The Fiscal Costs of Debt-Financed Government Spending

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Executive Summary

The persistently low interest rates on government debt over past decades has prompted some leading economists to question the wisdom of fiscal policies that restrict the use of deficits to finance government spending. This position is based on a simple model of public debt dynamics which implies that when the real interest rate on public debt, r, is less than the growth rate of the economy, g, the ratio of the government debt to GDP can be stabilized even if the government has a primary deficit, i.e. with current revenues less than current program expenditures. This has led to the view that there is a low "fiscal cost" to debt-financed government spending in the sense that tax revenues never have to equal program expenditures if the real interest rate on government debt is less than the growth rate of the economy.

In this paper, we show that the notion that debt-financed spending has a low fiscal cost is misleading. We review econometric studies of OECD countries that show that the growth rate declines, interest rates increase, and the r - g differential increases as a country's public debt ratio increases. We also estimate a simple regression model of the r – g gap in Canada based on the annual data from 1991 to 2019. Consistent with the findings of other more elaborate econometric studies, the regression results indicate that the r – g gap in Canada is affected by international financial and economic conditions, as reflected by the r – g gap in the United States, but also by the public debt to GDP ratio. In particular, a one percentage point increase in the debt to GDP ratio of the federal, provincial, territorial, and local government sector is associated with a 6.7 basis point increase in the Canadian r – g gap.

Accordingly, an increase in the government debt ratio by raising the r – g gap means that the primary deficit has to be reduced to stabilize the debt ratio. As a result, the average fiscal cost increases. As every first-year student of economics knows, when average cost increases, marginal cost is greater than average cost. This means that the increase in taxes needed to stabilize a government's debt can exceed the increase in program spending. In other words, the marginal fiscal cost of debt-financed spending can be greater than one if the difference between the real interest rate on government debt and the economy's growth rate increases with the public sector debt ratio.

We use a model of government debt dynamics that incorporates the link between higher government debt ratios and the r – g gap to calculate the average and marginal fiscal cost of a debt-financed increase in government program spending. The model indicates that if the spending increase results in a five percentage point increase in the debt ratio, an additional $1.00 of program spending means that taxes have to increase by $1.19 to stabilize the debt ratio. This demonstrates that there is no free lunch with debt-financed increased government spending even though the real interest rate on government debt is less than the economy's growth rate.

An additional reason for exercising fiscal prudence in the current low real interest rate environment is that international conditions may quickly change and the gap between the interest rate and the growth rates could be reversed. Such a reversal would require a large fiscal adjustment to stabilize the public debt ratio at its current level.

Finally, while the focus of this paper is on the fiscal cost of debt-financed government spending, it is important to recognize that there is an economic cost of debt-financed government spending in terms of the loss of private sector incomes when government borrowing crowds out private investment and lowers the economy's productive potential.

1. Introduction

Countries around the world incurred unprecedented fiscal deficits in response to the pandemic. With the resulting increase in public sector debt, governments, international financial institutions, and think tanks have started to consider new anchors for fiscal policies in a post-COVID world. This re-examination of fiscal policies has also been prompted by very low interest rates on government debt over the past decades, with some prominent economists, such as Olivier Blanchard, Barry Eichengreen, and Lawrence Summers, questioning the wisdom of fiscal policies that restrict the use of deficits to finance government spending (Blanchard, 2019; Eichengreen et al., 2021; Furman and Summers, 2020).

There is now a widely-held view that there is a low or no "fiscal cost" to debt-financed government spending in the sense that tax revenues never have to equal program expenditures if the interest rate on government debt is less than the growth rate of the economy.

In this paper, we argue that fiscal policies based on the current favourable differential between the interest rate on government debt and the growth rate of the economy can mislead policy makers into believing that debt-financed spending has a low or no fiscal cost. Econometric studies indicate that higher public sector debt levels can lead to higher real interest rates and lower economic growth rates. This means that the increases in taxes needed to stabilize a government's debt can exceed the increase in program spending. In other words, the marginal fiscal cost of debt-financed spending can be greater than one if the difference between the real interest rate on government debt and the economy's growth rate increases with the public sector debt ratio. Thus, there is no free lunch with debt-financed increased government spending even if the real interest rate on government debt is less than the economy's growth rate.

Although the focus of this paper is on the fiscal costs of debt-financing government spending, it is also always important to recognize that there is an economic cost which is the loss of private sector incomes if government borrowing crowds out private investment and lowers the economy's growth rate.

We begin in Section 2 with a basic model of the key fiscal and economic variables that determine a government's debt to GDP ratio. In Section 3, we review the historical trends in real interest rates, the growth rate, the primary fiscal balances, and debt ratios for the federal, provincial, territorial, and local governments in Canada. In Section 4, we review the econometric studies of how public sector debt affects interest rates and economic growth rates. In Section 5, we present a model of the average and marginal fiscal costs of debt-financed government spending. We show that the marginal fiscal cost of debt-financed spending can be greater than one when an increase in the public sector debt ratio increases the differential between the interest rate on public sector debt and the growth rate of the economy.

2. The Public Debt Dynamics [1]

We begin with a review of the basic model of the key fiscal and economic variables that determine a government's debt to GDP ratio. Equation (1) shows how this debt ratio evolves over time:

$$b_{t+1} = \frac{(1 + r) \bullet b_t - p_t}{(1 + g)} \qquad (1)$$

where b_t is the debt ratio in year t, r is the real interest rate on government debt, g is the growth rate of the economy (GDP), and p_t is the ratio of a government's primary budget balance to GDP. The primary balance is the government's total revenues minus its current and capital expenditures, including transfers to people and businesses. In particular, interest payments on debt are not included in the primary balance. If revenues exceed program expenditures, the government records a primary budget surplus which contributes to a smaller debt ratio in the following year. If revenues are less than program expenditures, the government has a primary deficit which contributes to an increase in the debt ratio in the following year. For a given primary surplus or deficit, the change in the debt ratio depends on the real interest rate on government debt and the economic growth rate. A key determinant of the change in the debt ratio is the gap between the real rate of interest and rate of economic growth, or r – g. When r exceeds g, the debt ratio tends to increase. When g exceeds r, the ratio tends to decline. Accordingly, the evolution of the debt ratio depends on these three variables—r, g, and p.

In order to stabilize the debt ratio at a particular value for b, the primary balance has to equal to:

$$pr = (r - g) \bullet b \qquad (2)$$

A government has to run a primary surplus to stabilize the debt ratio if the real rate of interest exceeds the growth rate of the economy. On the other hand, if the growth rate exceeds the real interest rate, the debt ratio can be stabilized with a primary deficit, i.e. with current revenues less than current program expenditures. For example, if the real interest rate is one percent and the growth rate of the economy is two percent, then a government can stabilize a debt ratio of 40 percent with a primary deficit of 0.40 percent of GDP. But if it increased its debt ratio to 60 percent, it could stabilize the debt ratio at this higher level with a primary deficit of 0.60 percent of GDP. In other words, if r is less than g, a higher debt ratio can be financed with a larger primary deficit ratio.

[1] In keeping with the literature, public debt refers to debt incurred by governments.

When r is less than g, some have argued that there is no "fiscal cost" to government debt in the sense that tax revenues never have to equal program expenditures. For example, Mian, Straub, and Sufi (2022) argue that when r is less than g "the fiscal cost of increased debt may be zero or even negative" (p.2) and that higher deficits are a "free lunch" in the sense that "permanent increases in deficits do not require tax increases going forward, even if they lead to permanently greater (non-explosive) debt levels" (p.13).

The view that there is a low or no fiscal cost to debt-financed government spending increases is highly misleading. [2] The debt dynamic equations in (1) and (2) are based on an accounting identity and do not indicate how the key economic variables, r and g, respond to increases in government debt. In particular, an increase in government spending financed by debt can crowd out private sector investment if the economy is operating at capacity. The economic cost of the debt-financed government spending is the loss of future income-generating opportunities if government borrowing crowds out private investment and lowers the economy's productive capacity. In Section 4, we review the economic studies on the impact of higher debt levels on the interest rate on government debt and the growth rate of the economy.

[2] See Rogoff (2020) and Cochrane (2021) on the delusion of basing expansionary fiscal policies on a negative r – g gap.

3. Trends in the Key Economic and Fiscal Variables for Debt Dynamics

Here we review the trends in the real interest rates, the growth rate, the primary balances, and debt ratios for the federal, provincial, territorial, and local (FPTL) government sectors in Canada. It is important to note that the FPTL sector is not synonymous with the concept of General Government that is used by the IMF to describe a country's fiscal condition, because we exclude the Canada Pension Plan (CPP), Quebec Pension Plan (QPP), and other social security funds that are included in the definition of General Government. We exclude the CPP and QPP because any fiscal anchors adopted by Canadian governments will generally not apply to the CPP and QPP, whose fiscal parameters are based on maintaining the long-run viability of the public pension systems. We also focus on FPTL, rather than the fiscal variables for the federal government or a particular province or territory, because we believe that it is important to look at the overall viability of public sector finances in Canada rather than focusing on any one of the 14 governments on its own.

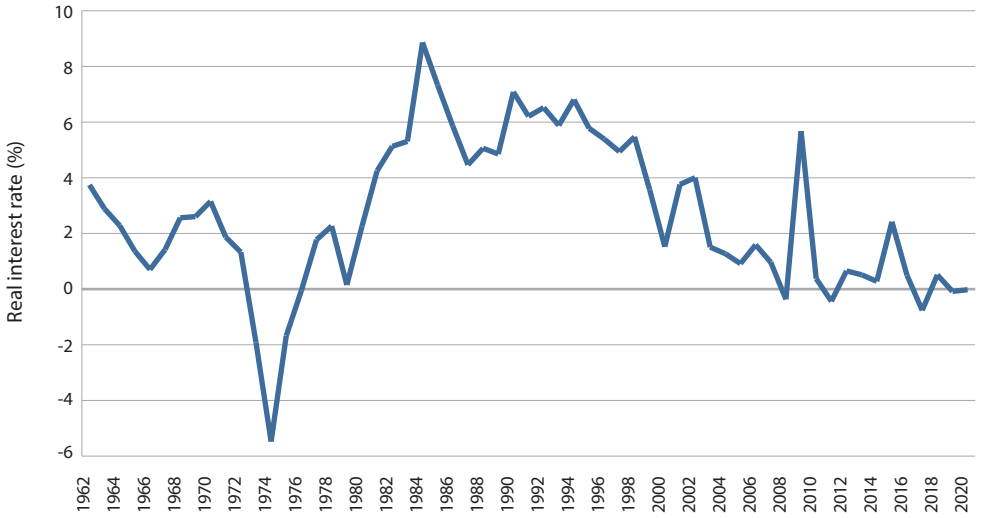
Figure 1 shows that the real interest rate on federal government debt has declined since the early 1980s. [3] In recent years, it has been close to zero and even negative in some years. The average real interest from 2010 to 2020 was 0.36 percent. The four-decade long decline in real interest rates on government debt is a worldwide phenomenon (Blanchard, 2019). It has been attributed to a structural change in global savings and investment that has led to what Lawrence Summer (2014) has described as secular stagnation. In this view, low interest rates are the result of a worldwide increase in the supply of savings and a reduction in the demand for funds for investment.

Rachel and Smith (2015) have attributed the increase in the global supply of savings to demographic changes from increased retirement savings with population aging and increased life expectancy, increasing income inequality within countries (as an increase in the income shares of higher income groups increases average savings rates [4]), and an increase in precautionary financial reserves by emerging countries and the establishment of savings funds by oil-producing countries. Their analysis suggests that these factors account for 1.60 percentage points of the 4.50 of the decline in real interest rates on government debt of advanced countries between 1980 and 2015 (**table 1**).

[3] The real interest rate is measured as the interest rate on 10-year bonds less the rate of increase in the nominal GDP deflator in the FRED database (2022). Based on these data, the average real interest rate from 2010 to 2020 was 0.36 percent.

[4] See Mian et al. (2021) for the impact of inequality on savings and returns on investment in the United States.

Figure 1: Real Interest Rate on Federal Government Debt, 1962 to 2020



Source: FRED, 2022.

Table 1: Global Factors Accounting for the Decline in Real Interest Rates, 1980 to 2015

Source	Factor	Comments	Impact (in basis points, bps)
Savings trends	Demographics	Increased percentage of population in peak savings years; decline in dependency ratios.	90 bps
	Inequality	Increases in within country income inequality (savings rates increase with income).	45 bps
	Risk avoidance	Governments in emerging countries increased financial reserves; oil producing states established saving funds.	25 bps
Investment trends	Relative prices	Decline in the price of capital goods.	50 bps
	Public investment	Declines in public investment rates.	20 bps
	Risk spreads	Increased spreads between risk free interest rates and the return on capital.	70 bps
Growth trends	Decline in growth rates	Lower growth rate of labour productivity due to slower rate of adoption of technological advances and other innovations.	100 bps
Unknown factors		Possible factors: shorter time horizons by investors, the shift from capital to labour intensive industries; deleveraging after the financial crisis; financial regulations increasing the demand for safe assets.	50 bps
Total impact		Total reduction in global real interest rates 1980 to 2015.	450 bps

Source: Rachel and Smith, 2015.

Rachel and Smith attribute the decline in investment rates to a decline in the relative price of capital goods, declines in public investment rates, and an increase in risk spreads between risk free assets and the return on capital investments. They estimate that these investment-related factors have lowered the real interest rates on government debt by 1.4 percentage points. Thirdly, Rachel and Smith argue that the decline in labour productivity growth rates from the slowdown in the adoption of productivity-enhancing technical innovations has reduced both saving and investment and accounts for a one percentage point decline in real interest rates on government debt since 1980.

Rachel and Smith see no reason for major changes to the factors that have depressed real interest rates on government debt around the world. Others are not so sure. Goodhart and Pradhan (2020) argue that the world is about to enter an era of lower growth rates and higher real interest rates because of the decline in the labour force in China. While the IMF is forecasting that growth rates will exceed interest rates in G7 countries, except Italy, until 2030, Chamon and Ostry (2021) point out that "history gives numerous episodes of abrupt upticks in borrowing costs once market expectations shift." Consequently, the risk of a higher real rate of return on government debt is a factor that should be considered in assessing the ability of Canadian governments to finance higher levels of public debt. [5]

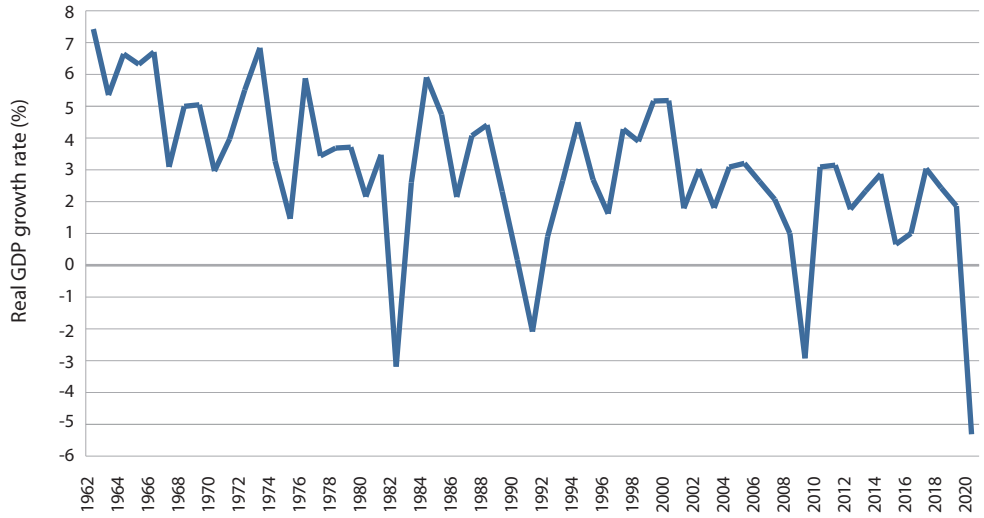
Figure 2 shows that there has been a long-term decline in the growth rate of real GDP in Canada, with large negative shocks in 1982, 1991, 2009, and 2020. We will refer to these as "recession shocks" where the average annual growth rate was about minus three percent. These recession shocks have occurred roughly once every 10 years over the past 40 years. If we exclude the years with recession shocks, the average growth rate has been about 1.8 percent since 2009. Recession shocks lead to high primary deficits because of declines in tax revenues, higher social assistance and unemployment insurance expenditures, and the adoption of fiscal stimulus measures and a sharp uptick in public sector debts.

As the previous section indicated, the gap between the real interest rate on government debt and the growth rate of the economy affects the trend in the public sector debt ratio and determines whether a government can run a primary deficit and keep its debt ratio at or below some ceiling. **Figure 3** shows that since 1962 the gap between the interest rate on federal government debt and the growth rate has gone through three lengthy periods. [6] From 1962 to 1979, the growth rate exceeded the interest rate in every year except 1970 and the average gap was four percentage points. From 1980 to 1998 there was a complete reversal with interest rates exceeding the growth rate. The average gap between the interest rate on federal debt and the growth rate over these 19 years was 3.3 percentage points. Finally, since 1999 growth rates have exceeded interest rates with the exception of 5 of the 22 years. The two years in which the interest rates exceeded

[5] See Clemens, Palacios, and Fuss (2021) on the impact of higher interest rate costs on the federal and provincial deficits.

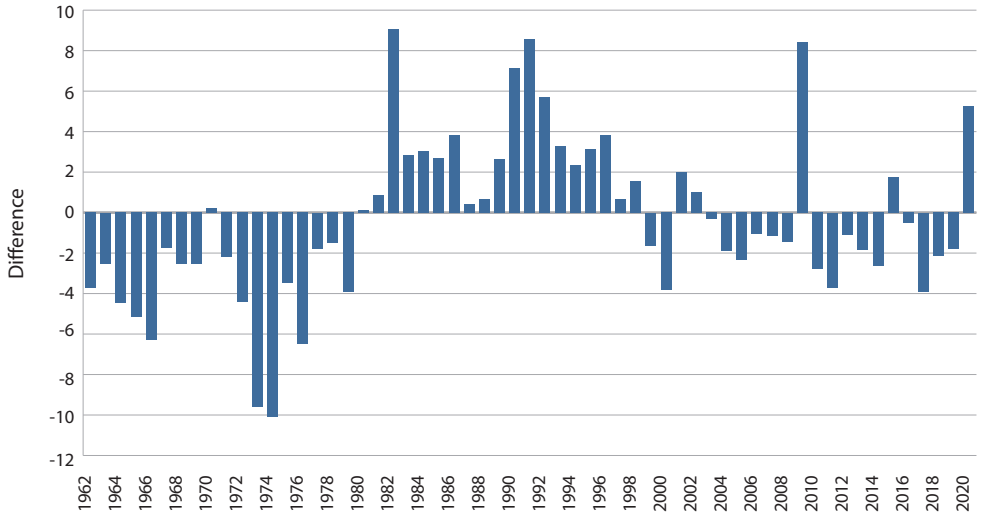
[6] The IMF database indicates that g exceeded r for the Canadian government in 56 percent of the years between 1945 and 2015, especially between 1945 and 1980 and since 2004.

Figure 2: Real GDP Growth Rate, 1962 to 2020



Source: FRED, 2022.

Figure 3: Difference Between Interest Rate on Federal Debt and the GDP Growth Rate (Percentage Points), 1962 to 2020



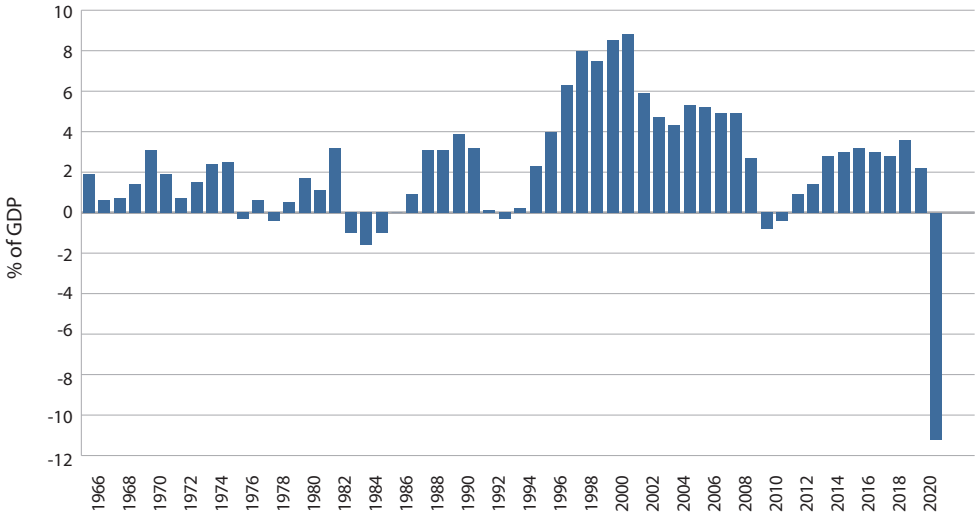
Source: FRED, 2022.

the growth rate by a large margin were in the 2009 and 2020 recessions. Therefore, in recent years under "normal conditions", the growth rate has exceeded the interest rate on federal debt by an average of 1.5 percentage points. As Section 2 indicated, this gap between the growth rate and the rate of interest on federal debt has important implications for the trend in debt to GDP ratios. However, Mauro and Zhou (2021) in a study of the interest rate-growth rate differentials of 55 countries over periods of up to 200 years, concluded "that after prolonged periods of low differentials based on average effective interest rates, marginal borrowing costs can rise suddenly and sharply, shutting countries out of financial markets at short notice." This means there is always a risk of sudden reversals in the currently "favourable" interest rate-growth rate differentials that could require relatively large fiscal adjustments to stabilize debt ratios.

The other factor affecting the trend in the debt ratio is the governments' primary budget balances. **Figure 4** shows the primary balances as a percentage of GDP for the FPTL sector from 1965 to 2020. These data, which are drawn from the Finances of the Nation database, indicate the FPTL sector has run primary surpluses over most of these 65 years. Notable recent exceptions were the relatively modest primary deficits in 2009 and 2010 and the unprecedented deficit in 2020 in response to the pandemic.

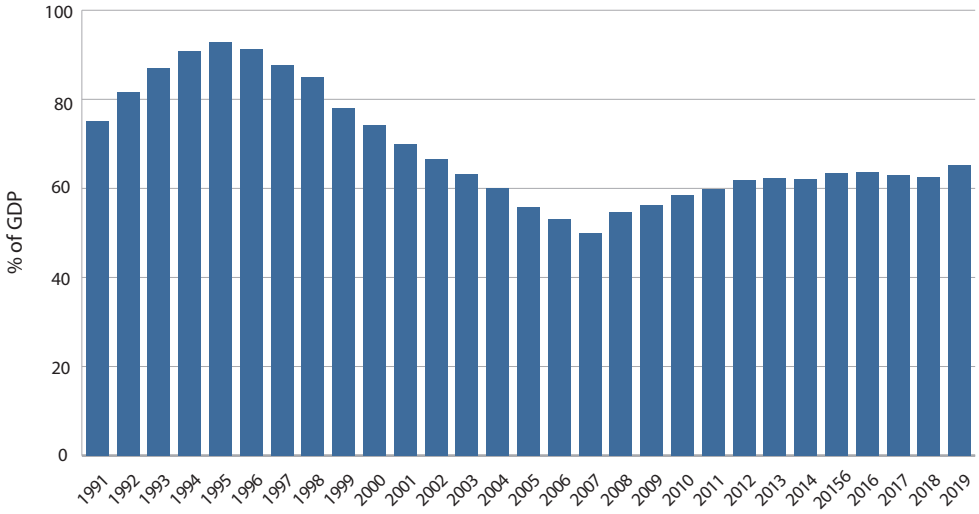
Figures 3 and 4 suggest that in recent years, under normal economic conditions, the combination of primary surpluses and growth rates in excess of interest rates should have produced a generally declining debt-to-GDP ratio for the FPTL sector. While **figure 5** shows a sharply declining net debt-to-GDP ratio from 1995 to 2007, when the FPTL sector was running very large primary surpluses, since 2008 the net debt-to-GDP ratio has slowly increased to 65 percent in 2019. This seems inconsistent with the primary surpluses and the favourable gap between the growth rate and the interest rate. However, we have used the federal interest rate on debt as a proxy for the average interest rate on debt for entire FPTL sector, and interest rates on provincial debt are generally above those paid on federal debt. These differences and the diverse sources used to calculate the primary balances of the FPTL sector in the Finances of the Nation database may explain this anomaly. Nonetheless, these data provide a useful baseline for analyzing fiscal policies that affect government deficits and the public debt.

Figure 4: Primary Balances of the FPTL Sector, 1965 to 2020



Sources: Finances of the Nation, 2022; calculations by authors.

Figure 5: The Net Debt to GDP Ratio of the FPTL Sector, 1991 to 2019



Sources: Finances of the Nation, 2022; calculations by authors.

4. The Economic and Financial Impacts of Government Deficits and Debt

The debt dynamics equation (1) is based on an accounting identity, and it does not indicate how the key economic variables—the interest rate on public debt and the growth rate of the economy—change with increases in the public debt ratio. In this section, we review the results from econometric studies on the impact of government deficits and debt on interest rates and economic growth rates.

4.1. Interest Rates and Public Debt

Blanchard et al. (2021) note that there are two channels through which government deficits and debt can raise interest rates on public debt. The first is crowding out of private sector investment, "which raises the marginal product of capital, and by implication increases all interest rates, risky or safe, in some proportion" (p. 9). The second "is the increase in the supply of sovereign bonds of a particular country relative to the total supply of sovereign bonds. Even in the absence of default risk, sovereign bonds from different member countries are not perfect substitutes, because of either liquidity or price-risk differences" (p.9).

Econometric studies have indicated that a one percentage point increase in the US government debt to GDP ratio is associated with a 2 to 5 basis point increase in the real interest rate on government debt. See Laubach (2003), Engen and Hubbard (2004), and Gamber and Seliski (2019). However, since changes in US deficits and debt levels can have a major impact on global financial markets, the more relevant studies from a Canadian perspective are studies of the effects of higher debt levels on interest rates in OECD countries.

Ardagna, Caselli, and Lane (2004) found that a one percentage point increase in a country's primary deficit relative to GDP increases contemporaneous long-term interest rates by about 10 basis points, based on data for 16 OECD countries from 1960 to 2002. However, they concluded that higher debt ratios only increased interest rates in countries with above average debt ratios. Kinoshita (2006) found that a one percentage point increase in government debt to GDP ratios increased long-term real interest rates by 4 to 5 basis points, based on a panel data from 19 OECD countries spanning 1971 to 2004. Similarly, Grande, Masciantonio, and Tiseno (2013), based on panel data for 18 OECD countries from 1995 to 2011, found that a one percentage point increase in the debt ratio increased interest rates by 3 basis points. A more recent study by Jiang et al. (2022) found that a one percentage point increase in a government deficit to GDP ratio increased the interest rate on government debt by about 10 basis points for nine EU countries from 2002 to 2020.

4.2. Growth Rates and Public Debt

Since the publication of Reinhart and Rogoff's book, *This Time Is Different*, many empirical studies have investigated the impact of public debt levels on economic growth rates. Puoni (2022) provides a recent survey of these studies. He notes that "the relationship between debt and growth is complex and depends on country-specific characteristics that may change over time ..." (p. 14). With this in mind, **table 2** summarizes the results of econometric studies based on data from advanced economies which are most relevant for Canada. While the widely cited study by Panizza and Presbitero (2014) did not find a significant relationship between public debt and economic growth, subsequent studies have generally documented a negative impact of public debt on growth. Perhaps the most comprehensive of these studies is by Woo and Kumar (2015) which concluded that a 10 percentage point increase in an advanced economy's debt ratio reduces the annual economic growth rate by 0.15 percentage points. Woo and Kumar (2015) also found that the adverse effect of public debt on growth was due to slower capital accumulation, i.e., reduced investment.

There are a variety of mechanisms by which higher public debt levels can reduce investment and hence economic growth. Higher public debt levels can mean higher taxes to finance higher interest payments and these erode incentives to save and invest. It can also result from reductions in infrastructure investment by governments. Increased government borrowing can also crowd out private investment in capital markets, even in open economies such as Canada, because of the well-documented "home bias" in allocation of investment funds. As interest rates on public debt increase with higher debt levels, the borrowing costs for private investment may increase. Higher public debt levels also increase the risk of fiscal and financial crises, and elevated uncertainty has a negative impact on private investment intentions.

The extent to which public sector deficits and debt crowd out private investment is an empirical question which has been addressed in a several recent studies. Salotti and Trecroci (2016) investigated the impact of public debt on private investment and productivity growth based on panel date for 20 OECD countries from 1970 to 2009. Their econometric model indicated that higher levels of government debt are associated with slower productivity growth, as well reduced private investment. They estimated that the elasticity of private investment to the government debt ratio was between -0.06 and -0.10. A more recent study by Kostarakos (2021), based on panel data for 28 EU countries from 1995 to 2019, found that a 10 percentage point increase in the public debt ratio was associated with a 2.3 percentage point reduction in the ratio of private investment to GDP and a 3.8 percentage point reduction in the public investment to GDP ratio. de Mendonça and Brito (2021) obtained similar negative impacts of public debt on investment in their study based on a sample of 24 emerging economies from 1996 to 2018, with a 10 percentage point increase in the public debt ratio associate with a 1.9 percent point reduction in private investment ratio and a 3.2 percentage point reduction in the public investment ratio. These studies of the adverse effect of public debt on investment explain why higher public debt levels are associated with slower rates of economic growth.

Table 2: Summary of Selected Studies on the Impact of Public Debt on Economic Growth

Study	Sample	Average impact
Checherita-Westhpahl and Rother (2010)	12 Euro area countries from 1970 to 2008	1 percentage points lower annual GDP growth rate from a 10 percentage point increase in the debt to GDP ratio.
Cecchetti et al. (2011)	18 OECD countries from 1980 to 2010	0.17 percentage points lower annual GDP growth rate from a 10 percentage point increase in the debt to GDP ratio.
Baum et al. (2013)	12 Euro area countries from 1990 to 2007	0.7 percentage points lower annual GDP growth rate from a 10 percentage point increase in the debt to GDP ratio.
Panizza and Presbitero (2014)	17 OECD countries from 1980 to 2010,	No evidence of a negative impact on growth rate.
Kumar and Woo (2015)	38 advanced and emerging economies 1970-2007	0.15 percentage points lower annual GDP growth rate from a 10 percentage point increase in the debt to GDP ratio.
Egbert (2015)	44 countries from 1960 to 2010	0.1 to 0.2 percentage points lower annual GDP growth rate from a 10 percentage point increase in the debt to GDP ratio.
Chudik et al. (2017)	19 advanced countries	Elasticity of GDP growth rate to the debt to GDP ratio between -0.02 and -0.07.
Gomez-Puig and Sosvilla-Rivero (2017)	11 Euro area countries from 1965 to 2010	Average 0.22 percentage point reduction in growth rate from 10 percentage point increase in debt to GDP ratio.

Source: Adapted from Puonti, 2022: Table 1, p. 11.

4.3. The r – g Gap and Public Debt

Given the evidence from econometric studies reviewed above that higher public sector debt ratios are associated with higher interest rates and slower growth rates, attention has turned to the factors that affect the differential between interest rates on public debt and growth rates because these two variables are interrelated, as Rachel and Smith (2015) pointed out, and because the differential is a key determinant of fiscal sustainability. An early study by Turner and Spinelli (2012) found that four factors had a significant impact on the interest rate–growth rate differential for 23 OECD countries from 1980 to 2010. First, a one percentage point reduction in the standard deviation of inflation rate eventually reduced the differential by about one percentage point. Second, a reduction in the difference between short- and long-term interest rates by one percentage point reduced the differential by 0.6 percentage points. Third, the emergence of the "global savings glut," as measured by the current account surpluses in Asian emerging markets and non-OECD oil exporters in the 2000s, reduced the differential by 1.25 percentage points. Fourth, and most importantly for our analysis, a one percentage point increase in the government debt ratio in excess of 75 percent raised the differential by 4 basis points.

Recent working papers from the IMF and the European Central Bank have also focused on the impact of higher government debt ratios on the r – g differential. Based

on a sample of 31 advanced economies from 1950 to 2019 and 25 emerging economies from 2000 to 2019, Lian, Presbitero, and Wiriadinata (2020) found that countries with higher debt ratios have "(i) a shorter duration of negative r - g episodes and a higher probability of reversal, (ii) higher average r - g, and (iii) a more right-skewed r - g distribution, that implies higher down-side risks." Checherita-Westphal and Domingues Semeano (2020) found that a 10 percentage point increase in the debt ratio increased the differential by 0.4-0.6 percentage points based on a sample of 12 euro area countries from 1985 to 2017. [7] They also found that the differential increased by 0.4 percentage points for every one percentage point increase in a country's output gap. In addition to these and other domestic factors, they found that a one percentage point increase in the US differential increased the euro area countries' differential by 0.3 percentage points. Alternatively, they also found that the current account surpluses of a group of Asian and commodity exporting economies was associated with a decline in the differential among the European area countries.

[7] These results were robust when the sample was expanded to 24 euro area countries from 1999 to 2017.

5. The Fiscal Costs of Debt-Financed Spending

This review of the econometric studies indicates that growth rates decline, interest rates increase, and the interest rate–growth rate differential increases as a country's public debt ratio increases. This raises two important questions. First, *as the debt ratio increases, how does the increase in the r – g differential affect the primary budget balance that is required to stabilize the debt ratio?* Second, *what is the fiscal cost of a deficit-financed increase in program spending when the r – g differential increases with the debt ratio?* In this section, we try to answer these two questions based on a simple regression model of the responsiveness of the r – g differential to the debt ratio for the Canadian FPTL sector.

With regard to the first question, Mian, Straub, and Sufi (2022) have developed a theoretical model for deriving the primary balances that are consistent with a stable debt ratio when r - g increases as the debt ratio increases. They call the resulting relationship the *deficit-debt locus* and they approximate this relationship for US and Japanese governments based on empirical literature on the elasticities of interest rates to government debt.

To derive the deficit-debt locus for Canada, we estimate a simple linear regression model of the form:

$$v_t = a0 + a1 \bullet b_t + a2 \bullet US(r - g) + \varepsilon \qquad (3)$$

where v_t is the r – g gap in Canada based on the annual data from 1991 to 2019, b_t is FPTL debt ratio, US(r – g) is the r – g gap for the US government and ε is a random error term. The US r – g differential is included in the regression model to capture the international factors affecting the growth rate and interest rate in Canada. The regression results are shown below with the t statistics in brackets.

$$CDN\,(r - g) = \underset{(3.17)}{-0.661} + \underset{(6.03)}{1.193}\,US(r - g) + \underset{(2.19)}{0.0674}\,Debtratio \qquad R^2 = 0.669 \qquad (4)$$

While the model is very simple, it captures the two key determinants of the r – g gap in Canada—international financial and economic conditions, and the public sector debt ratio. Both the debt ratio and the US (r – g) gap are statistically significant at the 5 percent level. This indicates that, while international trends in interest rates and growth rates affect the r – g gap in Canada, the debt ratio in Canada also affects the r – g gap. In particular, the positive coefficient on the debt ratio implies that a higher public debt ratio in Canada raises the interest rate on debt and/or reduces the economic growth rate. Note also the coefficient estimate on the debt ratio, 0.0674, is within the range of

estimated values in the Checherita-Westphal and Domingues Semeano (2020) study for the eurozone countries.

Recall that the primary budget balance that is required to stabilize the debt ratio is pr = (r – g)b. The primary budget balance that is required to stabilize the debt ratio in Canada can be written in terms of the coefficients of the linear regression model as:

$$pr = (a0 + a3 \bullet US(r - g)) \bullet b + a1 \bullet b^2 \quad (5)$$

Substituting the coefficient estimates from the regression model into the above equation and evaluating US(r – g) gap at its 2019 value, -0.00145, in order to reflect the pre-pandemic real interest rates and economic growth rates in the US and other countries, the primary balance required to stabilize the debt ratio of the FPTL sector in Canada is:

$$pr = -0.06783 \bullet b + 0.0674 \bullet b^2 \quad (6)$$

The PR curve in **figure 6** is the deficit-debt locus for the FPTL sector based on equation (6). It indicates that the maximum sustainable primary deficit is 1.7 percent of GDP when the net debt ratio is about 50 percent of GDP. It also indicates that the current debt ratio of 70 percent of GDP can be maintained with a primary deficit of 1.4 percent of GDP and that the FPTL sector can run primary deficits and still stabilize debt ratios of up to 100 percent of GDP. This seems to imply that the fiscal cost of deficit-financed program spending is low in the sense that the tax revenues can be less than program spending as long as the debt ratio is less than 100 percent of GDP.

To show why this perception is misleading, we will define the average fiscal cost of program spending as the ratio of the taxes to program spending. When r – g is negative, the debt ratio can be stabilized with a primary deficit and therefore the average fiscal cost (AFC) of program spending is less than one. In symbols, AFC = 1 + (r – g)(b/γ) where γ is the ratio of program spending to GDP. However, while the average fiscal cost of program spending is less than one when (r – g) is negative, the marginal fiscal cost (MFC) of a debt-financed spending increase can be greater than one if r – g increases with the debt ratio. In other words, the increase in taxes needed to stabilize the debt ratio can exceed the increase in program spending if the r – g differential increases with the debt ratio. In symbols, MFC = 1 + (r – g)(1 + η) where η is the elasticity of (r – g) with respect to the debt ratio. If (r – g) is negative, MFC is greater than one if η is less than -1.

Table 3 provides a numerical example where the marginal fiscal cost of a debt-financed increase in program spending is greater one. It is assumed that in the initial situation r – g is - 1.44 percentage points and the debt ratio is stabilized at 70 percent of GDP. The primary deficit is 1.008 percent of GDP. Program spending is 37 percent of GDP and the average fiscal cost is 0.973. (All numbers are rounded to three decimal points.) Based on the regression model in (4), a one percentage point increase in the debt ratio increases the r – g differential by 6.74 basis points. Given these values, η = -3.276 and therefore the condition for MFC to be greater than one is satisfied.

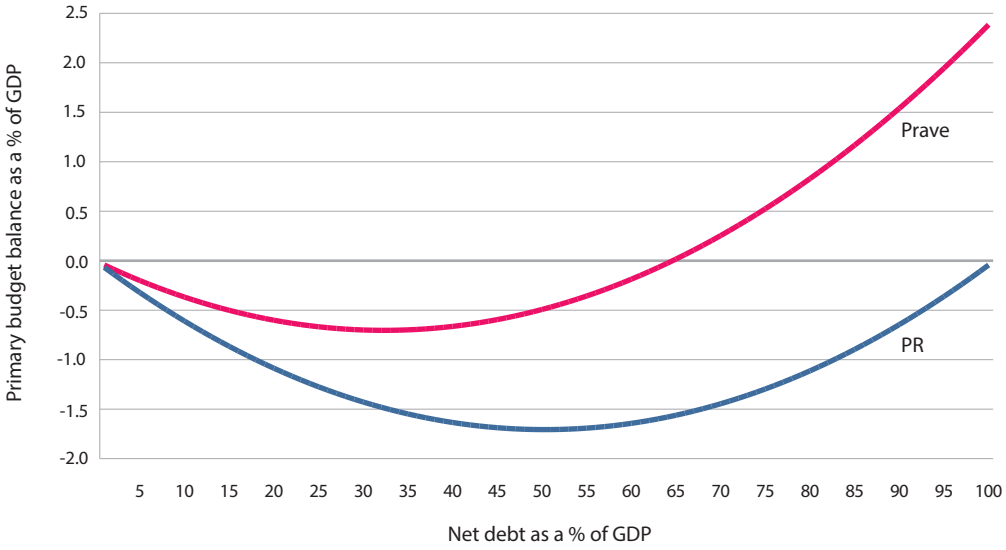
Table 3: The Average and Marginal Fiscal Cost of a Debt-Financed Increase in Program Spending

Increase in the Debt Ratio (percentage points)	Primary Deficit (percentage of GDP)	r - g (percentage points)	Average Fiscal Cost	Marginal Fiscal Cost
1.00	0.976	-1.375	0.974	1.032
2.00	0.944	-1.311	0.974	1.067
3.00	0.910	-1.246	0.975	1.104
4.00	0.874	-1.181	0.976	1.144
5.00	0.837	-1.117	0.977	1.187

Note: In the initial situation, the real interest rate is 0.36 percent, the growth rate is 1.80 percent, the debt ratio is 70 percent, and the primary deficit is 1.008 percent of GDP. Program spending is 37 percent of GDP..

Source: Calculations by authors.

Figure 6: Primary Budget Balances Required to Stabilize Debt Ratios



Source: Calculations by authors.

We use the model to simulate the long run impact of a permanent debt-financed one percentage point increase in the program expenditure ratio. As the debt ratio increases and r – g increases, the primary deficit that is required to stabilize the debt ratio declines. As a result, average fiscal cost increases. As every first year student of economics knows, when average cost increases, marginal cost is greater than average cost. The first row in the Table 3 shows that if a one percentage point increase in program spending results in a one percentage point increase in the debt ratio, a smaller primary deficit (0.976 percent versus 1.008 percent of GDP) is required to stabilize the debt ratio, given the 6.74 basis point increase in the r - g differential. As a result, the average fiscal cost increases from 0.973 to 0.974. The marginal fiscal cost is 1.032. In other words, a tax increase that is 3.2 percent higher than the increase in program spending is required to stabilize the debt ratio when the debt ratio increases by one percentage point. The other rows in the table show the average and marginal fiscal costs of a one percentage point increase in program spending if the fiscal adjustment is delayed and the debt ratio increases by more than one percentage point. In particular, if the spending increase results in a five percentage point increase in the debt ratio, an additional $1.00 of program spending means that taxes have to increase by $1.187 to stabilize the debt ratio. Therefore, contrary to the widely held view, there is no fiscal free lunch from debt-financed increases in program spending even though r – g is negative.

Furthermore, even though it appears that the average fiscal cost of program spending is currently less than one, it is prudent to lower debt ratios in the event that international economic conditions change, with higher interest rates and lower growth rates, reversing the currently favourable r – g gap in Canada. If we use the average US r – g gap for the period 1991 to 2019 as the reference value for international conditions, the deficit-debt locus would be the PRave curve in figure 6. In this case, the FPTL sector would have to maintain a primary balance of 0.3 percent of GDP to maintain the debt ratio at 70 percent of GDP. In other words, if the average US(r – g) gap over the last 30 years represents a return to normal conditions in the global economy, then a large fiscal adjustment equal to 1.7 percent of GDP would be required to stabilize the current debt ratio of 70 percent of GDP. This illustrates why prudent Canadian governments should adopt fiscal policies that lower their public debt ratios.

6. Conclusion

Governments have to re-examine their fiscal anchors in light of the substantial increases in public sector debts due to the pandemic. At the same time, prominent economists have advocated for less restrictive fiscal policies in view of the low interest rates on public debt. In this paper, we have shown that a favourable interest rate-growth rate differential can mislead policy makers into believing that debt-financed increases in program spending have a low a fiscal cost. Econometric studies indicate that higher debt levels lead to higher real interest rates and lower growth rates. We have shown that the marginal fiscal cost of deficit-financed spending increases can be greater than one if the difference between the real interest rate on government debt and the economy's growth rate increases with the debt ratio. That is, the increase in taxes needed to stabilize the debt ratio can exceed the increase in program spending if this differential increases with the debt ratio. Accordingly, there is no fiscal free lunch when the real interest rate on government debt is less than the economy's growth rate.

It is also important to reiterate that the economic cost of debt-financed government spending is the loss of private sector incomes when government borrowing crowds out private investment and lowers the economy's productive potential.

An additional reason for exercising fiscal prudence in the current low real interest rate environment is that international conditions may quickly change and the gap between the interest rate and the growth rates could be reversed. Such a reversal would require a large fiscal adjustment to stabilize the public debt ratio at its current level.

The case for Canadian governments to adopt fiscal anchors that lower debt-to-GDP ratios seems compelling. However, lowering the debt-to-GDP ratio means reducing primary deficits or even running primary surpluses for an extended period. Such a fiscal adjustment would involve lower spending on public services, public infrastructure, and transfers to people and businesses, and/or higher taxes. The particular fiscal package that governments adopt will have an impact not only on the services provided by government, but also on the productive capacity of the economy. In a future paper, we will examine how the fiscal adjustment required to lower debt-to-GDP ratios in Canada could affect economic growth and Canadians' standard of living.

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