The Use of Natural Resource Revenues in Canadian Provinces: A Panel Data Approach

By

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Abstract

Canada's endowment of natural resources in conjunction with the rise of commodity prices due to emerging countries' industrialization provide the country with a unique opportunity to improve its citizens' well-being. However, a development based on the resource sector needs to be controlled in order to be sustainable. In fact, the revenues accrued from this sector are both transitory and volatile; the government who can raise revenues from it- in a possibly non distortionary manner- faces two issues when choosing how to spend them. First, since natural resources are publically owned and revenues that accrue from it are transitory, some of the present revenues have to be saved or invested in reproducible assets as long as weight is given to future generations' well-being. Second, since booms in the commodity sector crowd-out production from manufacturing though real exchange rate appreciation, government spending should try to smooth the effect of this structural transition. The following paper models the impact of natural resource fiscal revenues on provincial governments' public policies in terms of public expenditures, tax rates and budget surpluses in order to evaluate these policies on both the inter-generational equity and Dutch Disease issues. We found out that resource revenues are not saved to insure future generations' consumption but that Dutch Disease effects are alleviated by fiscal boost to manufacturing firms.

1. Introduction

Fur, wood and minerals have shaped the Canadian economy for the 20th century; more recently, the commodity price boom that started in 2003 brought back the natural resource sector under the spotlight. As emerging countries engage in the path of industrialization and urbanization, the Canadian economy could profit from an increased demand for its diverse and abundant natural resources. However, as Mark Carney, former governor of the Bank of Canada, stated, Canada's challenge today is to 'minimize the pain of the inevitable adjustment and maximize the benefits of our resource economy for all Canadians.'

The 'inevitable adjustments' Canada is experiencing-usually referred to as Dutch Disease- has to do with the structural shift of capital and people from the manufacturing to the natural resource sector as commodity prices increase. This transfer from high productivity, knowledge based sectors to the extractive sector raises concern about future productivity growth. On the other hand, the additional revenue accruing to resource-rich provinces induces inefficient migration of people and capital though intra-federation tax competition. Finally, the concentration of the activity around the resource sector faces the whole economy with additional uncertainty due to the commodity price volatility, and the appreciation of the real exchange rate.

On equity grounds, 'the benefits of our resource economy' should benefit all Canadians. If the commodity boom raised hope about greater opportunities for all, the reality is more nuanced. In 2010, natural resources accounted for more than 50% of the country's exports and 11% of its GDP, whereas only 337,000 of Canada's 17 million jobs were in the resource sector. The heterogeneity is more pronounced when looking at the

regional level, with Alberta accounting for almost 70% of the country's fuel production, and Quebec and Ontario producing more than 50% of Canada's metallic minerals (Statistic Canada, 2011). But another equity issue not to overlook-and the one considered in the following paper- is the one that has to be insured among generations. By definition, natural resources are publically owned and the revenues that accrue from it are transitory[1]; if any weight is given to future generations' well-being, at least a portion of non renewable revenues should be saved. This can typically be done though financial or real assets. The government who raises revenues from the resource sector through specific taxes, royalties and licence fees can either alleviate or exacerbate both Dutch Disease symptoms and the intergenerational inequity. In Canada, the responsibility accrues to the provincial governments who have jurisdiction over their natural resources and collect the bulk of fiscal revenues.

This paper proposes to explore how the revenues raised by provincial governments are used and, subsequently, to infer on their consequences on the two main issues aforementioned. The goal is to provide the reader with an overall appreciation of the provincial public policies currently in place and the extent to which inter-generational equity is insured and Dutch Disease symptoms are dealt with. The main results drawn from this study are that while resources are not spread out among generations, the fiscal policies in place do not exacerbate the crowding-out effect.

The mechanism of Dutch Disease has been scrutinized (e.g. Corden, 1984; Davis, 1995) and empirical evidence in the Canadian context has been provided by Beine, Bos and Coulombe (2012) and Raveh (2012). On the other hand, Boadway, Coulombe and

[1] In the following paper, natural resource refers typically to non-renewable resources such as mining and oil. The case of forestry is ignored but summary statistics for this sector are provided in section 2

Tremblay (2012) have provided valuable insights on the challenges facing Canadian policy-makers in response to the rapid growth of resource-based sectors. Assuming the loss in competitiveness is due to the resource sector boom (Dutch Disease hypothesis), no empirical analysis offers an evaluation of the present policy choices on the crowding-out phenomena. Using a simplified model, the present paper investigates if the present fiscal system stimulates the manufacturing sector though fiscal incentives. An analysis of the impact of natural resource revenues on personal income tax and provincial surpluses also assesses if volatility in both private and public consumption is hedged.

On the inter-generational equity issue, a large literature proposes to characterize the optimal saving rate by including natural resource endowment in endogenous growth models (e.g.: Solow, 1986; Barbier, 1998). However, the literature on the choice of assets to be purchased is mainly concerned with developing economies. Taking into account institutional quality and governance risks, this part of the literature discusses more in depth the relative advantage of saving in financial or real assets (Collier, van der ploeg, Spence and Venable, 2009) domestically or abroad (Van der Ploeg and venables, 2011). They find that social and financial rates of return are greater when resource revenues are invested in public goods domestically than in global financial assets (e.g.: Sovereignty Wealth Funds) if there is underinvestment. This paper draws from the Conference Board Center on Productivity conclusions (Arcand and Lefebvre, 2010) where Canada lacks both physical and human capital to conclude on the ability of the country to save for future generations. The impact of natural resource revenues on different public expenditure categories, and more specifically on public investment and spending, is

evaluated. Also, an analysis of the provincial surpluses provides insights on the ability of the country to leave a healthy fiscal system to future generations.

A fixed effect model is used to estimate the impact of natural resource revenues on public expenditures (Section 5.1), personal and corporate income tax rates (Section 5.2) and provincial surpluses (Section 5.3). The remainder of this paper is organized as follow: Section 2 provides a succinct overview of the Canadian fiscal system with emphasis on the natural resource taxation, section 3 outlines the theoretical foundations of this paper in the context of a literature review, section 4 summarize the model selection process as well as the data and methodology used, section 5 presents the major results of the empirical analysis and section 6 concludes.

2. Overview of the Canadian Natural Resources and Fiscal System

Natural resources taxes, royalties and licences revenues represent a very small share of the total provincial and federal public revenues-on average less than 1%. However, the increasing importance of the sector, as well as the special features of this source of revenues requires a careful analysis.

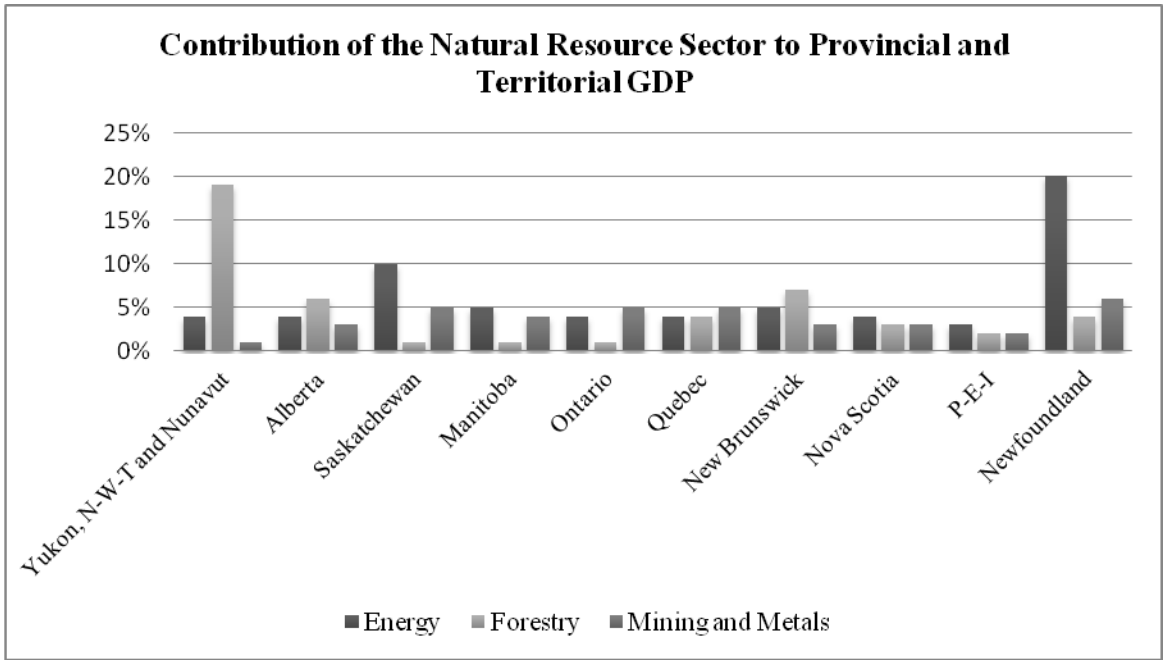
2.1 Canada's Natural Resources

Canada's economy is tightly tied to the resource sector. In fact, the sector generated 11.5%, or $142.5 billion, of Canada's gross domestic product, and employed directly and indirectly 763 000 people in 2010 (Natural Resources Canada, 2011). The global commodity boom that began in 2003, in conjunction with the industrialization of emerging economies, made the resource sectors important again. It is however

important to realize that the value of natural resource assets fluctuates more than that of other physical assets. This is mainly due to the volatility of commodities prices on world markets as most natural resource prices are driven by global demand and supply. As well, exploitation of resources may change when prices change, impacting at the same time the stock available and the financial estimations. Several prices falls during the last decades illustrated the dependence of the sector to the global economy well being. In the early 1990s, prices declined as a result of a recession in North America; they fell again in 1998 because of the East Asian financial crisis and in the early 2000s after the September 11 events. Most recently, resource asset values declined in 2009 during the global economic downturn (Statistics Canada, 2009). The revenues derived from the sector by the private firms as well as by government through taxes and licences are rather unpredictable in the long run.

The endowment of natural resources is also uneven among provinces. Albeit every Canadian province possess at least one of the main national natural resources, namely mining, energy, or forest, the quantity and nature of resources vary. In graph 2.1, one can notice that some provinces rely more on natural resources than other. For example, energy accounts for about 20% of the provincial GDP in Newfoundland and Labrador as well as in Alberta. In turn New Brunswick and Quebec rely nearly in the same proportion on energy, forestry and mining and each resource does not account for more than 7% of the provincial GDP.

Graph 2.1: Contribution of the Natural Resource Sector to Provincial GDP



Source: CIC-The 9 habits of highly effective resource economies

2.2 Natural Resource taxation

In Canada, taxes related to natural resources are levied by the provincial governments. The Constitution Act of 1867 (section 92) gave the provinces the power of 'Management and Sale of the Public Land Belonging to the Province and of the Timber and Wood Thereon'. Later, the 1982 amendments to the Constitution explicitly recognized the Constitutional right of the provinces to manage their non-renewable natural resources, forestry resources and electrical energy (section 92A):

"92A.(1) In each province, the legislature may exclusively make laws in relation to:

a. exploration for non-renewable natural resources in the province;

> *b. development, conservation and management of non-renewable natural resources and forestry resources in the province, including laws in relation to the rate of primary production therefrom ...".*

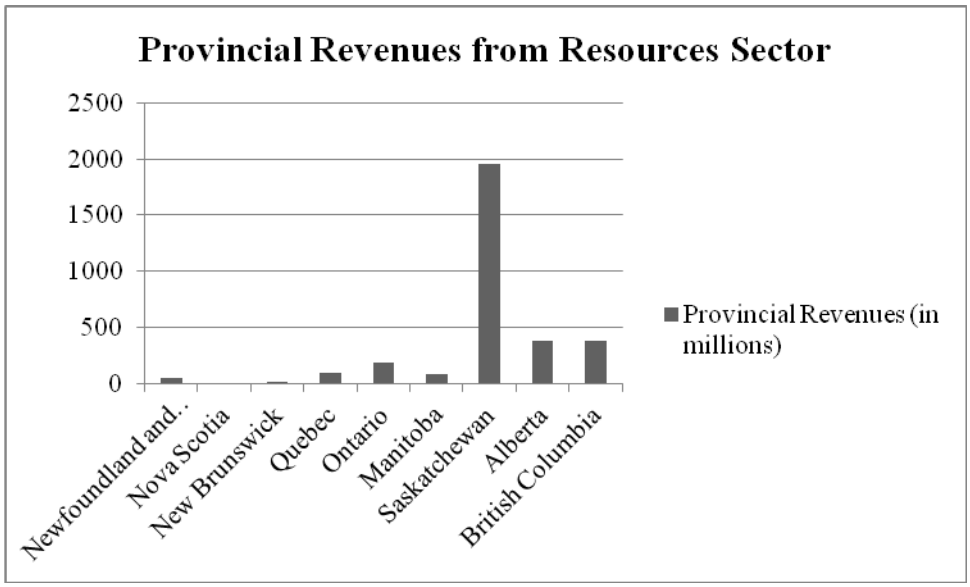
The Federal government imposes taxes and royalties on oil and mineral production in the three Canadian territories which won't be considered in the following paper.

These revenues are generated by various sources, namely the sale of the right to exploit natural resource properties on provincial lands, royalties on production in provincial lands, taxes on production from private lands and licence fees for permission to carry out natural resource extraction (Canadian Tax Association, 2006). One point not to be overviewed when analyzing tax revenues in Canada is Equalization. Since 1957, the federal government partially offset the difference in fiscal capacity among provinces through transfer payments. In 1962, 50% of the natural resource rents were added to the personal, business, sales and property taxes in measuring provinces revenues. The Equalization program has been added to the Constitution in the 1982 amendment. Following the 2007 renewal the formula-based approach, so-called have-not provinces have a fiscal capacity below the ten provinces average and are entitled to positive transfers. Have provinces with fiscal capacity above the national average are not taxed by the federal government. The Equalization transfers are financed by the federal government through its general revenues.

As aforementioned, the resource sector represents a small portion of the total revenues levied by the provinces (excluding transfers). Graph 2.2 illustrates that natural resources represent on average less than 1% of the total own sources revenues. In 2009,

Saskatchewan was an exception for both the amount levied and the proportion resource revenues represent in its budget (15%).

Graph 2.2: Provincial Tax Revenues from the Resource Sector



Source: Statistic Canada, table 385-0001

3. Literature Review

Natural resources are distinctive in two key respects: they are fixed in supply and immobile geographically. This provides governments with both a unique opportunity for raising revenues and a challenging dilemma when using them. If a well designed taxation scheme is set up, governments can raise revenues in a non-distortionary manner by capturing the economic rent of the natural resources (Boadway and Keen, 2010).

However, the natural resources windfalls should not be used in the same way as other public revenues. On inter-generational equity grounds, the revenues extracted from an exhaustible resource should be spread out among generations (Hartwick, 1977). In principle, natural resources are publically owned, and the revenues that flow from them

are transitory. The optimal amount of resource revenues to be saved for future generation depends on the form of the social welfare function considered by policy makers. Indeed, as long as some weight is given to future generations, one would want to save some of the resources.

In addition to this inter-temporal consideration, a rich literature describes the possibility of a crowding-out effect from high productivity, knowledge based sectors (manufacturing and other tradable) to extractive sectors through the appreciation of exchange rates (e.g.: Boadway, Coulombe and Tremblay, 2012). The underlying mechanism of this phenomenon (Dutch Disease) is that the real exchange rate appreciates with the rise of the export revenues from the resource sector. In turn, the appreciation harms the economy's exports from the manufacturing sector, leading overtime to de-industrialization (Corden and Neary, 1982; Corden, 1984). If the reallocation of resources is not intrinsically harmful under certain assumptions (competitive markets, perfect foresight), the specific features of natural resources and the industry they operate in have to be taken into account when assessing the impact of such reallocation.

First, as shown by Krugman (1991), the manufacturing sector is concentrated in core regions where knowledge externalities exist, whereas natural resource activity is in the hinterland or periphery. This causes the rate of productivity growth in manufacturing to be greater than in the natural resource sector (Sachs and Warner 2001). Albeit productivity level is generally assumed to be higher in resource than in manufacturing sector, the absence of knowledge externalities in the periphery may cause the productivity growth to be slower in the long-run. Also, Gylfason et al. (1999) have shown that natural resource abundance is likely to weaken private and public incentives to accumulate

human capital because of the related increase in non wage income such as lower taxes and social spending. This is because natural resource wealth can give a wrong security impression to governments that loses sight of the need of human capital accumulation (Rodriguez and Sachs, 1999). This decreased incentive to accumulate capital will in turn decreases the productivity growth rate in the long run. The second argument is specific to the Canadian context and comes from the fact that the bulk of resource tax revenues accrue to provincial instead of federal governments. If the natural resource revenues are not fully equalized, provinces are likely to use this additional revenue to attract people and capital though corporate and income tax reductions which induce inefficient migration (Wilson, 1986). They also have incentive to use these resources for regional development instead of saving them for future generation (Boadway, Coulombe and Tremblay, 2012). Finally, a transfer of capital and people from the manufacturing to the resource sector exposes the former to greater uncertainty. Indeed, in Canada where natural resources represent more than 50% of the overall exports (Drohan, 2011), the real exchange rate is sensitive to commodity prices which are in turn volatile and extremely sensitive to the world economy. Also, the recurrent booms and busts proper to the resource sector tend to increase real exchange rate volatility (Gylfason et al., 1999), thus reducing exports and imports of goods and services. The manufacturing sector is therefore, affected by this volatility as it relies on the dollar to export abroad.

Empirical evidences of Dutch Disease have been provided for the Canadian context. One of the main methods to demonstrate presence of Dutch Disease is to study the effect of the real exchange rate on the manufacturing sector. The method, used by Beine, Bos and Coulombe (2012) for the Canadian case is twofold. First, the effect of resource boom

on the real exchange rate is estimated; then, the effect of real exchange rate on manufacturing firms is analyzed. In their study covering the 2002-2008 period, Beine et al. found out that, first, 42% of the real exchange rate change was due to commodity price boom; second, the real exchange rate appreciation has an adverse effect on trade-related sector such as manufacturing concluding that there was symptoms of Dutch Disease in Canada. More specifically, they showed that the rapid appreciation of the Canadian dollar eliminated about 350,000 jobs in the Canadian manufacturing sector between 2002 and 2008. Another method to check for Dutch Disease symptom presence is to study the correlation between natural resource endowment and economic growth. This method is based on the hypothesis where resource transfers from central activities (manufacturing) to outlying regions decrease knowledge spillovers and, incidentally, productivity growth. The case of federations has been studied by Raveh (2012) who found a negative correlation between natural resource endowment and economic growth at the national level, and a positive one for some provinces. This phenomena-called the 'Alberta effect', is defined by a reallocation of resources among provinces that causes resource-rich provinces to have higher growth whereas resource-poor provinces experience a slower growth rate.

If empirical evidence is largely available for the Canadian context, some authors have singled different explanations for the appreciation of the Canadian dollar and the loss in competitiveness of the manufacturing sector, such as the integration of emerging nations into the global economy (MacDonald, 2007), or the weakness of American economy (Beine and Coulombe, 2007).

The crowding-out effect from high productivity, knowledge based sectors to extractive sectors can be alleviated or exacerbated by public policy choices. For example, public funding of scientific and technical research or fiscal incentives for Research and Development (R&D) can be used to hedge uncertainty in the non-resource sector and stimulate growth. First, as technologies and processes are developed, more value is added to the extracted resources and new businesses, such as refining or transformation firms, are created. One could also expect some of the knowledge to be transferred to non-resource firms and boost their productivity. Such policy would help transfer resources to less cyclical sectors and hedge the boom-and-bust of the resource sector (Drohan, 2011). Moreover, public funding of research through collabourative research centers such as FPInnovations have proven to stimulate knowledge spillovers in the resource sector and mitigate the low productivity rate mentioned earlier. Another policy that could be used to alleviate Dutch Disease symptoms and insure inter-generational equity is to transfer the collection and management of natural resource revenues to the federal government. This solution would mitigate inefficient fiscal competition since-before equalization- provinces would not be provided with additional revenues to reduce their personal and corporate income taxes and subsequently induce inefficient migration. Moreover, reducing resource induced competition among provinces for people and capital may encourage the government to save some of their resource revenues for future generations. Finally, the set up of a saving fund can also be used to alleviate the effects of Dutch Disease. If resource revenues are not made instantly available to governments, they cannot use these resources for province building and tax reduction, stimulating subsequently inefficient migration.

Consequently, the timing and the repartition of natural resource revenues spending has to be made carefully in order to insure both inter-generational equity and avoid macro-economic imbalance.

3.1 Insuring inter-generational Equity

Since the revenues raised from natural resources are temporary, at least some of the revenues have to be invested in reproducible capital in order for an increase in consumption to be sustainable (Solow, 1986). Moreover the present health of the fiscal system can insure the ability of future generations to fund their consumption at reasonable rates.

3.1.1 To Save or to Invest?

Typically, governments choose to either invest domestically in human and physical capital or to hold savings in financial assets. The latter option usually refers to Sovereignty Wealth Funds (SWF), 'state-owned investment fund mainly composed of foreign assets and used to maximize return in the long run and stabilize exchange rates on the short run' (Sovereign Wealth Fund Institute).

The dominant literature concerned with developed economies advocate the setting of a SWF where part or the total revenues are saved. For example, Garton and Gruen (2012) suggested that 'some portion of government revenues arising from high commodity prices should be quarantined from the current budget and invested in financial assets through a fund that operates at arm's-length from the government'. Earlier, Lücke (2010) demonstrated the necessity to use a Sovereignty Fund in Eastern Europe countries, whereas Dixon and Monk (2011) presented the necessary pre-existing conditions needed for a SWF to be efficient. Indeed, following the permanent income hypothesis, such

saving pattern enables a sustained increase in consumption through the interest on accumulated assets.

Notwithstanding, Collier et al. (2009) followed by Van der Ploeg and Venables (2011) found out that the SWF is not a one-size-fits-all solution. They argue that attention has to be given to the country's capital stock in order to assess if a saving fund is the optimal solution to insure inter-generational equity. More specifically, the authors state that investment in "tangible and intangible assets that are public goods" such as education and infrastructure is more efficient than saving in financial assets when there are signs of underinvestment.

The reason for that is twofold: first, in the case of capital-scarce economies, the domestic rate of return is higher than the foreign assets typically held in a SWF. If human or physical capital are scarce, the rate of return on domestic investments are more likely to be higher than abroad. Second, if the investments undertaken are complementary with private firms' production, productivity can be enhanced and greater consumption growth can be experienced. The difference between savings and investment is that, in the long run, productivity-enhancing investments ensure greater consumption through higher employment rates and higher wages, whereas savings ensure only sustainability in public consumption. An additional argument for investment in human capital is given by Solow (1974, 1993): as natural resources are exhausted and the environment possibly degraded by more aggressive extraction methods, the 'natural capital' Canada is provided with decreases. If natural and human capital are assumed to be interchangeable, the depletion of exhaustible resource ought to be replaced by human capital in order for any increase in consumption to be sustainable on the long-run.

Although Van der Ploeg and Venables' argument was mainly oriented toward developing economies, insight can be gained for the Canadian case. In fact, Canada exhibits a lack of physical capital that may be preventing its productivity from growing at a desirable rate. Between 1984 and 2010, labour productivity growth in Canada has fallen to less than half the growth experienced over the previous 20 years (Arcand and Lefebvre, 2010). This can be explained by the weak Canadian dollar in the 1990's and early 2000's that made capital more expensive to Canadian firms and governments. The country has a relatively well-educated population, which should encourage capital investment and support productivity growth. However, when compared to the other 22 OECD countries, Canada places in the top five for the quality of its labour force but 13th for the productivity level. This shows that Canada's capital/labour ratio is lower than one would expect, given the high quality of its labour force. Arcand and Lefebvre (2010) advocate investment in both physical and human capital for two reasons 1) Labour becomes more expensive, leading firms to substitute labour with physical capital. 2) Educated workers increase the return on physical capital, encouraging investment in physical capital.

In Canada, underinvestment in physical capital is observed on both the private and the public sides. Considering public investment, Canada suffers from a public infrastructure shortfall especially in transportation (Drohan, 2011). More specifically, congestion on the country's railways and roads increases the cost of doing business and hinders productivity growth. Private investment is low, partially due to taxation. Corporate income taxes, capital taxes and sales taxes on business inputs make Canada one of the world's least hospitable tax jurisdictions (Busby and Robson, 2010). However, the situation seems to be in the way of improvement with Ontario and British Columbia

lessening their burden on firms (Chen, Mintz and Tarazov 2007, Poschmann 2009). Although the Canadian labour force is of very high quality, investment on human capital has to be sustained, as investment in capital is undertaken in order to reach an optimal capital/labour ratio.

Given the capital stock situation of the country, an argument can thus be made in favour of domestic investment through capital accumulation incentives and public investment in human and physical capital. Governmental incentives for capital accumulation in private firms can take the form of fiscal benefits, access to affordable credit or technical support. For example, the Independent Panel on Federal Support to Research and Development (Innovation Canada: A Call to Action, 2011) recommended a redefinition of the Scientific Research and Experimental Development (SR&ED) Tax Credit, a greater supply of capital risk funding though the Business Development Bank of Canada, and the creation of a Industrial Research and Innovation Council that would provide companies with business expertise.

3.1.2 Fiscal sustainability

If the saving/investment dilemma has to do with how resource revenues are spent, 'fiscal sustainability' has to do with the ability of the government to sustain its fiscal policies in the long run without threatening its ability to provide essential public goods and services, as well as its solvency.

Most analytical discussions on fiscal sustainability take as their starting point a representative agent model in which the government must satisfy both an inter-temporal budget constraint and, in every period, a static budget constraint (e.g.: O'Connell and Zeldes, 1988). In this model, sustainability requires that future surplus exceeds future

deficit in present value term net of interest (Chalk and Hemming, 2000). Although this sustainability definition does not rule out high debt, the IMF and other international organizations still look at high debt to GDP ratio as a cause of concern. Canadian provinces have relatively low debt to GDP ratio over the period studied suggesting a relatively healthy fiscal system: the ratio is lower than 0.005 for almost all provinces with the exception of Quebec (0.015), Ontario (0.012) and Alberta (0.008).

The analysis changes slightly when the specificity of a resource rich country is taken into account. If natural resources were to be treated in the same manner as financial wealth, the conditions for sustainability change. Chalk and Hemming (2000) propose to include the net present value of natural resources in the future surplus. Without getting into details, the condition for fiscal sustainability becomes in present value terms. This implies that using resource wealth to build financial assets or to pay down debt does not improve sustainability while running down resources to fund government certainly worsens sustainability (Buiter, 1985).

More intuitively, using resource revenues to fund a fiscal deficit is equivalent to using it for short and medium term consumption which does not leave resources for the rainy days. In the case of a commodity price bust, the government is faced with constant needs and fiscal capacity but fewer resources and no savings.

3.2 Spending and Dutch Disease

The two Dutch Disease symptom reviewed in this paper are, first, the crowding-out of resources from the manufacturing to the extractive sector as well as the underlying decrease in productivity and, second, the increased volatility that the non-resource sectors face through the fluctuation of the exchange rate.

3.2.1 Boosting the manufacturing sector

Both saving in a SWF and public investment can insure inter-generational equity and a sustainable consumption growth. However, the two options also underlie two methods to cope with Dutch Disease. A SWF allow slowing down the real exchange rate appreciation by slowing the pace at which the incomes enter the country: by saving the revenues abroad, governments reduce the spending effect and insure a stable and constant stream of revenues. The other method to cope with Dutch Disease is to boost the manufacturing sector. This can be set through three main options (Collier et al. 2009). First, governments can redistribute totally or partially the resource revenues to the private sector through the tax/benefit system. Private firms are then faced with smaller costs and can have more incentive to invest and innovate, enhancing their competitiveness. Second, governments can provide the private sector with better goods and services though public investment. The choice of one of these options will determine how the natural resource revenues will affect the country's economy. It defines which economic agent will 1) control the time path of spending 2) decide the projects undertaken 3) decide in which proportion the revenues are to be spent in consumption and investment.

If public investment is to be chosen, private investment and economic growth can be promoted. In fact, "high growth countries invest 5 to 7% of GDP per year (over and above expenditures on basic education) in incremental education and infrastructure whereas, in contrast, most countries with lower growth invest only around 3%" (World Bank, 2008). Caution has to be taken when choosing where and how much government should spend, as public investment can raise prices and crowd resources out from the productive sector. The success of such policy depends on both governance and the nature

of public investment. If public investments are complementary to those of the private sector– such as improvement of productive infrastructure or labour skills – then these crowding-out effects are mitigated and may even be reversed.

In Canada, various studies indicate that the Canadian economy reacts positively to public investment. Mittnik and Neumann (2001) show that public investment tends to exert positive effects on GDP, and that there is no evidence of dominant crowding-out effects. Moreover, using a VAR approach on 17 developed economies; Afonso and St-Aubyn (2009) evaluate the macroeconomic effects of public and private investment and assess the extent of crowding-in (public investment leading to private investment) and crowding-out effects. Canada is found to have an above average rate of return and present signs of crowding in effect.

If distribution to the private sector is to be chosen, the allocation of resources could be more efficient since individual firms are better at identifying investment projects, and have higher incentives to succeed. However, in the specific case of natural resource revenues, the main counter-argument has to do with the time path of consumption chosen by individual agents who will typically give too little weight to future generation. This could lead to underinvestment.

3.2.2 Coping with Volatility

Another issue concerning the use of natural resource revenues rise is that of volatility. In fact, commodity prices are globally set and hardly predicable (Hamilton, 2008) and hence so are revenues. Hedging such volatility can be done through a liquidity fund held in foreign assets (Collier et al., 2009) and used to smooth the revenue fluctuations. However, such a fund may be difficult to implement because of the size it needs to be in

order to be efficient. If the revenue fluctuations are not hedged, they will give rise to fluctuation in either 1) consumption 2) foreign debt/asset 3) domestic investment. Using public expenditures and the tax-benefit system, policy makers can choose which account varies as natural resource revenues fluctuate.

Variation in consumption is obviously undesirable because of commitment issues and the cost of change in consumption habits. On the other hand, domestic investment is the most volatile element in the Canadian economy, suggesting low variation costs (Statistics Canada, 2011). Conversely to domestic investment, public service spending should be constant. If public spending is to be volatile, overheating and appreciation pressures can appear in times of booms. When the commodity prices fall and the revenues decrease, governments are led to reduce expenditures and cut basic public services (Medas and Zakharova, 2009). For example, Alberta's spending has been fluctuating with commodity prices highlighting the effect of the business cycle, and exposing its citizens to possible fluctuation in consumption (of public goods).

4. Model, Data and Method

As aforementioned, the objective of this analysis is to evaluate how Canadian provinces use their natural resource revenues and how their choices impact intergenerational equity and Dutch Disease symptoms. The impact of natural resource is evaluated in public expenditures, tax rates and surpluses. An analysis of the categorical public expenditures and more specifically, on public investment and consumption, allow us to infer on how much resources are saved for the benefit of future generations. Moreover, the estimation of the natural resource revenues impact on provincial surpluses

provides insights on the sustainability of the fiscal system. Regarding Dutch Disease symptoms, we verify if natural resource revenues are used to boost the manufacturing sector through reduced corporate tax rates and investment in productive assets. Finally, the impact of natural resource revenues on the personal tax rate allows us to asses if resource revenues are transferred to individuals. This would imply that the former are faced with consumption volatility.

4.1 Model specification

In this section a model to explain the impact of natural resource revenues on 1) public expenditures 2) tax rates 3) government surplus is defined. The determination of public policy design is complex and may include many factors, such as fiscal, political and economic factors. Several control variables are looked at and different model specifications are tested. Using robust Student test statistics and the overall significance of the model, five control variables are chosen: provincial gross domestic product ($PGDP$), unemployment ($Unpl$), industrial wage index ($wage$), total fiscal capacity ($FiscCap$) and an equalization dummy (Eq).

$$P_{it} = g(NRR_{it}, Unpl_{it-2}, PGDP_{it-2}, wage_{it}, FiscCap_{it}, Eq_{it}) \quad (1)$$

'P_{it}' is the dependent variable of interest i.e. public expenditures, tax rates and public surplus.

The macro-economic variables (unemployment and GDP) are lagged two periods in order to illustrate the time gap between budget design and implementation. The GDP measures the overall state of the economy and unemployment is one of its lead indicators. They are both looked at closely when defining public expenditures, tax design and budget management. A real industrial wage index is used to control for the difference in the cost

of providing public services and goods among provinces. It is generally assumed that wages are considerably higher in Alberta, British Columbia and Ontario than they are in Atlantic Canada or Saskatchewan (e.g: Courchene, 2005). This in turn impacts positively the cost of providing public goods and services. Faced with higher cost, provincial governments have to either decrease their spending, increase their revenues or contract debt. In particular, increases in revenues are typically financed by personal income tax, which represented 23.9% of the provincial revenues in 1993 (Esteller-More and Sole-Olle, 2002). Total fiscal capacity excluding the natural resources tax base is added as a control variable. As employed by the Department of Finance, fiscal capacity denotes each province's ability to generate revenues from its own sources. That is, it is the size of the province's tax personal income, corporate income, consumption, property and natural resource tax bases. The addition of this variable is necessary to control for the overall revenues possibly available to provincial governments. Fiscal capacity is chosen over actual governmental revenues in order to avoid an endogeneity issue. Public revenues are defined as the later being chosen by the government in the same manner as the dependent variable, public expenditures. The fiscal capacity on the other hand reflects the actual tax base available in the economy, and is assumed to be exogenous to the provincial government decisions. Finally, an equalization dummy is added to control for provinces receiving federal transfers. Under the Equalization system, have-not provinces -that is, those with fiscal capacity below the national average- are provided with more revenues than otherwise, which will impact their ability to spend and their need to contract debt. Moreover, under such a system, one level of government fiscal system is dependent to the other level of government. For example, the equalization grant reduces the marginal cost

of public funds, and so tends to raise provincial tax rates (Smart, 1998). This means that the tax rate will be higher in the receiving provinces under the equalization program than otherwise.

Model specifications including demographic and political variables are tested. A dependency ratio is added to illustrate the composition of the population. Demographic variables can influence the level and composition of public spending as an aging population demands greater spending on health, housing, and social security (Feldstein 1996). Similarly, a rise in the proportion of young people affects the demand for education spending (Marlow and Shiers 1999). A political dummy taking a value of one when left-to-center political parties are in power and zero otherwise is tested in several specifications. Indeed, ideological difference among parties in power is likely to influence both the size and the composition of public expenditure (Cusack, 1997). The two variables were nonetheless not used in the final model because of their lack of statistical significance. Under almost all specifications, the variables were not significant at the 90% significance level, and reduced the overall significance of the model.

4.2 Data

The present study uses data obtained from four primary sources: the Canadian Socioeconomic Database from Statistics Canada (CANSIM), the Canadian Tax Association's 'Finances of the Nations' reports (1989-2009), the Department of Finance and the different provincial budgets. Data regarding public expenditures, natural resource revenues, unemployment, Gross Domestic Product, and wage index was obtained from CANSIM; personal and corporate income tax rates were compiled from 'Finances of the Nations'; and the total fiscal capacity was obtained from the Department of Finance. The

equalization dummy was created using the provincial budgets and assigned a value of one if the province is 'have-not' and zero otherwise.

The analysis includes nine provinces: Prince-Edward Island was excluded because it did not raise any natural resource revenues during the period studied. Also, the Territories are not included in the analysis since their natural resource revenues are collected by the federal government. The sample for each province was annual data and covered the period 1989 to 2009 although two observations for and are lost for each province for because of the use of lagged variables. Public expenditures, surplus, natural resource revenues, GDP and fiscal capacity are re-expressed in real per capita term to account for inflation and demographic heterogeneity.

The primary variables of interest are 'public expenditures', 'tax rates', 'surpluses' (dependent variables) and 'natural resource revenues' (explanatory variable). The latter includes tax and licences paid by resource firms as well as mining and logging taxes. 'Public expenditures' refers to provincial governments' spending in various categories, namely, General Government services, Protection of persons and property, Transportation and communication, Health, Social services, Education, Recreation and culture, Labour and employment and immigration, and Regional planning and development. Although the tax system is complex, simplified average tax rates are used in this study to illustrate the level of both the personal and corporate income tax. The average personal income tax rate includes provincial tax over all income brackets whereas the corporate income tax refers to the 'general corporation' tax rate (excluding small business discounts). The 'total fiscal capacity' used in this paper includes personal income tax, business income tax,

consumption and property tax. Natural resource revenues are excluded from the 'total fiscal capacity' variable to avoid endogeneity.

Summary statistics for the natural resource revenues variable as well as chosen control and dependent variable are presented in table 3.1. The results are in real dollars per capita.

Table 4.1: Summary Statistics

Variable	**Average**	**Standard Deviation**	**Maximum**	**Minimum**
Explanatory variable				
Natural Resource Revenues	.6492755	1.611472	16.23334	-.0441945
Dependent Variables				
Total Expenditures	78.73954	10.12189	127.9365	59.72174
Surplus	-.6620449	6.796563	-25.44142	26.79312
Control Variables				
GDP	331.2922	85.86489	660.9275	192.9742
Total Fiscal Capacity	320.2167	43.37234	239.79	412.4644

4.3 Method

As a general modeling approach, a fixed-effect panel data model is estimated.

$$P_{it} = (\beta_0 + \gamma_i) + \beta_1 NRR_{it} + \beta_3 Unpl_{it-2} + \beta_4 PGDP_{it-2} + \beta_5 wage_{it} + \beta_6 FiscCap_{it} + \beta_7 Eq_{it} + \varepsilon_{it} \quad (2)$$

Panel data models examine individual-specific effects in order to deal with heterogeneity that may or may not be observed. These effects can be either fixed or random effect. A fixed effect model examines if intercepts vary across group or time period, whereas a random effect model explores differences in error variance components across individual or time period. Either fixed or random effect is an issue of unmeasured

variables or omitted relevance variables, which renders the pooled OLS biased. This heterogeneity is handled by either putting in dummy variables to estimate individual intercepts of individuals or viewing these different intercept as random element that can be treated as if they were included in the error term (Kennedy, 2008). Hence, a random effect model's error term includes an idiosyncratic error term and a 'random intercept' measuring the extent to which individual's intercept differs from the common constant. On the other hand, a fixed effect model includes an individual specific element along with the constant.

Fixed effect: $P_{it} = (\beta_0 + \gamma_i) + \beta x_{it} + \varepsilon_{it}$

Random effect: $P_{it} = \beta_0 + \beta x_{it} + (\varepsilon_{it} + \gamma_i)$

The key element in choosing which model to use is in the underlying assumption of the fixed and random effect models. In using random effect estimator, the individual effect is assumed to be uncorrelated with the dependent variables to avoid endogeneity issues. Conversely, for the fixed effect estimator, individual effect and dependent variables are allowed to be correlated.

The presence of fixed effects is tested by an F-test, while a random effect is examined by Breusch and Pagan's (1980) Lagrange multiplier test. The former compares a fixed effect model and OLS to see how much the fixed effect model can improve the goodness-of-fit, whereas the latter contrasts a random effect model with OLS. Subsequently, a Hausman test is used to choose between fixed and random effect models.

4.3.1 Test for Fixed effects

Provincial ID dummies are created and added to the original model.

$$P_{it} = g(NRR_{it}, Unpl_{it-2}, PGDP_{it-2}, wage_{it}, FiscCap_{it}, Eq_{it}, ID_{it}) \quad (3)$$

An OLS regression is run and a joint significance test is performed on the dummy variables. The null hypothesis whereby all dummy parameters are zero is rejected at the 95% significance level implying the presence of an individual fixed effect (Greene, 2003). In the absence of fixed effects, a pooled OLS regression could have been used. This regression treats observations as being serially uncorrelated for a given individual, with homoscedastic errors across individuals and time periods: i.e. with the individual effect, the idiosyncratic error term and the dependent variables. However, if an individual effect exists; other methods with the weaker assumption such as fixed or random effect models can be used.

4.3.2 Test for Random effects

Both random and fixed effect models are used in the presence of an individual effect. However, in 'random effect' model the individual effect is assumed not to be correlated with the explanatory variables whereas in 'fixed effect' models they are allowed to be correlated. The Breush-Pagan's Lagrange multiplier test examines if individual specific variance components are zero i.e. $H_0: \delta_\gamma^2 = 0$. The LM statistic follows the chi-squared distribution with one degree of freedom. The null is here rejected at the 95% significance level implying the presence of random effect

4.3.3 Random or Fixed effect Models

In the presence of both random and fixed effects, the Hausman test (Hausman, 1978) can be used in order to assess which model should be used. This test determines if 'the random effects estimate is insignificantly different from the unbiased fixed effect estimate' (Kennedy, 2008). Under the Null Hypothesis, there is no correlation between

individual effects and explanatory variables. Both random effects and fixed effects estimators are consistent, but the random effects estimator is efficient, while the fixed effects estimator is not. Under the Alternative Hypothesis, individual effects are correlated with the dependent variables. In this case, random effects estimator is inconsistent, while fixed effects estimator is consistent and efficient.

The Chi-square value is smaller than the critical value, the null is rejected and the fixed effect estimator is both consistent and efficient. Therefore, the fixed effects model is estimated.

4.3.4 Estimation

To estimate the model, a transformation needs to be performed in order to eliminate the individual effect. In this paper, the 'within estimator' strategy is used. The dependent variable, explanatory variables and error term are replaced by their variation from the individual mean.

$$(P_{it} - \bar{P}_i) = \beta(x_{it} - \bar{x}_i) + (\varepsilon_{it} - \bar{\varepsilon}_i) \quad (4)$$

With $\bar{P}_i$, $\bar{x}_i$, $\bar{\varepsilon}_i$ the average dependent variable, explanatory variable and idiosyncratic error term for individual i .

Two drawbacks that are usually attributed to the 'within' estimators either do not apply in this study or can be easily tackled. First, the 'within' estimator eliminates all time-invariant variables. However, all dependent variables used in this study vary over time for all individuals. Second, the reported r^2 statistic is not correct since the intercept is suppressed. However a r^2 corrected can be computed by using a linear model with categorical dummies in order to take into account the group effect.

Finally, cluster-robust standard error terms are systematically reported. The reason for that is that error term are likely to be serially correlated in panel data leading the standard error term to be understated (Bertrand, Duo and Mullainathan, 2004). Clustered error terms allow for serial correlation within individual's observation but not among groups.

5. Empirical Results

The following fixed effect model is used to measure the impact of natural resource revenues on policy design, where the variables have been defined earlier.

$$P_{it} = (\beta_0 + \gamma_i) + \beta_1 NRR_{it} + \beta_3 Unpl_{it-2} + \beta_4 PGDP_{it} + \beta_5 wage_{it} + \beta_6 FiscCap_{it} + \beta_7 Eq_{it} + \varepsilon_{it} \quad (5)$$

'P_{it}' is the dependent variable of interest. In section 5.1 the effect on public expenditures is estimated. Both total and categorical expenditures are presented in section 5.1.1 and 5.1.2. Next, the differential between the effect on public consumption and public investment is analyzed in section 5.1.3. In section 5.2, the impact of natural resource revenues on corporate and personal income tax rates is examined. Finally in section 5.3, the effect on provincial surplus is estimated. 'γ_i', the individual fixed effect is aggregated to the constant since it is assumed to be constant for each province in the fixed effect model. In each case, robust standard errors are reported and used to evaluate significance of the individual variables as well as the overall model.

5.1 Public Expenditures

Three main results can be drawn from the public expenditures regressions. First, Natural resource revenues impact positively and significantly most the public

expenditures categories. Second, a crowding-out effect from certain categories to others can be observed when resource revenues are considered. Third, public consumption is twice as sensitive to natural resource revenues as public investment.

Albeit the natural resource revenues variable is not significant at the aggregate level, most categorical expenditures are impacted significantly by the explanatory variable. At the aggregate level, the positive and negative effect of the natural resource revenues cancel out and yield the explanatory variable not to impact significantly the public expenditures.

5.1.1 Total Public Expenditures

The estimated regressors for the control variables are presented only for the 'total public expenditures' regression (table 5.1). For all the following regressions, only 'natural resource revenues' coefficients are presented (table 1.2) and coefficient for control variables for all regressions can be found in appendix 1.

With significantly large test statistics, the proposed regression model fits the data well for every expenditure category. More specifically, the model explains 67%[2] of the total provincial public expenditures. Moreover, the results for total public expenditures presented in table 1.1 show that all control variables are significant at least at the 95% significance level.

The control variable estimators' signs are consistent with basic economic theory. Intuitively, GDP should impact positively on the majority of the public expenditures since an increase in GDP generally implies an increase in wages or a decrease in unemployment and consequently an expansion of tax basis and governments' revenues

[2] This result is obtained by using a linear model with categorical dummies in order to take into account the group effect when calculating r^2 (Stata, 2012).

(Joulfaian and Mookerjee, 1990). One can suspect however that some categories of public expenditures are more likely to be higher when the economy is weaker such as unemployment benefits. These can be expected to impact negatively the dependent variable. Moreover, one could expect the wage index to impact positively public expenditures through higher cost of providing public goods and services.

Table 5.1: Total Public Expenditures-National

Explanatory variables	**Coefficient**	**Robust Standard Error**	$P > \|t\|$
Natural resource revenues	0.1494142	0.3774216	0.693
Unemployment	$-1.05e^{-06}$	.3774216	0.012**
Provincial GDP	0.0498531	0.015836	0.002***
Wage Index	0.0004302	0.000105	0.000***
Fiscal Capacity	0.0607908	0.0226832	0.008***
Equalization	$4.03e^{-06}$	$2.07e^{-06}$	0.088*

For this paper * denotes significance at the 90% level, ** at the 95% level and *** at the 99% level.

At the regional level (table 5.2), all the regions' public expenditures are impacted positively by the 'natural resource revenues' variable, however the effect is significant only for the Atlantic Provinces and Western Canada. The control variable significance provides insight on the economic indicators that stimulate public expenditures in the different Canadian regions.

Table 5.2: Total Public Expenditures-Regional

Explanatory variables	**Coefficient**	**Robust Standard Error**	$P > \|t\|$
Atlantic Provinces			
Natural resource revenues	4.205329	1.049264	0.057*
Unemployment	$-5.03e^{-07}$	1.27^{-07}	0.058*
Provincial GDP	0.0965599	0.0002098	0.109
Wage Index	0.0003612	0.0002098	0.277
Fiscal Capacity	0.0715805	0.0528841	0.309
Equalization	$9.36e^{-06}$	$4.27\ e^{-06}$	0.159
Central Canada			
Natural resource revenues	21.09364	20.30846	0.488
Unemployment	$6.89e^{-07}$	$4.33e^{-07}$	0.357
Provincial GDP	0.2017234	0.0316598	0.099*
Wage Index	0.0005043	0.0000826	1.103
Fiscal Capacity	0.0957975	0.0470626	0.291
Equalization	$1.75e^{-06}$	$8.54e^{-07}$	0.288
Western Canada			
Natural resource revenues	1.035331	0.1818397	0.005***
Unemployment	$-8.97e^{-07}$	$9.21e^{-07}$	0.385
Provincial GDP	0.0055871	0.0200455	0.794
Wage Index	0.0004635	0.0000853	0.006***
Fiscal Capacity	-0.025672	0.044411	0.594
Equalization	$5.87e^{-06}$	$9.21e^{-07}$	0.003***

For example, in the Atlantic Provinces, only the 'unemployment' control variable is significant suggesting that public expenditures in these provinces react more strongly to unemployment than to other economic indicators. In fact, the Atlantic Provinces' unemployment rate is 3.16 percentage points higher than the national average during the 1989-2009 period studied (Atlantic Canada Opportunity Agency, 2012). The gap has been- however- reducing steadily during the period partially thanks to various federal-provincial stimulus packages. In Central Canada, 'total public expenditures' is impacted significantly only by the provincial GDP. This impact is probably driven by the Quebec government spending which range first when compared to the other provinces. In 2009, the government spending accounted for 47% of the province GDP as compared with 38% for Ontario and 39% on average for all Canadian provinces (Deslaurier and Gagné, 2013). This implies that for a country wide positive shock, Quebec public expenditures typically increase by a larger amount. In Western Canada, along with natural resource revenues, the wage index (positive) and equalization are significant. This former comes with no surprise as the wage index is typically higher in the West (Stats Can, my table for wage) and as labour costs account for a large amount of the public expenditures (Ferris and Winer, 2007).

5.1.2 Categorical Public Expenditures

A positive reaction is observed for most regressions of public expenditure on natural resource revenues with the exception of general services, social services and regional development. These results will be discussed later.

Table 5.3: Categorical Public Expenditures

Dependent Variable Public Expenditure	**Coefficient Natural resource revenues**	**Robust Standard Error**	$P > \|t\|$	$F > \|t\|$
General Services	-.0225276	.0141142	0.149	0.0000***
Protection of person and property	.0649378	.0387753	0.133	0.0000***
Transportation	.0515405	.0307106	0.132	0.0000***
Health	.5694642	.1379142	0.003**	0.0000***
Social Services	-.1192095	.0660588	0.109*	0.0000***
Education	.2433818	.05719	0.003**	0.0000***
Recreation and Culture	.0327171	.0059538	0.001***	0.0000***
Labour and immigration	.0212081	.002292	0.000***	0.0000***
Regional Development	-.013957	.0044946	0.015 **	0.0000***

The results are also significant in the majority of the categorical expenditures regressions; namely, health, social services, education, recreation and culture, labour and immigration and regional development regressions. Although, general services, protection and transport are not significant, their p-value is very close to 0.1. The most important reaction is observed in the health and education expenditures regressions with respectively $57 and $24 increase for a $100 increase in natural resource revenues. The magnitude of these coefficients can be explained by the importance of these items of expenditures: when considering both provincial and federal spending, education and health expenditures represent respectively 14% and 17% of the overall outlays. Conversely, recreation and labour have the lowest (positive) reaction coefficients with respectively, 3 and 2 dollars increase for an additional $100 of natural resource revenues.

Control variable estimators presented in appendix1 also offer economic interpretation. For example, a higher wage index is predicted to have a positive effect on public expenditure for almost all the categories through higher labour costs. However, protection and recreation expenditure are less elastic to wage increases and are impacted negatively by the wage index variable. Also, the gross domestic product impacts positively on eight of the ten expenditure categories. This can be explained by an income effect: the more dynamic the economy (higher GDP), the greater the tax base and the higher the public expenditures. Conversely, social services and labour expenditures appear to be used in less prosperous periods in order tackle unemployment and its related problems.

Although, natural resource revenues impact positively on almost all public expenditures categories, a weak negative reaction is observed for general services and regional development outlays and a stronger negative reaction is observed for social services. The negative impact of natural resource revenues on social services is fairly intuitive. The resource sector represents about 11% of Canadian GDP and commodity booms have typically a positive impact on output (Collier and Goderis, 2009) which suggest that GDP and resource sector output are cointegrated. Albeit natural resource revenues to the government are modest (in average less than 1%), an expansion of the resource sector output is likely to increase revenues though a larger tax base. GDP and natural resource revenues are thus likely to increase together. Since, 'social services expenditures' are mainly composed of social assistance and workers' compensation benefits, it is by definition counter-cyclical. As GDP and-typically- natural resource revenues increase, social services expenditures decrease. The cyclical feature of social

services expenditures in conjunction with the resource sector importance in Canadian economy explains the negative resource revenues negative coefficient.

In contrast, the negative effect of natural resource revenues on regional development and general services may suggest a crowding-out effect. In other words, governments are likely to allocate differently their resources when provided with a natural resource revenue endowment. It is worth mentioning here that using Statistics Canada data, 'regional development' refers to local planning, zoning and urban renewal projects, and not economic support such as subsidies to local business or employment promotion. Moreover, 'general services' covers the executive and legislative aspect of government activities in addition to the general administration costs such as tax collection costs. Considering regional development and general services expenditures as 'non-productive' outlays, one could say that natural resource revenues crowd-out resources from non-productive public spending**.** Indeed, in the endogenous growth literature, productive public spending refers to the stock of public infrastructures. However, Tanzi and Zee (1996) broaden this concept and define all public spending that increases private sector productivity as being productive. They notably include public expenditures in education that enhance human capital -a key variable in endogenous growth. Even using this broader definition, general services and regional development appear to be non-productive expenditures.

The negative coefficient of natural resources in the general services and regional development implies that natural resource revenues endowment crowd-out resources from non productive spending.

5.1.3 To Invest or to Consume?

Aggregate expenditure categories are created in order to evaluate the effect of natural resource revenues on public investment and consumption. Transportation, education, recreation and culture are considered to be capital intensive spending whereas general services, protection, health, social services, labour and regional development are considered to be public consumption. Transportation and education are typically physical and human capital (investment). 'Recreation and culture' is included in this category because it refers to the construction of various recreational infrastructures such as stadiums, community centers and swimming pools. It also covers outlays on archives, historic sites, art galleries and museums.

On the other hand, 'General services" refers to the executive and legislative aspect of government activities, and 'protection' covers the costs of functioning of courts of law and correction services. Moreover, as mentioned before, 'social services' and 'regional development' refer respectively to the cost of social assistance and planning and zoning. Also, 'labour' typically refers to enforcement of minimum wage laws and arbitration in collective bargaining. They are all included in the 'consumption' category. Less intuitively, 'Health' is included in the 'consumption' category since it does not cover any infrastructure building but rather outlays in respect of all kinds of hospital services (general medical care and drug programs, preventive cares).

Although the 'total public expenditures' was not significantly impacted by 'natural resource revenues', both investment and public consumption are. This suggest that investment and consumption related expenditures do not react the same way to the different economic indicators. In fact, the model gains significance when investment and

consumption are regressed separately: the F-statistic is equal to 392 for the 'total public expenditures' regression and respectively 1093 and 1654 for the 'investment' and 'consumption' regressions. The result presented in table 5.4 demonstrate that public consumption represent the bulk of the expenditures. In fact, public consumption is impacted almost twice as strongly as investment.

Table 5.4: Consumption and Investment-National

Dependent Variable Public Expenditure	**Robust Coefficient Natural Resource Revenues**	**Robust Standard Error**	$P > \|t\|$
Investment	.3136824	.0415403	0.000***
Consumption	.5138729	. 2321108	0.058*

One element not to overlook is that the level of the 'consumption' category created in this section is higher than the investment one during the whole period studied: the difference is $57,300 million dollars in average. In the light of this information, the coefficient differential has to be interpreted with caution. One can suppose that an increase of revenues from any source (e.g. personal income tax) would lead to increase in public consumption. This could be due to cost differential. For example, provincial health expenditures alone represent in average, about 30% of total expenditure during the period studied. Another explanation is the "discretionary" nature of public investment. Public consumption programs are usually planned several years in advance and are liabilities to governments (example: unemployment benefits) whereas infrastructure building can be more easily postponed or stopped in case of economic downturn or political changes. In fact, domestic investment is the most volatile component of Canadian GDP (Statistic Canada, 2012).

Assuming the Canadian economy lacks of physical capital (Arcand and Lefebvre, 2010), a high sensitivity of public consumption with respect to natural resource revenues may be a cause for concern. Indeed, as mentioned in section 3 the transitory nature of natural resource revenues call for purchase of reproducible assets in order for any increase of consumption to be sustainable. Moreover, as mentioned in section 3, Canada has gaps in public infrastructure -particularly in transportation- that hinder private firms' productivity. In particular, the strong significant effect on education expenditures on one hand, and the weak non-significant effect on transportation on the other hand support the low capital/labour ratio discussed in section 3 'Natural resource revenues' seem to exacerbate rather than alleviate the unbalance between physical and human capital that may be present in the Canadian economy. Then again, investment in human capital might also be a leading indicator for physical investment in the future. In fact, high human capital increases the return on physical capital and- subsequently- encourages investment in physical capital. The impact of natural resource revenues on incentives for private firms' investment-such as through the corporate income tax rate- will be analyzed in order to conclude on the sustainability of public consumption. Although, natural resource revenues do not seem to be used mainly for public investment, they might be used as tools to stimulate private investment though lower taxes.

Table 5.5: Consumption and Investment -Regional

Dependent Variable Public Expenditure	**Robust Coefficient Natural Resource Revenues**	**Robust Standard Error**	$P > \|t\|$
Atlantic Provinces			
Investment	1.177378	.4871043	0.137
Consumption	3.078098	.2468989	0.006***
Central Canada			
Investment	2.859379	7.785455	0.776
Spending	14.25673	17.65205	0.567
Western Canada			
Investment	.318694	.018568	0.000***
Spending	1.067126	.231333	0.010***

The results shown in table 5.5 demonstrate that the investment/consumption differential exists in all regions but that the magnitude of the effect is rather different. Central Canada's governments seem to be more sensitive to natural resource revenues, increasing both their investment and spending in a greater way. Western Canada's governments seem less responsive to natural resource revenues. Caution has to be taken in the interpretation of these results since the estimators are derived from very short panel data: two to four individuals over 21 periods. Moreover, the coefficients are not significant for Western Canada and Atlantic Canada (Investment).

5.2 Fiscal Impact

Two main results can be drawn from the fiscal impact regressions. First, the personal income tax is impacted positively and the corporate income tax negatively by natural resource revenues. Second, in Central Canada both tax rates are positively impacted.

The same model used for the public expenditures regressions is used to portray the effect of natural resource revenues on both corporate and personal tax rates. Caution has to be taken when interpreting the estimated coefficient in table 5.5. Since the tax rate cannot be expressed in per-capita term, there is no easy interpretation of those. Insights can although be gained observing the significance and the signs of the coefficients.

In both regressions, natural resource revenues are significant at the 95% significance level. However, the control variables are mostly insignificant at the 90% significance level with the exception of and (see appendix 1). The results suggest that corporate tax rates tend to decrease with natural resource revenues and personal tax rates tend to increase. Both coefficients are strongly significant implying that tax rates do react to changes in natural resource revenues.

Table 5.6: Corporate and Personal Income Tax-National

Dependent Variable Tax Rates	**Robust Coefficient Natural Resource Revenues**	**Robust Standard Error**	$P > \|t\|$
Corporate Tax Rate	-3312.51	1056.647	0.014**
Personal Tax Rate	2024.789	414.6899	0.001***

Assuming government acts as a social planner when allocating public spending, the optimal allocation of resources is given by maximizing a weighted social welfare function. This function defined over a set of public services consumed by individuals is subject to a budget constraint equal to the sum of public service expenditures (Deacon 1978). Undoubtedly, for a same level of public goods and services, an increase in natural resource revenues unbinds the budget constraint. This allows the government to decrease

the taxes raised from firms and households. Since the latter are assumed to be more distortionary (Boadway and Keen, 2010), one should expect to observe negative coefficient for both the corporate and personal income tax. In fact, governments' can choose to use these revenues to finance their consumption and investment as seen in the previous section or to redistribute it to the public sector through the tax/benefit system. Here tax rates reduction in the corporate and personal income case is used as proxy for the more general tax/benefit system. If the previous section allowed us to gain insights on the sustainability of public and private consumption, this section inform us about who actually controls the revenues from the resource sector. The economic agent who controls the resource revenues also controls the time path of consumption (inter-generation equity) as well as the choice of the project undertaken (efficiency). The results presented in table 5.5 suggest that ownership of resource revenues is transferred to private firm through decreased tax rates.

On efficiency ground, redistribution to private firms can be beneficial since private firms can be assumed to be better at identifying investment projects **(**Odedokun, 1997**).** However, on equity ground, a transfer of resource revenues to the private sector can be non-sustainable as individual agents typically give too little weight to future generation. Furthermore, the significant adverse effect on corporate tax rate is interesting to analyze from the point of view of Dutch Disease. Decreasing the tax burden to corporations can be seen as a way to redistribute revenues from the natural resource sector to other industries to boost their competitiveness (Collier et al., 2009). The bulk of revenues raised from the resource sector come from royalties and resource-specific taxes (Finances of the Nations, 2002) whereas for other sectors, revenues to government come largely from the

corporate income tax. The significantly negative impact of resource revenues on the corporate income tax can be viewed as a transfer from the resource sector to the other areas of the economy. More specifically, manufacturing and trade (wholesale and retail) represent almost 30% of the total GDP during the period studied. A decrease in the corporate income tax rate benefits relatively more these sector than others.

The case of the personal income tax is a little more puzzling as it is positively impacted by resource revenues. It is important not to overlook that provincial income tax rates have been on an uprising trend since the 80s' (Esteller and Solé, 2002). Moreover, the steady increase in provincial taxes are often said to be caused by the different interaction that exist among governments layers in the Canadian federation (Dalhby, 1996). Tax design interaction may also exist at a horizontal level as shown by Hayashi and Boadway (2001) or Brett and Pinkse (2000). However, the addition of a time trend does not reverse the impact of natural resource revenues on the tax rates suggesting that the tax rates do not follow an uprising trend. Assuming natural resource revenues drive a great portion of the Canadian GDP, a positive natural resource shock would stimulate the economy, reducing unemployment and increasing wages. As personal income gets bigger, household are more elastic to tax rate changes and the governments can increase tax rates**.**

One positive aspect of a personal income tax reacting positively to natural resource revenues is that it hedges variability in consumption. If resource revenues were to be transferred totally or partially to households, shocks in commodity prices or production would directly affect their revenues. Assuming an overlapping generation model with low utility weight given to bequests (Fisher, 1930), individuals are likely to increase their consumption during their lifetime. Resource revenues are transitory and volatile, so

transferring them directly to households could thus raise two issues. First, an increase in consumption may not be sustainable if we assume low utility weight to future generation. Second, this exposes household to price volatility and costly shocks in the consumption path (Friedman et al., 1956).

Table 5.7: Corporate and Personal Income Tax-Provincial

Dependent Variable Public Expenditure	**Robust Coefficient Natural Resource Revenues**	**Robust Standard Error**	$P > \|t\|$
Atlantic Provinces			
Corporate Income Tax Rate	-17469.69	2514.922	0.020**
Personal Income Tax Rate	2151.089	2953.603	0.542
Central Canada			
Corporate Income Tax Rate	64000.19	24108.59	0.229
Personal Income Tax Rate	140726.5	27937.68	0.125
Western Canada			
Corporate Income Tax Rate	-1049.474	678.9058	0.197
Personal Income Tax Rate	1703.516	624.1955	0.052*

In the Atlantic Provinces as well as in Western Canada an adverse effect on corporate income tax and a positive effect on personal income tax are observed just like in the national regression. Central Canada stands as an exception with a positive impact on both corporate and personal income tax. Albeit not significant, the estimation offers an insight on both the revenue ownership and Dutch Disease issues in Central Canada. First, the positive coefficients imply that Quebec and Ontario governments' do not redistribute their resource revenues through the tax/benefit system. This, analyzed in conjunction with

their greater sensitivity to public spending, indicates that the two provinces choose to use their resource revenues to finance their own consumption and investment. Since government can be assumed to weigh future generations more heavily, such policy may imply a more sustainable consumption growth path. Then again, as seen in section 5.1 Central Canada governments seem to increase their consumption more than their investment in the case of an increase in resource revenues mitigating this sustainability implication. Second, the results whereby Central Canada does not redistribute its resource revenues to private firms suggest that they may be more strongly affected by Dutch Disease syndromes. A decline in corporate tax income allows revenues to be transferred from the resource sector to the manufacturing and trading sector in order to boost their competitiveness. However, Central Canada does not appear to be pro-active in transferring resource revenues to its manufacturing sector. One point not to overlook is the relative importance of the manufacturing sector with respect to the resource sector in Ontario and Quebec (Hydro rents are not included). In fact, mining, oil and gas extraction represent less than 1% of Central Canada GDP compared to 13% in the other provinces whereas manufacturing represent 16% of Ontario and Quebec GDP and only 6% of the other provinces' (CANSIM, 2012). This implies that resource revenues may be insufficient to finance decrease in corporate income tax. The impact on this tax rate is thus the same as the personal income one and is affected by both an increasing trend and government interactions.

5.3 Surplus

In this section, the natural resource revenues impact on the provincial surplus is analyzed using the same model as previously. The results presented in table 5.6 show that

both ‘surplus’ and ‘surplus to GDP ratio’ are impacted significantly and positively by ‘natural resource revenues’. The estimator for the first regression implies that an increase of $100 in natural resource revenues causes the provincial surplus (deficit) to increase (decrease) by $117. This suggests that provincial governments use their natural resource revenues to balance their budget.

Table 5.8: Surplus-National

Dependent Variable Coefficient Surplus	**Robust Coefficient Natural Resource Revenues**	**Robust Standard Error**	$P > \|t\|$
Surplus	1.174258	.1424778	0.000 ***
Surplus/GDP ratio	2679.963	339.225	0.000***

The second row in table 5.6 presents the natural resource revenues estimator when the dependent variable is chosen to be the surplus to GDP ratio. Here the coefficient does not offer a clear interpretation since the ratio is not expressed in per capita term. The sign and the significance of the coefficient does however suggest that the portion of surplus (deficit) to the provincial product increase (decrease) with natural resource revenues. This supports the hypothesis whereby provincial governments use their natural resource revenues to balance their budget. As seen in section 5.1, provincial governments do use their resource wealth to fund their spending. The fiscal system may not be sustainable. Although the ratio of debt to deficit is low and smaller than the average interest rate, the use of natural resource to finance public spending worsens the sustainability of the system.

Table 5.9: Surplus-Regional

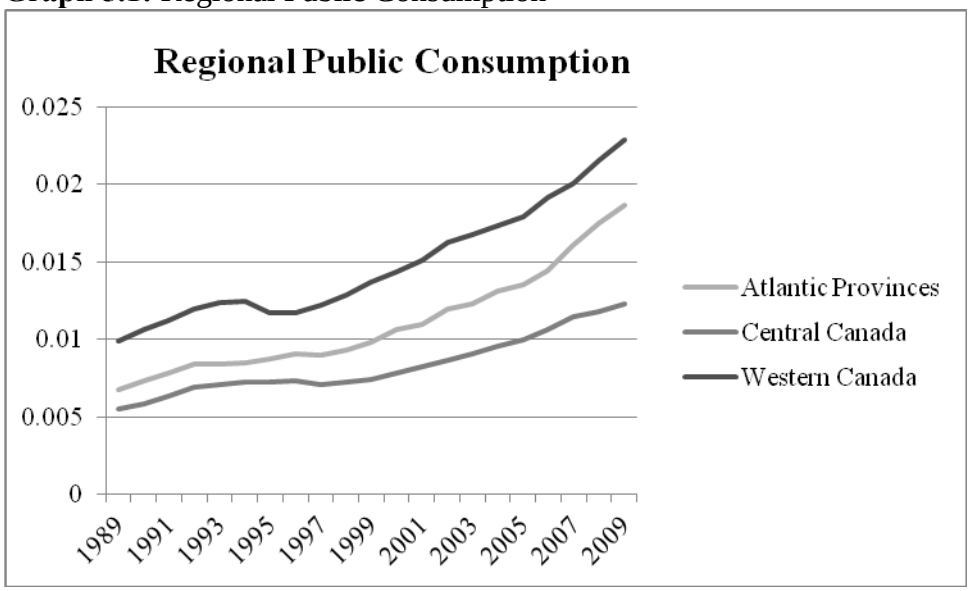
Dependent Variable Surplus	**Robust Coefficient Natural Resource Revenues**	**Robust Standard Error**	$P > \|t\|$
Atlantic Provinces			
Surplus	-1.037789	1.087582	0.441
Surplus/GDP ratio	-3480.493	3745.329	0.451
Central Canada			
Surplus	11.98714	10.48464	0.457
Surplus/GDP ratio	46597.9	43311.21	0.477
Western Canada			
Surplus	.9472471	.1460583	0.003***
Surplus/GDP ratio	2384.372	409.957	0.004***

The natural resource revenues variable is not significant at the 90% significance level in the Atlantic Provinces and Central Canada regression. Noticeably however, the Atlantic Provinces surplus (deficit) is impacted negatively (positively) by natural resource revenues. This result is surprising and suggests that the surplus (deficit) is likely to decrease (increase) as natural resource revenues increase.

In the Western Canada regression, natural resource revenues are significant at the 99% significance level as well along with most of the control variable. For an increase in revenues of $100, the surplus (deficit) is predicted to increase (decrease) by $94. In fact, in Western Canada, Alberta and Saskatchewan typically ran surpluses between 1989 and 2009 whereas British-Columbia had an average deficit of 336 million dollars during the same period. One drawback of Saskatchewan and Alberta positive surplus is that the resources used to balance the budget were not saved or used to build reproducible capital.

This is particularly acute in those provinces that rely more strongly on the resource sector to raise revenues; for example, Saskatchewan budget is fund at 15% by resource revenues. On inter-generational equity grounds, resource revenues should not be mixed with other resources and should rather be used to buy assets (Hartwick, 1977). Markedly, Alberta has been using its $17 million dollars saving fund (Alberta's Heritage Fund) to cover annual deficit. The positive balance may not be granting sustainability in this case.

Graph 5.1: Regional Public Consumption



Source: Statistic Canada, table 385-0001

The use of resource revenues to balance the budget also raises the issue of volatility: since resources previously saved in the Heritage Fund are used to balance budget and incidentally fund government consumption, the fall in commodity prices experienced in 2011-2012 could cause shocks in government consumption. Since resource revenues are transferred directly to the individual through steadily increasing public consumption (Graph 5.1), a shock in resource revenues has to be hedged though debt or increased revenues from other bases (income, sales or corporate tax). If such shock is not hedged

the full effect would be felt in public consumption though cuts in public services and goods.

6. Conclusion

For governments, natural resources offer both a unique opportunity to raise revenues and a challenge when spending these revenues. If a well designed fiscal policy can capture the economic rent in a non-distortionary manner, the revenues raised can both ease the 'inevitable adjustments' caused by the transfer of capital and people to the natural resource sector and insure that benefits from theses exhaustible resources are spread out among generations.

Using a simple model to illustrate the provincial governments' choices in using natural resource fiscal revenues, we find out that these revenues are likely not to profit to future generations of Canadian. In fact, an increase in natural resource fiscal revenues is likely to impact public consumption twice as heavily as public investment. In the absence of efficient saving fund at the provincial or federal level, this result suggests that resources are used for immediate consumption rather than placed in assets that would ensure future generations have an equivalent or superior level of consumption. Moreover, a strong positive and significant impact of natural resource revenues on provincial surpluses suggests that these revenues are used to balance provincial budget. The preponderant use of revenues for public consumption in conjunction with the balancing role of natural resource revenues raises concern about the stability of the current public consumption level. In the case of a commodity price bust, the provision of public goods and services is likely to be directly impacted*;* more so as both provincial and federal governments push for zero balanced budgets. As revenues from natural resources

fluctuate, governments are likely to cut in their provision of public goods and services instead of contracting debt. Moreover, the weak impact of natural resource revenues on public investment illustrates a missed opportunity for Canada to use its exhaustible resources to provide the private sector with more efficient infrastructures and better quality labour force in order improve its competitiveness in the long-run

Using the same model, we find out that the public policies presently in place are likely to hedge some of the symptoms of Dutch Disease. During the period studied, natural resource revenues impacted negatively and significantly corporate income tax which suggests that natural resource revenues are used to boost the other sectors competitiveness through the tax/benefit system. As private firms are faced with fewer costs they would be able to adapt more easily to the structural changes they are undertaking. For example, they would be able to invest in newer technologies or in physical capital in order to compete more efficiently on global markets. This paper does not, however, deal with the appreciation of the real exchange rate, tradable goods sector faces. Another symptom attributed to Dutch Disease and analyzed in this paper is that of possible shocks in consumption due to the commodity prices volatility. We found out that the public policies presently in place hedge private consumption variability but not public consumption's. In fact, the strong impact of natural resource on almost all public expenditures suggests that public consumption react strongly to variation in the commodity prices or production leading to possible variability in the provision of public goods and services. On the other hand, the personal income tax is not impacted negatively by natural resource revenues suggesting that theses resources are not transferred directly to households which consumption is not, in turn, subjected to commodity price

variability. Albeit no econometric evidence are given in this paper, reduction in consumption taxes fund by natural resource revenues could be viewed as a transfer to household and a channel for conveying uncertainty to them.

With this overall portray of the use of natural resource revenues in the federation, two main public policy concerns arise. First, it appears necessary to define the weight our society and governments give to future generations' well being and to assess consequently the optimal rate of saving. Sovereign Wealth Funds are not the only solution and, in Canada's case, a structured and responsible investment plan in infrastructure and education could be financially and socially more profitable. Second, citizens need to be protected from shocks in their consumption of public goods and services through sounder fiscal policies. As natural resources are exhausted, some funds ought to be saved or invested in order to avoid having to cut essential public goods and services during the rainy days. Finally, regarding the crowding-out of resources from the manufacturing sector and the loss of competitiveness that arise there-from, a rigorous cost/benefit analysis has to be undertaken in order to assess the efficiency of stimulus tools such as the through the tax/benefit system.

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Appendix 1

Table 1: Public Expenditures-General Services

Explanatory variables	**Coefficient**	**Robust Standard Error**	$P > \|t\|$
Natural resource revenues	-.0225276	0.0141142	0.149
Unemployment	$3.24e^{-08}$	$3.27e^{-08}$	0.351
Provincial GDP	0.0056782	0.0015338	0.006***
Wage Index	-0.00001	$7.28e^{-06}$	0.205
Fiscal Capacity	0.008751	0.0010044	0.409
Equalization	$-6.93e^{-08}$	$1.72e^{-08}$	0.697

Table 2: Public Expenditures-Protection

Explanatory variables	**Coefficient**	**Robust Standard Error**	$P > \|t\|$
Natural resource revenues	0.0649378	0.0387753	0.133
Unemployment	$-6.02e^{-09}$	$5.69e^{-08}$	0.918
Provincial GDP	0.0058669	0.0036504	0.147
Wage Index	$1.44e^{-06}$	$9.48e^{-06}$	0.883
Fiscal Capacity	0.0028288	0.0031384	0.394
Equalization	$-1.19e^{-07}$	$1.75e^{-07}$	0.514

Table 3: Public Expenditures-Transport

Explanatory variables	**Coefficient**	**Robust Standard Error**	$P > \|t\|$
Natural resource revenues	0.0515405	0.0307106	0.132
Unemployment	$5.25e^{-08}$	7.73^{-08}	0.496
Provincial GDP	0.0068583	0.002216	0.015**
Wage Index	0.000738	0.0000268	0.025**
Fiscal Capacity	-0.0038725	0.0035235	0.304
Equalization	$-5.13e^{-08}$	$3.28e^{-07}$	0.880

Table 4: Public Expenditures-Health

Explanatory variables	**Coefficient**	**Robust Standard Error**	$P > \|t\|$
Natural resource revenues	0.5694642	0.1379142	0.003***
Unemployment	$-9.16e^{-07}$	$3.55e^{-07}$	0.033**
Provincial GDP	0.0336836	0.0154223	0.060*
Wage Index	0.001429	0.00000492	0.020**
Fiscal Capacity	0.0287011	0.0139578	0.074*
Equalization	$3.20e^{-06}$	$7.0e^{-07}$	0.002***

Table 5: Public Expenditures- Social Services

Explanatory variables	**Coefficient**	**Robust Standard Error**	$P > \|t\|$
Natural resource revenues	-0.1192095	0.0660588	0.109
Unemployment	$-2.5e^{-07}$	$2.21e^{-07}$	0.209
Provincial GDP	-0.0077539	0.0069963	0.300
Wage Index	0.000534	0.0000335	0.149
Fiscal Capacity	0.0221459	0.0130789	0.129
Equalization	0.0221459	0.0130789	0.129

Table 6: Public Expenditures-Education

Explanatory variables	**Coefficient**	**Robust Standard Error**	$P > \|t\|$
Natural resource revenues	0.2433818	0.05719	0.003***
Unemployment	$-1.87e^{-07}$	$7.47e^{-08}$	0.036**
Provincial GDP	0.0241706	0.0041097	0.000***
Wage Index	0.0001282	0.00000661	0.088*
Fiscal Capacity	0.0064141	0.0068706	0.378
Equalization	$2.57e^{-06}$	$1.37e^{-06}$	0.098*

Table 7: Public Expenditures-Recreation and Culture

Explanatory variables	**Coefficient**	**Robust Standard Error**	$P > \|t\|$
Natural resource revenues	0.0327171	0.0059538	0.001***
Unemployment	$-1.15e^{-08}$	$1.47e^{-08}$	0.455
Provincial GDP	0.0014575	0.000436	0.010***
Wage Index	$9.75e^{-07}$	$3.07e^{-06}$	0.759
Fiscal Capacity	0.0001019	0.0006959	0.887
Equalization	$6.99e^{-08}$	$9.17e^{-08}$	0.468

Table 8: Public Expenditures-Labour

Explanatory variables	**Coefficient**	**Robust Standard Error**	$P > \|t\|$
Natural resource revenues	0.0212081	0.002292	0.000***
Unemployment	$9.00e^{-09}$	$1.04e^{-08}$	0.412
Provincial GDP	-0.0003174	0.0002522	0.244
Wage Index	$2.41e^{-06}$	$3.43e^{-06}$	0.503
Fiscal Capacity	-0.0014079	0.0003762	0.006***
Equalization	$1.70e^{-08}$	$3.28e^{-08}$	0.618

Table 9: Public Expenditures- Regional Development

Explanatory variables	**Coefficient**	**Robust Standard Error**	$P > \|t\|$
Natural resource revenues	-0.013957	0.0044946	0.015**
Unemployment	$5.30e^{-09}$	$8.82e^{-09}$	0.564
Provincial GDP	0.00034	0.0004192	0.441
Wage Index	$1.02e^{-06}$	$4.38e^{-06}$	0.564
Fiscal Capacity	0.0006845	0.0005894	0.279
Equalization	$-6.82e^{-08}$	$3.91e^{-08}$	0.119

Table 10: Public Expenditures- Investment

Explanatory variables	**Coefficient**	**Robust Standard Error**	$P > \|t\|$
Natural resource revenues	0.3136824	0.0415403	0.000***
Unemployment	$-1.38e^{-07}$	$4.68e^{-08}$	0.018**
Provincial GDP	0.0328263	0.0032067	0.000***
Wage Index	0.0002039	0.0000589	0.009***
Fiscal Capacity	0.0033279	0.00638	0.616
Equalization	$2.52e^{-06}$	$9.97e^{-07}$	0.036

Table 11: Public Expenditures-Consumption

Explanatory variables	**Coefficient**	**Robust Standard Error**	$P > \|t\|$
Natural resource revenues	0.5138729	0.2321108	0.058*
Unemployment	$-1.13e^{-06}$	5.08^{-07}	0.057*
Provincial GDP	0.0371575	0.0258552	0.189
Wage Index	0.0001901	0.0000546	0.008***
Fiscal Capacity	0.531429	0.0209506	0.035**
Equalization	$3.23e^{-06}$	$1.42e^{-06}$	0.052*

Table 12: Tax Rate- Corporate Income

Explanatory variables	**Coefficient**	**Robust Standard Error**	$P > \|t\|$
Natural resource revenues	-3312.51	1056.645	0.014**
Unemployment	0.0015313	0.001692	0.392
Provincial GDP	-24.70608	59.66721	0.690
Wage Index	-0.6216526	0.6806061	0.388
Fiscal Capacity	-24.99784	110.0619	0.826
Equalization	-0.0115291	0.0038167	0.017**

Table 13: Tax Rate- Personal Income

Explanatory variables	**Coefficient**	**Robust Standard Error**	$P > \|t\|$
Natural resource revenues	2024.789	414.6899	0.001***
Unemployment	0.0001236	0.0014496	0.934
Provincial GDP	-104.373	51.78747	0.079*
Wage Index	0.2736952	0.3440487	0.449
Fiscal Capacity	4.519172	51.83371	0.933
Equalization	0.0003161	0.0031526	0.923

Table 14: Surplus

Explanatory variables	**Coefficient**	**Robust Standard Error**	$P > \|t\|$
Natural resource revenues	1.174258	0.1424778	0.000***
Unemployment	$1.00e^{-07}$	$2.20e^{-07}$	0.662
Provincial GDP	0.0657669	0.011952	0.001***
Wage Index	-0.0003357	0.0000381	0.000***
Fiscal Capacity	0.0189327	0.0260214	0.488
Equalization	$-3.82e^{-06}$	$4.79e^{-07}$	0.000***

Table 15: Surplus/GDP Ratio

Explanatory variables	**Coefficient**	**Robust Standard Error**	$P > \|t\|$
Natural resource revenues	2679.963	339.225	0.000***
Unemployment	-0.0002818	0.0008086	0.736
Provincial GDP	164.4984	23.32491	0.000***
Wage Index	-1.079118	0.1645095	0.000***
Fiscal Capacity	149.1642	61.94589	0.043**
Equalization	-0.008945	0.0031024	0.020**

Appendix 2

Price index data obtained from CANSIM Table 326-0021

Public Expenditures data obtained from CANSIM Table 385-0001

Natural Resource Revenues data obtained from CANSIM Table 385-0001

Population data obtained from CANSIM Table 051-0001

Provincial Gross Domestic Product obtained from CANSIM Table 384-0002

Wage Indices data obtained from CANSIM Table 202-0107

Tax Capacities obtained from the Ministry of Finance

Personal and Corporate Income Tax Rates obtained from the 'Finances of the Nations' report from 1989 to 2006 (Canadian Tax Association)

Provincial Surpluses obtained from CANSIM Table 385-0002