various states of affairs arise in a social setting (Williamson et al., 2002; Saunders, Lewis & Thornhill, 2009).

In the deductive analysis procedure, an attempt is made to build on a realistic representation of facts. Three research methods can be distinguished (Wilde & Hess, 2006): (i) formal-deductive, (ii) conceptual-deductive, and (iii) argumentative-deductive analysis. According to deductive logic, conclusions follow inevitably from one or more arguments (premises), and conclusions are drawn from the general to the particular. A deductive approach is structured so that the conclusion is implicit in the arguments (premises). If the arguments (premises) are true or valid, then the conclusion drawn must also be valid (Turvey, 2012). Consequently, argumentative-deductive analysis is defined as a top-down process and as the ability to draw general conclusions about problems or issues based on multiple, even competing, opinions through logical reasoning (Saunders, Lewis & Thornhill, 2009; Keating, Demidenko & Kelly, 2019). Figure 1 below summarizes the research design.

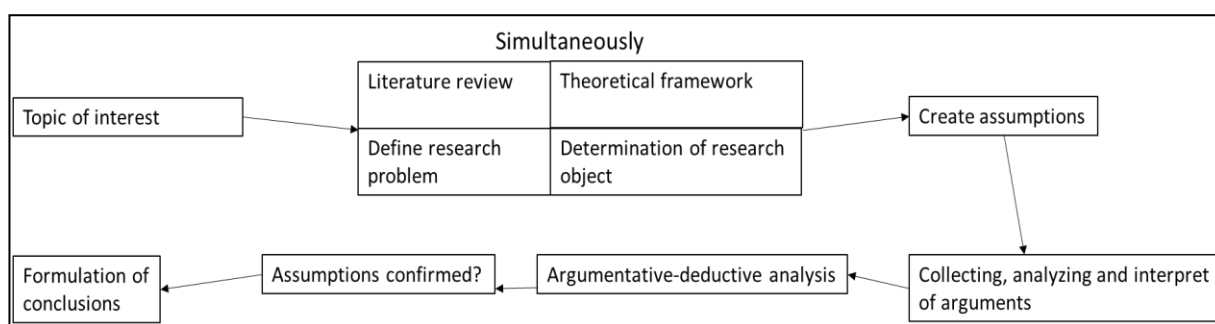


Figure 1. Research design

Source: in accordance with Williamson et al. (2002)

For this working paper, this means that the "topic of special interest" is defined in the title of the paper and described in the introduction. Numerous electronic literature databases such as GBV, EconBiz, IDEAS/RePEc search, and EconPapers are used for literature selection. These databases are beneficial due to the high percentage of open-access papers and journals they contain. For paid journal articles, they give access to their preprints or pre-publication versions. Moreover, even for paid articles, these databases provide an abstract or summary along with a library link for access. The process of searching these databases involves a keyword search. The definition of the theoretical framework, the research problem, and the object of study go hand in hand with the previously mentioned step. The theoretical framework and the research object at the same time are the GPT theory and the occurrence of FinTech. The research problem is to verify whether FinTech can be characterized as a possible GPT and what welfare effects result from it. Key assumptions are derived from GPT theory and possible FinTech effects. Arguments for confirmation or rejection are collected, analyzed, and

interpreted with the help of the literature to conclude argumentatively deductively from the general (GPT theory) to the particular (FinTech). At the same time, it is checked whether the assumptions are confirmed or not and conclusions are drawn.

### 3. Results and Discussion

#### 3.1 General Purpose Technologies and FinTech

General progress and growth occur in different ways in an economy. A first and simple theoretical view is that technological progress shifts the aggregate production function "upward" so that output is increased without increasing the input of production factors (Teubner, 2021). Technology is modeled as a scalar, which is either an argument or a multiplicative constant to an aggregate production function. The contribution of technology to overall growth is then typically viewed as the residual output after accounting for the contributions of measurable aggregate inputs (Bekar, Carlaw & Lipsey, 2018). However, technologies occur very heterogeneously and not always uniformly. Also, potential use cases, as well as economic impacts, vary and the term itself is not clearly defined (Bekar, Carlaw & Lipsey, 2018; Heikkilä & Wikström, 2021; Teubner, 2021). In retrospective terms, there is a general understanding in the economic doctrine that long waves of economic development, so-called Kondratyev cycles, are caused by fundamental technological innovations. These, called basic innovations by Schumpeter (1939), are technical innovations that gain widespread acceptance, lead to an upheaval of production as well as organization, and consequently result in efficiency gains that occur on average every 40 to 60 years (Ademer et al., 2017). Depending on the perspective and delimitation, four to five completed cycles can be identified. The first cycle was driven by the steam engine, the second cycle by railroads & steel, the third cycle by electricity & chemicals, the fourth cycle by automobiles & petrochemicals, and the fifth cycle by information technology & digital networks (Ademer et al., 2017; Heikkilä & Wikström, 2021; Teubner, 2021). The listed cycles show that a specific group of technologies is an important catalyst for industrial revolutions and drivers of economic development. These technologies can be referred to as general-purpose technologies (GPT).

The concept of GPTs was first introduced by Bresnahan & Trajtenberg (1992), building on an economic history paper by David (1990). Both authors wanted to examine the so-called "black box" technology in more detail and establish a link between technological change and aggregate growth. The original motivation for the idea of GPTs came from the history of economic growth and from the observation of economic historians who pointed to the central role of certain technologies in growth (Bresnahan, 2010). All recognized that a close link existed between eras of long-term economic growth and the innovative application of certain technologies.

According to Bresnahan and Trajtenberg (1992), GPTs in their original definition are technologies characterized by their diffusion, inherent potential for technological improvement, and innovative complementarities. The authors also emphasize the positive impact on productivity growth and economic growth, as GPTs have the potential to impact an entire economy in a variety of application areas (Bashir & Sadowski, 2014). Thus, three original features of GPTs can be characterized, which have been consolidated in the literature (e.g., Jovanovic & Rousseau, 2005; Cantner & Vannuccini, 2012; Bashir & Sadowski, 2014; Laino, 2019, Heikkilä & Wikström, 2021):

1. Ubiquity: GPT should cover many sectors.
2. Improvement: GPT should continue to improve over time, thus reducing costs for its users more and more.
3. Promotion of innovation: GPT should facilitate the invention and production of new products or processes.

These three characteristics are grounded on the assumption that a GPT is a dominant technology that has existed for a long period and is widely accepted. For these reasons, it has a pervasive, ameliorative, and innovation-enhancing effect on the economy (Cantner & Vannuccini, 2012). The advantage of this assumption and its characteristics is that GPTs can be mapped to commodities, markets, and industries in various ways. For example, GPTs can be disembodied knowledge, such as a factory system or mass production. Similarly, GPTs may be embodied in a good or service that is purchased or used by application sectors, such as data processing or a computer. At the same time, the basic GPT structure can be mapped to downstream markets, industries, or organizational structures (Bresnahan, 2010).

Since GPT was first introduced, its views, definitions, and characteristics have continued to evolve. Rosenberg & Trajtenberg (2004) understand GPT as a technology characterized by its general applicability, i.e., the fact that it performs a generic function that is essential for the functioning of a vast variety of products or production

systems. GPTs continue to have high technological momentum, so the efficiency with which the generic function is performed has increased over time. This benefits existing users. Likewise, other sectors are incentivized to adopt the improved technology. In conclusion, GPTs exhibit innovative complementarities with application sectors, in the sense that technological advances make it more profitable for its users to innovate and improve their technologies. Lipsey, Carlaw & Bekar (2005) define GPT as a single generic technology that is recognizable as such throughout its lifetime, initially contains much room for improvement, and eventually becomes widely adopted by having many applications and many spillover effects. The most extensive development is found in Bekar, Carlaw & Lipsey (2018), who first identify six GPT criteria and then propose a narrow definition and a broad definition:

1. Base technology that creates new use cases instead of providing a complete solution.
2. Increasing the productivity of research and development as a result of GPT
3. Creating and sustaining productivity gains for companies
4. Promoting downstream inventions and innovations that would not be possible without the technology
5. Possession of multiple or single generic uses
6. Absence of close substitutes

**Definition GPT-a:** A GPT is a single technology or closely related group of technologies that have many uses in parts of the economy, is technologically dynamic in the sense that it is evolving in terms of its efficiency and range of uses, and is used in many downstream sectors where that use triggers a cascade of further invention and innovation.

**Definition GPT-b:** A GPT is a single technology or a closely related group of technologies that are widely used in most sectors of the economy, is technologically dynamic in the sense that it is evolving in its efficiency and range of uses, and as an input to many downstream sectors where these uses trigger a cascade of further inventions and innovations.

The GPT concept, with its various definitions and characteristics, has been widely used after its introduction to identify technologies that can be characterized as GPT. For example, Heikkilä & Wikström (2021) list a variety of works that include the steam engine, railroads, electricity, information, and communication technology (including computers and the Internet), and artificial intelligence among GPTs. Field (2008) also presents a literature review on various technologies that are seen as GPT by different authors. However, an attempt is made here to answer the question of whether there are not already too many GPTs, since according to Field (2008) the GPT concept, in the hands of theorists, has developed a life of its own. Critically, it is seen that especially theoretically oriented economists have adopted the GPT concept because it has a good level of abstraction. This allows (too)many interesting conclusions, about temporal patterns of productivity improvement related to technological change (Field, 2008). As a result of his explanations, Field (2008) concludes that there are only three GPTs: Steam, Electric Power, and Information and Communication Technology. The most comprehensive examination of which technologies count as GPTs in the course of human evolution can be found in Lipsey, Carlaw & Bekar (2005), who propose a total of 24 technologies as GPTs. The enumeration is so detailed, balanced, and broad that it has found its way into the English Wikipedia page on the keyword GPT.

For the later application the original definition with its three characteristics, thus also the further developed definition GPT-a with its six characteristics is to be considered. This allows a broad focus when investigating whether FinTech can be classified as GPT. In addition, the aim is to counteract a one-sided fixation on just one view of the GPT concept, as this is not free of criticism either (cf. Field 2008).

Despite the term FinTech being first introduced almost 30 years ago, its interpretation still varies. (Schindler, 2017; Elsinger et al., 2018; Rupeika-Apoga & Thalassinou, 2020; Allen, Gu, & Jagtiani, 2020). Hence, different terms for the same activity or form are used by market participants and regulators, or the same term is used for different activities and forms. In the simplest sense, FinTech can be understood as a compound of the words "financial" and "technology" (Hikida & Perry, 2019; Mirchandani, Gupta & Ndiweni, 2020; Chemmanur et al., 2020; Ratecka, 2020). This approach represents the minimum consensus of all definitions and perspectives. For a comprehensive review of various definitions and perspectives, see Treu (2022). Defining the term FinTech poses a significant challenge due to the variety of existing applications and perspectives, along with the fact that this phenomenon is currently undergoing a highly active development phase (Rupeika-Apoga & Thalassinou, 2020). Dorfleitner, Hornuf & Wannemacher (2020) also state the latter by pointing out a dynamically growing market environment for FinTech. According to Treu (2022), the different views can be summarized into three groups:

1. Technology-oriented FinTech view
2. Function-oriented FinTech view
3. Technology-oriented and functionally-oriented FinTech perspective

The first group includes, for example, the ECB (2020), which sees FinTech as a complete financial technology and a term for any type of technological innovation that can be used to change, support, or deliver financial services in a variety of applications. Beck (2020) can also be classified in the first group by understanding FinTech as a new technology that competes with traditional financial institutions in the provision of financial services.

In the second group, Mirchandani, Gupta & Ndiweni (2020), for example, can be classified with their definition saying that FinTech can be divided into different areas - (i) asset management, (ii) cryptocurrency, (iii) crowdfunding, (iv) investment management, (v) marketplace lending. The same is true for Arner, Barberis & Buckley (2015), who define FinTech from the five areas - (1) finance and investment, (2) operations and risk management, (3) payments and infrastructure, (4) data security and monetization, and (5) customer interface.

The majority of definitions and views fall into the last group. For example, the OECD (2018) understands FinTech not only as the application of new digital technologies to financial services but also as the development of business models and products that rely on these technologies. The related areas are (i) payments, (ii) lending and funding, (iii) trading and investment, (iv) insurance, (v) cybersecurity, (vi) operations, and (vii) communication. As another example, Chemmanur et al. (2020) can be cited with their definition of FinTech as the newest technology in the financial sector, with eight possible applications at the same time (i) payments and money transfer, (ii) digital banking, (iii) digital wealth management, (iv) capital markets innovations, (v) Fintech lending, (vi) crowdfunding, (vii) InsureTech, (viii) PropTech.

To have the widest possible scope in answering the question of whether FinTech exhibits characteristics of a GPT, FinTech will be understood here in its third view. In this context, both the technological infrastructure and the application are included in the analysis, thus broadening the perspective.

### *3.2 FinTech as a Possible General-Purpose Technology*

Based on the definitions and characteristics of a GPT presented above, we will now examine the extent to which FinTech can count as a GPT and which characteristics apply. As is common in the literature, an aggregated approach is also chosen. The methodological approach is inspired by several economic history studies that attempt to classify various technologies as GPT (e.g., Bresnahan & Trajtenberg, 1992; Jovanovic & Rousseau, 2005; Lipsey, Carlaw & Bekar, 2005; Bresnahan, 2010; Ristuccia & Solomou, 2014; Bashir & Sadowski, 2014; Bekar, Carlaw & Lipsey, 2018). Starting with the original definition and characteristics according to Bresnahan & Trajtenberg (1992).

1. Ubiquity: GPT should span many sectors.

The technology-oriented and function-oriented view of FinTech shows that, depending on the definition, different numbers of sectors of the financial system are counted as FinTech (see chapter before). Figure 3 shows how extensively FinTech is used in different sectors, supplemented by selected example companies. Figure 4 also shows a variety of FinTech areas in finance and global distribution. The ubiquity of FinTech can also be extended to sectors such as insurance, real estate, and wealth management, so-called InsurTech, PropTech, and WealthTech (Treu et al. 2021). But also the so-called BigTech companies from e-commerce (Google, Amazon, Facebook, and Apple) use their network effects, economies of scale and scope, customer base, and customer data as well as market power to offer their cryptocurrencies, payment services, or other financial services with the help of financial technologies (Feyen et al. 2021; Treu et al. 2021). In doing so, they pursue the goal of strengthening their competitive position. FinTech is also showing an increasing adoption rate in various areas worldwide. This allows the conclusion of a high degree of diffusion (Figure 5).



Figure 2. FinTech in different sectors

Source: VentureScanner (2021)

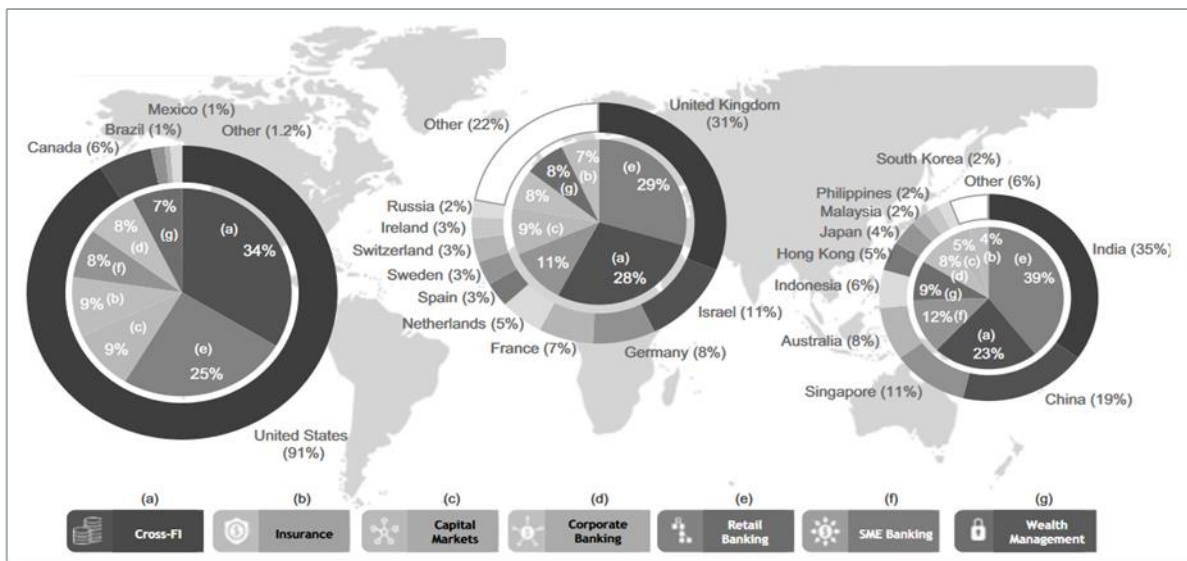


Figure 3. FinTech areas in finance and global distribution

Source: Gupta & Tham (2018)



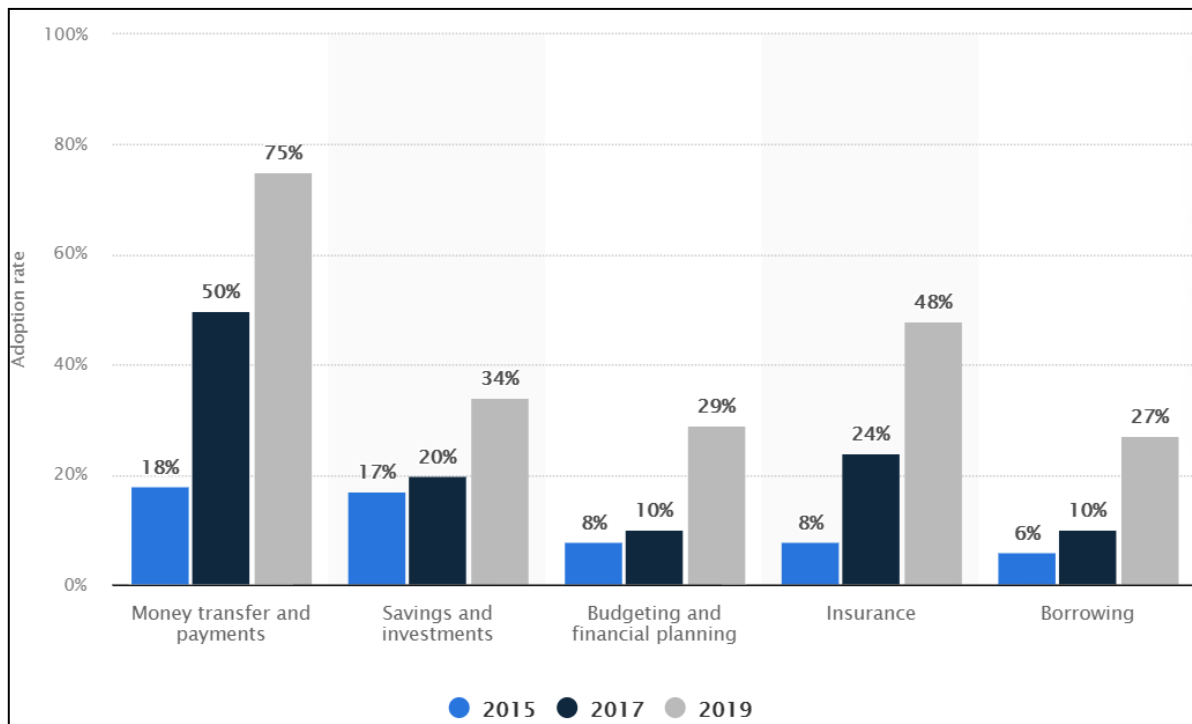


Figure 4. FinTech adoption rates global

Source: Statista (2019)

## 2. Improvement: GPT should continue to improve over time, further reducing costs for its users.

FinTech offers the chance to evade market irregularities as well as information asymmetries, agency conflicts, and costs between lenders and borrowers (Amstad, 2019; Beck, 2020; Frost, 2020; Feyen et al., 2021). A classic phenomenon of imperfect information in competitive credit markets is credit rationing. Accordingly, there is a group of borrowers who receive credit while others go empty. Credit rationing thus represents a market inefficiency and comes at a cost to the economy as a whole. FinTech can improve access to credit for excluded groups, especially those who lack collateral and credit history. Based on Big Data analytics and consumer data, FinTech can be used to collect and use the information to improve risk assessment and reduce the need for collateral as an indicator of creditworthiness in lending (Mhlanga, 2020; Feyen et al., 2021). This leads to greater comfort for users and better credit risk scores coupled with lower individual credit costs as well as a reduction in macroeconomic costs (Claessens et al., 2018; Beck 2020). In addition, FinTech promotes greater transparency and thus trust. With sufficient transparency between providers and demanders, intermediation of finance through third parties may itself be redundant, allowing investors and borrowers to negotiate directly with each other and save costs (Claessens et al., 2018; Feyen et al., 2021).

Closely related to the reduction of information asymmetries through FinTech is also the reduction of transaction costs. Thus, transaction costs can be reduced both ex-ante (e.g., initiation, information acquisition, and agreement costs) and ex-post (e.g., settlement, adjustment, and control costs). In addition to transaction costs, FinTech also reduces firm-specific costs such as fixed and marginal costs for creating financial services (Feyen et al., 2020, Beck, 2020; Barajas et al., 2020). These include fixed costs such as the provision of physical infrastructure with branches, front and back offices, and the like. FinTech can also reduce marginal costs through technology-enabled automation and "straight-through processes" that result from the expanded use of data and AI-based processes. For example, Philippon (2019) shows that the use of robo-advisors reduces fixed costs, which improves the financial inclusion of less affluent households, among other benefits. Furthermore, the use of FinTech and digital platforms reduces the costs as well as reduces risks of customer acquisition (Feyen et al., 2021). This cost reduction means that previously excluded customers with small and few transactions are now economically viable, in contrast to transactions via traditional banking channels (Beck, 2020).

Further reducing costs through FinTech, Philippon (2017, 2019) shows that the U.S. financial system has traditionally been inefficient as the mean charge of financial intermediation has consistently been around 2% of transaction values. Despite the advent of computers, e-commerce, and other innovations, financial services have

remained quite expensive in recent decades. (Frost 2020). In this approach, the use and development of FinTech are seen as a catalyst for increased competition and cost savings in financial intermediation.

FinTech also holds the ability to enhance the level of decentralization and diversification in the financial system, which could reduce the effect of future financial shocks and related macroeconomic costs. This is made possible by (Financial Stability Board, 2017; Claessens et al., 2018; Fáykiss et al., 2018), among other things:

- i. In comparison to a scenario where lending is dominated by a few banks, there is more diversification in credit or funding sources.
- ii. Compared to other asset classes, there is a lower correlation level.
- iii. When compared to an environment where credit allocation is restricted due to information asymmetry, credit allocation is improved.
- iv. Pricing is more effective compared to either the state-regulated banking sector or an existing monopoly or oligopoly structure.

In addition to cost savings, another point of the second characteristic is that GPTs improve or evolve over time. To examine this characteristic, a look at the historical development of FinTech is helpful (see Figures 5 and 6).

While the modern term FinTech originated in the 21st century, its inception traces back over a century and a half. Technological advancements aimed at enhancing efficiency in the financial sector took root in the 19th century (Arner, Barberis & Buckley, 2015). The invention and application of the telegraph showcased an early example of such developments. This technology, along with the first transatlantic telegraph cable, linked the financial hubs of New York and London. Furthermore, back in 1870, Western Union, a financial service company, provided customers with money transfer services using telegraphy (Thakor, 2019, Hikida & Perry, 2019). This marked the beginning of FinTech's evolution, which unfolded in three distinct phases, each marked by the advent of new technologies.

The inaugural phase of financial technology, known as FinTech 1.0, transpired from 1866 to 1967, a period marked by the utilization of telegraphy for accelerating financial transactions and the transfer of monetary information (Arner, Barberis & Buckley, 2015; Thakor, 2019). Technological breakthroughs abounded following the cessation of the Second World War, with advancements being made particularly in the field of communication and information technology. Noteworthy progressions during this period encompass the development of the first commercially available decoding tools. These were pioneered on nascent computers by companies, prominent among which was International Business Machines. The first handheld calculator's inception is also considered a landmark event of this phase in FinTech history. Concurrently, the U.S. banking sector witnessed the surge of novel credit card issuers in the 1950s, such as Diners Club in 1950 and American Express in 1958. This consumer-driven revolution was further fueled by the establishment of the Interbank Card Association, currently known as MasterCard, in the United States in 1966 (Arner, Barberis & Buckley, 2015, Ratecka, 2020).

The temporal segment characterized as FinTech 2.0 delineates a transformative process transitioning from the analog to the digital era, encompassing the years 1967-2008 (Arner, Barberis & Buckley, 2015; Thakor, 2019). The initiation of this epoch is marked by the year 1967, collinear with the emerging utilization and invention of the Automated Teller Machine (ATM). Furthermore, this span also witnesses significant technological advancements such as the evolution of the electronic payment system, "Fedwire", initiated in 1970, and the genesis of online banking services accessible for customers in 1980 in the United States and 1983 in the United Kingdom. Other pivotal developments within this period encompassed the escalating usage of Bloomberg terminals from 1984 and the pervasive dominance of the Internet (Arner, Barberis & Buckley, 2015; Ratecka, 2020).

According to Arner, Barberis, & Buckley (2015) and Thakor (2019), the third stage of financial technology advancement, referred to as FinTech 3.0, commenced in 2008 and continues to the contemporary period. The 2008 financial crisis is considered to catalyze this new phase. The enhancements observed during this phase take the basis of the extended possibilities of integrating technology with financial services, encompassing elements such as artificial intelligence and machine learning, extensive databases (Big Data), distributed computation, cryptographic techniques, and mobility of Internet access. This integration has spawned the inception of novel applications within the financial services realm (Arner, Barberis & Buckley, 2015; Ratecka, 2020).

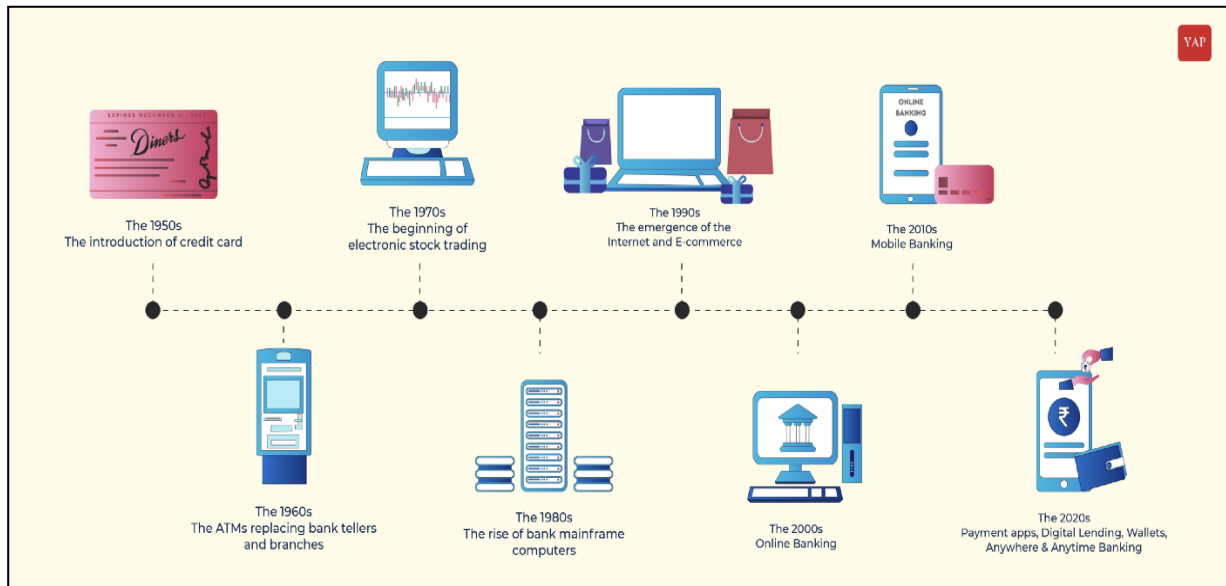


Figure 5. Historical development of FinTech 1950-2020

Source: M2P Fintech (2020)

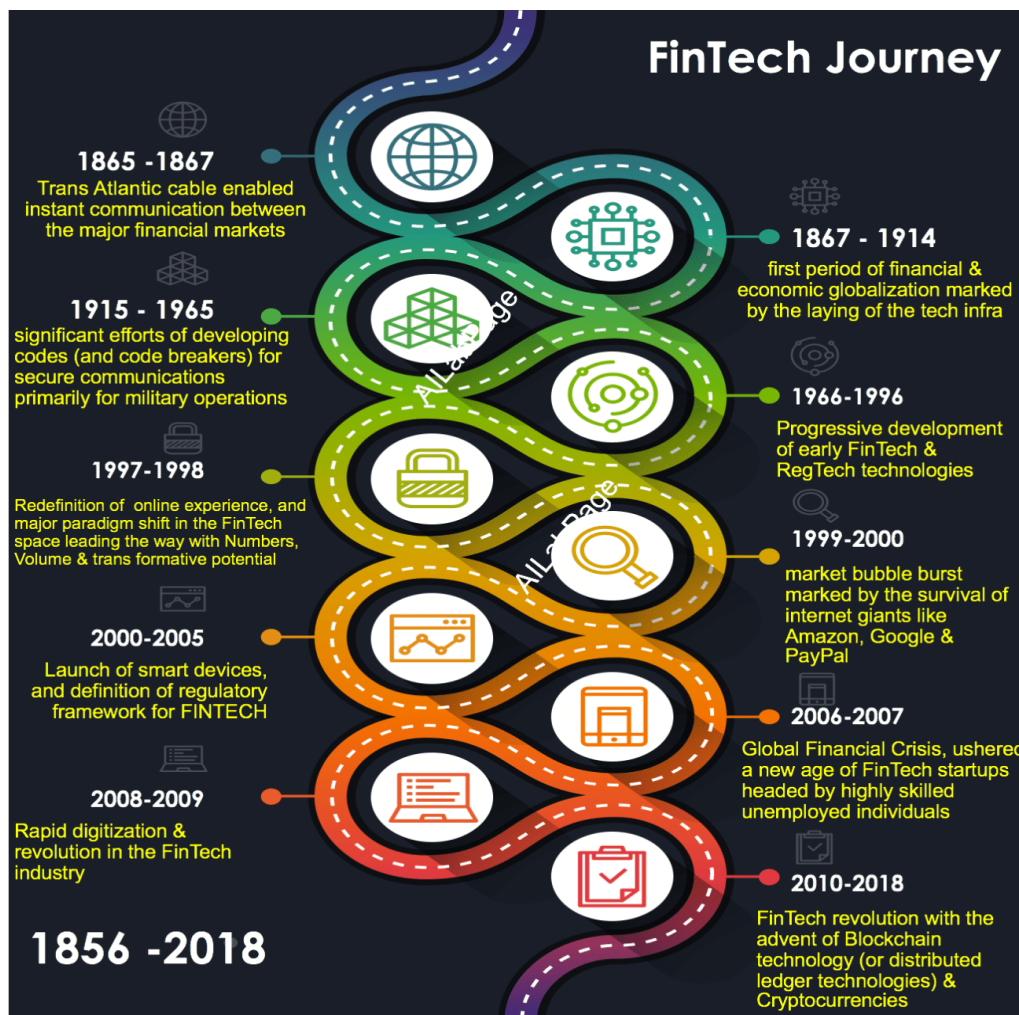


Figure 6. Historical development FinTech 1856-2018

Source: Sharma (2018)

3. Promotion of innovation: GPTs should facilitate the invention and manufacture of new products or processes.

If a GPT is intended to facilitate the invention and manufacture of new products, then a first look at the FinTech definitions presented is helpful. Different authors (e.g., OECD 2018; Chemmanur et al., 2020) show that FinTech includes not only the application of new digital technologies to financial services but also the development of products. Depending on the view, different numbers of items are enumerated. The most comprehensive enumeration is provided in Figure 3, which lists 16 new product developments that would not exist without FinTech.

The most direct link to the invention, as well as the production of new products through FinTech, concerns the use of smartphones with their integrated payment functions, which are available to every user. In conjunction with an (e.g. digital) account, this facilitates or expands the provision of financial services and the possibility of using them as a first step. As a result, the financial services provided by FinTech reach far-flung areas more easily. By doing so, they reduce, for example, the distance to access finance that would otherwise occur due to poor transport networks or long waiting times at bank premises (Ozili, 2018; Demirgüç-Kunt et al., 2018). At the same time, this reduces inefficiencies in cash payments, as well as theft and corruption through the intentional diversion of funds to the informal sector. One widely cited positive example of digital payments is "M-Pesa." This is a system introduced in Kenya in early 2007 for handling basic money transfers and cashless payment functions via cell phones. This service has caught on quickly, more than tripling the proportion of the population with a bank account in Kenya from 26.7% to 82.9% between 2006 (the year before its launch) and 2019 (Beck, 2020).

In addition, FinTech contributes to the development of new products by leading to the individualization of the financial services offered. For example, traditional core banking systems and marketing channels are characterized by being focused on standardized products and not offering a fully consumer-centric approach. Tailored financial services that consider the individual circumstances of a borrower in different countries and regions of the world previously required highly skilled and expensive experts (Feyen et al., 2021). In contrast, FinTech reduces the setup costs for customized financial services by leveraging its technology. The increasing availability of data and computing power makes it possible to better assess risks, and in this way tailor individual financial services to the needs of the consumer (Feyen et al., 2021). In addition, the collected data and the use of digital technologies facilitate the execution and monitoring of complex financial contracts. Furthermore, in this context, the development of cloud computing also benefits from FinTech. On the one hand, data is stored in the cloud, and on the other hand, clouds are used to manage customer relationships, human resources, and financial accounting (Financial Stability Board, 2019; Vučinić, 2020). This delivers different benefits, such as flexibility, economies of scale, and operational and cost-efficiency.

In addition to inventing and manufacturing new products, a GPT is also intended to facilitate processes. At the same time, the GPT concept states that it transforms economic and social structures (Bekar, Carlaw & Lipsey, 2018). In this context, the broad spectrum of FinTech can be used to advance the process of financial inclusion globally (BIS, 2019; Treu, 2022; Treu, 2022a). This means ensuring that economic agents have access to financial products and services that meet their needs and are provided in a responsible as well as sustainable manner (World Bank, 2018). An approximation suggests that a staggering 1.7 billion adult individuals worldwide lack the privilege of accessing a transaction account, thereby disqualifying them from the formal financial system. It is essential to note, as recognized by the G20, that financial inclusion serves as a decisive element in diminishing poverty and fostering economic growth, particularly in emerging and developing economies (World Bank 2020).

Especially in the private sector, there is great potential to facilitate the process of financial inclusion through FinTech. At its simplest, cell phones are used to enable individuals, merchants, and the government to conduct transactions without physical cash. This allows routine cash payments, such as wages to employees, distribution of pensions, and granting of government transfers, to be shifted into this realm. Globally, approximately 230 million unbanked persons work in the private sector and are paid exclusively in cash, with 78 percent of these wage earners owning a cell phone (Demirgüç-Kunt et al., 2018). In this regard, Demirgüç-Kunt et al. (2018) show that the number of these adults worldwide can be reduced by up to 100 million through this FinTech use, thus improving financial inclusion.

Under the premise that the services, products, and applications offered through FinTech are easy to understand and it is a convenient platform to perform basic financial transactions, such as making payments for electricity, water, rent, transferring money to family and friends, etc., the inclusion process can be further promoted and

facilitated. For example, users can help inform and persuade peers in the formal and informal sectors to use services provided through FinTech (Ozili, 2018). The net result is that a positive network effect occurs, promoting financial inclusion. Improved and increased use of FinTech can thus lead to a reduction in the informal economy while improving tax collection enforcement (Venet, 2019).

Further, FinTech is helping to reduce gender gaps in many countries, thus strengthening the process of financial inclusion. (Sahay et al., 2020; Chen et al., 2020). Women in developing countries in particular face multiple barriers to accessing financial services. These may include low literacy and numeracy skills, lack of documentation, different levels of risk aversion, family responsibilities, or societal attitudes. Solutions provided through FinTech seem to be particularly well adapted to the constraints, as they make interfaces consumer-friendly, reduce fears as well as barriers, and do not require physical presence (Sahay et al., 2020). Chen et al. (2020) also show that the gender gap is 50% smaller for new digital financial products that complement traditional financial services than for products that replace them. This suggests that women may be more willing to use fintech products that are coupled with existing financial services.

Considering the arguments listed, one can conclude that FinTech fulfills the characteristics and definition of a GPT according to Bresnahan & Trajtenberg (1992). Consequently, FinTech can be seen as a technology characterized by its diffusion, its inherent potential for technological improvement, and innovative complementarities. Within the framework of an argumentative-deductive analysis, it is possible to confirm the assumption made in chapters 1 and 2.

In the second part, the further developed GPT concept of Bekar, Carlaw & Lipsey (2018) will be used to verify to what extent FinTech fulfills their six criteria. Since some characteristics show similarities with the classic GPT criteria, these will be used for reasons of redundancy avoidance and will not be discussed further in part.

1. Base technology that creates new use cases instead of providing a complete solution.

This feature is very similar to the first feature of Bresnahan & Trajtenberg (1992). As in the previous section, understanding Fintech according to technology-oriented and function-oriented perspectives shows that different numbers of areas of the financial system use FinTech depending on the definition (see also Figures 3 and 4). Looking at the last part of the first characteristic, FinTech cannot be seen as a complete solution to remove all frictions in the financial system. As long as there is no 100 percent trust between the parties, market transactions will always involve risks due to, for example, principal-agent problems and incomplete or asymmetric information. The presence of uncertainty about future outcomes, such as whether or not a borrower will go bankrupt, also introduces further frictions. Since it is impossible to define a contract for all future states of the world and the resulting solvency status of the borrower, markets are not complete in the Arrow-Debreu sense (Feyen et al., 2021). FinTech can thus only be seen as an enabling technology that creates new use cases to partially remove or reduce friction.

2. Increasing the productivity of research and development as a result of GPT.

The emergence of FinTech can be seen as a starting point for increased as well as further research and development. Fong et al. (2021) see seven key technologies driving future development through FinTech over the next ten years. These include (i) blockchain (ii) cloud computing (iii) internet of things, (iv) open-source and software-as-a-service, (v) no-code and low-code application development, (vi) process automation, and (vii) artificial intelligence. The last point, in particular, is seen as an important research focus in conjunction with machine learning. Further development in these areas can help drive financial inclusion, improve risk management, enhance customer experience through chatbots, etc. (Mhlanga, 2020; OECD, 2020). Frame, Wall, and White (2018) go back as far as 30 years in their review, showing that financial technologies have increasingly driven the evolution from human judgment to automated analysis of consumer data, enabling significant advances in artificial intelligence/machine learning. Furthermore, the authors conclude that the recent emergence of FinTech has led to a greatly increased interest in the further development and exploration of new financial innovations. This is due to the ongoing continuity in the development and application of new products, services, production processes, as well as organizational forms. Breidbach, Keating, and Lim (2020) identify 27 topics related to FinTech that are of interest for further theoretical and managerial research. The opportunities for developing a new research agenda with great potential for creating high-quality academic knowledge in FinTech application areas are also seen by Gomber et al. (2018). In their view, important and useful insights can be gathered for practitioners and managers, as well as meaningful observations and ideas for regulators. This input can help monitor new developments in ways that maximize their positive potential to promote economic growth, new jobs for the high-tech workforce, and improved profitability through more customer-centric and value-added services.

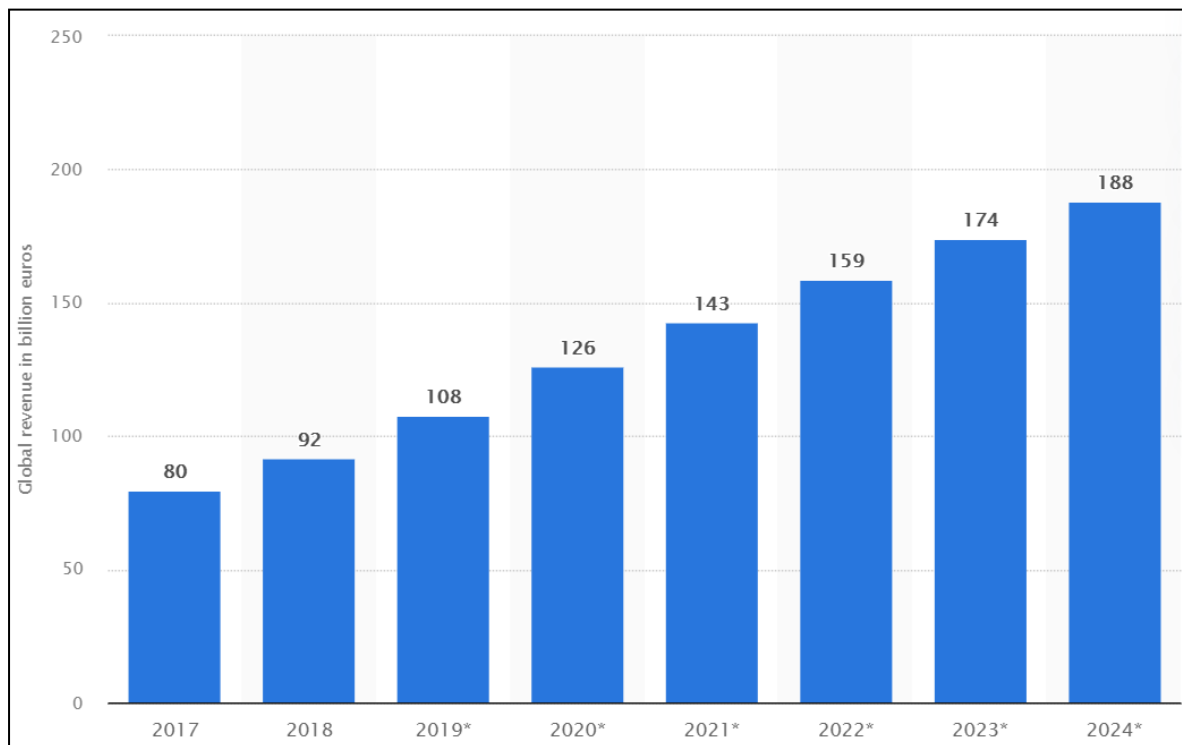


Figure 7. Global revenue of the FinTech sector

Source: Statista (2020)

### 3. Creating and sustaining productivity gains for businesses.

This point is closely related to the second characteristic according to Bresnahan & Trajtenberg (1992). As a result, FinTech provides the potential to mitigate market inefficiencies and information asymmetries, thus reducing the ensuing agency disputes and expenses between creditors and debtors. Further cost savings come from reducing transaction costs as well as firm-specific costs such as fixed and marginal costs of creating financial services. FinTech may also have the potential to improve the degree of decentralization and diversification of the financial system. Also, the reduction of operational and opportunity costs through more efficient business processes and new services such as remittances and small-value payments, which are impossible or too expensive in traditional banking, can enable new profits that would not be possible without FinTech (Venet, 2019). Overall, it can be assumed that all cost savings, compared to traditional providers, enable the creation and maintenance of productivity gains.

Looking at revenue as a measure of profit, it can be shown that it can increase globally from €80 billion in 2017 to a projected €188 billion in 2024 (Figure 8). This reveals a large profit potential for companies active in this sector.

### 4. Promoting downstream invention and innovation that would not be possible without this technology.

The fourth point has many similarities with point two. For example, all downstream inventions and innovations are based on increased research and development activity as a result of a GPT. For FinTech, this means that the seven key technologies according to Fong et al. (2021), for example (i) blockchain (ii) cloud computing (iii) internet of things, (iv) open-source and software-as-a-service, (v) no-code and low-code application development, (vi) process automation, and (vii) artificial intelligence are downstream invention and innovation that would not be possible without this technology. Similarly, Mehrotra and Menon (2021) still list (i) mobile payments & budgeting, (ii) crowdfunding, (iii) roboadvising, and (iv) cryptocurrency. The European Banking Authority (2018) additionally lists that FinTech also leads to downstream changes and innovations in corporate governance and organization. This is because internal processes and procedures must also be able to respond to the new competitive environment. On the technical side, in addition to the downstream inventions and innovations already mentioned, which would not be possible without FinTech, (i) the use of biometrics in financial services and (ii) open banking/API (application programming interfaces) are also mentioned. Overall, there is a great potential that FinTech will lead to further technological innovations.

### 5. Ownership of multiple or single generic uses

FinTech does not possess a single generic use case, but several. This becomes particularly clear when looking at figure three from the previous chapter. Here, 16 possible areas are listed in which FinTech is used. Depending on the perspective and definition, different many uses can be listed (Treu 2022a). For example, eight areas of application can be found in Imerman & Fabozzi (2020), while Sahay et al. (2020) list six. Looking for commonalities among the three sources mentioned, four common uses can be found: (i) payment, (ii) investment, (iii) lending, and (iv) digital banking.

#### 6. Lack of close substitutes

FinTech can act as a complement but also as a substitute for traditional bank lending. In a banking sector that is not too concentrated, has adequate liquidity, and is stable, it's more probable for both bank lending and FinTech lending to coexist and enhance each other. Whereas in a less stable and highly concentrated banking sector, fintech loans may act as a substitute for bank loans (Hodula, 2021). Erel & Liebersohn (2020) show for the U.S. the lack of close substitutes in zip code areas with few bank branches, lower incomes, and a larger proportion of minorities in the population, in that FinTech, is used disproportionately here. At the same time, FinTech use is also greater in countries where the economic impact of the COVID-19 pandemic was more severe. Still, the authors find that FinTech-backed lending only partially subsumes traditional banks' lending to small businesses. A similar conclusion is reached by Cornelli et al. (2020), who also speaks of complementarity rather than substitution. More specifically regarding the lack of close substitutes Cai (2018), shows that crowdfunding platforms take the place of traditional financial intermediaries and act as new intermediaries. Thus, it is not possible to prove whether the characteristic applies to FinTech or not.

Looking at FinTech under the more advanced GPT concept of Bekar, Carlaw & Lipsey (2018), the arguments show that FinTech fulfills five of the six characteristics. Only for characteristic number six can different evidence be found on whether the absence of close substitutes is present in FinTech or not. There is room for further investigation here. However, despite and because of the ambiguity of the arguments regarding point six, it should not be rejected but included in the conclusion so that FinTech can be defined as GPT-a. This means according to Bekar, Carlaw & Lipsey (2018): FinTech refers to one or a closely linked group of technologies that are widely applied in economic sectors. These technologies are characterized by their dynamism and evolution in terms of efficiency and application scope. They are utilized in several downstream sectors, where their application spurs subsequent inventiveness and innovation. In conclusion, for the chapter as a whole, according to both GPT concepts presented, FinTech can be seen as GPT based on an argumentative deductive analysis.

#### 3.3 An Analytical Framework for Determining the Welfare of FinTech

The multiple positive effects of FinTech are said to have welfare-enhancing effects (Vives, 2017; Ozili, 2018; Venet, 2019, Park, Kesuma, & Cho, 2021). In this context, it is assumed that FinTech will lead to efficiency improvements and improve financial intermediation (Philippon, 2017; Cho, 2020). The latter results from reduced costs as well as risk, tailored products, narrowing the credit gap, improving financial inclusion, better price discrimination, etc., among others. (Frame, Wall & White 2018; Cho, 2020; OECD 2020; Park, Kesuma, & Cho, 2021; Treu 2022; Treu, 2022a). However, most of these statements lack an analytical framework to determine the aggregate welfare effects of FinTech. Similarly, BIS (2019) notes that macroeconomic considerations of how digital financial innovation changes welfare in an aggregate model and how this may affect macroeconomic variables have not yet been adequately explored. In this regard, the theoretical possibilities for determining welfare effects due to FinTech are manifold. Naoyuki & Sahoko (2020) propose a model based on household utility maximization and bank profit maximization. According to their conclusion, consumer welfare increases in the course of efficiency improvements through FinTech. Another method of studying welfare effects is based on the concept of consumer and producer surplus. This is used, for example, by Hitt, & Brynjolfsson (1996), Brynjolfsson & Oh (2012), and Thieß (2018) to illustrate the welfare effects of IT, digitalization, and internet services. The advantage of this method is its broad applicability and ease of understanding. For these reasons and because the concept lends itself very well to an aggregate approach, the consumer and producer surplus will be considered. Both points will be integrated into the analytical framework of the AS-AD model. The model is a standard macroeconomic model at the aggregate level. This enables the representation of the effects of demand- and supply-related shocks on goods production and thus on economic growth as well as prices (Grömling, 2005). Furthermore, the use of the model is supported by the fact that, as is common in the literature, an aggregate approach was taken when investigating whether FinTech can be seen as a GTP. Based on the findings from the previous chapter, it is possible to characterize FinTech as a GTP. This statement is central to the further procedure of the welfare investigation. This is because GTPs can be viewed as exogenous pervasive technological shocks that are capable of generating long-term effects on economic growth by altering the productivity potential of economies. At the same time, such shocks can invigorate an economy

that tends to "relax" into a stationary equilibrium. (Cantner & Vannuccini 2012; Ristuccia, & Solomou, 2014; Laino, 2019). Consequently, it can be assumed that FinTech as a GPT represents a positive exogenous supply shock.

Figure 8 shows the AS-AD model in its short-run (Keynesian) view with a rising supply curve and falling demand curve. Let the starting point be a short-run arbitrary equilibrium at point A with  $Y^1$  and  $P^1$ . Considering the two rents, the following triangles are obtained:  $aAP^1$  for the consumer rent and  $bAP^1$  for the producer rent. In the next step, FinTech occurs as an exogenous supply shock and the short-run AS curve shifts to the lower right (Figure 9a). The following effects occur: goods production and thus GDP increases from  $Y^1$  to  $Y^2$  and the price level decreases from  $P^1$  to  $P^2$ . If we consider consumer surplus and producer surplus then new larger triangles result:  $aA^2P^2$  - consumer surplus and  $b^2A^2P^2$  - producer surplus. The occurrence of FinTech thus leads to an increase in overall economic welfare, measured in terms of consumer surplus and producer surplus.

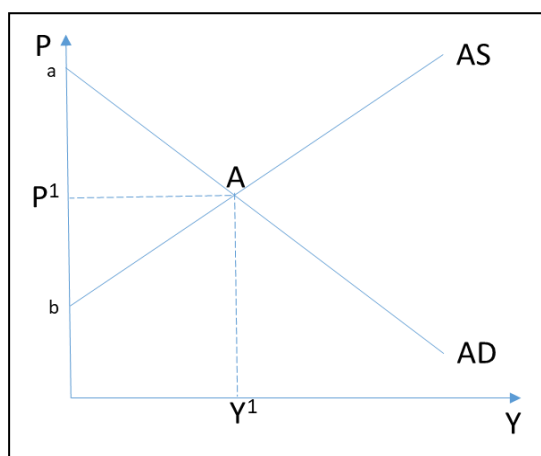


Figure 8. Short-term AS-AD model

Source: own illustration

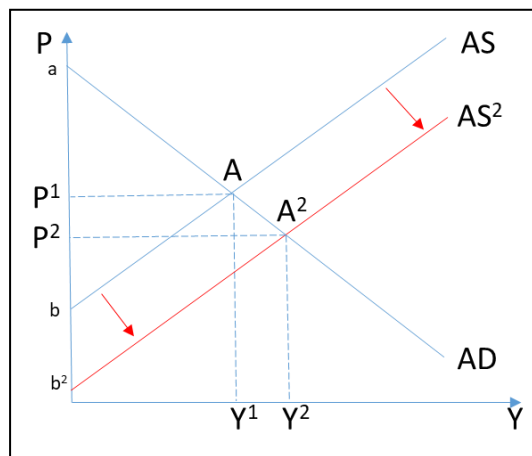


Figure 8a. Appearance of FinTech as a supply shock in the short-term model

Source: own illustration

According to the classical paradigm of economics, the long run AS curve is vertical and only demand shocks cause fluctuations in the economy. However, if one follows the RBC theory, a vertical curve is also assumed, but macroeconomic fluctuations are triggered by supply shocks (e.g. technical progress), which can shift the vertical AS curve (Grönlung, 2005). Figure 9 shows such a case. The starting point is an arbitrary long-run equilibrium between the AD curve and the long-run AS curve at point A. Here, the economy is at the natural production level  $Y^n$ . Consumer surplus and producer surplus here comprise the triangle  $aAP^1$  and the rectangle  $OY^nAP^1$ . According to the conclusion that FinTech is a GPT and thus a positive technological supply shock, the long run AS curve shifts to the right (Figure 9a). A new equilibrium emerges with a higher natural production level  $Y^n$  for the economy and a lower price level. If we consider consumer and producer surplus here, the following areas result:  $aA^2P^2$  and  $OY^nA^2P^2$ . Here, too, FinTech leads to an increase in overall economic welfare, measured in terms of consumer and producer surplus.



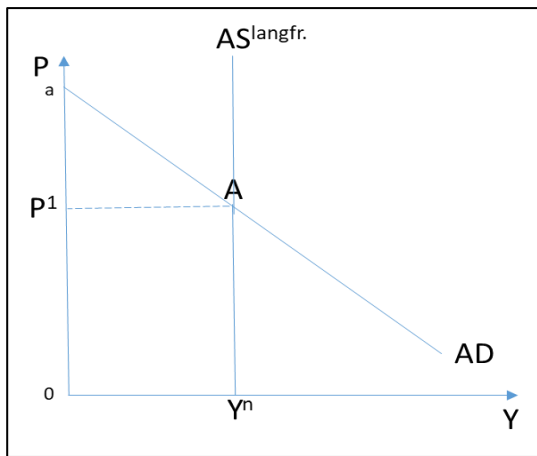


Figure 9. Long-term AS-AD model

Source: own illustration

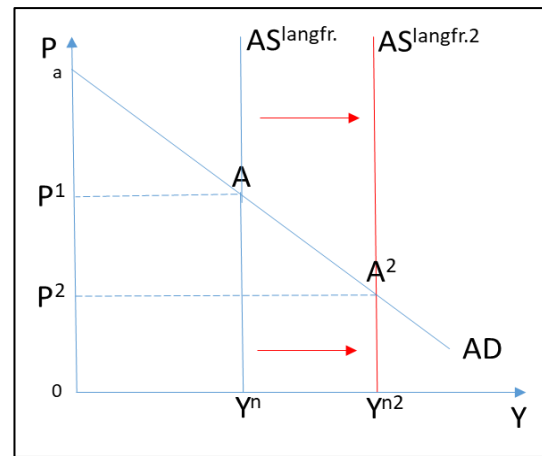


Figure 9a. Appearance of FinTech as a supply shock in the long-term model.

Source: own illustration

#### 4. Conclusion

GPTs are technologies which are characterized by their diffusion, their inherent potential for technological improvements and innovative complementarities. They have a positive impact on productivity growth and economic growth. In addition, GPTs have the potential to impact an entire economy in a variety of other application areas. Using the GPT concept in the classical version with three characteristics, in the extended version with seven characteristics, and after argumentative-deductive analysis, FinTech can be characterized as GPT. FinTech meets the conditions listed in the literature to be considered a GPT: ubiquity, cost reduction, fostering innovation, enabling technology, increasing productivity, creating, and sustaining productivity gains for businesses and possessing a generic use case. Consequently, FinTech can be seen as a technology characterized by its diffusion, inherent potential for technical improvement, and innovative complementarities. In this sense, the GPT-a definition applies that it is FinTech is a single technology or a closely related group of technologies that has many uses in parts of the economy, that is technologically has many uses in parts of the economy, is technologically dynamic in the sense that it is in the sense that it is evolving in terms of its efficiency and range of uses, and that is used in many downstream sectors, where these uses trigger a cascade of further invention and innovation.

At the same time, it is possible to view GPTs as exogenous technological shocks. These can have long-term effects on economic growth by changing the productivity potential of economies. Consequently, the emergence of FinTech in its form as a GPT can also be understood as an exogenous supply shock. This proposition is central to the welfare investigation in the AS-AD model. At the aggregate level, FinTech is shown to shift supply curves and there is a change in consumer and producer surplus. It can be stated that the occurrence of FinTech as an exogenous supply shock results in welfare-enhancing effects since both consumer and producer surplus are higher than before the occurrence of the shock. In addition, the aggregate approach of the model allows for the fact that in the long run FinTech can lead to an increase in natural production potential with a lower price level.

The promising positive effects attributed to the literature can be confirmed in this analytical framework.

Further research could be related to technology management to expand the possibilities of use. This could contribute to financial inclusion and thus promote goals such as sustainability or financial well-being. Future research may also address aspects of regulation and data protection, especially if the spread of use is rapid. As the use of FinTech as a GTP requires a certain level of education, it is also important to investigate to what extent better education improves the level of use and diffusion of FinTech. An investigation whether countries with a high level of financial literacy also have a high use of FinTech combined with positive economic welfare effects would be a possible approach.

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No additional data are available.

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### **References**

- Ademmer, M., Bickenbach, F., Bode, E., Boysen-Hogrefe, J., Fiedler, S., Gern, K. J., ... Krieger-Boden, C., (2017). *Produktivität in Deutschland – Messbarkeit und Entwicklung*. ifw- Institut für Weltwirtschaft, Kieler Beiträge zur Wirtschaftspolitik, Nr. 12.
- Allen, F., Gu, X., & Jagtiani, J. (2020). *A survey of fintech research and policy discussion*. FRB of Philadelphia Working Paper, No. 20-21. <https://doi.org/10.21799/frbp.wp.2020.21>
- Amstad, M. (2019). *Regulating fintech: objectives, principles, and practices*. ADBI Working Paper, No. 1016. <https://doi.org/10.2139/ssrn.3541003>
- Arner, D. W., Barberis, J. N., & Buckley, R. P. (2015). *The evolution of fintech: A new post-crisis paradigm?* University of Hong Kong Faculty of Law Research Paper, No. 2015/047, UNSW Law Research Paper, No. 2016-62. <https://doi.org/10.2139/ssrn.2676553>
- Barajas, A., Beck, T., Belhaj, M., & Naceu, S. B. (2020). *Financial inclusion: What have we learned so far? What do we have to learn?* IMF Working Papers, No. 2020/157. <https://doi.org/10.5089/9781513553009.001>
- Bashir, S., & Sadowski, B. M. (2014). General purpose technologies: A survey, a critique, and future research directions. In *25th European Regional Conference of the International Telecommunications Society (ITS): "Disruptive Innovation in the ICT Industries: Challenges for European Policy and Business"*, Brussels, Belgium, 22nd-25th June, 2014, International Telecommunications Society (ITS), Calgary.
- Beck, T. (2020). *Fintech and financial inclusion: Opportunities and pitfalls*. ADBI Working Paper, 1165. [https://doi.org/10.1016/S0169-7218\(10\)02002-2](https://doi.org/10.1016/S0169-7218(10)02002-2)
- Bekar, C., Carlaw, K., & Lipsey, R. (2018). General purpose technologies in theory, application and controversy: a review. *Journal of Evolutionary Economics*, 28(5), 1005-1033. <https://doi.org/10.1007/s00191-017-0546-0>
- BIS (2019). *Welfare implications of digital financial innovation*. Based on remarks by Mr. Luiz Awazu Pereira da

- Silva, Deputy General Manager of the BIS, with Jon Frost and Leonardo Gambacorta at the Santander International Banking Conference on "Banking on trust: Building confidence in the future". Madrid, 5 November 2019. BIS speech 20 November 2019.
- Breidbach, C., Keating, B., & Lim, C. (2020). Fintech: research directions to explore the digital transformation of financial service systems. *Journal of Service Theory and Practice*, 30(1), 79-102. <https://doi.org/10.1108/JSTP-08-2018-0185>
- Bresnahan, T. (2010). General Purpose Technologies. In Hall, B. H. & Rosenberg, N. (Ed.), *Handbook of the Economics of Innovation*. Volume 2 (pp. 761-791). North-Holland.
- Bresnahan, T. F., & Trajtenberg, M. (1992). *General purpose technologies: "Engines of growth?"* NBER Working Paper, No. 4148. <https://doi.org/10.3386/w4148>
- Brynjolfsson, E., & Oh, J. H. (2012). The attention economy: measuring the value of free digital services on the internet. In *Proceedings of the 33rd International Conference on Information Systems* (pp. 1-9). Orlando.
- Cai, C. W. (2018). Disruption of financial intermediation by FinTech: a review on crowdfunding and blockchain. *Accounting and Finance*, 58(4), 965-992. <https://doi.org/10.1111/acfi.12405>
- Cantner, U., & Vannuccini, S. (2012). *A new view of general purpose technologies*. Jena Economic Research Papers, No. 2012,054. <https://doi.org/10.1515/9783110504927-007>
- Chemmanur, T. J., Imerman, M. B., Rajaiya, H., & Yu, Q. (2020). Recent developments in the FinTech industry. *Journal of Financial Management, Markets and Institutions*, 8(1), 2040002-1–2040002-31. <https://doi.org/10.1142/S2282717X20400022>
- Chen, S., Doerr, S., Frost, J., Gambarcota, L., & Shin, H. S. (2021). *The fintech gender gap*. BIS Working Papers, No. 931.
- Cho, M. (2020). *FinTech megatrends: An assessment of their industrial and welfare implications*. KDI School of Pub Policy & Management Paper, No. DP21-03. <https://doi.org/10.2139/ssrn.3914569>
- Claessens, S., Frost, J., Turner, G., & Zhu, F. (2018). *Fintech-Kreditmärkte weltweit: Größe, Einflussfaktoren und Regulierungsfragen*. BIS Quarterly Review, September 2018. <https://doi.org/10.1596/978-1-4648-1259-0>
- Cornelli, G., Frost, J., Gambacorta, L., Rau, R., Wardrop, R., & Ziegler, T. (2020). *Fintech and big tech credit: a new database*. BIS Working Paper, No. 887.
- David, P. A. (1990). The Dynamo and the Computer: An Historical Perspective on the Modern Productivity Paradox. *American Economic Review*, 80(2), 355-361.
- Demirgüç-Kunt, A., Klapper, L., Singer, D., Sanjaya, A., & Hess, J. (2018). *The Global Findex Database 2017: Measuring Financial Inclusion and the Fintech Revolution. Overview booklet*. Washington, DC, World Bank.
- Dorfleitner, G., Hornuf, L., & Wannemacher, L. (2020). Der deutsche FinTech-Markt im Jahr 2020. *ifo Schnelldienst* 8/2020, 73(8), 33-40.
- Elsinger, H. et al. (2018). *Digitalization in financial services and household finance: fintech, financial literacy and financial stability*. Oesterreichische Nationalbank Financial Stability Report 35 – June 2018, 50-58.
- Erel, I., & Liebersohn, J. (2020). *Does fintech substitute for banks? Evidence from the paycheck pProtection program*. NBER Working Paper, No. 27659. <https://doi.org/10.3386/w27659>
- European Banking Authority (2018). *Report on the impact of Fintech on incumbent credit institutions business models*.
- European Central Bank (2020). *ESCB/European banking supervision response to the European Commission's public consultation on a new digital finance strategy for Europe/FinTech action plan*. August 2020.
- Fáykiss, P., Papp, D., Sajtos, P., & Törös, A. (2018). Regulatory Tools to Encourage FinTech Innovations: The Innovation Hub and Regulatory Sandbox. International Practice. *Financial and Economic Review*, 17(2), 43-67. <http://doi.org/10.25201/FER.17.2.4367>
- Feyen, E., Frost, J., Gambacorta, L., Natarajan, H., & Saal, M. (2021). *Fintech and the digital transformation of financial services: implications for market structure and public policy*. BIS Working Papers, No. 117.
- Field, A. J. (2008). *Does economic history need GPTs?* SSRN Paper, September 28, 2008.

- <https://doi.org/10.2139/ssrn.1275023>
- Financial Stability Board (2017). *Financial stability implications from fintech supervisory and regulatory issues that merit authorities attention*. 27. June 2017.
- Financial Stability Board (2019). *FinTech and market structure in financial services: Market developments and potential financial stability implications*. 14. February 2019.
- Fong, D., Han, F., Liu, L., Qu, J., & Shek, A. (2021). *Seven technologies shaping the future of fintech*. Retrieved March 9, 2022, from [https://www.mckinsey.com/cn/our-insights/our-insights/seven-technologies-shaping-the-future-of-fin tech](https://www.mckinsey.com/cn/our-insights/our-insights/seven-technologies-shaping-the-future-of-fin-tech)
- Frame, W. S., Wall, L., & White, L. J. (2018). *Technological change and financial innovation in banking: Some implications for fintech*. Federal Reserve Bank of Atlanta Working Paper, 2018-11. <https://doi.org/10.1093/oxfordhb/9780198824633.013.10>
- Frost, J. (2020). *The economic forces driving fintech adoption across countries*. BIS Working Papers, No. 838. <https://doi.org/10.2139/ssrn.3515326>
- Fu, J., & Mishra, M. (2020). *Fintech in the time of COVID-19: Trust and technological adoption during crises*. Swiss Finance Institute Research Paper Series, No. 20-38.
- Gomber, P., Kauffman, R. J., Parker, C., & Weber, B. W. (2018). On the Fintech Revolution: Interpreting the Forces of Innovation, Disruption, and Transformation in Financial Services. *Journal of Management Information Systems*, 35(1), 220-265. <https://doi.org/10.1080/07421222.2018.1440766>
- Grömling, M. (2005). *Fiskalpolitik kontrovers: Konjunkturpolitische Optionen für Deutschland*. Köln, Dt. Inst.-Verlag.
- Gupta, P., & Tham, M. (2018). *Fintech*. Berlin, Boston, De Gruyter. <https://doi.org/10.1515/9781547400904>
- Heikkilä J., & Wikström, J. (2021). Standardized general purpose technologies: A note. SSRN Paper, June 10, 2021. <https://doi.org/10.2139/ssrn.3863978>
- Hikida, R., & Perry, J. (2019). FinTech Trends in the United States: Implications for Household Finance. *Public Policy Review*, 16(4), 1-32.
- Hitt, L. M., & Brynjolfsson, E. (1996). Productivity, Business Profitability, and Consumer Surplus: Three Different Measures of Information Technology Value. *MIS Quarterly*, 20(2), 121-142. <https://doi.org/10.2307/249475>
- Hodula, M. (2021). Does Fintech credit substitute for traditional credit? Evidence from 78 countries. *Finance Research Letters*, 46(B). <https://doi.org/10.1016/j.frl.2021.102469>
- Imerman, M. B., & Fabozzi, F. J. (2020). Cashing in on innovation: a taxonomy of FinTech. *Journal of Asset Management*, 21(3), 167-177. <https://doi.org/10.1057/s41260-020-00163-4>
- Jovanovic, B., & Rousseau, P. (2005). *General purpose technologies*. NBER Working Paper, No 11093. <https://doi.org/10.3386/w11093>
- Keating, D. P., Demidenko, M. I., & Kelly, D. (2019). *Cognitive and Neurocognitive Development in Adolescence. Reference Module in Neuroscience and Biobehavioral Psychology*. Elsevier. <https://doi.org/10.1016/B978-0-12-809324-5.23636-5>
- King, R. G., & Levine R. (1993). Finance and Growth: Schumpeter Might be Right. *Quarterly Journal of Economics*, 108(3), 713-37. <https://doi.org/10.2307/2118406>
- Laino, A. (2019). General Purpose Technologies: Characteristics And Impact On Economic Growth. *International Journal of Academic Research in Business and Social Sciences*, 9(2), 734-748. <http://dx.doi.org/10.6007/IJARBS/v9-i2/5611>
- Lehmann-Uchner, K. & Menkhoff, L. (2020). Mobile Money treibt finanzielle Entwicklung Afrikas voran. *DIW Wochenbericht - Deutsches Institut für Wirtschaftsforschung (DIW)*, 87(2), 375-381. [https://doi.org/10.18723/diw\\_wb:2020-22-1](https://doi.org/10.18723/diw_wb:2020-22-1)
- Lipsey, R., Carlaw, K. I., & Bekar, C. (2005). *Economic Transformations: General Purpose Technologies and Long-term Economic Growth*. Oxford, Oxford University Press, 2005.
- M2P Fintech (2020). *Fintech 101 — Discover the 3W's of Fintech*. Retrieved April 6, 2022, from <https://medium.com/m2p-yap-fintech/fintech-101-discover-the-3ws-of-fintech-406385362a99>

- Mehrotra, A., & Menon, S. (2021). Second round of fintech - trends and challenges. In *Conference: 2021 2nd International Conference on Computation, Automation and Knowledge Management (ICCAKM)*. <https://doi.org/10.1109/ICCAKM50778.2021.9357759>
- Mhlanga, D. (2020). Industry 4.0 in Finance: The Impact of Artificial Intelligence (AI) on Digital Financial Inclusion. *International Journal of Financial Studies*, 8(3), S. 1-14. <https://doi.org/10.3390/ijfs8030045>
- Mirchandani, A., Gupta, N., & Ndiweni, E. (2020). Understanding the Fintech Wave: A Search for a Theoretical Explanation. *International Journal of Economics and Financial Issues*, 10(5), 331-343. <https://doi.org/10.32479/ijefi.10296>
- Naoyuki, Y., & Sahoko, K. (2020). The Macroeconomic Effects of Fintech. *Public Policy Review, Policy Research Institute, Ministry of Finance Japan*, 16(4), 1-19.
- OECD (2018). *Financial markets, insurance and private pensions: Digitalisation and finance*.
- OECD (2020). *Digital disruption in banking and its impact on competition*. Retrieved March 7, 2022, from: <http://www.oecd.org/daf/competition/digital-disruption-in-financial-markets.html>
- Ozili, P. (2018). *Impact of digital finance on financial inclusion and stability*. MPRA Paper No. 84771. <https://doi.org/10.1016/j.bir.2017.12.003>
- Park, S., Kesuma, P. E., & Cho, M. (2021). Did Financial Consumers Benefit from the Digital Transformation? An Empirical Investigation. *International Journal of Financial Studies*, 9(4), 1-18. <https://doi.org/10.3390/ijfs9040057>
- Philippon, T. (2017). *The fintech opportunity*. BIS Working Papers, No. 655. <https://doi.org/10.3386/w22476>
- Philippon, T. (2019). *On fintech and financial inclusion*. NBER Working Paper, No. 26330. <https://doi.org/10.3386/w26330>
- Ratecka, P. (2020). FinTech – definition, taxonomy and historical approach. *Zeszyty Naukowe Małopolskiej Wyższej Szkoły Ekonomicznej w Tarnowie / The Malopolska School of Economics in Tarnow Research Papers Collection*, 45(1), 53-67.
- Ristuccia, C. A., & Solomou, S. (2014). Can general purpose technology theory explain economic growth? Electrical power as a case study. *European Review of Economic History*, 18(3), 227-247. <https://doi.org/10.1093/ereh/heu008>
- Rosenberg, N., & Trajtenberg, M. (2004). A General-Purpose Technology at Work: The Corliss Steam Engine in the Late-Nineteenth-Century United States. *The Journal of Economic History*, 64(1), 61-99. <https://doi.org/10.1017/S0022050704002608>
- Rupeika-Apoga, R., & Thalassinou, E. (2020). Ideas for a Regulatory Definition of FinTech. *International Journal of Economics & Business Administration (IJEBA)*, VIII(2), 136-154. <https://doi.org/10.35808/ijebe/448>
- Sahay, R., Allmen, U. E., Lahreche, A., Khera, P., Ogawa, S., Bazarbash, M., ... Beaton, K.. (2020). *The promise of fintech: Financial inclusion in the post COVID-19 era*. Departmental Paper, No. 20/09. Washington, DC: International Monetary Fund. <https://doi.org/10.5089/9781513512242.087>
- Saunders, M., Lewis, P., & Thornhill, A. (2009). *Understanding research philosophies and approaches. Research Methods for Business Students*. 8th edition, Pearson Education.
- Schindler, J. (2017). *FinTech and financial innovation: Drivers and depth*. Board of Governors of the Federal Reserve System (U.S.) Finance and Economics Discussion Series, 2017-081. <https://doi.org/10.17016/FEDS.2017.081>
- Schumpeter, J. A. (1939). *Business Cycles. A Theoretical, Historical and Statistical Analysis of the Capitalist Process*. New York, Toronto, London, McGraw-Hill Book.
- Sharma, V. (2018). *The ultimate intuitive guide to fintech intelligence*. Retrieved April 6, 2022, from <https://vinodsblog.com/2018/10/22/the-ultimate-intuitive-guide-to-fintech-intelligence/>
- Statista (2019). *Consumer fintech adoption rates globally from 2015 to 2019, by category*. Retrieved March 6, 2022, from <https://www.statista.com/statistics/1055356/fintech-adoption-rates-globally-selected-countries-by-category/>
- Statista (2020). *Fintech financial technology sector revenue worldwide in 2017 and 2018, with a forecast until 2024*. Retrieved March 8, 2023, from <https://www.statista.com/statistics/1214244/global-fintech-revenue/>

- Teubner, A. (2021). Informationstechnologie, Produktivität und Wirtschaftswachstum. *WiSt - Wirtschaftswissenschaftliches Studium*, 50(5), 29-37. <https://doi.org/10.15358/0340-1650-2021-5>
- Thakor, A. V. (2019). Fintech and banking: What do we know?. *Journal of Financial Intermediation*, 41(C), 100833-100858. <https://doi.org/10.1016/j.jfi.2019.100833>
- Thieß, P. (2018). Auswirkungen der Digitalisierung auf Preisbildung und Wohlfahrt. *Wirtschaftsdienst*, 98(5), 340-346. <https://doi.org/10.1007/s10273-018-2296-5>
- Treu, J. (2022). The Fintech Sensation – What is it about? *Journal of International Business and Management*, 5(1), 1-19. <https://doi.org/10.37227/JIBM-2021-11-2094>
- Treu, J. (2022a). Economic aspects of financial inclusion through FinTech. In Mali, J. et al. (Ed.), *The Breakthrough of the Social* (pp. 243-261). Berlin: Springer. [https://doi.org/10.1142/9789811238819\\_0013](https://doi.org/10.1142/9789811238819_0013)
- Treu, J. et al. (2021). The rising of Fintech – How the tech revolution in financial services represents a paradigm shift. *Journal of International Business and Management*, 4(5), S. 1-8. <https://doi.org/10.37227/JIBM-2021-03-718>
- Turvey, B. E. (2012). *Criminal Profiling An Introduction to Behavioral Evidence Analysis: The Imperatives of Scientific Methodology and a Behavioral Science Education*. 4th edition, Academic Press.
- Venet, B. (2019). *Fintech and financial inclusion. A research agenda for financial inclusion and microfinance*. HAL Id: hal-02294648. <https://doi.org/10.4337/9781788114226.00024>
- VentureScanner (2021). *Venture scanner sector maps*. Retrieved March 6, 2022, from <https://www.venturescanner.com/2021/08/06/q3-2021-venture-scanner-sector-maps/>
- Vučinić, M. (2020). Fintech and Financial Stability Potential Influence of FinTech on Financial Stability, Risks and Benefits. *Journal of Central Banking Theory and Practice*, 9(2), 43-66. <https://doi.org/10.2478/jcbtp-2020-0013>
- Wikipedia contributors (2022). *General-purpose technology*. Retrieved March 8, 2022, from [https://en.wikipedia.org/w/index.php?title=General-purpose\\_technology&oldid=1072856054](https://en.wikipedia.org/w/index.php?title=General-purpose_technology&oldid=1072856054)
- Wilde, T., & Hess, T. (2006). *Methodenspektrum der Wirtschaftsinformatik: Überblick und Portfoliobildung*. (No. 2/2006). Arbeitsbericht, Institut für Wirtschaftsinformatik und Neue Medien, Fakultät für Betriebswirtschaft, Ludwig-Maximilians-Universität.
- Williamson, K. et al. (2002). *Research Methods for Students, Academics and Professionals*. 2nd edition, Chandos Publishing. <https://doi.org/10.1533/9781780634203>
- World Bank (2020). *How regulators respond to fintech: Evaluating the different approaches – sandboxes and beyond*. Fintech Note; No. 4, World Bank, Washington, DC.
- Xavier, V. (2017). The Impact of Fintech on Banking. *European Economy – Banks, Regulation, and the Real Sector*, 3(2), 97-106.

# Banking Transparency, Financial Information and Liquidity Risk Management: Case of Saudi Banks

Adel Bogari<sup>1</sup>

<sup>1</sup>Associate Professor, College of Business Administration, Al-Baha University, KSA

Correspondence: Adel Bogari, Associate Professor, College of Business Administration, Al-Baha University, KSA.

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## Abstract

The article aims to assess the impact of banking transparency on liquidity risk. To do so, we first test the determinants of Liquidity Coverage Ratio (LCR) as well as ensure the resilience of the Saudi banking system over the period from 2014 to 2021. Using System GMM with bank-specific and macroeconomic variables, results show that capital adequacy ratio, SIZE, GDP growth as well as past LCR levels significantly influence the LCR. Secondly, we adopt the Panel Vector Auto Regression (PVAR) approach to assess the response of the LCR to various shocks. Impulse Response Functions (IRF) and variance decomposition demonstrate that the shocks to past LCR, AQ, CAR and GDP increase future liquidity risk. Thirdly, we prove that Saudi banks implement less than 50% of the transparency dimensions. They mainly disclose financial information and information on information credibility. Barely 18% of information on non-financial components of banking activity is made available to the public. Information on liquidity risk and on the timeliness of information is not available either in annual reports or on the bank's website. On average, the banks in the sample do not give importance to the publication of reports. These results may undermine the effectiveness of the guidelines of the Basel Committee agreements to reduce risk-taking by Saudi banks.

**Keywords:** banking transparency, financial information, liquidity risk, stress tests, Saudi banks, GMM, PVAR

## 1. Introduction

The subprime crisis has encouraged researchers to focus on the subject of liquidity risk, since it was one of the main factors of the noted financial contagion and credit crunch. Most researchers pointed out that liquidity risk management in the banking sector reinforces financial stability, and an adequate management should have an accurate system of identification to control and monitor liquidity risks (El Chaarani, 2019). Basel III underscored the importance of maintaining an adequate level of liquid assets and encouraged banks to increase their liquidity level in order to fulfil their commitments and limit risks arising during crises in order to limit losses. Banks must be cautious when managing liquidity risk, as they cannot risk having liquidity problems, which will harm their reputation. Banks often rely on assets and liabilities management to deal with liquidity position and prevent liquidity runoff (Ahamed, 2021). Furthermore, the Basel III accord introduced several regulatory reforms aiming to monitor liquidity risk and reinforce stability and soundness of banks. Indeed, the Basel III accord underlined the need to develop a more robust and sound stress tests unlike Basel II. The reason is that, stress tests have become efficient tools for analysing financial stability, especially from the view of central banks where stress testing became a prudential measure to analyse risk exposure in banks (Jiang *et al.* 2018). Stress tests are a tool used to manage risks in the banking sector in order to examine the possible impact of extreme but plausible shocks on banks. This final stage of the Basel III framework, which is referred to as "Basel IV" by the industry, was published by the BCBS in December 2017. Basel IV comprises measures that aim at enhancing the robustness and risk sensitivity of the standardised approaches (SA) for credit risk and operational risk. In addition, it constrains the use of internal ratings-based (IRB) approaches to credit risk, removes the use of internal modelling approaches to operational risks from the calculation of regulatory capital requirements and overhauls standards with respect to credit valuation adjustment (CVA). These reforms are expected to facilitate the comparability of banks' capital ratios.

According to Flannery *et al.* (2017), reporting stress test results offers crucial information about the tested institutions. Indeed, disclosing stress test results boosts financial stability by restoring trust and reducing bank

opacity as these test help investors to identify resilient and vulnerable banks. Following the financial scandals that rocked the world, particularly the financial sector, the Basel Committee adopted more restrictive transparency standards. Indeed, the Basel 2 accords have been applied in several developed countries since early 2006, while most emerging countries have yet to follow. Indeed, since its creation in 1974, one of the Basel Committee's main objectives has been to increase the resilience of the global banking system. To achieve these objectives, the committee has sought to improve bank transparency, through the three pillars that make up the Basel Accords. In addition, the Basel Committee published a report in October 2010 in which it stressed that the 2007-08 international financial crisis had highlighted the inadequacy and inconsistency of the financial information provided by many banks on their risk exposure and regulatory capital. To address these reporting deficiencies, and following a careful assessment of best practices, the Committee decided in July 2009 to review Pillar 3 requirements for securitization exposure and support for off-balance sheet structures, among others. In addition, there is insufficient information on the components of equity, making it difficult to accurately assess their quality or to make relevant comparisons between banks. Furthermore, there is often no reconciliation with the published accounts. To improve transparency and market discipline, the Committee requires banks to disclose all the components of regulatory capital. Banks are required to ensure that the main features of capital instruments are easy to understand and consult. This crisis has revealed considerable shortcomings in the application of the basic principles of liquidity risk management. It has also highlighted the shortcomings and inadequacies of the Basel II framework and the shortcomings of financial institutions in monitoring liquidity risk. As a result, the Basel Committee for Banking Supervision has introduced international standards and prudential rules for managing and measuring liquidity risk as convened in the Basel III agreements, to enable banks to improve their liquidity and solvency.

In this study, we try to answer the following questions: What are the main determinants of liquidity risk in Saudi banks? Specifically, we try to answer the following two sub-questions: 1- To what extent are these determinants influential? 2- What is the impact of the main micro and macroeconomic shocks on bank liquidity risk? It is also a question of knowing the impact of banking transparency and the disclosure of financial information on liquidity risk. Our contribution consists of (1) adopting the Panel Vector Auto Regression (PVAR) approach to assess response of Liquidity Coverage Ratio (*LCR*) to adverse shocks; (2) Construction of the multidimensional index of banking transparency and measurement for the case of Saudi bank and (3) Test of the impact of banking transparency and the disclosure of financial information on the liquidity risk of banks.

The rest of the paper is structured as follows. Section 2 reviews the relevant literature. Data analysis and methodology are presented in Section 3. Section 4 reports and discusses the empirical results. Finally, Section 5 concludes the paper.

## 2. The Relevant Literature

### 2.1 Liquidity Risk Factors

Several studies have examined the main bank specific and macroeconomic factors that affect liquidity risk. Anindyajati & Hanggraeni (2022) studied 33 commercial banks in Indonesia during the 2018-2021 period in order to examine the determinants of *LCR* before and during the covid-19 crisis. They found that the factors that affected *LCR* before the pandemic are the Capital Adequacy Ratio (*CAR*), Non-Performing Loans (*NPL*) and Return on Assets (*ROA*). Kasana *et al.* (2022) studied the determinants of liquidity risk in the Indian banking system during the 2008-2020 period using two different liquidity measures. They found that the liquid assets to total assets ratio has a significant relationship with the Size, Net interest Margin (*NIM*) and Gross Domestic Product (*GDP*), while the loans to total assets ratio has a significant relationship with *NIM* and interest rate. Hussain *et al.* (2022) focused on liquidity risk in Islamic banks using the Loan to Deposit (*LTD*) ratio and found that non-performing loans, bank size, leverage ratio and return on assets are key unsystematic determinants of the liquidity risk of Islamic banks. Ahamed (2021) examined 23 commercial banks in Bangladesh during the 2005-2018 period and found that Bank size, *GDP* and domestic credit positively impacted liquidity while inflation negatively impacted it. El-Chaarani (2019) studied 183 Middle Eastern banks during the 2014-2016 period using two different liquidity measures and found that economic growth, assets quality, capital level and size all had a significant impact on liquidity. Khanal (2019) examined 10 Nepalese commercial banks during the 2007-2017 period using the *LTD* ratio. The author found that *ROE*, *SIZE* and inflation impact liquidity significantly and negatively while *ROA* impacts liquidity significantly and positively. Shah *et al.* (2018) used two liquidity measures to study liquidity risk in 23 Pakistani banks during the 2007-2016 period. They found that unemployment and *GDP* have a significant effect on liquidity while deposits have a significant negative impact on liquidity. Ghenimi *et al.* (2021) examined liquidity risk in 25 Islamic banks in the MENA region during the 2006-2014 period. They found that *NPL*, bank size, liquidity gap, capital adequacy and *GDP* all have a



significant impact on liquidity and that Islamic banks are more sensitive to bank-specific factors, because of prohibition of Riba. Taleblo *et al.* (2022) used macro stress tests to assess liquidity in the Iranian banking system. They found that exchange rate shocks and stock market price index have the greatest impact on banks' liquidity risk. Ekananda (2022) studied the response of the stock price index, inflation, consumer price index, and GDP in Southeast Asia countries to disturbances from global variables such as world liquidity. The author found that the shock on the world GDP and world liquidity affected inflation and GDP in the selected SEA countries. Patra & Padhi (2022) found that the impact of stress tests is substantial for public banks unlike for private and foreign banks. Khammasi *et al.* (2020) examined a sample of conventional and Islamic banks operating in the MENA region in order to assess the financial resilience of liquidity risk in the face of adverse shocks. They found that liquidity risk positively reacts to shocks arising from inflation, credit risk, size and GDP. Jiang *et al.* (2018) used macro stress tests to study resilience of the Chinese banking system. They found that shocks to GDP and exchange rate negatively affect the Chinese banking sector and that the Chinese banking sector proved to be resilient to interest rate shocks.

## 2.2 Measuring Banking Transparency

Few studies have addressed the issue of banking transparency. Three indices of bank disclosure are proposed in the literature. The first indicates that banks listed on the New York Stock Exchange, the Nasdaq or the American Stock Exchange must comply with the restrictive disclosure rules required by these markets, which, according to the authors, guarantees their transparency. As a result, the return demanded by depositors is relatively low compared with banks trading outside these markets. Leuz & Verrecchia (2000) have shown that German companies which voluntarily adopt US GAAP (Generally Accepted Accounting Principles in the United States) for their activities have recorded low levels of information asymmetries and high liquidity of their securities, in contrast to firms which have adopted the German regime. The second indicator is based on bank ratings. If an internationally recognised rating agency (Standard & Poor's, Moody's or Fitch) rates a bank, investors should have more information about the bank. Rating agencies act as intermediaries in the information disclosure process. They access information not obtained publicly by investors and incorporate it into the bank's rating estimates. In fact, Klinger & Sarig (2000) believe that this is the real reason why companies generally pay estimated costs. It allows companies to incorporate internal information into the assigned estimates without revealing specific details to the public. The index takes the form of indicator variables. If the bank is rated by an internationally recognised rating agency, the index value is 1, otherwise it is 0. The third information measure is based on the information contained in financial statements. This index provides information on 17 types of information disclosed in the annual report by the bank as indicated in the "Bank scope" database. All categories relate to one or more dimensions of the bank's risk profile (interest rate risk, credit risk, market risk, liquidity risk). Each category is represented by a sub-index, which measures the level of detail that the bank publishes in its annual report. Baumann & Nier (2004) and Nier (2005) also use this indicator as a transparency indicator. The first two indices are an indirect measure of the amount of information available to investors. The advantage of the third index is that it is a direct measure of the amount of information disclosed to the market. However, it does not take into account all the dimensions of information (exhaustiveness, periodicity, opportunities and accessibility). In addition, it ignores non-financial information disclosed by banks.

According to Nelson (2001), appropriate measurement standards include the following four dimensions: (1) completeness of information; with the exception of some information designated as undisclosed (internal staff issues, confidential negotiations with the private sector, etc.); (2) the accessibility of the information; depending on the nature of the publication medium (websites, specialist magazines, etc.), the language reporting the documents, the cost of consulting the documents, etc.; (3) the timeliness of the information: this is appropriate if the timing of the disclosure of the information enables investors to respond to company announcements. (Example: disclosure of project details before the board vote); (4) Investors' right of recourse; the possibility for investors to influence the bank's decision-making process. Furthermore, Baumann & Nier (2004), recognized that their disclosure measures could be improved by incorporating periodicity and timeliness of the information exchanged. Ben Douissa's (2011) study is the first to display a transparency measure based on four dimensions (completeness, timeliness, credibility and accessibility) of information. It should be noted that to study transparency, the author used elements disclosed by the bank in line with the recommendations of the third pillar of the Basel III agreements. The index developed includes 43 sub-indices. Each set of indices represents a specific dimension of information. Binary notation is used to score the sub-indices. Empirically, the author constructed a banking transparency index for a sample of 69 banks in 7 emerging economies. The results show that Turkish and Thai banks are ahead in terms of disclosure of financial information. However, North African banks are the most likely to lack transparency. According to Ben Douissa (2010) the major deficiencies in bank transparency in

emerging countries do not essentially affect the quantity of information disclosed but rather its quality. Nier's (2005) empirical study of 550 listed banks in 32 countries (developed and emerging) clearly showed that bank transparency has a positive impact on resilience. In the banking sector, depositors can strengthen controls and protect themselves more effectively against excessive risk-taking. Consequently, as a result of increased transparency, shareholders have imposed stricter controls on management. Bushman *et al.* (2004) constructed an average index of the frequency and completeness of interim reports for a sample of 60 countries. Therefore, disclosure credibility measures the degree to which the information disclosed by the bank has been checked by independent, professional and strict external audits (such as bank audit practice management regulations). Therefore, a high degree of transparency is required in a banking system marked by high information asymmetry, high risk and high risk of inefficient banks (Diamond & Verrechia, 1991; Hirtle, 2007; Akhigbe *et al.* 2017). A high degree of transparency is also necessary when a large number of banks are state-owned (Srairi, 2013). On the contrary, when the financial system is not well developed, banking activity is not very complicated, bank capital is concentrated and the quality of governance of the institution is poor, less transparency is required (Schadewitz & Blevins, 1998; Srairi, 2013). Similarly, according to Andrievskaya & Semenova (2016), a low degree of transparency is required when there are a large number of banks with doubtful assets (Andrievskaya & Semenova, 2016).

### 2.3 Transparency, Disclosure of Information and Banking Risk

There is an extensive theoretical literature on the relationship between transparency and banking risk. Overall, this literature shows that although credible public information about individual banks can improve the ability of regulators and market participants to monitor bank behaviour, transparency entails enormous internal costs. The consequences of transparency can be good or bad. However, it remains an open research question. According to Greuning & Iqbal (2008), transparency cannot prevent financial crises, but it can mitigate market players' reactions to bad news by helping them to anticipate and evaluate negative information. Empirical results show that greater information sharing will reduce banking risks and the possibility of financial crises. Moreover, in the event of a crisis, the cost of loss under a high disclosure system will be lower than under low disclosure systems. In a cross-border study of banking systems in 49 countries in the 1990s, Tadesse (2006) used a series of survey-based measures to find that in countries where disclosure and transparency are more regulated, banking crises are less likely. Furthermore, the literature points out that transparency and disclosure regulations can destabilize the banking system and hinder its growth. Cordella & Yeyati (1998) showed that when banks fail to control their risk exposure, the presence of informed depositors increases the possibility of bank failure. Transparency also affects financial institutions through information externalities. Yorulmazer (2003) showed that the collapse of sound banks can only be avoided with perfect information about bank assets, while Chen & Hasan (2006) argue that improving the accuracy of bank information for depositors will lead to the spread of banking panics. Acharya & Yorulmazer (2008) also showed that the threat of information contagion (spillovers) can lead banks to make correlated investments and amplify systemic risks. Information externalities do not just exist between banks. According to Bushman *et al.* (2004) financial accounting information plays an important role in corporate governance, supporting the oversight of the board, external investors and regulators, and the exercise of investor rights granted by existing laws. In the same line of thought, the banking literature assumes that transparency can promote banking stability by reinforcing market discipline in banks' risk-taking decisions (Flannery & Thakor 2006). The more information disclosed to the public, the stronger the market discipline (Wang *et al.* 2015). Market discipline is the process by which market participants use available information to monitor and prevent banks from taking excessive risks. Furthermore, according to Tadesse (2006) improving market discipline by reducing information asymmetry and increasing transparency contributes to resource allocation. Ariffin *et al.* (2007) argue that market discipline is a mechanism that can potentially inhibit the incentive to take excessive risks, thus making risk-taking more costly for banks. Sound banks are rewarded for their risk management and performance, while poorer banks are punished for higher funding costs. Market discipline encourages banks to manage risk prudently and operate efficiently. For example, Nier & Baumann (2006) used cross-country data to test the role of bank transparency in encouraging banks to limit risk. By constructing an index of 18 disclosure categories (interest rate risk, credit risk, liquidity risk, market risk and capital), they found that higher levels of transparency can strengthen market discipline and enable banks to improve their solvency, either by reducing their risk-taking or by increasing the coverage of risk by capital. Several studies have shown that with transparent information, banks can benefit from greater empathy from regulators (Kane, 1995). Furthermore, banks need to improve transparency of information in order to reduce the risk of disaster for the economy (Tadesse, 2006). Baumann & Nier (2004) studied the relationship between the long-term volatility of banks' share prices and level of transparency in annual reports and found that transparent bank information yielded better returns for investors. In addition, the more transparent the bank's disclosure of

information, the more profit it makes (Flannery et al. 2015) and the greater its incentive to manage risk (Nier & Baumann, 2006). Cheynel (2012), drawing on the theory of voluntary disclosure and cost of capital, explains that companies that voluntarily disclose their information have lower capital costs than companies that do not disclose.

The relationship between information disclosure and bank risk-taking is still debated in the literature. On the one hand, some studies have shown that regulation that requires accurate information to be disclosed can increase bank stability (Laeven & Levine, 2009; Flannery et al. 2015). Baumann & Nier (2004) have extensively studied the impact of information disclosure on banking operations. The results show that disclosure reduces stock volatility and increases the market value and usefulness of accounting information. Linsley & Shrivies (2006) point out that although it is impossible to obtain full disclosure, bankers are encouraged to do so. This would lead to better bank management and support market discipline mechanisms. Flannery et al. (2015) examined the relationship between the amount of information disclosed by banks and subsequent risk. The results showed that greater disclosure was associated with lower risk and higher returns. Building on recent research on bank disclosure and risk assessment, Wang *et al.* (2018) presented a risk disclosure index and link this index to bank soundness to measure the adequacy of bank risk-related disclosure in China. The study found a positive correlation between the disclosure index and bank soundness. Wang *et al.* (2018) also analysed the risk disclosure index into its components and found that the components linked to the profitability of risk offerings were the main drivers of banks' risk behaviour. On the other hand, some studies suggest that banks that disclose more information may face more risk-taking. Indeed, the more disclosure, the higher the bank's risk tolerance as some banks that disclose more information are subject to market discipline but then refuse to limit or control their risk-taking, (Kuranchie-Pong *et al.* 2016). Putu *et al.* (2012) also observed a negative correlation between voluntary disclosure and earnings management for banks listed on the Indonesian Stock Exchange. This affirms that profit margins decrease when banks voluntarily disclose additional information. According to Tadesse (2005) and Hirtle (2006, 2007), public disclosure of information by banks will enable supervisors to effectively assess bank soundness and provide appropriate solutions to help banks mitigate risks over the course of their operations. Chen *et al.* (2022), using a two-stage Generalized Method of Moments (GMM) approach combined with panel data from 28 Vietnamese commercial banks from 2007 to 2019, examined factors affecting Vietnamese commercial banks' risk-taking, including transparency and disclosure. Disclosure Index (TRANS), Disclosure Completeness Index (DISC), bank size and Capital Adequacy Ratio (CAR), before and after the adoption of Basel II. Furthermore, the results show that the implementation of Basel II will significantly contribute to the impact of transparency and disclosure on the Z-scores of Vietnamese commercial banks. The authors also demonstrated that large, well-capitalized banks are the least risky. As we learn more about the dynamics of financial stability, three interrelated features of the banking sector are increasingly attracting the attention of researchers and policy-makers alike: regulation in terms of disclosure requirements, competition and risk-taking. A relationship between these three factors was established by Keeley (1990). This paper sparked a lively debate on the possible link between these factors, at both the theoretical (see Hellmann *et al.*, 2000; Cordella & Yeyati, 2002) and the empirical levels (Salas & Saurina, 2002; Chen & Hassan, 2006). The mutual effects of transparency and competition measures show that banks with greater market power and less competition reduce credit market risk and improve financial stability, validating the competition-fragility hypothesis of Keeley (1990), Chen & Hasan (2006), Gorton & Huang (2002). Cordella & Yeyati (2002) studied banks' risk-taking behavior as a response to increased competition brought about by information disclosure and deposit guarantee schemes. Under mandatory disclosure, depositors and deposit insurance schemes tend to shift banks' risk-taking behavior from price-takers to asset-quality competitors. Cordella & Yeyati (1998) and suggest that transparency-enhancing practices can aggravate banks' default risks when exposed to exogenous shocks that lead to bank closures. The latter refers to mergers, acquisitions and bankruptcies that make some banks less competitive, increase their market power and reduce the number of competitors on the market. Gorton & Huang (2002) consider this exogenous shock to be systematic or idiosyncratic. Investors are unaware of the risks inherent in banks that are opaque to information. All market players expect the same outcome from an economic shock in the event of systemic risk. In turn, transparent systems enable investors to observe idiosyncratic risks and even reduce banking panics. Increased transparency also provides a powerful mechanism for market discipline, stimulating competition. However, a large number of risky banks leads to the accumulation of market power by a small number of very stable banks.

### 3. Methodology

#### 3.1 Sample

The study considers all the Saudi Banks into consideration except for one Islamic Bank (Al-Inma Bank) due to

lack of annual data between the years 2014 and 2021. Ten banks chosen for the study consists of 3 Islamic Banks and 7 Conventional Banks. The selected banks in this study are for Islamic banks Al Rajhi bank, Bank Al Jazira and Bank Al Bilad. For the conventional banks, we have selected The Saudi British bank, Saudi investment bank, Banque Saudi Faransi. Riyad Bank. Samba Financial Group. AlAhli Bank, and Arab National Bank.

### 3.2 Research Model

This subsection aims to assess the financial resilience of liquidity risk in the Saudi banking system. To this end, we estimate an empirical model that combines bank specific and external factors and tests the effect of the shocks of these factors on liquidity risk (LCR), in order to simulate liquidity risk resilience of the selected banks. Estimation by ordinary least squares (OLS) or even more sophisticated traditional panel data regression methods (such as random effects or fixed effects) is likely to be inappropriate because it fails to address endogeneity problems associated with this type of empirical model. When a direct solution to these problems is not possible, a new method is needed to solve these problems, hence the use of the generalized panel method of moments (GMM). The Generalized method of moments was introduced by Arellano & bond (1991) and improved later in subsequent studies. The reasons behind this choice of estimator are that OLS estimation as well as fixed and random effects are biased because of the lagged dependent variable or the presence of an endogeneity problem. Moreover, system GMM estimation is efficient even in the presence of heteroscedasticity and autocorrelation. Furthermore, the generalized method of moments is more efficient in our study because of its ability to control for individual effects and time specific effects as well as endogeneity. The econometric model is formulated as follows:

$$LCR_{i,t} = \beta_0 + \beta_1 LCR_{i,t-1} + \beta_2 SIZE_{i,t} + \beta_3 AQ_{i,t} + \beta_4 CAR_{i,t} + \beta_5 INF_{i,t} + \beta_6 GDP_{i,t} + \beta_7 UNEMP_{i,t} + \epsilon \quad (1)$$

$$LCR = \frac{\text{Stock of High-Quality Liquid Assets (HQLAs)}}{\text{Total net cash outflows over the next 30 calendar days}} \quad (2)$$

$\beta_0$  : Constant;  $\beta_i$  ( $i = 1, 2, 3, 4, 5, 6, 7$ ): the coefficients expressing the different independent variables;  $\epsilon$ : error term and  $t$  : time period (2014-2021) ; GDP : GDP growth rate ; UNEMP : unemployment rate ; INF : inflation rate; CAR : capital adequacy ratio ; SIZE : bank size ; AQ : asset quality. After estimating these determinants using the generalized method of moments (GMM), we conduct a PVAR analysis in order to assess resilience of liquidity risk against adverse shocks. In the past few years, there has been an acceleration in the use of VAR. For instance, Panel-VAR (PVAR), global VAR (GVAR), and the factor augmented VAR (FAVAR)...etc. (Khammasi *et al.* 2020). P-VAR has the advantage of determining the effect of a shock from one variable on another, while maintaining the other variables constant. We try to test liquidity risk resilience of Saudi banks against macroeconomic and bank-specific shocks using the panel-VAR approach. In order to conduct a PVAR on liquidity risk, we use the same variables used in the previous estimation to test their effect on the short-term liquidity ratio (LCR), which is the dependent variable in our model.

$$Y_{i,t} = Y_{i,t-1}A_1 + Y_{i,t-2}A_2 + \dots + Y_{i,t-p}A_p + X_{i,t}\beta + \mu_{i,t} + e_{i,t} \quad (3)$$

$$i \in (1, 2, \dots, N), t \in (1, 2, \dots, Ti)$$

$Y_{i,t}$  : vector of dependent variables ;  $X_{i,t}$  is a vector of normally distributed exogenous covariates  $\mu_{i,t}$  and  $e_{i,t}$  are fixed effects vectors specific to the dependent variable and normally distributed errors ;  $A_1$  ,  $A_2$  ,  $A_{p-1}$  ,  $A_p$  and  $\beta$  matrices are parameters to estimate. In order to determine which variable to exert shock, banks must choose the key risk factors. This implies choosing the variables of interest that are supposed to have a significant effect on liquidity.

$$Y_{i,t} = [LCR_{i,t}, CAR_{i,t}, AQ_{i,t}, SIZE_{i,t}, GDP_{i,t}, INF_{i,t}, UNEMP_{i,t}] \quad (5)$$

To do so, we proceeded as follows; first, we examined the evolution of our variables using unit root tests and the cointegration test. Next, we presented the results of our PVAR estimation. Then, we presented the results of the Granger causality test 'Wald test'. Finally, we calculated and plotted the impulse response functions (IRFs) through Cholesky variance decomposition. Our empirical study aims to examine the determinants of liquidity risk in Saudi banks; hence we target the largest ten banks in Saudi Arabia. The empirical validation of our study bears on annual data, covering a period extending from 2014 to 2021, more specifically during the Covid19 crisis and the Russo-Ukrainian war. The aim is to assess the financial resilience of liquidity risk in the face of adverse shocks, first by examining the factors that affect bank liquidity and second by assessing sensitivity of the

banking system to various macroeconomic and microeconomic shocks by analyzing their impact on LCR. To this end, we collected bank specific variables from the Bloomberg database and the annual report of each individual bank. The macroeconomic variables are taken from the World Bank database.

### 3.3 Construction of the Transparency Index

Our study draws on a 4-dimensional transparency analysis grid, inspired by Efogo (2019). Indeed, there is a variety of transparency indicators constructed in the literature (Baumann & Nier, 2004; Nier, 2005; Huang, 2006; Nier & Baumann, 2006; Tadesse, 2006; Ben Douissa, 2011; Manganaris *et al.*, 2017). These measures are more or less complementary and address different facets of information disclosure. Following Nelson (2001), we asserted that a complete indicator has 4 dimensions: completeness of information (*INF COMPL*), access to information (*INFACCES*), credibility of information (*INFCREDIB*) and timeliness of information (*INFOPPORT*). We propose a more complete transparency analysis grid; a four-dimensional grid from which a complete indicator can be built.

#### 3.3.1 Information Completeness Dimension (INF COMPL)

We propose adding sub-indices to take into account all the information published by banks in their annual reports. Specifically, the information contained in financial statements (balance sheet, income statement, cash flow statement) is financial in nature. This information is not in itself enough to give a true and fair view of a company. It therefore seemed appropriate to include non-financial information in the calculation of the index. This involves considering risk management quality, corporate governance, the firm's strategic vision, management quality and socio-environmental performance (Perrini *et al.* 2006). By accessing the different interest groups, these dimensions provide a better understanding of the company's overall performance, strategy and growth prospects. The information provided by a bank is complete if it covers both the financial and non-financial sides of the bank's activities. Financial matters denote the bank's resources and use. More specifically, this information covers loans and deposits (form, duration, counterparty, etc.) and the associated risks. Non-financial information relates to governance, operational risk and forecasts. The financial information sub-dimension consists of 17 items. The non-financial information sub-dimension consists of 21 items. There are 38 items in all. From this grid, an information completeness indicator is calculated. These items do not all have the same measurement scale.

#### 3.3.2 Information Timeliness Dimension (INFOPPORT)

In practice, timeliness of information is guaranteed by its regular updating. This dimension of information explains the need for interim reports (quarterly or half-yearly reports). These interim reports enable for checking the consistency of information published over different sub-periods. In this way, the indicator shows the extent to which information is published at the right time. Only one item is retained, namely availability of interim reports. This item takes 0 if there are no interim reports, 1 if the report is a half-yearly report and 2 if there is a quarterly report.

#### 3.3.3 Information Credibility Dimension (INFCREDIB)

This dimension of transparency focuses on those features that contribute to the increased reliability of published information. As such, information is credible if it is checked by accredited bodies with a good-faith preemption. For the purposes of this study, 3 items were selected (external audit, audit company identity, application of accounting standards, international accounting standards and inflation-adjusted accounts). Today, they are all involved in four major businesses: auditing, consulting, transaction services and legal and tax advice. We assign 0 if the bank does not disclose the identity of the firm that audited its accounts, and 1 if the bank is audited by a firm that is not one of the "Big Four". Finally, 2 is given if the bank is audited by a Big Four firm. Banks also use the Accounting Standards sub-index. This distinguishes between two standards adopted by banks: local standards and international standards. Thus, if the bank adopts the IFRS standard, the rating is 1, otherwise it is 0. Finally, there is the inflation-deflated results item, where a bank that publishes annual inflation-adjusted accounts is more transparent than one that does not.

#### 3.3.4 Information Accessibility Dimension (INFACCES)

To accurately measure accessibility of information, a distinction is made between public and private information. Public information is found in the financial statements that banks are required to publish in their annual reports. Private information, on the other hand, represents all elements that have not been disclosed to the public. Access to this information is restricted to key shareholders, financial analysts and risk rating agencies. Indeed, major shareholders rely on their decision-making power on the bank's Board of Directors to obtain private information. As for financial analysts, they can obtain private information about the bank through media briefings and

contacts with bank staff. This is the second channel for disseminating information. We propose to measure access to information through the first channel of dissemination (annual reports) by including or excluding these reports on the bank's website. On a bank's website, a certain amount of information is accessible (banking conditions, governance structure, proposed products, other branches, etc.). The choice of this measure stems from the fact that companies are generally required by law to publish their annual reports in at least one national daily newspaper. It will assign 1 to banks that publish annual reports on its website, otherwise 0. In addition, rating agencies are private companies whose main task is to assess the ability of debt issuers to meet their financial commitments. The main rating agencies currently on the market are Moody's, Standards & Poor's and Fitch Ratings. These three agencies alone account for around 85% of the market. This will be the third channel for disseminating information. Item three takes 1 if the bank is rated by an international agency, a regional agency including agencies such as Capital Intelligence, and 0 otherwise. This transparency dimension is designed to assess whether banks are open to the public.

#### **4. Data Analysis, Results and Discussion**

##### *4.1 Factors Influencing Liquidity Risk and Resilience of Banks*

We primarily use the following six variables: Real GDP growth rate; Unemployment rate; Inflation rate; Bank size; capitalization and Asset quality. In the GMM analysis, we assess the impacts of macroeconomic and bank-specific determinants on the liquidity coverage ratio (LCR). The Inflation rate and unemployment rate have an insignificant but positive effect on LCR. This means that in Saudi Arabia, these factors cannot be used to determine LCR. Their upward or downward fluctuations do not have a direct effect on this prudential measure. The Hansen test shows a P-value of 0.198, which is above 0.1, which means that we cannot reject the null hypothesis  $H_0$  of validity of instruments. Then, the instruments used for this regression are valid, which means the results are valid. The test for absence of second order autocorrelation displays a value of (-1.75) with a P-value of 0.081. This indicates that the hypothesis of the absence of first-order autocorrelation of errors is rejected, while the hypothesis of the absence of second order cannot be rejected. This means that the empirical model has been correctly specified because there is no autocorrelation in the transformed residuals. This indicates the validity of the instruments. Moreover, we observe that the lagged dependent variable is positive and significant, which checks the dynamic character of the model's specification (Daher *et al.*, 2015). Accordingly, we confirm the appropriate use of a dynamic specification in our study. The obtained results indicate a negative and statistically significant relationship between bank size and the liquidity coverage ratio. The results also show that when bank size increases by 1%, LCR decreases by 2.796%. The variable "SIZE" has a significant and negative effect on LCR at the 1% level. Specifically, LCR is lower in large banks. This study confirms the results obtained by Anindyajati & Hanggraeni (2022), Shah *et al.* (2018), El Khoury (2015). Large banks hold fewer liquid assets because they consider themselves "*too big to fail*", so they are less driven to hold liquid assets. Indeed, they rely on their size to refinance themselves with the best conditions on the interbank market. Moreover, given their systemic importance, and to ensure the financial stability of the entire banking system, these banks also benefit from the help of monetary authorities (lender of last resort). The impact of the total capital ratio on LCR is significant and positive. A 1% increase in CAR leads to an increase of 0.582% in LCR. This result confirms those obtained by Anindyajati & Hanggraeni (2022) Hussain *et al.* (2022) Shah *et al.* (2018), Zaghdoudi & Hakimi (2017). This can be explained by the "risk absorption hypothesis" where a higher capital reinforces risk absorption and liquidity creation ability of banks (Berger & Bouwman, 2009). According to our results, economic growth has a negative and significant impact on liquidity. If GDP increases by 1% LCR decreases by 1.035%. This finding confirms those obtained by El Chaarani (2019) and Shah *et al.* (2018). This can be explained by the fact that during an economic recession the number of profitable investment projects is lower, which discourages banks to lend and encourages them to hold a high level of liquid assets. Another explanation is the fact that banks will lose confidence in the repayment ability of customers. On the other hand, during economic growth, banks are encouraged to lend more, which results in a lower level of liquid assets (Zaghdoudi & Hakimi, 2017).

Table 1. GMM estimation

<i>LCR</i>	Coefficient	p-value
<i>L</i>	0.8631***	0.000
<i>SIZE</i>	-2.7963***	0.000
<i>AQ</i>	-0.0622	0.642
<i>CAR</i>	0.5821***	0.005
<i>INF</i>	0.0781	0.736
<i>GDP</i>	-1.0351***	0.000
<i>UNEMP</i>	0.3558	0.161
<i>Constant</i>	48.717***	0.000
<i>Wald Chi-square (7)</i>	4367.70	0.000
<i>AR(1)</i>	-4.35	
<i>P-value AR(1)</i>	0	
<i>AR(2)</i>	-1.75	
<i>P-value AR(2)</i>	0.081	
<i>Hansen test of over identification</i>	31.85	
<i>P-value</i>	0.198	

**Note:** \*\*\* p<.01, \*\* p<.05, \* p<.1

*Source:* Author's calculations

Before we begin our PVAR analysis, we have first to ensure stationarity of our variables. In order to test for stationarity, there are several test we can conduct on panel data. For instance, Levin, Lin and Chu (LLC), Im-Pesaran-Shin (IPS), Fisher augmented dickey fuller (ADF) and Fisher Phillips-Perron (PP). In our study, we conduct all these tests. Our results indicate that some variables are stationary in level while others are stationary in second order (first difference). The obtained stationary series will be used in our PVAR regression. Since the variables are integrated at a different order, it seems that there is cointegration between the variables, for that reason we perform the cointegration test.

Table 2. Panel unit-root test

Variable	Test	Level	Prob
<i>LCR</i>	LLC	Level	0.000
	Im-pesaron	First difference	0.000
	ADF	Level	0.000
	PP	Level	0.000
<i>SIZE</i>	LLC	First difference	0.000
	Im-pesaron	First difference	0.000
	ADF	First difference	0.000
	PP	First difference	0.000
<i>CAR</i>	LLC	Level	0.000
	Im-perason	Level	0.034
	ADF	Level	0.000
	PP	Level	0.000
<i>AQ</i>	LLC	Level	0.000
	Im-pesaron	First difference	0.000
	ADF	Level	0.000
	PP	Level	0.000
<i>GDP</i>	LLC	Level	0.000
	Im-pesaron	Level	0.000
	ADF	Level	0.000
	PP	Level	0.000
<i>INF</i>	LLC	First difference	0.000
	Im-pesaron	First difference	0.001
	ADF	Level	0.000
	PP	Level	0.000
<i>UNEMP</i>	LLC	Level	0.000
	Im-pesaron	First difference	0.000
	ADF	First difference	0.000
	PP	First difference	0.000

*Source:* Author's calculations

The cointegration test in a panel VAR (Vector Auto regression) model is used to check for cointegrating relationships between variables. The aim of this test is to assess the long-term relationship between the variables. In order to test for cointegration, we conduct the following tests: Kao test, Pedroni test and Westerlund test.

H0: No cointegrating equation

H1: All panels are cointegrated

Table 3. Cointegration test

Test	P-value
<i>Kao</i>	0.0005
<i>Pedroni</i>	0.0000
<i>Westerlund</i>	0.0001

Source: Author's calculations

Our results indicate that the P-value of all tests is under 0.05%, which means that we reject the null hypotheses, the cointegration relationship is checked and all panels are cointegrated. In order to assess response of bank liquidity to negative shocks, we run a PVAR analysis (Panel vector auto regressive). This method allows us to examine bank fragility and put their resilience to the test by determining the impact of shocks as well as the response of our liquidity measure (LCR). The panel vector auto regressive (PVAR) is a combination of the standard VAR approach, where all variables are considered endogenous, with the panel data technique, which allows the induction of a fixed effect in the model (Shank & Vianna, 2016). According to Canova & Ciccarelli (2013), the PVAR approach adds a cross-sectional dimension to traditional VARs, making them an effective estimation tool. Grossmann et al. (2014) note that the key advantage of the VAR system is that it allows us to determine the impact of orthogonal shocks, i.e., how a variable impacts another variable, while maintaining the variables constant.

Our results indicate that most variables have a significant relationship with liquidity i.e., LCR, AQ, CAR and GDP. LCR and CAR are significant at the 10% level while AQ and GDP are significant at the 5% level. The first lag of LCR shows a positive relationship with LCR with a coefficient of 0.6771. This indicates that an LCR shock increases future liquidity levels. On the other hand, the first lag of AQ, CAR and GDP shows negative coefficients of -3.03265, (-12.7944) and (-1.33268) respectively. This means that a shock arising from these variables decreases future liquidity levels. Bank size, inflation and unemployment present an insignificant relationship with LCR.

Table 4. PVAR estimation

	<i>L.LCR</i>	<i>L.SIZE</i>	<i>L.AQ</i>	<i>L.CAR</i>	<i>L.INF</i>	<i>L.GDP</i>	<i>L.UNEMP</i>
<i>LCR</i>	0.67711 (0.061)	115.8033 (0.235)	-3.03265 (0.044)	-12.7944 (0.074)	-1.33268 (0.768)	-1.33268 (0.047)	-0.55496 (0.874)
<i>SIZE</i>	0.00027 (0.679)	0.94527 (0.000)	-0.00464 (0.111)	0.017330 (0.216)	-0.00326 (0.483)	-0.00162 (0.361)	0.00684 (0.380)
<i>A</i>	-0.0008 (0.872)	0.88727 (0.605)	0.80537 (0.000)	-0.04947 (0.699)	0.12747 (0.318)	-0.00853 (0.821)	0.12917 (0.306)
<i>CAR</i>	-0.0452 (0.117)	-6.3298 (0.396)	-0.1311 (0.100)	1.1028 (0.129)	0.17919 (0.276)	-0.0405 (0.409)	-0.49841 (0.041)
<i>INF</i>	0.06181 (0.019)	9.927995 (0.090)	.267127 (0.060)	.804164 (0.092)	0.099378 (0.737)	.083391 (0.175)	1.09350 (0.002)
<i>GDP</i>	0.02946 (0.276)	18.8623 (0.002)	0.149000 (0.309)	0.395117 (0.480)	-0.64992 (0.002)	-0.28510 (0.000)	1.37256 (0.000)
<i>UNEMP</i>	0.005078 (0.371)	-3.16342 (0.034)	.01010 (0.703)	-0.20375 (0.094)	-0.04719 (0.435)	-0.06987 (0.000)	0.643931 (0.000)

**Note:** The parentheses indicate the P-value

Source: Author's calculations

Granger causality Wald test results for a first-order PVAR statistically proves the presence of a causal relationship between variables. Indeed, we found that asset quality and GDP are significant at the 5% level, while CAR is significant at the 10% level. Thus, asset quality, GDP and capitalization powerfully explain the liquidity risk of Saudi banks.



Table 5. Granger causality test

Variable		Df	Prob > chi2
LCR	SIZE	1	0.235
	AQ	1	0.044
	CAR	1	0.074
	INF	1	0.768
	GDP	1	0.047
	UNEMP	1	0.874

Source: Author's calculations

Panel-VAR-Granger causality Wald test.

H0: excluded variable does not Granger-cause equation variable.

H1: excluded variable Granger-causes equation variable.

IRF displays the response of our variable of interest (response variable) over time to a one-unit shock in the other variables (impulse variables). We can interpret IRF as the causal impact of a shock of one variable on the other variable in the model. Our results indicate that a positive liquidity risk shock causes a positive response to the future liquidity risk of Saudi banks. This can be explained by the fact that an increased liquidity risk shock increases future liquidity risk. This result confirms the findings of Khammasi *et al.* (2020). The impact of an AQ shock on the liquidity risk of Saudi banks is positive throughout the period. This indicates that an increased AQ shock increases future liquidity risk, confirming the results of Khammasi *et al.* (2020). Saudi banks' liquidity risk response to a CAR shock is negative during the first period, but from the second year onwards, it becomes positive. Thus, an increased CAR shock begins to increase liquidity risk from the second year onwards. A shock to economic growth (GDP) has a significant negative effect on LCR in Saudi banks during the first year. Then, the reaction is cancelled out until the end of the period. This indicates that a GDP growth rate shock increases liquidity risk in the subsequent years. This confirms the results obtained by Khammasi *et al.* (2020) El Chaarani (2019) and Shah *et al.* (2018).

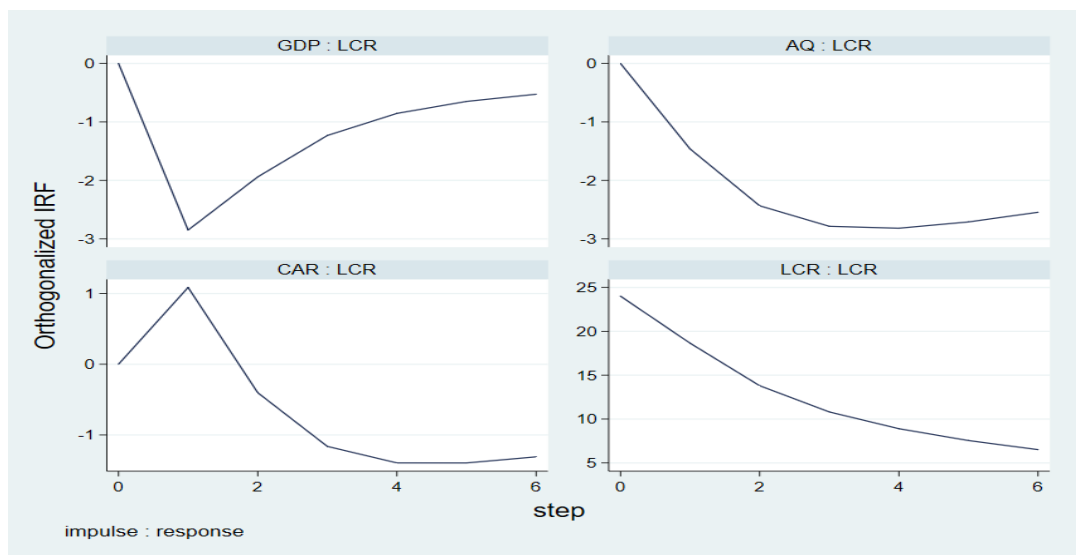


Figure 1. Impulse Response Variables

Source: Author's calculations

Variance decomposition in panel VAR is a method that explains the total variance of a variable into the contribution of shocks of other variables in the model; it is useful to comprehend the importance of different variables in steering fluctuation of our variable of interest, i.e., the liquidity coverage ratio (LCR). Our results indicate that at the beginning of the period, LCR could be explained by itself at about 78.5% (LCR=78.5% LCR). This means that past observations of liquidity risks largely contribute to explaining future observations. For the capital adequacy ratio, the effect gradually increases over time, varying from 17.7% until it reaches 30.6%. As for the other variables, the results show that SIZE, GDP and INF can explain the liquidity coverage ratio at the 3.2%, 0.5% and 0.1% levels respectively.

Table 6. Variance decomposition

<i>Horizon</i>	<i>LCR</i>	<i>SIZE</i>	<i>AQ</i>	<i>CAR</i>	<i>GDP</i>	<i>INF</i>	<i>UNEMP</i>
<i>LCR</i>							
0	0	0	0	0	0	0	0
1	1	0	0	0	0	0	0
2	0.785	0.032	0.000	0.177	0.005	0.001	0.000
3	0.698	0.052	0.001	0.243	0.003	0.003	0.001
4	0.650	0.064	0.002	0.266	0.007	0.009	0.002
5	0.620	0.066	0.002	0.289	0.009	0.011	0.002
6	0.610	0.065	0.003	0.299	0.009	0.012	0.003
7	0.606	0.063	0.003	0.303	0.010	0.012	0.003
8	0.604	0.061	0.003	0.306	0.010	0.012	0.003

Source: Author's calculations

#### 4.2 Breakdown of the Banking Transparency Index (BANKTRANS)

We propose a breakdown of the bank transparency (BANKTRANS) indicator. Table 7. Shows the statistics relating to the disclosure of financial information (2014-2021).

Table 7. Statistics relating to the disclosure of financial information (2014-2021)

<i>Dimensions</i>	<i>INFCOMPL</i>				
	<i>N_SIF</i>	<i>N_SINF</i>	<i>INFOPPORT</i>	<i>INFCREDIB</i>	<i>INF ACCES</i>
<i>Bank 1</i>	52,63%	25%	0%	50%	95,83%
<i>Bank 2</i>	65,79%	26,70%	0%	31,25%	66,67%
<i>Bank 3</i>	60,53%	26,14%	0%	50%	66,67%
<i>Bank 4</i>	61,84%	26,71%	0%	31,25%	66,67%
<i>Bank 5</i>	43,43%	23,87%	0%	50%	83,34%
<i>Bank 6</i>	55,26%	17,05%	0%	50%	66,67%
<i>Bank 7</i>	57,89%	21,59%	0%	50%	66,67%
<i>Bank 8</i>	55,92%	32,39%	0%	25%	66,67%
<i>Bank 9</i>	59,21%	23,35%	0%	50%	66,67%
<i>Bank 10</i>	52,63%	25,57%	0%	43,75%	66,67%
<i>Total</i>	56,51%	25%	0%	43%	71,25%

Source: Author's calculations based on banks' annual reports

It seems that the best performance relates to the information accessibility for most banks (*INF ACCES* = 71.25%). The information accessibility dimension (*INF ACCESS-AVERAGE*=71.25%) is made up of 3 items, namely the availability of a website, access to annual reports via the Internet and bank ratings by international agencies (Standard & Poor's Global Rating; Moody's; Fitch Ratings). This shows that, on average, the banks in the sample are increasingly reluctant to disclose information on their websites. Moreover, on average, banks tend to be rated by less internationally renowned institutions over the study period. All banks have a website. However, the annual report is not always available for subsidiaries of international groups. The second dimension covers the completeness of financial information. Indeed, the banks met most of the criteria for financial transparency (*N\_SIF- AVERAGE* = 56.51%). There has been a marked increase, reflecting a growing willingness by banks to disclose financial and non-financial information. This disclosure of information also makes it possible to carry out empirical analyses of the impact of this transparency dimension in these banks. Comparing this result with that reported by Chen et al. (2022), we observe an upward trend in financial transparency indicators in the post-crisis period (2014-2021) compared with the pre-crisis period (1994-2016) studied by the author (56, 51% > 49%). The dimension with the third-highest score, information credibility, is made up of 3 items dealing respectively with the presence of an external or internal audit firm, the application of international accounting standards and the publication of accounts net of inflation. These criteria contribute to increasing the credibility of the information published by the bank in its annual report. Each bank includes a reminder of the standards applied in its annual report. The BANKTRANSP indicator confirms that the banks in the sample provide 66.67% of public information, with the exception of Bank 1 and Bank 2. For the *INFACCESS* dimension, banks have an average practice, except for Bank 1 and Bank 2, which have a high practice. On the other hand, for the *INFCREDIB* dimension, bank practice is average, with the exception of Bank 2, Bank 6, Bank 8 and Bank 10, which scored low. As far as the completeness of information (*INFCOMPL*) is concerned, banks seem to have a tendency to disclose financial information and ignore the publication of non-financial information. To this end, they publish information on more than 50% of financial transparency items and less than 20% of non-financial transparency items. Finally, the *INFOPPORT* dimension is not put into practice. To sum up, the banks in the sample have a low level of transparency, as they have not implemented all the dimensions of transparency. More specifically, the information published is accessible (*INFACCESS*) and

credible (*INFCREDIB*) for some banks. In return, some dimensions need to be strengthened. Absolutely, banks need to make efforts on the dimension of timeliness of information (*INFOPPORT*), where they scored zero, and on the dimension of completeness of non-financial information, where the average level of practice is less than or equal to 25%. Table 8 shows the degree of bank transparency and its sub-indexes (2014-2021)

Table 8. Degree of bank transparency (2014-2021)

<i>Banks</i>	<i>Dimension 1</i>	<i>Dimension 2</i>	<i>Dimension 3</i>	<i>Dimension 4</i>	<i>TRANS Average</i>
<i>Bank 1</i>	77,63%	0%	50%	95,83%	55,87%
<i>Bank 2</i>	92,49%	0%	31,25%	66,67%	47,60%
<i>Bank 3</i>	86,67%	0%	50%	66,67%	50,84%
<i>Bank 4</i>	72,31%	0%	50%	66,67%	47,25%
<i>Bank 5</i>	67,30%	0%	50%	83,34%	50,16%
<i>Bank 6</i>	88,55%	0%	31,25%	66,67%	46,62%
<i>Bank 7</i>	79,48%	0%	50%	66,67%	49,04%
<i>Bank 8</i>	88,31%	0%	25%	66,67%	45,00%
<i>Bank 9</i>	82,56%	0%	50%	66,67%	49,81%
<i>Bank 10</i>	78,20%	0%	43,75%	66,67%	47,16%
<i>Total</i>	81,35%	0%	43,13%	71,25%	48,93%

Source: Author's calculations based on banks' annual reports

#### 4.3 Transparency and Bank Liquidity Risk

The model adopted is a dynamic *GMM*-type model that allows us to study the effect of transparency on bank liquidity risk. We found that the application of the generalized method of moments system was the most appropriate. In fact, the first-order self-creation test is less than 5% and the second-order self-creation test is greater than 5%. This confirms the absence of a second-order autocreation problem in our model. Sargan's instrument validity test also shows that the instruments are valid (probability > 0.05).

Table 9. Estimation results

<i>Variables</i>	<i>Coefficients</i>	<i>t-student</i>	<i>Prob</i>
<i>LCR<sub>t-1</sub></i>	0.92*	4.75	0.000
<i>BANKTRANS</i>	-0.08	-0.66	0.512
<i>ROA</i>	-0.04***	-1.93	0.053
<i>SIZE</i>	0.084***	1.65	0.099
<i>CAR</i>	-2.10***	-1.87	0.062
<i>GDP</i>	0.419*t	4.17	0.000
<i>Cst</i>	-1.05	-1.20	0.231
<i>AR(1)</i>	0.0078		
<i>AR(2)</i>	0.333		
<i>Test de Sargan</i>	2.37		
<i>Prob.</i>	0.9967		

Note: \*\*\* p<.01, \*\* p<.05, \* p<.1

Source: Author's calculations

The coefficient of the lagged value of liquidity risk is statistically significant and positive at the 1% threshold. In fact, it is 92%, with a probability of 0.000, indicating a strong correlation between the LCR ratio and its lagged values. Thus, a deterioration in bank liquidity in one year is likely to have a negative impact on the bank's liquidity in the following year. This also means that the banks in our sample are only managing to achieve 92% of the expected trend in terms of converting deposits into loans. We can conclude that the effect of liquidity risk is cumulative. Liquidity risk at time T-1 contributes significantly to an increase in liquidity risk at time T. The estimation results of our dynamic panel model show that, over this period (2014-2021), transparency has no significant effect on liquidity risk for the banks in the sample. This is an expected result. It can be explained by the fact that the transparency variable does not show significant variation between banks something we concluded from the measurement of the transparency index in the 10 Saudi banks between 2014-2021. Indeed, the results of the transparency index measurement show overall that transparency practice is similar for all banks. (Table. 8). In practical terms, banks implement less than 50% of the transparency dimensions. They mainly disclose financial information and information on information credibility. Barely 18% of information on non-financial components of banking activity is made available to the public. Information on operational risk and on the timeliness of information is not available either in annual reports or on the bank's website. In fact, the *INFOPPORT* dimension is not implemented in practice. Some dimensions need to be strengthened. Absolutely, banks need to work harder when it comes to the timeliness dimension of information (*INFOPPORT*), where they

scored zero, showing that on average the banks in the sample do not give importance to the publication of quarterly or half-yearly reports. We can explain this finding by the fact that banks have different risk-taking policies depending on the period. The completeness dimension of non-financial information or the average level of practice is less than or equal to 25%. (Table. 8). Thus, the transparency index (BANKTRANSP) shows that, for all observations, the average transparency between 2014 and 2021 was 48.94%. This means that overall bank transparency is low. The banks in the sample are well behind the Basel 2 transparency requirements. Indeed, the rationale behind Pillar 3 is that improving financial communication strengthens market discipline, which is seen as a behavioural response to action by the supervisory authorities. Information is made available to the public on assets, risks and their management, so practices must be transparent and standardized.

The impact of performance, measured by ROA, on liquidity risk is negative and significant at the 10% threshold. This indicates that an increase in performance leads to a 4% decrease in liquidity risk. This result can be explained by the fact that a bank's performance can reflect the quality of its bank management. In fact, good performance means that the bank succeeds in maximizing the profits generated by its different activities, while maintaining sufficient liquidity to meet withdrawal requests and commitments with other creditors. This is a significant and expected result, in line with the assumptions of Louzis et al. (2012). Bourke (1989) studied a sample of 90 banks in Europe, North America and Australia between 1972 and 1981. The author found a positive relationship between holding liquidated assets and bank profitability (measured by ROA). Indeed, it shows that banks with high profitability generally hold more liquidity (low liquidity risk) than banks with low liquidity, as the latter want to increase their profitability by holding illiquid assets that are more profitable than liquid assets. This means that the less profitable a bank is, the less liquid it will be, thereby increasing its exposure to liquidity risk. Similarly, bank size positively and significantly affects liquidity risk at the 10% threshold, i.e. the larger the bank, the greater the liquidity risk. In fact, a 1% improvement in the logarithm of total assets leads to an 8.4% increase in liquidity risk. This result is expected and corroborates the work of Dietrich et al. (2014), who have shown that large banks generally engage in severe restructuring activities that lead to a decrease in bank liquidity and thus increase its exposure to liquidity risk. Furthermore, the capital ratio shows a negative and significant impact at the 10% threshold on liquidity risk. This implies that an increase in the capital ratio leads to a decrease in liquidity risk. This finding is explained by the fact that an increase in the capital ratio results mainly from an increase in equity, which reduces liquidity risk. This result is inconsistent with that of Vodova (2011), Horváth et al. (2012), Roman & Sargu (2015). The impact of the macroeconomic variable, economic growth rate, on liquidity risk is positive and significant at the 1% threshold. This shows that higher economic growth leads to a 41.9% increase in liquidity risk.

## 5. Conclusion

Our study allows us to identify the main factors that affect liquidity risk in the Saudi banking sector as well as assess its resilience to different microeconomic and macroeconomic shocks. We focused on ten banks in Saudi Arabia over the 2014-2021 period. Our first analysis indicated that capital adequacy ratio, *SIZE*, *GDP* growth as well as past *LCR* levels significantly affect *LCR*. This amounts to saying that these are crucial variables to consider when studying liquidity risk. For our second analysis, we found that shocks to past *LCR*, *AQ*, *CAR* and *GDP* increase future liquidity risk. At this level, our study has some interesting implications: (1) Supervisors and policy makers can use these results to reinforce their liquidity risk management, since our results provide a better understanding of factors that impact liquidity within the Saudi banking system. (2) This study helps to identify most resilient banks during stress periods, where adverse macro and micro shocks impacted all of them equally and (3) This study may be useful for examining the preparedness of banks to face crisis periods and helps them to get themselves equipped with the needed liquidity levels to meet those adverse but plausible scenarios. Stress tests, without a doubt, are regularly used as a tool for macro-prudential analysis and crisis prevention. However, they are of great value only when they are followed by concrete and appropriate actions, first by the central authority and then by each bank separately. The banking system should be more forward-looking in order to increase liquidity provision levels, even in good times, so that in the event of an economic downturn, banks will be better protected and more resilient to various shocks.

The second aim of this paper is to study the effect of bank transparency on liquidity risk. We used the variable *BANKTRANS* as an indicator of interest that measures the degree of transparency in banks. In fact, national averages of bank transparency show a wide disparity between banks in the same country. Some Banks had a transparency index of over 50%, while others had an index of less than 50%, reflecting a disparity in voluntary transparency practices between banks in the same country. The result also shows that Saudi banks are taking advantage of the legal delay in banking regulation.

Firstly, we have noted that there is no measure of transparency in the literature that respects the specificities of

banking. Indeed, the measures put forward by previous studies on banking transparency do not take into account new banking risks, such as liquidity risk. The first contribution of our study is that we have calculated a multidimensional average transparency index. We used the transparency variable as an indicator of interest that measures the degree of transparency in banks. The result shows that banks are taking advantage of the legal delay in banking regulation. In fact, market discipline can fail when investors have no knowledge of the bank's risk profile, or more when the information disclosed is limited. Hence, practices cannot be transparent in terms of the information made available to the public on assets and their management. Some dimensions need to be strengthened. Absolutely, banks need to improve on the timeliness of information dimension (*INFOPPORT*), where they scored zero, showing that on average, the banks in the sample do not give importance to the publication of quarterly or half-yearly reports. We can explain this finding by the fact that banks practice different risk-taking policies depending on the period. The completeness of non-financial information or the average level of practice is less than or equal to 25%, which shows the weakness and ineffectiveness of market discipline mechanisms.

In this paper, we use only the accounting-based risk measure since in our sample a limited number of banks are listed in the stock exchange market. This issue constitutes the major limitation of this study. With regard to future research, it is recommended to extend the sample to GCC countries and make a comparison between Islamic versus conventional banks. Furthermore, as banks are sensitive to sustainability themes, we suggest considering the importance of non-financial disclosures, namely sustainability reports, which could represent an advance in future research.

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#### **Data sharing statement**

No additional data are available.

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#### **References**

Acharya, V. V., & Yorulmazer, T., (2008). Information contagion and bank herding. *Journal of Money, Credit and Banking*, 40, 215-231. <https://doi.org/10.1111/j.1538-4616.2008.00110.x>

- Ahamed, F. (2021). Determinants of Liquidity Risk in the Commercial Banks in Bangladesh. *European Journal of Business and Management Research*, 6(1), 164-69. <https://doi.org/10.24018/ejbmr.2021.6.1.729>
- Akhigbe, A., McNulty J. E., & Stevenson, B. A. (2017). Additional evidence on transparency and bank financial performance. *Review of Financial Economics*, 32, 1-6. <https://doi.org/10.1016/j.rfe.2016.09.001>
- Andrievskayaa, I., & Semenova, M. (2016). Does banking system transparency enhance bank competition? Cross-country evidence. *Journal of Financial Stability*, 23, 33-50. <https://doi.org/10.1016/j.jfs.2016.01.003>
- Anindyajati, N., & Dewi, H. (2022). *Analysis of Determinant Factors of Liquidity Coverage Ratio (LCR) on Conventional Banks in Indonesia Periods 2018 – 2021*. In Proceedings of the 1st International Conference on Contemporary Risk Studies, ICONIC-RS 2022, 31 March-1 April 2022, South Jakarta, DKI Jakarta, Indonesia. DKI Jakarta, Indonesia: EAI, 2022. <https://doi.org/10.4108/eai.31-3-2022.2320620>
- Arellano, M., & Stephen, B. (1991). Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations. *The Review of Economic Studies*, 58(2), 277. <https://doi.org/10.2307/2297968>
- Ariffin, N. M., Archer, S., & Abdel Karim, R. A. (2007). *Transparency and market discipline in Islamic banks*. In Advances in Islamic economics and finance, proceeding of the 6th international conference on Islamic economic and finance. Saudi Arabia: Islamic Research and Training Institute.
- Baumann, U., & Nier, E. (2004). *Disclosure, Volatility, and Transparency: An Empirical Investigation into the Value of Bank Disclosure*. Federal Reserve Bank of New York Economic Policy Review, September, pp. 31-45.
- Ben Douissa, I. (2011). Measuring banking transparency in compliance with Basel II requirements. *Current Issues of Business and Law*, 6(1), 90-110. <https://doi.org/10.5200/1822-9530.2011.05>
- Bourke, P. (1989). Concentration and Other Determinants of Bank Profitability in Europe, North America and Australia. *Journal of Banking and Finance*, 13, 65-79. [https://doi.org/10.1016/0378-4266\(89\)90020-4](https://doi.org/10.1016/0378-4266(89)90020-4)
- Bushman, R., Piotroski, J., & Smith, A. (2004). What determines corporate transparency? *Journal of Accounting Research*, 42(2), 207e252. <https://doi.org/10.1111/j.1475-679X.2004.00136.x>
- Canova, F., & Ciccarelli, M. (2013). *Panel vector autoregressive models: a survey*, ECB. Working Paper, No. 1507, European Central Bank (ECB), Frankfurt. [https://doi.org/10.1108/S0731-9053\(2013\)0000031006](https://doi.org/10.1108/S0731-9053(2013)0000031006)
- Chadewitz, H., & Blevins, D. (1998). Major determinants of interim disclosures in an emerging market. *American Business Review*, 16, 41-55.
- Chen, Q., Goldstein, I., Huang, Z., & Vashishtha, R. (2022). Bank transparency and deposit flows. *Journal of Financial Economics*, 146(2), 475-501. <https://doi.org/10.1016/j.jfineco.2022.07.009>
- Chen, Y., & Hasan, I. (2006). The transparency of the banking system and the efficiency of information-based bank runs. *Journal of Financial Intermediation*, 15(3), 307-331. <https://doi.org/10.1016/j.jfi.2006.01.001>
- Cordella, T., & Yeyati, E. L. (1998). Public Disclosure and Bank Failures. *International Monetary Fund Staff Papers*, 45(1). <https://doi.org/10.2307/3867331>
- Cordella, T., & Yeyati, E. L. (2002). Financial opening, deposit insurance, and risk in a model of banking competition. *European Economic Review*, 46(3), 471-485. [https://doi.org/10.1016/S0014-2921\(01\)00150-7](https://doi.org/10.1016/S0014-2921(01)00150-7)
- Daher, H., Mansur, M., & Mansor, I. (2015). The Unique Risk Exposures of Islamic Banks, Capital Buffers: A Dynamic Panel Data Analysis. *Journal of International Financial Markets, Institutions and Money*, 36, 36-52. <https://doi.org/10.1016/j.intfin.2015.02.012>
- Diamond, D., & Verrecchia, R. (1991). Disclosure, liquidity and cost of capital. *The journal of finance*, 46(4), 1325-1359. <https://doi.org/10.1111/j.1540-6261.1991.tb04620.x>
- Dietrich, A., & Wanzenried, G. (2014). The determinants of commercial banking profitability in low-, middle-, and high-income countries. *Q. Rev. Econ. Finance*, 54, 337-354. <https://doi.org/10.1016/j.qref.2014.03.001>
- Ekananda. (2022). The impact of global liquidity on macroeconomic and financial variables of selected Southeast Asian countries: a panel vector autoregression method. *Journal Ekonomi Dan Kebijakan Publik* 13(1), 57-70. <https://doi.org/10.22212/jekp.v13i1.2155>
- El-Chaarani H. (2019). Determinants of Bank Liquidity in the Middle East Region. *International Review of Management and Marketing*, 9(2), 64-75.

- Flannery, M., & Thakor, A. V. (2006). Accounting, transparency and bank stability. *Journal of Financial Intermediation*, 15, 281-284. <https://doi.org/10.1016/j.jfi.2006.05.001>
- Flannery, M., Hirtle Beverly, J., & Kovner, A. (2015). *Evaluating the information in the Federal Reserve stress tests*. Staff Report, N<sup>o</sup>. 744, Federal Reserve Bank of New York, New York, NY. <https://doi.org/10.2139/ssrn.2669837>
- Ghenimi, A., Hasna, C., & Omri, M. A. B. (2021). Liquidity Risk Determinants: Islamic vs Conventional Banks. *International Journal of Law and Management*, 63(1), 65-95. <https://doi.org/10.1108/IJLMA-03-2018-0060>
- Gorton, G., & Huang, L. (2002). *Banking Panics and the Origin of Central Banking*. NBER Working Paper No:9137, Cambridge, MAUS. <https://doi.org/10.3386/w9137>
- Greuning, H. V., & Iqbal, Z. (2008). *Risk analysis for Islamic banks, the international bank for reconstruction and development*. Washington, D.C: The World Bank.
- Grossmann, A., Inessa, L., & Alexei, G. O. (2014). The Dynamics of Exchange Rate Volatility: A Panel VAR Approach. *Journal of International Financial Markets, Institutions and Money*, 33, 1-27. <https://doi.org/10.1016/j.intfin.2014.07.008>
- Hellmann, T. F., K. C. Murdock, & J. E. Stiglitz, (2000). Liberalization, Moral hazard in banking, and prudential regulation: Are capital requirements enough? *American Economic Review*, 90(1), 147-165. <https://doi.org/10.1257/aer.90.1.147>
- Hirtle, B. (2007). *Public Disclosure, Risk, and Performance at Bank Holding Companies*. Federal Reserve Bank of New York Staff Report, n<sup>o</sup> 293, pp.1-43. <https://doi.org/10.2139/ssrn.1003219>
- Horváth, R., Seidle, J., & Laurent, W. (2012). *Bank Capital and Liquidity Creation: Granger Causality Evidence*. Institute for East and Southeast European Studies, 318. <https://doi.org/10.2139/ssrn.2178383>
- Hussain, A., Ploypailin, K., Bushra, M. I., & Fitim, D. (2022). Determinants of systematic and unsystematic liquidity risk in Islamic banks. *Journal of Islamic Monetary Economics and Finance*, 8(2), 325-40. <https://doi.org/10.21098/jimf.v8i2.1474>
- Jiang, B., Bruce, P., & Zhongmin, W. (2018). Macro Stress Testing in the Banking System of China. *Journal of Banking Regulation*, 19(4), 287-98. <https://doi.org/10.1057/s41261-017-0057-9>
- Kane, E. J. (1995). Three Paradigms for the Role of Capitalization Requirements in Insured Financial Institutions. *Journal of Banking & Finance*, 19, 431-459. [https://doi.org/10.1016/0378-4266\(94\)00132-M](https://doi.org/10.1016/0378-4266(94)00132-M)
- Kasana, E., Kshamta, C., & Bibhu, P. S., (2022). Investigation of Bank Liquidity of Macroeconomic and Bank-Specific Determinants – A Panel Data Approach. *The Economics and Finance Letters*, 9(2), 221-234. <https://doi.org/10.18488/29.v9i2.3125>
- Keeley, M. (1990). Deposit Insurance, Risk and Market Power in Banking. *American Economic Review*, 80, 1183-1200.
- Khammassi, I., Boufateh, T., & Naoui, K. (2020). Do Stress Tests Reduce Liquidity Risk Opacity? *American J. Finance and Accounting*, 6(2), 135-58. <https://doi.org/10.1504/AJFA.2020.110322>
- Khanal, S. (2019). Determinants of Liquidity in Commercial Banks of Nepal. *International Journal of Economics and Management Studies*, 6(8), 11-16. <https://doi.org/10.14445/23939125/IJEMS-V6I8P103>
- Klinger, D., & O. Sarig (2000). The Information Value of Bond Ratings. *Journal of Finance*, December, 2879-2902. <https://doi.org/10.1111/0022-1082.00311>
- Kuranchie-Pong, L., Bokpin, G. A., & Andoh, C. (2016). Empirical evidence on disclosure and risk-taking of banks in Ghana. *Journal of Financial Regulation and Compliance*, 24(2), 197-212. <https://doi.org/10.1108/JFRC-05-2015-0025>
- Laeven, L., & Levine, R. (2009). Bank governance, regulation and risk taking. *Journal of Financial Economics*, 93, 259-275. <https://doi.org/10.1016/j.jfineco.2008.09.003>
- Leuz, C., & R. Verrecchia. (2000). The Economic Consequences of Increased Disclosure. In “Studies on Accounting Information and the Economics of the Firm,” supplement. *Journal of Accounting Research*, 38, 91-124. <https://doi.org/10.2307/2672910>
- Linsley, P. M., & Shrivess, P. J. (2006). Risk reporting: a study of risk disclosures in the annual reports of UK companies. *British Accounting Review*, 38, 387-404. <https://doi.org/10.1016/j.bar.2006.05.002>

- Louzis, D. P., Vouldis Angelos, T., & Metaxas, V. L. (2012) Macroeconomic and bank-specific determinants of non-performing loans in Greece: a comparative study of mortgage, business and consumer loan portfolios. *J. Bank. Finance*, 36(4), 1012-1027. <https://doi.org/10.1016/j.jbankfin.2011.10.012>
- Manganaris, P., Elena Beccalli, B. C., & Panagiotis, D. (2017). Bank transparency and the crisis. *The British Accounting Review*, 49(2), 121-137. <https://doi.org/10.1016/j.bar.2016.07.002>
- Nelson, P. J. (2001). Transparency Mechanisms at the Multilateral Development Banks. *World Development*, 29(11), 1835-1847. [https://doi.org/10.1016/S0305-750X\(01\)00073-0](https://doi.org/10.1016/S0305-750X(01)00073-0)
- Nier, E. W., & Baumann, U. (2006). Market Discipline, Disclosure and Moral Hazard in banking. *Journal of Financial Intermediation*, 15, 332-361. <https://doi.org/10.1016/j.jfi.2006.03.001>
- Nier, E.W. (2005). Bank Stability and Transparency. *Journal of Financial Stability*, 1, 342-354. <https://doi.org/10.1016/j.jfs.2005.02.007>
- Patra, B., & Puja, P. (2022). Resilience of Indian Banks: Macroeconomic Stress Test Modeling for Credit Risk. *Journal of Public Affairs*, 22(1). <https://doi.org/10.1002/pa.2350>
- Perrini, F., Pogutz, S., & Tencati, A. (2006). Corporate Social Responsibility in Italy: State of the Art. *Journal of Business Strategies*, 23(1), 65-91. <https://doi.org/10.54155/jbs.23.1.65-91>
- Putu, I., Sanjaya, S., & Young, L. (2012). Voluntary disclosure and earnings management at companies listed in Indonesia stock exchange. *USA Business Review*, 6(1), 361-395.
- Roman, A., & Sargu, A. C. (2015). The impact of bank-specific factors on the commercial banks liquidity: Empirical evidence from CEE countries. *Procedia Economics and Finance*, 2, 571-579. [https://doi.org/10.1016/S2212-5671\(15\)00110-0](https://doi.org/10.1016/S2212-5671(15)00110-0)
- Salas, V., & Saurina, J. (2002). Credit Risk in Two Institutional Regimes: Spanish Commercial and Savings Banks. *Journal of Financial Services Research*, 22, 203-224. <https://doi.org/10.1023/A:1019781109676>
- Shah, S. Q. A., Imran, K., Syed, S. A. S., & Muhammad, T. (2018). Factors Affecting Liquidity of Banks: Empirical Evidence from the Banking Sector of Pakistan. *Colombo Business Journal*, 9(1), 1. <https://doi.org/10.4038/cbj.v9i1.20>
- Shank, C. A., & Andre, C. V. (2016). Are US-Dollar-Hedged-ETF Investors Aggressive on Exchange Rates? A Panel VAR Approach. *Research in International Business and Finance*, 38, 430-38. <https://doi.org/10.1016/j.ribaf.2016.05.002>
- Srairi, S. (2013). Ownership structure and risk-taking behavior in conventional and Islamic banks. *Borsa Istanbul Review*, 13, 115-127. <https://doi.org/10.1016/j.bir.2013.10.010>
- Tadesse, S. (2006). The economic value of regulated disclosure: Evidence from the banking sector. *Journal of Accounting and Public Policy*, 25(1), 32-70. <https://doi.org/10.1016/j.jaccpubpol.2005.11.002>
- Taleblo, R., Mohajeri, P., Mohammadi, T., & Khodkari, L. (2022). Stress test of Liquidity risk in Iran's banking system: Calculating of loss distribution of banks liquidity risk with Monte Carlo simulation method. *Stable Economy Journal*, 3(2), 1-35.
- Wang, Z., Chen, J., Wan, Y., Jin, Y., & Mazzanti, J. A. (2015). Information disclosure and bank risk-taking under a partially implicit deposit insurance system: Evidence from China. *The Australian Economic Review*, 48(2), 163-176. <https://doi.org/10.1111/1467-8462.12114>
- Yorulmazer, T (2003). *Herd behavior, bank runs and information disclosure*. Working paper, New York University. <https://doi.org/10.2139/ssrn.587481>



# Corporate Governance and Operational Performance of Banks in the MENA Region

Khodor Trad<sup>1</sup>

<sup>1</sup> Al Jinan University, Tripoli, Lebanon

Correspondence: Khodor Trad, Al Jinan University, Tripoli, Lebanon, Zaytoun Abi-Samra, P.O.Box: 818. Tripoli, Lebanon. E-mail: khodor.mtrad@hotmail.com

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## Abstract

This article aims to study the impact of corporate governance on the performance of banks operating in the MENA region over the period 2009-2020. The results, obtained using the maximum likelihood method and the system generalized method of moments (system-GMM), show that the size of the board of directors, CEO-chairman role duality, ownership concentration and the presence of remuneration and nomination committees have a significant impact on the performance of banks in MENA countries. In addition, the empirical results revealed that bank size, credit risk, capitalization ratio, economic growth and the quality of the institutional environment are indeed explanatory factors of bank performance. Our findings provide useful information to regulatory authorities to improve the governance mechanisms of banks in the MENA region.

**Keywords:** corporate governance, banking efficiency, MENA region

## 1. Introduction

The theoretical and empirical literature on corporate governance is large, nonetheless, bank governance in particular remained limited until the emergence of the 2007-8 international financial crisis, where bank management became under question (Salim et al., 2016; Safiullah and Shamsuddin, 2019; Bhatia and Gulati, 2021; Safiullah, 2021, as the practices of bank governance have been the reason behind the crisis, and the excessive race for financial profitability, initiated by banks, led to excessive risk-taking. The interest in this topic centers on good governance, where bank shareholders try to identify an adequate system of economic control beneficial to all stakeholders. Although corporate governance is constantly the subject of interest of several researchers, the impact of the structure of governance on banking performance has been discussed only recently. King and Levine (1993) and Levine (1998) show that banks play a dominant role in financial systems as engines of economic growth, and banks in most countries are an essential source of financing for businesses.

Our research analyzes the impact of two internal governance mechanisms, represented by board composition and ownership structure, on the productive, economic and financial performance of banks in the MENA region. The empirical literature focuses on the indicators used to measure banking performance (Dong et al., 2017; Herkin et al., 2020; Bhatia and Gulati, 2021; Safiullah, 2021). The first two indicators are based on two ratios to measure performance: return on assets (ROA) and return on equity (ROE). On the other hand, a third indicator uses the productive frontier techniques to measure the performance of banks using cost efficiency. In this aspect, several studies have been performed in various contexts around the world and specifically in developed countries and have significantly contributed to the explanation of the relationship between corporate governance and bank performance (Staikouras et al., 2007; Pathan et al. al., 2007; Salim et al., 2016; Safiullah and Shamsuddin, 2019; Gupta et al., 2022). However, we note that such research is rare in emerging countries and more particularly in the banking sectors of MENA countries (Ghosh, 2018). The objective of this paper is therefore, to study the impact of the determinants of the performance of banks in the MENA region over the period 2009-2020. The interest of the article is threefold. First of all, while the majority of research focuses on the banking sectors of developed countries, our article is specifically interested in studying the impact of banking governance and control variables on the banking sectors of the MENA region. Secondly, to our knowledge, no study has been carried out in this regard within the framework of banks operating in the MENA region. Finally, most research on the impact of governance and specific factors on performance uses traditional indicators based on the ratios method to measure performance, whereas in our study we use the stochastic cost frontier technique to quantify

the performance of banks, which presents the advantage of simultaneously measuring individual distances from the efficiency frontier due to the effect of a certain number of variables governance, the individual behavior of each bank and the environment in which banks operate.

The remaining of the article is as follows. Section 2 highlights the review of the literature on the relationship between corporate governance and bank performance. In section 3, we present the methodology and the selection of variables used in the econometric analysis. Section 4 highlights the dataset. Section 5 presents and analyzes the obtained results. Robustness tests are included in Section 6. Finally, Section 7 includes the conclusion and the policy recommendations.

## **2. Literature Review**

The 2007-8 financial crisis revealed a number of inadequacies in the governance of financial institutions. However, few studies have empirically analyzed the consequences of governance mechanisms on bank performance. By aligning the interests of managers with those of shareholders, governance mechanisms are likely to improve company performance (Jensen and Meckling, 1976). In addition, the board of directors plays a crucial role in the effectiveness of the internal control system (Jensen, 1993). However, the weakness of company's internal control system can cause financial difficulties. Many authors (e.g. Sok-Gee et al., 2016; Salim et al., 2016; Dong et al., 2017; Harkin et al., 2020; Bhatia & Gulati, 2021) have studied the link between corporate governance and performance of banks and confirm that the characteristic variables of governance have a significant impact on the performance of banks.

Certain number of governance variables are measured and compared in our analysis, mainly relating to the characteristics of the board of directors and the internal dimension of governance. In the following, we shed light on these variables and their impact on bank performance, as found by the literature.

### *2.1 The Size of the Board of Directors*

Jensen (1993) argues that a board of a reasonable size (seven to eight members) would be more effective because it would allow better coordination, faster decisions and a reduction in agency costs. Salim et al. (2016) reveal the existence of a positive relationship between the board of directors and the efficiency of banks. On the other hand, Staikouras et al. (2007) and Pathan et al. (2007) found that board size negatively affects bank performance. In the same vein, Dong et al. (2017) show that the size of the board of directors has a negative effect on the cost efficiency and profit efficiency of Asian banks. In contrast, Mishra and Nielsen (2000), Zulkafli and Sumad (2007) and Bektas and Kaymak (2009) do not find a significant effect of the size of the board of directors on the profitability of banks.

### *2.2 The Role Duality*

The separation of management and control functions can also be considered as a determining factor in the performance of banks. Based on the Agency Theory, Jensen (1993) states that the accumulation of functions emphasizes agency costs and weakens the effectiveness of the board of directors and, therefore, reduces firm performance. Empirical studies show that this combination of functions has indeed a negative impact on the effectiveness of the board of directors as well as on the performance of the company (Agrawal and Knoeber, 1996). Similarly, according to the Organizational Theory, multiple roles strengthen the leadership of senior management. Based on this theory, Pi and Timme (1993) and Wang et al. (2012) conclude that in the case of combination of CEO and Chairperson roles, banks become less profitable and less efficient. They explain that the consolidation of control and decision-making functions aggravates conflicts of interest and therefore, weakens the performance of banks. This result is confirmed by Grove et al. (2011), Mollah and Zaman (2015), Dong et al. (2017) and Sarkar and Sarkar (2018) who find that duality negatively affects performance. On the other hand, other studies have shown that duality can have a positive effect on banking performance (e.g. Mamatzakis and Bermpei, 2015; Harkin et al., 2020).

### *2.3 Gender Diversity and the Presence of Women on the Board of Directors*

Several studies have highlighted the impact of gender diversity on boards of directors, essentially by detecting the association between the percentage of women board members and bank performance. The results of such research are mixed. Some studies show that the higher gender diversity has significantly positive relationship with bank performance (Mahadeo et al., 2012; Ryan and Haslam, 2005; Carter et al., 2003; Erhardt et al., 2003; Gulamhussen and Santa, 2015; Dong et al., 2017). In contrast, others find the opposite and show a negative effect of gender diversity on performance (Kramaric and Pervan, 2016; Ahem and Dittmar, 2012; Adams and Ferreira, 2009) or even no significant relationship (Carter et al., 2010; Mamatzakis and Bermpei, 2015; Pletzer et al., 2015).

#### 2.4 The Existence of a Nomination and Remuneration Committee

The nomination and remuneration committee is an internal body formed of non-executive members with a good knowledge of the specificities of the company's activity and have the objectivity and freedom of judgment necessary to carry out their missions. This committee helps the governance body to implement an appropriate incentive and transparent wages policy for the company's senior executives and employees. Laing and Weir (1999) demonstrated that the existence of a remuneration committee positively affects the performance of British firms during the period 1992-1995. Along the same lines, Dalton et al. (1998) showed that the establishment of various committees within the board of directors, such as the remuneration and nomination committee, will improve performance. In contrast, Wei Leong et al. (2015), find a negative and significant impact of the existence of this committee on the return on assets of Malaysian listed companies during the period 2010-2012.

#### 2.5 Ownership Concentration

The concentration of ownership is a guarantee of effective control of management by shareholders (Shleifer and Vishny, 1986; Agrawal and Mandelker, 1990; Bethel and Liebeskind, 1993; Agrawal and Knoeber, 1996). Indeed, shareholders holding a significant proportion of a firm capital have interest in investing in controlling the management of the bank and in limiting the risk of discretionary behavior by managers (García-Herrero et al., 2009; Dong et al. 2014; Bian and Deng, 2017). However, at high levels of concentration, the positive effect of this alignment mechanism diminishes and the high concentration gives rise to another agency conflict between majority and minority shareholders (Villalonga and Amit, 2006). In this regard, García-Herrero et al. (2009) and Lin and Zang (2009) showed that when ownership concentration is high, banks become less efficient and tend to take on more risk. Finally, other studies revealed the existence of a non-significant relationship between ownership concentration and bank performance (Iannotta et al., 2007; Ben Slama and Boulila, 2014).

### 3. Variables Selection and Empirical Methodology

#### 3.1 Definitions and Measurements of Variables

##### 3.1.1 The Dependent Variable: Bank Performance

Performance can be measured using market indicators that use the stock price (e.g. Market-to-Book Ratio, Price Earnings Ratio, Stock Return, etc.). Unfortunately, market data for the majority of MENA banks are not available. Hence, we resorted to using, following Harkin et al. (2020), accounting data, and in particular, return on assets (ROA) and return on equity (ROE), to measure economic and accounting performance, in addition to cost efficiency to measure the productive performance of banks in MENA countries.

Therefore, we use in this study ROA and ROE, which are considered as the most popular ratios used to measure the operational performance of firms. The return on assets ratio shows the ability of management to acquire deposits at a reasonable cost and invest them in profitable investments (Simpson and Kohers, 2002), while the return on equity ratio expresses the ability of capital invested by shareholders to generate a certain level of profit (Hopkins et al., 1997).

Ratio analysis has the advantage of being very easy to implement. Nonetheless, this method poses a problem insofar as it is based on a single production factor. Concerning the cost efficiency indicator (CE), the use of production frontier techniques, and more precisely the data envelopment analysis (DEA) method resulting from Linear programming – initially developed by Charnes et al. (1978) and developed by Banker et al. (1984) – allows measuring the technical efficiency, the allocative efficiency, and the cost efficiency of the decision-making unit (banks in our case). More precisely, this method measures the efficiency of a bank from an empirical perspective by calculating the difference separating the point representing the values of the observed inputs and outputs relative to a hypothetical point on the production frontier. In this way, we can estimate the degree of efficiency of each bank in relation to this frontier, which determines the best practices. In other words, each bank is referenced in relation to efficient banks and provided with an efficiency score with a value ranging between 0 and 1.

The advantage of the DEA method is that it allows taking into account several inputs to produce several outputs in order to calculate the cost efficiency of banks. Nevertheless, the disadvantage of this method is that the calculated inefficiencies do not have statistical properties. They are obtained with sensitivity to the presence of “classic hazards”, and the sensitivity to measurement errors and outliers, which can, if necessary, serve as “peers” in the calculation and calibration of the performances of the sample.

Other methods can be used to measure bank performance such as the stochastic cost frontier technique. This method allows taking into account the unexplained variations in the data, while imposing a functional form of the production technology, which makes the calculation of cost efficiency somehow sensitive to the technology

adopted (Cobb-Douglas type function, translogarithmic boundary, etc.). The advantage of the stochastic approach is that it allows decomposition of the error term into two components. The first represents the random term, which allows considering measurement errors, specifications and randomness that could affect the production process. The other component represents the effects of technical inefficiency in the production process. These latter terms are assumed by Aigner et al. (1977) interdependent and identically distributed according to an exponential or semi-normal distribution. These distributions have been criticized because they arbitrarily restrict the average of inefficiency effects to zero. Consequently, some economists have proposed other alternative distributions. For instance, Stevenson (1980) suggested a truncated normal distribution, while Greene (1980) proposed a gamma distribution. Battese and Coelli (1995) developed their famous stochastic frontier model, which takes into account the effects of firm-specific and environmental variables on cost inefficiency. In this article, we will use this model to estimate a stochastic cost frontier with cost inefficiency effects.

The production technology is that of a Translog type cost function similar to that adopted by Mester (1996), Berger and Mester (1997) and Maudos et al. (2002) can be formulated as follows:

$$\ln TC_{it} = \ln TC(y_{it}, w_{it}) + v_{it} + u_{it} \quad (1)$$

Where  $TC_{it}$  represents the total cost of bank  $i$  at time  $t$ ;  $y_{it}$  denotes a  $(1 \times k)$  vector of outputs produced by bank  $i$  at time  $t$ ;  $w_{it}$  represents a  $(1 \times k)$  vector of prices of inputs used in the production process by bank  $i$  at time  $t$ . The terms  $v_{it}$  are assumed to be independent and identically distributed according to  $N(0, \sigma_v^2)$ . The terms  $u_{it}$  represents cost inefficiency and are assumed to be independent and distributed according to a normal distribution truncated at zero with a mean  $\mu_{it}$  and a variance  $\sigma_u^2(N(\mu_{it}, \sigma_u^2))$ . Under these assumptions, the average of the cost inefficiency,  $\mu_{it}$ , is expressed as follows:  $\mu_{it} = Z_{it}\delta + \varepsilon_{it}$ , where  $Z_{it}$  is a vector of bank-specific variables expected to influence their cost efficiency,  $\delta$  is a  $(m \times 1)$  vector of unknown parameters to be estimated, and  $\varepsilon_{it}$  represents the random error terms. Consequently, the stochastic cost function can be written as follows:

$$\begin{aligned} \ln(TC_{it}) = & \alpha_0 + \sum_{i=1}^3 \beta_i \ln(y_{it}) + \sum_{j=1}^3 \eta_j \ln(w_{j,it}) + \frac{1}{2} \sum_{k=1}^3 \sum_{l=1}^3 \phi_{kl} \ln(w_{k,it}) \ln(w_{l,it}) + \\ & \frac{1}{2} \sum_{i=1}^3 \sum_{m=1}^3 \ln(y_{it}) \ln(y_{mt}) + \sum_{k=1}^3 \theta_{ij} \ln(w_{it}) \ln(w_{jt}) + v_{it} + u_{it} \end{aligned} \quad (2)$$

To define the activity of banks in the MENA region, we adopt the intermediation approach proposed by Sealey and Lindley (1977) which, unlike the production approach, assumes that banks transform short-term resources into long-term assets such as loans, using labor, physical capital and financial capital. Based on Berger and Master (1997), Turk-Ariss (2010), and Rakshi and Bardhan (2022), three outputs are used to define the production activity: total earning asset ( $y_1$ ), other earning asset ( $y_2$ ) and off-balance sheet activities ( $y_3$ ). These three outputs are realized from the use of three inputs, namely: interest expenses, personnel expenses, and administrative expenses. The prices of these three inputs are: the price of financial capital measured by the interest expenses to consumer deposits ratio ( $w_1$ ); the price of the labor factor is approximated by personnel expenses to total assets ratio ( $w_2$ ); and the price of physical capital measured by administrative expenses to total assets ratio ( $w_3$ ). Finally, the total cost ( $TC$ ) is measured by the sum of general expenses and interest expenses.

### 3.1.2 The Independent Variables: Corporate Governance Variables

In order to determine the impact of governance on the performance of banks in the MENA region, we follow Pathan et al. (2007), Adam and Mehran (2012), Dong et al. (2017), Sarkar and Sarkar (2018), and Bhatia and Gulati (2021) for the selection of governance variables.

#### 3.1.2.1 Board Size (BOS)

Board size is measured by the total number of directors. This variable has been used by Pathan (2007), Dong et al. (2017), and Sarkar and Sarkar (2018).

#### 3.1.2.2 CEO Duality (DUA)

This variable considers whether the positions of CEO and chairman of the board of directors are combined or not. In this study, we use a dummy variable, which takes the value 1 in the case of a combination of the two functions, zero otherwise. This variable has been used by Simpson and Gleason (1999), Adam and Mehran (2012), and

Bhatia Gulati (2021).

### 3.1.2.3 The Existence of a Nominations and Remuneration Committee (NRC)

The existence of a remuneration and nominations committee is measured by a dummy variable taking the value 1 in case of the presence of such committee, zero otherwise (Agyemang-Mintah, 2016; Harkin et al., 2020).

### 3.1.2.4 Gender Diversity/the Proportion of Women Board Members (WOM)

Based on Dong et al. (2017), Harkin et al. (2020), and Bhatia and Gulati (2021), we define gender diversity as the proportion of female board members among total number of board members.

### 3.1.2.5 Ownership Concentration (OWN)

As indicated above, some studies have found a positive impact of the presence of major shareholders on performance, while other research have concluded no relationship between ownership concentration and bank performance. Ownership concentration is measured by the proportion of shares held by the three largest shareholders (Ozili and Uadiale, 2017; Dong et al., 2017; Abid et al., 2021; Gupta et al. 2022).

## 3.1.3 Specific and Environmental Control Variables

We also introduce in the translogarithmic cost function specific and environmental control factors that may affect the productive performance of banks in the MENA region. These are the following.

### 3.1.3.1 Bank Size (SIZE)

As in Harkin et al. (2020), Safiullah (2021), we introduce into the estimated specification a variable reflecting the size of the bank assets. This variable, measured by the natural logarithm of asset size, allows verifying the existence of economies of scale in the case of the banking sectors of the MENA region (Akhavain et al., 1997; Azorfa and Santamaria, 2011).

### 3.1.3.2 Bank Capital Ratio (BCR)

The capital ratio is also adopted to take into account the effect of banking regulations on the performance of banks. Following Lee and Hsieh (2013), Tan and Floros (2013), and Rakshit and Bardhan (2022), we define the capital ratio by the total equity to total assets ratio.

### 3.1.3.3 Credit Risk (NPL)

Based on Fiordelisi et al. (2011), Phan et al. (2019), and Rakshit and Bardhan (2022), we integrate into the cost frontier a variable reflecting the risk taking by banks in the MENA region. This variable is measured by the ratio of non-performing loans to total loans granted by banks.

### 3.1.3.4 Macroeconomic and Institutional Variables

Three variables are used in our empirical model to take into account the macroeconomic and institutional environment. Based on Fang et al. (2014), Addo et al. (2021), and EL Moussawi and Mansour (2021), we include the growth rate of the economy (GDPG), the control of corruption variable (COCR) and the quality of regulation variable (REQ).

Table 1. Description of the exploited variables

Variable	Description	Sources
Dependent variables		
Bank cost efficiency (CE)	Estimation d'une fonction de coût de type translog	Orbis Bank Focus - Author's Calculation
Return on Asset (ROA)	Net Income to total asset	Orbis Bank Focus - Author's Calculation
Return on Equity (ROE)	Total equity to net income	Orbis Bank Focus - Author's Calculation
Board governance variables		
Board size (BSZ)	The total number of directors on the board	Bank Annual Reports
Women on board (WOM)	The proportion of female directors on the board	Bank Annual Reports
CEO/Chairman duality (DUA)	A dummy variable taking the value of 1 if the CEO and the chairman of the board is the same person, and 0 otherwise	Bank Annual Reports
The existence of a nomination and remuneration committee (NRC)	A dummy variable taking the value of 1 in the existence of a nomination and remuneration committee, zero otherwise.	Bank Annual Reports
Ownership concentration (OWN)	A dummy variable taking the value of 1 if	Bank Annual Reports

	the biggest shareholder has more than or equal to 3% of total ownership and 0 otherwise				
Capital adequacy ratio (BCR)	Bank and country level characteristics Ratio of total equity to total asset	Orbis	Bank	Focus	- Author's Calculation
Non-performing loans (NPL)	Ratio of non-performing loans to gross loans	Orbis	Bank	Focus	- Author's Calculation
Bank size (SIZE)	Natural logarithm of total assets of a bank	Orbis	Bank	Focus	- Author's Calculation
GDP Growth Rate (GDPG)	Annual GDP growth rate	World Bank Financial Indicators			
Control of corruption (COCR)	Control of corruption index measures the ability of the government and public officials to control corruption in public services, which includes the corruption level between the public administration and citizens, businesses and foreign companies.	World Bank Governance Indicators			
Regulatory quality (REQU)	Regulatory quality captures the quality of the government in formulating and implementing sound policies and regulations to promote private sector development	World Bank Governance Indicators			

### 3.2 The Empirical Methodology

Following Battese and Coelli (1995), Kumbhakar et al. (2014) and Huljak et al. (2019), we use the Maximum Likelihood method to estimate the parameters of the stochastic frontier model and those relating to the cost inefficiency model, which allows determining the impact of bank governance variables and the other control variables on the performance of banks operating in the MENA region. For robustness tests, we employ the system-GMM technique to determine the relationship between governance and control variables on one hand, and bank performance measured by the ROA and ROE variables.

Nickell (1981) showed that the estimation of a dynamic model on a panel dataset using the Ordinary Least Squares (OLS) and the Least Squares Dummy Variable (LSDV) estimators is biased when N is large and T is fixed because the endogenous variable is correlated with the error term. As Bond (2002) points out, the estimate of the coefficient of the lagged variable is biased upwards for the OLS estimator and downwards for the LSDV estimator. Since Nickell's (1981) article, the econometric literature has developed numerous consistent estimators that use the methods of instrumental variables (Anderson and Hsiao, 1982) and generalized moments (Arellano and Bond, 1991; Blundell and Bond, 1998).

There are two types of GMM estimators for dynamic models on panel dataset, namely: the difference GMM estimator and the system GMM estimator. The first estimates the model in first difference using as instruments the variables in level, while the second estimates a system of equations both in first difference and in level using as instruments in the equations in level, and the first differences of the shifted variables. As shown by Blundell and Bond (1998), when the data are highly persistent and the number of periods is small, the difference GMM estimator provides poor estimates because under these conditions the level-lagged variables constitute weak instruments. Blundell and Bond (1998) show the superiority of the system GMM estimator in this case. Thus, to estimate our model, it is better to adopt a system GMM estimator rather than with a difference GMM estimator due to the specificities of our sample.

## 4. Data

The objective of the study is to analyze and compare the impact of governance and other control variables on the performance of banks operating in the MENA countries over the period 2009-2020. The used dataset includes 150 commercial banks. The bank level data are extracted from the Orbis Bank Focus database, published by Bureau van Dijk and from banks' annual reports. On the other hand, the macroeconomic variables are obtained from the World Bank database. Table 2 presents some descriptive statistics of the variables included in our study.

Table 2. variables descriptive statistics

	Mean	Median	Maximum	Minimum	Std. Dev.	Coef. Of Variation	Observations
SIZE	15.84	15.81	23.79	11.98	1.59	0.10	1789
ROA	0.01	0.01	0.09	-0.11	0.01	0.99	1789
ROE	0.09	0.10	0.66	-4.52	0.18	1.93	1789
BCR	0.12	0.11	0.82	0.02	0.06	0.50	1789
NPL	0.07	0.05	0.56	0.01	0.10	1.43	1789
CEF	0.62	0.62	1.00	0.03	0.24	0.39	1789
BOS	9.68	10.00	18.00	3.00	2.31	0.24	1789
DUA	0.17	0.00	1.00	0.00	0.37	2.24	1789
WOM	0.09	0.08	1.50	0.00	0.13	1.46	1789
OWN	0.74	0.79	1.00	0.05	0.26	0.35	1789
NRC	0.75	1.00	1.00	0.00	0.44	0.58	1789
GDPG	0.04	0.01	0.10	-0.21	0.08	1.99	1789
CORP	-0.37	-0.15	1.57	-1.15	0.63	-1.73	1789
REQ	0.19	0.05	1.43	-1.30	0.40	2.04	1789

Source: Orbis Bank Focus data and author calculation.

## 5. Empirical Results

The values of the coefficients estimated by the maximum likelihood method of the stochastic cost frontier model are presented in Table 3. Note that we run several regression models in order to test the impact of different combinations of explanatory variables on the dependent variables.

As shown in Table 3, the value of the variance and its level of significance ( $P < 0.01$ ) suggest that the effects of cost inefficiency are largely significant in explaining the level and the variation in the banking costs. Thus, the traditional OLS cost function, without taking into account the explanatory factors, is not the appropriate representation of the data used in the different estimated specifications. These results therefore, indicate that the specific and the environmental variables of banking firms included in the cost inefficiency model together explain the level of cost efficiency observed during the period of the study. In addition, the results show in all presented estimations the absence of dependence of the error terms between the banks in our sample (Pesaran, 2015).

Regarding the impact of the explanatory variables on bank performance, we observe the following. The results show that the negative sign of the coefficient of the size of the board of directors is in line with the predictions of the agency theory supporting the argument that larger boards would possibly create conflicts of interest between directors and shareholders. This presents a greater potential for disagreement and lack of coordination in management decisions (Simpson and Gleason, 1999). Indeed, our results show that increasing the size of the board of directors implies a decline in performance. Consequently, a large board size increases conflicts within the board, which promotes an increase in control costs, and thus deteriorating performance. The result of our study is consistent with Staikouras et al. (2007), Pathan et al. (2007) and Dong et al., (2017).

Table 3. The impact of corporate governance on bank cost efficiency – method: Maximum Likelihood

	1	2	3	4	5	6	7	8	9
Intercept	0.217***	0.204***	0.238***	0.247***	0.213***	0.274***	0.251***	0.249***	0.211***
BOS	-0.008**	-0.008**	-0.007**	-0.007**	-0.008**	-0.011**	-0.007**	-0.006**	-0.008**
WOM	-0.039		-0.028	-0.036	-0.033	-0.019	-0.005		
DUA		-0.007**	-0.009**	-0.009**	-0.003*			-0.005*	-0.007**
NRC		0.052**	0.067**	0.057**	0.061**			0.059**	0.063**
OWN		-0.059**	-0.064***	-0.055***	-0.073***			-0.016	-0.039**
BCR	0.065**	0.049*	0.081**	0.066**	0.047*	0.058*	0.065**	0.065**	0.057*
NPL	-0.037*	-0.019	-0.021*	-0.007	-0.009	0.008	-0.093**	-0.016	-0.087**
SIZE	-0.019**	-0.029**	-0.037***	-0.033***	-0.028**	-0.041***	-0.037***	-0.036***	-0.017*
GDPG	0.091**	0.0715**	0.092***	0.097***	0.115***	0.068**	0.073**	1.015***	0.085***
CORP				0.0057**		0.0049**		0.027**	
REQ					0.0038**		0.0025**		0.0018
$\sigma^2$	0.198***	0.145***	0.138***	0.159***	0.162***	0.183***	0.149***	0.145***	0.140***
$\gamma$	0.726***	0.602***	0.591***	0.647***	0.642***	0.69***	0.723***	0.598***	0.586***
N ° Obs	1789	1789	1789	1789	1789	1789	1789	1789	1789
Cross-Section Independence Test									
	205.90	204.98	204.78	206.73	205.14	207.07	206.83	206.82	205.35

Notes: \*\*\*, \*\*, \* denote statistically significant 1%, 5% and 10% levels respectively. t-statistics in parentheses.

We observe that the coefficients of the variable concerning the presence of female directors on the board of directors are negative but insignificant in all the estimated specifications. In other words, the presence of women on boards of directors does not improve nor deteriorate the performance of banks in the MENA region. This result highlights the failures of heterogeneous boards of directors and confirm the results those of Adams and Ferreira (2009) and Harkin et al. (2020), which show that board gender diversity makes their governance practices stricter, but does not have a systematic positive effect on their cost efficiency.

Regarding duality, our results reveal the existence of a negative and significant relationship in all estimated specifications. Thus, this result is in line with those of Pi and Timme (1993), Dong et al. (2017) and Safiullah (2021) and those arising from the agency theory (Jensen, 1993), suggesting that duality amplifies agency costs (specifically, impartiality of control, ambiguity of responsibilities, conflicts of interest, imbalance of power, asymmetry of information, etc.) and weakens the effectiveness of the board of directors and thus reduces efficiency.

As for the presence of a nomination and remuneration committee, the results show a positive and significant impact on the cost efficiency of banks in MENA countries. This result is consistent with Dalton et al. (1998) and Laing and Weir (1999) and indicates that the practice of good governance through the presence of a nomination and remuneration committee improves the cost efficiency of banks, because the presence of an independent nomination and remuneration committee allows implementing appropriate and transparent salary and incentive policy and generates a remuneration package based on profitability (Harkin et al., 2020; Bahatia and Gulati, 2021).

Our results show that the ownership concentration negatively affects the cost efficiency of banks in the MENA countries, which contradicts Jensen and Meckling (1976), Ozili and Uadiale (2017), and Gupta et al. (2022) who show that the greater the share of capital held by managers, the lower the divergence of interests between shareholders and managers will be. Indeed, when the interests of managers coincide firmly with those of shareholders, conflicts and therefore, agency problems is mitigated, and performance is improved. Nonetheless, our results reveal the existence of a negative relationship between ownership concentration and cost efficiency. This result can be explained by the fact that the concentration of shareholding is at the origin of divergence of interests and conflicts between majority shareholders and minority shareholders. Major shareholders, when are also managers, are accused of attributing private benefits at the expense of smaller shareholders. In these circumstances, the shareholding concentration can lead to a phenomenon of entrenchment of the controlling shareholder, detrimental to the performance of the bank (García-Herrero et al., 2008; Lin and Zang, 2009; Dong et al. 2017).

Concerning the specific and environmental control variables, the results of the different specifications show that these variables have a significant effect on cost efficiency. Specifically, bank size captures a negative and significant relationship in all estimated specifications. Thus, our results are consistent with those of Salim et al. (2016) and Rakshit and Bardhan (2022) and can be explained by the fact that production costs are higher in large banks compared to small and medium ones, which translates into pressure on the profitability of large banks and by a reduction in their cost efficiency.

Our results reveal the existence of a positive and significant relationship between the capital ratio and the cost efficiency of banks in MENA countries. This result is consistent with Berger and De Young (1997) and Fiordelisi et al. (2011) and reveals that the increase in capital should lead to a reduction in the incentive of banks to take excessive risks, which contributes to the reduction of non-performing loans and the improvement of bank performance. On the other hand, the results in Table 3 show the existence of a negative relationship between risk and cost efficiency of banks in MENA countries. This result is consistent with several empirical studies (e.g. Dong et al. 2017; Phan et al. 2019) and shows that banks with the highest operating costs also have the lowest level of efficiency and credit losses.

Our results show the existence of a positive association between the growth rate of the economy and the cost efficiency of banks. Thus, the improvement in the economic environment is translated into an improvement in the cost efficiency of banks in the MENA region, and is consistent with the work of Safiullah, and Shamsuddin (2019) and Dong et al. (2017).

Finally, we found out that the institutional quality variables are also relevant as they positively and significantly influence the efficiency of banks in the MENA region. Thus, low levels of corruption, improved transparency and stronger financial regulation and supervision are all factors that positively affecting the performance of banks operating in the MENA region. These results are in line with those of Sok-Gee and Mohd Zaini Abd (2016), Addo et al. (2021) and EL Moussawi and Mansour (2021), and suggest that a deterioration of the institutional environment discourages private investment, which increases costs for banks while increasing



uncertainty about the expected return on investment.

## 6. Robustness Test

In the following, several tests are performed to verify the stability of our results. We first replace the cost efficiency variable with ROA. The results included in Table 4, and obtained through the GMM-system method are very close to those obtained previously. Indeed, the results revealed the existence of a significant negative relationship between the size of the board of directors, function duality, and concentration of ownership on one hand, and bank performance measured by ROA on the other hand. Conversely, the coefficients associated with the variable WOM are insignificant. Finally, we note that the control variables bank specific and environmental variables are found to be explanatory factors of the performance of banks in MENA countries.

Table 4. The impact of corporate governance on Return on Asset (ROA)

	1	2	3	4	5	6	7
Intercept	0.159***	0.171***	0.155***	0.118***	0.168***	0.142***	0.118***
BOS	-0.005**	-0.003**	-0.006**	-0.09**	-0.005**	-0.009**	-0.005**
WOM	0.022	0.027	-0.019	-0.028			
DUA	-0.07**	-0.07**	-0.07*		-0.05*	-0.028*	-0.013**
NRC	0.059**	0.059**	0.066**		0.048**	0.048**	0.072**
OWN	-0.024**	-0.018**	-0.028**		-0.027**	-0.037	-0.041**
BCR	0.057**	0.044*	0.051*	0.049*	0.053**	0.053**	0.058*
NPL	-0.038**	-0.017	-0.015	-0.029**	-0.085**	-0.023**	-0.074**
SIZE	-0.041***	-0.029**	-0.036**	-0.035***	-0.042***	-0.033***	-0.028*
GDPG	0.046***	0.077***	0.081***	0.057**	0.052**	0.048***	0.075***
COCR		0.028**				0.032**	
REQU			0.041**				0.029**
Hansen Test	0.274	0.328	0.195	0.248	0.316	0.307	0.328
AR2 Test	0.557	0.553	0.483	0.382	0.573	0.621	0.552
Observations	1789	1789	1789	1789	1789	1789	1789
	Cross-Section Independence Test						
	87.94	88.19	88.85	87.48	88.14	88.42	89.31

Notes: \*\*\*, \*\*, \* denote statistically significant 1%, 5% and 10% levels respectively. t-statistics in parentheses.

Furthermore, we verified the stability of our results by replacing the dependent variable with ROE. Following these modifications, we observed that our results included in Table 5 remain stable. Finally, it is worth noting that the two models estimated by the system-GMM method give satisfactory econometric results. Firstly, the validation of the instruments used is confirmed by the Hansen test since the p-value of the test is greater than the 10% level, which indicates that the null hypothesis of non-correlation of the variables instrumental with the error terms is verified. Consequently, the used instruments are valid and the GMM-system estimator converges. This result is reinforced by the non-rejection of the null hypothesis of absence of a second-order autocorrelation of errors, which is deduced from the p-values of the AR2 test, which are greater than the 10 % level in all regressions performed.

Table 5. The impact of corporate governance on Return on Equity (ROE)

	1	2	3	4	5	6	7
Intercept	0.116***	0.137***	0.115***	0.132***	0.113***	0.157***	0.142***
BOS	-0.03**	-0.04**	-0.04**	-0.07**	-0.06**	-0.03**	-0.06**
WOM	0.006	0.004	-0.021	-0.007			
DUA	-0.054**	-0.062**	-0.051**		-0.029	-0.068**	-0.053**
NRC	0.044**	0.039**	0.071**		0.083**	0.057**	0.069**
OWN	-0.037**	-0.029**	-0.036**		-0.055**	-0.049	-0.051**
BCR	0.066**	0.057*	0.053*	0.068*	0.073**	0.077**	0.062*
NPL	-0.038**	-0.023*	-0.017	-0.029**	-0.048**	-0.048**	-0.034**
SIZE	-0.055**	-0.047**	-0.056**	-0.029**	-0.061***	-0.047**	-0.038*
GDPG	0.013	0.026**	0.033**	0.042**	0.028**	0.039**	0.046**
COCR		0.046**				0.061**	
REQU			0.029**				0.032**
Hansen Test	0.372	0.306	0.358	0.228	0.381	0.276	0.316
AR2 Test	0.417	0.472	0.504	0.467	0.593	0.483	0.447
Observations	1789	1789	1789	1789	1789	1789	1789
	Cross-Section Independence Test						
	75.91	81.17	83.22	77.49	82.32	80.12	78.35

Notes: \*\*\*, \*\*, \* denote statistically significant 1%, 5% and 10% levels respectively. t-statistics in parentheses.

## 7. Conclusion

This study aimed to examine the relationship between governance mechanisms and the performance of commercial banks in the MENA region over the period 2009-2020. More precisely, we studied the effect of board characteristics (board size, presence of women on the board, role duality, concentration of ownership, and presence of remuneration and nomination committees) on banking performance measured by cost efficiency, and two economic ratios, namely: ROE and ROA. The obtained results show, in accordance with expectations, that the size of the board and the combination of functions have negative effects on the performance of banks. On the other hand, the impact of the presence of women does not seem to have a significant impact on banking performance. Our results also show that the presence of a nominations and remuneration committee positively affects banking performance. On the other hand, our results revealed the existence of a negative relationship between function duality and bank performance. Finally, it has been found that the specific and environmental variables are indeed explanatory factors that shape the performance of banks in the MENA region.

The results obtained suggest that regulatory authorities must take into account governance mechanisms in the design of regulatory policies. In particular, regulators may maintain a maximum number of board members in order to reduce the lack of cooperation and harmonization among board members. Secondly, the combination of CEO and chairperson roles may be prohibited. Thirdly, a ceiling on the ownership concentration could be also enforced.

Finally, it should be noted that this study has some limitations, which pave the way for future research. In particular, it could be useful to examine the relationship between the governance framework and the stock performance of banks in the MENA region. Secondly, in addition to using ROE and ROA, it could have been useful adopting the net interest margin, which is specific for banking as a profitability measure. Similarly, the usage of adoption of tier 1 common equity-to-total assets could have been more appropriate as this ratio is more specific to banks.

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## References

- Abid, A. Gull, A., Hussain, N., & Nguyen, D. (2021). Risk governance and bank risk-taking behavior: Evidence from Asian banks. *Journal of International Financial Markets, Institutions & Money*, 75, 101466. <https://doi.org/10.1016/j.intfin.2021.101466>
- Adam, R., & Mehran, H. (2012). Bank Board Structure and performance: Evidence for Large Bank Holding Companies. *Journal of financial Intermediation*, 21, 243-267. <https://doi.org/10.1016/j.jfi.2011.09.002>
- Adams, R., & Ferreira, D. (2009). Women in the boardroom and their impact on governance and performance. *Journal of Financial Economics*, 94, 1291-1309. <https://doi.org/10.1016/j.jfineco.2008.10.007>
- Addo, K., Hussain, N., & Iqbal, J. (2021). Corporate Governance and the Systemic Risk: A Test of Bundling Hypothesis. *Journal of International Money and Finance*, 115, 102327. <https://doi.org/10.1016/j.jimonfin.2020.102327>
- Agrawal, A., & Knoeber, C. (1996). Firm performance and mechanisms to control agency problems between managers and shareholders. *Journal of Financial and Quantitative Analysis*, 31, 377-397. <https://doi.org/10.2307/2331397>
- Agrawal, A., & Mandelker, G. (1990). Large shareholders and the monitoring of managers, the case of antitakeover charter amendment. *Journal of Financial and Quantitative Analysis*, 25, 143-167. <https://doi.org/10.2307/2330821>
- Agyemang-Mintah, P. (2016). Remuneration Committee governance and firm performance in UK financial firms. *Investment Management and Financial Innovations*, 13, 176-190. [https://doi.org/10.21511/imfi.13\(1-1\).2016.05](https://doi.org/10.21511/imfi.13(1-1).2016.05)
- Ahern, K., & Dittmar, A. (2012). The changing of the boards: The impact on firm valuation of mandated female board representation. *Quarterly Journal of Economics*, 127, 137-197. <https://doi.org/10.1093/qje/qjr049>
- Aigner, J., Lovell, K., & Schmidt, P. (1977). Formulation and Estimation of Stochastic Frontier Production Models. *Journal of Econometrics*, 6, 21-37. [https://doi.org/10.1016/0304-4076\(77\)90052-5](https://doi.org/10.1016/0304-4076(77)90052-5)
- Akhavein J., Berger A., & Humphrey D. (1997). The effects of megamergers on efficiency and prices: evidence from a bank profit function. *Review of Industrial Organisation*, 12, 95-139. <https://doi.org/10.1023/A:1007760924829>
- Anderson, T., & Hsiao, C. (1982). Formulation and Estimation of Dynamics Models using Panel Data. *Journal of Econometrics*, 18, 47-82. [https://doi.org/10.1016/0304-4076\(82\)90095-1](https://doi.org/10.1016/0304-4076(82)90095-1)
- Arellano, M., & Bond, S. (1991). Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations. *Review of Economic Studies*, 58, 277-297. <https://doi.org/10.2307/2297968>
- Azofra, V., & Santamaria, M. (2011). Ownership, control, and pyramids in Spanish commercial banks. *Journal of Banking and Finance*, 35, 1464-1476. <https://doi.org/10.1016/j.jbankfin.2010.10.029>
- Banker, R., Charnes, A., & Cooper, W. (1984). Some models for estimating technical and scale inefficiencies in data envelopment analysis. *Management Science*, 30, 1078-1092. <https://doi.org/10.1287/mnsc.30.9.1078>
- Battese, G. E., & Coelli, T. J. (1995). A Model for technical Inefficiency Effects in Frontier Production Function for Panel Data. *Empirical Economics*, 20, 325-342. <https://doi.org/10.1007/BF01205442>
- Bektas E., & Kaymak T. (2009). Governance mechanisms and ownership in an emerging market: The case of Turkish banks. *Emerging Markets Finance and Trade*, 45, 20-32. <https://doi.org/10.2753/REE1540-496X450602>
- Ben Slama, S., & Boulila, T. (2014). Ownership structure and financial performance in Islamic banks: Does bank ownership matter? *International Journal of Islamic and Middle Eastern Finance and Management*, 7, 146-160. <https://doi.org/10.1108/IMEFM-01-2013-0002>
- Berger, A., & Mester, L. (1997). Inside the black box: What explains differences in the efficiencies of financial institutions. *Journal of Banking and Finance*, 21, 895-947. [https://doi.org/10.1016/S0378-4266\(97\)00010-1](https://doi.org/10.1016/S0378-4266(97)00010-1)
- Bethel, J., & Liebeskind, J. (1993). The effects of ownership structure on corporate restructuring. *Strategic*

- Management Journal*, 14, 15-31. <https://doi.org/10.1002/smj.4250140904>
- Bhatia, M., & Gulati, R (2021). Board governance and bank performance: A meta- analysis, *Research in International Business and Finance*, 58, 101425. <https://doi.org/10.1016/j.ribaf.2021.101425>
- Bian, W., & Deng, C. (2017). Ownership dispersion and bank performance: Evidence from China. *Finance Research Letters*, 22, 49-52. <https://doi.org/10.1016/j.frl.2016.12.030>
- Blundell, R., & Bond, S. (1998). Initial Conditions and Moment Restrictions in Dynamic Panel Data Models. *Journal of Econometrics*, 87, 115-143. [https://doi.org/10.1016/S0304-4076\(98\)00009-8](https://doi.org/10.1016/S0304-4076(98)00009-8)
- Bond, S. (2002). Dynamic Panel Data Models: A Guide to Micro Data Methods and Practice. *Portuguese Economic Journal*, 1, 141-162. <https://doi.org/10.1007/s10258-002-0009-9>
- Carter, D., D'Souza F., Betty J., Simkins, B., & Gary, S (2010). The Gender and Ethnic Diversity of US Boards and Board Committees and Firms. *Corporate Governance: An International review*, 18, 396-414. <https://doi.org/10.1111/j.1467-8683.2010.00809.x>
- Charnes, A., Cooper, W., & Rhodes, E. (1978). Measuring the efficiency of DMUs. *European Journal of Operational Research*, 2, 429-444. [https://doi.org/10.1016/0377-2217\(78\)90138-8](https://doi.org/10.1016/0377-2217(78)90138-8)
- Dalton, D., Daily, C, Ellstrand, A., & Johnson, J. (1998). Meta-analytic Reviews of Board Composition, Leadership Structure, and Financial Performance. *Strategic Management Journal*, 19, 269-290. [https://doi.org/10.1002/\(SICI\)1097-0266\(199803\)19:3<269::AID-SMJ950>3.0.CO;2-K](https://doi.org/10.1002/(SICI)1097-0266(199803)19:3<269::AID-SMJ950>3.0.CO;2-K)
- Dong, Y., Girardone, C., & Kuo, J (2017). Governance, efficiency and risk taking in Chinese banking, *The British Accounting Review*, 49, 211-229. <https://doi.org/10.1016/j.bar.2016.08.001>
- Dong, Y., Meng, C., Firth, M., & Hou, W. (2014). Ownership structure and risk-taking: Comparative evidence from private and state-controlled banks in China. *International Review of Financial Analysis*, 36, 120-130. <https://doi.org/10.1016/j.irfa.2014.03.009>
- EL-Moussawi, C., & Mansour, R. (2021). Competition, Cost Efficiency and Stability of Banks in the MENA region. *The Quarterly Review of Economics and Finance*, 84, 143-170. <https://doi.org/10.1016/j.qref.2021.12.005>
- Erhardt, N., Werbel, D., & Shrader, C. (2003). Board of director diversity and firm financial performance. *Corporate Governance: An International Review*, 11, 102-111. <https://doi.org/10.1111/1467-8683.00011>
- Fang, Y., Hassan, I., & Marton, K. (2014). Institutional development and bank stability: Evidence from transition countries. *Journal of Banking and Finance*, 39, 160-176. <https://doi.org/10.1016/j.jbankfin.2013.11.003>
- Fiordelisi, F., Marques-Ibanez, D., & Molyneux, P. (2011). Efficiency and risk in European banking. *Journal of Banking and Finance*, 35, 1315-1326. <https://doi.org/10.1016/j.jbankfin.2010.10.005>
- García-Herrero, A., Gavilán S., & Santabarbara, D. (2009). What explains the low profitability of Chinese banks? *Journal of Banking and Finance*, 33, 2080-2092. <https://doi.org/10.1016/j.jbankfin.2009.05.005>
- Ghosh, S. (2018). Governance reforms and performance of MENA banks: Are disclosures effective? *Global Finance Journal*, 36, 78-95. <https://doi.org/10.1016/j.gfj.2018.01.002>
- Greene, W. (1980). Maximum Likelihood Estimation of Econometric Frontier Functions. *Journal of Econometrics*, 13, 27-5. [https://doi.org/10.1016/0304-4076\(80\)90041-X](https://doi.org/10.1016/0304-4076(80)90041-X)
- Grove, H., Patelli, L., Victoravich, L. M., & Xu, P. (2011). Corporate governance and performance in the wake of the financial crisis: Evidence from US commercial banks. *Corporate Governance: An International Review*, 19, 418-436. <https://doi.org/10.1111/j.1467-8683.2011.00882.x>
- Gulamhussen, M., & Santa, S. (2015). Female directors in bank boardrooms and their influence on performance and risk-taking. *Global Finance Journal*, 28, 10-23. <https://doi.org/10.1016/j.gfj.2015.11.002>
- Gupta, N., Mittal, S., Agarwal, T., Bakhshi, P., & Sahoo, M. (2022). Ownership concentration and bank performance: Evidence from India. *Cogent Economics and Finance*, 10, 2114177. <https://doi.org/10.1080/23322039.2022.2114177>
- Harkin, S., Mare, D., & Crook, J. (2020). Independence in bank governance structure: Empirical evidence of effects on bank risk and performance. *Research in International Business and Finance*, 52, 101177. <https://doi.org/10.1016/j.ribaf.2019.101177>
- Hopkins, D., Harris, A., & Jackson, D. (1997). Understanding the school's capacity for development. *School*

- Leadership and Management*, 17, 40-11. <https://doi.org/10.1080/13632439769944>
- Huljak, I., Martin, R., & Moccerro, D. (2019). The cost-efficiency and productivity growth of euro area banks. European Central Bank, Working Paper, WP 2305. <https://doi.org/10.2139/ssrn.3430356>
- Iannotta, G., Nocera, G., & Sironi A. (2007). Ownership Structure, Risk and Performance in the European Banking Industry. *Journal of Banking and Finance*, 31, 2127-2149. <https://doi.org/10.1016/j.jbankfin.2006.07.013>
- Jensen M. (1993). The modern industrial revolution, exit, and the failure of internal control systems. *Journal of Finance*, 48, 831-880. <https://doi.org/10.1111/j.1540-6261.1993.tb04022.x>
- Jensen, M., & Meckling, W. (1976). Theory of the firm: Managerial behavior, agency costs, and capital structure. *Journal of Financial Economics*, 3, 305-360. [https://doi.org/10.1016/0304-405X\(76\)90026-X](https://doi.org/10.1016/0304-405X(76)90026-X)
- King, R., & Levine, R. (1993). Finance and Growth: Schumpeter Might be Right. *Quarterly Journal of Economics*, 108, 717-738. <https://doi.org/10.2307/2118406>
- Kramaric, T., & Pervan, M. (2016). Does Board Structure Affect the Performance of Croatian Banks? *Journal of Financial Studies & Research*, 2016, C1-C10. <https://doi.org/10.5171/2016.158535>
- Kumbhakar, S. C., Gudbrand, L., & Hardaker, J. B. (2014). Technical efficiency in competing panel data models: a study of Norwegian grain farming. *Journal of Productivity Analysis*, 41, 321-337. <https://doi.org/10.1007/s11123-012-0303-1>
- Laing, D., & Weir, C. (1999). Governance structures, size and corporate performance in UK firms. *Management Decision*, 37, 457-464. <https://doi.org/10.1108/00251749910274234>
- Lee, C., & Hsieh, M. (2013). The impact of bank capital on profitability and risk in Asian banking. *Journal of International Money and Finance*, 32, 251-281. <https://doi.org/10.1016/j.jimonfin.2012.04.013>
- Levine, R. (1998). The legal environment, banks, and long-run economic growth. *Journal of Money, Credit, and Banking*, 30, 596-613. <https://doi.org/10.2307/2601259>
- Lin, X., & Zhang, Y. (2009). Bank ownership reform and bank performance in China. *Journal of Banking and Finance*, 33, 20-29. <https://doi.org/10.1016/j.jbankfin.2006.11.022>
- Mahadeo, D., Soobaroyen, T., & Hanuman, V. (2012). Board Composition and Financial Performance: Uncovering the Effects of Diversity in an Emerging Economy. *Journal of Business Ethics*, 105, 375-388. <https://doi.org/10.1007/s10551-011-0973-z>
- Mamatzakis, E., & Bermpei, T. (2015). The effect of corporate governance on the performance of US investment banks. *Financial Markets, Institutions and Instruments*, 24, 191-239. <https://doi.org/10.1111/fmii.12028>
- Maudos, J., Pastor J., Pérez, F., & Quesada, J. (2002). Cost and profit efficiency in European banks. *Journal of International Financial Markets, Institutions and Money*, 12, 33-58. [https://doi.org/10.1016/S1042-4431\(01\)00051-8](https://doi.org/10.1016/S1042-4431(01)00051-8)
- Mester, L. (1996). A study of bank efficiency taking into account risk-preferences. *Journal of Banking and Finance*, 20, 1025-1045. [https://doi.org/10.1016/0378-4266\(95\)00047-X](https://doi.org/10.1016/0378-4266(95)00047-X)
- Mishra, C. S., & Nielsen, J. F. (2000). Board independence and compensation policies in large bank holding companies. *Financial Management*, 29, 51-70. <https://doi.org/10.2307/3666229>
- Mollah, S., & Zaman, M. (2015). Shari'ah Supervision, Corporate Governance and Performance: Conventional vs. Islamic Banks. *Journal of Banking and Finance*, 58, 418-435. <https://doi.org/10.1016/j.jbankfin.2015.04.030>
- Nickell, S. (1981). Biases in Dynamic Models with Fixed Effects. *Econometrica*, 49, 1417-1426. <https://doi.org/10.2307/1911408>
- Ozili, P., & Uadiale, O (2017). Ownership concentration and bank profitability. *Future Business Journal*, 3, 159-171. <https://doi.org/10.1016/j.fbj.2017.07.001>
- Pathan S., Skully M., & Wickramanayake J. (2007). Board size, independence and performance: an analysis of Thai banks. *Asia-Pacific Financial Markets*, 14, 211-227. <https://doi.org/10.1007/s10690-007-9060-y>
- Pesaran, H. (2015). Time series and panel data econometrics. *Oxford University Press*, Oxford. <https://doi.org/10.1093/acprof:oso/9780198736912.001.0001>
- Phan, H., Anwar, S., Alexander, W., & Phan, M. (2019). Competition, efficiency and stability: An empirical

- study of East Asian commercial banks. *The North American Journal of Economics and Finance*, 50, 100990. <https://doi.org/10.1016/j.najef.2019.100990>
- Pi, L. & Timme, S. G. (1993). Corporate control and bank efficiency. *Journal of Banking and Finance*, 17, 515-530. [https://doi.org/10.1016/0378-4266\(93\)90050-N](https://doi.org/10.1016/0378-4266(93)90050-N)
- Pletzer, J., Romina, N., Kedzior, K., & Voelpel, S. (2015). Does Gender Matter? Female Representation on Corporate Boards and Firm Financial Performance-A Meta-Analysis. *PLoS One*, 10. <https://doi.org/10.1371/journal.pone.0130005>
- Rakshit, B., & Bardhan, S. (2022). An empirical investigation of the effects of competition, efficiency and risk-taking on profitability: An application in Indian banking. *Journal of Economics and Business*, 118, 106022. <https://doi.org/10.1016/j.jeconbus.2021.106022>
- Ryan, M., & Haslam, A. (2005). The glass cliff. evidence that women are over-represented in precarious leadership positions. *British Journal of Management*, 16, 81-90. <https://doi.org/10.1111/j.1467-8551.2005.00433.x>
- Safiullah, M. (2021). Stability efficiency in Islamic banks: Does board governance matter? *Journal of Behavioral and Experimental Finance*, 29, 100442. <https://doi.org/10.1016/j.jbef.2020.100442>
- Safiullah, M., & Shamsuddin, A. (2019). Risk-adjusted efficiency and corporate governance: Evidence from Islamic and conventional banks. *Journal of Corporate Finance*, 55, 105-140. <https://doi.org/10.1016/j.jcorpfin.2018.08.009>
- Salim, R., Arjomandi, R., & Heinz Seufert, J. (2016). Does corporate governance affect Australian banks' performance? *Journal of International Financial Markets, Institutions & Money*, 43, 113-125. <https://doi.org/10.1016/j.intfin.2016.04.006>
- Sarkar, J., & Sarkar, S. (2018). Bank ownership, board characteristics and performance: evidence from commercial banks in India. *International Journal of Business Studies*, 6, 1-30. <https://doi.org/10.3390/ijfs6010017>
- Sealey, J., & Lindley, T. (1977). Inputs, outputs, and a theory of production and cost at depository financial institutions. *Journal of Finance*, 32, 1251-1266. <https://doi.org/10.1111/j.1540-6261.1977.tb03324.x>
- Shleifer, A., & Vishny, R. (1997). A Survey of Corporate Governance. *Journal of Finance*, 52, 737-783. <https://doi.org/10.1111/j.1540-6261.1997.tb04820.x>
- Simpson, W., & Gleason, A. (1999). Board structure, ownership and financial distress in banking firms. *International Review of Economics and Finance*, 8, 281-292. [https://doi.org/10.1016/S1059-0560\(99\)00026-X](https://doi.org/10.1016/S1059-0560(99)00026-X)
- Simpson, W., & Kohers, T. (2002). The Link between Corporate Social and Financial Performance: Evidence from the Banking Industry. *Journal of Business Ethics*, 35, 97-109. <https://doi.org/10.1023/A:1013082525900>
- Sok-Gee, C., & Mohd Zaini Abd, K (2016). Financial market regulation, country governance, and bank efficiency: Evidence from East Asian countries. *Contemporary Economics*, 10, 39-54. <https://doi.org/10.5709/ce.1897-9254.197>
- Staikouras, P. K., Staikouras, C. K., & Agoraki, M. E. K. (2007). The effect of board size and composition on European bank performance. *European Journal of Law and Economics*, 23, 1-27. <https://doi.org/10.1007/s10657-007-9001-2>
- Stevenson, R. (1980). Likelihood function for generalized stochastic frontier estimation. *Journal of Econometrics*, 13, 57-66. [https://doi.org/10.1016/0304-4076\(80\)90042-1](https://doi.org/10.1016/0304-4076(80)90042-1)
- Tan, Y., & Floros, C. (2013). Risk, capital and efficiency in Chinese banking. *Journal of International Financial Markets, Institutions and Money*, 53, 378-393. <https://doi.org/10.1016/j.intfin.2013.07.009>
- Turk Ariss, R. (2010). On the implications of market power in banking: Evidence from developing countries. *Journal of Banking & Finance*, 34, 765-775. <https://doi.org/10.1016/j.jbankfin.2009.09.004>
- Villalonga, B., & Amit, R. (2006). How do Family Ownership, Control and Management affect Firm Value ? *Journal of Financial Economics*, 80, 385-417. <https://doi.org/10.1016/j.jfineco.2004.12.005>
- Wang, W. K., Lu, W. M., & Lin, Y. L. (2012). Does corporate governance play an important role in BHC performance? Evidence from the US. *Economic Modelling*, 29, 751-760.

<https://doi.org/10.1016/j.econmod.2012.01.021>

Wei Leong, M., Paramasivam, M., Sundarasan, S., & Rajagopalan, U. (2015). Board Composition and Companies' Performance: Does Political Affiliation Moderate the Relationship? *International Journal of Business and Management*, 10, 1-17. <https://doi.org/10.5539/ijbm.v10n10p216>

Zulkafli, A. H., & Samad, F. A. (2007). Corporate Governance and Performance of Banking Firms: Evidence from Asian Emerging Markets. *Advances in Financial Economics*, 12, 49-74. [https://doi.org/10.1016/S1569-3732\(07\)12003-X](https://doi.org/10.1016/S1569-3732(07)12003-X)

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