

INSTITUTE OF INTERGOVERNMENTAL RELATIONS WORKING PAPER

Terms-of-trade changes, the Dutch disease, and Canadian provincial disparity

Serge Coulombe
Department of Economics
University of Ottawa

In this paper, I first show that Canadian provincial disparities in 2012 have been essentially shaped by the relative evolution of regional terms of trade during the resource boom of 2002 to 2008. Differences in productivity growth across provinces in the past 25 years have not contributed to provincial disparities in living standards. Second, I argue that the resource boom might have been detrimental to the economy of some provinces because of a Dutch disease.

**Institute of Intergovernmental Relations
School of Policy Studies, Queen's University**

Working Paper 2013 - 01



Introduction

In an economy opened to international trade, improvements in living standards are determined in the long run by productivity gains and terms of trade changes. To illustrate this, suppose the economy produces only cakes that are sold in international markets for other goods. The economy will get richer when productivity gains generate an increase in the numbers of manufactured cakes. Improvements in terms of trade also make the economy richer with the increase in prices cakes are sold for other goods in international markets.

The primary purpose of this paper is to show that the favourable evolution of terms of trade during the resource boom of 2002 to 2008 has largely shaped Canadian provincial disparity in 2012. This results from the uneven spread of valuable natural resources across the territory and the provincial ownership of resources. In the second part of the paper, I will argue that the resource boom might not have been beneficial to all Canadian provinces due to a 'Dutch disease'.

The relative importance of productivity gains and terms of trade changes depends on the degrees of openness and diversification of an economy. In a large and diversified economy such as the United States, exports do not account for a substantial portion of GDP (14 % only in 2011¹) and the export base is well diversified. We should not be surprised that American economists are not very interested in measuring and analysing the contribution of terms of trade changes to living standards. For American economist, the only driver that matters is productivity gain. Canadian economists, however, should devote more attention to terms of trade changes since exports in Canada account for a larger part of GDP (31 % in 2011). Furthermore, Canada is a net exporter of natural resources and it is well known that the prices of energy and other commodities are more volatile than for manufacturing goods in international markets. Canadian regional economists should devote even more attention to terms of trade changes since Canada is a vast and sparsely populated country and its large endowment of natural resources is not evenly distributed across provinces. Furthermore, a whole is usually more diversified than any of its part. Consequently, most Canadian provinces, with the exception of Quebec and Ontario, are not as diversified as Canada.

In a nutshell, the smaller the economy is, the more open it is, and the less diversified it is (three things that usually go together), the more the evolution of welfare is determined by the good fortune of terms of trade changes. Given that the evolutions of commodity prices are much more volatile than that of manufacturing goods, the effects of terms of trade on living standards are exacerbated in a small resource base economy.

Labour productivity, the primary concept of productivity, is measured as the ratio between the quantity of output (GDP) and the units of labour (hour worked). Productivity gains can be achieved by three sources: 1) giving labour better and more tools (capital deepening), 2) improving the skills of the labour forces with education, training, and/or learning-by-doing (human capital), and 3) adopting new and more efficient technologies (multifactor productivity growth).

Canada has long been recognized in the abundant productivity literature as a very poor performer among developed economies (see for example, Tang, Rao, and Li, 2010). Between 1990 and 2004, Coulombe (2011, 6) reports that productivity growth in Canada was on average one-half percentage point per year smaller than the average of OECD countries. In matters of productivity growth, one-half a point per year is a substantial number. Suppose that two

¹ Data source for export to GDP is the World Bank, <http://data.worldbank.org/indicator/NE.EXP.GNFS.ZS>

economies, A and B, initially have the same per capita GDP and that economy A is able to sustain for a long period of time a productivity growth one-half percentage point per year larger than economy B. After 140 years, economy A will be twice as rich as economy B.

An economy can also become richer if the prices of goods it is selling to its trading partners are increasing compared with the prices of the goods it is purchasing. Changes in terms of trades may be best viewed as the relative evolution of the prices of exports and imports. For example, when the prices of manufacturing goods are slowly decreasing in world markets and the prices of commodities are increasing, as it has been the case between 2002 and 2008, terms of trade of countries like Canada, Australia, and Norway, and provinces like Alberta, Saskatchewan, and Newfoundland, are improving. It is important to point out that terms of trade changes work both ways. When the relative price of potash for example increases in world markets, the terms of trade for potash sellers improve whereas they deteriorate for purchasers of potash.

Terms of trade gains might result from a favourable industrial structure when an economy, because of historical accidents or well thought industrial policy, has acquired a know-how in producing goods and services with raising relative prices. Kohli (2004) has argued that it might be the case of Switzerland, which saw its terms of trade improving by 34 % between 1980 and 1996. Generally speaking, however, if productivity gains result from hard work and from being smarter, terms of trade gains result from luck (Coulombe, 2011). This is particularly true for natural resources since the endowment is determined by geography, ownership by law and political competition, and commodity prices are determined in international markets.

Luck is also very important in the case of Canadian provinces since thanks to historical events (see Plourde 2012), ownership and most of the resource revenues (including for offshore oil extraction) were granted to provinces. Anderson (2012) analyses the division of power between local, provincial, and the federal governments regarding the ownership, management, and resource revenues for petroleum in 12 federations (Argentina, Australia, Brazil, Canada, India, Malaysia, Mexico, Nigeria, Pakistan, Russia, United States, and Venezuela). He shows that for onshore resources, Canada is the only federation for which the resource is owned and managed by provinces, which also received the resource revenues accrued from their exploitation. For offshore resources, even if the resource ownership and management are both within federal jurisdiction by the constitution, Canada is the only federation where the resource revenues have been ceded entirely to the provinces.

In the following section, I will show that terms of trade changes that occurred during the resource boom of 2002-2008 are the key driver of the actual provincial disparity in Canada.

Luck matters not productivity

Before looking at numbers, I briefly highlight the methodology used to derive the provincial and national terms of trade effect. The data on productivity (used for Figure 4) and terms of trade (Figures 1 and 3) were taken from Coulombe (2011). The data on labour productivity is straightforward and is measured by provincial real GDP divided by the number of hours work.

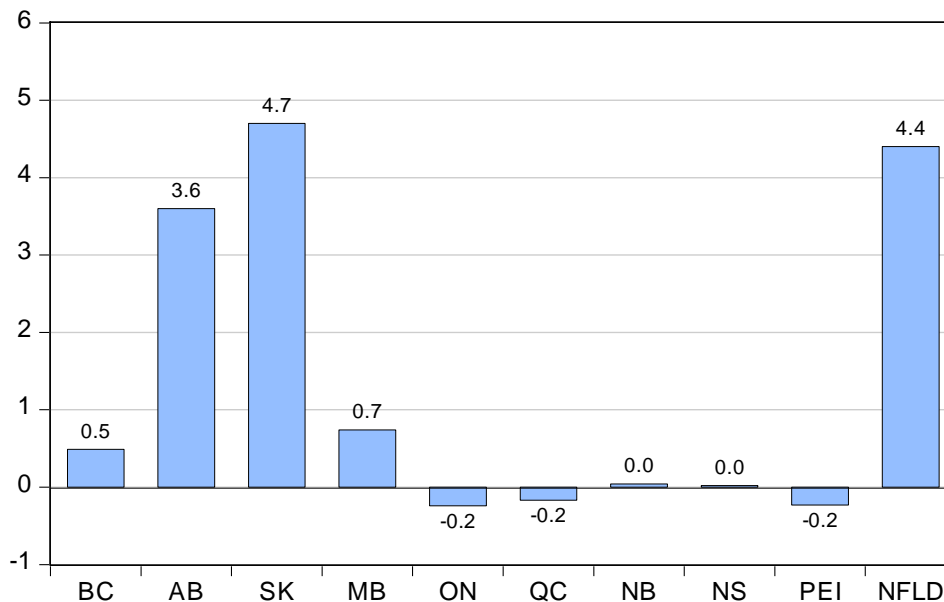
I derived my own data on terms of trade following a simple methodology that I have developed in my studies on Canadian provincial convergence that go back to Coulombe and Lee (1995). The methodology is based on the concept that terms of trade are included in the measure of nominal GDP but are excluded from the measure of real GDP. This is why real GDP growth (and productivity growth) is a very incomplete measure of improvement in living standards for regional economies that are experiencing rapid changes in their terms of trade. For big economies such as the United States, terms of trade changes are not important on a year-to-year

basis or in the long run, and real GDP growth is a good proxy for improvement in living standards.

To measure the changes in terms of trade, I first deflate nominal GDP (Canada and the ten provinces) using a national consumer price index (CPI).² With this, I get a concept analogous to national income. Terms of trade changes are measured as the difference between the growth of the CPI deflated nominal GDP and the growth of real GDP. With this methodology, it is important to point out that I capture the effect of terms of trade changes for a Canadian province resulting from both its international and interprovincial trade. This simple methodology provides results that are generally very similar to measures obtained by more sophisticated approaches such as in Kohli (2004) and Diewert and Yu (2012).

During the resource boom period between 2001 and the fall of 2008, improvements in terms of trade have accounted for 30 % of the progress of living standards in Canada. The key point that comes out of Figure 1 that depicts the provincial distribution of the windfall is that this good fortune has not been equally spread. A positive (negative) number in this figure indicates that terms of trade have improved (deteriorated) on average during the 2002-2008 period.

Figure 1. Contribution of terms of trade changes to provincial income growth
annual % average 2002-2008



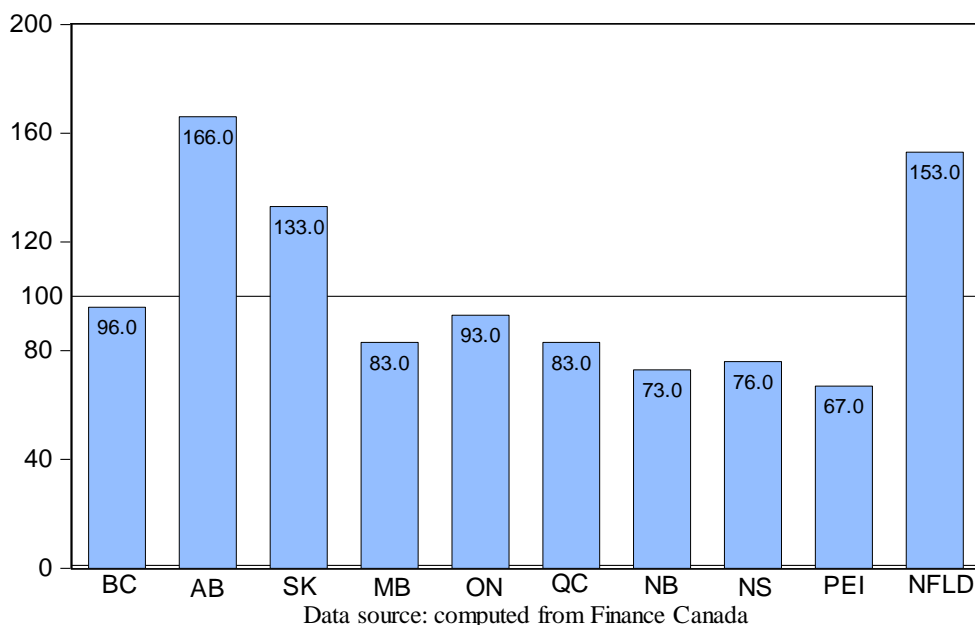
Saskatchewan, Newfoundland, and Alberta, three provinces that account for only 15% of the Canadian population, were the winners of the resource-boom lottery. In Saskatchewan, with an annual improvement in living standards generated by a terms of trade gain of 4.7%, the resource boom accounted for a 33% increase in national income over a six year period only. This is close to the 34% improvements in living standards by Switzerland that was achieved over a 16 year period as mentioned by Kohli (2004). Newfoundland and Alberta have also benefitted from substantial bonanza. The effect of terms of trade changes is almost null, or slightly negative, in

² Provincial CPI cannot be compared in levels between provinces, only in growth rates.

Central Canada and the Maritimes. The term of trade effect is positive in British Columbia and Manitoba but on a much smaller scale than in the three booming provinces.

I am using the fiscal capacity before equalization as the indicator of a province's living standard. The numbers, obtained directly from Finance Canada, is a measure of the capability of a province to raise revenues and to provide quality public services at a reasonable tax rates. The numbers, normalized at 100 for the province average, are depicted at Figure 2 for fiscal year 2011-2012.

Figure 2. Fiscal capacity before equalization 2011-2012
province average = 100



The provincial disparity painted in Figure 2 is substantial. In Alberta and Newfoundland, the fiscal capacity is more than twice that the one of any of the Maritime Provinces. If Alberta and Ontario were applying the same tax rate to their respective tax base, Alberta would be able to raise 1.80 dollar for each dollar Ontario can raise in tax revenues. In 2011-2012, equalization was able to bring the fiscal capacity of the receiving provinces (Manitoba, Ontario, Quebec, New Brunswick, Nova Scotia, and Prince Edward Island) up to 95 % of the province average. It is important to mention that equalization does not change the fiscal capacity of the non-receiving provinces. Consequently, even after equalization, the fiscal capacity of Alberta was 75 % larger than for any of the receiving provinces. For Newfoundland it was 61 % larger and for Saskatchewan 40 %.

The striking point that comes out of the analysis of both Figures 1 and 2 is that the distribution of fiscal capacities across provinces appears to be closely related (or correlated) with the terms of trade changes that occurred during the resource boom period. This point is emphasized in Figure 3 with a scatter diagram.

The scatter and the fitted regression line (equation R1) illustrate the close relationship between the good fortune of Canadian province (terms of trade changes during the resource boom) and living standards in 2011-2012. In the regression equation R1, the variable *FS* (measured in 2012) stands for the fiscal capacity (Figure 2). This is our dependant variable. The variable is regressed on a constant and the terms of trade variable *TT* (the change between 2002

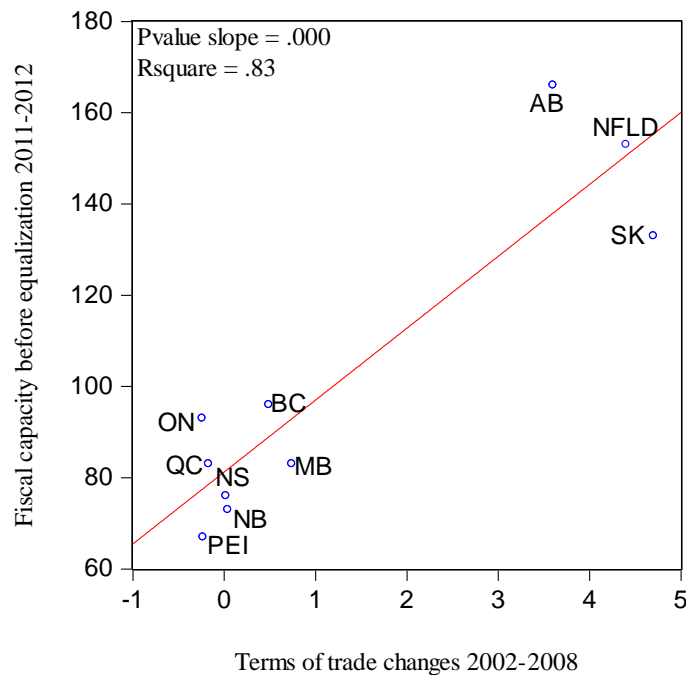
and 2008 as depicted in Figure 1). The R-square and the p-value (significance level) of the estimated coefficient (the slope in Figure 3) are shown below the regression equation.

With just ten observations (one per province) for the variables (ten points only to fit in Figure 1) it is usually extremely difficult for any variable to reach statistical significance in a regression. Statistical theory tells us that significance levels increase (*ceteris paribus*) with the number of observations. In our case, however, the coefficient of terms of trade is significant well below the 1% level. In order to have the slope coefficient significant at the 1% level with only ten observations you need: a good model, good data, and ... luck.

$$FS_{2012} = 81.3 + 15.76 * TT_{2002-2008} \quad (R1)$$

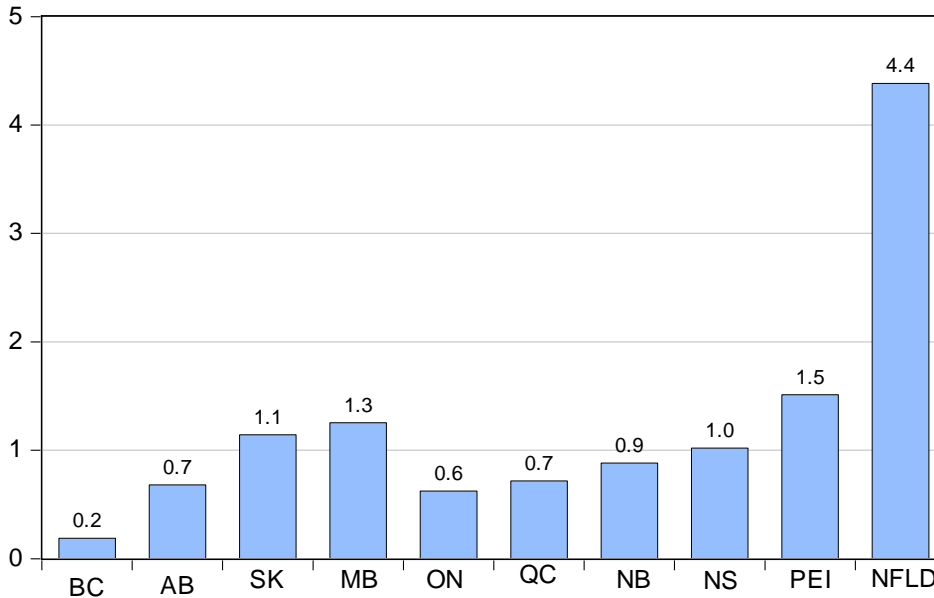
$$R^2 = 0.83 \quad (0.000)$$

Figure 3. Luck Matters



Another interesting result coming from the regression analysis is the high level of the R-square (0.83). This number indicates that 83% of the fiscal capacity of Canadian provinces in 2011-2012 is 'explained' by the simple model that includes only a constant term and terms of trade changes. That does not left much room for other explanations.

Figure 4. Labour productivity growth annual % average 2002-2008



We now turn to see if productivity growth across Canadian provinces is also a significant determinant of today's portrait of Canadian disparity. The data on labour productivity during the resource boom are depicted in Figure 4. Only Newfoundland stands out in terms of labour productivity gains. With average annual growth of 4.4% per year, Newfoundland clearly outpaces the average growth of the other nine provinces, which average only 0.9%. Newfoundland performance results from the shift in its industrial structure from a low productivity level activity, fishing, to a high productivity level activity, off-shore oil extraction. Consequently, taking into account both the terms of trade and the productivity factors, Newfoundland stands out as the clear winner for the resource boom across Canadian provinces.

$$FS_{2012} = 83.5 + 16.53 * TT_{2002-2008} - 2.65 * LPG_{2002-2008} \quad (R2)$$

$$R^2 = 0.83 \quad (0.001) \quad (0.640)$$

The regression equation R2 tests if labour productivity growth (the *LPG* variable in R2) during the resource boom period 2002 to 2008 can also account for a substantial and significant contribution of 2012 provincial disparity together with terms of trade changes. The answer is no. The coefficient on the productivity variable is far from being significant with a p-value of 0.640. Interestingly, the coefficient on the terms of trade variable remains significant well below the 1 % level.

One could argue that it takes times for productivity growth to create substantial differences in living standards such as those depicted in Figure 2 and, consequently, the time period 2002 to 2008 during which productivity changes are measured might be too short. In the regression equation R3, we use the mean labour productivity growth during the 25 year period of 1984 to 2009 (the whole sample used in Coulombe 2011). The results concur with those of R2. The productivity growth variable is far from being significant. The terms of trade variable remains highly significant and the small model continues to explain more than 80% (R-square) of the observed disparity in 2012. In equation regressions R2 and R3, one could also note that the estimated coefficient for the productivity variable has the wrong sign (negative). However, since the p-values in both cases are very high, these coefficients are not significantly different from 0.

$$\begin{aligned}
 FS_{2012} &= 100.00 + 16.84 * TT_{2002-2008} - 21.3 * LPG_{1984-2009} & (R3) \\
 R^2 &= 0.84 & (0.000) & (0.497)
 \end{aligned}$$

The results for R3 and R2 illustrate the robustness of the key stylized facts highlighted in this section. Provincial disparities in 2012 have been to a large extent shaped by terms of trade changes that occurred during the relatively short period of time between 2002 and 2008. Productivity differences across provinces do not matter statistically. Of course, economically, productivity growth does matter for Newfoundland.

The fruits from the resource boom are unevenly distributed across provinces. The consequences of these imbalances are exacerbated in Canada given the high degree of decentralization of the federation (see Boadway, Coulombe, and Tremblay, 2012). Of course federal equalization payments transfer some of the bitumen bust to non-booming provinces. Yet, the fiscal capacities of the have and have-not provinces are far from being equalized at 100%. In the next section, we will go a step further in our argument that the resource boom has contributed to shape the current provincial disparity in Canada. We will argue that it is possible that the resource boom might have been detrimental to the economy of some provinces because of a Dutch disease.

Reflections on the Dutch disease and provincial disparity

It has long been alleged in the development literature that the abundance of natural resources might be detrimental for economic development. Van der Ploeg (2011) provides a survey of the so-called Resource Curse. The Dutch disease is a more specific phenomenon that can affect the growth patterns and the industrial structure of well-developed countries. A Dutch disease might occur when a resource boom in an economy pushes the exchange rate up and crowds out trade-exposed manufacturing industries. Furthermore, the resource boom attracts scarce labour and capital from the manufacturing sector. This resource movement factor contributes to rising costs and to a loss of competitiveness of trade-exposed manufacturing industries.

In the absence of market failures and intertemporal dimension, a market adjustment might be best viewed as a ‘Dutch affair’ more than a disease, implying a temporarily costly transfer of labour and capital from the manufacturing to the more productive booming sector. However, the Dutch affair becomes a disease when the resource boom is over; the manufacturing base is gone and will not come back. Krugman (1987) argues on theoretical grounds that it might be the case with the presence of learning-by-doing that is industry specific. This is an example of a market failure known as an externality. After a while, when the manufacturing base is gone, it is not possible to start again making manufacturing goods because the know-how had disappeared.

Historically, the exploitation of many natural resources has been characterized by booms and busts. Sometimes the bust arises from the complete depletion of the resource (gold rush) and the economy is left with a ghost town. At other times, the bust comes with technological progress in substitutes that renders obsolete a specific resource extraction process (the Guano Boom in Peru in the mid-1800s). Boom and busts are the main reason why a Dutch disease might occur from the exploitation of natural resources. It is more delicate to plan consumption and savings from an income arising from temporary windfalls rather than from a steady stream of income generated by economic activities from the secondary and tertiary sectors. Some economic activities from the primary sector such as agriculture and livestock also generate a relatively steady stream of income and are not subject to generating a Dutch disease.

Of course it is not possible today to know if the manufacturing activities lost in Canada due to the resource boom will come back or not when the resource boom will be over. There is too much uncertainty. It is possible however to quantify if some manufacturing economic activities in Canada have been lost because of the resource boom. This is precisely the subject of the empirical analysis of Beine, Bos and Coulombe (2012) (BBC thereafter).

The BBC (2012) analysis consists of three steps. First, the evolution of the Canada-US bilateral (real) exchange rate (CAD) is divided into a Canadian and a US component. The division is based on the observation that an exchange rate is a relative price, i.e., the ratio between the value of the Canadian and the US dollar in international markets. Second, they show that the Canadian component is driven by commodity (energy and non-energy) prices whereas the US component is not. Third, they show that employment in the trade-exposed manufacturing sector have been negatively affected by the evolution of the Canadian component during the resource boom of 2002-2008.

During the 2002 to 2008 period, the results of BBC (2012) suggest that 42 % of the appreciation of the CAD was due to the resource boom (the Canadian component). The remaining 58% was the results of the depreciation of the US component following the bust of the dot.com bubble and other events unrelated to the Canadian resource sector. They also find some evidence that the appreciation of the CAD resulting from commodity prices has harmed the employment in trade-exposed manufacturing industries. They found that around 100 000 job loss in the manufacturing sector between 2002 and 2008 can be related to the resource boom and the consequent appreciation of the CAD. Not all manufacturing industries have been affected but those affected negatively were generally exposed to international competition. The employment model they are estimating is a dynamic adjustment model. Consequently, the numbers reported represent long-run job lost.

Other factors have also affected negatively the contraction of the manufacturing sector during the resource boom. Only the employment lost associated with the Canadian component is Dutch-disease related. That accounts for only 31% of the 328,000 employment positions lost in the manufacturing sector in Canada between 2002 and 2008. Another 55% (180,000) are due to the depreciation of the US component that occurred mainly between 2002 and 2005. Finally, 14% of employment positions lost (46,000) are the result of the structural decline in the manufacturing sector that affects most developed countries and that can be associated in part with the rise of China economy.

Since the end of 2008, the developed economies have gone through five years of financial crisis, deep recession, and Euro crisis. The US economy, still our main trading partner, has been particularly affected by the turmoil. The resource sector has been negatively affected early in the crisis but has rebounded thereafter. The manufacturing sector has also been negatively affected initially due to the substantial drop in international trade. Consequently, most of the employment lost in Canadian manufacturing since the beginning of 2009 are cyclically related and cannot be associated to a structural shift such as a Dutch disease.

Manufacturing employment in Canada is unevenly distributed. The best way to understand the geography of the Canadian economy is to borrow the core-periphery model of Krugman (1991). In this celebrated (Nobel Prize) modelling, Canada served as a practical illustration. Krugman assumes economies of scale for the production of manufacturing goods and transportation costs. Krugman argues that the production of manufacturing goods will tend to concentrate geographically in the center, or the core, of the economy. The main economic activity

in the periphery will be based on the exploitation of natural resource and other non-traded goods. That would be the equilibrium distribution of economic activity in a closed economy. According to Krugman (1991), Canada was developed as a closed economy following the National Policy of John A. Macdonald after 1879. With the introduction of high tariffs, the trade followed an artificial East-West axis where manufacturing goods were provided by the core located in Southern Ontario and Quebec. The gradual opening of Canada to U.S. trade after WWII did not alter the core-periphery structure because of scale economy. After the removal of tariffs, the Canadian core was an efficient supplier of manufacturing goods and was able to remain competitive thanks to its excellent location close to two cores in the US economy: New York and the Great Lakes.

The two ingredients of my 'model' of Canadian regional economies nowadays are Krugman's Core-Periphery model and the Dutch disease. A booming periphery with rising prices of various commodities and the acceleration of oil-sand production is detrimental to the Canadian core which is located in the Quebec-Windsor axis. If we add to this model the negative impact of the 2008 financial crisis on world trade and manufacturing output, and the rise of China economy as the world manufacturer, Canada's manufacturing core is going through difficult times.

Conclusion

The contribution of this paper deals with the diagnostic of a particular problem rather than its treatment. The reader mostly interested on treatment is referred to Boadway, Coulombe and Tremblay (2012). This reader, however, should remember that a good diagnostic is often a necessary condition for a successful treatment. It is also beneficial to avoid unnecessary therapy.

The problem under study is the substantial level of provincial disparity in living standards in Canada. This is a serious problem since Canada is a highly-decentralized federation. Consequently, Canadians might have to move closer to the oil barrel in order to have access to good health and education services at affordable tax rates. Equalization, the constitutionally-entrenched tool designed to solve the problem, can only alleviate a fraction of the disparity in provincial fiscal capacities.

In this paper, we show that the problem results from good fortune (terms of trade) rather than hard work (productivity). The level of disparity in the provinces' fiscal capacity in 2012 is almost uniquely determined by the evolution of terms of trade during the 2002-2008 resource boom. The consequence of this analysis is that the fact that Ontario, which historically was always a rich province up to 2009, is now receiving equalization has nothing to do with its relatively weak productivity performance. The Canadian productivity problem is certainly a very unpleasant national problem. However, weak productivity growth is not a determinant of living standards differences across Canadian province at the present time. Of course improving productivity performance in Canada will be good for Ontario and for all Canadians. But it will not cure the disparity problem.

If productivity gains are good for everyone, terms of trade changes generate winners and losers by definition. Newfoundland, Saskatchewan, and Alberta are the clear winners. Ontario, Quebec, and the Maritimes are the losers. They did not see the terms of trade improvements but they have to live with a higher exchange rate.

Whether the problem encountered by Canadian non-booming provinces is simply a costly adjustment process (Dutch affair) or a serious problem (Dutch disease) cannot be answered now. It depends on the duration of the resource bonanza in Canada and to what will happen when it

will eventually end up. What we know however is that the necessary conditions for a Dutch disease are met in Canada. Only the future will let us know if these conditions were also sufficient. But as the wise man know, nothing is harder to predict than the future.

Bibliography

- Anderson, G. (2012) 'Reflections on Oil and Gas in Federal Systems', in *Oil and Gas in Federal Systems*, G. Anderson ed. Chapter 14: 371-408, Oxford University Press.
- Beine, M., C. Bos and S. Coulombe (2012). 'Does the Canadian Economy Suffer from Dutch Disease?' *Resource and Energy Economics*, 34(4): 468–92.
- Boadway, R., S. Coulombe, and J.F. Tremblay. (2012) 'The Dutch Disease and the Canadian Economy: Challenges for Policy-Makers', Prepared for the Conference in Celebration of Thomas J. Courchene: *Thinking Outside the Box*, Queen's University, October.
- Coulombe, S., (2011). 'Lagging Behind: Productivity and the Good Fortune of Canadian Provinces', *Commentary No 331*, C.D.Howe Institute, Toronto.
- Coulombe, S., and F.C. Lee (1995). 'Convergence Across Canadian Provinces, 1961 to 1991', *The Canadian Journal of Economics*, 28.4: 886-898.
- Diewert, W.E., and E. Yu, (2012). 'A Canadian Business Sector Data Base and New Estimates of Canadian TFP Growth', Discussion Paper 12-04, Department of Economics, University of British Columbia.
- Kohli, U., (2004). 'Real GDP, real domestic income, and terms-of-trade changes', *Journal of International Economics* 62 (2004) 83– 106.
- Krugman, P. (1987). 'The Narrow Moving Band, the Dutch Disease, and the Competitive Consequences of Mrs. Thatcher: Notes on Trade in the Presence of Dynamic Scale Economies.' *Journal of Development Economics*, 27(1–2): 41–55.
- Krugman, P. (1991). *Geography and Trade*. (Cambridge, MA.: MIT Press).
- Tang, J., S. Rao, and M. Li. 2010. 'Sensitivity of Capital Stock and Multifactor Productivity Estimates to Depreciation Assumptions: A Canada-U.S. Comparison,' *International Productivity Monitor* 20 (fall): 22–47.
- van der Ploeg, F. (2011). 'Natural Resources: Curse or Blessing?' *Journal of Economic Literature*, 49(2): 366–420.