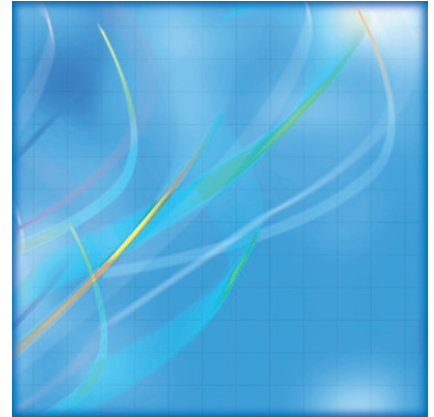**Analytical Paper**

Insights on the Canadian Economy

The Resource Boom: Impacts on Provincial Purchasing Power

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Abstract

The present study illustrates the differential impact on regional economies of relative price changes stemming from commodity price movements, exchange rate changes and changes in international manufactured goods prices. It focuses on Canadian provinces, which are a large, geographically distributed federation of regional economies with widely differing economic bases. In this regard, the study illuminates an important method for examining regional economic performance that is particularly well suited to federations such as Russia or the European Monetary Union, or to large countries such as the United States.

Keywords: economic growth, real income, terms of trade

Executive summary

From 2003 to 2007 the rising price of commodities, falling import prices and the appreciating dollar led to substantial gains in purchasing power for Canada. They also led to increases in purchasing power for most provinces. However, the magnitude of the provincial impacts differs importantly across provinces, as do the changes in export and import prices that drive changes in provincial terms of trade.

Unlike earlier resource booms, the post-2002 period stands out because the prices of almost all commodities increased. As a result, there have been terms of trade increases in most provinces.

Coinciding with the resource boom was an appreciation of the Canadian dollar, which—when combined with the effect of China on global prices—decreased import prices for a wide range of goods. The falling import prices have, in many cases, been as important as, or more important than, rising export prices for terms of trade improvements.

The combination of falling import prices and rising commodity prices led to a widespread sharing of benefits from the terms of trade improvement across Canada—something that has not occurred in the last 25 years. This paper empirically illustrates the gains provinces experienced from 2003 to 2007. In doing so, it examines a number of questions about the post-2002 period:

> ➢ Which is more important: rising export prices of falling import prices?

On average, Canadian import prices, which declined on average at 2.6% per year from 2003 to 2007, contributed more to terms of trade growth than export prices, which rose about 1% per year.

However, this pattern is not consistent across provinces. In Newfoundland and Labrador, Nova Scotia, New Brunswick and Saskatchewan, export prices grew faster than import prices leading to terms of trade improvements. In Quebec, Manitoba, Alberta and British Columbia, the terms of trade rose as export prices increased, and import prices decreased. In Ontario, export prices declined more slowly than import prices leading to a rising terms of trade. In Prince Edward Island, export prices declined and import prices rose, leading to a terms of trade deterioration.

> ➢ Why has the impact of relative price changes been larger after 2002 than previously?

Two occurrences have led to a sizable impact after 2002. First, a broad range of commodities experienced price increases, spreading demand-driven price rises to many provinces. Gains were not confined to energy producing provinces as had happened in the past. Second, the emergence of low cost developing nations, particularly China, and the appreciation of the Canadian dollar lowered import prices at the same time.

While the individual provinces experienced differential effects from the rising commodity and falling import prices, the distribution of the impact has generally been the same— improved terms of trade for most provinces. Unlike the periods during the first and second oil shocks, when terms of trade improvements in oil-producing provinces were offset by

deteriorations in oil-importing provinces, the post-2002 period has seen the regional offset evaporate. As a result, during the 2003-to-2007 years relative price movements were an important source of real income growth.

➢ How does provincial economic structure interact with relative price movements?

Examining provincial economic structures using industry value added shares suggests that provincial economies are quite diversified. In all provinces, industries like construction, manufacturing, wholesale trade, retail trade and finance, insurance, real estate and leasing contribute importantly to gross domestic product. While there are differences in industry contributions across provinces, in most cases one industry does not tend to dominate.

However, the apparent diversification across industries belies the dependence of provincial economies on particular product areas. For example, from 2003 to 2007, energy products in Newfoundland and Labrador accounted, on average, for 69.4% of exports by value. In Prince Edward Island, 68.0% of exports were accounted for by agriculture and fishing products. In Quebec, machinery and equipment accounted for 35.4% of exports, while in Ontario, 43.3% of exports were accounted for by automotive products. In Alberta, energy commodities accounted for 69.0% of exports, while in British Columbia, 40.5% of exports are forestry products.

The dependence of many provinces on particular product areas makes them sensitive to changes in demand and prices for particular goods. During periods when a small number of product prices change rapidly, relative price effects can be offsetting and have little overall impact. However, when similar broad based product price changes occur, the effects can be felt, sometimes acutely, across most provinces, leading to noteworthy aggregate changes.

1   Introduction

Bode and Rey (2006) note that closed economy models in the spirit of Sala-i-Martin (1990) and Mankiw, Romer and Weil (1992) have been the basis for much of the work examining regional income convergence. Studies following this tradition often use real gross domestic product (GDP) as an aggregate income measure. However, real GDP does not adequately represent real income growth when certain types of relative price change occur. This is particularly true for regional economies that are, by definition, small, open and sensitive to price shocks. This paper illustrates how a measure of real income can be calculated for regional economies that takes into account relative price changes, such as terms-of-trade improvements.[1]

Real GDP captures the volume of income that is produced during a particular period, within a set of geographical boundaries, measured in terms of the product that is produced. It does not take account of the effect of changes in the relative price of traded goods on an economy's purchasing power. A broader measure of real income that encompasses real GDP, but also takes account of purchasing power changes, is necessary for understanding the evolution of economic aggregates, such as consumption, investment or imports and, ultimately, economic welfare across regions, when large traded-goods-related relative price changes occur.

The international handbook used by statistical agencies for calculating real GDP—the 1993 System of National Accounts—describes how this broader measure of real income, referred to as real gross domestic income (GDI), can be calculated. In doing so, it outlines how to go from measuring the income produced by an economy to the goods and services that the economy can purchase with that production.

To illustrate the empirical importance of understanding how relative price changes affect a country and its constituent regions, real GDP and real GDI in Canada and each of the 10 Canadian provinces is examined from 1981 to 2007. This is a period that encompasses important trade-related relative price changes for Canada, particularly during the latter part of the period, when commodity prices increased. The focus is on Canada because the Provincial Economic Accounts from Statistics Canada provide a high quality and consistent set of regional estimates. Moreover, Canada's provinces are geographically dispersed with widely differing economic structures, whose individual responses to relative price shocks can be significantly different from each other, and from the Canadian aggregate. As such, Canada provides an example of how relative price changes affect regions. While similar analysis could be performed with other large countries such as the United States, Russia or Japan, there is in practice no reason why this type of analysis could not also be applied to any group of economies, such as the European Union or the Organisation for Economic Co-operation and Development, provided that a consistent set of National Account estimates for the constituent regions exists.

The remainder of the paper is structured as follows. In Section 2, the relationship between real GDP and real GDI is discussed. In Section 3, the difference that the inclusion of the trading gain has for the Canadian and provincial economies is illustrated, and Section 4 concludes.

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1. This paper provides a measure of real gross domestic income by province but does not move to producing estimates of gross national income at the provincial level because data on inter-provincial income flows are not available (see Macdonald 2007).

2 Real gross domestic product compared with real gross domestic income

Economic theory and statistical practice dictate that nominal gross domestic product (GDP) and nominal gross domestic income (GDI) are equal so that value added is equal to the value of purchases. However, the inflation-adjusted real measures can differ significantly when the volume of production and the volume of domestic purchases grow at different rates. Because GDP and GDI are equal in nominal terms, differences between real GDP and real GDI stem from deflator choice.

Real GDP is a measure of the price-adjusted flow of income generated by an economy in terms of the goods and services produced. It is a production-based measure. Its deflator accounts for price changes so that the resulting volume measure only changes when inputs or productivity change. While this feature makes real GDP a measure of real value added, it prevents real GDP from illuminating how relative price shifts affect the volume of goods and services that can be purchased with that income.

The GDI deflator allows relative price changes to affect the number of goods and services that may be purchased in an open economy. The GDI deflator achieves this by deflating net exports by one price index, rather than exports and imports separately. Deflating net exports directly leads to a real series that is different from the implied real net exports that come from subtracting real imports from real exports. The difference between the implied and the directly deflated real net exports is the change in the purchasing power of domestic production.

A decision about which price index should by used to value net exports must be made. The System of National Accounts 1993 (SNA93) does not explicitly preclude any method for deflating net exports. It does, however, note that:

> There is a large but inconclusive literature [about selecting which price index to use to deflate net exports], but one point on which there is general agreement is that the choice of [that index] can sometimes make a substantial difference in the results. Thus the measurement of real GDI can sometimes be sensitive to the choice of [the price index] and this has prevented a consensus being reached on this issue.
>
> SNA93, no. 16.153

This paper follows Kohli (2006) by using the final domestic demand (FDD) deflator because recent research suggests that it allows for a broader range of relative price changes and has fewer measurement issues—it alleviates concerns that arise when unit price indices are used for export and import price deflators (Silver 2007). The FDD deflator is one of the options put forward in SNA93, which makes it a real income measure that is officially recognized by the Organisation for Economic Co-operation and Development, World Bank, International Monetary Fund, United Nations and Commission of the European Communities. Unlike other options, Kohli's (2006) derivation shows that a trading gain based on the FDD deflator is consistent with an economy that engages in trade and has a current account imbalance. It is, therefore, consistent with the general equilibrium models of Corden and Neary (1982) and Corden (1984), and with the dependent economy model of the balance of payments.

Using the FDD deflator provides more information than other options by allowing the decomposition of the trading gain into terms-of-trade effects and an effect from the change in the relative price of traded to non-traded goods. Because some regions, such as the Canadian provinces or European Union member states, are affected by policies that transfer funds from richer regions to poorer regions, both relative price effects are crucial for understanding real income growth.

The terms of trade represents the volume of domestic goods and services that must be forgone to acquire a foreign good or service. A shift in the terms of trade, therefore, represents a real change in the volume of goods and services that an economy can purchase with what it produces. Terms-of-trade improvements have an impact analogous to productivity growth (Diewert and Morrison 1986).

The relative price of traded to non-traded goods and services has been referred to as the real exchange rate and as the Salter ratio, after W.E.G. Salter (1959) who placed the role of relative price changes between non-tradable and tradable goods at the centre of balance of payments adjustments. This paper follows Corden's (1992) example and refers to the price ratio as the Salter ratio to avoid confusion.

Changes in the relative price of tradable to non-tradables (the Salter ratio) can lead to changes in the income earned from, or spent on, net exports. Over time, this can lead to changes in the expenditure patterns of domestic agents by making tradables relatively more or less attractive. As a result, changes in domestic demand, inflationary pressures, unemployment rates and net exports can occur when the Salter ratio changes. The outcome from a change in the Salter ratio is more complex than terms-of-trade changes and depends on the source of the change (export, import or domestic prices), the relevant elasticities, the magnitude of the changes and the net export balance. Nevertheless, changes in the Salter ratio lead to changes in domestic purchasing power.

To illustrate how real GDI measure captures the trading gain, consider the following derivation which is based on Kohli (2006). It shows how, by deflating nominal GDP using two different deflators, it is possible to mathematically decompose the trading gain into terms-of-trade and Salter-ratio effects.

The GDP deflator is calculated as the weighted average of movements in FDD prices (i.e., consumption prices, investment prices and government expenditure prices), export prices and import prices where imports enter with a minus sign. By denoting $\ln(P_{Y,t/t-1})$ as the Törnqvist index value for the GDP deflator, it can be written as

$$\ln(P_{Y,t/t-1}) = \sum_i \bar{v}_{i,t/t-1} \ln(P_{i,t/t-1}) \quad i = FDD, X, M \, ,$$

where *FDD*, *X* and *M* represent final domestic demand, exports and imports; and the weights are calculated as each aggregate's share of nominal GDP,

$$v_{i,t} = \frac{\gamma_i}{GDP} \quad \gamma_i = FDD, X, M,$$

and are averaged across t and $t-1$:

$$\bar{v}_{i,t/t-1} = \frac{(v_{i,t} + v_{i,t-1})}{2} \quad i = FDD, X, M.\,^2$$

Given the deflator, real GDP growth is defined as nominal GDP growth minus deflator growth:

$$\ln(y_{Y,t/t-1}) = \ln(GDP_{t/t-1}) - \ln(P_{Y,t/t-1}). \tag{1}$$

By assumption, the real GDI deflator growth equals FDD deflator growth:

$$\ln(P_{GDI,t/t-1}) = \ln(P_{FDD,t/t-1}).$$

Real GDI growth is calculated in the same manner as real GDP growth. In the event that one does not need to decompose the trading gain into its components, it is possible to directly deflate nominal GDP with the FDD deflator to calculate real GDI. Using the FDD deflator, real GDI growth is equal to nominal GDP growth minus FDD deflator growth:

$$\ln(y_{GDI,t/t-1}) = \ln(GDP_{t/t-1}) - \ln(P_{GDI,t/t-1}).$$

The trading gain from relative price changes that occur between t and $t-1$ is calculated as the difference between the real GDI growth and real GDP growth,

$$\ln(T_{t/t-1}) = \ln(y_{GDI,t/t-1}) - \ln(y_{Y,t/t-1}), \tag{2}$$

that reduces to the difference between GDP deflator growth and GDI deflator growth—i.e., to the difference between domestic price and import/export prices:

$$\ln(T_{t/t-1}) = \ln(P_{Y,t/t-1}) - \ln(P_{GDI,t/t-1}).$$

Since real GDP and real GDI are closely related, it is possible to calculate real GDI growth as real GDP growth plus the trading gain:

$$\ln(y_{GDI,t/t-1}) = \ln(y_{Y,t/t-1}) + \ln(T_{t/t-1}). \tag{3}$$

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2. The gross domestic product deflator also includes inventories and a statistical discrepancy. These are omitted from the analytical section.

In order to calculate real GDI growth as the sum of production changes (real GDP) and relative price changes (the trading gain), an estimate of trading gain growth is necessary. By decomposing the trading gain into a terms-of-trade (*ToT*) effect and a Salter ratio (*E*) effect, it is possible to calculate changes in the trading gain as follows:

- Define terms-of-trade growth as :

$$\ln(ToT_{t/t-1}) = \ln(P_{X,t/t-1}) - \ln(P_{M,t/t-1}) ;$$

- Define growth in traded prices as:

$$\ln(P_{T,t/t-1}) = \frac{1}{2}\left(\ln(P_{X,t/t-1}) + \ln(P_{M,t/t-1})\right); \text{ and,}$$

- Define growth in the Salter ratio as:

$$\ln(E_{t/t-1}) = \ln(P_{T,t/t-1}) - \ln(P_{FDD,t/t-1}).$$

Using these definitions and (2), it can be shown that trading gains are the weighted sum of the Salter-ratio and terms-of-trade movements:

$$\ln(T_{t/t-1}) = (\bar{v}_X - \bar{v}_M)\left\{\ln(E_{t/t-1})\right\} + \frac{1}{2}(\bar{v}_X + \bar{v}_M)\left\{\ln(ToT_{t/t-1})\right\}. \tag{4}$$

By combining (3) and (4), the decomposition of real GDI growth becomes

$$\ln(y_{GDI,t/t-1}) = \ln(y_{Y,t/t-1}) + \left[(\bar{v}_X - \bar{v}_M)\left\{\ln(E_{t/t-1})\right\} + \frac{1}{2}(\bar{v}_X + \bar{v}_M)\left\{\ln(ToT_{t/t-1})\right\}\right]. \tag{5}$$

The weights attached to the Salter ratio and terms of trade have economic interpretations. The sign of the Salter ratio weight, $(\bar{v}_X - \bar{v}_M)$, is positive (negative) when the trade balance is in surplus (deficit), while its magnitude captures the size of the surplus (deficit) relative to nominal GDP. The weight attached to terms-of-trade growth, $\frac{1}{2}(\bar{v}_X + \bar{v}_M)$, is the average value of trade as a proportion of nominal GDP. Real GDI in economies that are more open to trade is more susceptible to terms-of-trade shifts while a larger trade imbalance makes real GDI more susceptible to Salter ratio movements. Regions are often more susceptible to Salter ratio changes than countries are, because transfers from richer to poorer regions can lead to relative trade imbalances.

Because relative price changes play an important role in the evolution of real GDI, it can behave quite differently from real GDP. For instance, suppose that there is a *ceteris paribus* appreciation of the nominal exchange rate that lowers the price of imports. All else being equal, the appreciation means that less domestic income is spent purchasing foreign goods, which raises

nominal GDP. Since the GDP deflator adjusts to account for price change, the volume measure of GDP will not change, or may decline, if domestic production is displaced.

The real GDI deflator, on the other hand, allows the nominal appreciation to affect the volume of goods and services that may be purchased. When the nominal exchange rate appreciates, it lowers the price of traded goods relative to non-traded goods (a shift in the Salter ratio). The appreciation simultaneously lowers export revenues and import costs. The net effect depends on whether net exports are in surplus or in deficit (Kohli 2006). Additionally, the import price falls relative to the price of exports (a terms-of-trade improvement), allowing the economy to transform each export into more imports. As a result, real GDI growth differs from real GDP growth.

When the effect of the appreciation on economic aggregates is examined, further differences between real GDP and real GDI materialize. First, while real GDI has increased, there may be no accompanying increase in the volume of imports. In reality, there is no guarantee that an increase in real GDI from trading gains will lead to an accompanying increase in real domestic expenditures if additional expenditures must come from this source. The increase may, instead, translate into lower exports or greater savings. The relative price shifts cause a re-allocation of expenditures that is captured in real GDI changes but not necessarily in real GDP changes.

Second, if the lower import price is allowed to affect import volumes, economic theory suggests that import volumes will rise. If the rise leads to substitution away from domestic production, the increased level of imports will tend to lower real GDP. Real GDI, however, increases. The paradoxical result is that a nominal exchange rate appreciation can lower real GDP while raising real GDI (Kohli 2004).

3   Terms of trade, real gross domestic income and real gross domestic product

3.1   Data and presentation

The data for gross domestic product (GDP), final domestic demand, exports, and imports come from Statistics Canada's Provincial Economic Accounts. Commodity price data, provincial industry and export data, and exchange rate information come from Statistics Canada's CANSIM database. To illustrate the impact of relative price changes on real income, two sets of analysis are presented. The first part of the analysis focuses on Canada as a whole from 1981 to 2007. However, it is primarily concerned with examining the response to the relative price changes after 2002. The historical record is employed, where necessary, as a stylized example for comparison. Because examining different points across business cycles can influence results, an effort has been made to examine similar phases of Canada's business cycles. Where necessary, the 1981-to-1982 and the 1991 recessions are omitted when average growth rates are calculated.

The second part examines the response to the post-2002 relative price shifts. However, rather than examine macroeconomic variables affecting all of Canada, it focuses on the varying regional impacts of the relative price change, and how they have changed over time. Ultimately,

as the analysis shows, understanding how the provinces respond is key to understanding how Canada responds.

3.2 Canadian real gross domestic product compared with real gross domestic income

Canada is a resource-rich nation that engages extensively in trade, predominantly with the United States. Although there is a substantial manufacturing industry, located principally in the provinces of Quebec and Ontario, resources remain a mainstay of many areas of the economy. Consequently, Canada's trading gain is intimately linked to changes in commodity prices.

Figure 1 illustrates this relationship by plotting the Bank of Canada's commodity price index against an index of Canada's trading gain. In each case, the indices are set to equal 100 in 2002. Over the entire 1981-to-2007 period, changes in commodity prices have been mirrored by changes in Canada's trading gain. Prior to 2003, the trading gain oscillated within a stable band that followed commodity price cycles. After 2002, commodity prices have risen to record levels, driving up Canada's trading gain.

Figure 1
Changes in commodity prices and trading gain, 1981 to 2007
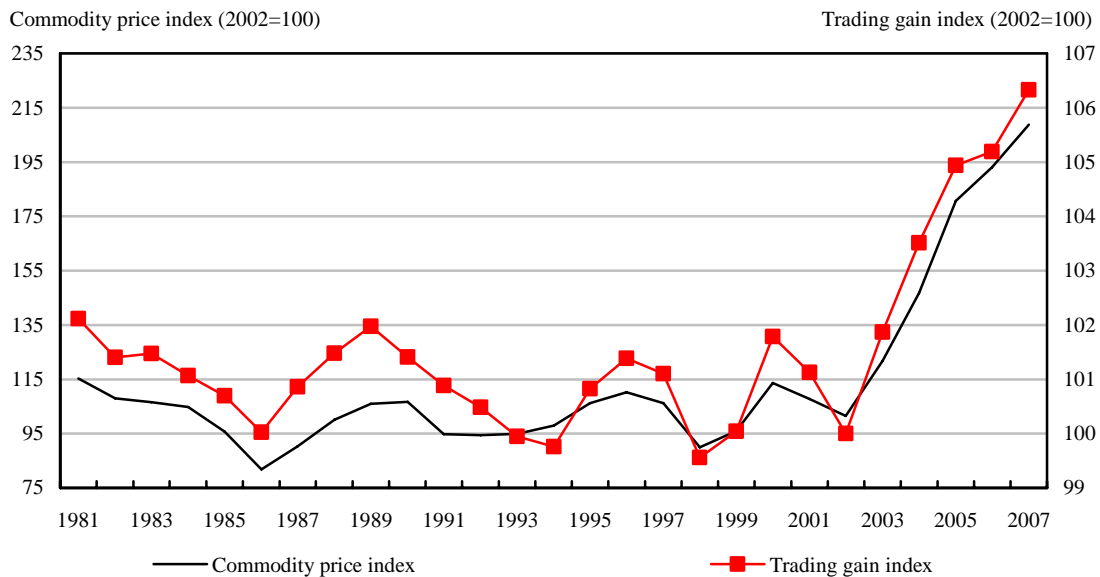
Source: Author's calculations based on Statistics Canada, CANSIM table 176-0001.

Additional factors have also affected the trading gain. First, the Canadian dollar has appreciated by nearly 50% relative the U.S. dollar, lowering import costs, especially for manufactured goods.[3] Second, the emergence of Asia, primarily China, as a manufacturing super-power has driven down the prices of many consumer products on a global scale (Francis 2007).

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3. See Amano and van Norden (1993) or Bailliu and King (2005) for a discussion of the determinants of the Canadian-U.S. exchange rate.

As a result, unlike previous periods when trading gains rose, the post-2002 trading gain is the result not just of resource-related export price increases, but also of lower import prices. In fact, import prices declined on average by 2.6% per year from 2003 to 2007 while export prices rose by about 1% per year.

Consequently, the difference between real gross domestic product (GDP) growth and real gross domestic income (GDI) growth is larger after 2002 than in almost every previous year. Figure 2 shows the contribution to real GDI growth that comes from real GDP growth and from the trading gain for the 1982-to-2007 period. In most years, the contribution to real GDI growth that came from relative price changes was modest, and it followed commodity price cycles. After 2002, however, the combination of falling import prices and rising export prices led to large, ongoing trading gains.

Because Canada has a modest trade surplus—it typically makes up less than 5% of GDP—the Salter ratio effect is muted in Canada (Table 1). The terms-of-trade effect, however, is significant. The average share of exports and imports in nominal GDP ranged between a low of 24% in the 1980s and a high of 41% in the late 1990s. Because Canada engages heavily in trade but only runs a modest surplus, it is more susceptible to terms-of-trade shifts than Salter-ratio changes.

Figure 2
Real gross domestic income growth, by source
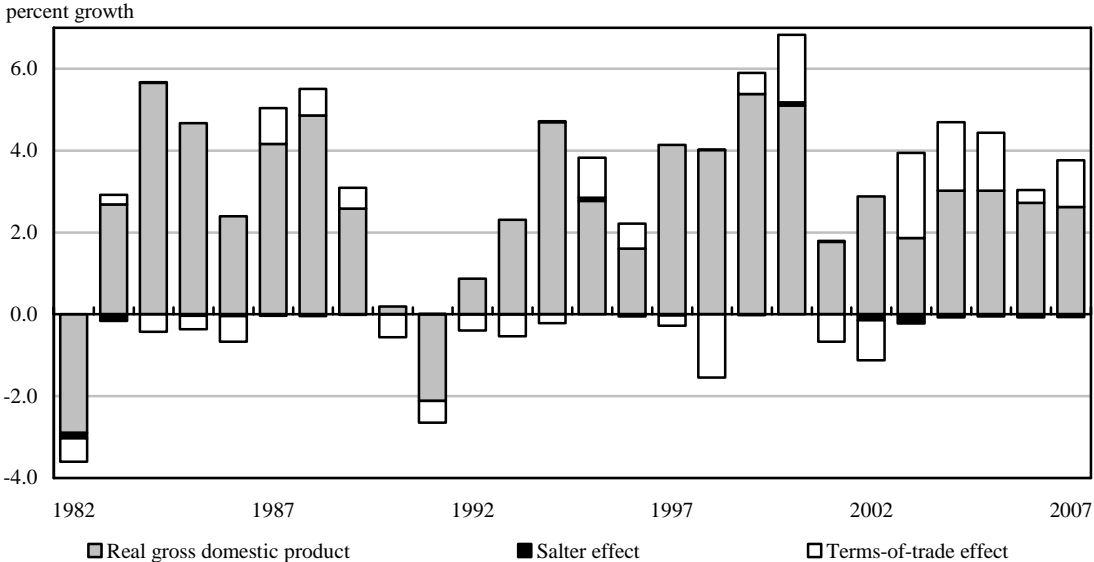
Source: Author's calculations based on Statistics Canada, CANSIM table 380-0017.
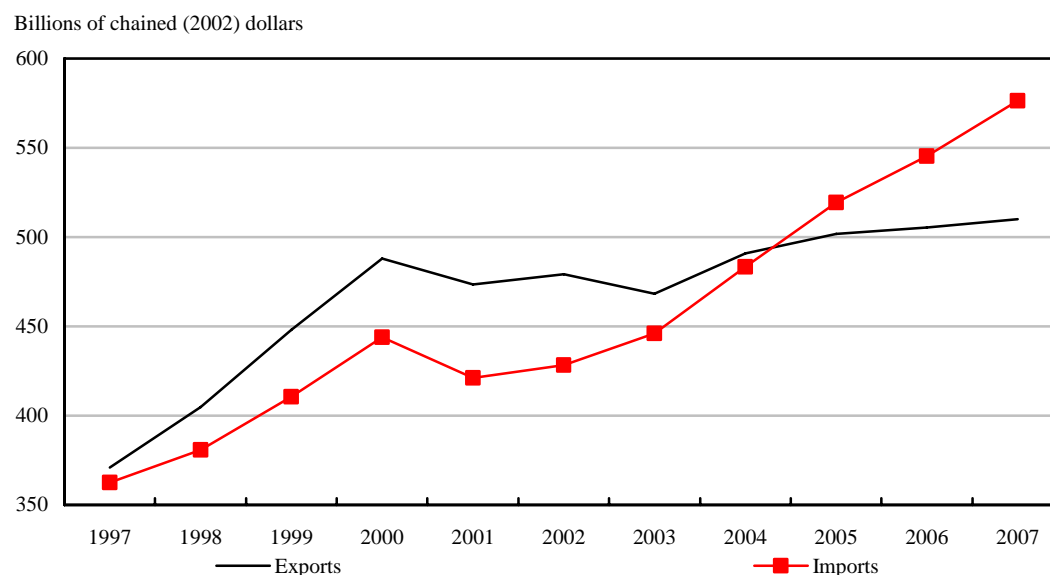
Table 1
Real gross domestic income growth decomposed

	Average real gross domestic income growth by source			Average contribution to growth		Average change		Average weight	
	Real gross domestic income	Real gross domestic product	Trading gain	Salter ratio	Terms of trade	Salter ratio	Terms of trade	Salter ratio	Terms of trade
	percent		percentage-point contribution			percent			
1983 to 1990	3.40	3.40	0.00	-0.04	0.04	-2.83	0.16	0.02	0.26
1992 to 2002	3.15	3.23	-0.08	0.00	-0.08	0.87	-0.27	0.03	0.36
2003 to 2007	3.88	2.65	1.23	-0.10	1.32	-2.74	3.65	0.04	0.36

Source: Author's calculations.

A country can capitalize on its terms-of-trade improvement in different ways: by transforming its stream of exports into a larger stream of imports, lowering its exports or raising its savings. If the first option occurs, import growth should outpace export growth, which is in fact what has occurred in Canada (Figure 3). From 2003 to 2007, real imports have expanded at an average annual rate of 6.1% while exports have risen by an average of 1.3%. Higher consumption and investment levels have resulted as the domestic economy has absorbed the increased stream of imports. From 2003 to 2007, consumption growth has risen at an annual average rate of 3.8%, while investment has risen at an average rate of 6.7%. Both consumption and investment outpaced real GDP's average annual growth of 2.7%, and are more in line with the 3.9% annual average growth in real GDI.[4]

Figure 3
Real imports and real exports, 1997 to 2007

Billions of chained (2002) dollars

Source: Author's calculations based on Statistics Canada, CANSIM table 380-0017.

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4. Canada's investment in machinery and equipment is heavily dependent on imported goods. As a result, investment is more elastic than consumption to changes in import prices. From 2003 to 2007, import prices declined at an average annual rate of 2.6%, contributing to investment growth.

Analysis of Canada as a whole points to two main features. First, the relative price changes affecting the Canadian economy after 2002, while drawn from similar sources as previous shifts, have a more pronounced effect than they had previously. Second, price changes have a different composition; in particular, while resource export prices have risen, import prices have also fallen.

3.3 Provincial real gross domestic product compared with real gross domestic income

While the contribution to Canada's real GDI growth from its trading gain is historically large after 2002, the impact of relative price changes have also been significant for many of the provinces. Because the Canadian provinces have broadly differing economic structures, relative prices changes have led to significant differences in economic performance. To a large extent, the differences across regions stem from the type of commodity whose price changes.

During the 1980s and 1990s, it was unusual for a broad range of commodity prices to increase or decrease in tandem. In fact, energy and industrial material commodity price movements had a negative correlation of -0.62 from 1981 to 1989 (Table 2). Food and energy commodities exhibited a moderate positive correlation, while food and industrial materials were weakly correlated. During the 1990s, the correlations across commodities tended to remain weak, except for food and industrial commodity prices. After 2002, however, there has been a strong positive correlation between commodities price movements.

Because commodity prices tend not to move in tandem, changes in commodity prices have historically led to a redistribution of purchasing power across provinces. The post-2002 commodity-price movements have similarly redistributed purchasing power, but in an importantly different manner. Prior to 2002, a rise (fall) in energy-producing provinces' purchasing power was accompanied by a decrease (rise) in the purchasing power of energy-importing provinces; after 2002, a redistribution has occurred because certain provinces have seen larger gains than others. Only in one instance do the relative price changes detract from real income growth after 2002. The difference comes from how provincial economies have dealt with increased commodity costs and falling world manufactured goods prices.

Table 2
Correlations in commodity price movements

	Energy	Food	Industrial materials
1981 to 1989			
Energy	1.00	0.51	-0.62
Food	0.51	1.00	0.30
Industrial materials	-0.62	0.30	1.00
1990 to 1999			
Energy	1.00	0.30	0.07
Food	0.30	1.00	0.58
Industrial materials	0.07	0.58	1.00
2002 to 2007			
Energy	1.00	0.88	0.90
Food	0.88	1.00	0.95
Industrial materials	0.90	0.95	1.00

Source: Author's calculations based on Statistics Canada, CANSIM table 176-0001.

Prior to examining real GDP, the trading gain and real GDI, a discussion of the structure of the provincial economies will serve to illustrate why the differing composition of price changes in the 1980s, 1990s and 2000s is important. A breakdown of each province's economic structure is provided in Table 3. For each province, the average share of nominal business sector GDP for each industry is shown.

GDP in the most eastern province, Newfoundland and Labrador, is dominated by mining, oil and gas extraction, which is a relatively new phenomenon. Traditionally, the Newfoundland and Labrador economy had been dominated by fisheries and the service sector. However, following the collapse of the cod stocks in the late 1990s, and the initiation of offshore oil and gas extraction, the make up of the province's economy has changed dramatically.

The economies of Prince Edward Island, Nova Scotia and New Brunswick are broadly similar. Agriculture and fisheries activities play an important role in GDP, particularly in Prince Edward Island which produces a significant number of potatoes and mussels. Mining, oil and gas extraction is relatively unimportant, except in Nova Scotia, where there are offshore energy deposits. In each of these provinces, manufacturing and finance, insurance, real estate and leasing (FIREL) activities are important sources of value added.

The central economies of Quebec and Ontario form the manufacturing heartland of the Canadian economy. They are also the largest provincial economies. While manufacturing has the largest GDP share, FIREL, retail, wholesale and professional, scientific and technical services industries also make significant contributions to these economies. FIREL is particularly large in Ontario, which is the centre of the Canadian financial industry.

Table 3
Nominal value added shares, 2003-to-2004 average

	N.L.	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.
	percent									
Agriculture, fishing, hunting and forestry	3.4	13.1	4.5	5.3	2.6	1.3	6.7	11.4	2.8	4.4
Mining, oil and gas extraction	42.6	0.1	7.4	1.8	0.9	1.0	3.2	25.8	34.8	6.8
Utilities	4.6	1.9	4.0	5.4	5.5	3.0	4.4	3.3	2.5	2.8
Construction	5.8	8.2	8.6	8.6	7.1	6.8	5.6	6.2	8.6	7.6
Manufacturing	7.1	18.8	16.9	22.1	26.5	26.4	19.1	9.3	9.4	14.5
Wholesale	3.9	4.9	6.6	7.2	7.0	7.7	7.9	6.5	5.2	6.6
Retail	7.0	11.5	10.1	9.2	8.1	7.3	9.1	6.4	5.0	8.4
Transportation and warehousing	4.0	4.1	5.9	7.5	5.7	5.0	9.5	7.5	5.9	8.2
Information and culture	4.0	5.4	5.2	4.7	5.1	5.1	4.7	3.2	3.0	5.4
Finance, insurance, real estate and leasing	7.3	13.9	14.3	12.4	14.1	18.1	14.6	9.8	9.5	16.5
Professional, scientific and technical services	3.2	3.7	4.7	4.0	5.7	7.2	3.8	2.3	5.3	6.0
Administrative and support, waste management services	1.3	2.6	3.2	3.3	3.5	3.7	2.6	1.4	2.2	2.8
Arts, entertainment and recreation	0.5	1.7	1.1	1.0	1.5	1.3	1.5	1.0	0.8	1.7
Accommodation and food services	2.5	5.6	3.8	3.4	3.1	2.7	3.2	2.6	2.5	4.2
Other services	2.7	4.5	3.7	3.9	3.5	3.3	4.3	3.2	2.6	4.2

Source: Statistics Canada, CANSIM table 379-0025.

Although their physical geography is similar, the Prairie provinces of Manitoba, Saskatchewan and Alberta have notably different economic structures. Although Manitoba's agricultural value added share is larger than Quebec's or Ontario's, in most other respects it is quite similar to the central Canadian economies. Saskatchewan, while more dependent on agriculture, as well as Alberta, generates a significant portion of value added from mining, oil and gas extraction. These provinces, especially Alberta, are the major oil producers in Canada. British Columbia's major source of value added comes from manufacturing, while retail trade, transportation and FIREL also have important shares.

Although the value added shares illustrate the different regional economic structures, they do not sufficiently illustrate the degree of difference across the regions on their own. The mix of commodities produced, particularly in the goods sector, has important implications for how the provinces respond to terms-of-trade and Salter-ratio shocks. Table 4 shows the export share for broadly grouped product types from each province to destinations outside of Canada.

An examination of the export shares indicates that the provinces are less diversified than the value added shares suggest. In almost every province, the proportion of exports accounted for by the top two product groupings exceeds 60%. In some cases, such as Newfoundland and Labrador and Alberta, more than half of all exports by value are related to a single type of product. In British Columbia and Ontario, forestry and automotive exports, respectively, make up over 40% of exports. Although each of these two provinces has a manufacturing industry, the export shares reinforce the notion that manufacturing in Ontario is dominated by automotive products, while manufacturing in British Columbia is dominated by wood products.
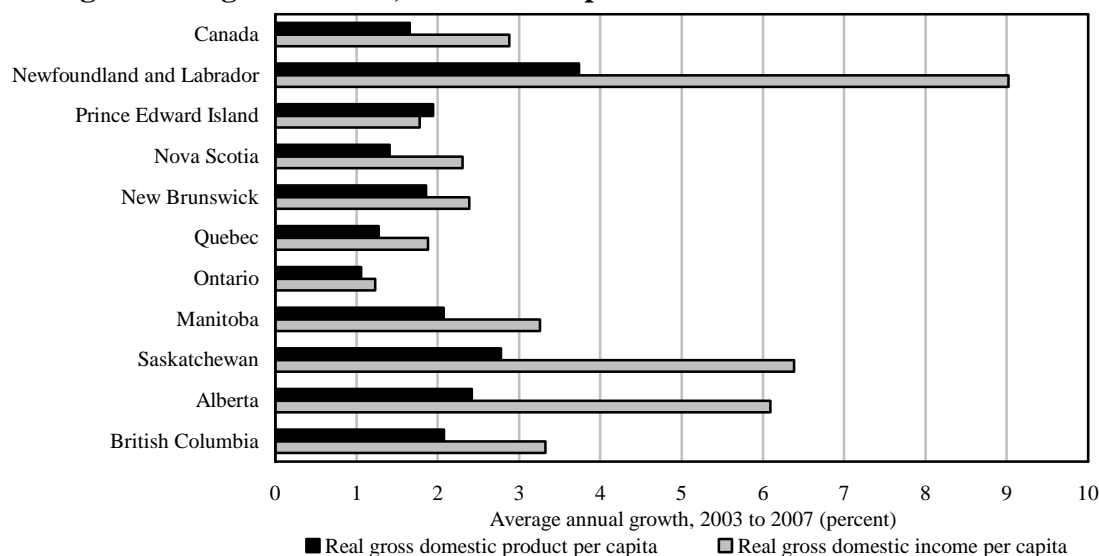
Table 4
Nominal export shares by product type, 2003-to-2007 average

	N.L.	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.
					percent					
Agriculture and fish	10.9	68.0	23.9	12.4	5.8	4.5	28.5	28.5	6.8	7.3
Energy	69.4	0.0	23.3	53.8	3.0	1.5	8.3	37.4	69.0	18.8
Forestry	5.9	1.8	16.6	18.7	14.1	3.4	5.6	4.0	3.8	40.5
Industrial goods and materials	12.1	2.8	9.2	8.0	27.0	19.9	23.6	24.5	12.8	15.8
Machinery and equipment	0.8	11.3	21.4	4.9	35.4	20.6	18.8	4.1	5.8	12.3
Automotive products	0.0	0.5	2.5	0.4	3.8	43.3	6.7	0.5	0.7	1.2
Other consumer goods	0.0	2.7	1.3	0.7	6.4	4.4	5.8	0.2	0.3	2.3

Source: Statistics Canada, CANSIM table 228-0034.

The concentration of exports in particular product areas means that relative price changes, either through the terms of trade or the Salter ratio, will have differential impacts across provinces. As a result, real GDP and real GDI changes take on very different magnitudes between 2003 and 2007. Figure 4 plots the average annual growth rate of real GDP and real GDI for Canada and for each of the provinces from 2003 to 2007. While including the trading gain does lead to some minor changes in the rankings of which provinces have grown the fastest (mostly due to changes in the ranking of oil-producing provinces), the trading-gain-adjusted measure illustrates how much stronger the growth in the purchasing power of income has been relative to the volume of income produced across most provinces.

Figure 4
Real gross domestic product compared with real gross domestic income average annual growth rates, Canada and provinces
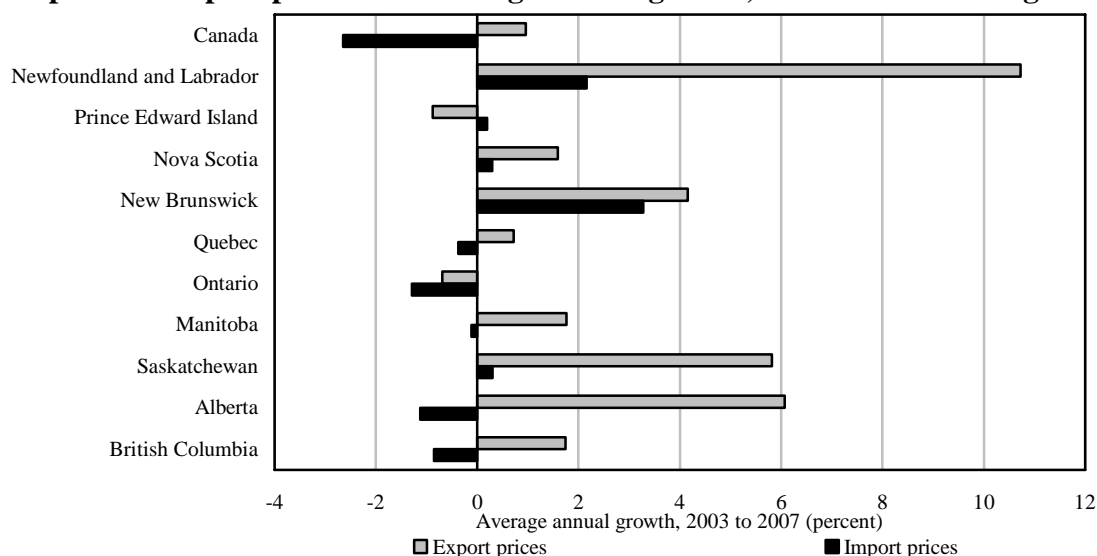

Source: Statistics Canada, CANSIM table 394-0002.

During the 2003-to-2007 period, one of the more striking changes is the decline in import prices. The decline in import prices, induced by the appreciating Canadian-U.S. exchange rate and the integration of Asian manufacturing into the world economy, have contributed to Canada's trading gain. However, each of the provinces has benefited to a different degree.

Although Canada has seen an increase in its terms of trade due to falling import prices and rising export prices, many provinces have, in fact, seen import and export prices move in the same direction (Figure 5). In Newfoundland and Labrador, Nova Scotia, New Brunswick and Saskatchewan, both import and export price indices have risen. However, the rise in export prices is larger than the rise in import prices, leading to terms-of-trade improvements in each case. In Ontario, import and export prices declined as the currency appreciated; however, the decline in import prices is more pronounced leading to small terms-of-trade improvements. In Quebec, Manitoba, Alberta and British Columbia, import prices fell while export prices rose, a situation that potentially generates large terms-of-trade improvements. Prince Edward Island is the only province to have experienced a terms-of-trade deterioration.

While the terms of trade tend to contribute to real income growth, the impact of the Salter ratio is less consistent across provinces. Inter-provincial transfers, which take many forms including governmental transfers, redistribute income from richer to poorer regions. These transfers of funds affect the level of aggregate expenditures in both the sending and receiving provinces. Since the impact of the Salter ratio is weighted by net exports as a share of nominal GDP, inter-provincial transfers can make the Salter ratio effect more pronounced at the provincial level.[5]

Figure 5
Import and export price index average annual growth, 2003-to-2007 average

Source: Statistics Canada, CANSIM table 384-0002.

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5. The System of National Accounts does not produce data on these inter-provincial income flows; accordingly, current account balances at the provincial level are not available. As a result, the analysis cannot move from producing estimates of real gross domestic income to real gross national income.

The contribution to the trading gain from the terms of trade and the Salter ratio for each of the provinces, and for Canada, is shown in Table 5. The first two columns show the average annual contributions during the 2003-to-2007 period. The last four columns show the average annual contributions for each relative price ratio during the 1993-to-2002 and the 1983-to-1990 periods, respectively. The contributions during the years 2003 to 2007 help to explain the size of the trading gain that has been realized, while the contributions during the earlier periods illustrate why the Canadian trading gain was modest during the 1980s and 1990s and pronounced after 2002.

Table 5
Contribution to real gross domestic income growth from Salter-ratio and terms-of-trade changes across periods

|	2003 to 2007		1992 to 2002		1983 to 1990	
	Salter ratio	Terms of trade	Salter ratio	Terms of trade	Salter ratio	Terms of trade
Canada	-0.10	1.32	0.00	-0.08	-0.04	0.04
Newfoundland and Labrador	0.26	5.02	-0.33	0.68	0.43	-0.41
Prince Edward Island	0.52	-0.69	-0.04	0.11	0.29	0.60
Nova Scotia	0.17	0.73	-0.09	-0.14	0.61	0.29
New Brunswick	-0.17	0.70	-0.11	-0.07	0.37	0.64
Quebec	0.01	0.60	-0.02	-0.06	0.05	0.75
Ontario	-0.19	0.36	0.02	-0.32	-0.22	0.68
Manitoba	0.04	1.14	-0.01	-0.08	0.08	0.02
Saskatchewan	0.09	3.51	0.00	0.64	0.20	-1.56
Alberta	0.08	3.75	0.08	0.79	-0.38	-2.36
British Columbia	0.06	1.18	-0.03	0.17	0.03	0.33

Source: Author's calculations.

During the 2003-to-2007 period, terms-of-trade changes have been the dominant factor affecting provincial trading gains, especially for the energy-producing provinces of Newfoundland and Labrador, Saskatchewan and Alberta. Energy-importing provinces have also seen terms-of-trade improvements contribute positively to their trading gains. The Salter-ratio contribution, on the other hand, has been negligible in many cases. Nevertheless, there are particular provinces where the contribution from the Salter ratio is important. In Ontario from 2003 to 2007, the Salter ratio and terms of trade have had, on average, similar, offsetting effects. Similar offsetting effects have occurred in Prince Edward Island and New Brunswick, although the magnitude of the terms-of-trade effect is slightly larger than the Salter ratio effect in these cases.

Strikingly, during the 2003-to-2007 years, provincial trading gains have been mostly positive. In every province, except for Prince Edward Island, the trading gain has contributed to real income growth. In previous periods, the trading gain was not as widespread. During the 1983-to-1990 period, when energy prices were falling, trading gains tended to contribute to real income growth in the energy-importing provinces such as Quebec, Ontario, Nova Scotia and New Brunswick and they detracted from real income growth in the energy-exporting provinces of Alberta and Saskatchewan (Newfoundland and Labrador did not develop its offshore oil and gas industry until the 1990s). A similar pattern emerged in the 1990s, when trading gains detracted from real income growth in energy-importing provinces and contributed to real income growth in energy-exporting provinces.

The dichotomy between the 1980s, 1990s and post-2002 years is well illustrated by Alberta, Quebec and Newfoundland and Labrador (Figures 6 to 8). Alberta's real GDI rose and fell much more rapidly than its real GDP, as changes in energy prices affected the purchasing power of its income. The effect was consistent across decades—fluctuations in energy prices always drive trading gains.

Figure 6
Real gross domestic product compared with real gross domestic income in Alberta

Millions of chained (2002) dollars
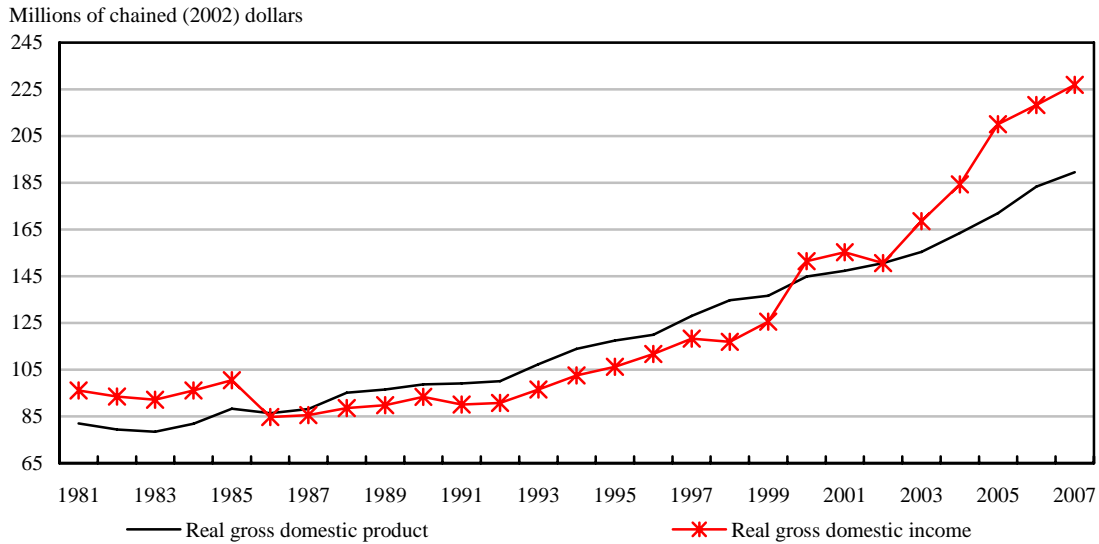
Source: Author's calculations based on Statistics Canada, CANSIM table 384-0002.

Figure 7
Real gross domestic product compared with real gross domestic income in Quebec

Millions of chained (2002) dollars
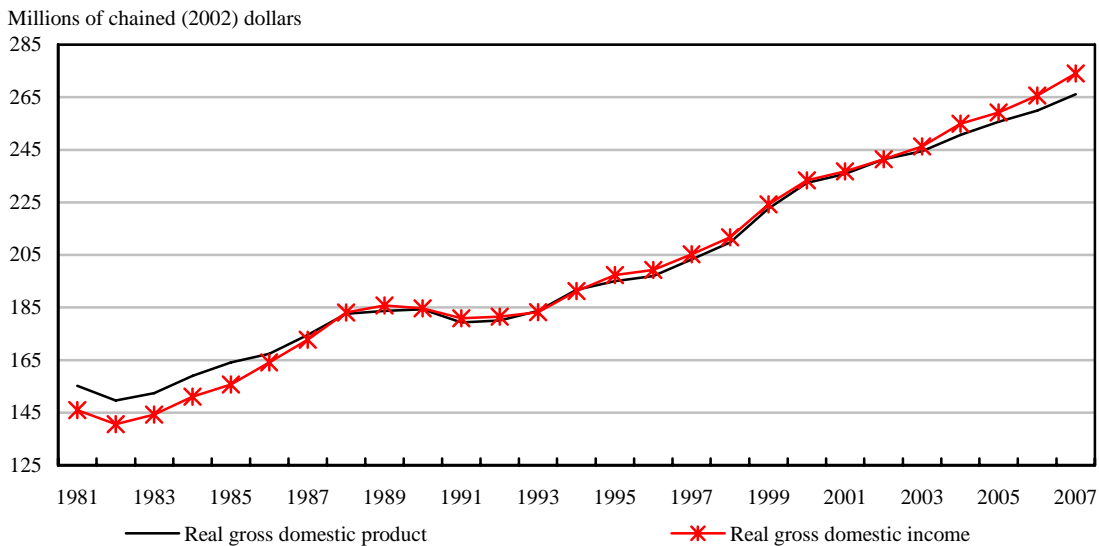
Source: Author's calculations based on Statistics Canada, CANSIM table 384-0002.

In Quebec, trading gains were positive in the early 1980s and after 2002. In the earlier period, the positive effect had come from falling energy prices, while in the later years the positive effect came in spite of rising energy prices. Movements in other commodities, which were not well correlated in the 1980s, and falling prices for other imports overcame the negative effects of rising energy prices on Quebec's purchasing power after 2002.

In Newfoundland and Labrador, there was little effect from relative price changes during the 1980s. During the 1990s, the province expanded its resource base when offshore oil and gas began being marketed. When prices for energy began rising after 2002, real GDI in Newfoundland and Labrador accelerated sharply.

Figure 8
Real gross domestic product compared with real gross domestic income in Newfoundland and Labrador

Millions of chained (2002) dollars
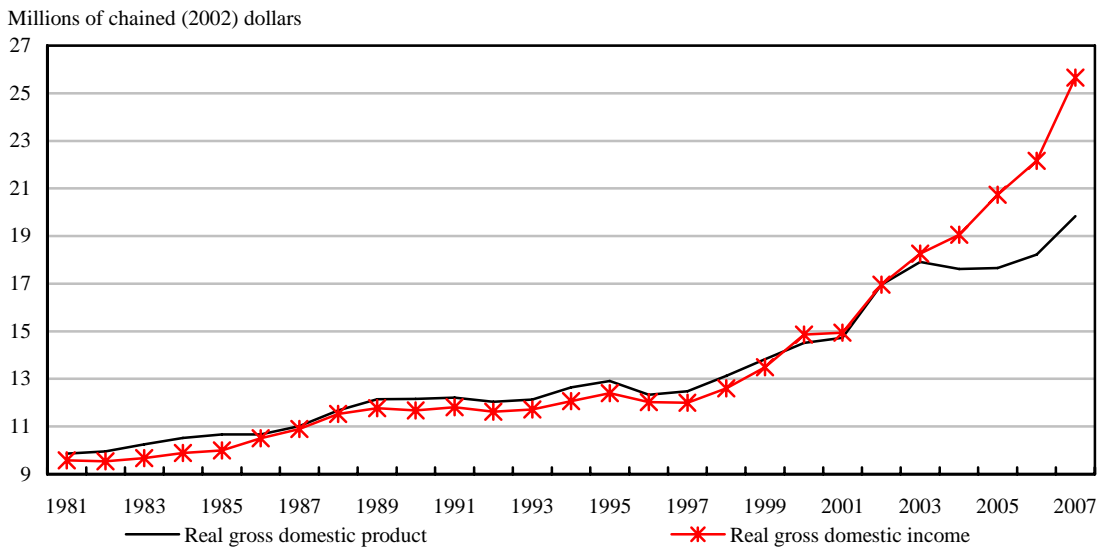
Source: Author's calculations based on Statistics Canada, CANSIM table 384-0002.

The two major differences between the post-2002 years and the 1980s and 1990s—the widespread commodity price rises and the integration of Asian manufacturers into the global economy—have allowed almost all provinces to benefit to some degree. Because the source and composition of the relative price changes were substantially different from previous periods, the response of the provinces has been more consistent across the country and, in many cases, stronger. The offsetting nature of energy price shocks from the past has been overcome in the post-2002 years.

4   Concluding remarks

Relative price changes, whether from terms-of-trade or Salter-ratio fluctuations, have significant impacts on the purchasing power of domestic economies. By explicitly incorporating the trading gain into a real income measure, it is possible to more accurately describe and analyse regional economic performance. In a world where relative prices undergo large, rapid changes, real gross domestic product is a less than ideal real income measure, particularly when compared with a measure such as real gross domestic income. The inclusion of the trading gain allows for analysis that moves beyond production; in Canada's case it explicitly includes the impact of the economy's endowment.

The analysis here has shown that the impact of relative price changes can vary over time as economies evolve, and that understanding the composition of price changes is crucial for explaining changes in an economy's real income growth. The Canadian economy is in the midst of a structural shift, much of which is fuelled by the relative price changes. By examining the structures of the provincial economies, and their differential response to relative price shocks, it becomes clear why Canada as a whole has done so well in the face of rising commodity prices and an appreciating currency with its largest trading partner, the United States.

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