



# How Provincial Governments Respond to Fiscal Shocks and Federal Transfers

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## Executive Summary

The COVID-19 pandemic and its associated adverse economic impacts put substantial strains on governments' budgets. When governments face a sharp increase in their budget deficits, they can respond by raising taxes, reducing government spending, increasing borrowing, or some combination of these strategies. How governments respond and the timing of their responses can have a significant impact on business production and investment decisions, household spending and savings, the provision of public services, and government debt levels. Understanding how governments respond to budgetary shocks is essential for evaluating their policies and recommending fiscal policy reforms.

In this study, we investigate how Canadian provincial governments have responded to fiscal shocks, including changes in federal transfers, based on annual data spanning over half a century. We find that provincial governments have responded to a \$1.00 increase in their per-capita budget deficits by cutting program spending by \$0.18 and increasing own-source revenues by \$0.09 the following year. As these responses only partially offset the deficit, provincial debt levels increase, and debt service costs rise. Thus, provinces that face adverse fiscal shocks and/or rising budget deficits in a given period inevitably respond by reducing program spending and/or hiking own-source revenues in future periods. This undermines the arguments advanced by some politicians and policy analysts who believe provinces can run ongoing deficits without having to “face the fiscal music” in the future.

Similarly, we find that a \$1.00 increase in per-capita provincial program spending, which causes a rise in the budget deficit, results in a \$0.71 decline in future program spending, a \$0.26 increase in future own-source revenues, and a \$0.10 increase in debt service payments, all measured in present value terms. This means that an increase in provincial program spending in the current period is not entirely offset by future spending reductions and that there will be an associated increase in the future tax burden. Thus, the impacts of fiscal shocks can reverberate for several years.

In Canada, federal cash transfers to the provinces represent a sizable portion of total provincial government revenues, particularly for provinces that receive equalization grants. This study also highlights the importance of federal grants and transfers in

provincial governments' fiscal adjustments. According to the available empirical estimates, a \$1.00 permanent increase in equalization grants and other federal transfers such as the Canada Health Transfer (CHT) and Canada Social Transfer (CST) causes provincial program spending to increase by \$0.69 and \$0.80, respectively, with no significant change in provincial governments' own-source revenue. Thus, an important policy implication of this study is that the federal government can use grants to encourage provincial governments to spend on vital public services.

# 1. Introduction

The COVID-19 pandemic and its negative economic impacts recently put a considerable strain on provincial governments' budgets. This was particularly true in the fiscal year 2020/21. Provincial governments substantially increased their spending to lessen the damage done by the pandemic to workers, households, and businesses. On the revenue side, provincial revenue sources declined in 2020/21 as a result of the negative effects of pandemic-related economic disruptions and job losses on tax collections. The net result was a deterioration of provincial budget balances. For instance, in the fiscal year 2020/21, Canadian provincial governments' collective real per-capita budget balance deteriorated by about \$1,100. Of course, one would expect large adverse shocks to the budget balance to require future fiscal adjustments. When governments face growing budget deficits, they may raise taxes, reduce government spending, increase borrowing, or some combination of these measures. However, the way provincial governments respond, and the timing of their responses, can have a significant impact on society and the economy. Thus, examining the dynamics of fiscal adjustment is crucial to informing policy makers and citizens about the effects of governments' responses to various budgetary shocks. How do provincial governments attempt to restore their fiscal balances after experiencing adverse revenue or spending shocks? Do they respond by raising taxes or reducing spending when they face large budget deficits? How do provincial governments respond to increases in federal transfers? These are pertinent public-policy questions, and investigating them can help illuminate current Canadian debates on budget deficits and public debt.

This study, therefore, examines the fiscal adjustment of Canadian provincial governments and the role of federal grants and transfers in this adjustment process using annual provincial data spanning over half a century. Our main theoretical framework is based on a model of dynamic fiscal adjustment initially proposed in the seminal work of Bohn (1991) and used to investigate the budget adjustments of the US federal government. This model highlights how fiscal adjustments consistent with the intertemporal budget constraints occur over time. We believe such an approach is useful to understanding provincial governments' responses to various spending and revenue shocks. The same theoretical framework was also employed in similar studies such as Buettner and Wildasin (2006), Buettner (2009), Solé-Ollé and Sorribas-Navarro (2012), Bessho and Ogawa (2015), Ferede (2018), and Jaimes (2020) to investigate the dynamic fiscal responses of municipal governments.

Our analysis indicates that, in general, provincial governments respond to current budget deficits by cutting future program spending and raising their own-source revenue. According to our estimates, a \$1.00 increase in a province's per-capita budget deficit causes a \$0.18 decline in program spending, a \$0.09 rise in own-source revenues, and a \$0.01 increase in debt-service costs in the following year. The increase in debt-service costs indicates a permanent increase in the government's debt level. Similarly, we find that a \$1.00 increase in per-capita provincial program spending, which causes a rise in the budget deficit, results in a \$0.71 decline in future program spending, a \$0.26 increase in own-source revenues, and a \$0.10 increase in debt-service payments, all measured in present value terms. This means that an increase in provincial program spending is not completely offset by future spending reductions and that there is also an increase in the future tax burden. We also find that provincial governments tend to spend increases in revenues, that is, extra revenues lead to extra spending rather than to a greater focus on paying down debt. Thus, the impacts of fiscal shocks can reverberate for several years.

The empirical results of this study also highlight the importance of federal transfers and grants to provincial governments' fiscal adjustments. According to our estimates, each additional dollar of permanent increase in equalization transfers and other federal grants like the Canada Health Transfer (CHT) and the Canada Social Transfer (CST), causes provincial program spending to increase by \$0.69 and \$0.80, respectively, with no significant impact on own-source revenue. This result is consistent with previous studies of the "flypaper effect"—the empirical observation that lump-sum grants have more significant government spending impacts than equivalent increases in average personal income in the jurisdiction—, which indicate that the federal government can employ grants to stimulate provincial spending (e.g., Dahlby and Ferede, 2016). Further, our analysis reveals that recipients of equalization grants tend to adjust to current budget deficits by cutting their program spending—with no significant change in revenue sources. Non-recipients of equalization transfers tend to cut their program spending in response to budget deficits and raise their own-source revenue. An important policy implication of this study is that the federal government can employ equalization and other grants as significant public-policy tools to encourage provincial governments to spend on vital public services.

The remainder of this paper is organized as follows. Section 2 briefly discusses the relevant data to provide background on the fiscal situations of Canadian provincial governments. The main empirical results of past provincial fiscal adjustments are presented and discussed in section 3. Section 4 provides a brief conclusion.



## 2. Background

The empirical analysis of this study uses panel data from the ten Canadian provinces over the fiscal period 1966/67 to 2020/21. All the fiscal variables are in 2020 dollars and measured in fiscal year terms. The data for the fiscal variables were obtained from the Finances of the Nation (2022) online database. Note that, because of the variation in local government fiscal responsibilities and the corresponding differences in provincial governments' revenue and expenditures, we use the consolidated provincial and local fiscal variables in our analysis. To account for the effects of inflation over time, we deflate all fiscal variables using provincial consumer price indices. Further, since the provincial economies vary in size, we use per-capita variables to facilitate comparison across provinces. We show the basic summary statistics of the fiscal variables in table 1.

**Table 1: Descriptive Statistics, 1966/67-2020/21**

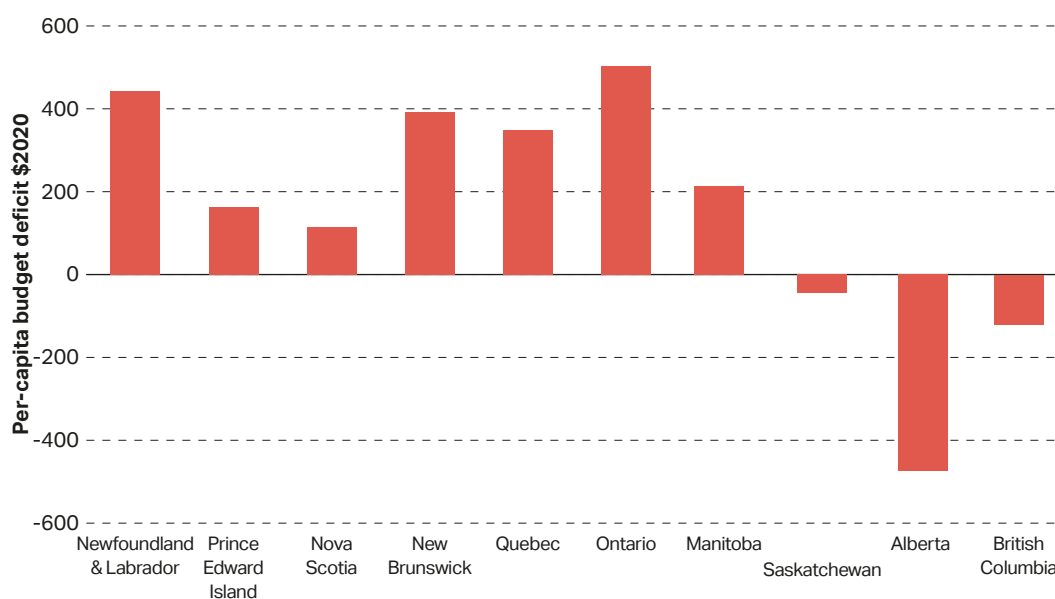
Variables	Mean	Std. dev.	Min	Max
<b>Budget components (per capita in 2020 dollars)</b>				
Program spending	10353.18	3364.96	3185.26	17805.25
Debt service	1089.00	559.71	113.87	2888.24
Equalization grants	979.30	937.87	0.00	3260.51
Other grants	1645.49	817.03	437.44	8672.03
Own-source revenue	8731.00	3549.90	1428.15	18414.85
Budget deficit	153.68	1006.07	-4511.24	3749.78
<b>Changes in budget components (per capita in 2020 dollars)</b>				
Program spending	204.42	632.05	-3388.91	5375.85
Debt service	14.06	104.98	-458.49	456.60
Equalization grants	15.02	144.57	-1139.77	1037.27
Other grants	39.78	537.83	-4936.62	5353.00
Own-source revenue	169.01	583.45	-3656.64	3893.08
<b>Control variable</b>				
Lagged change in GDP (per capita in 2020 dollars)	695.51	2018.39	-14144.49	9084.91

Note: The sample period is 1966/67 to 2020/21. The fiscal variables are for the consolidated provincial and local governments. Negative values for the budget deficit show budget surplus.

Source: Authors' calculations based on data obtained from *Finances of the Nation*, 2022.

Table 1 shows there is significant variation in the various fiscal variables across provinces during the sample period. Often, one can obtain important insights into the fiscal performance of a government by looking at its overall budget balance, which is the difference between its total spending and revenue. As this fiscal variable summarizes the overall position of provincial governments' budgetary situations, we focus our discussion on this key variable. During the sample period, there is significant variation in the budget balance, ranging from a deficit of \$4,511.2 in 2009 for Saskatchewan to a surplus of \$3,749.8 in 1987 for Alberta. Similarly, the provincial sample average per-capita budget balance ranges from a deficit of about \$504 for Ontario to a surplus of about \$475 for Alberta, both in 2020 dollars (figure 1). The three western provinces of British Columbia, Alberta, and Saskatchewan, on average, have budget surpluses during the sample period. On the other hand, the other provinces, on average, run budget deficits.

**Figure 1: Average per-capita budget deficit (\$2020) of the Canadian provinces, 1966/67–2020/21**



Source: *Finances of the Nation*, 2022; authors' calculations.

Of course, average values often mask the year-to-year fluctuations of provincial budget balances. Thus, to visualize the overall fiscal situation of each province, in figure 2, we show the evolution of budget balances for all ten provinces during the full sample period. Note that, as we indicated before, negative values of a budget deficit indicate that the province has a budget surplus.

Figure 2 shows that provincial governments' budget balances exhibit significant variations over the sample period. The figure reveals that shocks to provincial budget

Figure 2: Per-capita budget deficits (\$2020) of the Canadian provinces, 1966/67–2020/21



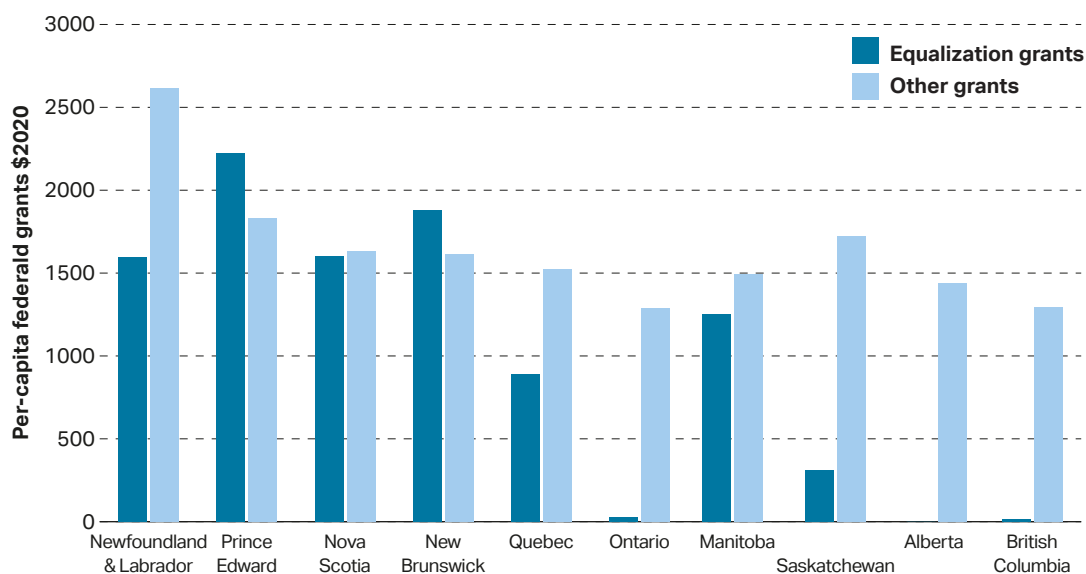
Source: *Finances of the Nation*, 2022; authors' calculations.

balances are often persistent. The above figure also shows that resource-based economies such as Alberta and Saskatchewan and, to some extent, British Columbia, experienced quite marked fluctuations in their budget balances. Newfoundland & Labrador also showed a similar trend in more recent years as the provincial government began relying relatively more on energy revenue. These significant variations in budget balances are mainly the result of fluctuations in resource revenue, which in turn is caused by volatility in the global prices of the major export commodities. While provinces such as Nova Scotia and Quebec experienced a decline in their budget deficits in recent years, others such as Alberta exhibited a rise in budget deficits during the same period. Note, for instance, that in the fiscal year 2020/21, on average, Canadian provincial governments' real per-capita budget balance deteriorated by about \$1,100 because the COVID-19 pandemic substantially reduced provincial governments' revenue and boosted their spending.

The observed variations in the Canadian provincial governments' budget balances are the result of fluctuations in their program spending and own-source revenue sources. As is well known, in the Canadian federation health care, social services, and education are primarily the responsibilities of provincial governments, and these spending categories account for a majority of provincial program spending. In this regard, the federal government provides grants to provincial governments to assist them in the provision of such public programs and services.

In this study, we decompose the federal grants into equalization grants and "other grants". Other grants include all federal transfers other than equalization grants. An important component of intergovernmental transfers in the Canadian federation is fiscal equalization. This is a block transfer offered to eligible provinces to enable them to provide an acceptable level of public services without resorting to even higher taxation of their residents. Basically, this federal grant is designed to address the problem of disparities in the fiscal capacities among provinces. Under the equalization program, eligibility and the amount from grants that provinces receive depend on their fiscal capacities, as measured by their per-capita tax bases. During the 55-year sample period under consideration, Alberta did not receive any equalization grants. Some provinces were eligible to receive the grant only in some years: British Columbia received equalization payments in 7 years, Saskatchewan in 35, Ontario in 10, and Newfoundland & Labrador in 42 years. All other provinces were eligible to receive equalization grants throughout the sample period. **Figure 3** shows the variation across provinces in their dependence on equalization grants. Earlier studies such as Smart (2007) and Ferede (2016) indicate that equalization grants influence the fiscal choices of recipient provincial governments.

**Figure 3: Average federal grants per-capita (\$2020) to the Canadian provinces, 1966/67–2020/21**



Source: *Finances of the Nation, 2022*; authors' calculations.

In the current context, the major components of other grants are the Canada Health Transfer (CHT) and the Canada Social Transfer (CST), which have been in place since 2004. The various components of the Canadian federal transfers have undergone many changes over time.<sup>1</sup> The amounts and the allocation of federal grants have varied over time, and provincial governments can generally use the funds received from Ottawa however they like, as these federal grants are not tied to any specific area of provincial spending.

1. The discussion of these changes is beyond the scope of this paper. See Dahlby and Ferede, 2016 and the references contained therein for a more detailed discussion.



## 3. Empirical Results and Discussion

### 3.1. Short-term fiscal responses to budget deficits

Our empirical model, specified and discussed in Appendix 1 (pp. 21–22), allows us to investigate the dynamic fiscal responses of provincial governments to budget deficits. Our results in **table A2.1** in the appendix (p. 23) show that the budget deficit is stationary.<sup>2</sup> In a statistical sense, a variable is “stationary” if its mean and variance are constant over time. In our model, the stationarity of the budget deficit suggests that, on the whole, the budget deficits of Canadian provincial governments have been sustainable. Alternatively, this finding implies that provincial governments have followed fiscal policies consistent with intertemporal budget constraints.<sup>3</sup>

Consequently, we use our empirical model to assess the effects of current budget deficits on future values of provincial program spending, own-source revenues, debt service payments and transfers from the federal government. The system of equations in our empirical model shown in **table A2.3** in the appendix (pp. 24–25) yields many parameter estimates. Here, we focus on the short-term responses of the various fiscal variables to an increase in the budget deficit.

The results (**table 2**) indicate that a budget deficit has statistically significant effects on future provincial program spending, own-source revenues, and debt service payments. In response to a \$1.00 increase in the per-capita budget deficit, provincial governments reduce their program spending by \$0.18 and raise their own-source revenue by about \$0.09 in the following fiscal year. As these fiscal adjustments do not completely offset the previous year’s budget deficit, there is an increase in the public debt, which in turn raises the associated debt-service payments in the following year (and beyond).

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2. A variable is considered “stationary” if its mean and variance do not change over time. We use the Breitung panel unit-root test to check the non-stationarity of the various variables of interest. The null hypothesis in the unit-root test is that the variables are non-stationary. As the results reported in **table A2.1** indicate, we do not reject the null hypothesis of a unit root for all variables in levels except for the budget deficit. On the other hand, we reject the null hypothesis of a unit root for the budget deficit and other variables in their first differences. Thus, the error correction estimation method we employ is statistically appropriate.

3. See the discussion in Hamilton and Flavin, 1986. According to the Parliamentary Budget Officer’s *Fiscal Sustainability Report 2021* (2021), while the debt of the federal government is sustainable, the debt level of many provinces (except Ontario, Quebec, and Nova Scotia) is not sustainable over time.

**Table 2: Short-term responses to a \$1.00 increase in the per-capita budget deficit**

	Response		Response
Program spending	-0.183***	Equalization grants	0.006
Own-source revenue	0.092**	Other grants	0.035
Debt service	0.011**		

Note: These results are from the first row of the regression results in table A2.3. Significance levels are shown by \*\*\* for 1%, \*\* for 5%, and \* for 10%.

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

Consequently, a \$1.00 increase in the per-capita budget deficit is associated with a \$0.01 increase in debt-service payments in the following year.<sup>4</sup>

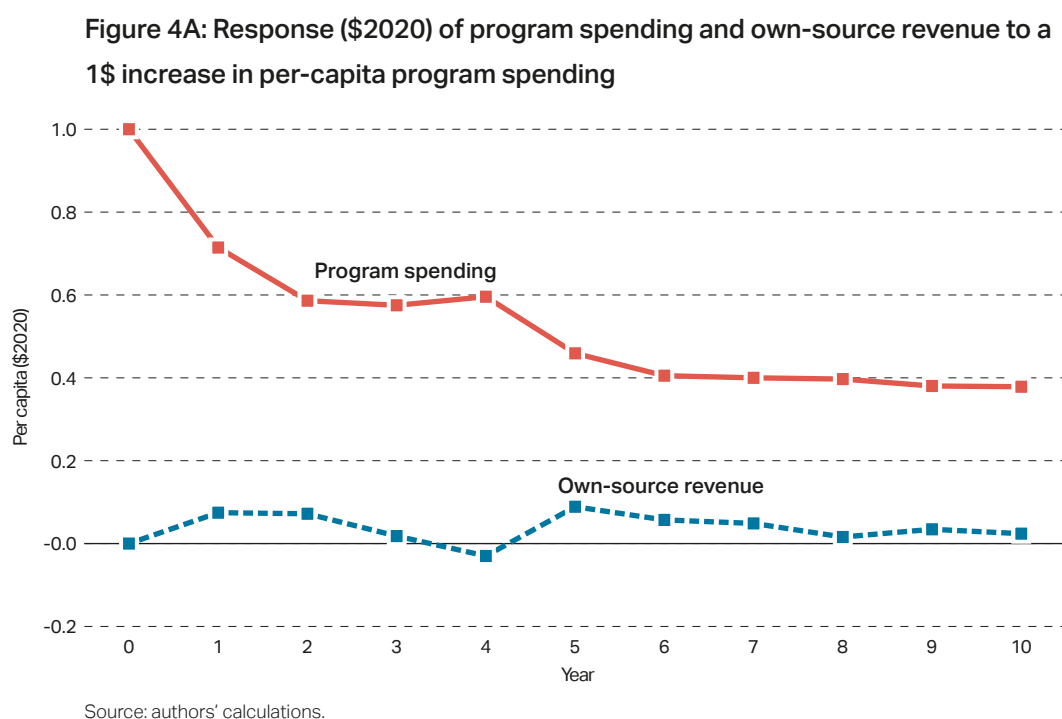
On the other hand, our empirical results indicate that a provincial budget deficit does not have a statistically significant effect on either equalization grants or other federal transfers and grants in the following year. This result is expected, because the equalization grants for the most part are determined by the fiscal capacity of the province while the other federal grants, at least in recent years, tend to increase with the growth rate of the economy and are thus independent of provincial governments' previous year's budget deficits.

### 3.2. Long-term responses to temporary fiscal shocks

A temporary fiscal shock can cause multi-year changes in provincial program spending, revenues, and debt-service payments. To visualize how fiscal shocks affect the various budgetary variables over many years, we show in the figures below the impact of an unexpected \$1 increase in provincial program spending (**figure 4A**), own-source revenue (**figure 4B**), and other grants (**figure 4C**). Along the horizontal axis, we show the number of years after the fiscal shock while the vertical axis denotes the real per-capita values of the relevant budgetary components. Note also that the figures are simply the impulse responses of the variables over the different time periods, and we show them only for the first ten years after the fiscal shock occurs.

4. Buettner and Wildasin (2006) interpret the estimated increase in debt-service costs as the real interest rate on government debt.

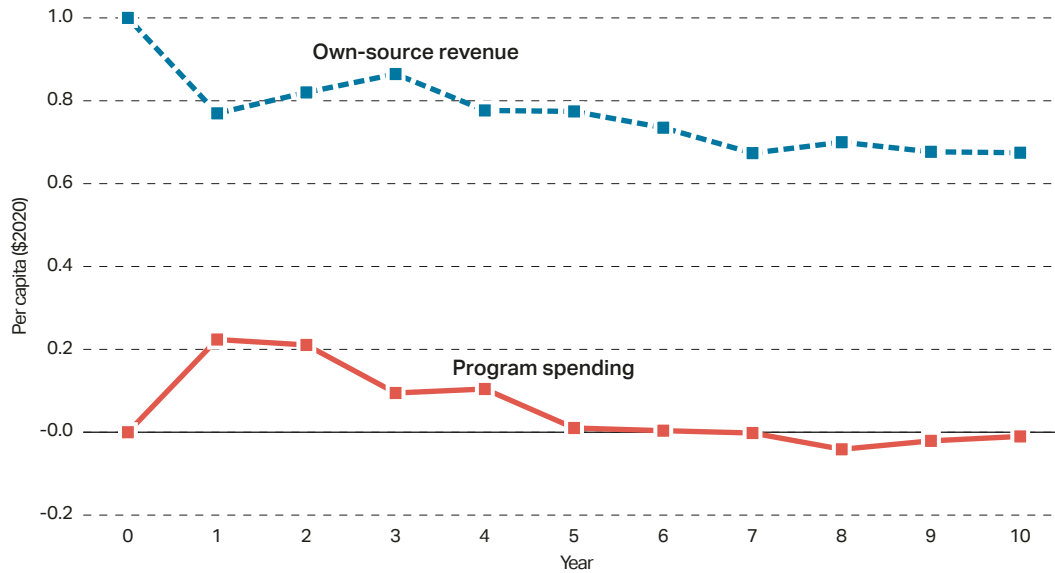
Figure 4A illustrates the provincial responses of program spending and own-source revenue to a \$1 increase in per-capita program spending. As the figure indicates, in the year following the unexpected rise in program spending, there is a significant drop in program spending. This suggests that almost 40% of the variation in program spending is temporary, due to the subsequent year's offsetting changes. Since governments operate within their intertemporal budget constraints, the increase in program spending is offset by an increase in own-source revenue. Similarly, figure 4B shows the responses of program spending and own-source revenue to an unexpected \$1 rise in own-source revenue. While own-source revenue falls in the subsequent year, program spending rises as a result of the unexpected increase in own-source revenue.



Likewise, figure 4C depicts the response of provincial program spending and own-source revenue to unexpected increases in other federal grants such as CST and CHT. The unexpected increase in the federal grant causes program spending to rise in the following year, suggesting the stimulative effects of such grants on program spending. On the other hand, the response of own-source revenue seems to be small.

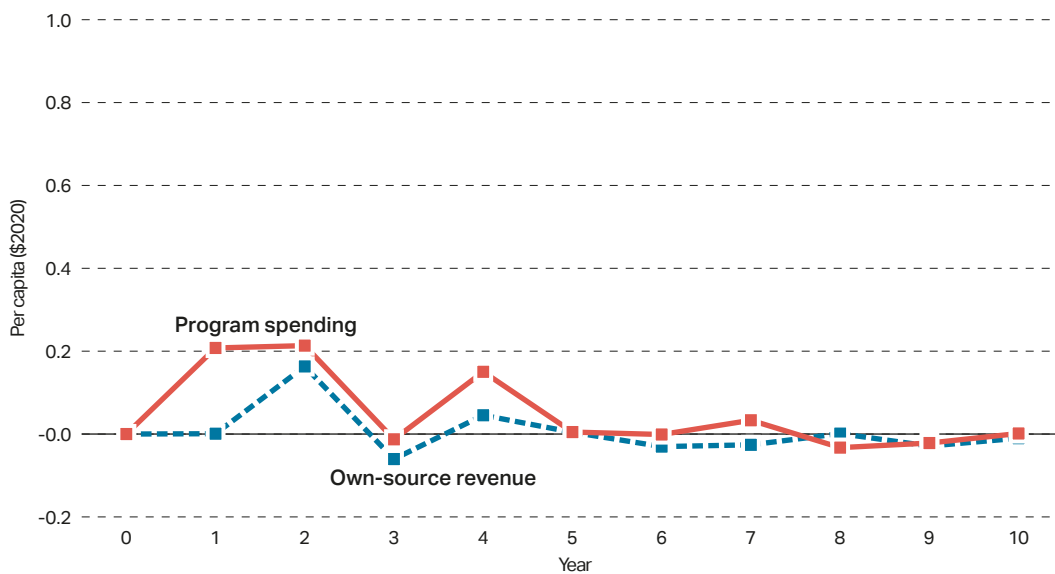
While figures 4A, 4B, and 4C help us visualize how fiscal adjustments occur over the first few years after a province experiences a budget shock, perhaps one can obtain a complete view of provincial governments' budgetary adjustments by computing the long-term total fiscal responses in present-value terms. To this end, the long-term

**Figure 4B: Response (\$2020) of program spending and own-source revenue to a 1\$ increase in per-capita own-source revenue**



Source: authors' calculations.

**Figure 4C: Response (\$2020) of program spending and own-source revenue to a 1\$ increase in other grants**



Source: authors' calculations.

effects can be summarized as the present value of the responses, since the changes occur over multiple years. We show the present value of the responses in **table 3**.

To quantify the multi-year responses to fiscal shocks that reverberate for several years, table 3 shows the present value of the responses using a discount factor of 3%.<sup>5</sup> Column (1) indicates that a \$1.00 increase in per-capita provincial program spending, giving rise to an increase in the budget deficit, results in a \$0.71 decline in future program spending, a \$0.26 increase in own-source revenues, and \$0.10 increase in debt-service payments, all measured in present-value terms. This means that an increase in provincial program spending is not completely offset by future spending reductions and that there is also an increase in the future tax burden.<sup>6</sup> It is also important to note that an increase in program spending does not affect future equalization grants and other federal transfers. Again, this is not surprising as these federal transfers are generally not tied to recipient provinces' spending, which is a sensible feature of Canada's intergovernmental transfer system (Gamkhar and Shah, 2007).

Column (2) of table 3 indicates that a \$1.00 increase in per-capita own-source provincial revenue leads to a \$0.54 increase in future program spending and a \$0.38 decline in own-source revenue. The fact there is no change in subsequent debt-service payments implies that an increase in revenues is not saved. This means that provincial governments tend to spend increases in revenues, that is, extra revenues lead to extra spending rather than to an effort to pay down debt. To the degree an increase in provincial revenues is temporary, the provincial fiscal response is not consistent with the tax-rate smoothing model of optimal fiscal policy.<sup>7</sup>

In column (3), we present the response of budgetary components to a \$1.00 increase in debt-service payments. In provincial governments' budgets, a \$1.00 increase in

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5. These calculations are based on the coefficient estimates in table A2.3 using the method discussed by Bohn (1991), Buettner (2009), and Bessho and Ogawa (2015) to compute the impulse response of the government budget to various fiscal shocks. Using different discount factors does not influence our results much. We would like to thank Shun-ichiro Bessho and Hikaru Ogawa for sharing their Stata code to compute the present value of the impulse responses.

6. Note that the coefficient estimates used in the present-value computations are obtained from the historical data. However, as is common in the literature, we rely on an out-of-sample forecast to analyze the impact of any future change in one of the fiscal variables (e.g., future changes in federal grants) on future values of the other budgetary variables. Such computation of the present value of responses is generally possible for any number of years into the future.

7. The tax-smoothing model recommends that, in response to a temporary increase in revenues, a government should maintain its tax rates and expenditure levels, run a budget surplus, and reduce its debt.



**Table 3: Present-value responses to changes in fiscal variables**

Present value of the response of:	To a \$1.00 increase in the fiscal variable:				
	(1) Program spending	(2) Own-source revenue	(3) Debt-service payments	(4) Equalization grants	(5) Other grants
Program spending	-0.705*** (0.117)	0.537*** (0.177)	-1.769*** (0.555)	0.714** (0.357)	0.471** (0.169)
Own-source revenue	0.264** (0.109)	-0.382** (0.151)	0.567 (0.417)	-0.308 (0.248)	0.078 (0.145)
Debt-service payments	0.095** (0.034)	-0.049 (0.036)	0.799*** (0.193)	0.112 (0.107)	0.060 (0.049)
Equalization grants	0.030 (0.029)	-0.007 (0.023)	0.342** (0.168)	0.021 (0.201)	-0.067* (0.037)
Other grants	-0.018 (0.061)	-0.046 (0.105)	-1.065** (0.423)	0.139 (0.260)	-0.412*** (0.081)

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 A2.3. We use a discount rate of 3% to compute the present values.

Source: calculations by authors.

per-capita debt-service payments could arise if there is a large deficit in the previous year and a corresponding increase in the per-capita debt. For example, if the interest rate is 3% on government debt, a \$1.00 per-capita increase in debt-service payments means the per-capita debt has increased by \$33.33. The present value of the cut in spending associated with the \$1.00 increase in debt-service payments as shown in column (3), \$1.77, may seem large, but it is not large enough to reduce the debt back to its initial level and therefore we see an increase in debt-service payments in subsequent years. Further, column (3) shows that the rise in the debt-service payments causes a \$0.57 increase in own-source revenue, although this is not statistically significant. While the negative response of other grants to debt-service payments is unexpected, the statistically positive response of equalization grants to an increase in debt-service payments may be caused by a deterioration in the fiscal position of the recipient province and the associated rise in the federal equalization grant. This result suggests that increases in provincial budget deficits and the public debt that lead to higher debt-service payments are followed by fiscal adjustments in the form of a cut in program spending and to some extent a rise in own-source revenue as the affected provinces take steps to increase revenues to tackle their growing deficits.

We now turn to the impact of increases in federal transfers to the provinces. Column (4) shows that a \$1.00 increase in federal equalization grants causes a \$0.71 increase in provincial program spending. Further, consistent with the findings of previous studies, provincial own-source revenue responds negatively to increases in equalization grants. However, this effect is not statistically significant in our model. The response of the other budgetary components to increases in equalization grants also appears to be statistically insignificant. This finding implies that provincial governments devote part of higher equalization grants to raising their program spending.

Finally, the results reported in column (5) indicate that a \$1.00 increase in other grants (that is, non-equalization federal grants such as CST and CHT) causes a \$0.47 increase in future program spending. This result is also consistent with other studies of the large stimulative effect of intergovernmental grants on provincial spending, known as the “flypaper effect” (see, for example, Dahlby and Ferede, 2016). On the other hand, these categories of federal grants do not seem to have statistically significant long-term effects on provincial governments’ own-source revenue and debt-service payments. The negative response of equalization grants to a temporary increase in other grants as shown in column (5) is perplexing, as the former generally does not depend upon the latter. Further, the results suggest that an increase in other grants causes a decrease in these grants in the following year. As we will see later, this implies that the response of provincial program spending and other budgetary components to permanent increases in other grants will be much higher.

Note that a government’s fiscal policy is sustainable if the present value of current and future primary balances—the difference between governments’ program spending and total revenue—is equal to the value of its debt. Thus, any shock to a province’s own-source revenues, grants, or program expenditures that changes the current primary balance must be offset by future changes in these budget components to maintain the present value of the primary budget balance and the debt level.<sup>8</sup> For instance, the results reported in column (1) of table 3 indicate that an additional dollar of provincial program spending causes an offsetting change of approximately \$1 in the primary surplus, that is, spending is reduced by \$0.71, and revenues are increased by \$0.26 in present-value terms, which offsets the \$1.00 increase in spending. Similarly, column (2) shows that a \$1 increase in own-source revenue results in an offsetting change of \$0.97 in the present value of future primary surpluses.

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8. See Bohn (1991), Ghosh (1995), and others for further discussion. Bohn (1991) shows that the intertemporal budget constraint of a government is satisfied if the budget deficit is stationary.

### 3.3. Long-term fiscal responses to permanent fiscal shocks

So far, our analysis has focused on the direct fiscal adjustment of provincial governments' budgetary components to temporary shocks. But note that, as discussed above, an adjustment of a fiscal variable typically involves offsetting changes in the future value of the variable. For instance, while an increase in other federal grants causes an increase in provincial program spending in the following year, the rise in program spending, in turn, causes the future value of other grants to decrease. Further, major policy reforms usually involve permanent changes in a fiscal variable such as equalization grants and the CST and CHT. In this regard, it may be interesting to investigate how provincial governments respond to a permanent \$1 increase in other grants and other budgetary components. Accordingly, we compute and report the fiscal adjustment associated with a permanent increase in any given budgetary component in **table 4**.<sup>9</sup>

**Table 4: Responses to permanent increase in fiscal variables**

Present value of the response of:	To a \$1.00 increase in the fiscal variable:				
	(1) Program spending	(2) Own-source revenue	(3) Debt-service payments	(4) Equalization grants	(5) Other grants
Program spending		0.861*** (0.125)	-0.986** (0.304)	0.693** (0.307)	0.797*** (0.229)
Own-source revenue	0.959** (0.425)		0.318 (0.235)	-0.312 (0.252)	0.131 (0.235)
Debt-service payments	0.396 (0.537)	-0.080 (0.052)		0.111 (0.107)	0.105 (0.081)
Equalization grants	0.127 (0.227)	-0.010 (0.035)	0.189** (0.086)		-0.115* (0.063)
Other grants	-0.196 (0.868)	-0.084 (0.165)	-0.594** (0.241)	0.143 (0.264)	

Note: Robust standard errors in parenthesis. Significance levels are shown by \*\*\* for 1%, \*\* for 5%, and \* for 10%. The results are computed using the present value responses reported in table 3.

Source: calculations by authors.

9. Note that the results are computed using the present value responses presented in table 3. For instance, column 2 of table 3 shows that a \$1 increase in provincial own-source revenue is followed by a \$0.382 decrease in the variable in the subsequent year. Thus, the permanent component of the shock in own revenue is 0.618 (i.e.,  $1 - 0.382$ ). If we divide the values of the second column of table 3 by 0.618, we obtain the results reported in column 2 of Table 4. The other results are also computed using a similar method.

Table 4 shows the response of the various fiscal variables to permanent increases in the different components of the provincial budget. Note that as the results of table 4 are based on table 3, we limit our discussion to fiscal variables with statistically significant effects for brevity. Column (1) indicates that a \$1.00 permanent increase in provincial program spending is associated with a \$0.96 increase in own-source revenue. A close examination of column (2) of table 4 also suggests that each additional dollar of permanent increase in provincial governments' own-source revenue leads to a \$0.86 increase in program spending. These results imply a strong association between own-source revenue and program spending of provincial governments.

In column (3), we show the effects of a permanent increase in debt-service payments on the various budget components. The results suggest that a \$1.00 permanent increase in debt-service payments caused by a rise in the provincial debt level results in a reduction in program spending by about \$1.00 with no significant impact on own-source revenue. The implication of this finding is that provincial governments that run large budget deficits and accumulate the additional public debt will eventually make a costly cut in program spending to achieve debt sustainability. Further, the results suggest that permanent increase in debt-service payments causes statistically significant positive effects on equalization grants and statistically significant negative effects on other grants. While the impact of debt-service payments on other grants in column (3) is difficult to explain, the positive effect on equalization grants could be the result of a deterioration in the fiscal capacity of provinces, which then makes them eligible for more equalization entitlements.

Similarly, columns (4) and (5) of table 4 show that permanent increases in federal grants cause significant boosts in provincial program spending. Column (4) indicates that a \$1.00 permanent increase in equalization grants causes a \$0.69 increase in provincial program spending. Although, as expected, the increase in equalization grants has a negative impact on own-source revenue, the effect is statistically insignificant. Its effects on debt-service payments and other grants are also not significant. In addition, column (5) indicates that almost 80% of an additional permanent increase in other federal grants such as CHT and CST shows up in the form of extra provincial program spending, with no significant impact on own-source revenue. These empirical estimates suggest that federal grants strongly stimulate provincial spending. Previous studies by Dahlby and Ferede (2016), Ferede and Islam (2016), and others also find a positive impact of federal grants on provincial government expenditure, but the magnitude of our empirical estimate is higher.

### 3.4. Equalization grants and fiscal adjustment

Thus far, our analysis has focused on the fiscal adjustment of the 10 Canadian provinces. However, one may wonder whether the fiscal adjustments of provinces that are recipients of equalization grants differ from those of non-recipients. Since federal grants complement the provincial governments' own revenue sources, one may expect the fiscal adjustment of provincial governments to depend on the type of federal grants and the amounts that they receive each year. Several previous studies, such as those by Dahlby (2002), Smart (2007), and Ferede (2016), show that federal equalization grants influence the fiscal incentives of recipient provinces. If this is indeed the case, the nature of fiscal adjustment to budget deficits may well differ between provinces that receive equalization grants and those that do not. Thus, to investigate how federal grants influence provincial fiscal adjustments, we separate our sample data into that of recipients of equalization grants and that of non-recipients, and then re-estimate the model. The results are reported in table 5. We report only the coefficient of the budget deficit, which is our principal variable of interest.

**Table 5: Equalization grants and fiscal responses to \$1.00 increase in a budget deficit**

	(1) Equalization grants recipients	(2) Equalization grants non-recipients
Program spending	-0.180*** (0.069)	-0.229*** (0.047)
Own-source revenue	0.029 (0.036)	0.152*** (0.045)
Debt service	0.020* (0.011)	0.006 (0.008)
Equalization grants	0.001 (0.014)	-0.005 (0.004)
Other grants	-0.053 (0.048)	0.043 (0.043)
Number of observations	334	166

Note: Heteroscedasticity and autocorrelation robust standard errors in parenthesis. Significance levels are shown by \*\*\* for 1%, \*\* for 5%, and \* for 10%. We use four lags in the estimation. We also use one period-lagged change in real per-capita GDP as an additional control variable.

Source: calculation by authors.



The results of table 5 are broadly consistent with our findings discussed previously. But, importantly, the results highlight that the fiscal responses to budget deficits of recipients of equalization grants differ from those of non-recipients. While both recipients and non-recipients respond to an increase in the provincial budget deficit by cutting their program spending in the following year, the non-recipients appear to reduce their program spending by more. Note also that provinces not receiving equalization grants respond to a higher budget deficit by raising their own-source revenues in the following year. On the other hand, for recipients of equalization grants, although a higher budget deficit is associated with an increase in own-source revenue in the following year, this response is not statistically significant. This shows that equalization-grant recipients tend to adjust only their program spending in response to a higher budget deficit. Earlier studies on equalization grants indicate that recipient provinces are more likely to impose high tax rates because of offsetting increases in equalization grants from tax-induced declines in their tax bases (Ferede, 2016). Thus, our results indirectly imply that the reduction in the tax base associated with the tax-rate increases is high and the increase in own-source revenues for recipient provinces may be negligible.

### 3.5. Fiscal adjustment of resource-rich provinces

One important feature of Canadian fiscal policy is the marked variation in natural resource endowments and the associated provincial government revenues obtained from economic activity based on natural resources. Provinces such as Alberta, Saskatchewan and Newfoundland & Labrador generate substantial resource revenue and rely on this important revenue source. For instance, over the last two decades, on average, natural resource revenue accounted for 21.7% of Alberta's total government revenue, 12.4% of Saskatchewan's, and 12.3% of Newfoundland & Labrador's. This revenue source is very volatile and exposed to sometimes large fluctuations in global commodity prices. Thus, one may wonder whether the fiscal adjustment in these three provinces differs from that in other provinces in the federation. To this end, we check the robustness of our results by re-estimating the basic model using the decomposed data between the two groups of provinces. The results are reported in table 6.

The results indicate that both groups of provinces respond to an increase in the current budget deficit by reducing their program spending in the following year. So, there is not much disparity in their spending responses to budget deficits. However, there is a marked difference in the way they adjust their own-source revenue in response to

**Table 6: Fiscal Responses of resource-rich provinces and other provinces to a \$1.00 increase in budget deficits**

	(1) Resource-rich provinces Alberta, Saskatchewan, Newfoundland & Labrador)	(2) Other provinces
Program spending	-0.192*** (0.055)	-0.188*** (0.065)
Own-source revenue	0.106 (0.066)	0.077*** (0.024)
Debt service	0.004 (0.009)	0.015* (0.008)
Equalization grants	-0.002 (0.015)	0.005 (0.009)
Other grants	0.109 (0.076)	-0.093*** (0.018)
Number of observations	150	350

Note: Heteroscedasticity and autocorrelation robust standard errors in parenthesis. Significance levels are shown by \*\*\* for 1%, \*\* for 5%, and \* for 10%. We use four lags in the estimation. We also use one period-lagged change in real per-capita GDP as an additional control variable.

Source: calculations by authors.

budget deficits. The results show that budget deficits do not have statistically significant effects on own-source revenues in the resource-rich provinces. This suggests that, when these provinces face budgetary challenges, they tend to wait for a rebound of resource revenue rather than attempting to raise additional revenue from other sources.

## 4. Conclusion

This study empirically investigates the fiscal adjustment of provincial governments when faced with shocks, as well as the role of federal grants in this adjustment process, using annual provincial data spanning over half a century. We find that provincial governments respond to current budget deficits by cutting their future program spending and raising their future own-source revenues. According to our estimates, a \$1.00 increase in the provincial per-capita budget deficit causes a \$0.18 decline in program spending and a \$0.09 rise in own-source revenue in the following year. The results also reveal that, while recipients of equalization grant respond to current budget deficits by cutting only their program spending in the following year, non-recipient provinces' fiscal adjustments involve a cut in future program spending along with a rise in future own-source revenue. Thus, we find evidence that provinces that experience adverse fiscal shocks and/or rising budget deficits in a given period inevitably respond by reducing program spending and/or raising own-source revenues in future periods. This undermines the arguments advanced by some politicians and policy analysts who believe provinces can run on-going deficits without having to “face the fiscal music” in the future.

The empirical results of this paper also shed some light on provincial governments' long-term responses to various temporary and permanent fiscal shocks. According to our estimate, a temporary \$1.00 increase in current program spending causes future program spending to decline by \$0.71, own-source revenue to rise by \$0.26, and debt-service payments to increase by \$0.10, all in present value terms. This result highlights that a significant part of the long-term fiscal adjustment to provincial program spending shocks occurs through offsetting changes in future spending.

Furthermore, this study finds that a permanent \$1.00 per-capita increase in equalization and other federal grants increases provincial program spending by between \$0.69 and \$0.80. This empirical finding implies that federal grants have a significant impact on various aspects of provincial spending. Thus, an essential policy implication of this study is that the federal government can use grants to encourage provincial governments to spend on vital public services.

## Appendix 1: Technical specifications

This paper’s theoretical framework is based on a model of dynamic fiscal adjustment that was originally proposed in the seminal work of Bohn (1991). Bohn originally adopted this model to investigate the budget-balance adjustment of the US federal government. However, later studies such as Buettner and Wildasin (2006), Buettner (2009), Solé-Ollé and Sorribas-Navarro (2012), Bessho and Ogawa (2015), Ferede (2018), and Jaimes (2020) used the same theoretical framework to investigate the dynamic fiscal responses of various levels of government. An essential characteristic of the model is that it explicitly considers the intertemporal budget constraints of governments, that is, the constraints that governments face in their policy choices in the current and future periods. This feature of the model is crucial to investigating how governments respond when they face adverse fiscal shocks which increase their budget deficits. We believe this empirical methodology is very suitable for examining how Canadian provincial governments respond to various fiscal shocks such as higher budget deficits and changes in federal grants.

In our empirical specification, following Bohn (1991) and Buettner and Wildasin (2006), we consider all the components of the government budget constraint. Generally, Canadian provincial governments have two main revenue sources: federal grants—which include equalization grants ( $EG_{it}$ ) and other grants ( $OG_{it}$ )—and own-source revenue ( $OR_{it}$ ). Note that other grants ( $OG$ ) refer to all grants that provincial governments receive from the federal government other than equalization payments. In the current context, this variable mainly includes such grants as Canada Health Transfer (CHT), Canada Social Transfer (CST) and others. The provincial governments use their own-source revenues and federal grants to finance program spending ( $PS_{it}$ ) and debt service payments ( $DS_{it}$ ). Given these notations, in any given fiscal year, the provincial governments’ current budget deficit ( $D_{it}$ ) can then be expressed as:

$$D_{it} = PS_{it} + DS_{it} - OR_{it} - EG_{it} - OG_{it} \quad (1.1)$$

where the subscript  $i$  denotes the province and  $t$  denotes the fiscal year. Bohn (1991) shows that if the budget deficit ( $D_{it}$ ) is stationary, which means the budget deficit is sustainable, then the intertemporal budget constraint of a government, as shown by equation (1.1), has a vector error correction representation of the following form:

$$\Delta X_{it} = \Theta_0 D_{it-1} + \Theta_1 \Delta X_{it-1} + \Theta_2 \Delta X_{it-2} + \Theta_3 \Delta X_{it-3} + \dots + \Theta_p \Delta X_{it-p} + u_{it} \quad (1.2)$$

where  $\Delta$  denotes first-difference (or change),  $\Theta$  denotes a vector of coefficient estimates,  $D_{it-1}$  is the one period lagged budget deficit (which is simply the error correction term in the model),  $X$  is a vector that includes the fiscal variables  $PS$ ,  $DS$ ,  $OR$ ,  $EG$ , and  $OG$ ,  $p$  shows the lag length and  $u_{it}$  is the error term. Equation (1.2) is basically an abbreviated representation of a system of five equations corresponding to each fiscal variable. More specifically, since we have five budget components,  $\Theta_0$  is a  $(5 \times 1)$  vector of the coefficients of the lagged budget deficit, and  $\Theta_p$  is a  $(5 \times 5)$  matrix of the coefficient estimates of the fiscal variables for lag length  $p$ . Equation (1.2) indicates that each component of the provincial government budget constraint (or fiscal variables) can be estimated on lagged values of itself, lagged value of the budget deficit, and lagged values of other components of the budget constraint. Consequently, our empirical model helps us investigate the dynamic fiscal responses of provincial governments to budget deficits. Note that the fiscal variables enter the system of equations in first differences or change form to account for the non-stationarity of the variables.

Estimation of equation (1.2) requires first testing for the time series properties of the fiscal variables. The unit root test results presented in **table A2.1** confirm that the budget deficit is stationary, and the remaining fiscal variables are also stationary in their first differences. Thus, the specified error correction model is appropriate in our case as it satisfies the required time series properties consistent with the suggestion of Bohn (1991). Estimation of our model also requires specifying the appropriate lag length. Following previous similar empirical studies such as Bohn (1991) and Buettner and Wildsain (2006), and given our sample period, we begin with four lags in the model. As **table A2** shows, lag reduction tests below four lags are statistically rejected. Thus, we use four lags in our empirical model of the differenced fiscal variables.

Although our model is specified in the first differences, one may wonder whether provincial fixed effects are important in the model due to the presence of the budget deficit. As reported in **table A2**, provincial fixed effects are not jointly statistically significant. Thus, our model is estimated with no fixed effects. Since the model comprises five separate equations with the same explanatory variables and no fixed effects, joint estimation of the model does not improve its efficiency. Thus, following the approach of previous related empirical studies, we estimate each of the five equations separately with Ordinary Least Squares (OLS) using robust standard errors. As the model provides many coefficient estimates, in addition to analyzing the impact of past budget deficits on current government spending and revenue, we compute impulse responses to investigate how the various fiscal variables respond to different shocks.



## Appendix 2: Additional Results

**Table A2.1: Panel unit root tests**

Variables (per capita in 2020 dollars)	Breitung test statistics
Program spending	-0.437
Own-source revenue	1.135
Debt service	0.491
Equalization grants	0.761
Non equalization grants	-0.457
Budget Deficit	-3.906***
$\Delta$ Program spending	-4.239***
$\Delta$ Own revenue	-2.908***
$\Delta$ Debt service	-4.243***
$\Delta$ Equalization grants	-4.449***
$\Delta$ Non equalization grants	-2.256**

Note: lag 2 is used for pre-whitening. We use trend in all tests except deficit. Significance levels are shown by \*\*\* for 1%, \*\* for 5%, and \* for 10%.

Source: calculations by authors.

**Table A2.2: Specification tests**

Lag length	4	3
<i>Provincial fixed effects (<math>\chi^2(45)</math>)</i>	21.53	20.61
<i>(p-value in parentheses)</i>	(0.999)	(0.999)
Lag reduction	4 to 3	3 to 2
<i>Lag-order reduction (<math>\chi^2(25)</math>) statistic</i>	79.30	103.71
<i>(p-value in parenthesis)</i>	(0.000)	(0.000)

Note: Likelihood-ratio statistics on cross-equation restrictions.

Source: calculations by authors.

Table A2.3: Dynamic Fiscal Adjustment of Canadian Provinces, 1966/67-2020/21

	(1) Program spending	(2) Own-source revenue	{3} Debt service	(4) Equalization grants	(5) Other grants
Deficit <sub>t-1</sub>	-0.183*** (0.036)	0.092** (0.042)	0.011** (0.005)	0.006 (0.007)	0.035 (0.049)
Program spending <sub>t-1</sub>	-0.210*** (0.069)	0.044 (0.063)	-0.001 (0.009)	0.009 (0.010)	-0.092 (0.118)
Program spending <sub>t-2</sub>	-0.095** (0.048)	-0.019 (0.032)	0.015 (0.011)	0.002 (0.013)	-0.025 (0.064)
Program spending <sub>t-3</sub>	0.012 (0.065)	0.003 (0.035)	0.024*** (0.008)	-0.018 (0.017)	-0.012 (0.054)
Program spending <sub>t-4</sub>	0.066* (0.038)	-0.073 (0.053)	0.012 (0.007)	-0.027** (0.013)	0.001 (0.027)
Debt service <sub>t-1</sub>	-0.328 (0.259)	0.007 (0.264)	0.184*** (0.054)	0.002 (0.050)	0.059 (0.157)
Debt service <sub>t-2</sub>	-0.373 (0.325)	0.227 (0.205)	0.121** (0.051)	0.062 (0.064)	-0.583 (0.365)
Debt service <sub>t-3</sub>	-0.049 (0.260)	-0.044 (0.240)	0.053 (0.034)	0.008 (0.050)	-0.419 (0.322)
Debt service <sub>t-4</sub>	0.187 (0.228)	0.098 (0.388)	0.169*** (0.059)	-0.006 (0.045)	-0.337* (0.203)
Equalization grants <sub>t-1</sub>	0.170 (0.175)	0.160 (0.162)	0.011 (0.025)	0.076 (0.130)	-0.238 (0.223)
Equalization grants <sub>t-2</sub>	0.305 (0.213)	-0.325** (0.162)	-0.063 (0.044)	0.025 (0.056)	0.037 (0.199)
Equalization grants <sub>t-3</sub>	-0.142 (0.247)	-0.624*** (0.175)	0.058 (0.042)	-0.044 (0.077)	0.272 (0.175)
Equalization grants <sub>t-4</sub>	0.483* (0.281)	0.474 (0.295)	0.013 (0.021)	-0.033 (0.077)	0.390* (0.223)
Other grants <sub>t-1</sub>	-0.036 (0.083)	0.023 (0.064)	0.024** (0.009)	-0.027** (0.013)	-0.548*** (0.059)

Table A2.3: continued

	(1) Program spending	(2) Own-source revenue	{3} Debt service	(4) Equalization grants	(5) Other grants
Other grants <sub>t-2</sub>	0.259*** (0.057)	0.249*** (0.058)	0.008 (0.013)	0.002 (0.026)	-0.167** (0.082)
Other grants <sub>t-3</sub>	0.119** (0.049)	0.086 (0.077)	0.003 (0.014)	-0.056** (0.026)	0.304** (0.136)
Other grants <sub>t-4</sub>	0.085 (0.052)	0.067 (0.055)	0.030** (0.012)	-0.002 (0.020)	0.033 (0.050)
Own-source revenue <sub>t-1</sub>	0.079 (0.056)	-0.267** (0.121)	-0.009 (0.011)	0.032** (0.016)	0.009 (0.046)
Own-source revenue <sub>t-2</sub>	0.089** (0.044)	-0.008 (0.093)	-0.014 (0.010)	0.009 (0.008)	-0.005 (0.041)
Own-source revenue <sub>t-3</sub>	0.055 (0.050)	0.056 (0.092)	-0.010 (0.008)	-0.023 (0.016)	0.049 (0.066)
Own-source revenue <sub>t-4</sub>	0.068 (0.062)	-0.034 (0.075)	0.005 (0.006)	0.023 (0.021)	-0.031 (0.044)
Change in per-capita GDP <sub>t-1</sub>	-0.033 (0.024)	0.108*** (0.030)	0.001 (0.002)	-0.013* (0.007)	0.009 (0.014)
Constant	217.973*** (49.083)	112.421** (45.835)	-5.385 (5.113)	20.840*** (6.029)	74.507*** (25.747)
Observations	500	500	500	500	500
Adjusted R <sup>2</sup>	0.200	0.176	0.219	0.121	0.371
Test of joint significance of lagged grants (chi-squared (4) statistic)*					
Equalization grants	16.81***	28.46***	5.04	4.85	4.61
Other grants	37.96***	40.36***	34.88***	14.88***	165.37***

Notes: Heteroscedasticity and autocorrelation robust standard errors in parenthesis. Significance levels are shown by \*\*\* for 1%, \*\* for 5%, and \* for 10%. We use one period-lagged population growth rate and GDP growth rate as additional control variables, but their coefficient estimates are not reported for the sake of brevity. The total number of observations is 500. \*For the chi-squared test, the null hypothesis is that all the lags of the fiscal variable are zero. Rejection of the null hypothesis indicates that the fiscal variable has direct influences. Source: calculations by authors.

**Table A2.4: Sensitivity analysis of the present value responses of fiscal variables**

Response of :	Shock				
	Program spending	Own revenue	Debt-service payments	Equalization	Other grants
Program spending	-0.814*** (0.211)	0.592*** (0.200)	-2.411*** (0.632)	-0.612 (1.081)	0.605** (0.330)
Own-source revenue	0.324** (0.143)	-0.405*** (0.121)	0.878** (0.441)	0.467 (0.661)	0.019 (0.196)
Debt-service payments	0.112*** (0.050)	-0.047 (0.044)	0.941*** (0.209)	0.247 (0.238)	0.054 (0.065)
Equalization	0.049 (0.044)	-0.017 (0.039)	0.459** (0.208)	0.195 (0.309)	-0.094 (0.077)
Other grants	-0.028 (0.110)	-0.034 (0.132)	-1.016*** (0.354)	0.247 (0.535)	-0.418*** (0.169)

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 A2.3. We use a discount rate of 1.1% to compute the present values.

Source: calculations by authors.

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