The Impact of Government Debt on Labour Productivity in Canada

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Contents

Executive summary

- Labour productivity plays a crucial role in powering economic growth and improving living standards. Consequently, many commentators express their concerns over the slowdown of Canada's productivity, which became more pronounced after the COVID-19 pandemic.

- A legacy of the pandemic is the rise in budget deficits and government debt at both federal and provincial levels. Canada's ratio of general government gross debt to GDP surged by 28 percentage points from 2019 to 2020, the highest among the G7 countries. Currently, Canada has the 7th highest debt ratio among 38 advanced economies.

- This study investigates the impact of Canada's general government gross debt on labour productivity. It finds that a ten percentage-point reduction in the ratio of general government gross debt to GDP increases the growth rate of labour productivity by about 1.04%.

- The study suggests that, if Canada's ratio of general government gross debt to GDP were gradually reduced over five years to its pre-pandemic level, labour productivity would increase by about 1.6% at the end of the fifth year, compared to the baseline scenario where there is no debt reduction. This would raise Canada's output per hour worked by $1.01 and could boost the annual income of an average employee working 40 hours a week by approximately $2,100, adjusted for inflation.

- A key policy takeaway is that governments should curb deficit-financed spending and reduce debt to reverse the slowdown in labour productivity. In this context, relying on credible fiscal anchors could help the government prevent excessive debt accumulation during adverse budgetary shocks.

1. Introduction

Labour productivity—the level of output produced per unit of labour—plays a crucial role in powering economic growth and improving living standards in a country. This study looks closely at the evolution of Canada's labour productivity over time, comparing it with those of similar countries such as the United States and other OECD countries. Many commentators and researchers have expressed deep concerns over how improvement of the country's productivity has slowed and the implications of this for the growth of wages and overall living standards for Canadians. Indeed, the Bank of Canada's Senior deputy governor, Carolyn Rogers, describes the slowdown in labour productivity as an economic "emergency" for the country (Rogers, 2024).

The decline in Canada's labour productivity became more pronounced after the COVID-19 pandemic. From 2019 to 2023, Canada's annual average labour-productivity growth rate in the business sector was just 0.13%. In contrast, the United States saw a much higher growth rate of 1.94% during the same period.[1] As a result, in 2023, the last year for which comparable data is available, Canada ranks 18th out of 37 OECD countries in labour productivity, suggesting that the country lags far behind in labour productivity among its peers. In this regard, a relevant question is: Can Canada solve its productivity problem using appropriate fiscal policies? Previous studies have explored the critical productivity question in relation to tax policies, fiscal discipline, and reductions in red tape (Mintz, 2021; Whalen and Fuss, 2021). This study, on the other hand, focuses on the impact of government debt on labour productivity.

One of the main legacies of the COVID-19 pandemic in Canada is the increased budget deficits and public debt accumulated by both the federal and provincial governments. More specifically, the adverse effects of the pandemic on the overall economy and the pandemic-related deficit-financed increases in government spending caused a massive deterioration in the federal and provincial governments' overall budget balances. As a result, Canada's general government gross debt-to-GDP ratio rose by about 28 percentage points between 2019 and 2020, the highest increase among the group of seven (G7) advanced countries (IMF, 2024). Thus, given Canada's

1 US government debt instruments are considered one of the safest (i.e., risk-free) investments. In addition, the United States has a dominant global currency and the largest and a well-diversified economy. Among other things, these two factors create a strong demand for US government debt instruments and help the government maintain and enjoy low interest rates even as its debt-to-GDP ratio rises (Reinhart and Rogoff, 2008). Because of these realities, the effect of a rise in government debt on the interest rate and its adverse impact on labour productivity is likely to be higher in Canada than in the United States. This may partly explain why labour productivity is higher in the United States than in Canada, even though the former has a higher government debt ratio.

relatively poor performance in labour productivity and the focus on this critical issue among academic and policy circles, one may wonder whether government debt plays some role.

One channel through which government deficits and debt can affect labour productivity is through its effect on the interest rate—the crowding out effect—which, in turn, can adversely affect investment. Blanchard (2019; 2022) argues that increasing government debt raises the interest rate, thereby reducing investment. Indeed, some of the previous empirical studies, such as those by Engen and Hubbard (2004), Laubach (2009), Gamber and Seliski (2019), and Neveu and Schafer (2024) find that a one percentage-point rise in the US government debt-to-GDP ratio is associated with an increase of two to five basis points in the real interest rate on government debt. Similarly, Ardagna, Caselli, and Lane (2004), Kinoshita (2006), Jiang, Lustig, Van Nieuwerburgh, and Xiaolan (2022), and others also find empirical evidence supporting the positive effects of government debt on interest rates using data from OECD countries.[2] A recent Canadian study by Dahlby and Ferede (2023) also find a positive effect of government debt on the interest rate.

In addition, adverse fiscal environments can cause businesses to face elevated uncertainty as they may expect future hikes in tax rates to finance the debt. The rise in business uncertainty as a result of higher government debt and the increase in the interest rate discourages private investment, and will have a negative effect on overall capital accumulation.[3] When workers have less capital to work with, their labour productivity can decline, and the country can face a slowdown in productivity growth, implying a negative association between government debt and labour productivity.

In one strand of the empirical literature, earlier researchers examine the impact of government debt on labour productivity. These empirical studies include those by Alfonso and Jalles (2013), Salotti and Trecroci (2016), and Carvelli and Trecroci (2024), who find empirical evidence of a negative relationship, where high budget deficits and high public debt result in significant declines in aggregate investment and productivity growth.[4]

This empirical study investigates the impact of Canada's ratio of general government gross debt to GDP on business-sector labour productivity using time series data from 1980 to 2023,

2 See Dahlby, Ferede, and Fuss, 2022 for a survey of the some of the earlier studies.

3 Note also that, in the context of a small open economy, when governments accumulate excessive debt, investors may consider the debt risky and require a risk premium, increasing the borrowing costs for all investors in the country and adversely affecting capital accumulation (see for instance, Alesina, De Broeck, Prati, and Tabellini 1992).

4 Another strand of the literature focuses on the impacts of government debt on economic growth, rather than labour productivity. Falling in this strand are studies such as Reinhart and Rogoff, 2010, Woo and Kumar, 2015, Cecchetti, Mohanty, and Zampolli, 2011, Checherita-Westphal and Rother, 2012, Heimberger, 2022 and the Canadian studies, Childs, 2024 and Dahlby and Ferede, 2023. See Salmon, 2021 for a more recent review of the relevant literature.

with the results showing that general government gross debt has a statistically significant negative effect on labour productivity in the country. The main empirical result of this study indicates that a ten percentage-point reduction in Canada's ratio of general government gross debt to GDP leads to an increase in the labour productivity growth rate by about 1.04%. The empirical finding of a statistically significant negative association between government debt and labour productivity is robust to various sensitivity checks and consistent with results obtained by similar previous studies on the issue.

Furthermore, we use the principal empirical estimates of the study to simulate the possible impacts of government debt reductions on labour productivity under alternative scenarios. The main result of this study suggests that, if the Canadian ratio of general government gross debt to GDP was gradually reduced over five years from its current level of 106% to the pre-pandemic level of 90%, business-sector labour productivity would increase by about 1.6% at the end of the fifth year, compared to the baseline scenario with no reduction in government debt.[5] This is equivalent to a rise in output per hour worked by about $1.01, adjusted for inflation. For average Canadian employees working 40 hours a week, this improvement in labour productivity would lead to an increase in their annual income of around $2,100 after accounting for inflation. This represents the tangible benefits Canadian workers and businesses could reap if Canada's federal and provincial governments take decisive steps to reduce the national debt.

An important policy implication of this study is that even small reductions in the country's debt level, coupled with a commitment to maintaining it at lower levels, can lead to gains in labour productivity and enhance living standards. Therefore, a key policy takeaway from this study is that governments should curb deficit-financed spending and reduce government debt to reverse the slowdown in labour productivity and improve living standards. In this context, relying on credible fiscal anchors could help the government prevent excessive debt accumulation during adverse fiscal shocks

The remainder of the study is organized as follows. Section 2 provides a brief discussion of the background to the issues surrounding government debt and labour productivity in the country. The empirical analysis is presented and discussed in section 3. The main policy implications of the study are highlighted in section 4. Section 5 concludes.

5 A government's gross debt is more comprehensive, encompassing all liabilities requiring principal and interest payments. In contrast, net debt is a narrower measure calculated by subtracting the government's financial assets from its gross debt. This study's empirical analysis uses gross rather than net debt because the former is more comprehensive and reflects the actual burden of government debt. The European Union also uses such a debt measure in its fiscal rules target. See Fuss, Palacios and MacLeod, 2024 for a discussion of this issue.

2. Background

This section provides background on two key variables of interest: labour productivity and the ratio of general government gross debt to GDP. Labour productivity is generally defined as output produced per unit of labour. In this regard, our two main data sources, Statistics Canada and the Organisation for Economic Co-operation and Development (OECD), commonly define labour productivity as real GDP per hour worked. During the period under consideration, labour productivity and government debt show significant variations, and it is essential to shed light on their evolution and change so that one can contextualize Canada's performance with its peers.

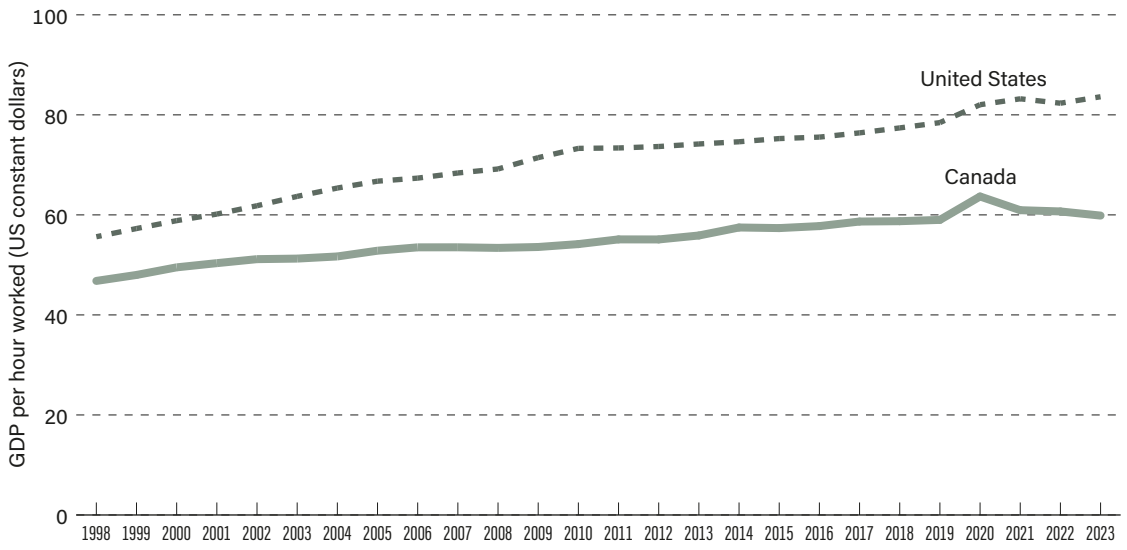
Labour productivity

The empirical analysis of this study focuses on labour productivity as it is generally considered the key to fostering economic growth and improving living standards. **Figure 1** shows the evolution of Canada's aggregate labour productivity over the period from 1998 to 2023. To contextualize Canada's performance, we also show the labour productivity of the United States over the same period. For both countries, the figure plots GDP per hour worked (in US constant dollars), indicating that it shows the economy's aggregate labour productivity rather than just the business sector. As the dataset for both countries comes from the OECD (2025a), it is directly comparable and helps us shed some light on the trend of labour productivity. Note that the figure begins in 1998 because directly comparable labour productivity data for the two countries is not available for the earlier years. Furthermore, although this study mainly focuses on labour productivity in the business sector, we show aggregate labour productivity in the figure for comparison purposes because there are no directly comparable labour productivity data related to the business sectors for the two countries.[6]

Figure 1 shows that the labour productivity for both countries largely trended upward during the period under consideration. Although the aggregate labour productivity increased in both countries during the period, the two countries exhibited a significant divergence in the labour productivity growth rates. In 1998, Canada's labour productivity was about 84% of the that in the United States. However, Canada's labour productivity growth rate slowed over the years, and

6 For Canada, while Statistics Canada (2025f) provides labour productivity measured as an index for the business sector in Canada, Federal Reserve Economic Data (FRED) offers a similar type of measure for the United States. Since these datasets are presented as an index with a specifically chosen base year (i.e., 2017=100), it is impossible to use them to compare the level of labour productivity in the two countries. However, one can use such datasets to compare labour productivity growth rates, as shown in figure 2.

Figure 1: Trends in labour productivity in Canada and the United States, 1998–2023



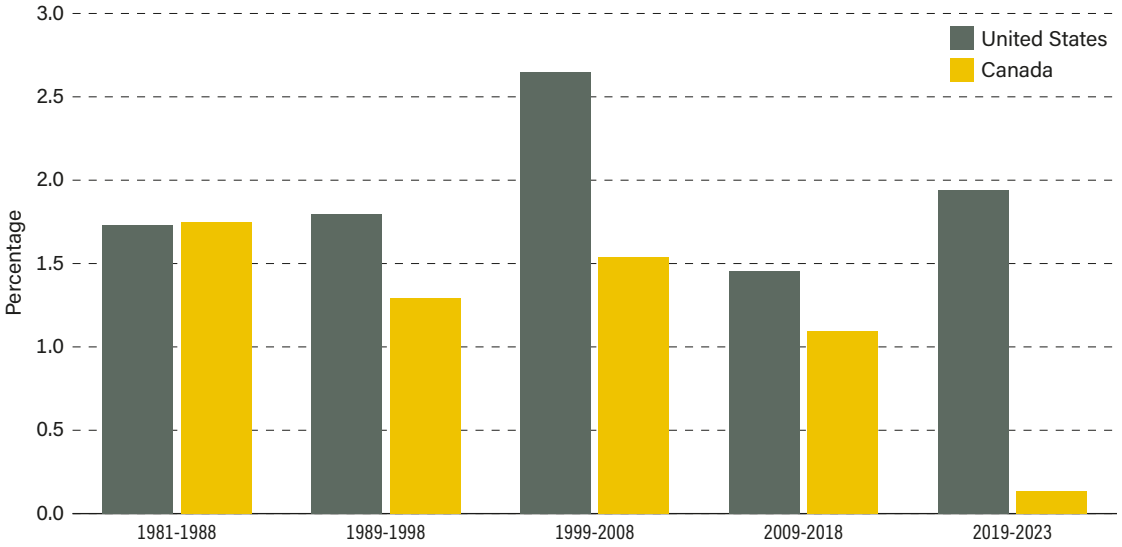
Note: GDP per hour worked (in US constant dollars), showing the economy's aggregate labour productivity.
Source: OECD, 2025a.

the gap between the two countries' labour productivity widened. As a result, in 2023, Canada's labour productivity stood at 71.6% of the corresponding value for the United States. Not surprisingly, many commentators and policy analysts express their concern about the slowdown in the growth of Canada's labour productivity in recent years.

To visualize the trends in Canada's labour productivity growth slowdown during the period under consideration, we plot the average annual growth rates of labour productivity over different time periods in **figure 2**. We also include the corresponding figures for the United States for ease of comparison.[7] The figure shows that, while Canada's and the United State's labour productivity growth rates were similar in the 1980s, the performance of the two countries showed a marked divergence afterwards, with Canada consistently experiencing a lower rate of labour productivity growth than the United States. The slowdown in Canada's labour productivity growth rate has become more pronounced since 2009. Furthermore, as figure 2 shows, Canada's labour productivity growth rate fell dramatically since the COVID-19 pandemic. Over the 2019-to-2023 period, Canada's annual average labour productivity growth rate was merely 0.13%, while the comparable figure for the United States over the same period was 1.94%. Such differences in the labour productivity growth rate can amount to significant variations in economic growth and living standards in the two countries in the long term.

7 Note that for both countries the figure shows labour productivity growth rates in the business sector and are computed from labour productivity measures constructed as indexes.

Figure 2: Average growth rates (%) of labour productivity in Canada and the United States, various periods, 1981–2023



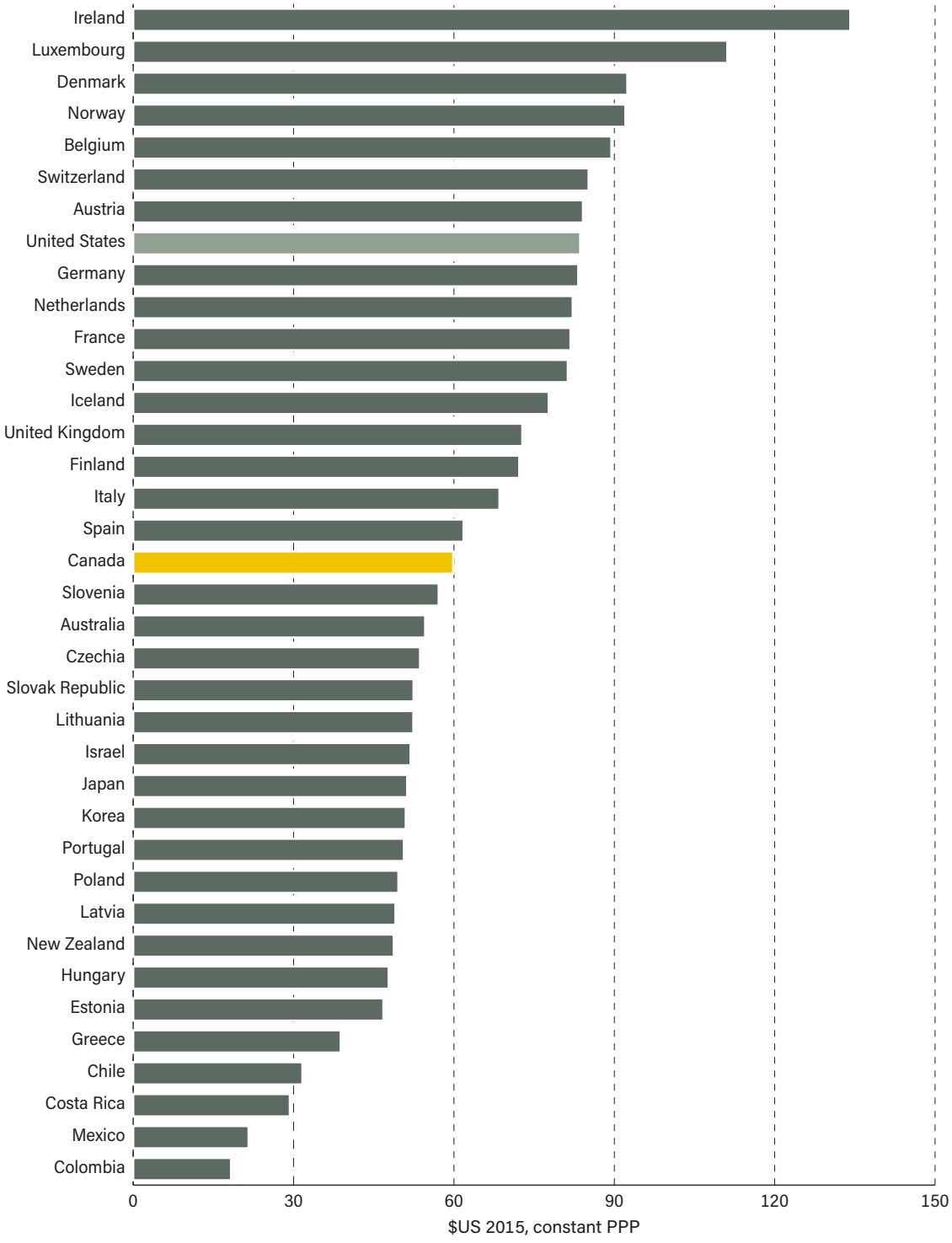
Note: For both countries the figure shows labour productivity growth rates in the business sector and are computed from labour productivity measures constructed as indexes.
Source: Statistics Canada, 2025f; Federal Reserve Economic Data (FRED), 2025.

Although most discussions on Canada's labour productivity growth focus on comparing it with performance in the United States because of the close relationship between the two economies, one will obtain a better picture of Canada's relative standing if we compare the country with other multiple advanced countries. Accordingly, in **figure 3**, we illustrate the labour productivity of OECD countries for the year 2023. Note that while our previous discussion of figure 2 focused on the business-sector labour productivity, figure 3 illustrates the OECD labour productivity, which is measured as GDP per hour worked in US dollars, comparing the whole economy and not just for the business sector. The numerical values also show US dollars per hour, measured in constant 2015 prices. Of the 37 OECD countries, Canada ranks 18th in labour productivity, suggesting that the country is lagging far behind the labour productivity of many of its peers.

Ratio of gross debt to GDP

Given Canada's poor performance in labour productivity, an important question would be: what are the contributions of the country's fiscal environment? In the literature, government debt is often considered an essential indicator of the fiscal health of an economy. Thus, we now turn our attention to Canada's overall general government debt. This study focuses on the country's ratio of general government gross debt to GDP. Note that the definition of general government includes both the federal and provincial governments so that the fiscal impacts of all levels

Figure 3: Labour productivity ($US per hour) in OECD countries, 2023



Note: Labour productivity is measured as GDP per hour worked in US dollars, PPP converted constant prices 2015, for the whole economy.
Source: OECD, 2025a.

of government are captured. In various government reports and documents released by the International Monetary Fund (IMF) (e.g., IMF, 2024), there are two standard definitions of government debt: Gross debt and Net debt. A government's gross debt is a broader measure that includes all government liabilities that require payments of principal and interest. Net debt, on the other hand, focuses on a narrower definition, which is simply obtained as the gross debt of the government minus its financial assets. This study uses gross debt, which is more comprehensive and reflective of the actual burden of government debt, as argued in Fuss, Palacios and MacLeod (2024). In fact, as Barnes, Botev, and Rawdanowicz (2012) discussed, the European Union's (EU) fiscal rules target also uses such a debt measure.

Canada's ratio of general government gross debt to GDP exhibited a marked rise over the period from 1980 to 1996 (**figure 4**). However, the country's debt continuously declined over the period from 1997 to 2007. The onset of the Great Recession and its aftermath caused the Canadian federal and provincial governments to run significant budget deficits and, as a result, the country's ratio of general government debt to GDP began an upward trend in 2007 and continued afterwards.

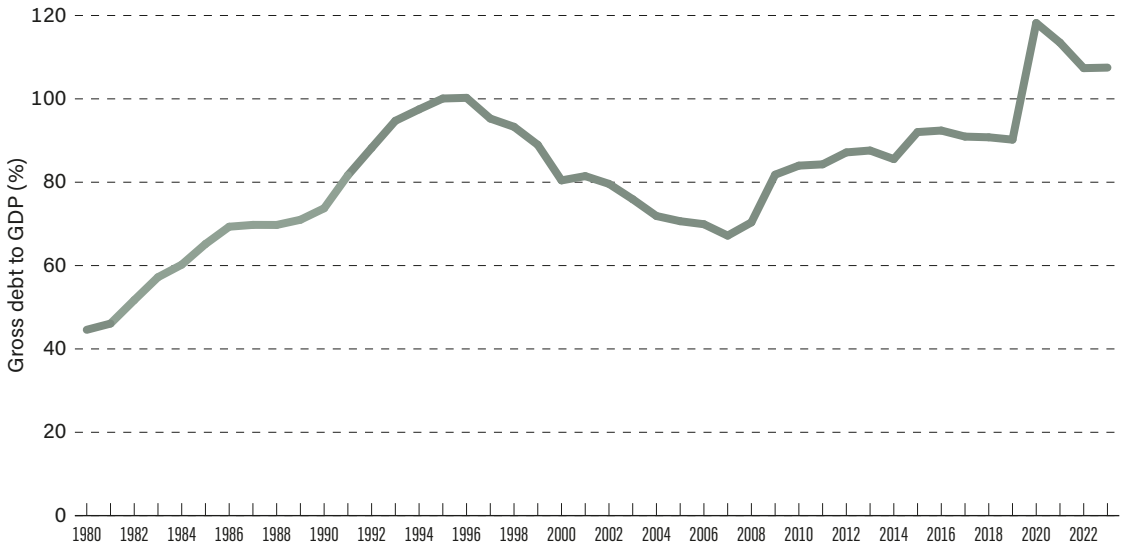
Perhaps the greatest jump in the country's ratio of gross government debt to GDP occurred in 2020 as a result of the COVID-19 pandemic. The adverse effects of the pandemic on the overall economy and tax revenue, as well as the pandemic-related deficit-financed increases in government spending, caused a massive deterioration in the government's overall budget balances.[8] As a result of this, Canada's ratio of general government debt to GDP rose by about 28 percentage points. Indeed, as **figure 5** shows, this spike in ratio of general government debt to GDP is the highest among the advanced group of seven (G7) countries.

The dramatic increase in Canada's ratio of general government debt to GDP as a result of the COVID-19 pandemic indicates that the government needs to be cognizant of possible future fiscal shocks that can have a severe impact on the government's overall fiscal position. If the country's general debt level remains elevated, this can have adverse effects on the overall economy and the country's global competitiveness. In fact, in 2023, the latest year for which there is complete actual data, Canada's burden of general government gross debt represented about 107% of the national economy, and the country ranked 7th highest for its debt-to-GDP ratio among a group of 38 advanced countries. This indicates a seriously weak fiscal position for the country to meet any future significant shock (IMF, 2024) (**figure 6**).[9]

8 See Fuss and Hill (2022, 2023) and Tombe (2020) for discussion of pandemic-related government spending and budgetary situations in Canada.

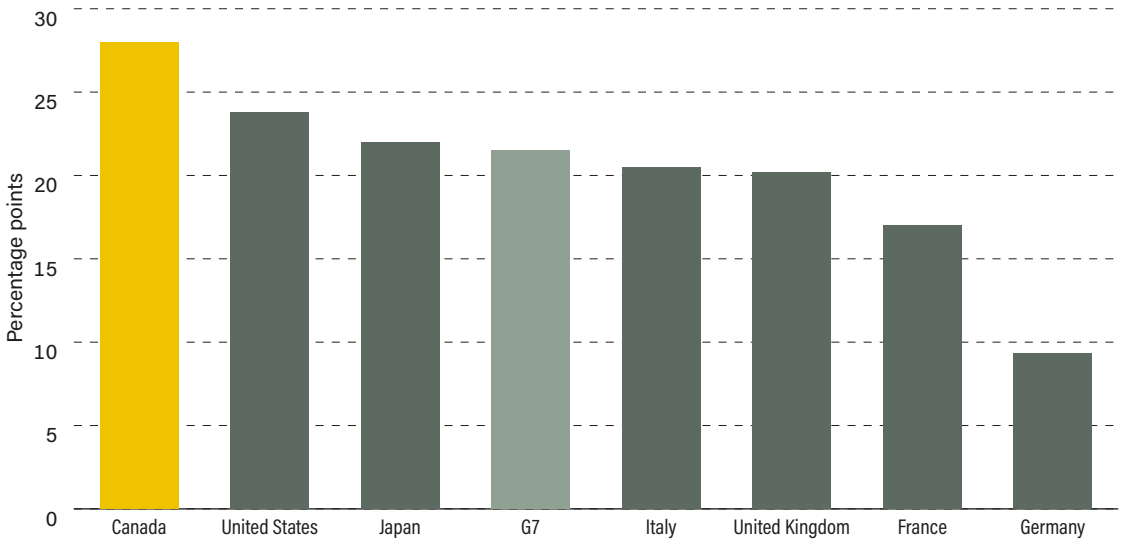
9 According to estimates by the IMF (2024), Canada's ratio of general government gross debt to GDP in 2024 was about 106%, and the country's ranking among the group of advanced countries remained unchanged.

Figure 4: Ratio (%) of general government gross debt to GDP, Canada, 1980–2023



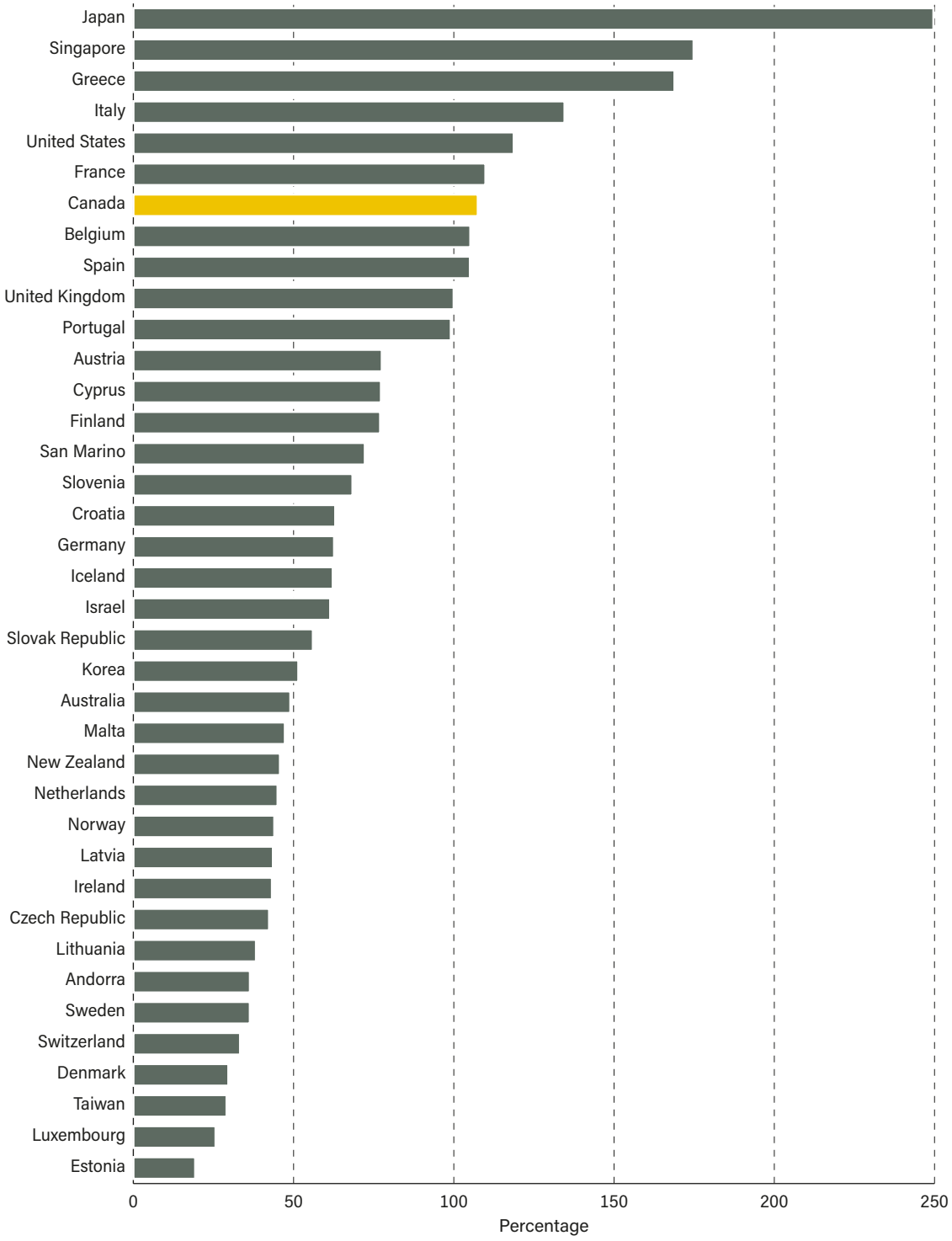
Source: International Monetary Fund, 2024.

Figure 5: Percentage-point increase in the ratio of general government debt to GDP as a result of the COVID-19 pandemic, Canada, G7, and other countries, 2020



Source: International Monetary Fund, 2024.

Figure 6: Ratio (%) of general government gross debt to GDP, Canada and other advanced countries, 2023



Source: International Monetary Fund, 2024.

The spike in the country's general government gross debt from the COVID-19 pandemic and the observed post-pandemic slump in the growth of labour productivity have recently come to the forefront of public policy discussions. Thus, in the next section, using time-series data over the period from 1980 to 2023, this study empirically investigates the possible impact of Canada's general government gross debt on labour productivity in the business sector. Such an analysis will contribute to the ongoing policy discussions on the critical issue of the slowdown in the growth of the country's labour productivity.

3. Empirical Results and Discussions

3.1 Specification and data

In this section, we provide a brief description of the empirical specification and the relevant economic variables used in the model. The empirical analysis of this study is based on the theoretical underpinnings discussed previously. Thus, we use a simple empirical model that has been commonly employed in similar empirical studies such as those of Chand (1999), Valadkhani (2003), Belorgey, Lecat, Maury (2006), and Salotti and Trecroci (2016). The basic model for the empirical analysis is specified in a reduced form as:

$$\Delta \ln Y_t = \beta_0 + \beta_1 \Delta(GGD_t) + \beta_2 \Delta Edu_t + \beta_3 \Delta Inf_t + Z_t + u_t \quad (1)$$

where Δ denotes change, Y_t represents labour productivity in year t, as measured by output per hours worked (in 2017 dollars), so that ln (Y_t) represents the logarithm of labour productivity in year t. Further, *GGD* is the ratio of general government gross debt to GDP, *Edu* is the level of education, *Inf* is the inflation rate, and u_t denotes the error term. In addition, Z represents a vector of other control variables that can affect labour productivity, which are discussed below. Note that the dependent variable in equation (1) is the change in the logarithm of output per hour worked, and it represents the annual labour productivity growth rate. More specifically, we use labour productivity in the business sector, as this has been the focus of discussions in previous commentaries and analyses. Further, as discussed before, we use general government gross debt rather than net debt.[10]

In equation (1), we are interested in the coefficient of the debt-to-GDP ratio (β_1), which indicates the response of labour productivity to changes in the ratio of general government gross debt to GDP. More specifically, β_1 shows the percentage change in labour productivity associated with a one percentage-point change in the ratio of general government gross debt to GDP. Previous theoretical and empirical studies highlight that interest rates generally increase when governments face large budget deficits and accumulate substantial debt. These fiscal conditions also create more significant uncertainty for businesses, as they may foresee future tax hikes to

10 We also use the ratio of general government net debt to GDP in our sensitivity analysis to check the robustness of the main results of the study.

finance the debt. Such uncertainty, combined with higher interest rates, discourages private investment and slows down overall capital accumulation. With less capital available to workers, labour productivity declines, assuming all other factors remain constant. Thus, we expect β_1 to be negative, suggesting a negative relationship between government debt and labour productivity.

In time-series empirical analysis such as ours, spurious regression can affect the results if the variables of interest are non-stationary.[11] To address such a concern, equation (1) is specified in terms of first-differences or change forms. As presented in **table A1.2** in the appendix (p. 28), the time series properties of the main variables satisfy the requirements that they are non-stationary and, hence, the results obtained from such a regression are statistically appropriate.

In addition to government debt, other variables can influence labour productivity in the country. One such variable often considered in the literature is the level of education. Higher levels of education equip workers with advanced skills and specialized knowledge, which enables them to perform tasks more efficiently, adopt new technology easily, and directly boost productivity. Consequently, previous studies such as those by Valadkhani (2003) and Salotti and Trecroci (2016) control for the level of education in their empirical model. Thus, we include education, which is measured by the share of the population with a university degree, as an additional explanatory variable in the model.

The country's monetary policy, which primarily focuses on stabilizing the inflation rate, can influence the country's labour productivity through its effects on investment and general business uncertainty. When the central bank raises the interest rate to reduce the inflation rate, it can have an adverse impact upon capital accumulation, which ultimately reduces labour productivity. To capture such effects of the monetary policy, following previous studies such as that of Salotti and Trecroci (2016), we include the country's inflation rate as an explanatory variable in equation (1). For the reasons described above, we expect the coefficient of the inflation rate to be negative.

In addition to the key explanatory variables described above, labour productivity can be influenced by other determinants. In equation (1), Z denotes a vector of such control variables that can affect labour productivity. We discuss the justifications and relevance of these additional explanatory variables along with the empirical results in the next section. The definitions of the variables and their data sources are shown in **table A1.1** in the appendix (p. 27).

Our empirical analysis is based on time-series data for the country over the period from 1980 to 2023. The study's sample period is restricted by the availability of relevant data for our key variables of interest. The data come from various sources, as summarized in table A1.1 in the appendix. The ratios of general government gross and net debt to GDP come from the International Monetary Fund (IMF) World Economic Outlook Database (2024). Data on labour

11 Economic variables are considered "nonstationary" if their means and variances are not stable over time.

productivity, the Consumer Price Index (CPI), population, terms of trade, exports, imports, GDP, public employment, total employment, education level, and the unemployment rate come from Statistics Canada's database (2025f, 2025h). We use the imports, exports, and GDP datasets to construct the Openness variable, which is defined as the sum of exports and imports as a share of GDP. Further, the data on terms of trade, which is measured as the ratio of the export price index to the import price index of the country, are directly obtained from Statistics Canada. **Table 1** provides summary statistics for our key variables of interest.

Table 1 shows a lot of variations in our key variables of interest during the sample period. For the sake of brevity, we limit our discussion of the data for only the two key variables of interest: government debt and labour productivity. During the period under consideration, the index of labour productivity (2017=100) ranged from about 59 in 1980 to 110 in 2020. Similarly, growth in labour productivity ranges from a 5.84% reduction in 2021 to a jump of 8.71% in 2020 during the COVID-19 pandemic. In our empirical analysis, we attempt to control for these extreme values' effects by including year dummy variables for 2020 and 2021.

Canada's ratio of general government gross debt to GDP exhibits significant variations during the period under consideration. Table 1 shows that the country's gross debt as a share of the total economy ranges from about 44.6% in 1980 to 118.2% in 2020. The highest debt level occurred as a result of the deficit-financed increase in government spending associated with the COVID-19 pandemic, suggesting the need to account for the effects of the pandemic in the empirical analysis.

Table 1: Basic summary statistics for key variables, 1980–2023

Variable	Mean	Standard deviation	Minimum	Maximum
Labour productivity (index, 2017=100)	82.81	14.13	59.36	110.09
Ratio of general government gross debt to GDP (%)	81.80	16.68	44.59	118.20
Labour productivity growth (%)	1.22	2.16	−5.84	8.71
Change in ratio of general government gross debt to GDP (%)	1.46	5.78	−8.53	27.99
Openness (%)	62.77	9.41	46.62	82.76
Education	13.51	5.55	5.71	24.02
Terms of trade (%)	95.64	7.72	85.70	114.40
Population growth rate (%)	1.14	0.36	0.55	2.90
Inflation rate (%)	2.85	2.13	0.12	10.54

Source: Author's computation based on data obtained from various sources, as shown in Table A1.

3.2 Empirical results

This section presents the main empirical results of the study, which are reported in **table 2**. The empirical analysis covers the period from 1980 to 2023; as indicated before, the dependent variable is the annual rate of labour productivity growth for the business sector. We show the heteroskedasticity and autocorrelation robust standard errors in parentheses. Note also that, in the regression results reported in table 2, the dependent variable is the change in the log of labour productivity in the business sector, which is measured as an index (2017=100). Thus, it shows the rate of growth in labour productivity. All the explanatory variables, except the rate of population growth, enter as first differences (or change forms) to account for non-stationarity and circumvent the potential empirical problem of spurious regressions.

Our empirical analysis begins in column 1 by regressing the rate of labour productivity growth on changes in the ratio of general government gross debt to GDP, the level of education, and the inflation rate using the Ordinary Least Square (OLS) estimation approach. As discussed before, to account for the huge impacts of the COVID-19 pandemic on both government debt and labour productivity, we also include dummy variables for the years 2020 and 2021. All the explanatory variables have their respective expected signs, and the coefficients of government debt and the inflation rate are negative and statistically significant at the one-percent level. More specifically, the coefficient estimate for the government debt is –0.139, suggesting that a one percentage-point increase in the ratio of general government gross debt to GDP is associated with a 0.139% reduction in the business sector's annual labour productivity growth rate.

The results also show that an increase in the country's inflation rate has statistically significant adverse effects on labour productivity. On the other hand, the coefficient of the education variable is not statistically significant, although it has the expected positive sign in the model. The coefficients of the dummy variables for the years 2020 and 2021 are negative and statistically significant, suggesting the adverse impact of the pandemic on the country's labour productivity.

A number of previous empirical studies have indicated that population growth has adverse effects on labour productivity. Thus, to account for such effects of the country's population growth rate on labour productivity growth, in column (2) we include the population growth rate as an additional control variable in the model. The results indicate that, as expected, the population growth rate has adverse effects on labour productivity. Previous studies such as that by Checherita-Westphal and Rother (2012) also find similar effects of population growth on labour productivity. The coefficient estimate of government debt remains negative and statistically significant, and the magnitude of the estimate is similar to that of column (1).

As discussed previously, the interest rate is one of the channels through which the government debt affects labour productivity. Higher government debt can raise the interest rate, adversely

Table 2: Public debt and the growth of productivity, Canada, 1980–2023

	(1) OLS	(2) OLS	(3) OLS	(4) IV	(5) IV	(6) IV
Ratio of gross debt to GDP	−0.139***	−0.140***	−0.141***	−0.172***	−0.145**	−0.104**
	(0.041)	(0.036)	(0.034)	(0.048)	(0.063)	(0.046)
Education	0.140	−0.285	−0.275	−0.367	−0.141	−0.238
	(0.813)	(0.930)	(0.887)	(0.819)	(1.112)	(1.099)
Inflation	−0.424***	−0.397***	−0.407***	−0.434***	−0.433***	−0.390**
	(0.142)	(0.131)	(0.148)	(0.161)	(0.153)	(0.153)
Dummy 2020	10.874***	10.988***	11.009***	11.886***	11.624***	10.405***
	(1.117)	(1.309)	(1.282)	(1.480)	(1.637)	(1.144)
Dummy 2021	−7.373***	−8.619***	−8.610***	−8.732***	−8.062***	−8.112***
	(0.553)	(0.350)	(0.338)	(0.258)	(0.687)	(0.601)
Population growth		−2.194***	−2.234***	−2.242***	−2.348***	−2.332***
		(0.299)	(0.316)	(0.367)	(0.363)	(0.289)
Lagged interest rate			0.044	0.052	0.193	0.141
			(0.124)	(0.130)	(0.128)	(0.131)
Terms of trade					−0.050	−0.036
					(0.083)	(0.071)
Openness					12.816***	9.861***
					(3.177)	(3.525)
Dummy GFC						−1.425***
						(0.225)
Constant	1.202***	3.921***	3.971***	4.046***	4.027***	4.089***
	(0.343)	(0.675)	(0.712)	(0.750)	(0.699)	(0.595)
Observations	42	42	42	42	42	42
Sargan statistic (chi-squared)				0.870	0.671	0.458
Adjusted R^2	0.580	0.712	0.704	0.700	0.724	0.732

Notes: The dependent variable is the change in the log of labour productivity in the business sector, as measured by an index (2017=100) of real GDP per hour worked. Thus, it shows the labour productivity growth rate. All the explanatory variables, except the population growth rate, enter their first differences (or change forms) to account for non-stationarity. In columns 3 to 6, the general government gross debt to GDP ratio is treated as endogenous. The instruments used are contemporaneous change in the share of public employment in total employment and one period lagged value of the federal governing party. Heteroskedasticity and autocorrelation robust standard errors in parentheses. Significance levels are shown by * for 10%, ** for 5% and *** for 1%.
Source: Author's computation.

affecting the country's capital accumulation, and the adverse impact on capital accumulation has a negative effect on productivity. Thus, including contemporaneous values of the interest rate as an explanatory variable in the model is not feasible. However, it is still possible that interest rates in the previous period will have lingering effects on capital accumulation and labour productivity. To capture such impacts of lagged interest rates on labour productivity, we include one-period lagged long-term interest rate as an explanatory variable in column (3). While the lagged interest rate coefficient is not statistically significant, the coefficient of our key variable of interest remains negative and statistically significant.

Thus far, our empirical analysis treats government debt as exogenous and relies on OLS estimation. However, some may view the assumption of exogenous government debt in the labour productivity estimation model as unrealistic. First, when a country's labour productivity decreases and individuals' income falls, the government's fiscal capacity may diminish with it. This is because the reduction in national income reduces taxable income and the associated revenue governments can collect. Other things remaining the same, such an event may cause budget deficits and increase the government debt-to-GDP ratio. Thus, government debt may be endogenous in the sense that there can be a two-way relationship between labour productivity and government debt. To circumvent this possible problem of the endogeneity of government debt in the model, we treat the variable as endogenous in columns (4) to (6) and employ the two-state least-squares instrumental variable (IV) estimation method.

A common challenge in empirical studies that rely on the instrumental variable estimation method is to obtain suitable instruments related to the variable of interest that do not directly affect the dependent variable. Previous studies such as those by Baker, Payne, and Smart (1999), Kneebone and McKenzie (2001), and others find that left-leaning governments generally tend to be pro-spending, which can ultimately raise government debt. Thus, the political ideology of the governing party and the amount of government debt can be related and serve as a suitable instrument in the empirical model. Therefore, the dummy variable for the governing party of the federal government can be a valid instrument for government debt in our empirical model. To this end, we use the federal party dummy, which is equal to one if the federal governing party is the Liberal party and zero otherwise, as an instrument in the first stage regression of the instrumental estimation method.

Furthermore, the size of the public sector, as measured by its employment share in the economy, can have significant impacts on government spending and debt. It can also be seen as a proxy for an intrusive regulatory state whose rules and restrictions throttle innovation and productivity. Thus, we use the share of public employment in the country's total employment as an additional instrument for the general government debt. Thus, more specifically, we use one-period lagged values of the federal governing party dummy and contemporaneous

change in the share of public employment as instruments. The validity of these instruments is checked with different commonly used statistical tests. In this regard, the first-stage regressions show that the coefficients of the instruments are statistically significant. Further, the Sargan Chi-squared statistical test of over-identification indicated in table 2 confirms the validity of the instruments.

Column (4) reports the IV estimation results of the empirical model. For brevity, we focus the discussion on the coefficient of the ratio of government debt to GDP, which is our key variable of interest. The results show that the coefficient of government debt continues to be negative and statistically significant. Compared to the results of column (3), the magnitude of the coefficient estimate is now higher (in absolute value), suggesting that the effect of government debt will be downward biased if the empirical problem of endogeneity is not adequately addressed. Regarding the other control variables in the model, the coefficient estimates are largely similar to those of the previous column.

Canada is a small open economy, so global events can affect many aspects of the country's economic activities. To capture the impacts of global events on labour productivity, we include the terms of trade (that is, the ratio of export price index to import price index) as an additional explanatory variable in column (5). Previous empirical studies such as that by Woo and Kumar (2015) follow a similar approach. For instance, Duguay (2006) argues that terms of trade have positive effects on productivity growth. Another possible channel through which developments in the global economy affect Canada is through its volume of international trade. For instance, if our exports expand as a result of increased access to global markets, we will be able to produce more, and labour productivity can rise. Thus, in column (5), we also account for such effects of international trade on labour productivity by including *Openness*, which is defined as the ratio of the sum of exports and imports to GDP. See Alfonso and Jalles (2013) for a similar approach.

Results reported in column (5) show that the coefficient of Openness is, as expected, positive and statistically significant. However, the coefficient of terms of trade is negative, but it is statistically insignificant. Note that controlling for the openness and terms of trade variables in the estimation improved the explanatory power of the empirical model, as shown by the increased adjusted R-squared value of the model. Again, the coefficient of government debt is still negative and statistically significant, which is reassuring regarding the robustness of the impact of this variable on labour productivity.

The global financial crisis (GFC) of 2008/09 that began in the United States affected many aspects of the Canadian economy. It arguably marked a significant era for the Canadian economy. The global financial crisis caused substantial contractions in the Canadian business investment and overall economy in 2008 and 2009 (Boivin, 2011). Thus, capturing such regime or era effects

in the empirical analysis is essential. Our empirical model explicitly accounts for this significant GFC event on productivity in column (6) by including a dummy variable, *Dummy GFC*, which is equal to one in 2008 and 2009, and zero otherwise as an additional explanatory variable. As column (6) contains all the relevant explanatory variables, it is the main empirical model of this study, and our discussions focus on this column's results.

Column (6) shows that, as expected, the coefficient of the Dummy GFC is negative and statistically significant, indicating that the Global Financial Crisis had an adverse impact on labour productivity. Note also that the model's explanatory power slightly increased after the inclusion of the Dummy GFC variable. The statistical significance and signs of the coefficients of the other control variables are similar to the earlier results of column (5). In particular, the results indicate that the inflation rate, population growth rate, and the COVID-19 pandemic dummies have statistically significant adverse effects on labour productivity. The remaining control variables are not statistically significant. Although it is not statistically significant, the finding of a negative coefficient for the education variable is surprising.[12] However, previous studies such as that by Salotti and Trecroci (2016) also find similar results. More importantly, the coefficient of general government debt is −0.104, and it is statistically significant at the 5% level. The results suggest that a ten percentage-point reduction in Canada's general government debt-to-GDP ratio increases labour productivity growth by about 1.04%. As before, the instruments used in our empirical estimations are also valid, as shown by the Sargan test statistic of instrument validity. The economic importance and policy implication of this empirical finding are discussed in a later section, where we use the empirical estimate to simulate the possible effects of reducing government debt on labour productivity.

3.3 Sensitivity analysis

In this section, we perform a sensitivity analysis to evaluate the robustness of our main finding. More specifically, we examine whether our results are sensitive to using a different estimation method and debt measure, excluding the COVID-19 pandemic years, and including other additional control variables. The regression results are presented in **table 3**. It is important to note that the robustness checks are based on our primary regression results reported in column (6)

12 Empirical studies that focus on the economic effects of education use different alternative measures of educational attainment and treat the variable as endogenous using various suitable instruments (Salotti and Trecroci, 2016). As this study's primary focus is on the impact of government debt rather than education, we neither experimented with alternative measures of education attainment nor treated the variable as endogenous. This might explain the finding of the unexpected negative sign of the coefficient of education in our empirical model.

Table 3: Sensitivity Analysis, 1980-2023

	(1) LIML	(2) Excluding COVID-19 years	(3) Using net debt	(4) Unemployment	(5) Population ageing	(6) Lagged inflation
Ratio of gross debt to GDP	−0.105**	−0.104**		−0.132**	−0.085*	−0.100*
	(0.044)	(0.046)		(0.059)	(0.050)	(0.057)
Ratio of net debt to GDP			−0.089*			
			(0.046)			
Unemployment				0.514*		
				(0.282)		
Population over 64 years					−0.809	
					(1.485)	
Lagged inflation						−0.315*
						(0.166)
Observations	42	40	42	42	42	41
Adjusted R^2	0.732	0.445	0.723	0.748	0.722	0.744

Notes: Heteroskedasticity and autocorrelation robust standard errors in parentheses. Significance levels are shown by * for 10%, ** for 5% and *** for 1%. The dependent variable is the growth rate of labour productivity in the business sector. The sensitivity analysis is based on the main empirical result of column (6) of table 2, and we use instruments similar to those in table 2. The other explanatory variables are included in the estimation but not reported in the table for brevity. The explanatory variables enter the regression in their first difference form.

of table 2. Thus, all the explanatory variables of the main empirical model are also included in the sensitivity analysis. However, for brevity, we report only the coefficient estimates for the key variables of interest in table 3, omitting the coefficients for the other control variables.

Our primary empirical analysis employs the two-stage least squares (2SLS) instrumental variable (IV) estimation method, using various instruments for the key variables of interest. However, previous research suggests that, if the instruments are weakly correlated with the endogenous variables, 2SLS may produce biased estimates. One may prefer the Least Information Maximum Likelihood (LIML) estimation method to address concerns about the potential problem of weak instruments in the empirical model. Therefore, in column 1, we estimate our model using the LIML method. While 2SLS and LIML are asymptotically equivalent, LIML generally exhibits better small sample properties and is less influenced by weak instruments. The results show that government debt still adversely affects labour productivity, with the coefficient magnitude close to those in our main results from table 2. This confirms that our findings are not driven by weak instruments.

In the main empirical analysis, we use dummy variables to capture the significant effects that the COVID-19 pandemic had on both government debt and productivity. An alternative empirical approach is to drop the observations for those pandemic years from the empirical analysis. To this end, we check the sensitivity of our empirical results by omitting the pandemic years of 2020 and 2021 in column 2. Again, the results are similar to our main empirical finding, suggesting that including the COVID-19 dummies effectively captured the potential effects of the pandemic.

As discussed above, we believe that government gross debt, rather than net debt, better captures the actual impacts of the government's fiscal policy choices on labour productivity. Nonetheless, some government reports often emphasize the country's relatively lower net debt level. Thus, to check whether our key finding is sensitive to the use of an alternative definition of government debt, in column 3, we use the ratio of general government net debt to GDP instead of ratio of gross debt to GDP as our main explanatory variable. The reported sensitivity results indicate that the ratio of general government net debt to GDP has a statistically significant negative relationship with labour productivity. According to the estimated results, a one percentage-point increase in the government net debt is associated with a 0.089% decrease in labour productivity, which is slightly lower than (in absolute value) the magnitude of our main empirical result.

Due to the nature of our empirical specification, which focuses on the short-run relationship between labour productivity and government debt, one may be concerned that the business cycle can influence the results. To check the sensitivity of our main finding to such a potential empirical issue, we include the unemployment rate as an additional control variable and re-estimated the model in column (4). The results show that the coefficient of general government debt to GDP continues to be negative and statistically significant, suggesting the robustness of our main empirical finding.

Previous studies such as that by Ferede and Dahlby (2023) indicate that population ageing can have adverse effects on labour productivity growth. Thus, we included the share of the population that is 65 years old and above as an additional explanatory variable and re-estimated the main empirical model. As column (5) of table 3 shows, the coefficient of general government gross debt continues to be negative and statistically significant, indicating that our main empirical result is robust to the inclusion of various possible control variables. However, the coefficient of population aging is not statistically significant.

As discussed before, we include the inflation rate as an explanatory variable to capture the possible effects of monetary policy on the interest rate and capital accumulation, which in turn affects labour productivity. However, one may be concerned that such a link will necessarily occur with a significant time lag, suggesting that the lagged inflation rate might be a better explanatory variable. We address this concern by including one-period lagged value of the interest rate as an explanatory variable in the main empirical model. However, as an additional robustness check,

in column (6), we use one-period lagged inflation rate instead of the contemporaneous inflation rate and re-estimated the main empirical model. The result indicates that the statistically significant negative association between government debt and labour productivity still holds, assuring the robustness of our empirical finding.

In sum, the various sensitivity analyses discussed above suggest that the finding of a negative association between government debt and labour productivity is robust. Thus, an important policy implication of this study's empirical finding is that, if Canada wishes to reverse the decline in the country's labour productivity growth, restraining deficit-financed government spending, which is often the main reason for the rise in the general government debt, would be an essential policy to consider seriously.

4. Policy Implications

The empirical analysis of the previous section indicates that increases in Canada's general government debt, which is often caused by a rise in deficit-financed government spending, can adversely affect labour productivity in the business sector. This suggests that policy makers concerned with the slowdown in the growth of labour productivity need to restrain government spending and reduce the debt level. This raises an important question: what would be the labour productivity gains for Canadians if the government embarked on a gradual debt-reduction reform? In this section, we conduct a simulation analysis based on the empirical results of the previous section to shed light on how reducing government debt can improve labour productivity in the country.

In our empirical analysis of the previous section, we used Statistics Canada's (2025f) labour productivity index dataset because it covers a more extended period, making it ideal for our study. However, Statistics Canada's table showing labour productivity and related measures (2025h) also provides labour productivity data measured in dollars per hour worked (in 2017 dollars), but only for the period from 1997 to 2023. While the two datasets are expressed differently, they show similar trends and growth rates. In fact, as explained in more detail in Appendix 2, the growth rates from both datasets are 99.1% correlated. This is unsurprising because labour productivity indexes are generally computed from actual monetary values with a particular assumption about the base year (for instance., 2017=100). Thus, one can use the previous section's empirical estimates along with Statistics Canada's (2025h) dataset to contextualize the monetary gain associated with debt reductions and its positive effects on labour productivity growth.

For this reason, the simulation analysis is conducted using the main coefficient estimate of column (6) of table 2 and the following assumptions. First, the study assumes that the impact of changes in government debt on the growth of labour productivity is the same whether the growth rate is computed from labour productivity measured as an index or in terms of dollars per hour. Second, in the baseline scenario—that is, in the absence of any reduction in Canada's ratio of general government gross debt to GDP—the country's labour productivity is assumed to grow at an annual rate of 0.63%, which corresponds to the average growth rate of labour productivity over the period from 2014 to 2023. Third, the government debt reduction is assumed to be gradual, beginning in 2025 and ending in 2029.

The debt reduction simulation exercise of this study considers two alternative scenarios. The Canadian ratio of general government gross debt to GDP was about 90% in 2019, the year before the onset of the COVID-19 pandemic. However, as discussed before, the country's debt rose

significantly as a result of the pandemic-related, deficit-financed increase in government spending. As a result, the country's ratio of general government gross debt to GDP is about 106% in 2024. Thus, in the first scenario (Scenario 1), we assume that the government gradually reduces the debt ratio over five years from 106% to 90%, at the rate of about 3.2 percentage points in the government debt annually. Essentially, this is tantamount to undoing the pandemic-related increases in the debt.

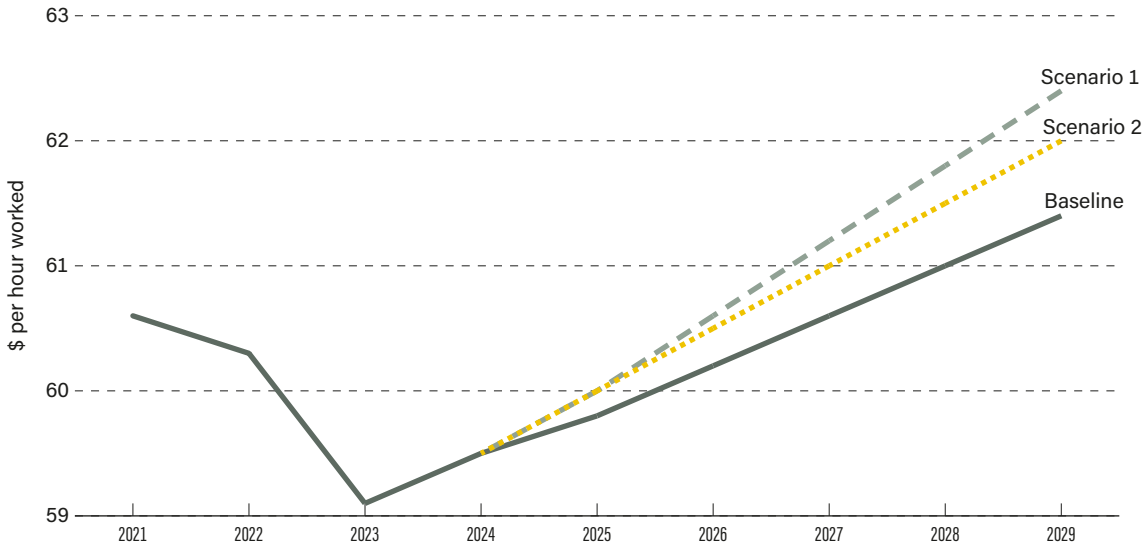
The International Monetary Fund (IMF) forecasts Canada's ratio of general government gross debt to GDP for the period from 2025 to 2029. Thus, for comparative purposes, we also consider an alternative scenario built on the IMF's government debt forecast for Canada. In the second scenario (Scenario 2), we assume that the debt reduction will be consistent with the forecast of general government gross debt to GDP provided by the IMF for the five years beginning in 2025. The simulated effects of government debt reduction on labour productivity under the two alternative scenarios are illustrated in **figure 7**. We also include the baseline projection of the labour productivity for ease of comparison. In addition, the figure depicts on the baseline actual observed data from Statistics Canada (2025h) for the period from 2021 to 2024 to contextualize the change in labour productivity. The reported results for the period from 2025 to 2029 are obtained through our simulation under the different alternative assumptions discussed above.

Figure 7 indicates the impact of reducing general government debt on labour productivity under alternative scenarios. The effects on labour productivity are shown in dollars per hour, adjusted for inflation (the vertical axis). Recall that we assume that the effects of government debt on the growth rate of labour productivity that were obtained in the regression analysis also apply to labour productivity measured in terms of dollars per hour. Thus, to assess the possible impact of debt reduction on labour productivity in dollar terms, the simulation analysis begins with the initial labour productivity of 2024, which is $59.47.[13] Under the baseline scenario, the country's labour productivity is assumed to grow from its 2024 level at the assumed baseline annual growth rate of 0.63%. In figure 7, this is indicated by the solid line.

In Scenario 1, it is assumed that the general government gradually reduces the debt ratio at an annual rate of about 3.2 percentage points to move the debt ratio to its pre-pandemic level. The empirical analysis of this study shows that such debt reduction raises the labour productivity growth rate. More specifically, using the coefficient estimate of government debt in column (6) of table 2, the 3.2 percentage reduction in the general government debt ratio increases the labour productivity growth rate by about 0.33% annually ($-0.00104 \times -3.2 = 0.0033$). Consequently, relative to the baseline scenario of no debt reduction, labour productivity increases by $1.01 per hour in 2017 dollars at the end of the fifth year. This is equivalent to a 1.6% increase in labour

13 Statistics Canada (2025h) shows the latest available data on labour productivity in dollars per hour for 2023. To compute the corresponding labour productivity in 2024, we apply our assumed baseline labour productivity growth rate and obtain $59.5 ($59.1 × (1 + 0.0063) = $59.5).

Figure 7: Effect of reductions in general government debt on labour productivity ($ per hour worked; 2017$), 2021–2029



Sources: Statistics Canada, 2025h; author's computation.

productivity relative to the baseline scenario. For an average Canadian employee working 40 hours per week full time, this increase in labour productivity corresponds to an increase in annual income of about $2,100, adjusted for inflation. The corresponding values for the remaining years are computed similarly and shown in figure 7 by the broken line.

Scenario 2 considers a slower debt-reduction path consistent with the IMF's forecast of Canada's ratio of general government gross debt to GDP for the coming five years. In figure 7, the dotted line shows the effects of this decrease in the debt ratio on labour productivity, and the computation is similar to Scenario 1. The simulation analysis suggests that, relative to the baseline scenario of no debt reduction, under Scenario 2, Canada's labour productivity increases by about 0.63 dollars per hour in 2017 dollars at the end of the fifth year. Even this seemingly small hourly gain will help raise income and living standards in the country, suggesting the merits of government debt reductions. For an average Canadian employee working full time 40 hours per week, the labour productivity gains under Scenario 2 are equivalent to an increase in annual income by roughly $1,310, adjusted for inflation.

In sum, the previous simulation analysis demonstrates that even small reductions in the country's gross debt, coupled with a commitment to maintaining it at lower levels, can lead to significant gains in labour productivity and enhance living standards. Therefore, a key policy takeaway from this study is that governments should curb deficit-financed spending and work to reduce government debt to reverse the slowdown in the growth of labour productivity. In this context, relying on credible fiscal anchors could help the government prevent excessive debt accumulation during adverse budgetary shocks (Mintz, 2021; Dahlby and Ferede, 2023).

5. Conclusions

The slowdown in Canada's labour productivity and its drop in rankings compared to other countries have become key issues in academic and political discussions. This topic has gained even more attention in public debates, particularly in the aftermath of the COVID-19 pandemic. Furthermore, the pandemic-induced rise in deficit-financed government spending has substantially increased the country's general government debt, prompting concerns about whether this fiscal situation exacerbates the challenge of encouraging growth in labour productivity.

Consequently, this study empirically investigates the impacts of Canada's ratio of general government gross debt to GDP on the growth of business-sector labour productivity. The study relies on time series data spanning over forty years. The empirical results indicate that general government gross debt has a statistically significant adverse impact on labour productivity. According to the main empirical estimate of this study, a ten percentage-point increase in Canada's ratio of general government gross debt to GDP is associated with a 1.04% reduction in the growth rate of labour productivity. This empirical finding is robust to various sensitivity checks.

This study then uses the empirical results to simulate the likely effect of reducing government debt on labour productivity. The principal simulation analysis of the study indicates that, if Canada were to gradually lower its general government gross debt-to-GDP ratio over five years—from the current 106% to the pre-pandemic level of 90%—the business sector could see a 1.6% increase in labour productivity by the end of the fifth year, compared to a scenario where government debt remains unchanged. This would translate to an increase of output by about $1.01 per hour worked, adjusted for inflation. For average Canadian employees working full time 40 hours per week, this is equivalent to an increase in their annual income by roughly $2,100, accounting for inflation.

For this reason, this study highlights a vital policy takeaway: if Canada aims to reverse the decline in the growth of labour productivity and improve living standards, among other essential policy interventions it should also consider reducing the national debt by limiting government spending funded by deficits. This type of spending is often the main driver behind the increase in national debt, which has an adverse impact on labour productivity.

Appendix 1: Additional Results

Table A1.1: Data descriptions and sources

Variable	Definition	Sources
Labour productivity	Labour productivity (Index, 2017=100); business sector	Statistics Canada, 2025f: table 36-10-0208
Labour productivity (in dollars)	Labour productivity (Chained [2017] dollars per hour); business sector	Statistics Canada, 2025h: table 36-10-0480
Ratio of general government gross debt to GDP	Total stock of debt liabilities by the general government (federal and provincial governments) as a share of GDP	International Monetary Fund, 2024: World Economic Outlook Database (October)
Ratio of general government net debt to GDP	Ratio of general government net debt to GDP (i.e., gross debt minus financial assets corresponding to the debt instruments).	International Monetary Fund, 2024: World Economic Outlook Database (October)
Education	The share of the population with a university degree	Statistics Canada, 2025b: Table 14-10-0118 (1990-2003); Statistics Canada, 1986; and interpolation between census years.
Inflation rate	Annual inflation rate	Statistics Canada, 2025d: table 18-10-0005
Population growth	Annual total population growth rate	Statistics Canada, 2025c: table 17-10-0005
Openness	The sum of exports and imports as a ratio of GDP	Statistics Canada, 2025g: table 36-10-0222
Terms of trade	Terms of trade index (2017=100), which is the ratio of export price index to import price index	Statistics Canada, 2025e: table 36-10-0129
Unemployment rate	Canada's aggregate unemployment rate	Statistics Canada, 2025a: CANSIM table 14-10-0023
Interest rate	Long-term Canadian government bond yields (10 year)	(OECD) (2025b). Interest Rates: Long-Term Government Bond Yields: 10-Year: for Canada.

Source: Author's compilation.

Table A1.2: Unit-root tests, 1980–2023

Variables	DF-GLS (with trend)	DF-GLS (with no trend)
	Variables in levels	
Labour productivity	−1.848	0.342
Ratio of general government debt to GDP	−1.811	−0.551
Term of trade	−2.526	−0.635
Openness	−1.741	−1.482
Inflation rate	−1.699	−1.132
Education	−1.037	0.573
Population growth[a]	−1.593	−1.381
	Variables in first differences	
Labour Productivity	−4.227***	−4.095***
Ratio of general government debt to GDP	−4.422***	−4.407***
Term of trade	−6.232***	−2.262*
Openness	−3.812**	−3.465***
Inflation rate	−5.354***	−3.429***
Education	−4.675***	−3.052***
Population growth*	−2.289	−2.643***

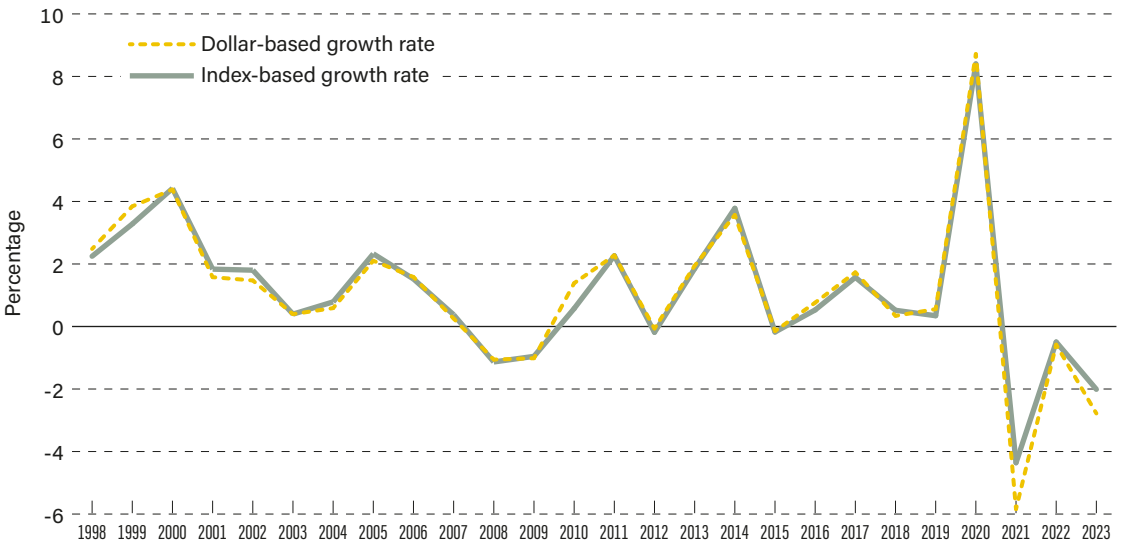
Notes: Lag selections are using the Schwarz Information Criterion (SIC). Significance levels are shown by *** for 1%, ** for 5%, and * for 10%. [a} The spike in the population growth rate in 2023 caused a structural break in the data. This variable is stationary with a structural break.
Source: Author's computation.

Appendix 2: Notes on Labour Productivity Data Comparisons

In this appendix, we compare the labour productivity data measured in dollar terms and as an index to justify one of the main assumptions of the simulation analysis of this study. The nature of the available data dictates the approaches we use in our empirical and simulation analyses. While Statistics Canada (2025a) provides data on the labour productivity index (2017=100) for an extended period, Statistics Canada (2025b) provides data on labour productivity in terms of dollars per hour worked (in 2017 dollars) for a short period (between 1997 and 2023). As discussed before, the dependent variable in our primary empirical model is based on labour productivity measured as an index (2017=100) obtained from Statistics Canada (2025a). However, the simulation analysis relies on labour productivity measured in terms of dollars per hour to easily communicate the main message of the study to the general audience. At first glance, one may think such an approach is inconsistent. However, as **figure A2.1** exhibits, the two data sets convey the same message, and the rates of growth in labour productivity computed using both data sets are comparable.

Figure A2.1 plots the labour productivity growth rates obtained from the two data sources to visualize their relationships over time. The figure shows that the two data sources convey the same

Figure A2.1: Growth rates (%) of labour productivity as computed from alternative data sources, 1998–2023



Source: Author's computation using data from Statistics Canada, 2025f, 2025h.

message regarding the country's labour productivity growth rate. In the figure, the dotted line shows the labour productivity growth rate computed from Statistics Canada's (2025b) data source, which provides Canada's labour productivity in terms of dollars per hour worked (in 2017 dollars). On the other hand, the solid line exhibits the labour productivity growth rate calculated using the labour productivity index from Statistics Canada (2025a). Thus, the figure shows that the rates of the growth of labour productivity computed from the two datasets are comparable.

The strong statistical relationships between the two datasets are also confirmed as the correlation between the labour productivity growth rates obtained from the two data sources is 99.1%. To provide additional evidence that the labour productivity growth rates computed based on Statistics Canada's two sources (2025a, 2025b) are comparable, we also run a simple regression using the Ordinary Least Square (OLS) estimation method based on Column (1) of table 2 for the period from 1997 to 2023 (**table A2.1**). In sum, the relationship between government debt and the growth of labour productivity is similar whether the growth rate is computed from labour productivity measured as an index or in terms of dollars per hour, confirming the appropriateness of one of our critical assumptions of the simulation analysis.

Table A2.1 Public debt and productivity using different datasets, 1997-2023

	(1) OLS	(2) OLS
Ratio of gross debt to GDP	−0.204*** (0.047)	−0.206*** (0.042)
Education	0.857 (0.893)	0.293 (0.890)
Inflation	−0.066 (0.279)	−0.025 (0.331)
Dummy 2020	12.992*** (1.246)	13.033*** (1.164)
Dummy 2021	−7.889*** (0.596)	−6.332*** (0.643)
Constant	0.568 (0.604)	0.828 (0.543)
Observations	26	26
Adjusted R^2	0.651	0.635

Notes: The dependent variable is the labour productivity growth rate. While Column (1) is based on the labour productivity index from Statistics Canada (2025a), Column (2) uses labour productivity measured in dollars per hour obtained from Statistics Canada (2025b). All the explanatory variables, except the year dummies, enter the model in their first differences (or change) forms to account for non-stationarity. Heteroscedasticity and autocorrelation robust standard errors in parentheses. Significance levels are shown by * for 10%, ** for 5% and *** for 1%.

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