HOW HAVE CANADIAN FEDERAL GOVERNMENTS RESPONDED TO BUDGET DEFICITS?

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Contents

Executive Summary

- The objective of this study is to investigate, based on econometric modelling using time-series data from 1868 to 2021, how Canadian federal governments have responded to budget deficits.

- The fiscal responses of Canadian federal governments to budget deficits have depended on the ratio of net debt to GDP and the ratio of interest payments to revenue. When the federal government has a debt-to-GDP ratio exceeding 37.1% or ratios of interest payments to revenue above 12.5%, they have responded to budget deficits by reducing program spending and raising revenue. When debt or interest-cost ratios have been below these thresholds, governments have postponed fiscal adjustments.

- According to this classification, Canada is currently in a fiscal environment with a high debt ratio and low interest-cost ratio. The Liberal government has postponed deficit reduction in its recent budgets, which indicates that its fiscal policies are based more on the ratio of interest payments to revenue than the ratio of net debt to GDP.

- Postponing fiscal adjustments and incurring greater deficits results in higher interest payments. In the future, the fiscal adjustment will require deeper cuts in program spending and larger increases in tax rates that will have substantial economic and social costs.

- We find that a short-term increase in program spending is only partially offset by future spending restraint and about 30% of the adjustment involves increases in future taxes. This is consistent with the spend and tax hypothesis—that higher program spending ultimately leads to higher tax burdens.

- We also find that a short-term increase in revenues is followed by an increase in the present value of future program spending. This is consistent with the tax-and-spend hypothesis—that is, revenue increases lead to increases in program spending.

1. Introduction

Since Confederation, Canadian federal governments have faced economic shocks emanating from multiple sources resulting in budget deficits. Recently, the COVID-19 pandemic and the associated adverse economic and social impacts compelled the federal government to substantially increase its program spending. At the same time, the government's revenue showed a marked decline, with a considerable jump in its budget deficit, and a rise in the debt-to-GDP ratio from about 33% in 2019 to 45% in 2021. In the aftermath of this shock, the federal government adopted a new fiscal anchor—reducing the debt ratio in the medium to long term. Despite this, the federal government plans to increase program spending and run budget deficits until at least 2028/29, according to the *2023 Fall Economic Statement* (Canada, Department of Finance, 2023). In the longer term, achieving this objective will depend on how the government responds to future fiscal shocks, such as economic recessions or rises in the interest rate. In addition, recent studies, such as Fuss (2023), Tombe (2023), Dodge and Dion (2023), and Dahlby and Ferede (2023, 2024), express concerns about the federal government's overall fiscal position and its ability to accommodate future budgetary shocks.

When a government incurs a higher budget deficit and its debt level increases, it needs to cut spending or raise taxes in subsequent years to attain long-term fiscal sustainability if the interest rate exceeds the economic growth rate.[1] However, which of these policy choices the government ultimately adopts can have significant social and economic effects on Canadians. What can we learn from how previous federal governments have responded to budget deficits? Have they tried to attain budget balance through spending or revenue adjustments or some combination of the two? Do the federal governments' budgetary responses actually reflect their selected fiscal anchors? These crucial questions cut to the heart of current debates about fiscal policy.

The objective of this study is to investigate, based on econometric modelling using time-series data from 1868 to 2021, how Canadian federal governments have responded to budget deficits. Our study relies on an empirical methodology introduced by Bohn (1991) to assess the fiscal adjustments of the US federal government and was used by later researchers such as Buettner and Wildasin (2006), Young (2009), and Ferede and Dahlby (2023). Our study reveals the average or typical fiscal responses of Canadian federal governments over the past one and a half centuries and serves as a yardstick for judging the current federal government's fiscal policies.

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1   The government can continuously borrow money without adversely affecting fiscal sustainability if the interest rate is less than the growth rate. See Blanchard (2019) and Dodge (2020).

Our study finds that in response to a one-percentage point increase in the current budget deficit-to-GDP ratio, federal governments have responded by cutting program spending by 0.20 percentage points and raising revenue by 0.11 percentage points the following year. Thus, roughly two thirds of the short-term fiscal responses to a budget deficit appear on the spending side of the government budget. We also find evidence that the implementation of these fiscal responses to budget deficits depends on the ratio of net debt to GDP and the ratio of interest payments to revenue. When the federal government has debt-to-GDP exceeding 37.1% or interest-to-revenue ratios above 12.5%, they have responded to budget deficits by reducing program spending and raising revenue. However, when debt or interest cost ratios are below these thresholds, they have postponed fiscal adjustments. Such behaviour is manifested in the Liberal government's most recent federal budget, with increases in program spending despite the budget deficit it is currently facing. According to the above criterion, we are currently in an environment characterized by a high debt ratio but a low interest-cost ratio. The Liberal government's delayed responses to its budget deficits imply that its fiscal policies are based on its current interest-cost ratio rather than its debt ratio.

Nevertheless, postponing fiscal adjustments until the interest-cost ratio exceeds a threshold means that future budgetary adjustments will involve deeper cuts in program spending and a larger hike in tax rates that will have substantial economic and social costs. This is so, as our study indicates, because in the long run only 70% of a deficit caused by increases in program spending is eliminated by a reduction in program spending in subsequent years, while the remainder is eliminated through increases in future taxes. A major implication of this study is that it is better if the government embarks on fiscal adjustments early on and reins in its program spending before its debt ratio rises significantly and its debt sustainability is endangered by adverse future fiscal shocks. This is crucial because, as Dahlby and Ferede (2023, 2024) indicate, the government's fiscal plans often do not consider the possibilities of recessions and other downside risks that can have an adverse impact on the government's fiscal position.

The remainder of this study is organized as follows. Section 2 describes the relevant data and provides brief background information on the evolution of the federal government's budgetary components. The study's main empirical findings are presented and discussed in section 3. Section 4 concludes the study.

2. Background

In this study, the empirical analysis of the federal government's fiscal adjustments rely on time-series data from 1868 to 2021. The data source for the main fiscal variables is the online database of Finances of the Nation (2023). As is common in the literature, all the fiscal variables are expressed as a percentage of GDP. **Table 1** reports the summary statistics for the key variables of interest.

Table 1: Summary statistics, 1868–2021

| Variable	Obs.	Mean	Std. Dev	Minimum	Maximum
Budget components (as a ratio of GDP, in percent)					
Program spending	154	11.0	6.6	2.6	41.9
Debt service payment	154	2.2	1.3	0.4	6.0
Total revenue	154	11.2	5.3	3.6	24.8
Budget Deficit	154	1.9	3.7	−4.2	21.2
Gross debt to GDP ratio (in %)	154	49.9	20.2	17.9	147.1
Net debt to GDP ratio (in %)	154	37.1	17.4	11.6	110.3
Changes in budget components (as a ratio of GDP, in percent)					
Program spending	153	0.1	2.9	−23.1	20.8
Debt service payment	153	0.0	0.3	−0.8	1.1
Total revenue	153	0.1	1.2	−3.6	5.8

Source: Authors' calculations, based on data obtained from Finances of the Nation (2023).

Since the sample period of this study covers data spanning over 150 years, there is a huge variation in the overall fiscal position of the federal government, as summarized by its budget deficit, which is computed as total expenditure minus total revenue. Note that a negative numerical value for the budget deficit indicates a budget surplus. The government's ratio of budget deficit to GDP ranged from −4.2% (a surplus of 4.2% of GDP) in the year 1948 to a whopping 21.2% in the year 1945. These extreme fiscal positions occurred during and after the Second World War when Canada, like many other countries, dramatically increased its government spending to support the

war effort, with the federal budget deficit as a share of GDP reaching 21.2% in 1945. On the other hand, at the end of the War, with military demobilization and reductions in government spending, the federal government's budget balance as a share of GDP rose to a surplus of 4.2% in 1948.

Summary statistics often mask significant variations in the fiscal positions of the federal government. Thus, in **figure 1**, we show the evolution of the federal government's expenditure and revenue. As the net effect of changes in the various budgetary components is captured by the government's budget balance, in **figure 2**, we show the federal government's budget net debt-to-GDP ratio and the deficit-to-GDP ratio to obtain some insight into the evolution of the government's fiscal position during the period under consideration.

Figure 1: Spending and revenue (% of GDP) of Canada's federal government, 1868−2021
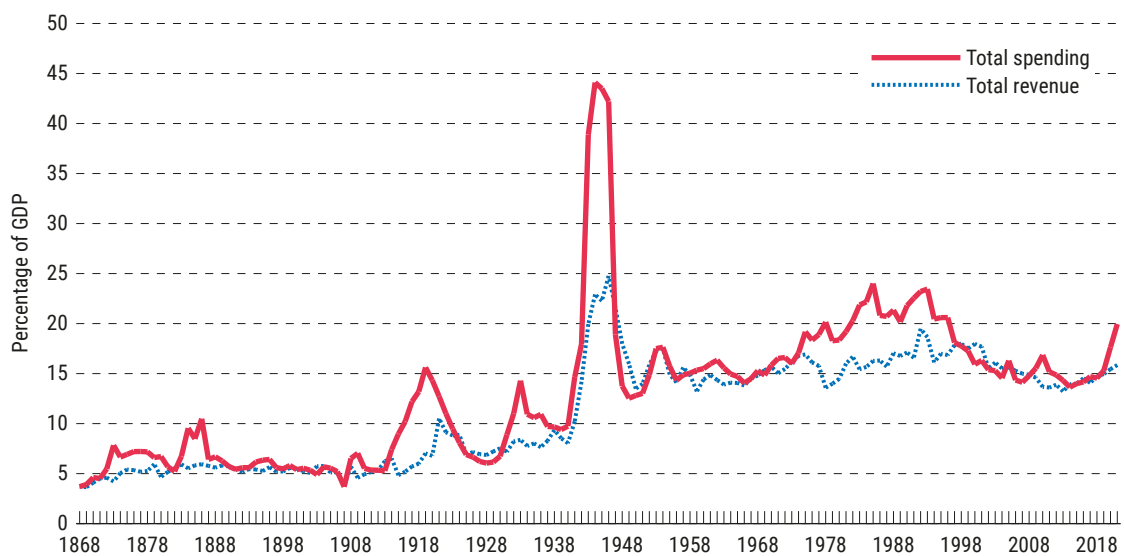
Sources: Finances of the Nation, 2023.

The figures above indicate that the federal government's budgetary components, as well as its overall fiscal balances, exhibited significant variation during the period under investigation. Prior to 1920, the overall fiscal position of the federal government exhibited very low budget deficits and debt-to-GDP ratios as its expenditures were more in accord with revenues. However, in the first half of the 20th century, the country faced substantial economic challenges, including the Great Depression. Further, during the Second World War, as in many other countries, the federal government markedly raised its spending to support the war effort, leading to a spike in program spending. The net effect of this fiscal shock was that the budget deficit-to-GDP ratio jumped to 21.2% in 1945, which is historically the highest deficit level, and the country's net debt-to-GDP ratio soared to 93.7% in 1945 and to 110.3% in 1946.

Figure 2: Ratios (%) of net debt and deficit to GDP of Canada's federal government, 1868−2021
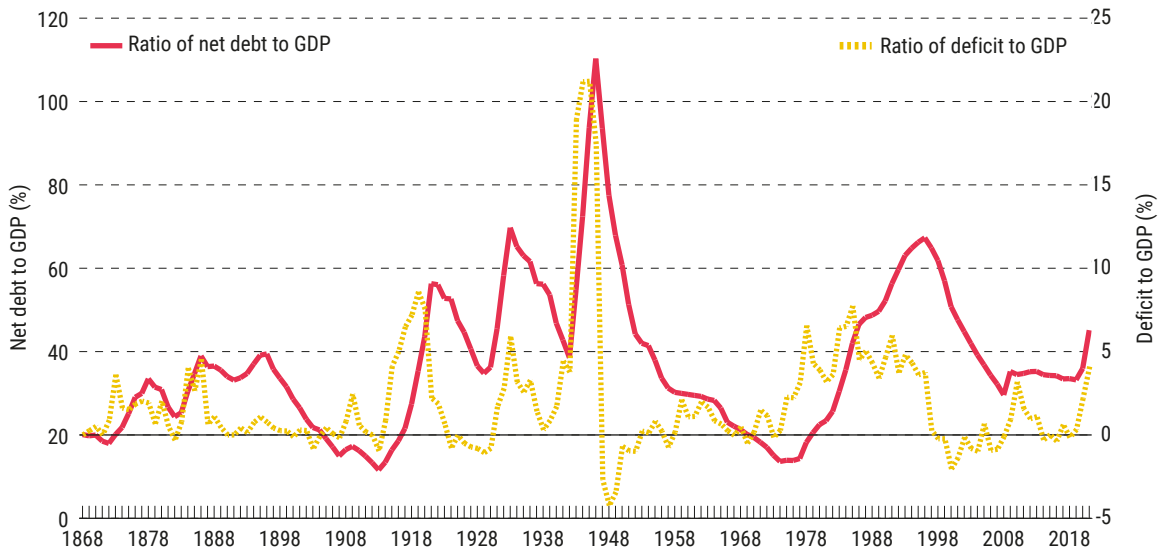
Sources: Finances of the Nation, 2023.

In the 1950s and 1960s, the fiscal position of the federal government improved substantially, and the net debt-to-GDP ratio continuously fell.[2] However, in the late 1970s and 1980s, the fiscal balance began deteriorating as a result of various economic challenges, such as the global oil-price shocks. Furthermore, the slower economic growth during these periods and the increase in the federal spending on social programs that were introduced in the 1960s—such as the Old Age Security (OAS), Guaranteed Income Supplement (GIS), health-care grants, and other federal-provincial transfers—contributed to the deterioration in the government's fiscal balance. Consequently, the fiscal effects of the adverse economic shocks and elevated program spending were manifested through an increase in the net debt-to-GDP ratio in the 1970s and 1980s.

In the late 1990s and early 2000s, successive Canadian federal governments embarked on various measures that involved reductions in program spending and tax increases to eliminate the budget deficit and reduce the debt level. In broad terms, this period of fiscal restraint improved the overall fiscal position of the federal government and, as a result, the net debt-to-GDP ratio continuously followed a downward trend. This trend continued until the global financial crisis in 2008 caused budget deficits and the net debt-to-GDP ratio to rise slightly in the post-2008 period.

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2   This improvement resulted from two key things: war debt that had been contracted at patriotically low interest rates and a booming economy. The result was that the net debt-to-GDP ratio fell until the 1970s.

The COVID-19 pandemic produced the largest peacetime fiscal shock, with the federal net debt-to-GDP ratio jumping by 12 percentage points (from about 33% to 45%). The adverse fiscal effects of the pandemic still linger, with the recent surge in inflation and the Bank of Canada's interest-rate hikes to fight inflation giving rise to higher interest costs. Given such fiscal challenges, it is crucial to examine empirically and shed light on the federal government's budgetary responses to fiscal imbalances, an issue explored in more detail in the following section.

3. Empirical Results and Discussions

3.1 Short-term fiscal responses to budget deficits

We now turn our attention to the investigation of the budgetary responses to fiscal imbalances. We use time-series analysis to examine the nature of federal government budgetary responses to fiscal imbalances.[3] In a time-series analysis such as that employed in this study, the first step is to empirically check the time-series properties of the various fiscal variables of interest. As shown in table B1 in the appendix, we find that program spending (PS), debt service payments (DS), and total revenue (TR) (all expressed as a ratio of GDP) are non-stationary in levels, but they are stationary in first differences.[4] The deficit-to-GDP ratio, on the other hand, is found to be stationary. This implies that, during the period under consideration, the mean and the variance of the federal government's budget deficit are stable over time. In other words, the budget deficit has been sustainable, suggesting that government's expenditure has a long-term relationship with its revenue. This is not unexpected since Canadian federal governments have never defaulted on their public debt. In addition, we formally check for the presence of a long-term relationship among the various fiscal variables using the Johansen Cointegration test. As table B2 in the appendix shows, there is evidence of cointegration among the fiscal variables, suggesting that there is indeed a stable long-run relationship among the various fiscal variables, which is consistent with the federal government's intertemporal budget constraint. In other words, federal governments' revenue and spending tend to move together in the long term.

When a government faces a fiscal shock, its budget deficit often increases, and the debt burden rises, necessitating, sooner or later, a fiscal adjustment to at least stabilize the debt ratio. In this regard, as discussed in Appendix 1, the presence of a statistically valid long-term relationship among the fiscal variables allows us to estimate an error correction model, where we estimate a model of the change in the fiscal variables on the lag changes of the variables and the lagged budget deficit to GDP ratio. This approach enables us to shed light on fiscal responses to a budget deficit.

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3 See Appendix 1 for a discussion of the econometric model.

4 In a statistical sense, a variable is "stationary" if its mean and variance are constant over time.

In **table 2**, we report our main empirical results. Note that for the sake of brevity we only report the coefficient estimates, which show the responses of program spending (*PS*), debt service (*DS*), and total revenue (*TR*) to budget deficits and some additional statistical tests that are discussed below. The complete estimation results are shown in **table B3** in appendix B. **Table 2** indicates that an increase in the federal budget deficit has a statistically significant effect on the government's future program spending, debt-service payments, and total revenue. Specifically, in response to a one percentage point increase in the federal government's budget deficit-to-GDP ratio, program spending falls by about 0.20 percentage points and revenue rises by 0.11 percentage points in the following fiscal year. Furthermore, debt-service payments as a ratio of GDP rises by about 0.04 percentage points in the following year in response to a one percentage-point increase in the deficit-to-GDP ratio.

**Table 2: Short-term fiscal responses to the budget deficit, 1868-2021**

	Dependent variables		
	(1)	(2)	(3)
	Program spending (ΔPS)	Debt service (ΔDS)	Total Revenue (ΔTR)
Lagged budget deficit	−0.199***	0.036***	0.108***
	(0.064)	(0.014)	(0.040)
	Joint significance tests		
F-test on coefficients of changes in program spending (p-value)	0.000	0.060	0.000
F-test on coefficients of changes in total revenue (p-value)	0.526	0.016	0.000

Note: Δ denotes change. Autocorrelation and heteroscedasticity robust standard errors in parentheses. Significance levels are shown by *** for 1%, ** for 5%, and * for 10%. In addition to fiscal variables, the empirical model includes dummy variables for WWII.
Sources: Finances of the Nation, 2023; calculations by authors.

Running a budget deficit in any year will have fiscal repercussions in subsequent years. We can obtain some insights into how the budgetary components respond to fiscal imbalances by looking at the total or cumulated responses over the different periods after any given shock. **Figure 3** shows the impact of budget deficits on program spending and revenue in the years after a deficit occurs. It indicates that federal governments have responded by cutting program spending but this fiscal response is statistically significant only in the first two years following the increase in the budget deficit. Similarly, figure 3 suggests that total revenues rise in the years following a budget deficit, but these fiscal adjustments are not statistically significant. Thus, the historical evidence shows that the short-run effects of fiscal imbalances manifested themselves in the following first two years, mainly through reduced spending, with the debt ratio stabilizing after these initial years.

**Figure 3: Responses (%) of program spending and total revenue to a budget deficit**
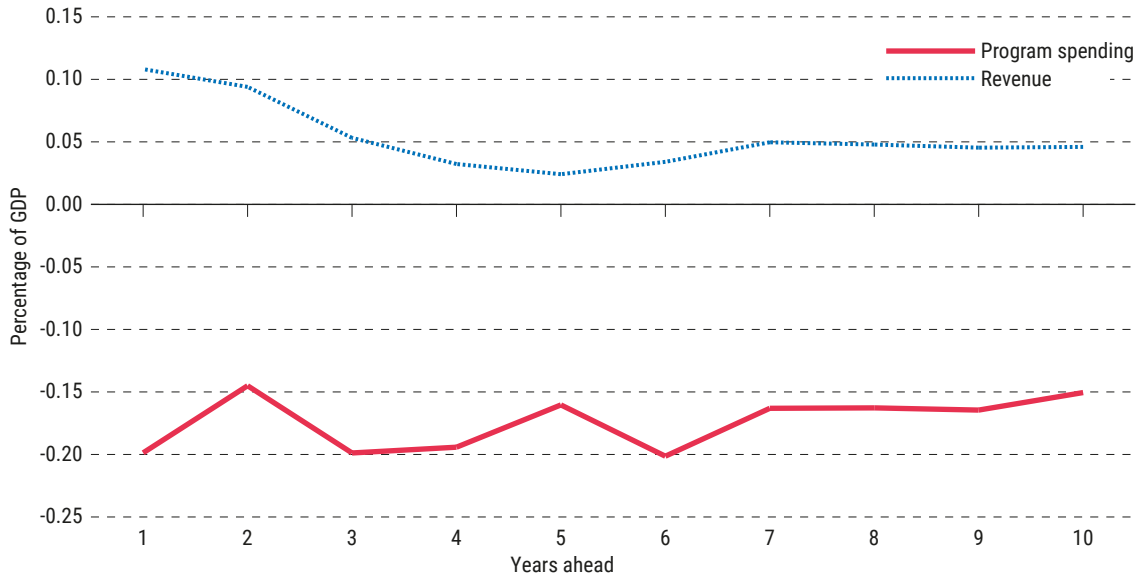
Note:The vertical axes show changes in budgetary components as a share of GDP; years ahead are shown in the horizontal axis.
Source: Calculations by authors.

3.2 Long-term fiscal response to temporary fiscal shocks

Fiscal shocks in any given year can have lingering and cumulative effects on future government revenue and expenditures. For instance, an unexpected spike in government program spending in a year causes an increase in the budget deficit in the current fiscal year, which then raises debt-service payments in the following and subsequent year. Thus, if the interest rate is greater than the economic growth rate, the government needs to cut spending, raise revenue, or both in subsequent years to achieve fiscal sustainability. To shed light on such fiscal adjustments, we plot the impulse responses from our estimated empirical model in figure 4a and figure 4b. Note that we show the future periods after the shock along the horizontal axis and the vertical axis represents the fiscal variable as a share of GDP.

Figure 4A shows the estimated future effects resulting from a one-time, one percentage-point increase in program spending on future revenues and program spending, all measured as a ratio of GDP. The figure illustrates that the spending increase is partially reversed in subsequent years. However, about 40% of the initial increase in program spending (as compared to the average value that would prevail in the absence of the shock) persists. The figure also indicates that there is a lagged and persistent response of government revenue to an increase in program spending, with the revenue ratio remaining about 0.30 above the initial level.

Figure 4A: Response of program spending and revenue to a one-time, one percentage-point increase in program spending
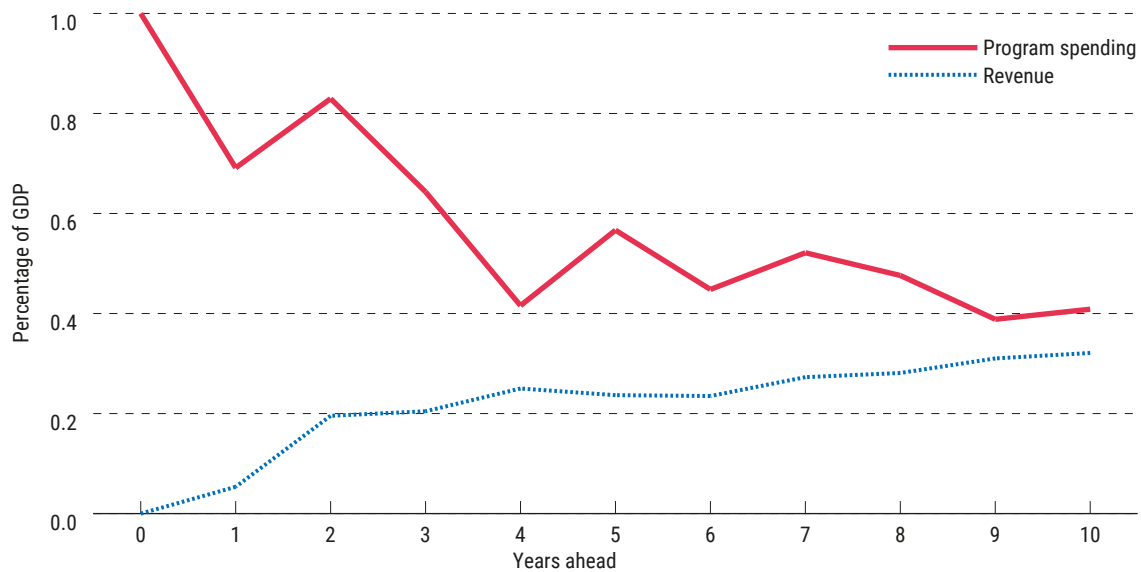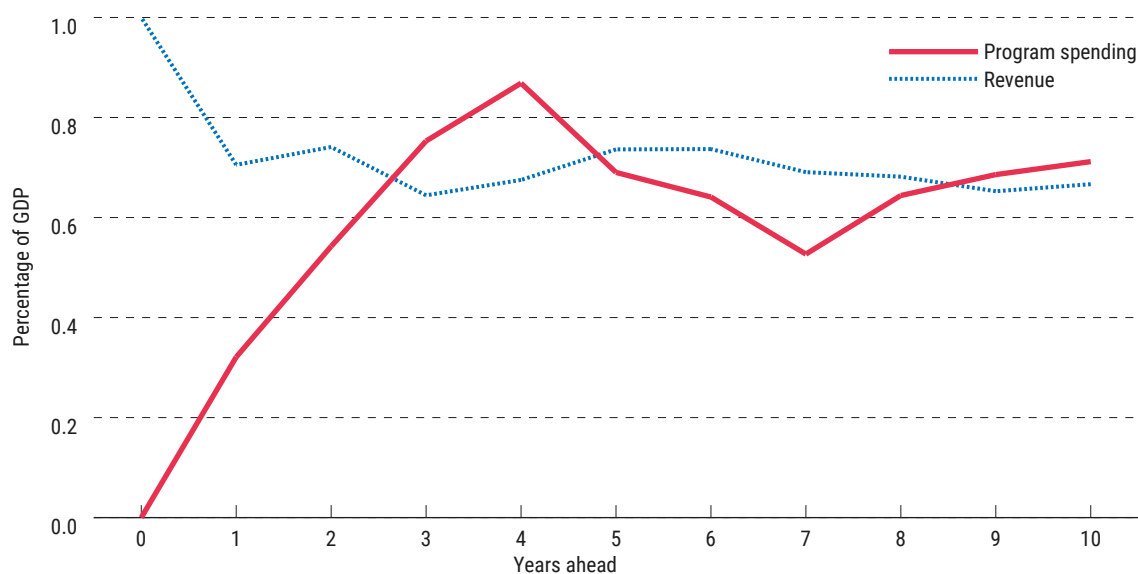

Note: Figure 4A shows the impulse-response functions after a shock in program spending. All the impulse-response functions are based on our main error-correction model estimates shown in table B3.
Source: Authors' calculations based on empirical estimates shown in table B3.

Figure 4B depicts the future responses to a one-time, one percentage-point increase in revenue. Although some of the initial revenue increases seem to be reversed in subsequent years, about 60% of the increase in revenue appears to persist. The figure also suggests that an increase in revenue is followed by an increase in program spending in subsequent periods.

The preceding discussion indicates that fiscal policy shocks can have long-lasting effects on government budgets. While figures 4A and 4B show responses to fiscal shocks in the years after the shock, one can obtain a better and more complete picture of budgetary adjustment by computing the present value of the projected responses. **Table 3** shows the present value of the responses to increases in program spending, revenue, and debt-service payments based on a discount rate of 3%, all expressed as a share of GDP. Column 1 shows that a one percentage-point increase in program spending is followed by a decrease in future spending and a rise in future taxes, and these fiscal responses are statistically significant. The results suggest that about 70% of a deficit caused by increases in program spending is eliminated by a reduction in program spending in subsequent years, while the remainder, about 30%, is eliminated through increases in future taxes. Thus, we find that the historical data provides empirical evidence in support of the spend-and-tax hypothesis, that is, *increases in program spending lead to increases in taxes.* The results also suggest that an increase in program spending may result in an increase in public debt because the present value of debt-service payments increases, although the coefficient estimate is only statistically significant at the 10% level.

Figure 4B: Response of program spending and revenue to a one-time, one percentage-point increase in revenue

Note: Figure 4B shows the impulse-response functions after a shock in revenue. All the impulse-response functions are based on our main error-correction model estimates shown in table B3.
Source: Authors' calculations based on empirical estimates shown in table B2.

Table 3: Present-value responses to increases in fiscal variables (as a share of GDP)

| Present value of the response of: | One percentage-point increase in the fiscal variable (as a percentage of GDP) | | |
	(1) Program spending	(2) Revenue	(3) Debt-service payments
Program spending	−0.72***	0.60***	−1.10**
	(0.20)	(0.12)	(0.48)
Total revenue	0.34*	−0.44***	0.21
	(0.20)	(0.12)	(0.51)
Debt service payments	0.20*	-0.11	0.53*
	(0.11)	(0.08)	(0.31)

Note: Robust standard errors in parenthesis. Significance levels are shown by *** for 1%, ** for 5%, and * for 10%. Results are based on the basic model reported in table A3. We use a discount rate of 3% to compute the present values.
Source: calculations by authors.

Column 2 indicates that a one percentage-point increase in revenue is followed by an increase in the present value of future program spending by 0.60. This result is broadly consistent with the tax-and-spend hypothesis, that is, *tax increases lead to program spending increases*. Column 3 shows that a one percentage-point increase in the ratio of debt-service payments to GDP leads to a reduction in future program spending and a rise in revenue, although the later response is not statistically significant.

3.3 Fiscal anchors and short-term fiscal responses to budget deficits

Governments adopt fiscal anchors to ensure that they are on a sustainable fiscal trajectory. As explained in Dodge and Dion (2022) and Dahlby, Ferede, and Fuss (2023), the debt-to-GDP ratio and the ratio of interest payments to revenue are the two most common fiscal anchors. If governments strictly adhere to their chosen fiscal anchors, their budgetary responses should depend on the anchors' targeted values. **Table 4** shows the expected fiscal-policy responses in each of four debt ratio/interest-cost ratio regimes. Empirically, we consider the federal government to be in a high-debt ratio regime if the debt ratio is above the average ratio during the sample period, 37.1%, and to be in a high-interest-cost regime when the interest-cost ratio is above 12.5% (which is the 25th percentile in the sample).[5] The boundary for the low-interest-cost ratio regime is where the ratio of interest payment to revenue is very close to the 10% interest-cost ratio that Dahlby and Ferede (2023) termed the "Dodge Rule" for initiating fiscal adjustments. The percentages of the sample in each of the four regimes are shown in table 4. Furthermore, based on its current net debt-to-GDP ratio of 46.7% and an interest-payment-to-revenue ratio of 10.2%, the federal government is in a high debt ratio/low interest-cost ratio regime (Canada, Department of Finance, 2023: 77, table A1.4).

In the following sections, we investigate whether the short-term fiscal responses of federal governments to budget deficits depend on the debt ratio and the interest-cost ratio.[6] As a result of sample−selection bias, a limited number of observations, and other econometric issues, it is not possible to estimate the fiscal policy responses for each of the four regimes separately. Accordingly, in section 3.1.1 we estimate the short-term fiscal responses to budget deficits based on whether the debt ratio is high or low and, in section 3.1.2, based on whether the interest-cost ratio is high or low.

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5   One may be concerned that the sample period's average debt-to-GDP ratio of 37.1% may be influenced by the pre-1950 period, which includes spikes for WWI, the Depression, and WWII. To address this issue, we check the sensitivity of our results based on an average for the post-1950 period of the debt-to-GDP ratio (36.5%) and report the results in table B4 in the appendix. We find the results to be robust to such a sensitivity check.

6   One may also wonder if the federal government's fiscal responses to budget deficits depend on whether the interest rate is above or below the economic growth rate. Unfortunately, we have not explored fiscal responses in this context as data on the long-term interest rate is available only in the latter half of the sample period.

Table 4: Fiscal policy choice matrix—expected responses

		Debt-to-GDP ratio regimes	
		High debt ratio	Low debt ratio
Interest-cost-to-revenue ratio regimes	High cost ratio	cut spending, raise tax revenues—33%	no spending response, raise tax revenues—42%
	Low cost ratio	**cut spending, no revenue response—4%**	no fiscal responses required—21%

Note: The numerical figures are the percentages of observations in each of the four regimes during the sample period.
Source: Authors' computation.

3.3.1 The debt ratio and short-term fiscal responses

In the previous section, we presented evidence that the federal government responds to an increase in the budget deficit by cutting its program spending and raising revenue in the following year. However, one may wonder whether the federal government's response to fiscal imbalances and its policy choices depend on the country's debt ratio, which is a commonly used fiscal anchor. When the debt burden is high, a government may be pressured by bond rating agencies and international institutions, such as the IMF and OECD, to adopt fiscal restraint, especially when interest rates are high. Thus, one may expect that a government's response to a budget deficit may be more robust in a high-debt-ratio environment. To shed light on such possible asymmetric fiscal responses based on the debt ratio, we investigate the issue by decomposing our sample into high-debt and low-debt regimes. During the period under investigation, the government's debt level is considered "high" if the federal net debt-to-GDP ratio is higher than the average net debt-to-GDP ratio during the sample period, 37.1%.[7] Otherwise, it is classified as low. Based on this criterion, with the current net debt-to-GDP ratio of 46.7%, the Liberal government is operating in a high-debt environment.

Table 5 indicates that the short-term fiscal responses to budget deficits depend on the debt ratio, with a positive revenue response and a negative spending response in a high-debt environment. On the other hand, in the low-debt environment, revenues and spending responses are not statistically significant. A formal test of the difference in responses is the Chi-squared statistic in the last row, which indicates that the null hypothesis that spending and revenue responses to a budget deficit are independent of the debt-to-GDP ratio can be rejected. Consistent with this result, there is a substantially larger increase in debt-service payments in the low debt-ratio environment

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7   One may be concerned that the sample period's average debt-to-GDP ratio of 37.1% may be influenced by the pre-1950 period, which includes spikes for WWI, the Depression, and WWII. To address this issue, we check the sensitivity of our results based on an average for the post-1950 period of the debt-to-GDP ratio (36.5%) and report the results in table B4 in the appendix. We find the results to be robust to such a sensitivity check.

Table 5: The debt ratio and short-term fiscal responses to the budget deficit, 1868−2021

		Dependent variables		
		(1)	(2)	(3)
Regimes	Explanatory variable	Program spending (ΔPS)	Debt service (ΔDS)	Total Revenue (ΔTR)
High debt ratio	Lagged Budget Deficit	−0.260***	0.027**	0.134**
		(0.076)	(0.013)	(0.064)
Low debt ratio	Lagged Budget Deficit	−0.030	0.063***	0.038
		(0.091)	(0.013)	(0.051)
		Test of symmetry		
	Chi-squared (1) statistic	9.37***	12.03***	2.91*

Note: Δ denotes change. Autocorrelation and heteroscedasticity robust standard errors in parentheses. Significance levels are shown by *** for 1%, ** for 5%, and * for 10%.
Source: Authors' computation.

because spending and revenue are not adjusting to a deficit. In other words, when the debt ratio is low, governments tend to finance budget deficits by borrowing more, which ultimately increases debt-service payments and raises the social and fiscal cost of future budgetary adjustments.

The asymmetric responses to budget deficits based on the size of the debt ratio have an important policy implication. The fiscal adjustments in response to a budget deficit involve cutting program spending and/or increasing tax rates, actions that impose substantial economic costs on society. Thus, it is better if the government embarks on fiscal adjustments early on and reins in its program spending or adjusts tax rates before the debt ratio rises significantly and the ability to sustain the debt is endangered in the event of future adverse fiscal shocks. Postponing a fiscal adjustment until the debt ratio becomes very high requires deeper cuts in program spending or larger increases in tax rates, which will have substantial economic, social, and political ramifications.

3.3.2 The Interest-cost ratio and short-term fiscal responses

The preceding section provides evidence that the federal government's short-term responses to the budget deficit depend on the debt ratio. A related interesting question is whether the interest-cost ratio (the ratio of interest payment to revenue) influences its fiscal responses to a budget deficit. In this section, we examine whether the short-term fiscal responses to a budget deficit depend on the interest-cost ratio. To this end, we divide the data into low and high interest-cost regimes where the latter occurs when the interest-cost ratio is below 12.5% (which is the 25th percentile in the sample). The boundary for the low interest-cost regime is where the ratio of interest payment to revenue is very close to the 10% interest-cost ratio that Dahlby and Ferede (2023) termed the

"Dodge Rule" for initiating fiscal adjustments. Based on this classification, the 2023/24 fiscal year is in the low interest-cost-ratio regime since the ratio of interest payments to revenue is 10.2%, and that is projected to rise to 10.6% in 2028/29 (Canada, Department of Finance, 2023: 77, table A1.4).

In **table 6**, we test for asymmetric fiscal responses to a budget deficit based on the interest-cost ratio. In column 1, the coefficient of program spending is negative and statistically significant in the high interest-cost regime, but it is not statistically significant in the low interest-cost regime. Similarly, column 3 shows that the revenue response to a budget deficit is positive and statistically significant only in the high interest-cost regime. The null hypothesis that the fiscal responses to a budget deficit are the same in the low and high interest-cost regimes is rejected in the program spending and revenue equations. These results suggest that in a low interest-cost environment, such as the one currently prevailing in the country, the federal government has the incentive to postpone fiscal adjustment as it can finance budget deficits by borrowing in the capital markets without the pressure to cut spending or raise revenue.

Table 6: The interest-cost ratio and short-term fiscal responses to the budget deficit, 1868−2021

Regimes	Explanatory variable	Dependent variables		
		(1) Program spending (ΔPS)	(2) Debt service (ΔDS)	(3) Total Revenue (ΔTR)
High interest-cost ratio	Lagged Budget Deficit	−0.246***	0.037**	0.120***
		(0.058)	(0.015)	(0.043)
Low interest-cost ratio	Lagged Budget Deficit	0.025	0.035***	0.053
		(0.091)	(0.012)	(0.039)
		Test of symmetry		
	Chi-squared (1) statistic	17.73***	0.04	6.02**

Note: Δ denotes change. Autocorrelation and heteroscedasticity robust standard errors in parentheses. Significance levels are shown by *** for 1%, ** for 5%, and * for 10%.
Source: Authors' computation.

In sum, the preceding sections highlight that federal governments' responses to budget deficits depend on the common fiscal anchors—debt-to-GDP and interest-cost ratios. Our analysis suggests that the policy choice of the government can vary across various fiscal-anchor regimes. Although we are currently in the high debt-ratio regime, the Trudeau government's recent budgets have postponed deficit reductions. This inaction is consistent with the econometric results that federal governments delay fiscal responses to deficits when interest costs are low. This also suggests that the Liberal government adopted the interest-cost ratio, rather than the debt ratio, as its true fiscal anchor.

4. Conclusions

This study investigates how Canadian federal governments have responded to budget deficits based on data spanning over the last 150 years. Federal governments have historically faced various fiscal shocks that resulted in a jump in the budget deficit and significant accumulation of debt. In the most common fiscal environment, where the interest rate exceeds the rate of economic growth, when a government faces a budget deficit, sooner or later, it must embark on fiscal adjustment involving tax hikes and spending cuts to maintain fiscal sustainability.

Our study indicates that Canadian federal governments generally have responded to budget deficits through spending cuts and tax hikes. Roughly two thirds of the fiscal responses to budget deficits appears on the spending side of the government budget. We also find that federal governments' fiscal responses are generally consistent with *spend-and-tax* and *tax-and-spend* hypotheses, which suggest a robust fundamental link between the Canadian federal government's fiscal position and program spending. We also find that federal governments faced with an increase in deficits have generally delayed making budgetary adjustments when the debt and interest-cost ratios are low. As we are currently in a high debt ratio and low interest-cost ratio environment, the Liberal government's delayed responses to its budget deficits imply that it is more influenced by its current interest-cost ratio than its debt ratio.

Delaying fiscal adjustment until the interest-cost ratio increases means that there will need to be larger future budgetary adjustments, which involve deeper cuts in program spending and a hike in tax rates that will have substantial economic and social costs. Thus, an essential implication of this study is that it is better if the federal government embarks on fiscal adjustment early on and reins in its program spending before its debt ratio and interest-cost ratio rise significantly and unforeseen future adverse budgetary shocks jeopardize its fiscal sustainability.

Appendix A: Analytical framework

The analytical framework of this study relies on an empirical methodology that was previously introduced by Bohn (1991) to assess the fiscal adjustment of the US government and used by later researchers such as Buettner and Wildasin (2006), Ferede and Dahlby (2023), and others. This section heavily draws from Ferede and Dahlby (2023). An essential characteristic of the analytical framework is that it explicitly reflects the intertemporal budget constraints of the federal government and helps us investigate how the government responds when it faces adverse fiscal shocks and its budget deficits increase as a result.

Our empirical specification considers all the components of the government budget constraint. The federal government's budget is decomposed into three main components: Total revenue (TR_t), program spending (PS_t) and debt service payments (DS_t). Given these notations, in any given fiscal year, the federal government's current budget deficit (D_t) can then be computed as:

$$D_t = PS_t + DS_t - TR_t \qquad\qquad\qquad 1.1$$

where the subscript t denotes the fiscal year. As Bohn (1991) shows, if the budget deficit (D_t) is stationary, then the intertemporal budget constraint of the government will have a vector error correction representation of the following form:

$$\Delta Z_t = \Pi_0 D_{t-1} + \Pi_1 \Delta Z_{t-1} + \Pi_2 \Delta Z_{t-2} + \dots + \Pi_p \Theta_p \Delta Z_{t-p} + u_t \qquad\qquad 1.2$$

where Δ denotes first-difference (or change), Π denotes a vector of coefficient estimates, D_{t-1} is the one-period lagged overall budget deficit (which is simply the error correction term in the model), Z is a vector that includes the fiscal variables PS, DS, and TR, p shows the lag length, and u_t is the error term. Equation 1.2 succinctly shows a system of three equations corresponding to each fiscal variable. Thus, Π_0 is a (3x1) vector of the coefficients of the lagged budget deficit and Π_p is a (3x3) matrix of the coefficient estimates of the fiscal variables for lag length p. In other words, our empirical specification indicates that each component of the federal government budget can be estimated on lagged values of itself, lagged value of the budget deficit, and lagged values of other components of the budget constraint. -

Note that our main empirical approach, as specified in Eq. 1.2, relies on certain time series properties of the fiscal variables. More specifically, the model assumes that the federal government's overall budget deficit is stationary while the other fiscal variables are non-stationary. In statistical terms, an economic variable is considered "stationary" if its mean and variance are time-invariant. On the other hand, if the variable's mean and variance change over time, it is considered non-stationary. Thus, before employing the empirical model, we check the time-series properties of the fiscal variables using various unit root tests that are commonly used in the empirical literature. Our results reported in **table B.1** show that the federal overall budget deficit is stationary in levels while the other fiscal variables are non-stationary. Therefore, our error-correction empirical specification of equation 1.2 is appropriate to investigate the dynamic fiscal adjustment of the federal government and provide insight into the budgetary responses to fiscal imbalances.

Appendix B: Additional results

Table B1: Unit root tests

Variables	ADF (lags=10)	DF-GLS
Variables in levels		
Program spending to GDP ratio	−1.894	−1.251
Debt service to GDP ratio	−2.285	−1.681
Total revenue to GDP ratio	−1.330	−0.828
Budget Deficit to GDP ratio	−3.474**	−4.941***
Variables in first differences		
Δ Program spending to GDP ratio	−4.701***	−9.724***
Δ Debt service to GDP ratio	−2.936**	−5.057***
Δ Total revenue to GDP ratio	−3.709***	−7.528***

Notes: The lag length for the DF-GLS unit root test is chosen by the Modified-Schwarz Information Criterion (SIC). All the unit root tests include a constant term. KPSS test also provides similar results. Significance levels are shown by *** for 1%, ** for 5%, and * for 10%.

Source: Authors' computation.

Table B2: Johansen tests for cointegration

Hypothesized number of cointegration vectors	Trace Statistic	Critical value
None	40.6379**	29.68
At most 1	8.6192	15.41
At most 2	2.2854	3.76

Note: We reject the null hypothesis of no cointegration, but we do not reject the null hypothesis of the presence of one cointegration vector at the 5% (**) significance level.

Source: Authors' computation.

Table B3: Federal government fiscal adjustment (OLS)

	(1) Program spending	(2) Debt service	(3) Total revenue
Program spending t-1	−0.131	−0.012	−0.042
	(0.149)	(0.009)	(0.054)
Program spending t-2	0.265***	0.016**	0.110***
	(0.051)	(0.007)	(0.013)
Program spending t-3	0.093	−0.003	0.111**
	(0.064)	(0.005)	(0.048)
Program spending t-4	−0.267***	0.002	−0.006
	(0.101)	(0.008)	(0.021)
Debt service t-1	0.348	0.279***	−0.203
	(0.528)	(0.101)	(0.225)
Debt service t-2	−1.017	−0.101	0.165
	(1.160)	(0.075)	(0.411)
Debt service t-3	0.503	0.077	−0.125
	(0.580)	(0.104)	(0.328)
Debt service t-4	0.375	−0.073	0.048
	(0.895)	(0.072)	(0.295)
Revenue t-1	0.138	−0.016	−0.141*
	(0.167)	(0.016)	(0.078)
Revenue t-2	0.381	−0.016	−0.208*
	(0.316)	(0.026)	(0.113)
Revenue t-3	0.070	0.046*	−0.130*
	(0.230)	(0.027)	(0.067)
Revenue t-4	−0.166	−0.048**	−0.187**
	(0.172)	(0.024)	(0.077)
Budget Deficit t-1	−0.199***	0.036***	0.108***
	(0.064)	(0.014)	(0.040)

Table B3, continued: Federal government fiscal adjustment (OLS)

	(1)	(2)	(3)
	Program spending	Debt service	Total revenue
WWII dummy [a]	8.960***	−0.025	3.704***
	(0.884)	(0.088)	(0.309)
End of WWII dummy [b]	−6.337***	−0.411*	−2.482***
	(1.458)	(0.210)	(0.766)
Constant	0.388***	−0.058***	−0.132**
	(0.118)	(0.020)	(0.056)
Observations	149	149	149
Adjusted R-squared	0.567	0.280	0.429
F-test on ΔG (p-value)	0.000	0.060	0.000
F-test on ΔR (p-value)	0.526	0.016	0.000

Notes: Autocorrelation and heteroscedasticity robust standard errors in parentheses. Significance levels are shown by *** for 1%, ** for 5%, and * for 10%. The fiscal variables are expressed as a ratio of GDP, and all of them, except the budget deficit, enter the regression in the first differences. [a] WWII dummy is equal to one for years between 1941 and 1944 (during which war-related spending spiked) and zero otherwise. [b] End of WWII dummy is equal to one for years between 1945 and 1948 (during which the war-related spending dropped) and zero otherwise.

Source: Authors' computation.

Table B4: Sensitivity analysis of fiscal responses to budget deficit based on various debt-to-GDP ratios, 1868−2021

		Dependent variables		
		(1)	(2)	(3)
Regimes	Explanatory variable	Program spending (ΔPS)	Debt service (ΔDS)	Total Revenue (ΔTR)
High debt ratio	Lagged Budget Deficit	−0.262***	0.027**	0.134**
		(0.076)	(0.013)	(0.064)
Low debt ratio	Lagged Budget Deficit	−0.027	0.063***	0.038
		(0.089)	(0.013)	(0.051)
		Test of symmetry		
	Chi-squared (1) statistic	10.37***	11.39***	2.90*

Notes: Δ denotes change. Autocorrelation and heteroscedasticity robust standard errors in parentheses. Significance levels are shown by *** for 1%, ** for 5%, and * for 10%. The debt-to-GDP ratio is considered "high" if it exceeds 36.5% (which is the average debt-to-GDP ratio for the period from 1950 to 2021) and "low" if the debt ratio is less than 36.5%.

Source: Authors' computation.

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