

**Examining the Interplay between Natural Resources
and Equalization in the Canadian Federation: An
Empirical Analysis**

by

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Abstract

Canada is a federation composed of vastly diverse provinces: it is the difference in provinces ability to provide comparable levels of public goods using comparable levels of taxation that motivated the entrenchment of Equalization into the Canadian Constitution in 1982 (Section 36). However, the conferment of property rights over natural resources to the province (Section 92A) and the non-uniform distribution of natural resources throughout the federation operate contrary to the ideals expressed in Section 36. This article contends that Alberta, armed with the supernatural rents from their resource sector, actively involves itself with province-building - much to the detriment of the other provinces in the federation (and sometimes even to itself). By examining the interplay between Alberta's petroleum industry and the economic prosperity of the federation, we determine that there are adverse effects attributable to Albertas lack of fiscal discipline the existence of the Resource Curse in Canada along with the associated Dutch Disease and the fettering of the Equalization system. With the recent decade characterized by a global resource boom and the coinciding surge in commodity prices, the sustainability of the Equalization system is unlikely given the externalities highlighted in this paper. The only viable solution for Canada is for Alberta to adopt the 'Norwegian Model'.

1 Introduction

The management of the provinces natural resource rents has been the Achilles heel of the Canadian Equalization system since its inception in 1957. More specifically, the Canadian government has struggled with accurately determining the costs and benefits of equalizing natural resource revenues and the impact they have on entitlement payments, efficiency of the internal economy and the sustainability of the program. The complexity of this problem has resulted in numerous changes over the years to the list of revenues to be equalized as well as the standard to which revenues are equalized. Furthermore, complicating factors resulting from provincial natural resources, least of which the perverse incentive associated with the tax-back problem, result in ad hoc amendments to the equalization system: as an example, the Generic Solution¹ imposed in 1994.

Economists and political scientists have developed an expansive array of literature exploring the Canadian equalization system on both efficiency (Boadway and Flatters, 1982) and equity (Graham, 1964) grounds. Further, a growing literature is developing which explores the influence of natural resource revenues on economic development, with an interesting result that countries abundant in natural resources experience lower economic growth relative to countries with little natural resources (Sachs and Warner, 1995). Most of the analysis performed in the Resource Curse literature is at the national level, and focuses on cross-country comparisons. However, emerging work by Michaels (2007), Michaels and Caselli (2009) and Aragon and Rud (2009) established the potential for a reversed Resource Curse effect at the regional level within a country. Raveh (2010) considered the case of federations and found within federations resource abundance is more of a blessing than a curse (while between them the curse remains).

The finding made by Sachs and Warner (1995) in conjunction with those made by Michaels (2007) and Raveh (2010) suggest a tangible influence of natural resource

¹The generic solution ensures that provinces with a substantial amount of a specific resource lose only 70 percent of the increase in their fiscal capacity due to resource development. Examples where this is applicable would be Potash development in Saskatchewan and Asbestos in Quebec.

development on the amount of payments made by the Canadian equalization system. This paper builds upon the research of Raveh (2010) by restricting analysis to the Canadian federation so that we might investigate the incidence of a ‘Resource Curse’ with respect to Alberta’s development of its non-renewable resources and the influence of resource abundance in Alberta on provincial equalization entitlements.

That said, it is imperative to understand why a province’s development of its natural resource endowments, and subsequently the existence of a Resource Curse, affects not only equalization entitlements owing to that province, but also the equalization payments to be made to other provinces within the Canadian federation. Firstly, it is prudent to establish the underlying cause for the externalities conferred on other provinces- through the equalization system-which is primarily through Section 92A of The Constitution Act, 1867. Section 92A confers on the provinces the right to manage and tax nonrenewable natural resources. The Canadian federation is unique in that it allows provincial ownership of non-renewable resources. As will be the reoccurring theme of this analysis, provincial ownership of natural resources creates an environment conducive to inefficiency because provinces, in this case Alberta, make decisions while maximizing the utility of the agents within their province and not the federation as a whole.

Secondly, we must understand the principles upon which the equalization program was predicated. Section 36 of the Constitution Act provides a succinct representation of these principles, and reads as follows:

- Without altering the legislative authority of Parliament or of the provincial legislatures, or the rights of any of them with respect to the exercise of their legislative authority, Parliament and the legislatures, together with the government of Canada and the provincial governments, are committed to
 1. promoting equal opportunities for the well-being of Canadians;
 2. furthering economic development to reduce disparity in opportunities; and
 3. providing essential public services of reasonable quality to all Canadians.
- Parliament and the government of Canada are committed to the principle of mak-

ing equalization payments to ensure that provincial governments have sufficient revenues to provide reasonably comparable levels of public services at reasonably comparable levels of taxation.

As noted by Boadway (2004), Section 36(2) is the part specific to equalization, but the commitments established by Sections 36(1) and 36(2) are not mutually exclusive, rather they are inextricably linked by their joint contributions to the obligations of both sections.

Regardless of the many changes to the formula used to calculate equalization entitlements, the Canadian equalization system determines have provinces from have-not provinces based on fiscal capacity, that is, the ability to raise revenues given their tax bases. Intuitively, the policies implemented and investments undertaken within a province have a direct impact on its fiscal capacity. Less obvious, but almost certain particularly within a confederated state is the indirect impact of a resource boom as it occurs in a single province, on the fiscal capacity of all provinces. The problem of fiscal externalities is enhanced in a federation because decisions of provinces made unilaterally with respect to the provision and financing of public goods distorts the interregional allocation of resources within the federation. (Boadway, 1998) To be sure, the effects of resource development can be either positive or negative, for both the developing province and the federation as a whole, depending on the equilibrium adjustment of productive inputs.

The intuition for the negative externality of Albertas province building is simple: Alberta has a greater fiscal capacity due to natural resource endowments and therefore can provide a wider variety of public goods at lower tax rates. The Net Fiscal Benefit (NFB) differential between provinces with natural resources and those without natural resources results in fiscally induced migration, among other effects, regarding mobile factors of production. The resulting reallocation of resources affects variables that are used to determine fiscal capacity - the tax base of a province, provincial tax rates, and personal income. The inefficiency in the triggered mechanism occurs when the differences in fiscal capacity are driven by the non-uniform endowment of natural

resources and the derived natural resource rents of an endowed province: the end result being the weakening of an external provinces fiscal capacity thereby necessitating or reinforcing the need for equalization payments.

To be sure, province building by Alberta, as partly characterized by the attraction of labor from other provinces, will be mitigated partially because many resource sectors, particularly the oil and gas industry, are capital-intensive. However, to the extent that there are positive externalities from the Albertan resource sector into other industries of their resource based economy, particularly labor-intensive service and construction sectors, the out-migration effect, as characteristic of labor mobility from other provinces into Alberta, will be pronounced (Boadway, 2006). The resulting upward pressure on wages not only reinforces the out-migration effect, but will also harm sectors in other provinces while inducing unemployment due to structural changes in the industrial composition of the national economy.

It is the tendency of Alberta to spend the rents generated from their resource sector - while acknowledging some of the revenue is earmarked for their Sovereign Wealth Fund - which triggers many of the adverse outcomes occurring throughout the federation. The Norwegian approach to resource development serves as an ideal example of how a country might prevent the onslaught of the Resource Curse and the associated Dutch Disease. Larsen (2004) noted that Norway was able to foster economic growth while expanding their resource sector by implementing factor movement policies. Two of such policies were the *central wage formation system* - moderates the impact on wages in other sectors from the influence of the resource sector - and the *spending effect policy* - sterilizes the rents generated from the resource industry by maintaining a petroleum fund overseas and restricting access to the principle of the fund. The upshot of the Norwegian model is that the Resource Curse would be non-existent if either Alberta exhibited fiscal restraint with respect to its resource rents or the Federal government owned natural resources.

Through a disparate mechanism (an argument made possible due to the provincial structure of Canada) a provinces development of their natural resources can confer

positive externalities on neighboring provinces. Through mechanisms characterized by expansion of the technological frontier, attraction of foreign direct investment and absorption of displaced labor, the natural resource rents of a particular province can strengthen the fiscal capacity of external provinces. Just as the resource sector can stimulate demand in other sectors within the resource-based province, similarly it can promote demand in the labor-intensive service and construction sectors of neighboring provinces. It is also reasonable to assume the adjustment period is not characterized by substantial dead-weight loss. The low transaction costs of productive-input mobility within Canada suggest a relatively rapid return back to equilibrium from potential disturbances induced by the expansion of the resource sector.

For the purposes of this analysis, Alberta provides an ideal example of a province whose treatment of its natural resource sector has the potential to exert influence on the real economy of the other provinces. Furthermore, Albertas competitive spending public expenditure aimed at attracting productive inputs from other regions is made feasible by the exploitation of their natural resource rents. As noted by Raveh (2010), the Net Fiscal Benefit, *defined as the difference between provincial spending (less transfers) and tax revenue*, was the largest relative to all other provinces. Furthermore, the differences in the fiscal capacities of the provinces, arising from the growth in nonrenewable resource revenues in Alberta, is a contributing factor [for the horizontal fiscal imbalance present among the provinces], but at least as important is the Atlantic Accord that the federal government recently signed with Newfoundland and Labrador and Nova Scotia (Dahlby, 2005).

Subsequently, the expansion of the natural resource sector in Alberta contributed to the decline in Ontario's relative competitive advantage (Courchene, 2008) Ontario qualified for equalization payments in 2008 and its automotive industry contracted in 2009. The significance of these events is apparent when we consider that historically Ontario was one of the richest have provinces, but is now colloquially referred to as Ontari-owe. Trefler (2010), in his article The Loonacy of parity: How a strong dollar is weakening Canada, spoke briefly about the woes of a resource boom leading to currency

appreciation. He issued this warning: the upward pressure on the loonie is killing our [Canada's] most innovative, export-oriented firms.

In this paper we will attempt to model the evolution and interdependence of provincial prosperity as proxied using per capita fiscal capacity, entitlements and national provincial income in the context of fiscal externalities created by the development of the petroleum industry within Alberta. The remainder of the paper is organized as follows: Section II provides a succinct overview of the development of the Canadian equalization system, Section III outlines the theoretical foundation of this paper in the context of a literature review, Section IV summarizes the data and methodology implemented, Section V presents the major results of our empirical analysis, Section VI provides a brief discussion of the policy implications of this research and Section VII concludes. *The principal claim of this paper is that the Canadian federation is not well suited to deal with a resource boom when it is concentrated predominantly in one province primarily because provinces have ownership over their natural resources and because of the decentralized nature of governance existent within Canada.*

2 Overview of the Canadian Equalization System

There exists the potential for three types of fiscal imbalances within a governmental structure like Canada's: vertical fiscal imbalance², horizontal fiscal imbalance³ and structural fiscal imbalance⁴. Horizontal fiscal imbalance, resulting in a difference in the individual provinces' ability to provide comparable levels of public services at comparable levels of taxation, is addressed using the Federal Equalization Program.

The system whereby provinces receive equalization payments was first articulated in the

²Vertical Fiscal Imbalance denotes a difference in revenue generating capacity and expenditure responsibilities between different levels of government.

³Horizontal Fiscal Imbalance denotes a difference in revenue generating capacity and expenditure responsibilities between different regions at the same level of government.

⁴Structural Fiscal Imbalance is synonymous with the overreliance on a certain tax source for generating revenue.

Report of the Royal Commission on Dominion-Provincial Relations (1940)⁵, established in Canada in 1957 and was subsequently enshrined in the Constitution in 1982. (Brown, 1996)

The initial equalization program introduced in 1957 equalized only 3 revenue sources using a weighted average of the per capita revenue of Ontario and British Columbia (based on provincial government tax rates): personal income taxes, corporate income taxes and succession duties. In 1962, natural resource rents⁶ were added to the list of revenues to be equalized and the standard to which revenues were equalized was changed from the two richest provinces (then Ontario and British Columbia) to the average of the ten provinces. The changes made in 1962 were undone in 1963: the standard was returned to the average of the two richest provinces and natural resource revenues were excluded from the revenues to be equalized.

A series of expansions to the list of revenues to be equalized occurred in 1967 and 1982, from four to sixteen and thirty, respectively. The coverage of thirty revenue sources founded the equalization program on the principle of a Representative Tax System (RTS) and in 1982 the five-province standard was introduced. The five-province standard equalized revenue based on the average of Ontario, British Columbia, Saskatchewan, Quebec and Manitoba. With the implementation of the five-province standard Alberta was strategically excluded to keep its natural resource revenues out of the standard. The formula-based approach for equalization was discontinued in 2004 and replaced with a fixed-sum program called the Fixed Framework.

In 2007, a formula-based approach was re-introduced: $E^i = t^s(B^s - B^i)$. Where E denotes per-capita equalization entitlements, t denotes the average tax rate, B denotes per-capita tax base (fiscal capacity) and superscripts 'i' denotes province and 's' denotes standard. The average per-capita fiscal capacity, denoted by B with superscript 's', is based on a ten-province standard. A have province has a fiscal capacity above the ten-province standard (negative entitlements), while a have-not province has a fiscal

⁵The report was also known as the Rowell-Sirois Report.

⁶Natural resource rents were equalized at the rate of 50 percent.

capacity below the ten-province standard (positive entitlements). As is made evident, equalization entitlements are determined based on fiscal capacity as compared to the ten-province standard and are unconditional. Equalization payments are financed using federal government general revenues. The Canadian equalization system is a gross system meaning have-not provinces receive positive transfers while have provinces are not taxed.

To capitalize on the treatment of natural resources I discuss its current application in equalization payments here. Prior to the reforms made in 2004 (with the exception of a few years) 100 percent of resource revenues were included in determining a provinces equalization entitlements. Alberta's resource revenue, due to its susceptibility to high volatility (given the variance of petroleum prices), was excluded from the standard against which entitlements were determined. Since 2007, a dual parallel equalization scheme was implemented with respect to resource rents. The basic formula includes 50 percent of resource revenues aggregated into a single base and provinces were given the option to opt into the new system. The current equalization program maintains the benefits conferred to Nova Scotia and Newfoundland and Labrador in the Atlantic-Offshore Accords (2005)⁷. Both provinces were given the choice to opt into the new equalization scheme or operate under the pre-2007 scheme with a guarantee that their cumulative entitlements will not decline if they convert to the new scheme. Nova Scotia has since chosen the new program while Newfoundland remains under the Fixed Framework system.

3 Literature Review

Many previous researchers have noted the impact of the Resource Curse on resource-based economies. Furthermore, there has been an extensive amount of literature analyzing the effectiveness of the equalization system in Canada. However, to the best of our knowledge, there has been no applied research that studied the relationship

⁷The Offshore Accords provide 100 percent compensation for any reduction in equalization entitlements due to enhanced fiscal capacity attributable to the development of offshore resources until 2012.

between resource development and fiscal federalism. To this extent, the motivation of this paper appeals to two literatures: the literature studying equalization in the context of a horizontal fiscal imbalance and the literature analyzing the adverse effects of resource abundance.

Earlier studies by Gelb (1988) and Auty (1990) initiated the empirical foundation for Sachs and Warners (1995) introduction of the theoretical concept ‘Resource Curse’ - *the concept applies to the observation that countries abundant in natural resources grow slower than those with relatively little natural resources*. These studies concluded that the misallocation of productive inputs in resource-based economies is attributable to resource windfalls and that the benefits of resource development can be far outweighed by the costs it imposes on the overall economy. Where Sachs and Warner (1995) improved upon prior research was by establishing a negative relationship between resource intensity and per capita GDP growth using a cross-national comparative growth framework. They estimated this relationship for 95 developing countries using data spanning the interval 1970-1989. Their preferred proxy for resource intensity was the ratio of primary product exports to GDP. Their finding was robust even after controlling for regional differences, degree of openness, quality of bureaucracy, measure of inequality, investment to GDP ratio and use of alternative measures of resource intensity.

The observation of the adverse effects of resource development on growth is present from a historical as well as regional context. Historically, resource-rich Russia grew slower than resource-poor Japan (Sachs and Warner, 1995)⁸. According to the work of Buiters, Esanov and Raiser (2001), some resource-rich economies transitioning from the dissolution of the Soviet Union had lagged behind in development relative to the resource-poor Commonwealth of Independent States (CIS). In the West Indies, St. Kitts and Nevis, a country with very little natural resources, had one of the highest growth rates between 1978 and 2004, while Guyana, a resource-rich country experienced one of the lowest growth rates in the region. (Kida, 2006)

⁸Sachs and Warner (1995) determined an inverse relationship between resource intensity and a country's growth rate using cross-country regressions based on data spanning the time interval from 1970-1989.

By adopting the methodology of Sachs and Warner (1995) and extending it to analyze the impact of resource development on federations, Raveh (2010) tested the following model: $G^i = \alpha_0 + \alpha_1 \ln(Y_0^i) + \alpha_2 R^i + \alpha_3 E^i + \alpha_4 \text{Australia} + \dots + \alpha_{13} \text{US} + \varepsilon^i$. He regressed real per capita GDP growth on the natural logarithm of initial GDP, the resource share proxy, a measure for federal inequality and federal-dummies⁹. Raveh(2010) showed that there exists a ‘reversed resource curse’¹⁰ within a federation while between them the adverse effects remain. Furthermore, he confirmed that institutional quality could not explain the difference observed when comparing intra-federal and cross-federal: rather the different outcomes stems from the difference in the magnitude of the resource movement effect which is triggered by the difference in the costs of factor mobility.

The cost of factor mobility across provinces is extremely low within Canada relative to factor movements across the border, or movements of factors from one country to another. Therefore, consistent with the finding of Raveh (2010), provinces with natural resource endowments should experience higher growth than those without natural resource endowments. Building upon this insight, the effects of developing the natural resources of a province in the federation (acknowledging factor mobility is high due to low costs) imposes direct benefits to the developing province and direct costs on all other provinces in the federation; the ability of a province to attract factors of production from other provinces based on its resource rents is what Raveh (2010) termed the ‘Alberta-effect’. The implication is that there should be a significant impact on provincial fiscal capacity and by extension on required equalization attributable to the development of the petroleum industry within Alberta.

Evidently, provincial ownership of resources creates an environment where the affects of a Resource Curse are pervasive, particularly when provinces use rents to finance current spending as opposed to saving them. Intra-federal competition leads provinces

⁹Federal-dummies are binary variables distinguishing federations i.e. Australia, Canada, United States etc.

¹⁰A reversed resource curse denotes the observation that resource-rich regions grew faster than resource-poor regions.

to reduce taxes, reform their labor market policies and/or expand their provision of public goods to attract factors into their jurisdiction. The impact of competitive spending is appreciable for a federation that shares a common currency and few restrictions on inter-federal migration. The crippling effect on the manufacturing industries within Ontario and Quebec of the Canadian dollar appreciation due in part to the expansion of Alberta's natural resource sector serves as one such example of the potential for there to be rippling effects attributable to the decentralized policies of the provinces (Drache, 2009).

Further, the differentials in Net Fiscal Benefits, as induced by inter-federal competition translating to differences in comprehensive income across provinces, result in artificial incentives of labor, investment and capital to migrate (Bird and Smart, 1996)¹¹. Unilateral decisions by provincial governments may alter the inter-federal allocation of resources (Boadway, 1998). The misallocation of productive inputs affects the fiscal capacity of provinces. To put the matter succinctly, the fiscal choices [of provinces] are the source of the fiscal inequities and inefficiencies that are the ultimate rationale for equalization (Boadway, 2001).

The fiscal externality is exacerbated due to the Canadian equalization system being a gross system. In the context of the Canadian federation, the gross system produces a perverse effect whereby an increase in resource rents by a have-province increases entitlements at high cost to other provinces by means of an increase in federal tax rates. It should also be clear that even after equalization, provinces with higher per capita income due to a resource boom will remain with a higher revenue-raising capacity because, while have-not provinces are equalized-up to the national average, have provinces are not equalized-down (Boadway, 2006). As noted by Usher (2007):

A rise in the price of oil harms Ontario twice over: once because people in Ontario must pay more for the oil they consume, and again because of the increase in the equalization-induced transfer, through the federal gov-

¹¹Comprehensive income is composed of labor market income, transfers from the government and implicit income associated with public goods provision net of taxes (Hobson, 2002).

ernment, from the people of Ontario to the people in provinces receiving equalization payments.

Moreover, equalization payments are financed through general federal revenues that result in net revenue flows from all provinces (Hobson, 1998). This reality when applied to the fact that natural resource rents are not fully equalized - particularly in the case of Nova Scotia and Newfoundland and Labrador where their offshore resources are equalized at zero percent - provinces fail to internalize the full costs of developing their natural resources. In failing to internalize the full marginal cost of their policies and given the assumption of low mobility costs, the ‘Alberta Effect is reinforced (Raveh, 2010). The general sentiment of the ‘Alberta Effect was noted by Drache (2009): “Canadas resource curse has become a blessing for the once have-not provinces of the Confederation”. To further amplify, the benefits of Alberta’s development of their resources is concentrated within the province primarily (with allowance for potential regional spillover effects) and not uniformly distributed throughout the federation.

Fiscally induced labor migration results in an inefficient outcome through the introduction of a difference in the marginal product of labor across provinces. Differences in the marginal product of labor lead to differences in the value of services for equally skilled labor resulting in a misallocation of labor (Usher 2007). This inefficient outcome is partly driven by the motivation to move due to the Net Fiscal Benefit of migrating otherwise known as the ‘passive consequences’ of resource development (Boadway, 2006) and not productivity concerns.

To amplify, Usher (1995) presents the argument as follows. An efficient economy maximizes national income while an equalization program is efficient if it raises national income relative to what it would be otherwise. National income is reduced when transfer-induced migration, in equalizing the net income of labor, generates a difference in the marginal product of labor between provinces. For example, when Alberta distributes oil revenue only within its jurisdiction, it attracts labor from other regions. With the introduction of equalization payments, the labor force in the resource-based

province falls, but remains above its pre-resource transfer levels so that the inefficiency created by the unequal distribution of resource rents is not completely undone. Consequently, the national income is lower than it would be otherwise. Such an outcome is increasingly apparent within Canada: resource-rich provinces Saskatchewan, Alberta, British Columbia and Newfoundland and Labrador have outranked Ontario and Quebec, the former “locomotive[s] of the Canadian economy”, in terms of job growth (Drache, 2009).

4 Data and Methods

4.1 Data

The present study used data obtained from three primary sources: the Canadian Socioeconomic Database from Statistics Canada (CANSIM), the Canadian Association of Petroleum Producers (CAPP) Statistical Handbook and the Department of Finance. Data regarding investment in exploration and development for the Petroleum Industry within Alberta and the average price of crude oil was obtained from CAPP, the Department of Finance provided the data pertaining to the fiscal capacity and Equalization entitlements of the provinces and all other economic data were obtained from CANSIM. The analysis includes nine of the ten Canadian provinces: the territories and Prince Edward Island were excluded because of their size (both in terms of Gross Domestic Product and population) relative to the other provinces.

The sample used for each province was annual data and covered the time interval 1981- 2008 for most data, the exceptions were Equalization entitlements (1975-2008) and provincial manufacturing industry investment (1976-2008). The primary variables of interest included fiscal capacity, equalization entitlements, real Gross Domestic Product and a proxy for Albertas resource abundance¹². As employed by the Department of Finance, fiscal capacity denotes a provinces ability to generate revenue from its own sources - *fiscal capacity is measured using 5 tax bases and includes 100 percent of re-*

¹²An extensive list of data series used and where they were obtained from is provided in Appendix Two.

*source revenues: personal income tax, business income tax, consumption tax, property tax and natural resource revenues. Equalization entitlements, as distinct from ‘actual’ equalization payments received*¹³, *are defined as the difference between the fiscal capacity (yield) of a province and revenue generating capacity of a ten province standard.* The measure of Alberta’s resource sector employed throughout the analysis is the real per-capita value of crude oil reserves in Alberta; the real per capita value of crude oil reserves was imputed using Albertas crude oil reserves and the average Albertan price of crude oil.

4.2 Methods

As a general modeling approach, Vector Error Correction models (VECM) were estimated. Error correction and cointegration are based on the Granger Representation Theorem. According to Engle and Granger (1987), a combination of integrated series that are error correcting are cointegrated and subsequently, all series that are cointegrated can be expressed with an error correcting representation. In the case of a VECM, we do not estimate it directly: rather, a model containing all variables in levels is estimated with the VECM derived from the output. This approach is functionally equivalent to estimating the VECM directly - model equivalence.

The benefits of using a VECM rather than Ordinary Least Square Estimation (or even a Vector Autoregressive framework) are primarily three-fold: first and foremost, first-differencing is not required, which reduces sample variation and results in subsequent loss of information: in a finite sample, as was used for this analysis, this improves the efficient use of sample information provided the series are cointegrated. Second, as noted by Naka and Tufte (1997), a Vector Autoregressive framework, where first differences are used, is misspecified provided there exists a cointegrating relationship; therefore, a VECM enhances efficiency in terms of parameter estimation. Third, Vector Error Correction Models allow for the analysis of both contemporaneous and equilib-

¹³Only provinces with positive entitlements receive equalization payments: this is the fundamental feature of the ‘gross approach to equalization.

rium (long run) causal relationships: it is the ability of a VECM to identify the long run causal relationship between cointegrated variables that enhances the depth of this analysis.

Prior to estimating any of the postulated models, unit root analysis was performed on all variables to determine their stationary and non-stationary representations. For the purposes of this analysis, variables must be non-stationary to test the hypothesis of cointegration but they must be stationary for all OLS and VAR modeling. The Augmented Dickey-Fuller Unit Root Test was performed. For robustness, we performed the Phillips-Perron Unit Root Test; the Phillips-Perron test improves upon the Augmented Dickey-Fuller Test by utilizing Newey-West standard errors to account for potential serial correlation. The Chow statistic was also generated for all variables to test for structural breaks. Given that the Chow test requires pre-identification of breaks, the oil shocks occurring over the time interval of the sample were used as potential candidates. Identification of potential breaks are noted in Appendix One based on the work of Hamilton (2011). If the null of no structural break was rejected, controls for structural breaks were added in the deterministic component of the model.

As an approach to testing the theories presented by this paper, a systematic approach was adopted based on an intuitive understanding of the impact of Albertas resource sector on the Canadian federation. Using the models of Sachs and Warner (1995)¹⁴ and Cavalcanti, Mohaddes, Raissi (2009)¹⁵, the theory of the Resource Curse was tested with respect to Alberta. The framework suggested by Cavalcanti, Mohaddes, Raissi (2009) was used to estimate the externalities conferred on other provinces by the Albertan petroleum industry using a VECM framework. Using Zellners (1962) efficient method of estimating ‘seemingly unrelated regressions’, the effect on provincial per-capita equalization entitlements of Alberta’s petroleum industry (controlling

¹⁴The Sachs and Warner (1995) regression equation estimated the influence of the resource sector on GDP growth controlling for initial GDP. However their analysis was cross-sectional. Given that our analysis is time-series, we included a de-trending variable to preserve the otherwise consistent representation of Sachs and Warners original equation

¹⁵Cavalcanti, Mohaddes, Raissi (2009) found that there is an equilibrium relationship between real gross domestic product (GDP) per capita, the share of capital investment in real GDP, and the real value of natural resource (oil) production per capita.

for employment) and provincial outmigration by Alberta's net fiscal benefit (controlling for each province's net fiscal benefit) was captured. As aforementioned, the net fiscal benefit of a province measures the difference between the revenue generated from its own sources and public expenditure the higher public expenditure is relative to tax revenue, the higher the net fiscal benefit. The Breusch Pagan Test of Independent Errors was performed to test the assumption that the errors across equations were contemporaneously correlated and therefore should not be estimated individually. Finally, the impact on provincial per-capita manufacturing investment was estimated, controlling for the provincial employment rate, also using a VECM framework.

To determine the number of cointegrating vectors, the Johansen Cointegration Test was used to determine the rank of the Π (Π) matrix. Based on graphical analysis, Chow tests, formal mean-comparison testing and the research of Hendry and Juselius (2001), the deterministic components of the Vector Error Correction Models were determined. Although we are not explicit about the components of the deterministic (denoted by 'D') and 'X' vectors, it should be noted that the determinist vector contains controls such as 'restricted constant', 'restricted trend', 'no constant' etc necessary for accurate estimation of the cointegrating relationship. The 'X' vector contains all variables within the specified equation with the exception of the dependent variable: to clarify, if we are looking at GDP, employment and oil reserves, when the VECM is written in terms of GDP (GDP is on the left-hand-side in growth form) the X vector is composed of employment and oil reserves.

In modeling, significant weight was given to parsimonious models. As a supplement to the robustness checks performed otherwise, and given the low power of unit root tests in finite samples, Bartlett's Test for White Noise was performed on the residuals of all regressions to check for spurious results results presented in Appendix One (relevant equation specified in title). Although not reported, Lagrange-multiplier tests for residual autocorrelation and Jarque-Bera tests for normally distributed error terms were performed after estimating all Vector Error-Correction and Autoregressive Models.

The goal of Section V is to empirically test the theoretical suppositions presented in Section III. To accomplish this goal we disaggregate the theory into five questions and perform independent analyses aimed at providing an answer to the questions posed. Section V is organized such that every subsequent sub-section builds upon the last and, when considered collectively forms a coherent narrative consistent with the thesis of this paper. The five questions posed and answered in Section V are:

1. Does the Canadian federation suffer from the Resource Curse?
2. How is the Fiscal Capacity of Provinces impacted by Albertas resource sector?
3. Is the affordability of the Equalization system strained by Albertas resource sector?
4. Is there fiscally induced interprovincial migration?
5. Does the Canadian federation suffer from Dutch Disease?

5 Empirical Results

As aforementioned, we evaluate the validity of the major premises presented by this paper by undertaking five interrelated investigations. Namely, we evaluate the impact of Alberta's resource abundance on the real per-capita Gross Domestic Product of provinces (Section 5.1), their per capita fiscal capacity (Section 5.2), per-capita equalization entitlements of provinces (5.3), interprovincial outmigration (5.4), and provincial per-capita investment in the respective Manufacturing Industries (Section 5.5). Although the models estimated are oversimplified, the results derived serve as an initial foray for which a more structural assessment of fiscal federalism in the context of an isolated resource boom can be established. Foreshadowing the results of the following sections, the simplistic yet enlightening result of this analysis is that provincial development and distance from Alberta matters in terms of the significance of the externality created by Alberta's resource sector. This study determined that the development of the petroleum industry in Alberta has substantial influence on the macroeconomic variables of other provinces, particularly the provinces with objectively

a less comparable industrial structure to that of Alberta's.

5.1 Does the Canadian Federation suffer from the Resource Curse?

The model introduced by Cavalcanti, Mohaddes and Raissi (2009) was used to test the relationship between the natural log of provincial per-capita income and Alberta's resource abundance while controlling for each provinces capital investment as a share of Gross Domestic Product. The vector error correction specification of the model is:¹⁶

$$\Delta \ln y_{it} = \alpha(\ln y_{it-1} - \beta \ln share_{it-1} - \beta \ln rvc crude_{it-1}) + \sum_{i=1}^{k-1} \Gamma_i \Delta X_{it-1} + \Phi D_{it} + \varepsilon_{it} \quad (1)$$

Where 'lny' is the natural logarithm of real per-capita GDP, 'lnshare' is the natural logarithm of capital investment as a share of GDP, 'lnrvcrude' is the natural logarithm of the real value of crude oil reserves in Alberta¹⁷, the matrix 'X' contains all exogenous variables and the matrix 'D' contains all deterministic components. Although the equation estimated is in levels, the Vector Error Correction Model presented in equation 1 is functionally equivalent. Results for the equilibrium relationships are presented by region in Tables 1- 3.

The results presented in Tables 1- 3 illustrate the variety of experience with respect to the externality created by the Albertan petroleum industry throughout the federation. A long run equilibrium relationship - as defined by the cointegrating vector - between Alberta's resource abundance and provincial income was determined for all provinces using Johansen's Likelihood Ratio and Maximum Eigen-value Tests. Of the nine provinces included in the analysis, a positive relation for three provinces characterized the equilibrium relationship: Newfoundland, New Brunswick and British

¹⁶In equation one, and for the remainder of this paper, subscripts i denotes province and 't' denotes time.

¹⁷Even when not specified, the real value of Albertas crude oil reserves was adjusted for Albertas population size.

Table 1: The Impact of Alberta's resource industry on provincial Real GDP per-capita

Atlantic Provinces				
Newfoundland				
<i>Variable</i>	<i>lny</i>	<i>lnshare</i>	<i>lnrvcrude</i>	<i>Constant</i>
R^2	0.3592	0.1397	0.1709	
Cointegrating Coefficients	1	1.53*** (0.3571)	1.062*** (0.2385)	6.0417*** (0.6851)
Adjustment Parameters	0.0681*** (0.0182)	0.0895** (0.044)	0.281** (0.124)	
Nova Scotia				
R^2	0.6020	0.0009	0.0703	
Cointegrating Coefficients	1	0.8*** (0.0933)	-0.191*** (0.07)	5.015*** (0.1831)
Adjustment Parameters	-0.143*** (0.0232)	0.0203** (0.1375)	-0.578** (0.42)	
New Brunswick				
R^2	0.6724	0.1706	0.0702	
Cointegrating Coefficients	1	1.13*** (0.252)	0.81*** (0.201)	5.15*** (0.5)
Adjustment Parameters	0.051*** (0.0071)	0.0846** (0.0372)	0.1623 (0.1623)	
Observations: 27				
Standard errors in parentheses				
*** p<0.01, ** p<0.05, * p<0.1				
Johansen Normalization restriction imposed on real GDP per capita				

Table 2: The Impact of Alberta’s resource industry on provincial Real GDP per-capita

Central Canada				
Ontario				
<i>Variable</i>	<i>lny</i>	<i>lnshare</i>	<i>lnrvcrude</i>	<i>Constant</i>
R^2	0.6101	0.8441	0.4471	
Cointegrating Coefficients	1	1.256*** (0.129)	-0.593*** (0.171)	6.17*** (0.261)
Adjustment Parameters	-0.0162 (0.0367)	0.273** (0.0595)	-0.1472 (0.4869)	
Quebec				
R^2	0.5232	0.5523	0.2265	
Cointegrating Coefficients	1	0	-0.1434*** (0.04)	0.04*** (0.0091)
Adjustment Parameters	-0.275*** (0.0745)	0.2511 (0.2656)	1.648 (1.6)	
Observations: 27				
Standard errors in parentheses				
*** p<0.01, ** p<0.05, * p<0.1				
Johansen Normalization restriction imposed on real GDP per capita				

Columbia. The remaining provinces Nova Scotia, Ontario, Quebec, Manitoba, Saskatchewan and Alberta had a negative relationship in equilibrium between Albertas resource proxy and real per-capita GDP.

The outcome whereby a majority of provinces are adversely affected with respect to per-capita national income by Albertas petroleum industry suggest a form of the Resource Curse and the related Dutch Disease operating in the Canadian federation during transition periods when variables are out of equilibrium¹⁸. Understanding this statement is contingent on the distinction made between spatial concepts and those relating to recalibration. Although we can apply spatial concepts like short run or long run to economic activity, it is not accurate to assume the adjustment period is strictly a feature of the short run. The importance of this distinction becomes evident when acknowledging the Resource Curse is generally presented as a long-run phenomenon. The result of this section is not inconsistent with the Resource Curse affecting the long

¹⁸The long run relationship is defined as the space orthogonal to the cointegrating vector. Therefore, the adjustment parameters span the space orthogonal to the equilibrium estimates presented.

Table 3: The Impact of Alberta's resource industry on provincial Real GDP per-capita

Western Canada				
Manitoba				
<i>Variable</i>	<i>lny</i>	<i>lnshare</i>	<i>lnrvcrude</i>	<i>Constant</i>
R^2	0.6785	0.6496	0.4291	
Cointegrating Coefficients	1	0.551*** (0.0426)	-0.212*** (0.0516)	4.732*** (0.095)
Adjustment Parameters	-0.373*** (0.11)	0.4514 (0.34)	-2.165 (1.9)	
Saskatchewan				
R^2	0.1015	0.2870	0.0348	
Cointegrating Coefficients	1	0.6749*** (0.144)	-0.487*** (0.103)	4.68*** (0.2658)
Adjustment Parameters	0.0767* (0.0456)	0.392*** (0.1235)	-0.386 (0.407)	
British Columbia				
R^2	0.4476	0.3907	0.5151	
Cointegrating Coefficients	1	0.3*** (0.0438)	0.1337*** (0.048)	4.21*** (0.0895)
Adjustment Parameters	0.2631*** (0.077)	0.6522*** (0.285)	3.676*** (0.9198)	
Alberta				
R^2	0.1383	0.5311	0.1284	
Cointegrating Coefficients	1	0.3549*** (0.035)	-0.217*** (0.045)	4.4847*** (0.06)
Adjustment Parameters	0.159** (0.08)	0.937*** (0.176)	-1.319* (0.69)	
Observations: 27				
Standard errors in parentheses				
*** p<0.01, ** p<0.05, * p<0.1				
Johansen Normalization restriction imposed on real GDP per capita				

run equilibrium; rather, it identifies a more specific condition - the Resource Curse is a feature of the provincial economies reaction to a shock - that is made independent of time.

The difference in experiences appears to be indiscriminate as there is no obvious consistency for which provinces benefit and which ones lose. However, if we look at the magnitude of the effect a trend becomes apparent. Newfoundland, an oil-producing province, benefits markedly relative to New Brunswick and British Columbia: the provinces that benefit in absolute terms from Albertas resource abundance. British Columbia has the second largest positive effect: British Columbia also has the second largest natural gas reserve (next to Alberta) in the Canadian federation. Provinces with industries complementary to Albertas petroleum industry appear to benefit in equilibrium. This hypothesis, in explaining the negative externality conferred on Saskatchewan, must be extended to account for distance. Saskatchewan is also an oil-producing province but its close proximity to Alberta might result in an offsetting effect: given the sheer size of the Albertan petroleum industry, it is conceivable that growth in Saskatchewan's petroleum industry is lubricated while other sectors in their economy contracts for a net effect that is negative.

The loading¹⁹ (adjustment) factor in conjunction with the long-run coefficient estimates characterizes the disequilibrium adjustment growth path. As one can infer from the estimates presented in Tables 1- 3, the real value of Alberta's crude oil reserves is negatively related to the growth rate of real per-capita income for all provinces excluding Saskatchewan and Alberta. Stated differently, when real per-capita GDP, the share of capital in GDP and the real value of Albertas crude oil reserves are out of equilibrium, an increase in the real value of crude oil reserves induces negative growth in real per-capita GDP for Newfoundland, Nova Scotia, New Brunswick, Ontario, Quebec, Manitoba and British Columbia. In contrast, the disequilibrium relationship is positive for Saskatchewan and Alberta: an increase in the real value of Albertas crude oil

¹⁹Values for the adjustment factor near (or exceeding) one suggest rapid returns back to equilibrium while values near zero suggest slow returns back to equilibrium.

reserves induces a positive growth rate in real per-capita GDP as the variables return back into equilibrium. All of the adjustment parameters are below one; this suggests that the return back to equilibrium is slow.

The growth rate of real per-capita GDP having a negative response to Albertas resource proxy for Newfoundland, Nova Scotia, New Brunswick, Ontario, Quebec, Manitoba and British Columbia implies the Resource Curse is a feature of the disequilibrium adjustment period. Working through a theoretical example will affirm the viability of this conjecture and present the mechanism through which the curse is introduced. Taking Newfoundland for example, a sudden increase in the real value of the crude oil reserves in Alberta shocks the equilibrium relationship between itself and the real per-capita GDP of Newfoundland resulting in a loss in stability. The sudden increase in the value of the petroleum industry in Alberta will attract productive inputs, namely capital (physical, financial and human) and labor. Transportation costs among productive inputs within a federation are relatively low suggesting a substantial adjustment in the distribution of factors. Labor and capital will migrate out of Newfoundland and into the resource sector located in Alberta: the movement of these factors will result in the contraction of industries within Newfoundland leading to a fall in real per-capita GDP. The structural changes induced in the federation suggest the transition from the old equilibrium to the new one will be established with negative growth for Newfoundland and positive growth for Alberta. This province-stealing effect is consistent with Alberta having positive growth during the adjustment period (which it does) and other provinces for which productive inputs leave having negative growth.

The graph presented in Figure 1 plots the impulse response function for the real per-capita GDP of Alberta in response to a shock in the real value of their crude oil reserves. The graph presented in Figure 2 plots the impulse response function for Newfoundland in response to a shock from Alberta's resource abundance proxy. Careful analysis of these two graphs illustrates the inefficiency inherent in province-building and fiscally induced migration: the fall in Newfoundland's growth rate is larger

in magnitude than the increase in Alberta's. Furthermore, the integration of capital and labor into Alberta's economy takes time, which explains the incremental stimulus to growth, whereas the harm done to Newfoundland's growth is relatively quick. The rapid decline in Newfoundland's growth rate in response to a shock in Alberta confirms the hypothesis of low transportation costs of factor inputs.

Saskatchewan stands as an exception once again to the shared experience of the other provinces in the Federation (excluding Alberta). Alberta's petroleum industry conferring a positive externality on Saskatchewan's national income growth rate is feasible not only because of the proximity of Saskatchewan to Alberta but also because it is conceivable that the resource boom in Alberta stimulates growth in the complementary sectors in Saskatchewan given that the economic structure of their economy is similar to Alberta's (particularly with respect to their oil production). When Alberta attracts productive inputs to the west, some of these are absorbed by Saskatchewan's petroleum industry. Furthermore, the integration of financial markets (both within the Federation as well as internationally) ensures that capital ownership within Alberta's petroleum industry is not merely restricted to Albertans so that an increase in value benefits all those with vested interests. To be sure, capital ownership extends to other provinces aside from Saskatchewan, however the net effect is positive for Saskatchewan given the collective effects of its proximity, degree of capital market integration and comparable industrial makeup.

The Π (II) matrix, defined as the inner product of the alpha (adjustment parameters) and beta (cointegrating parameters) matrices, specifies the adjustment period: both in terms of direction and magnitude. Table 13 (presented in Appendix One) presents the adjustment parameters indicating the change in real per-capita GDP in response to a change in the real value of Alberta's crude oil reserves during the adjustment period. The table is formatted to show an underlying trend that is informative regarding the variety in experiences of the provinces. As aforementioned, an increase in value in Alberta's petroleum industry attracts productive inputs away from other regions in the federation into the resource sector in Alberta. However, it is intuitive

that the rate and magnitude of response should not be uniform across the federation. Provinces like Newfoundland and Manitoba that have industries complementary to Alberta’s petroleum industry experience a quicker and larger adjustment than provinces like Ontario and Quebec that have a markedly different industrial composition. Capital and labor in every province adjusts when there is a shock to the Albertan resource sector, but capital (particularly financial and human) as well as labor located in the oil and gas industry in Newfoundland are likely to migrate before capital and labor in Ontario’s car manufacturing industry.

Table 4 presents the results from the analysis of the impact of resource abundance on the rate of growth of Albertas GDP using equation (2) -the framework suggested by Sachs and Warner (1995). We were able to replicate the results derived in their seminal paper while restricting analysis to a single province: there exists a resource curse in Alberta *development of the Petroleum industry reduces growth in per-capita income*. The finding of a Resource Curse in Alberta is consistent with the previous results, including the finding of positive growth during the disequilibrium adjustment period.

$$\text{deltalb}_t = \mu + \alpha_1 \ln y_{alb_{t-1}} + \alpha_2 \ln r_{vcrude_{t-2}} + \alpha_3 t + \varepsilon_t \quad (2)$$

The equilibrium relationship between Albertas real per-capita GDP and their petroleum industry is negative (presented in Table 3), furthermore, in the long run their income growth is negatively related to their resource sector (presented in Table 4). The positive growth induced by the resource sector is a feature of the short run. When there is a positive shock to the value of the Albertan petroleum industry, productive inputs from other regions are attracted into the industry, which stimulates growth in the short run.

However, capital and labor are also attracted from other sectors within Alberta’s economy and subsequently these sectors contract. In the long-run the productivity gains in the resource sector are smaller in magnitude relative to the losses in the contracting sectors. Further, the long-run is characterized by Albertas economy be-

ing increasingly dependent on the petroleum industry (a sector characterized by high volatility), the other sectors in the economy are strained by both a loss in productive inputs and upward pressure on wages as well as the spending effect generated by the resource rents results in an appreciation of the Canadian dollar, which makes inputs cheaper to purchase but also exports with high elasticity less competitive. On net, the adverse affects of the resource sector boom offset the conferred benefits resulting in negative growth.

It is important to note that the externalities created by Alberta’s petroleum industry are a direct consequence of Section 92A. A resource boom restricted to a particular region would have a dampened affect on the redistribution of the factors of production in a nation where the federal government owned the natural resources and developed the sector while maximizing *national* utility. Furthermore, the national progressive personal income tax system would adjust for inequality in income created by the resource boom, while employment insurance and welfare programs would redistribute resource rents to provide temporary social protection for displaced workers in contracted sectors.

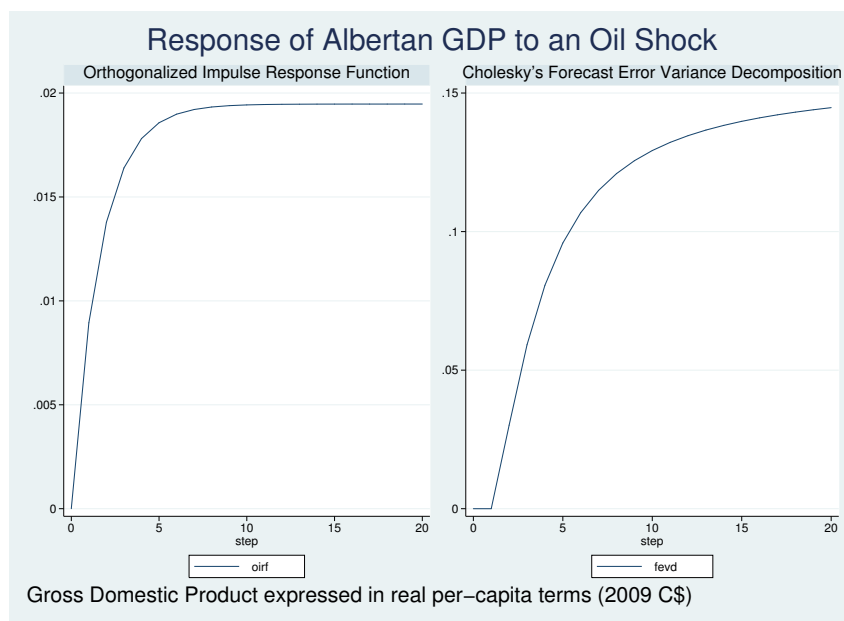


Figure 1: Orthogonalized Response to a shock in the value of Alberta’s petroleum resources

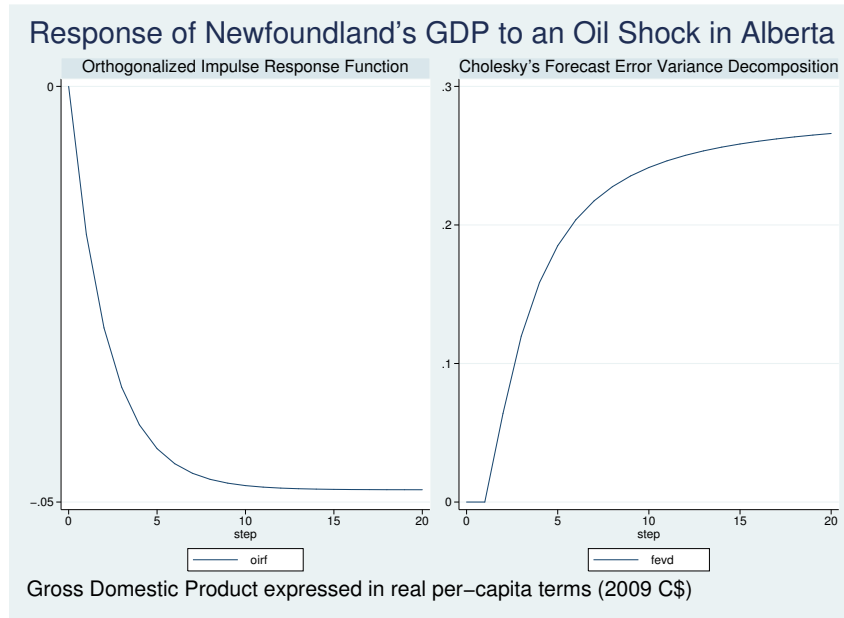


Figure 2: Orthogonalized Response to a shock in the value of Alberta’s petroleum resources

Although present, these mechanisms operate imperfectly leaving the disparity in regional wealth intact under a system where the provinces own their non-renewable resources and the derived rents, and develop the sector accounting only for the utility of the residents in their province. Even with the redistribution that occurs under the equalization system, Alberta maintains its superior fiscal capacity because of the supernatural rents generated from their petroleum industry in conjunction with the fact that they are not equalized down to the Canadian average. In brief, the fundamental difference between national and provincial ownership of natural resources is that the province utilizes rents to province-build while national ownership will ensure a more uniform (and synonymously equitable) distribution of the benefits of resource rents.

5.2 How is the Fiscal Capacity of provinces impacted by Albertas resource sector?

Equation three presents the vector error correction specification for the model evaluating the impact of Albertas resource abundance on per-capita provincial fiscal capac-

Table 4: The Impact of Alberta’s resource industry on it’s economy

Alberta	
Sachs and Warner (1995)	
<i>Variable</i>	<i>Parameter Estimates</i>
R^2	0.4365
$\ln yalb_{t-1}$	-0.55*** (0.174)
$\ln rvcru_{t-2}$	-0.042** (0.0163)
t	0.01*** (0.003)
cons	2.04*** (0.631)
Observations: 25	
Standard errors in parentheses	
*** p<0.01, ** p<0.05, * p<0.1	
Bartlett’s Test for White Noise: P-value = 0.3748	

ity²⁰ ; ‘fc’ denotes per-capita fiscal capacity, ‘taxrev’ denotes per-capita tax revenue and ‘rvcrude’ denotes the real value of Alberta’s crude oil reserves. The long-run equilibrium relationships are presented by region in Tables 5 (Atlantic Provinces), 6 (Central Canada) and 7 (Western Canada). There was no cointegrating relationship for British Columbia therefore it is excluded from the tables.

$$fc_{it} = \alpha(fc_{it-1} - \beta taxrev_{it-1} - \beta rvcru_{it-1}) + \sum_{i=1}^{k-1} \Gamma_i \Delta X_{it-1} + \Phi D_{it} + \varepsilon_{it} \quad (3)$$

Setting statistical significance aside for the moment, with the exception of Manitoba and Alberta, the development of the petroleum industry in Alberta confers a negative externality on the fiscal capacity of all provinces within the Canadian federation. Restricting attention to statistically significant relationships, an increase in the real value of Alberta’s crude oil reserves reduces the per-capita fiscal capacity of New Brunswick, Ontario, Quebec, and Saskatchewan in equilibrium. A positive equilibrium relationship characterizes the interaction between Alberta’s petroleum industry and

²⁰To remind the reader, fiscal capacity refers to a provinces ability to generate revenues to fund its expenditure from its own revenue sources relative to a national standard.

the per-capita fiscal capacity for Alberta solely. One of the fundamental inferences deducible from the results of this sub-section is that size²¹ and proximity to Alberta matters with respect to the influence commanded by Alberta's resource abundance.

Statistical significance appears to depend on geography: provinces closer to Alberta experience a statistically significant effect. As an example of this, the coefficient on Alberta's resource proxy is negative for all of Atlantic and Central Canada but the relationship is significant only for Central Canadian provinces²². Adjustment when the system is out of equilibrium depends on both the size of the province and its location relative to Alberta. Ontario adjusts back to equilibrium the quickest of the provinces with a statistically significant relationship: Ontario is the largest province based on share of Canadian GDP and population and the second closest to Alberta (after Saskatchewan).

The empirical results of this section are intuitive, deceptively simply yet profound; it affirms the speculation that a resource boom in Alberta impairs the revenue-raising abilities of provinces in other regions, particularly those with less industrialized economies. The implied relationship is clear; the existence of such an event reinforces differences in provincial ability to provide comparable levels of public services at comparable levels of taxation.

The primary mechanism through which Alberta's resource industry impairs the fiscal capacity of other provinces is through its attraction of productive inputs into the resource sector in Alberta. Given that the petroleum industry is highly capital-intensive, it is more likely that physical and financial capital respond on a larger magnitude than labor to an increase in the value of oil and gas. To the extent that foreign capital and immigration satiates some of this demand, the effects will be mitigated, however the increase in wages, reduction in taxes, and increase in public services will tend to reinforce the mobility of productive inputs towards the resource sector in Alberta. All of these mechanisms have the effect of reducing the tax base of external provinces.

²¹Size in this context is interpreted to mean level of industrialization, provincial wealth and diversification of the provincial economy.

²²New Brunswick creates an exception to this statement.

Furthermore, to compete with Alberta's competitive spending, provinces will be motivated to reduce taxes to attract investment while the federal government must raise taxes to finance the increase in entitlements induced by the resource boom - both of which exacerbate the inefficiency of the overall economy.

Table 5: The Impact of Alberta's resource industry on provincial per-capita Fiscal Capacity

Atlantic Provinces				
Newfoundland				
<i>variable</i>	<i>fc</i>	<i>taxrev</i>	<i>rvcrude</i>	<i>constant</i>
R^2	0.7693	0.7172	0.2835	
Cointegrating Coefficients	1	1.1*** (0.042)	-0.004 (0.003)	134.9 (109)
Adjustment Parameters	2.38*** (0.44)	0.16 (0.1)	-15.42 (15)	
Nova Scotia				
R^2	0.7456	0.6604	0.0083	
Cointegrating Coefficients	1	1.26*** (0.09)	-0.004 (0.007)	1408.5*** (265.7)
Adjustment Parameters	-0.193*** (0.022)	-0.138*** (0.019)	-1.7 (3.73)	
New Brunswick				
R^2	0.6686	0.6381	0.0877	
Cointegrating Coefficients	1	1.12*** (0.048)	-0.01*** (0.003)	764.9*** (143)
Adjustment Parameters	-0.412*** (0.058)	-0.32*** (0.048)	-13 (8.4)	
Observations: 27				
Standard errors in parentheses				
*** p<0.01, ** p<0.05, * p<0.1				
Johansen Normalization restriction imposed on fiscal capacity				

Aside from the direct reduction in the tax base of external provinces, there is an indirect effect on the tax base through the inducement of structural change to their economies. To the extent that the resource boom in Alberta stimulates the non-resource industries, particularly labor-intensive non-traded service and construction sectors, the upward pressure on wage rates will induce a contraction of manufacturing

Table 6: The Impact of Alberta’s resource industry on provincial per-capita Fiscal Capacity

Central Canada				
Ontario				
<i>variable</i>	<i>fc</i>	<i>taxrev</i>	<i>rvcruide</i>	<i>constant</i>
R^2	0.2113	0.0516	0.3242	
Cointegrating Coefficients	1	1.22*** (0.029)	-0.015*** (0.0025)	10789.6*** (105.5)
Adjustment Parameters	-0.6*** (0.233)	-0.215 (0.018)	-45.25*** (13.06)	
Quebec				
R^2	0.6596	0.6679	0.0316	
Cointegrating Coefficients	1	0.461 (0.48)	-0.083* (0.047)	7615.5*** (2036)
Adjustment Parameters	-0.031*** (0.004)	-0.032*** (0.0045)	-0.58 (0.646)	
Observations: 27				
Standard errors in parentheses				
*** p<0.01, ** p<0.05, * p<0.1				
Johansen Normalization restriction imposed on fiscal capacity				

and high-technology sectors in other provinces. Furthermore, an overwhelming majority of Albertas oil is exported which means an expansion of their resource sector generates revenue that is spent on current consumption resulting in an appreciation of the real exchange rate (the spending effect). An appreciation of the real exchange rate is yet another mechanism through which contraction of sectors in external provinces like Ontario’s manufacturing industry is promoted. As a general effect, other regions within Canada will lose working-age population, leaving them with an older population, lower employment levels, higher social service expenditures and ultimately lower tax revenue. At the risk of belabouring the point, the spending effect would not apply if Alberta were to save their resource rents in an offshore Sovereign Wealth Fund.

Based on the results presented in Table 7, there is a positive and significant effect on Albertas fiscal capacity in the long run. However, the adjustment parameter is not statistically different from zero suggesting the Vector Error Correction Model for Alberta’s fiscal capacity is independent of the cointegrating vector. The implication is

Table 7: The Impact of Alberta's resource industry on provincial per-capita Fiscal Capacity

Western Canada				
Manitoba				
<i>variable</i>	<i>fc</i>	<i>taxrev</i>	<i>rvcrude</i>	<i>constant</i>
R^2	0.5811	0.5527	0.0016	
Cointegrating Coefficients	1	1.12*** (0.12)	0.011 (0.009)	1246*** (374.8)
Adjustment Parameters	-0.235*** (0.04)	-0.181*** (0.0326)	0.94 (4.67)	
Saskatchewan				
R^2	0.4758	0.3444	0.0179	
Cointegrating Coefficients	1	0.429** (0.21)	-0.052*** (0.019)	1997.5*** (696.4)
Adjustment Parameters	0.16*** (0.034)	0.07*** (0.019)	-1.15 (1.7)	
Alberta				
R^2	0.00	0.1355	0.1831	
Cointegrating Coefficients	1	0.047 (0.094)	0.067*** (0.008)	-524.8* (280)
Adjustment Parameters	0.008 (0.263)	0.154** (0.078)	10.71** (4.52)	
Observations: 27				
Standard errors in parentheses				
*** p<0.01, ** p<0.05, * p<0.1				
Johansen Normalization restriction imposed on real GDP per capita				

that the change in Albertas fiscal capacity depends solely on previous values. These empirical findings are consistent with the hypothesis that Alberta participates in active Province Building: the resource rents generated are used to distort the distribution of the factors of production rather than directly strengthen and diversify their economy.

Attributable to the fact that Alberta owns their resources and equalization is performed in a gross system, Alberta remains with a considerably higher revenue-raising capacity relative to other provinces even after equalization using a ten-province standard and including 100 percent of natural resource rents. Such a persistent horizontal imbalance facilitates fiscal incentives for productive input migration. Instead of making investments that diversify the Albertan economy and induce growth in innovative sectors like manufacturing, the opposite occurs. Resource windfalls are earmarked for activities that contract conventional productive sectors (in Alberta and other provinces) at the expense of expanding the resource sector - which is an inherently volatile sector. To the extent that this analysis is accurate, it makes sense that Alberta suffers from a Resource Curse and that their fiscal capacity does not depend directly on the value of their crude oil reserves.

In other words, there is an illusory rationalization for expanding the resource sector by confining analysis to the transitory positive adjustment in Alberta's real per-capita GDP to oil shocks. In the context of the decentralized decisions made by policy makers in Alberta, a positive relationship between resource abundance and their real GDP per capita provides motivation for expanding the resource sector. However, the negative long-run equilibrium relationship with their per-capita GDP and the independence of changes in fiscal capacity with the resource sector seems to imply a cancelling out of any benefits bestowed by the resource sector. Furthermore, as would be the case if the Federal government owned natural resources, Alberta's resource development should account for the costs of industrial and regional adjustment, which based on the results of this section are significant and perverse for external provinces.

5.3 Is the affordability of the Equalization System strained by Alberta’s resource sector?

Intuitively, if the resource boom in Alberta has an adverse effect on the fiscal capacity of provinces then it should be expected that it will increase the amount of entitlements required to equalize provinces. The impact is compounded considering the combined effect whereby a provinces fiscal capacity is lowered and the disparity between the revenue-raising capacity of Alberta and other provinces is enlarged. The relationship between Albertas resource sector and provincial entitlements captures the strain imposed on the equalization system due to the externalities resulting from Albertas resource sector. The following model was estimated:

$$\Delta ent_{it} = \mu + \alpha_1 \Delta emp_{it} + \alpha_2 \Delta \ln rvcru_{it} + \varepsilon_{it} \quad (4)$$

Where ‘ent’ is the per capita entitlements of provinces (indexed by subscript i), ‘emp’ is the employment rate in each province and ‘lnrvcrude’ denotes the natural logarithm of the real value of per-capita crude oil reserves. Results are presented in Table 8. It can be seen that the coefficient on Albertas resource abundance proxy is positive and significant for five of the nine provinces: Nova Scotia, New Brunswick, Quebec, Ontario and Manitoba. The relationship between Albertas petroleum industry and provincial entitlements is negative for Saskatchewan and Alberta, and insignificant for the remainder.

During the period of investigation an increase in the growth rate of the real value of Albertas crude oil reserves resulted in an increase in the growth rate of entitlements for Nova Scotia, New Brunswick, Quebec, Ontario, and Manitoba while it decreased the growth of entitlements for Saskatchewan and Alberta. The relationship was negative but insignificant for British Columbia and Newfoundland. The highlighted results provide an indication that the affordability of the equalization program is strained by the disparities created by the petroleum industry in Alberta. As an aside, a resource boom in Alberta is likely to occur during a resource boom in the other petroleum-producing

provinces. This might explain the statistically insignificant relationship for British Columbia and Newfoundland as well as the negative relationship for Saskatchewan.

Table 8: The Impact of Alberta's resource industry on provincial per-capita Equalization Entitlements

Independent Variables				
<i>province</i>	<i>emp</i>	<i>lnrvcrude</i>	<i>cons</i>	R^2
Atlantic Provinces				
Newfoundland	-71.91* (42.4)	-113.9 (475.5)	-1225.3 (128.1)	0.01
Nova Scotia	14.7 (9.7)	241.3*** (67)	32.7* (18.1)	0.3064
New Brunswick	-8.36 (14)	183.24*** (80)	62.6*** (22.1)	0.1357
Central Canada				
Quebec	-0.03 (5.22)	198.4*** (55)	-45.6*** (15)	0.2868
Ontario	-15.3*** (2.7)	218.35*** (70)	19.6 (19)	0.2745
Western Canada				
Saskatchewan	123.03*** (27)	-433.3*** (202)	-96.6* (54.7)	0.0634
Manitoba	22.91 (14.23)	231.15*** (71.6)	35.1* (19)	0.2456
British Columbia	-8.49 (6.34)	-8.97 (76)	10 (20)	0.0633
Alberta	32.9*** (9.2)	-1364*** (299)	-154.9* (80)	0.3909
Observations: 33				
Standard errors in parentheses: ***p<0.01, **p<0.05, *p<0.1				
Breusch Pagain Test of Independence: Chi-squared = 206 P-value = 0.000				
Note: All Variables First Differenced and dependent variable is Provincial per-capita Entitlements				

5.4 Is there fiscally induced interprovincial migration?

The theory presented in this analysis predicts that the resource industry in Alberta will attract productive inputs away from other provinces and into Alberta: the two

primary mobile productive inputs are labor and capital (both physical and financial). One of the fundamental assumptions of the province building hypothesis is that it is the conscious single-minded actions of a province that operates contrary to the progress of the remainder of the federation. Whereas the real value of crude oil reserves captures partially the direct decisions of the province through the amount of oil to extract, the net fiscal benefit is largely the product of conscious choices of the province and captures province building motives. Therefore, with recourse to equation five, the impact of Albertas decision on how fast to develop their natural resources and utilize the rents to attract labor from other provinces was captured: ‘outmig’ denotes inter-provincial outmigration, ‘nfb’ denotes the net fiscal benefit of a province (except Alberta) and ‘nfbalb’ denotes the net fiscal benefit of Alberta.

$$\Delta outmig_{it} = \mu + \alpha_1 \Delta nfb_{it-1} + \alpha_2 \Delta nfbalb_{t-1} + \varepsilon_{it} \quad (5)$$

The Maximum Likelihood estimates obtained from estimating equation (5) are presented in Table five. Alberta’s net fiscal benefit has a positive effect on outmigration for all provinces with exception to itself: the net fiscal benefit in Alberta increases outmigration from Newfoundland, Nova Scotia, New Brunswick, Quebec, Ontario, Saskatchewan, Manitoba and British Columbia and reduces outmigration from Alberta. This result is statistically significant for New Brunswick, Quebec, Saskatchewan, Manitoba and British Columbia. Subsequently, we have validated the hypothesis of fiscally induced labor migration: labor is prompted to migrate from provinces with low fiscal capacity to Alberta with lower taxes and a higher provision of public goods - a higher net fiscal benefit.

The results of this section also provide empirical grounding for the anecdotal evidence that the expansion of Albertas petroleum industry and the subsequent improper use of resource rents induce contraction of the labor-intensive sectors in other provinces. Abstracting away from statistical significance, careful analysis of Table 9 shows that the net fiscal benefit of Alberta has the largest effect in Central Canada, otherwise

known as the manufacturing core of Canada. The response by labor to an increase in value occurring in Alberta's petroleum industry is not expected to be efficient because the goal of migration is not to equalize marginal products across provinces rather fiscally induced migration leaves such disparities intact. Fundamentally there is a gap in the rationalization for the migration of labor into Alberta because there exists no economic imperative that posits the best place for agglomeration is in a resource abundant province.

Table 9: The Impact of Alberta's resource industry on inter-provincial Outmigration

Independent Variables				
<i>province</i>	<i>nfb</i>	<i>nfbalb</i>	<i>cons</i>	R^2
Atlantic Provinces				
Newfoundland	-0.029 (0.057)	0.345 (0.027)	10.72 (126)	0.0441
Nova Scotia	-0.256 (0.214)	0.203 (0.259)	0.75 (121)	0.0355
New Brunswick	0.056 (0.17)	0.333* (0.191)	29.4 (92)	0.1133
Central Canada				
Quebec	0.181 (0.607)	0.926* (0.433)	-185 (195)	0.1806
Ontario	-1.209 (1)	1.33 (0.964)	133 (444)	0.0597
Western Canada				
Saskatchewan	0.052 (0.145)	0.795* (0.431)	-2.4 (202)	0.111
Manitoba	-0.326 (0.242)	0.53* (0.29)	-48.29 (133)	0.099
British Columbia	1.11*** (0.33)	1.84*** (0.568)	57.46 (261)	0.4077
Alberta		-0.44 (1.04)	-358.6 (486)	0.0069
Observations: 27				
Standard errors in parentheses: ***p<0.01, **p<0.05, *p<0.1				
Breusch Pagain Test of Independence: Chi-squared = 217 P-value = 0.000				
Note: All Variables First Differenced and dependent variable is inter-provincial outmigration				

5.5 Does the Canadian federation suffer from Dutch Disease?

In section 5.1 it was established that Alberta experiences a Resource Curse in equilibrium while the other provinces in the federation experience a Resource Curse during the adjustment phase after a shock from Alberta's petroleum industry. To test for the associated Dutch Disease as well as validate the theory, which posits that both labor and capital migrate in response to an increase in value of Albertas resource sector, equation (6) was estimated. Equation 6 regresses the natural logarithm of per-capita manufacturing industry investment ('lnmaninv') on the natural logarithm of the real value of Alberta's crude oil reserves ('lnrvcrude') while controlling for the provincial employment rate ('emp'). Estimation results are presented in table 10 - 12 for the provinces that had a cointegrating relationship.

$$\Delta \ln maninv_{it} = \alpha (\ln maninv_{it-1} - \beta emp_{it-1} - \beta \ln rvcrude_{it-1}) + \sum_{i=1}^{k-1} \Gamma_i \Delta X_{it-1} + \Phi D_{it} + \varepsilon_{it} \quad (6)$$

The results presented in the highlighted tables show that the symptom of Dutch Disease is present in Newfoundland, Nova Scotia, Ontario and British Columbia while investment in the manufacturing sector of Alberta and Quebec benefit from Albertas resource sector. The relationship between manufacturing business investment and the real value of Albertas crude oil reserves is statistically significant for five of the six provinces: British Columbia is the exception.

Baldwin and Rafiqzaman (1994) characterized the manufacturing sector of the Canadian provinces using five major sectors as defined by the primary input used in production: natural-resource based, labor-intensive, scale-based, product-differentiated and science-based. According to their analysis the manufacturing industries of provinces differs in a significant way: Ontario and British Columbia are scale-based, the maritime and prairie provinces are natural resource based and Quebec is labor-intensive. To be succinct, the four categories - natural-resource based, scale-based, product-differentiated and science-based - can all be lumped into a single category: capital

intensive. This characterization of the manufacturing industry in each province provides a valid rationalization for the overwhelming negative impact of Albertas resource sector on manufacturing investment.

With the manufacturing industry being characterized by either capital or labor-intensive production, and the province-stealing effect posited by the theory presented in this paper, it follows that an increase in the value of Alberta's petroleum industry reduces investment in the manufacturing sector in Newfoundland, Nova Scotia, British Columbia and Ontario whose production is capital-intensive. It is also intuitive that only the labor-intensive sector should benefit from Alberta's resource industry given the increase in the supply of labor likely to occur from the contraction of the manufacturing sector in the other provinces from the migration of capital. Furthermore, given that the analysis uses financial capital and the low cost of its movement particularly within the federation, a small change in the value of Alberta's petroleum industry induces a large reaction from manufacturing investment. As an example, a one percent increase in the real value of Alberta's crude oil reserves reduces investment in Ontario's manufacturing industry by thirty-four percent and investment in Newfoundlands manufacturing industry by approximately eight percent.

Table 10: The Impact of Alberta's resource industry on provincial per-capita Manufacturing Industry Investment

Atlantic Provinces				
Newfoundland				
<i>variable</i>	<i>lnmaninv</i>	<i>emp</i>	<i>lnrvcrude</i>	<i>constant</i>
R^2	0.046	0.0055	0.4571	
Cointegrating Coefficients	1	0.62*** (0.17)	-9.71*** (1.86)	-22.24*** (7.8)
Adjustment Parameters	0.26 (0.022)	-0.037 (0.092)	-0.081*** (0.016)	
Nova Scotia				
R^2	0.2055	0.009	0.3575	
Cointegrating Coefficients	1	0.143*** (0.028)	-1.07*** (0.326)	1.33 (1.51)
Adjustment Parameters	-0.34*** (0.122)	0.24 (0.47)	-0.44** (0.11)	
Observations: 32				
Standard errors in parentheses: ***p<0.01, **p<0.05, *p<0.1				
Johansen Normalization restriction imposed on manufacturing investment				

Table 11: The Impact of Alberta's resource industry on provincial per-capita Manufacturing Industry Investment

Central Canada				
Ontario				
<i>variable</i>	<i>lnmaninv</i>	<i>emp</i>	<i>lnrvcrude</i>	<i>constant</i>
R^2	0.561	0.3129	0.3826	
Cointegrating Coefficients	1	2.9*** (0.66)	-34*** (7.4)	-177.7*** (40.9)
Adjustment Parameters	0.012*** (0.002)	0.05* (0.03)	-0.02*** (0.006)	
Quebec				
R^2	0.5275	0.1824	0.3283	
Cointegrating Coefficients	1	-2.7*** (0.644)	21.4*** (7.9)	160.44
Adjustment Parameters	-0.008*** (0.0027)	-0.031 (0.03)	0.018*** (0.007)	
Observations: 32				
Standard errors in parentheses: ***p<0.01, **p<0.05, *p<0.1				
Johansen Normalization restriction imposed on manufacturing investment				

Table 12: The Impact of Alberta’s resource industry on provincial per-capita Manufacturing Industry Investment

Western Canada				
British Columbia				
R^2	0.6892	0.2292	0.1395	
Cointegrating Coefficients	1	-0.5*** (0.113)	1.7 (1.15)	35.8*** (6.7)
Adjustment Parameters	-0.099*** (0.0189)	-0.329* (0.1827)	-0.008 (0.044)	
Alberta				
R^2	0.2883	0.4056	0.3293	
Cointegrating Coefficients	1	0	0.645** (0.29)	0.0987
Adjustment Parameters	-0.462*** (0.14)	-2.22*** (0.55)	0.0966 (0.14)	
Observations: 32				
Standard errors in parentheses: ***p<0.01, **p<0.05, *p<0.1				
Johansen Normalization restriction imposed on manufacturing investment				

6 Policy Implications

The analysis performed in this paper has several implications for public policy. The policy responses presented in this section are functions of the unique governmental system implemented within Canada. Returning to a central point of this paper, the plan of action to correct the externalities due to Alberta’s petroleum industry would differ in many distinguishing ways under a system where the Federal government owned the natural resources of provinces as opposed to the current system. In fact the need for certain responses by the government would be null if rents were to accrue to the Federal government (or Alberta were to adopt the ‘Norwegian Model’). Nevertheless, provincial ownership of natural resources, while imposing inefficiency throughout the Federation, necessitates the concerted effort of both the federal and provincial governments to rectify the market failures, with particular onus on Alberta.

Many of the externalities imposed on the federation by way of Alberta’s petroleum industry would be mitigated if Alberta exemplified fiscal discipline with respect to the treatment of their resource rents. As noted by Larsen (2004), Norway was able to avoid

the Resource Curse and the associated Dutch disease because resource rents entirely accrued to the [federal] government and the rents were placed in a Sovereign Wealth Fund held in foreign assets and only the capital income was spent. The Albertan government created the Alberta Heritage Savings Trust Fund in 1976, however it was used as a tool for strategic business investment (province-building) rather than a saving fund aimed at shielding the domestic economy from the “spending effect” as suggested by the Norwegian Model. The report by the Premier’s Council for Economic Strategy (2011) entitled “Shaping Albertas Future” recommended, rightly so, that Alberta’s new sovereign wealth fund called Shaping the Future Fund develop a rule-based policy for allocating the rents generated from their resource sector. Barring the reallocation of resource property rights away from provinces to the federal government - in conjunction with saving the principle of the rents in a fund located overseas, the Albertan government should restrict themselves to use of the interest earned from the fund and take care not to distort the responsibilities of tax payers and/or industry.

Associated with the problem of how best to use the rents generated from the resource sector is how fast to develop natural resources? Currently consideration is given to the price of oil (its movement and volatility), demand (both domestic and international) and environmental degradation, however the results of this analysis suggest that consideration should also be given to the costs (both within the province and the federation at large) of industrial and regional adjustment. A cost-benefit analysis performed at the federal level is required to accurately determine the optimal speed of developing Albertas petroleum industry: unilateral decisions by the Albertan government will not consider the externalities created federation wide.

Much like the central wage formation system implemented in Norway, a comprehensive scheme could be implemented at the federal level to sterilize the impact on migration and wages in other regions and sectors. Furthermore, mitigating the impact on the exchange rate reinforces the suggestion that Alberta should save their rents in an international fund. Implicit in the recommendation that a sovereign fund should be used - primarily for savings - is the response to the question of what share

of the resource rents should accrue to the public sector? Using rents to finance current spending induces the Resource Curse and Dutch disease symptoms; therefore the interest earned on the fund should be used to make long-term investments like human capital development, infrastructure improvement and industry diversification.

Currently the federal government finances equalization payments using general revenue. Theoretically such a system is undesirable on both equity and efficiency grounds: using federal revenue to finance equalization is inefficient to the extent that it uses provincial revenue to pay for their own equalization which represents an undoing of the intent behind equalization and it is non-equitable to the extent that a province subsidizes another province with a potentially higher per-capita fiscal capacity. As noted by Usher (2007) “Equalization payments are not ultimately a transfer from the federal government to the governments of the provinces. They are a transfer through the intermediary of the federal government from Canadians in some provinces to Canadians in other provinces.”

Furthermore, equalization does not account for undue strain placed on the system by provinces, like that placed on the system by Alberta’s petroleum industry. As a result of Alberta’s resource sector adversely affecting the fiscal capacity of other provinces in the federation, their resource sector should be taxed individually for redistributive purposes. Not only will this bring the federation closer to true equalization, but it will also prevent some of the fiscally induced migration of both capital and labor and make the program more affordable.

The current equalization scheme does not explicitly account for different costs in providing public goods; in fact, there is an implicit assumption that the cost of providing public goods is uniform across provinces. Without recourse to the results of this analysis, it is a valid statement that costs differ markedly across provinces with respect to provision of public goods. By the very fact that provinces have very different economic structures presupposes a difference in public provision costs. The result that Alberta confers a negative externality on other provinces in the federation by reducing their national income, increasing outmigration of working-age population,

contracting their manufacturing sector and reducing their fiscal capacity only exacerbates the problem of differing costs for public good provision. The Equalization scheme should be amended to explicitly account for differences in the costs of providing public goods. Albertas share of financing the scheme should reflect the burden placed on other provinces by means of reducing the working age group of their population effectively reducing their tax base while simultaneously increasing their share of spending allocated to welfare.

7 Conclusion

A systematic within-country empirical analysis of the provinces of Canada suggests that the economic argument that a resource boom in Alberta adversely affects other regions within Canada and by extension places undue strain on the Canadian equalization system is valid. The most robust finding is that the experiences within the federation are varied while direction and magnitude of effect seem to depend significantly on distance and similarities in industrial composition. Even with respect to Alberta, their petroleum industry has no consistent narrative. The upshot of there being winners and losers is that an effective response to the development and structuring of Albertas petroleum industry must balance the two to ensure a federation-wide net benefit.

In arguing that Alberta retains a superior fiscal capacity even after equalization due to their resource industry, it is shown that many provinces within the federation suffer from the Resource Curse and the associated Dutch disease primarily because Alberta participates in active ‘province-building’ initiatives. Additionally, the supernatural rents generated by Alberta’s resource sector and their use for current consumption threatens the sustainability of the equalization system: Alberta’s resource rents simultaneously increases the standard to which provinces must be equalized while reducing their fiscal capacity by inducing outmigration of their productive inputs.

Undoubtedly, Section 92A was born from an egalitarian motive: it seems fair that

a province should have complete control over their natural resources. However, the affect appears to be pernicious. It seems intuitive that decisions made in an isolated region should affect outcomes federation-wide, however this effect is almost certainly overlooked. With the federal and provincial governments jointly committed to equalization and the acknowledgment of binding budget constraints, it is prudent to correct for the externalities outlined in this analysis to ensure the continued affordability of the equalization scheme.

The insights presented are attached to certain policy implications for a federation coping with an isolated resource boom, especially when the threat of ‘province-building’ is imminent. Nonetheless, due to the restricted sample size, it is practical to realize the potential sensitivity of results to the specific period or sector investigated. Future research may test the presented hypotheses using more sophisticated models for an extended time period and for additional resource sectors.

8 Appendix One

It is evident from Figure 3 that the real value of Albertas crude oil reserves is highly volatile. The observable volatility in the series is attributable to oil-price shocks. Hamilton (2011) provides an in-depth analysis of the history of world oil shocks - of particular relevance the oil-shocks occurring Post-World-War-II. Given the interval over which the time series spans, the relevant oil shocks are The OPEC oil embargo (1973-1974), the Iranian Revolution (1978-1979), the commencement of the Iran-Iraq war (1980), the Persian Gulf War (1990-1991) and the Oil price spike (2007-2008).

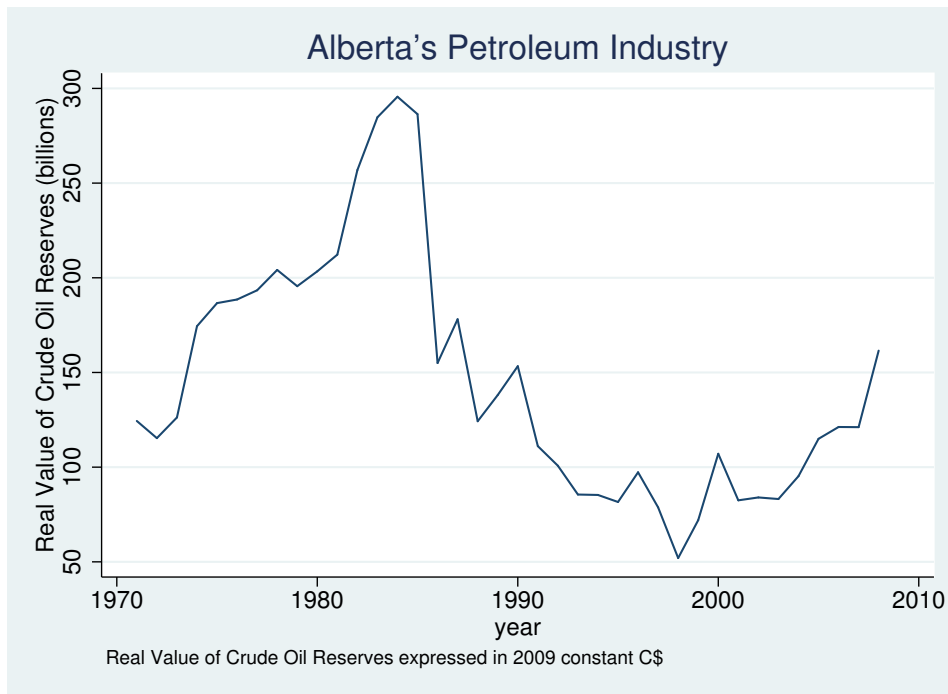


Figure 3: The value of Alberta's crude-oil reserves

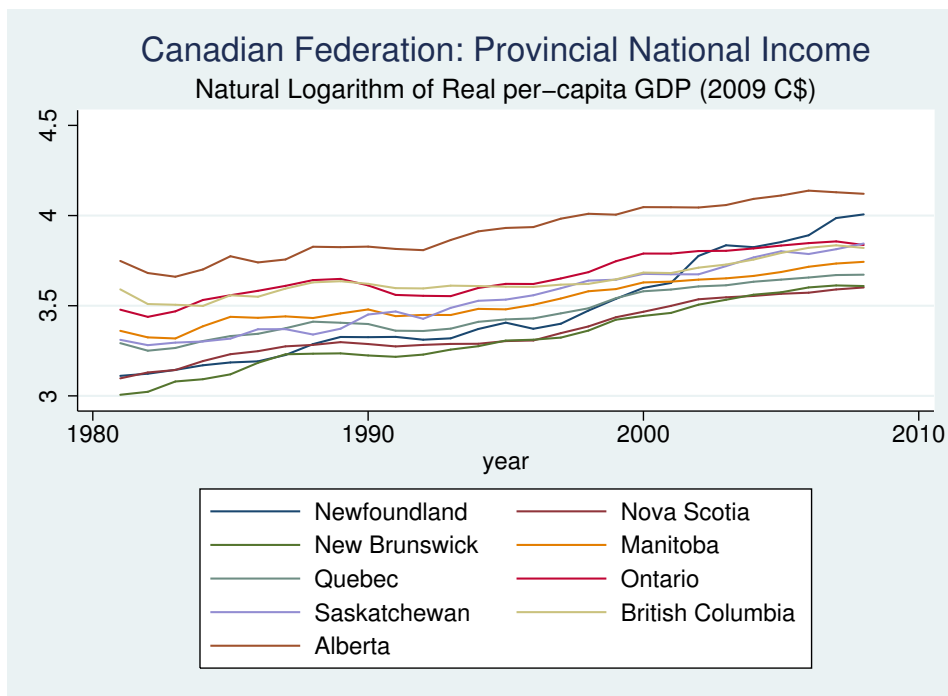


Figure 4: Provincial per-capita Real Gross Domestic Product

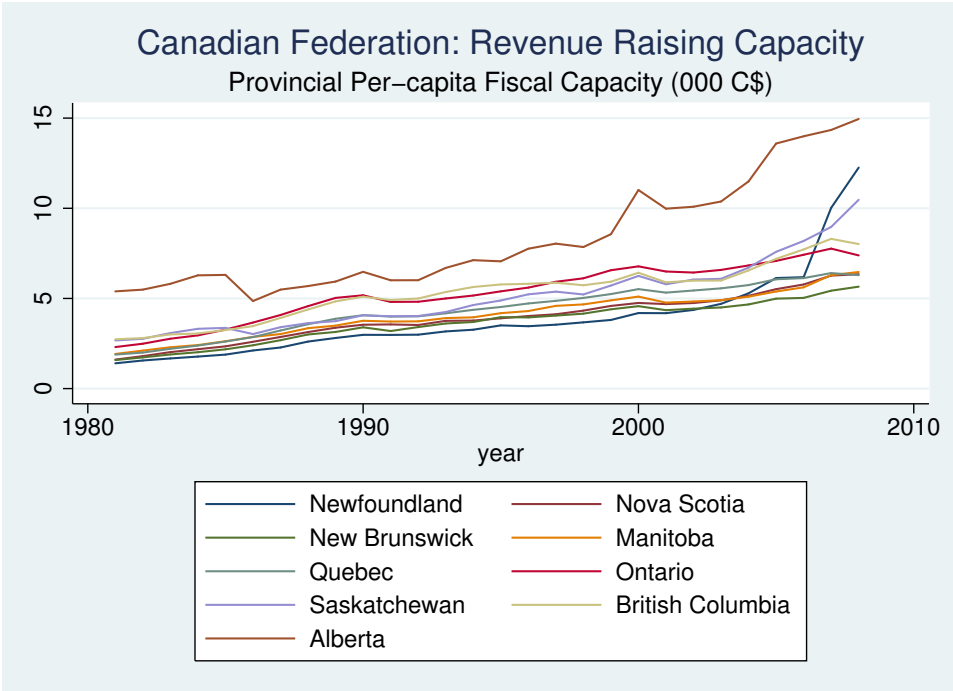


Figure 5: Provincial per-capita Fiscal Capacity

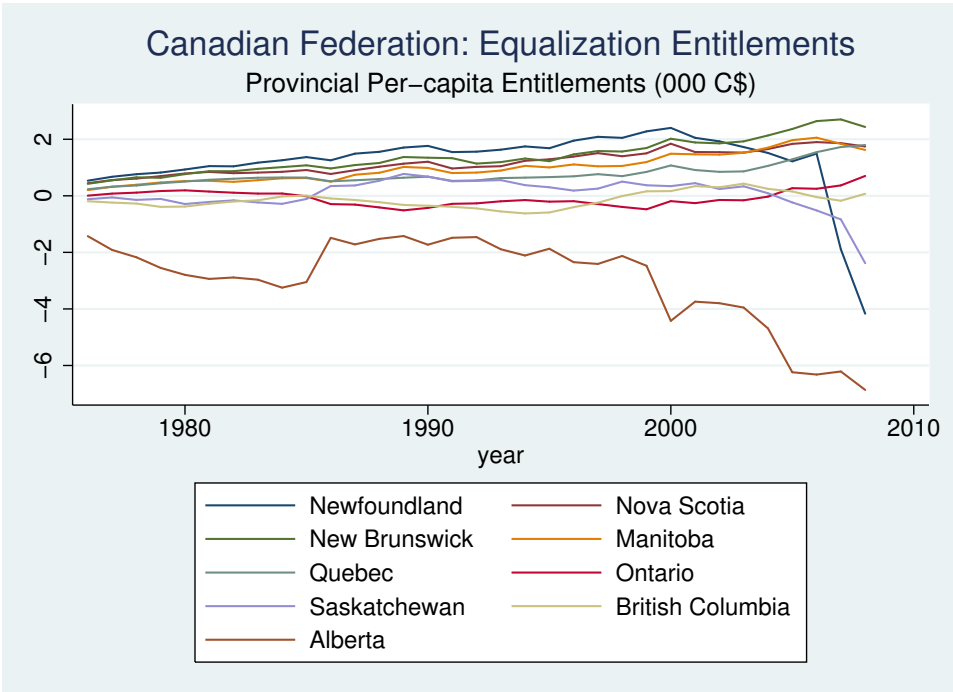


Figure 6: Provincial per-capita Equalization Entitlements

The Graphs presented in Figures 4 - 6 depict the clear differentiation between Alberta and the rest of Canada in terms of national income, fiscal capacity and equalization entitlements. The graphs presuppose Alberta as the wealthiest province with an observably higher volatility experienced by its economic variables, undoubtedly attributable to the volatility inherent within the energy sector. One can also note from these graphs that Newfoundland has grown substantially over the latter part of the period with respect to their fiscal capacity: this no doubt is attributable to their offshore-oil developments. The growing petroleum industry in Newfoundland, should it become comparable in size to Albertas, will compound the effects discussed in this paper.

Table 13: Disequilibrium Adjustment Parameters

<i>Province</i>	<i>Pi Matrix</i>
Manitoba	-0.079
Newfoundland	-0.072
New Brunswick	-0.041
Quebec	-0.0394
British Columbia	-0.0352
Nova Scotia	-0.027
Ontario	-0.0096
Saskatchewan	0.079
Alberta	0.0345

Table 14: Bartlett's White Noise Residual Test: Equation One

<i>Province</i>	<i>P-value</i>
Atlantic Canada	
Newfoundland	0.5676
Nova Scotia	0.2636
New Brunswick	0.8459
Central Canada	
Quebec	0.9622
Ontario	0.8286
Western Canada	
Saskatchewan	0.3420
Manitoba	0.7298
British Columbia	0.9848
Alberta	0.6514
Null Hypothesis: residuals are white noise	

Table 15: Bartlett's White Noise Residual Test: Equation Three

<i>Province</i>	<i>P-value</i>
Atlantic Canada	
Newfoundland	1.00
Nova Scotia	0.2511
New Brunswick	0.651
Central Canada	
Quebec	0.5684
Ontario	0.6547
Western Canada	
Saskatchewan	0.9727
Manitoba	0.8751
Alberta	0.6547
Null Hypothesis: residuals are white noise	

Table 16: Bartlett's White Noise Residual Test: Equation Six

<i>Province</i>	<i>P-value</i>
Atlantic Canada	
Newfoundland	0.4174
Nova Scotia	0.9946
Central Canada	
Quebec	0.3522
Ontario	0.5629
Western Canada	
British Columbia	0.6782
Alberta	0.2846
Null Hypothesis: residuals are white noise	

9 Appendix Two

- Data for Albertas crude oil reserves obtained from CANSIM Table 1530013.
- The average price of crude oil in Alberta obtained from Canada Association of Petroleum Producers Statistical Handbook.
- Final Domestic Demand (FDD) implicit price index obtained from CANSIM Table 3840036.
- Nominal Gross Domestic Product obtained from CANSIM Table 3840002.
- Population by province obtained from CANSIM Table 0510001.
- Capital Investment by province obtained from CANSIM Table 290034.
- Per-capita Fiscal Capacity and Equalization Entitlements obtained from Ministry of Finance.
- Tax revenue by province obtained from CANSIM Table 3840004.
- The employment rate by province obtained from CANSIM Table 2820002.
- Provincial government expenditure obtained from CANSIM Table 3840004
- Transfers by province obtained from CANSIM Table 2020301.
- Investment in the Manufacturing Sector by province obtained from CANSIM Tables 290034 and 290005.

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