

DOES PUBLIC DEBT MATTER?
EMPIRICAL EVIDENCE FROM CANADIAN PROVINCES

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ABSTRACT

It has always been a major priority for policymakers to know whether national debts are fiscally sustainable. The purpose of this research is to investigate the impact of public government debt levels (debt as a share of GDP) on per-capita GDP growth in the ten Canadian provinces. Using panel data from 1989 to 2008 and the standard two-stage least squares approach (IV/ 2SLS) as well as GMM estimation, the study concludes that public debt is inversely related to the growth rate of GDP per capita. Consistent with other existing studies, this paper also shows evidence that debt levels are nonlinearly associated to economic growth with a debt turning point estimated to be around 40% of GDP on average. This threshold may seem small compared to an average of 80-90% that has been reported in previous studies but it would be both irrelevant and misleading to make such a comparison. This is because the analysis in this paper is based on net financial debt (the difference between total financial assets and total liabilities) and not gross debt. Therefore, given how significant the gap between gross debt and net debt can be, the debt turning point estimated in this study is not small per se. Generally, this empirical work serves as a wake-up call to the provincial governments to start handling their fiscal management.

Key words: Economic Growth, Per capita GDP Growth, Public Net Debt Canadian Provinces, Nonlinear.

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For any errors that may remain in this paper, the responsibility is entirely mine.

1. INTRODUCTION

Does public debt really matter? There is no doubt that this important question has been highly debated, and politicians and policymakers have voiced contradictory views. This was even more evident during the recent global financial crisis, as government debt financing became the primary policy used to stimulate economic performance in most of the advanced countries. As a result of the bailout policies, many countries lost control of their fiscal management and found themselves on the brink of a debt crisis. While Canada has been well-ranked among its US and Euro Zone counterparts (when it comes to debt management), its provincial governments are heading on an unsustainable path (Parliamentary Budget Officer, 2013).

Despite the federal government's fiscal sustainability,¹ the high and rising debt of the provincial governments should be a concern to Canadian policymakers. According to the Parliamentary Budget Office's (PBO) statistics, local government debts are projected to reach 359.9% of real GDP by 2087, as seen in Figure 1. This projected increase in government expenditures is attributed to multiple factors such as the increase in life expectancy combined with low fertility rates (see Figures 2 and 3). These factors contribute to higher old-age dependency rates that significantly increase total healthcare and retirement costs.² If matched by a rise in real GDP growth, this increase in program costs would not be a concern.³ However, the two variables are exponentially heading in different directions. Philip Cross (2013) acknowledges that the federal government has managed to be fiscally sustainable by shifting

¹Parliamentary Budget Office's projections in its July 2013 fiscal sustainability report suggests that the federal government is fiscally sustainable .Report retrieved from http://www.pbo-dpb.gc.ca/files/files/FSR_2013.pdf

² According to the PBO's fiscal sustainability report, healthcare costs are projected to increase from 7.5% of GDP in 2012 to 11.7% in 2050. Report retrieved from http://www.pbo-dpb.gc.ca/files/files/FSR_2013.pdf

³The PBO (2013) reports that real GDP growth is projected to decline over the next 30 years with a 0.7% annual growth from 2013 to 2042. Report retrieved from http://www.pbo-dpb.gc.ca/files/files/FSR_2013.pdf

debt burdens to local governments through transforming the Health Care Transfer (HCT) escalator. He also notes that Canada's debt issue is underestimated when only the federal government statistics are analyzed. Moreover, the absence of fiscal regulations to restrict the amount local governments can borrow encourages a moral hazard problem where governments may not work hard enough to responsibly manage and reduce their liabilities. Allers and Merkus (2013) argue that local governments tend to operate under "soft budget constraints" expecting financial support whenever things go wrong. Due to the existence of equalization payments in Canada, it is highly possible that a moral hazard problem contributes to inefficient fiscal management by the Canadian provinces.⁴

Given projected slow real GDP per capita growth and rising program costs, it is inevitable that government-bond financing will continue to be utilized in the long run. As debt levels continue to build up, policymakers worry about harmful effects on the economy as a whole. My empirical paper seeks to examine whether public debt build-ups are detrimental to economic performance. To draw an analogy to existing literature, this study also investigates whether a Debt Laffer curve exists in the context of Canadian provinces.⁵

This empirical study covers the period from 1989 to 2008. Two reasons are fundamental to the selection of this study period. First, some provincial data before 1989 and after 2009 are currently unavailable in the Statistics Canada database. Although provincial data can be collected from multiple sources, it is important to note that their measurement may not be consistent across provinces and may lead to misleading results. Statistics Canada numbers are based on the

⁴ According to the definition provided by Finance Canada, equalization payments enable less prosperous provincial governments to provide their residents with public services that are reasonably comparable to those in other provinces, at reasonably comparable levels of taxation.

⁵ The Debt Laffer curve is explained in Bachvarova (2008) as a situation where excessive borrowing, which exceeds a certain threshold of debt, leads to "efficiency losses."

national accounts system of measurement, following concepts recommended by the United Nations. This allows for comparisons not only across provinces but also across countries. Second, with the recent global financial crisis, it is important to isolate the impact of debt on economic growth from that of the crisis.

In contrast to previous empirical papers, this study looks at the net public debt (net financial debt as reported by different government levels in Canada) as opposed to gross debt. Even though the results can show a non-linear relationship between public debt and growth, comparing the magnitudes of the debt threshold, which is defined as the level beyond which debt is harmful to growth, to those of other studies, would be misleading given the different debt measurements adopted.

The econometric estimation in this paper uses growth regressions and applies different methodologies that have been utilized before. For instance, the model is based on Checherita and Rother (2010) and Kutivadze (2011), who have regressed the growth rate of real GDP per capita on the log of initial real GDP per capita and other macroeconomic variables that are determinants of economic growth. Their models are augmented to include debt and debt squared, as they are the variables of interest in the study.

Following the lead of these authors, my empirical study investigates the impact of debt on the subsequent growth of real GDP per capita to capture the short-term impact. It also looks at a longer time period (five years) to explore the longer-term impact as in other empirical papers. Following concerns raised by previous studies, the study uses a number of techniques to deal with a potential reverse causality that might be present in the model used in this study: high levels of debt may have an adverse impact on economic growth, while low growth rates may also

contribute to rising debt levels. This issue has been dealt with in growth literature using various estimation techniques. While Checherita and Rother (2010) use the average debt of other countries in their study covering 18 OECD countries, Kumar and Woo (2010) and Kutivadze (2011) stress that finding a valid instrument is not easy, and choose other techniques to deal with the endogeneity problem. In this study, we use equivalent instruments to that applied by Checherita and Rother (2010). In the case of data on provincial governments, the equivalent becomes the average debt level for other provinces. In addition, both provinces fixed effects (FE) and time fixed effects are added to the model to account for other characteristics that may vary across provinces and time. These characteristics may include events that took place within provinces at certain points in time.

With reference to empirical estimation techniques, the paper compares and contrasts different estimation methodologies to finally come up with an estimation that is more reliable, given the study in question as well as the sample size utilized. The results indicate a non-linear relationship between the initial debt-to-GDP ratio and per capita GDP growth.⁶ This evidence suggests that governments can use public debt-financed spending to stimulate economic growth, but after a certain level of debt is reached, more borrowing exerts a negative impact on economic growth. However, the suggestion that public debt can be used to stimulate economic growth is valid only if we assume that the economy is not at full employment in the short run.⁷ Our empirical work indicates that, on average, the provincial governments can safely rely on debt financing up to around 40% of GDP. Beyond this threshold, more government debt is expected to reverse the economic gains that have been previously achieved.

⁶ The initial debt-to-GDP is defined as the lagged value of the debt-to-GDP variable. It is important to note that a nonlinear relationship holds when the depended variable is estimated in period t-1 and does not prevail when a longer term period (t-5) is investigated. More explanations are discussed in the results section.

⁷ See the discussion of the Keynesian approach in the next section (literature review).

The remainder of this paper is structured in the following manner: section 2 features relevant previous (theoretical and empirical) studies. This is followed by sections 3 and 4 that respectively describe the econometric model specification and data utilized in this study. Subsequently, section 5 discusses empirical results and attempts to compare them with the results of existing studies. Finally, section 6 reports concluding remarks and major policy implications of the study.

2. LITERATURE REVIEW

Debates among politicians on fiscal sustainability have dominated macroeconomic policy and have been a defining factor in who wins elections, at least in the West. This is perhaps the reason why this topic has attracted many famous economists with opposing but equally important traditional views on the subject. For instance, policy debates concerning the impact of debt on economic growth have always based their arguments on three important schools of thought. First, the neoclassical paradigm states that budget deficits increase total life time consumption by imposing a tax burden on future generations (Bernheim, 1989). This theory assumes that economic resources are fully employed in the long run. In this case, budget deficits are translated into current increased consumption, thereby reducing saving and rendering credit more expensive (Bernheim, 1989). Thus budget deficits defund investment and negatively affect economic growth. Second, the Keynesian paradigm assumes underemployment of economic resources in the short run and states that postponing taxation increases aggregate demand and creates wealth (Coulombe, 2004). Coulombe further explains that the neoclassical theory concerns the effects of permanent deficits, whereas the Keynesian view concerns those of the temporary deficits. Third, in contrast to the previous views, Barro (1974) rejects both paradigms, arguing that increasing current public debt is equivalent to increasing taxes in the future, thus

postponing taxation does not affect economic activity (a view referred to in economics as the Ricardian Equivalence). Although there has been no agreement among economists on which paradigm holds, most economists have found the Ricardian Equivalence to be inconclusive.⁸ Given these differing views, anyone involved in the debt debate seems to have a persuasive argument. Along these lines, empirical testing is required to distinguish between these arguments.

Incorporating a government sector that runs permanent deficits, Futagami and Shibata, (2003) build a simple theoretical endogenous growth model to examine the interaction between budget deficits and long-run economic growth. This study demonstrates that if the size of the budget deficit is modest, then at most two steady-growth equilibria exist. The study defines high growth equilibrium as a low ratio of public debt-to-GDP, and low growth equilibrium as a high ratio of public debt-to-GDP. In this case, the authors suggest that the government can run permanent budget deficits by issuing bonds if three conditions hold: (i) the ratio of the budget deficit to GDP is not too large, (ii) the primary level of government bonds does not exceed a critical value, and (iii) the population growth rate is relatively high and the subjective discount rate is relatively low. In the same fashion, Prunera (2000) employs a simple growth model which links deficits and human capital with economic growth to show that there is an inverse relationship between deficits and human capital accumulation. This is to imply that deficits may slow down human capital growth and consequently economic growth. His model also indicates how initial values for deficits may determine the future evolution of an economy as well as the likely presence of various equilibria: big deficits may lead to significant inefficiencies and end in underdevelopment traps, whilst small deficits may drive the economy to a superior equilibrium.

⁸ See Bernheim (1989) for a detailed discussion of the mentioned three schools of thought.

A paper related to Prunera (2000) is the work by Alam et al. (2010). To analyze the long-run relationship between social expenditure and economic performance in ten Asian developing nations, they investigate the long run impact of expenditure on sectors like education, health and social security (welfare) on economic growth. Using the Johansen cointegration approach as well as the specific rank test (a panel cointegration test), this empirical study concludes that expenditures in the social sector can affect economic growth. Such social expenditures improve productivity by providing infrastructure, education and healthcare, and by harmonizing private and social interests. As a result, expenditure composition can also play an important role in fostering economic growth: fiscal adjustment that reduces unproductive expenditures and protects expenditures in the social sector has proved to be more sustainable and more likely to lead to faster growth. Likewise, using Malaysian quarterly data from 2000-2011, Rahman (2012) concludes that there is a significant positive long run relationship between productive expenditures and economic growth, but find no relationship between unproductive expenditures and growth. As defined in their paper, productive expenditures include components such as defence, security, agriculture and rural development, transport, education, health as well as housing, whereas non-productive expenditures refer to components such as lump-sum payments by the government including subsidies.

The studies mentioned above conform to a response given by Mario Seccareccia,⁹ a professor of economics at the University of Ottawa, when he was interviewed to make his case on why governments should run deficits now: “Our economy is credit-driven; you have to go into debt in order to grow. When firms undertake investment they borrow, and governments

⁹Mario Seccareccia was interviewed on July 21st, 2011 by the Institute for New Economic Thinking. The theme of the interview was: “Why government can run deficits now?” Retrieved from <http://ineteconomics.org/people/mario-seccareccia>.

should do the same,” he suggested. He also emphasized that “they should borrow, not for consumption, but for productive investments in education, health care, and infrastructure.” In the end, what matters is not just the debt but also its composition.

In another strand of the literature, Checherita and Rother (2010) use panel data on 12 European nations to analyze the average impact of government debt on per capita GDP growth, with data mainly collected from the European Commission (AMECO) database from 1970-2011 (including EC Autumn Forecast data from 2009-2011). They apply panel fixed effects and either 2SLS (two stage least squares) or GMM estimators, and find compelling evidence for a non-linear impact of public debt on the rate of per capita GDP growth across the twelve countries in the sample. The most interesting result of this paper is the existence of a concave (inverted U-shape) relationship between the public debt and the economic growth rate, and most importantly, a debt turning point at around 90-100% of GDP. This finding means that once a government has reached this limit, more debt reduces growth.

Yet, it is important to note that Checherita and Rother (2010) is not the only study to underline the existence of a debt turning point. Similar or close conclusions have been made in various papers. Using the same sample of countries but a different time period (1990-2010), Checherita and Rother (2012) demonstrate that additional debt beyond a 95% threshold negatively impacts economic activity. Furthermore, Reinhart and Rogoff (2010) conclude that when debt rises above 90% of GDP, median growth rates fall by one percent in the case of advanced economies, and annual growth rates decline by two percent when external debt reaches 60% of GDP in the case of advanced economies. However, Herndon et al. (2013) discover that there are methodological and coding errors in the paper and the review of the paper confirms that debt beyond 90% of GDP is not harmful to economic growth as previously reported. Baldacci et

al. (2003), in their investigation of a relationship between debt and economic growth in 55 low-income countries covering the period of 1970 to 1999, conclude that the turning point in the net present value of external debt is around 20-25% of GDP.

In the same vein, Kumar and Woo (2010) look at the impact of high public debt on long run economic growth (real per capita GDP growth) using panel data for both advanced and emerging economies, after controlling for other possible determinants of economic growth. The researchers use growth regressions and growth accounting and pay particular attention to reverse causality and simultaneity bias. Their reasoning is that high debt may have an adverse effect on growth, resulting in low growth being associated with high debt, or that such an association may exist simply because government debt and growth might be jointly determined by another variable. Using data covering four decades (1970-2007), Kumar and Woo (2010) reveal that, on average, a 10 percentage point increase in the initial debt-to-GDP ratio contributes to an annual decrease of around 0.2 percentage points in real per capita GDP growth in emerging economies, but that impact is smaller in advanced countries (around 0.15 smaller). This empirical work also finds some evidence of a nonlinear relationship, suggesting the common result in debt-growth discussions that only high levels of debt have a significant negative effect on growth (above 90% of GDP in most papers).

Schclarek (2004) empirically explores a sample of 59 developing countries and 24 industrial economies with data averaged over seven 5-year periods from 1970 to 2002 (such as 1970-74, 1975-79, 1980-84, etc.) to study the impact of debt on economic growth. His study does not reveal any robust linear or nonlinear relationship between gross government debt and economic growth in advanced economies, an important result implying that higher public debt levels are not necessarily associated with lower growth rates. Moreover, the study finds that

lower external debt in developing countries is associated with higher growth rates. However, when we consider developing countries, Poirson et al. (2004) contradict Schclarek's findings. In estimating a model that allows for a nonlinear impact of external debt on growth using panel data for 93 developing countries (with fixed effects and GMM as methods of estimation) for the period 1969 to 1998, they confirm the existence of a nonlinear effect on growth, noting that the average impact of debt on per capita growth appears to be negative for debt levels exceeding 160-170 percent of exports and 35-40 percent of GDP. This result is also an indication of a debt turning point, as emphasized in the literature discussed earlier. Furthermore, it provides stronger evidence of a hump-shaped relationship between debt and growth in the case of the debt-to-GDP indicator than in the case of the debt-to-exports variable.

Comparing middle and low-income countries, Kutivadze (2011) analyzes the effect of public debt on growth by controlling for country characteristics, using panel data on 130 countries from 1970 to 2007. Like those of many other studies, his findings support the existence of a non-linear relationship between total public debt-to-GDP and per capita growth variables in subsets of middle and low-income countries. According to his study, this result implies that high levels of external debt are associated with low per capita growth, but Kutivadze notes that high domestic debt levels are not necessarily associated with low growth. The paper also shows that the level of optimal public debt is around 80% of GDP for middle income countries, while it is around 70% for low-income countries, thus confirming the theoretical assertions in the existence of a Debt Laffer curve.

While it seems that a well-defined turning point exists beyond which economic performance slows down (above 90% of GDP in advanced countries), Irons and Bivens (2010) argue that there is little in economic theory or in the US data to support this proposition. While

they agree with the need to address projected unsustainable US deficits, they reject the idea of specifying a turning point as attempted by many researchers in this domain.

Several theoretical and empirical contributions looking at budget deficits and economic growth have also indicated the existence of a deficit-to-GDP ratio turning point, as opposed to a debt-to-GDP ratio turning point. In this line of research, Adam and Bevan (2005) investigate the impact of budget deficits on economic growth in a sample of 45 developing countries covering the period 1970 to 2009. Using an overlapping generations (OLG) model of savings behaviour, which is then embedded in an endogenous growth model with a fairly elaborate government sector, they conclude that the government budget need not be balanced. Their empirical analysis suggests that annual deficits above 1.5% of GDP slow down economic growth.

By applying the Johansen methodology, vector error correction models and Granger causality to time series data from 1970-71 to 2011-12, Mohanty (2013) thoroughly investigates both short and long-term relationships between budget deficits and economic growth in India. His main findings also reveal a negative relationship between the two variables in the long run. He demonstrates that increasing deficits by 1% leads to a decrease of approximately 0.22 in the GDP growth rate, an estimate significant at the 1% level. As in the case of the relationship between debt and growth in the literature highlighted earlier, Mohanty's discounts any existence of a short run relationship. Similarly, in their 2012 empirical work on the Nigerian economy, Ezeabasili et al. (2012) also conclude the existence of a negative relationship, but with an adjustment lag in the system.¹⁰ In contrast, Rahman (2012) finds no evidence to support the

¹⁰ They further demonstrate that a 1% increase in fiscal deficits can dampen economic growth by 0.023%.

existence of a long run relationship between budget deficits and economic growth in Malaysia, a conclusion that confirms the Ricardian neutrality paradigm.

Another interesting paper that also examines the association between fiscal imbalance and economic growth is by Odhiambo et al. (2013). In the paper, the authors use exploratory and causal research designs and apply OLS as an estimation method to investigate the relationship between fiscal deficits and economic growth in Kenya for the period 1970 to 2010. The empirical findings show a positive relationship between budget deficits and economic growth, a result consistent with the traditional Keynesian paradigm. They further recommend prudent financial management and enhanced revenue collection to prevent the crowding-out of private sector investment by borrowing domestically. The same study suggests that any attempt to rapidly eliminate budget deficits in the short run would lead to slower economic growth, but when a longer time period is considered (with delayed fiscal adjustments), correcting fiscal imbalances contributes to positive growth and an improved standard of living. It is also further shown that prompt correction of budget deficits by exchange rate adjustments is likely to be related to lower near term growth even if the adjustment occurs smoothly. However, Achchuthan et al. (2013) indicate that there is no significant impact of fiscal deficits on Sri Lankan economic growth.

To empirically investigate the effects of central government budget deficits and economic freedom on per capita real economic growth in 29 OECD countries, Cebula (2013) employs Fixed Effects Models and Two Stage Least squares (2STLS) estimations. His main conclusion is that economic growth is a decreasing function of higher central government deficits, but an increasing function of economic freedom. His study thus suggests, among other things, that governments must be wary of policies that generate large and persistent budget deficits.

Conversely, other studies have recorded an ambiguous relationship between budget deficits and economic growth. For example, Roy and Berg (2009) use US time-series data from 1973 to 2004 to analyze the relationship between these two variables. By applying a simultaneous equation model, the authors show that, *ceteris paribus*, an improvement in the budget balance boosts US economic growth and vice versa. Therefore, the study displays a complex bi-directional relationship between budget deficits and economic growth.

Krugman (1998) contends that the best way to think about the debt problem is as one of debt overhang: the “inherited” debt of some countries is larger than the present value of the resource transfer their creditors expect them to make in the future. In this case, according to Krugman (1998), because the burden of the debt service is so significant, current output accrues to foreigners, and hence a disincentive to invest. In a similar vein, evaluating cross-section regressions for a sample of 99 developing countries (sub-Saharan, Latin America, Asia and Middle East), Elbadawi et al. (1997) estimate a growth equation to capture channels through which indebtedness negatively influences growth in per capita incomes. They propose two channels, namely current debt inflows and past debt accumulation (debt overhang). According to these authors, the former stimulates growth while the latter negatively impacts economic growth. The most interesting result of this paper is that putting together these channels produces a debt Laffer curve which indicates that there is a limit at which debt accumulation stimulates growth — a turning point beyond which further debt accumulation impacts negatively on growth.

Similarly, Imbs and Ranciere (2005) investigate the relationship between debt and growth using a panel data for 87 countries from 1969 to 2002. They too demonstrate the existence of a debt Laffer curve and the relevance of policy institutions. In addition, they note that debt

overhang sets in when the face value of debt reaches 60% of GDP or 200% of exports, or when the present value of debt reaches 40% of GDP or 140% of exports.

One thing certain about debt and deficits arguments is the ambiguity surrounding empirical studies in this realm.¹¹ Saleh (2006) argues that the effects of budget deficits and economic variables on economic growth are inconclusive, and notes that measurement issues, econometric techniques and methodology applied, as well as the time period and country of study, are the main factors underlying different conclusions. The same can be argued for the case of public debt. It is worth underscoring that many economists agree that debt by itself is not a cause of concern, as long as the growth rate of GDP exceeds that of interest on the debt, a government can run deficits indefinitely without imposing any detrimental consequence on its economy.

The most important questions economists and policymakers have always sought to answer is whether debt matters on economic growth and who bears its burdens. While macroeconomists have tried to answer this question, their responses have been based on theoretical views often guided by a set of assumptions that may not be realistic in day-to-day life.¹² It is therefore important to empirically study this topic. As discussed above, numerous empirical studies have indicated that debt is not necessarily bad, because it can boost economic performance if a debt turning point is not surpassed. Differently stated, there exists a non-linear relationship between debt and growth since "reasonable levels of debt" can enhance economic activity, while high levels of debt can damage it.

¹¹ Although debt and budget deficits are different, they are closely related and any discussion of debt also involves talking about budget deficits.

¹² See Bernheim (1989).

Moreover, while existing previous studies have included Canada in their sample of countries (panel data); studies singling out Canada and in particular looking at its provincial governments are scarce. Although Canada is a federal state with a common monetary policy, the provincial governments also have jurisdiction over many aspects of fiscal policy, including spending, taxation and borrowing.¹³ The importance of the provinces 'contribution to Canadian fiscal policy is illustrated by the fact that in 2008, the provinces accounted for 32.63% of the net financial debt of the consolidated government, as compared to 66.30% of the federal government share.¹⁴ Furthermore, the level of indebtedness differs considerably across provinces as figure 4 indicates. Thus it is of interest to examine the impact of provincial government fiscal policies on provincial economic growth. My empirical research paper investigates the impact of provincial public debt on economic growth in ten Canadian provinces and seeks to determine whether there exists evidence that provincial public debts endanger the future growth of provincial economies. Given Canada's federal nature, if high public debts are detrimental to economic growth in the Canadian provinces, Canada's overall economy will be endangered. It is also important to note that, in contrast to other researchers who have used gross debt levels as a measure of indebtedness; this study uses net debt as a share of GDP.

2. MODEL SPECIFICATION AND METHODOLOGY

This paper builds on the work of Checherita and Rother (2010). They seek to examine the relationship between gross debt (as a share of GDP) and economic growth in 18 OECD countries. Likewise, my study seeks to investigate this relationship in the ten Canadian provinces, using the same model augmented with other potential determinants of economic growth. The model is based on the hypothesis of conditional convergence, where the real GDP per capita growth rate is regressed on the initial level of income per capita, investment or the saving-to-GDP rate and the population growth rate. Checherita and Rother (2010) extend this

¹³ See Makarenko (2009).

¹⁴ Data are from CANSIM database, Table 385-0014. Note that the total does not add to a 100% because of possible errors. The numbers used here to approximate the provincial share include an insignificant portion of the territorial governments.

model to include the level of gross government debt (as a share of GDP). In my paper, the model is slightly modified, with small differences in the included control variables. It is important to understand that the selection of control variables was dictated by economic theory as well as the availability of data at the provincial level.

The dependent variable is the real per capita GDP growth rate. Instead of using gross debt as a share of GDP, net public debt as a share of GDP is used, following the measurement of debt indicators adopted in Canada. The baseline panel econometric model estimated using Canadian data is given by the following equation:

$$g_{i,t+k} = \beta + \beta_1 \ln \left(\frac{GDP}{Pop} \right)_{it} + \beta_2 (Debt^2)_{it} + \beta_3 (Debt)_{it} + \beta_4 (Invest.rate)_{it} + \beta_5 (Pop_growth)_{it} + other \quad control$$

$$vars + \mu_i + v_t + \varepsilon_{it}$$

where g_{it} stands for the growth rate of real GDP per capita in province i , a proxy for economic growth. We use the annual growth rate $g_{i,t+1}$ to analyse the short-term impact and the 5-year cumulative overlapping growth rate $g_{i,t+5}$ to capture the longer-term impact of debt levels on economic activity. g_{it} is computed as the difference between the log of real per capita GDP and its lagged value, for example, as $\ln \left(\frac{GDP}{Pop} \right)_{it} - \ln \left(\frac{GDP}{Pop} \right)_{i,t-1}$. In other words, the study utilizes one-year and five-year forward growth rates as the dependent variables.

$\ln \left(\frac{GDP}{Pop} \right)_{it}$ represents the natural logarithm of the initial level of real GDP per capita in province i . This is the log of GDP per capita of period t (lagged log of GDP per capita). According to Barro and Sala-i-Martin (2004), this variable is important in highlighting the

“conditional convergence” that has been discussed by prominent macroeconomists in the growth literature.¹⁵

Initial debt, $Debt_{it}$, is given by net financial debt as a share of GDP.¹⁶ The square of debt is included in the model to check whether a non-linear relationship between the two variables of interest (debt and growth) exists. In addition, it allows the determination of a debt threshold beyond which financing economic activities with debt leads to adverse economic consequences, thus eliminating growth that occurred at lower levels of debt. It is important to note that this debt turning point can only be defined if the results confirm the existence of a non-linear relationship.

Initial investment rate, $Invest.rate_{it}$, is also incorporated in the model through its proxy, gross fixed capital formation as a share of GDP. According to the definition provided by Statistics Canada, gross fixed capital formation measures the value of acquisitions of new or existing fixed assets in the economy. Note that this variable does not represent the value of total investment, but it is a useful proxy for investment as they are closely related.¹⁷

Other control variables as described in the next section are also included (see Table 1), following previous studies that have found numerous growth determinants to have statistically significant effects. The selection of provincial control variables was largely but not entirely

¹⁵ Conditional convergence is a very important concept in economic growth. See Coulombe (2003) for a study of conditional convergence among Canadian provinces.

¹⁶ According to Finance Canada, the net debt is the difference between the government’s total liabilities and its financial assets and it should not be confused with gross debt. The difference between gross debt and net debt can be very large.

¹⁷ Gross fixed capital formation can be used as a proxy for investment because it shows the value of new acquired fixed assets in the economy. Data on total investment were available for a shorter period than gross fixed capital formation.

based on the empirical work of Barro and Sala-i-Martin (2004) (see Table 1 for a detailed description).¹⁸

Finally, the model includes three error terms. μ_i represents province fixed effects, ν_t denotes time fixed effects and ε_{it} stands for the error term to account for measurement errors and missing variables.

The fact that Canada is a federation raises the question of whether some national-level variables, in particular the federal debt-to-GDP ratio, should be included in the model specification. However, it is essential to note that such variables would be the same across provinces, and including them in a model with year dummies, would cause perfect multicollinearity. Thus the roles played by province and year dummies included in the estimated equation in this study are important. Specifically, time fixed effects control for shocks common to all provinces during 1989-2008 and also monetary policies enacted by the federal government. Likewise, province fixed effects address other characteristics specific to each province which do not change over time.

With respect to estimation, reverse causality is one of the main issues encountered when examining the debt-growth nexus. High levels of debt are thought to be detrimental to economic growth, while low growth rates may lead to increased debt levels as well. The same issue has been previously addressed in numerous empirical growth models. For instance, Checherita and Rother (2010) deal with the endogeneity problem using the average debt levels for other countries, for each country and each year, as an instrumental variable. However, one weakness can be identified in their paper. If the debt variable is considered to be endogenous, debt squared

¹⁸ Data availability at the provincial level was also a factor in the selection of control variables.

should be endogenous as well and two instruments rather than one should be used in the study (one for debt and the other for debt squared). Based on the same reasoning, the average debt level for other provinces and its square are used as instrumental variables in this research paper.

This paper considers a variety of estimation techniques such as Ordinary Least Squares (OLS), IV Two Stage Least Squares (IV/2SLS) and Two-Step Feasible GMM. Based on economic theory, I think that the model may suffer from reverse causality bias if OLS is applied. However, it is a good econometric practise to produce OLS results in the sense that it allows comparisons with results obtained under instrumental variable approaches (IV).¹⁹ Significantly different results may be an indication that using IV approaches is indeed desirable.

Econometric wisdom recommends verifying the validity of instruments, because using bad instruments could lead to misleading conclusions. Therefore, this study takes into consideration that a valid instrument should meet the following conditions:

- An instrument should not be weak
- An instrument should be highly correlated with endogenous variable(s) but uncorrelated with the error term.

This study carries out an endogeneity test (equivalent to the Wu-Hausman test), as well as a weak instrument test (Craig-Donald Wald F-Statistics are reported) and the Pagan- Hall general test for heteroskedasticity.²⁰

In addition, when dealing with macro panels, the presence of non-spherical disturbances may become problematic due to the presence of both potential heteroskedasticity and autocorrelation, which may cause the results to be inconsistent or inefficient. A number of options exist for remedying this issue. In this paper, the method of robust covariance matrix

¹⁹ Estimation was carried out using the downloadable Stata command `ivreg2`. See Baum et al. (2007) for details.

²⁰ All these test statistics are computed using the `ivreg2` command.

estimation proposed by Driscoll and Kraay (1998) to correct autocorrelation that may render my results unreliable is applied.

Finally, in an attempt to find the debt turning point beyond which government debt financing may be growth-damaging, I maximize the growth rate of real GDP per capita with respect to debt and compute the value manually. Yet, it is important to underscore that a reliable debt turning point can only be obtained from a specification which provides both expected signs and statistically significant estimates. Note that this debt turning point is estimated for all the provinces jointly and not for each province individually.

4. DATA

The dataset consists of a panel of ten Canadian provinces and covers the period from 1989 to 2008. The data are obtained entirely from Statistics Canada's CANSIM (Canadian Socio-Economic Information Management System) database, a Canadian socioeconomic database containing various statistics available in Canada. Information on CANSIM is updated daily and is classified in different sections and subsections to ease access and navigation by users.

In addition to the variables described earlier, the model encompasses more control variables to ensure its validity. For instance, trade openness is an important variable in the growth literature. Barro and Sala-i-Martin (2004) define it as the sum of imports and exports as a share of GDP and argue that it reflects the size of a country, as large countries tend to rely more on domestic trade. In the Canadian context, where we have different levels of government, statistics on intra-provincial and international imports/exports are recorded for each province.

Therefore, given the above definition, I found it logical to use total exports and imports to compute this variable.²¹ Other common control variables in growth regressions appear to be terms of trade and the inflation rate. According to Barro and Sala-i-Martin (2004), the terms of trade are defined as the growth rate of the ratio between exports and imports. According to this definition, this variable indicates the inflows and outflows of capital in the economy and therefore plays a vital role in the growth model. In contrast to other variables which enter the model as initial values, the variable is estimated for period $t+1$ and $t+5$ (as it is the case for the dependent variable). To compute this variable, I took the difference between the log of terms of trade and its lagged counterpart. Moreover, inflation rate in each province was calculated using CPI information on each province as reported by CANSIM table 326-0021. Furthermore, following the model presented by Kutivadze (2011), we also include fiscal deficit as a share of GDP in our econometric specification, and the variable is estimated for the period $t+1$ and $t+5$ (as it is the case for the dependent variable) to avoid high correlations among independent variables.

The choice of sample period is dictated by the availability of data. Statistics Canada provides statistics that are consistent in terms of measurement techniques, which allows comparison across levels of government. Most provinces follow accounting standards issued by the Public Sector Accounting Board, a private organization that recommends accounting standards for governments in Canada, but the numbers are not necessarily consistent across all provinces. Hence, Statistics Canada numbers are more reliable for study purposes. I also exclude 2009 to 2013 from the study to abstract from the impact of the recent global financial crisis,

²¹ By total exports and imports, I refer to both intra-provincial and international imports /exports. Given that Canadian provinces are involved in both interprovincial and international flows, the variable was estimated using the sum of the two.

which has undoubtedly had a significant impact on debt levels following expansionary policies implemented in the aftermath of the crisis.

It is important to underscore that, unlike numerous previous studies, this study uses net financial debt-to-GDP as a measure of indebtedness. Following recommendations by the International Monetary Fund (IMF), Canadian governments have started to use this measure to allow comparability across the globe by the IMF. According to Statistics Canada, net financial debt is given by the difference between financial assets and total liabilities. This new measure, however, does not include the Canada Pension Plan (CPP) or the Quebec Pension Plan (QPP).

A complete list of all the variables used in the analysis can be found in Table 1, while Table 2 presents summary statistics. It can easily be noted from the table that the average net financial debt as a share of GDP was around 21.61% during the sample period. However, there is a large indebtedness disparity across Canadian provinces as indicated by the high standard deviation (12.14%) for this variable recorded in the table (see also figure 4). This reflects differences in income, expenditure behaviour and fiscal policies across the Canadian provinces. With respect to income, the same table shows that the minimum real per capita GDP is about \$22,312.2 while the maximum is around \$74,475.91. This explains why some provinces are “in the red” while others are enjoying big surpluses.

The Canadian provinces are Newfoundland and Labrador, Prince Edward Island, Nova Scotia, New Brunswick, Quebec, Ontario, Manitoba, Saskatchewan, Alberta and British Columbia. Note that the territories were excluded from the study due to the lack of data for a longer time period.

5. EMPIRICAL RESULTS AND DISCUSSIONS

This paper explores the debt-growth nexus, looking at both short and longer-term impacts. Following the existing literature in this field, the paper verifies whether a non-linear relationship between public debt and economic growth in the Canadian economy (Canadian provinces) exists. In other words, we explore whether debt has a positive impact on economic growth up to a certain point, beyond which government debt financing becomes detrimental to economic performance. Before presenting and analyzing the results, Figure 5 shows that there is an upward-sloping relationship between public debt levels and real per capita GDP growth. However, it is important to note that the possibility of a non-linear relationship, which is incorporated in the estimated equation through the square of the debt variable, is not reflected in the displayed graph, perhaps because other factors are not held constant. It is also important to note the existence of a downward relationship between private saving rate and initial net debt-to-GDP (see Figure 6).²²

The empirical results are shown in Tables 3-6 and they are obtained using OLS, IV/2SLS and Two- Step GMM estimation.²³ A quick examination of the results for all estimation techniques reveals the insignificance of most of the coefficients (including those of interest in this study: debt and its square term) when the longer term investigation ($g_{i,t+5}$) is undertaken. However, it is extremely important to underline that the lack of a larger sample period in this study may have contributed to the insignificance of the coefficients for the longer-term specifications. Therefore, the discussion in this section will mostly be based on the short term

²² Even though I mention this relationship, note that this study has not investigated it empirically.

²³ We use the `ivreg2` command developed by Baum et al. (2007) and we add the “`dkraay`” option to we ensure that the possible presence of heteroskedasticity and autocorrelation are corrected.

specification, where the dependent variable is growth in period $t+1$. The findings partially support the conventional view, that debt can boost economic growth through increasing demand and output in the short run, but crowds out investment in the long run (Elmendorf and Mankiw, 1999). Yet, given the previously-mentioned data limitation in this empirical work, the paper is not able to conclude whether debt has an impact in the long run.

The study vigorously carried out different estimation techniques for comparison purposes. The Ordinary Least Squares estimates are presented to actually see whether the results differ with those obtained under the instrumental variable approach. Compared to Tables 4-6, the OLS estimates reported in Table 3 are quite different. It can be noted that the coefficients of the debt variable and its squared term - for the short term specification (columns 1 and 2 of Table 3) display the expected signs in accordance with previous empirical studies. From Table 3, we can also notice that the coefficient of the debt variable is statistically significant for the short term specification (period $t+1$) while the coefficient of its squared term is statistically insignificant. A quick review of all the estimation results presented in this study shows that the longer term specification (period $t+5$) displays both insignificant results and as well as unexpected signs for the variables of interest (debt and its square term).

Returning to the OLS results reported in Table 3, while the initial debt coefficient for the short term specification is 0.17, other estimation methods presented in the paper record 0.313 for the same coefficient. What this difference (OLS versus other IV approaches) may be suggesting, however, is that the endogeneity problem is an issue in the model, and hence the need to rely on IV approaches. To ensure this is indeed true, I test whether the variables considered to be

endogenous regressors are exogenous.²⁴ As displayed in Table 6, the endogeneity test rejects the null hypothesis that debt and its square are exogenous.²⁵ Thus, the study concludes that the OLS results presented in Table 3 are not reliable.

The analysis is now reduced to Tables 4-6, which present estimates using instrumental variables approaches. Nonetheless, the GMM estimation presented here comes with some limitations, at least in the case of this study. Originally developed by Hansen (1982), GMM is widely respected by econometricians for its efficient estimates. However, as noted by Hayashi (2000), this technique is only reliable when using a very large sample. Given that the authors do not explain how big a sample must be to suit GMM applications, we still run regressions using this technique to investigate whether our sample is large enough for a GMM application. However, our sample size was found to be too small to suit GMM applications, as indicated by warning signs displayed in the results that the “covariance metrics of moment conditions were not of full rank,” citing one of the possible causes as being “insufficient number of clusters required to calculate robust covariance matrix”. For comparison purposes, Table 6 (columns 1 and 2) presents another set of estimates obtained using GMM.²⁶ This estimation provides similar estimates compared to those obtained in Tables 4-5. It is with this empirical exercise that I conclude that, despite the warning messages displayed in the results, my estimates reported in Tables 4-5 are reliable and can be used to make a causal inference.

²⁴ Ivreg2 with the “endog” option performs an endogeneity test which is equivalent to the famous “Wu-Hausman test”.

²⁵ The P-values in column 1 and 3 of Table 6 are less than the 5% level of significance.

²⁶ These estimates were obtained without using the “dkraay” option which corrects the standard error for contemporaneous correlations as well as autocorrelation. Table 6 presents estimates with corrected standard errors.

As briefly highlighted earlier, our findings seem to provide a partial support for the conventional view.²⁷ We find that debt matters only in the short run but we carefully do not rule out the possibility of a long-term impact given the small sample size dealt with in this study. Furthermore, the coefficient of the ratio of public debt appears to have a positive sign, while its squared term appears to have a negative sign, both coefficients being statistically significant at 1% and 10% respectively for both IV/2SLS and Two-Step feasible GMM estimation in the case of the short term investigation,(period t+1,with fixed effects included). Specifically, the presence of these signs points to a concave relationship between public debt and per capita GDP growth. Alternatively stated, our findings are supportive of the existence of a debt turning point beyond which more borrowing by the government may hurt economic growth. This result is in line with the findings of Checherita and Rother (2010) and Reinhart and Rogoff (2010) but contradicts Schclarek (2004), whose findings rule out the existence of a relationship between debt and growth in advanced economies.²⁸ Again, this comparison might be irrelevant given that these studies used gross debt as a measure of indebtedness, while my study investigates the impact of net public debt.

Additionally, a statistically significant coefficient for both debt and its quadratic term allows computation of the debt turning point. I compute the debt turning point by maximizing the fitted equation with respect to the debt-to-GDP ratio.²⁹ Given the empirical results, the fitted regression model becomes:

²⁷ As stated in Elmendorf and Mankiw (1998), the conventional view states that debt can boost aggregate demand and output in the short run but reduces capital and output in the long run.

²⁸ Note that although these studies are compared, only Checherita and Rother (2010) use the same time periods in estimating their models.

²⁹ Many empirical papers have used the delta method to compute standard errors for the debt turning point, but this has not been done in this study.

$$g_{it} = -0.0789 \ln\left(\frac{\text{GDP}}{\text{POP}}\right) - 0.313 \text{ initial_gvt_debt} - 0.396 \text{ initial_gvt_debt_sq} + \beta X$$

where βX stands for other control variables (see Table 1). By maximizing g_{it} with respect to debt, we obtain: $0.313 \text{ initial_gvt_debt} + (2) * (-0.396) \text{ initial_gvt_debt_sq} = 0$. By solving this equation, I find that the debt turning point for Canadian provinces is approximately 40% of GDP. While this threshold appears to be small, it is important to note that the estimated threshold is based on net public debt and not on gross debt as in earlier studies. Thus, comparing our results to previous studies would not only be irrelevant but also misleading. Given that the difference between net and gross debt can be large depending on what is included or excluded in the calculation of indebtedness, 40% of GDP is not small per se. According to the debt levels projected by the PBO,³⁰ however, this reflects how seriously economic growth in the Canadian provinces will be critically damaged if public spending behaviour and fiscal policy are not changed. Table 1 indicates that public debt-to-GDP was approximately 22% by 2008, but it is important to highlight that debt has been increasing since then and the PBO's projections in its 2013 fiscal sustainability reports show that provincial debts are not sustainable.

To summarize my empirical findings, it can be noted that low levels of public debt are positively correlated with economic growth (as evidenced by the positive sign on the debt variable, see Tables 4-6, short term specifications) while high public debt levels are negatively related to economic growth (as shown by the negative sign of the debt squared variable in the same tables). Except for the OLS estimates, all the other estimation techniques applied in this study lead to the same conclusion with a very small difference in standard errors. To be specific, robust standard errors for the IV/2SLS estimates (Table 4) are larger than the standard errors

³⁰ The PBO's 2013 fiscal sustainability reports project that debt as a share of GDP would reach 359% by 2087.

displayed by the GMM (two-step GMM) estimation reported in Table 5. Checherita and Rother (2010) state that, given the advantage of correcting for both heteroskedasticity and autocorrelation, the Two-Step GMM estimation presents more efficient estimates compared to the IV/2SLS estimation. Our results are therefore consistent with this econometric theory.

With respect to the interpretation of the results, our main focus is on the variables of interest (per capita GDP growth, debt and its square term). The coefficients of debt and its quadratic term are interpreted together, and as has been discussed, they show evidence of a non-linear relationship between economic growth and the debt-to-GDP ratio for the short term specifications. However, it is possible that the same conclusion could be reached for the longer-term specification (period $t+5$).

It is also important that most of the control variables are statistically significant with expected signs. For example, the coefficient of log of the initial per capita GDP has a negative sign, consistent with the findings by researchers such as Barro and Sala-i-Martin (2004). According to their interpretation, higher per capita GDP growth rates are responsive to lower initial per capita GDP, assuming that the other independent variables are constant. Moreover, population growth, which is frequently discussed when it comes to the “conditional convergence” theory, has a negative sign as expected, but it is not statistically significant. A possible explanation might be the small and even insignificant differences when it comes to population growth within the Canadian provinces. Furthermore, statistically significant estimates obtained for the trade openness variable shed light on the important role that a province’s size plays in its economic growth. A final note on the control variables is that some have statistically significant coefficients in the short-term specifications and not in the longer-term specifications and vice versa, with the exception of education expenditure as a share of GDP (used as a proxy

for human capital), which has a statistically significant coefficient in both specifications (short and longer term).

5.1 Robustness Tests

In attempting to ensure more reliable results, I tackled the potential reverse causality issue present in the model using the instrumental variables approach. As will be discussed below, the validity of the instruments was checked and they were found to meet all the required conditions. By the same token, I also used lagged explanatory variables to emphasize the elimination of the endogeneity problem. Moreover, different estimation methods were applied. First, Ordinary Least Squares were used for purposes of comparison with the other estimation methods, aiming to shed light on whether an instrumental variables approach was indeed desirable. Obtaining quite different results under OLS estimation when compared to other methods was a sign that the IV approach or equivalent was required in the study (compare Table 3 to Tables 4-5). To ensure that our conclusion is not based on a “guessing game,” we performed the endogeneity test for the variables the estimating equation treated as endogenous (debt and its square). As reported in Table 6, the test rejects the null hypothesis that debt and its squared term are exogenous. With this evidence, OLS estimates are ruled out and cannot be used to make a causal inference.

In addition, to account for the possibility of varying provincial characteristics over time, we incorporated time fixed effects and provincial fixed effects across all the estimation techniques. Next, we excluded fixed effects in the model for comparison purposes to check whether coefficients are significantly different. Table 5 compares IV/2SLS estimates which take into account fixed effects and IV/2SLS estimates which exclude these dummies. It can be seen

that excluding the province and year dummies will result in insignificant estimates for both specifications (short and longer term) and for most of the coefficients (see columns 2 and 4 in Table 5). According to this evidence, I conclude that provincial characteristics and time have an influence on debt levels.

Furthermore, I carefully evaluated the risk of using weak instruments. The results for a weak identification test, as displayed in Table 5, show that the instruments we employed in this study are not weak (the Cragg-Donald Wald F statistics are 28.149 and 20.861 for the short and longer term specifications respectively). Although I am sure that the instruments used are not weak, I am unable to check whether they are uncorrelated with the error term because the equation to be estimated is exactly identified. Finally, we checked whether our empirical estimates suffer from heteroskedasticity; the Pagan-Hall general test failed to reject the null hypothesis that the disturbances are homoscedastic (see Table 4).

6. CONCLUDING REMARKS

Although the Canadian federal government has been well ranked among its Euro Zone and USA counterparts when it comes to fiscal management, local government fiscal sustainability should be a concern for Canadian policymakers. Program-spending increases unmatched with per capita GDP growth over the long-term leads to serious concerns about the future of local governments.

This empirical work explored both the short-term and the longer-term direct impact of public debt (net debt) on economic growth. I examined whether initial debt levels have an impact on subsequent per capita GDP growth and applied different estimation techniques (OLS,

IV/2SLS and Two-Step GMM) aiming at deciding which estimation method provides more reliable results. First, the endogeneity test has ruled out the possibility of the debt and its squared term variables being exogenous variables. In comparing IV/2SLS and the Two-Step GMM results, we concluded that they reach the same conclusion, but with the former estimates displaying larger standard errors. Therefore, the Two-Step GMM estimation provides more efficient results.

In my evaluation, both debt and its quadratic term are included in the model. The quadratic term of the debt variable allows checking whether debt is non-linearly related to growth. Numerous problems in the estimation process were encountered. First, reverse causality and potential heterogeneity issues in the model could lead to inconsistent or inefficient estimates. I therefore used province fixed effects and time fixed effects to control for hidden differences across provinces and time. With respect to reverse causality which may cause the estimated model to suffer endogeneity problems, I tackled the issue by applying the instrumental variable approach. Following Checherita and Rother (2010), who used the average debt of other countries in their sample of 18 OECD countries, this study used the average debt level for other provinces.

My results partially support the conventional view that debt increases demand and output in the short run but crowds out investment in the long run. Although, this seems to suggest that debt matters only in the short run in the Canadian economy (for provincial governments), I am careful about ruling out the possibility of a long-term impact because our analysis is based on a small sample and this makes it difficult to investigate the long term impact. To state this clearly, to evaluate the short-term impact, I forwarded the per capita GDP growth (the dependent variable) by one period and forwarded it by 5 periods when examining the longer-term impact of debt on growth. Forwarding the dependent variable by 5 periods is equivalent to lagging all the

explanatory variables by 5 periods, which leads to losing many observations in an already short time period. Therefore, insufficient sample length may be the main reason why the coefficients of the longer term specification investigated in this paper are not statistically significant.

Based on our reliable results obtained using the standard Two-Stage Least Squares (IV/2SLS) econometric technique, the study suggests an inverse relationship between subsequent per capita GDP growth and initial net debt-to-GDP. Centered on the same estimation technique, we also find evidence of a nonlinear relationship. On average, net public debt levels have a positive impact on provincial economic growth, but only up to around 40% of GDP. Beyond this threshold, more government debt financing is detrimental to economic gains previously achieved. Future research should focus at investigating the impact of public debt levels on the different macroeconomic channels through which debt affects economic growth.³¹

These results imply that spending behaviour change coupled with fiscal coordination at all levels of the government should be implemented as soon as possible if the future of the entire Canadian economy is to be preserved. It was earlier discussed in the introduction how the federal government has recently changed the Health Care Transfer formula, a decision which reduced the federal government expenses but increased those of the provincial governments. As stated earlier in this paper, a moral hazard problem might be one of the factors leading to fiscal mismanagement of the provincial governments, where some provinces may not responsibly manage their finances, expecting the federal government's intervention when things go wrong. Fiscal regulations imposing a limit on how much a provincial government can borrow could prevent this moral hazard problem, and consequently would partially address fiscal

³¹ Checherita and Rother (2010) determined that debt levels impact economic growth through private saving and private investment, total factor productivity (TPF) and sovereign long-term nominal interest rates.

mismanagement on the part of the same governments. However, the feasibility would require some changes in the constitution and this comes with long political fights.

To sum up, my empirical work in this paper provides an important contribution to Canadian policymakers at both the federal and provincial levels. The paper has shown that public debt can have a positive or negative impact on economic growth at the provincial level. Said differently, it serves as a wake-up call to the governments that fiscal management should be taken seriously, as excessive borrowing may weaken economic performance. If this is the case, the federal government should be concerned with the high public debt levels of some provincial governments. It is straightforward that when the provincial governments' economies are weakened, then the entire Canadian economy is damaged. Therefore, when dealing with debt, the focus should be on the consolidated Canadian debt if a strong and resilient economy is to be preserved.³²

32 Parliamentary Budget Officer (2013) indicates that the federal government is fiscally sustainable while the provincial governments are taking a different direction.

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8. TABLES AND FIGURES

Table 1: Variable Descriptions and Sources

Variable Abbrev.	Variable name/ and descr.	Source
Real_per_capita_gdp_growth (dependent variable).	Computed as the difference between log of real per capita GDP and the log of real per capita GDP in period t-1	Statistics Canada (CANSIM tables 384-0038&051-0001)
Initial_ln_gdp_capita	The log of GDP as a share of population in period t-1	Statistics Canada (CANSIM tables 384-0038&051-0001)
Initial_gvt_debt	The net debt as a share of GDP in period t-1	Statistics Canada (CANSIM tables 385-0014 &384-0038)
Initial_gvt_debt_sq	The net debt squared as a share of GDP in period t-1	Statistics Canada (CANSIM tables 385-0014 &384-0038)
Deficit_gdp_1	Fiscal deficit as a share of GDP in period t+1	Statistics Canada (CANSIM tables 385-0003&384-0038)
Initial_trade_openess ³³	The sum of exports and imports as a share of GDP in period t+1	Statistics Canada (CANSIM table384-0038)
Initial_pop_growth	Population growth in period t-1 Computed as $\log Pop - \log Pop_{t-1}$	Statistics Canada (CANSIM table 051-0001)
Initial_gfcf_gdp	Gross fixed capital formation as a share of GDP in period t-1	Statistics Canada (CANSIM table 384-0038)
Tems_trade_growth_1	Growth rate of exports price relative to import prices ³⁴ in period t+1	Statistics Canada (CANSIM table 384-0038)
Initial_eduexp_gdp	Education expenditure as a share of GDP (a proxy of human capital) in period t-1	Statistics Canada (CANSIM table 385-0001)
Initial_infl_rate	Inflation rate in period t-1	Statistics Canada table 3260021)
Deficit_gdp_5	Fiscal deficits as a share of GDP in period t+5	Statistics Canada (CANSIM tables 385-0003&384-0038)
Terms_trade_growth_5	Growth rate of exports prices relative to import prices in period t+5	Statistics Canada (CANSIM table 384-0038)

Note: Data for the entire study have been collected from Statistics Canada (CANSIM tables) but exact variables used for econometric regression purposes have been computed using both Excel and Stata.

³³ See Barro and Sala-i-Martin(2004)

³⁴ See Barro and Sala-i-Martin(2004)

Table 2: Summary of Statistics

Variable	Obs.	Mean	Std.Dev.	Min.	Max.
GDP Growth rate	190	0.0185003	0.0251981	-0.0484085	0.1542034
Debt_gdp	200	0.2161228	0.1214428	-0.1392482	0.4633731
Debt-sq_gdp	200	0.0613837	0.0475477	4.17e-06	0.2147146
gdp_capita	200	38641.54	11138.94	22312.2	74475.91
Deficit_gdp	200	-0.0057495	0.0178324	-0.0712	0.0499
Trade_openess	200	1.041235	0.2200481	0.7169787	1.735226
Pop_growth	190	0.0058096	0.0089461	-0.0202951	0.0299044
Gfcf_gdp	200	0.0351813	0.009872	0.0148656	0.0728511
Terms-trade-growth	190	0.0000305	0.0446589	-0.125991	0.2664143
Eduexp_gdp	200	0.037955	0.012251	0.0193691	0.109248
Infl_rate	200	0.0233855	0.0137415	0.0125427	0.075255

Table 3: Panel Regression-Growth and Initial Government Debt (1989-2008)**Dependent Variable: Real Per capita GDP Growth****Ordinary Least Squares Estimation**

Explanatory variables	Period t+1	Period t+1	Period t+5	Periodt+5
Initial_gvt_debt	0.170*** (0.0621)	0.170*** (0.0641)	-0.129 (0.123)	-0.129 (0.123)
Initial_gvt_debt_sq	-0.113 (0.0983)	-0.113 (0.104)	0.188 (0.230)	0.188 (0.214)
Initial_ln_gdp_cap	-0.0642** (0.0256)	-0.0642*** (0.0204)	-0.0513 (0.0775)	-0.0513 (0.0627)
Fiscal_defict_gdp_1	0.291** (0.146)	0.291** (0.140)		
Initial_trade_openess	0.140*** (0.0271)	0.140*** (0.0242)	0.0155 (0.0359)	0.0155 (0.0344)
Initial_pop_growth	-0.304 (0.393)	-0.304 (0.363)	-1.031** (0.457)	-1.031*** (0.373)
Initial_gfcf_gdp	-0.0184 (0.264)	-0.0184 (0.304)	-0.111 (0.299)	-0.111 (0.259)
Terms_trade_growth_1	0.235*** (0.0590)	0.235*** (0.0593)		
Initial_educexp_gdp	0.651*** (0.151)	0.651*** (0.146)	0.308** (0.150)	0.308** (0.137)
Initial_infl_rate	-0.0949 (0.185)	-0.0949 (0.150)	-0.302 (0.246)	-0.302 (0.259)
Fiscal_defict_gdp_5			0.0849 (0.110)	0.0849 (0.107)
Terms_trade_growth_5			0.265*** (0.0664)	0.265*** (0.0645)
Constant	0.511* (0.272)	0.511** (0.221)	0.581 (0.808)	0.581 (0.661)
Observations	180	180	140	140
Prob>F	0.0000	0.0000	0.0000	0.0000
R-squared	0.646	0.646	0.563	0.563
Debt turning point	75.22%	75.22%	N/A	N/A
Province fixed-effects	YES	YES	YES	YES
Year fixed-effects	YES	YES	YES	YES

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

- Columns 1&2 report OLS estimate generated using ivreg2 with dkraay(1) and dkraay(2) respectively for the short term specification(period t+1) while colume 3&4 record estimates generated by ivreg2 with dkraay(1) and dkraay(2) respectively for the long term specification(period t+5)
- The dependent variable is either estimated for the period t+1 or t+5 to respectively capture the short and long term impact of debt on economic growth. Note that forwarding the dependent variable by one period or by five periods automatically lags the control variables by one or by five.
- All explanatory variables except fiscal deficit and the growth of terms of trade represent estimations for period t-1 and for t-5.

Table 4: Panel Regression-Growth and Initial Government Debt (1989-2008)

Dependent Variable: Real per capita GDP Growth

The standard IV/2SLS estimation

Explanatory variable	Period t+1	Period t+1	Perodt+5	Period t+5
Initial_gvt_debt	0.313*** (0.0909)	0.313*** (0.0911)	-0.156 (0.206)	-0.156 (0.180)
Initial_gvt_debt_sq	-0.396* (0.231)	-0.396* (0.218)	0.290 (0.444)	0.290 (0.382)
Initial_ln_gdp_cap	-0.0789*** (0.0265)	-0.0789*** (0.0180)	-0.0482 (0.0782)	-0.0482 (0.0638)
Fiscal_deficit_gdp_1	0.312** (0.151)	0.312** (0.152)		
Initial_trade_openess	0.127*** (0.0314)	0.127*** (0.0307)	0.0203 (0.0387)	0.0203 (0.0341)
Initial_pop_growth	-0.0116 (0.409)	-0.0116 (0.401)	-1.026** (0.426)	-1.026*** (0.344)
Initial_gfcf_gdp	0.0254 (0.250)	0.0254 (0.282)	-0.0826 (0.296)	-0.0826 (0.247)
Terms_trade_growth_1	0.249*** (0.0643)	0.249*** (0.0640)		
Initial_educexp_gdp	0.642*** (0.167)	0.642*** (0.164)	0.339** (0.159)	0.339** (0.160)
Initial_infl_rate	-0.00563 (0.213)	-0.00563 (0.178)	-0.318 (0.274)	-0.318 (0.283)
Fiscal_deficit_gdp_5			0.0869 (0.106)	0.0869 (0.101)
Terms_trade_growth_5			0.260*** (0.0684)	0.260*** (0.0656)
Constant	0.650** (0.281)	0.650*** (0.198)	0.546 (0.817)	0.546 (0.672)
Observations	180	180	140	140
P>F	0.0000	0.0000	0.0000	0.0000
Chi-sq(32) P-val ³⁵	0.2717	0.4036		
Debt turning point	39.52%	39.52%	N/A	N/A
R-squared	0.632	0.632	0.561	0.561
Province fixed-effects	YES	YES	YES	YES
Years fixed-effects	YES	YES	YES	YES

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Notes:

- Columns 1&2 report the standard IV/2SLS estimates generated using ivreg2 with dkraay(1) and dkraay(2) respectively for the short term specification(period t+1) while colums 3&4 record IV/2SLS estimates generated by ivreg2 with dkraay(1) and dkraay(2) respectively for the long term specification(period t+5)
- The dependent variable is either estimated for the period t+1 or t+5 to respectively capture the short and long term impact of debt on economic growth. Note that forwarding the dependent variable by one period or by five periods automatically lags the control variables by one or by five.
- All explanatory variables except fiscal deficit and the growth of terms of trade represent estimations for period t-1 and for t-5.

³⁵ This is the P-value given by the Pagan- Hall general test for heteroskedasticity. The null hypothesis is that the disturbance is homoscedastic.

Table 5: Panel Regression Growth and Initial Government Debt (1989-2008)

Dependent Variable: Real per capita GDP Growth

Two-Step GMM estimation (gmm2s)

Explanatory variables	Period t+1	Period t+1	Period t+5	Periodt+5
Initial_gvt_debt	0.313*** (0.0879)	-0.442 (0.405)	-0.156 (0.147)	2.166 (6.807)
Initial_gvt_debt_sq	-0.396* (0.231)	1.336 (0.937)	0.290 (0.303)	-4.738 (14.76)
Initial_ln_gdp_cap	-0.0789** (0.0336)	-0.0319 (0.0505)	-0.0482 (0.0427)	0.366 (1.098)
Fiscal_defict_gdp_1	0.312*** (0.112)	-0.275 (0.258)		
Initial_trade_openess	0.127*** (0.0339)	0.0567* (0.0337)	0.0203 (0.0416)	-0.156 (0.449)
Initial_pop_growth	-0.0116 (0.349)	0.467 (1.021)	-1.026*** (0.365)	-0.942 (2.394)
Initial_gfcf_gdp	0.0254 (0.255)	-0.600 (0.375)	-0.0826 (0.311)	0.724 (2.302)
Terms_trade_growth_1	0.249*** (0.0342)	0.142* (0.0760)		
Initial_eduexp_gdp	0.642*** (0.188)	-0.402 (0.541)	0.339 (0.301)	4.022 (11.83)
Initial_infl_rate	-0.00563 (0.213)	-0.584*** (0.207)	-0.318 (0.231)	-0.134 (0.965)
Fiscal_defict_gdp_5			0.0869 (0.133)	-0.0323 (0.447)
Terms_trade_growth_5			0.260*** (0.0393)	0.682 (1.310)
Constant	0.650* (0.349)	0.355 (0.563)	0.546 (0.445)	-3.995 (12.16)
Observations	180	180	140	140
Prob>F	0.0000	0.0000	0.0000	0.0000
Weak ident.(C-Donald W	28.149	1.861	20.861	0.054
Debt turning point	39.52%	N/A	N/A	22.86%
R-squared	0.632	-0.278	0.561	-6.124
Province fixed effects	YES	NO	YES	NO
Year fixed effects	YES	NO	YES	NO

Standard errors in parentheses

**** p<0.01, ** p<0.05, * p<0.1*

Notes:

- Columns 1&2 report Two-Step GMM estimates generated using ivreg2 respectively for the short term specification (period t+1) columns 3&4 report the longer term specification (t+5) . Note that columns 2&4 exclude time effects and province fixed effects
- The dependent variable is either estimated for the period t+1 or t+5 to respectively capture the short and long term impact of debt on economic growth. Note that forwarding the dependent variable by one period or by five periods automatically lags the control variables by one or by five.
- All explanatory variables except fiscal deficit and the growth of terms of trade represent estimations for period t-1 and for t-5.
- Dkraay () option is not applicable here.

Table 6: Panel Regression-Growth and Initial Government Debt (1989-2008)

Dependent Variable: Real per capita GDP Growth

IV/2SLS and GMM2S estimations: Test for Endogeneity

Explanatory variable	Period t+1 IV/2SLS	Period t+5 IV/2SLS	Period t+1 GMM2S	Period t+5 GMM2S
Initial_gvt_debt	0.313*** (0.0879)	-0.156 (0.147)	0.313*** (0.0879)	-0.156 (0.147)
Initial_gvt_debt_sq	-0.396* (0.231)	0.290 (0.303)	-0.396* (0.231)	0.290 (0.303)
Initial_ln_gdp_cap	-0.0789** (0.0336)	-0.0482 (0.0427)	-0.0789** (0.0336)	-0.0482 (0.0427)
Fiscal_deficit_gdp_1	0.312*** (0.112)		0.312*** (0.112)	
Initial_trade_openess	0.127*** (0.0339)	0.0203 (0.0416)	0.127*** (0.0339)	0.0203 (0.0416)
Initial_pop_growth	-0.0116 (0.349)	-1.026*** (0.365)	-0.0116 (0.349)	-1.026*** (0.365)
Initial_gfcf_gdp_1	0.0254 (0.255)	-0.0826 (0.311)	0.0254 (0.255)	-0.0826 (0.311)
Terms-trade_growth_1	0.249*** (0.0342)		0.249*** (0.0342)	
Initial_educexp_gdp	0.642*** (0.188)	0.339 (0.301)	0.642*** (0.188)	0.339 (0.301)
Initial_infl_rate	-0.00563 (0.213)	-0.318 (0.231)	-0.00563 (0.213)	-0.318 (0.231)
Fiscal_defict_gdp_5		0.0869 (0.133)		0.0869 (0.133)
Terms_trade_growth_5		0.260*** (0.0393)		0.260*** (0.0393)
Constant	0.650* (0.349)	0.546 (0.445)	0.650* (0.349)	0.546 (0.445)
Observations	180	140	180	140
P>F	0.0000	0.0000	0.0000	0.0000
Weak ident. (C. D.W) ³⁶	28.149	20.861	28.149	20.861
Endog. test ³⁷ (P-val)	0.0000	0.4355	0.0000	0.4355
Debt turning point	39.52%	N/A	39.52%	39.52%
R-squared	0.632	0.561	0.632	0.561
Province fixed effects	YES	YES	YES	YES
Year fixed effects	YES	YES	YES	YES

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Notes:

- Columns 1&2 report IV/2SLS estimates generated using ivreg2 respectively for the short term specification (period t+1) and the longer term specification (t+5) while columns 3&4 records GMM2S estimates respectively for the short term (t+1) and the longer term specification (t+5).
- The dependent variable is either estimated for the period t+1 or t+5 to respectively capture the short and longer term impact of debt on economic growth. Note that forwarding the dependent variable by one period or by five periods automatically lags the control variables by one or by five.

³⁶ Weak identification test ((Cragg-Donald Wald F statistic).

³⁷ This the equivalents of the Wu-Hausman test for endogeneity.

Figure 1.

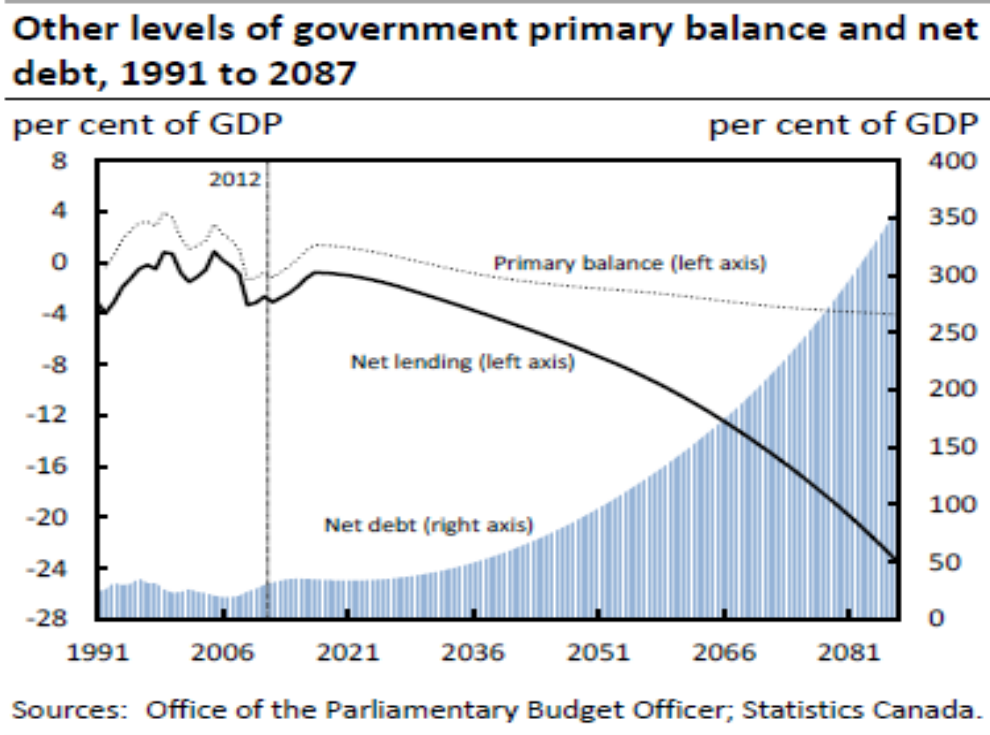


Figure 2.

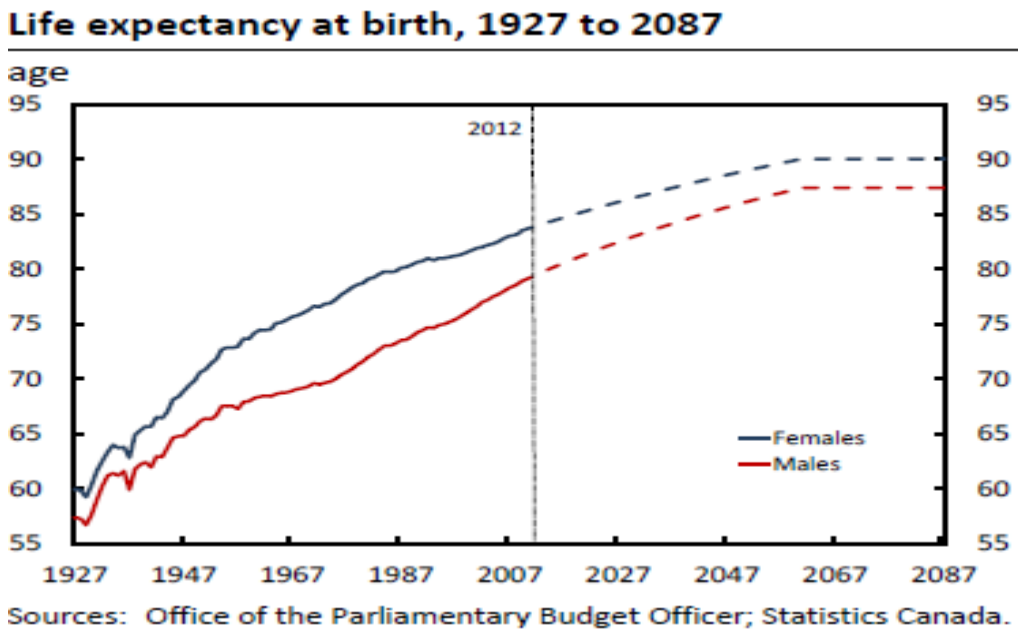
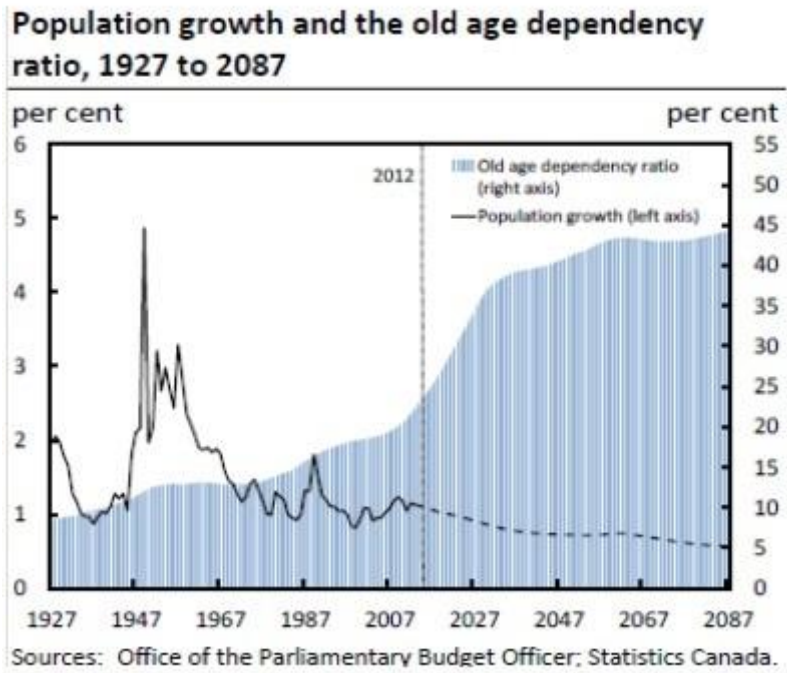
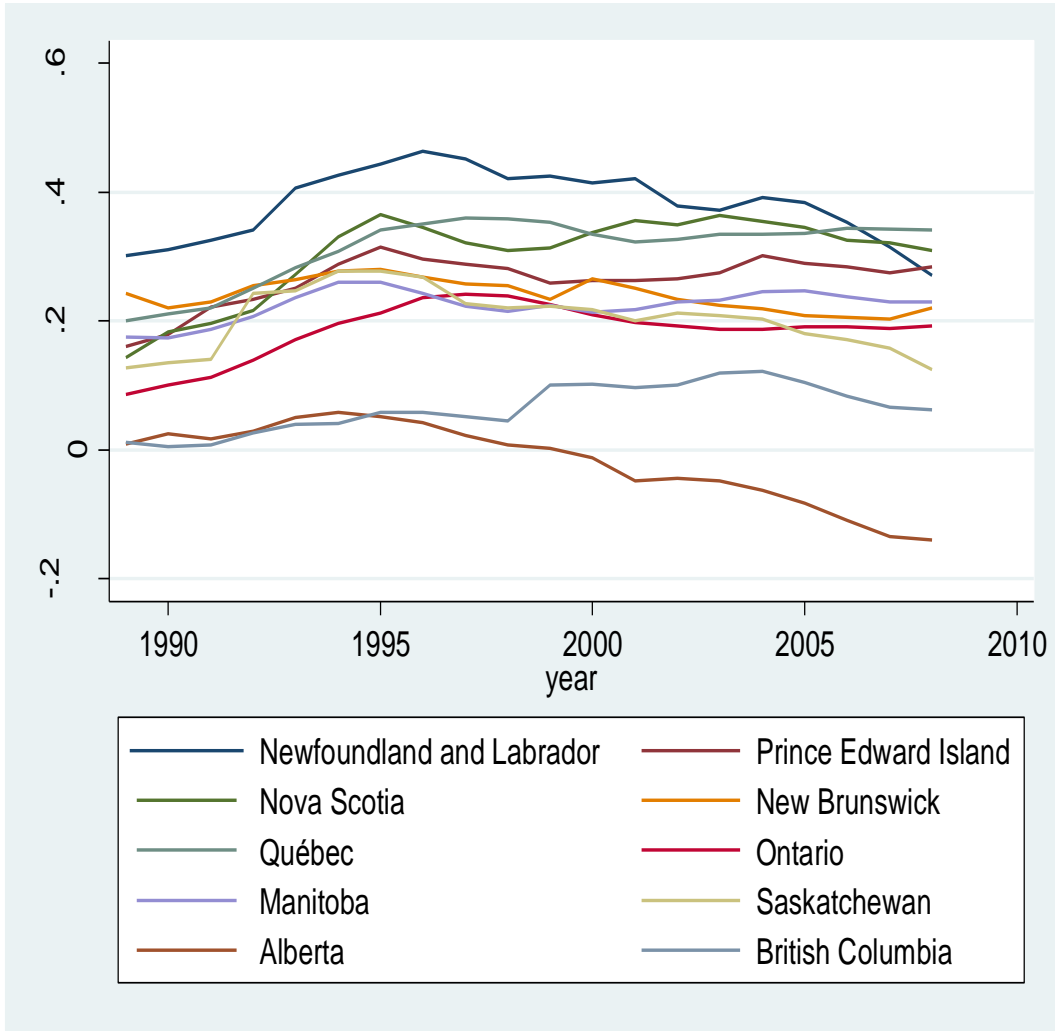


Figure 3.



Note: Figures 4-6 were all retrieved from PBO's Fiscal sustainability reports produced in July, 2013.

Figure 4. Debt Accumulation among Provinces: 1989-2008



Note: ndptgdp= net debt-to-GDP

Figure 5. Correlation between Per capita real Growth and Initial Net debt-to-GDP

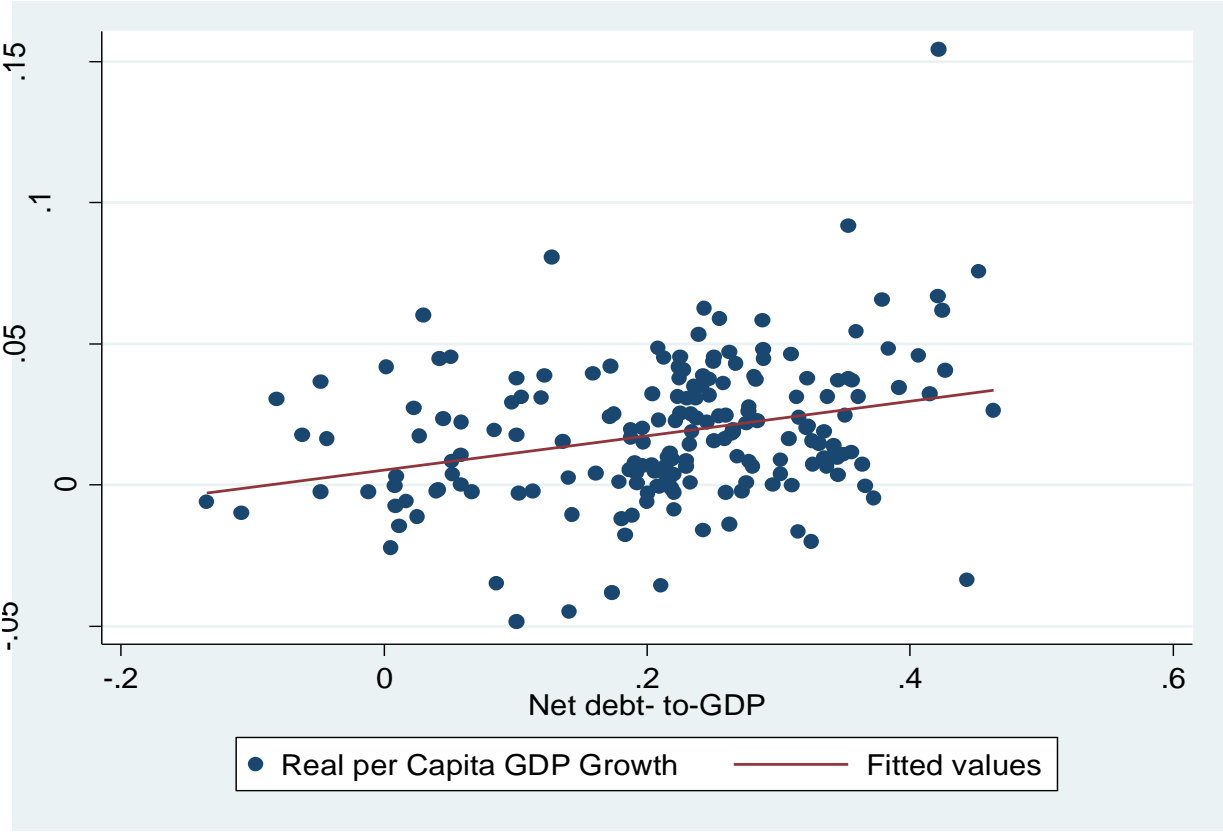


Figure 6. Correlation between Private Saving Rate and Initial Net Debt-to GDP.

