The Volatility of Alberta's Tax Bases Implications for Tax Policy Choices

Ergete Ferede

6 The Volatility of Alberta's Tax Bases

Implications for Tax Policy Choices

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Over the last two decades, on average, the largest single source of revenue for Alberta's government comes from non-renewable resources when oil and natural gas prices are high, while PIT and CIT provide the second and third major sources of revenue for the government.[1] Resource-dependent economies such as Alberta rely heavily on resource revenue to fund their various public services and infrastructures. As a result, their budgets are often exposed to the vagaries of fluctuating world commodity prices. Previous analyses of Alberta's resource revenue volatility focus on finding ways to reduce the volatility of this type of revenue (Landon and Smith 2010). This chapter focusses instead on the crucial role that taxes can and do play in providing stability for government budget planning. Such a study is crucial for Alberta in particular, given its current economic and fiscal prospects.

The amount of tax revenue that a provincial government collects depends on both its tax rates and tax bases. A tax base is the income or consumption that is (or, the case of sales tax in Alberta, could be) liable to taxation. The three major tax bases I will be focussing on are CIT, PIT, and PST.[2] In the absence of tax rate changes, the stability of government

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tax revenue depends on how the tax bases respond to the business cycle. The business cycle refers to the fluctuations in output, or GDP. One main feature of business cycles is that most macroeconomic variables such as the various tax bases tend to fluctuate together. Thus, the business cycle poses an important challenge to policy makers and budget planners as it can have a significant effect on tax bases, and thus on government tax revenues.

The main objective of this chapter is to assess the volatility of Alberta's major tax bases by looking at how, exactly, they respond to the business cycle. Ultimately, the chapter aims to answer the question: Could the provincial government lessen the adverse impacts of revenue volatility by changing the tax mix?

Taxation in Alberta

The Alberta government spends on various essential public services such as health care, education, infrastructure, social services, and so on. The sources of funds for these services come from tax revenue, non-renewable resource royalties, various fees, and federal grants. Between 1981 and 2016—the sample period used throughout this chapter—around two-thirds of Alberta's revenue come from taxes. The amount of tax revenue that the government can collect significantly depends on the overall performance of the economy. This is because the various tax bases tend to fluctuate with the economy.

Like other Canadian provinces, Alberta imposes CIT and PIT on tax bases that are generally consistent with the federal government's definition of tax bases. However, unlike all other provinces, Alberta does not levy a PST. Figure 6.1 shows the shares of own-source revenue (excluding resource revenue) accounted for by Alberta's various tax revenue sources, as well as those of Alberta's two neighbours, Saskatchewan and British Columbia, and for Ontario and Canada as a whole.[3] Aside from resource royalties and non-renewable resource revenue, PIT accounts for the largest share of Alberta's revenue over the period under consideration: about 32 percent. The comparable figures for British Columbia, Saskatchewan, and Ontario over the same period were 31, 36, and 33 percent, respectively.

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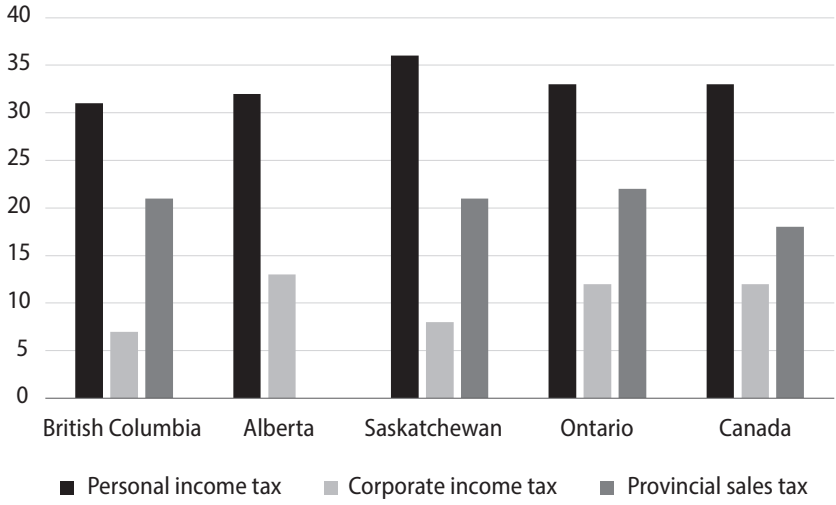

Figure 6.1. Tax revenue shares of selected provinces as percentage, 1981 to 2016

Source: Author's calculations using data from Ronald Kneebone and Margarita Wilkins, "Canadian Provincial Government Budget Data—All Provinces Updated to 2019/20 and Some to 2020/21" (Excel spreadsheet), October 2021 version, available from University of Calgary School of Public Policy, "Research Data," http://www.policyschool.ca/publication-category/research-data/.

CIT accounts for the second largest share of the province's tax revenue, averaging 13 percent over the 1981 to 2016 period—the highest in the country. The remaining 55 or so percent of Alberta's revenue over the same period comes from other own-source revenue such as investment income, net income from government business enterprises, and other revenue including premiums, fees, and licenses.

Figure 6.1 shows the average actual revenue accounted for by different taxes in Alberta and other selected provinces. This is, however only one way to understand potential variations in provincial governments' tax revenues. Another way is to look at tax bases. Figure 6.2 shows the per capita tax bases for Alberta and other selected provinces over the same sample period. Again, we include British Columbia, Saskatchewan, Ontario, and Canada as a whole for comparison purposes. As figure 6.2 shows, during the period under consideration, Alberta has the highest CIT and PIT bases per capita when compared to the other

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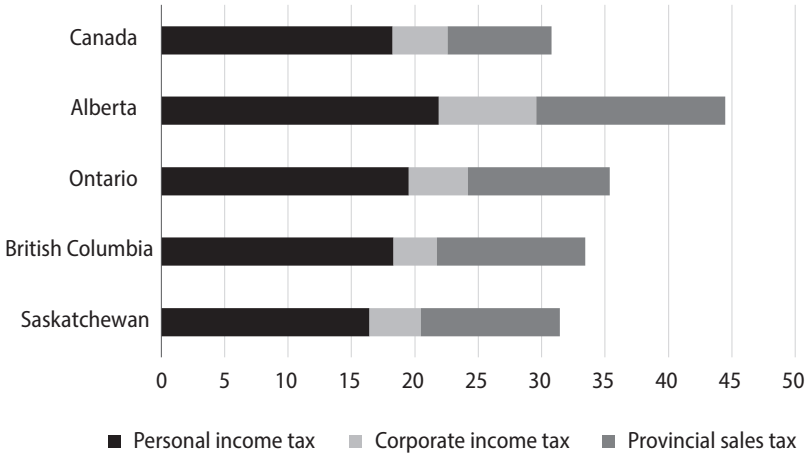

Figure 6.2. Tax bases per capita for selected provinces, 1981 to 2016 ($ thousands)

Source: Author's calculations using data obtained from Department of Finance, Canada, workbooks used in the calculation of equalization entitlements, provided at the author's request for data.

provinces and to the Canadian average. Alberta also has the largest PST base, even though the province does not currently levy a PST. Figure 6.2 thus suggests that Alberta has huge tax revenue potential, particularly if it taps into the hitherto unused PST base in the province.

It should be noted that tax bases are sensitive to tax rate changes. Thus, the government's tax rate choices impact tax revenue through both changes in the tax rate and their resulting effects on the tax base. Generally, an increase in a tax rate results in decrease of the tax base. Similarly, when governments lower tax rates, there will be more economic activity and the tax base can expand (Dahlby and Ferede 2012). The Alberta government introduced a flat-rate income tax system in 2001, which significantly lowered the progressivity of the PIT system in the province. Other things remaining the same, this change resulted in less volatility in PIT revenue. However, there are more factors than just tax rate that effect tax base changes, meaning that we cannot rely on tax rate changes alone to eliminate tax base volatility. It is important to see how tax bases vary over time. Since we are interested in assessing the volatility and responses of tax bases to the business cycle, it is better to look at how

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the tax bases evolve over time relative to the business cycle, measured in terms of fluctuations in GDP. Looking at tax bases as a percentage of GDP allows us to see the size of the tax base compared to the total GDP at a given time, as well as how the size of the tax base changes relative to GDP over time. Figure 6.3 shows the three tax bases as a share of GDP in Alberta over the sample period.

We can glean the following facts about Alberta's tax bases and GDP from figure 6.3. First, although there are temporary ups and downs, the tax bases are shown to be somewhat stable relative to GDP. Throughout the period under consideration, the share of the CIT base in GDP is the lowest. Prior to 1988, the PST base had the highest share. In 1988, there was a dramatic jump in the PIT base due to that year's major federal income tax reform, which eliminated several exemptions and deductions. As provincial tax rates were, at the time, given as a percentage of the federal rate, this reform significantly expanded the PIT base in every province, including Alberta. Consequently, since 1988, the PIT base has been higher than both PST and CIT bases.

Figure 6.3. Alberta's tax bases as a share of GDP (percent), 1981 to 2016

Sources: Author's calculations using data obtained from Department of Finance, Canada, workbooks used in the calculation of equalization entitlements, provided at the author's request for data; Statistics Canada, "Table 36-10-0222-01: Gross Domestic Product, Expenditure-Based, Provincial and Territorial, Annual (× 1,000,000)," released 9 November 2021, https://doi.org/10.25318/3610022201-eng.

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The Relation of Tax Bases to Business Cycle in Alberta

This section assesses the volatility and co-movement of Alberta's tax bases and GDP during the business cycle.

Tax Base Volatility

As is common in the literature, volatility is measured using the standard deviations of variables: the higher the standard deviation, the higher the volatility of the variable. To understand the volatility of Alberta's tax bases, however, we must look at them in relation to fluctuations in the province's GDP, or business cycle. These fluctuations—the cyclical component of the GDP—are called the "output gap": the deviation of an economy's actual GDP from its full potential GDP, or what it would achieve it if were producing at its full capacity. The output gap is not an observable variable and therefore must be estimated.

There are a number of different techniques we can use to filter the data in order to isolate the cyclical components of all of our variables of interest, including the estimated output gap. The specifics of how these calculations are carried out are not important here. The point is that each technique isolates the cyclical fluctuations in our variables in different ways, and thus sees them from different perspectives. The simplest of all these methods is log differencing, which simply uses the growth rates of GDP and the tax bases to assess how they fluctuate over time. Another strategy is log-quadratic detrending, which isolates the cyclical components in the data by removing the effects of changes in trend, or mean, over time. This method thus shows you *only* the fluctuations in the data, undistorted by trends.[4] Arguably, however, the most commonly used method of filtering these datasets is the Hodrick-Prescott (1997) technique, or HP filter. The HP filter involves using a sophisticated statistical procedure to isolate short-term fluctuations related to the business cycle, allowing us to see cyclical fluctuations separate from long-term trends.

In table 6.1, I use these techniques to filter Alberta's CIT, PIT, and PST base datasets over the sample period. I then calculate the standard deviations of this filtered data to shed light on their volatility from different perspectives. The results in table 6.1 show that, no matter how you filter the data,

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CIT, PIT, and PST bases are more volatile than GDP, with the CIT base showing the highest volatility and the PST base showing the least volatility.

Knowing the standard deviations of these variables for the whole sample period gives us a quick glance at the general volatility of each repeated variable in the long term, but it doesn't allow us to look at this volatility in any detail. We may, for instance, want to know how the volatility of the tax bases evolve over time. To this end, figures 6.4 and 6.5 chart the standard deviations of each variable on an annual basis over the course of the sample period (using HP-filtered data, as this method is more commonly used in the literature). There are various ways of computing standard deviations for the purpose of assessing volatility. In figure 6.4, I use standard deviations computed using a rolling windows method. This method does not flatten out outlier data, and thus allows us to see in detail all of the spikes and dips of the business cycle over time. By contrast, the recursive or sliding window method, which I use in figure 6.5, is not influenced by the presence of outlier observations. It therefore provides a better picture of the general trends of Alberta's tax base volatility over time.

Table 6.1. Volatility of Alberta's tax bases and GDP, 1981 to 2016

	Cyclical components measured using:		
	Log differencing method	*Log-quadratic detrending method*	*HP-filter method*
Gross domestic product	3.4	4.1	2.9
Corporate income tax	16.9	31.2	14.8
Personal income tax	9.6	14.4	8.7
Provincial sales tax	7.5	8.8	6.9

Source: Author's calculations using data obtained from Department of Finance, Canada, workbooks used in the calculation of equalization entitlements, provided at the author's request for data; Statistics Canada, "Table 36-10-0222-01: Gross Domestic Product, Expenditure-Based, Provincial and Territorial, Annual (× 1,000,000)," released 9 November 2021, https://doi.org/10.25318/3610022201-eng.

Note: Volatility is measured by standard deviation (in percent) of the variously calculated cyclical components of each variable.

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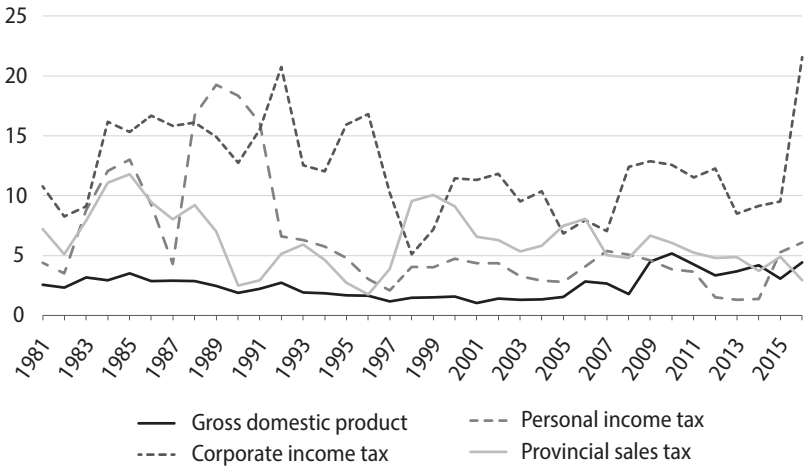

Figure 6.4. Volatility of Alberta's tax bases (five-year rolling window), 1981 to 2016

Sources: Author's calculations using data obtained from Department of Finance, Canada, workbooks used in the calculation of equalization entitlements, provided at the author's request for data; Statistics Canada, "Table 36-10-0222-01: Gross Domestic Product, Expenditure-Based, Provincial and Territorial, Annual (× 1,000,000)," released 9 November 2021, https://doi.org/10.25318/3610022201-eng.

Note: Volatility is measured by standard deviation (in percent) of the HP-filtered variables.

Again, higher standard deviation indicates higher volatility. As figures 6.4 and 6.5 show, while all the three major tax bases are generally more volatile than GDP, Alberta's CIT base shows the highest volatility and its sales tax base exhibits the lowest volatility. This is broadly consistent with the general perception that sales taxes are relatively more stable than other tax bases—yet Alberta, with its highly volatile resource revenues, is currently the only province in the country that does not rely on PST. These findings suggest that Alberta could benefit significantly in using sales tax bases as a reliable and stable government tax revenue source over the course of the business cycle.

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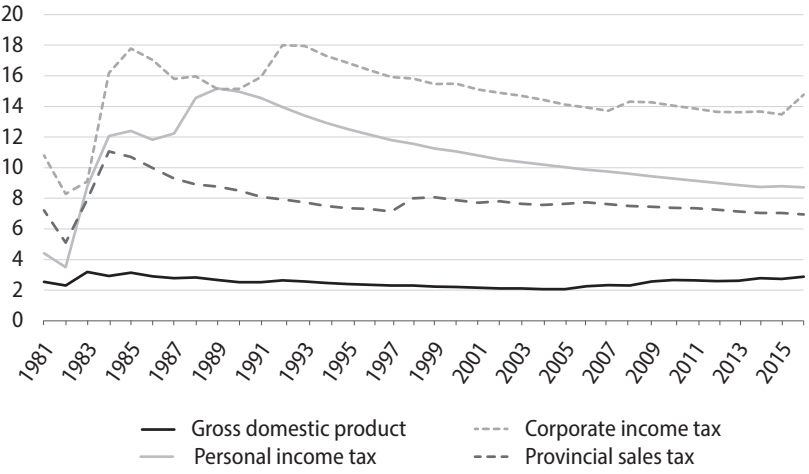

Figure 6.5. Volatility of Alberta's tax bases (recursive window), 1981 to 2016

Sources: Author's calculations using data obtained from Department of Finance, Canada, workbooks used in the calculation of equalization entitlements, provided at the author's request for data; Statistics Canada, "Table 36-10-0222-01: Gross Domestic Product, Expenditure-Based, Provincial and Territorial, Annual (× 1,000,000)," released 9 November 2021, https://doi.org/10.25318/3610022201-eng.

Note: Volatility is measured by standard deviation (in percent) of the variables.

Tax Base Co-movement

During the business cycle, many macroeconomic variables including tax bases tend to grow and decline together. In this section, I check whether the movement of our variables of interest are correlated. Co-movement among variables is often measured by the correlation coefficient: a numerical measure between −1 and +1 that describes the linear relationship between two variables. A strong correlation can either be positive or negative, with +1 describing a strong linear relationship in the same direction, −1 describing a strong linear relationship in opposite direction, and 0 describing the strongest possible disagreement. In the context of this study, I'm interested in whether there are positive correlations between the growth and decline of tax bases and the growth and decline of GDP. Table 6.2 presents the correlation coefficients of each tax base's movement with GDP movement. GDP itself is not presented in the table because

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Table 6.2. Correlation of tax base movement with business cycle (GDP), Alberta, 1981 to 2016

	Correlations computed based on:			
	Growth rates of all variables	*Output gap and tax base growth*	*HP-filtered GDP and tax base growth*	*All variables, HP-filtered*
Corporate income tax base	+0.50	+0.50	+0.36	+0.37
Personal income tax base	+0.30	+0.24	+0.41	+0.26
Provincial sales tax base	+0.01	+0.15	+0.35	+0.11

Source: Author's calculations using data obtained from Department of Finance, Canada, workbooks used in the calculation of equalization entitlements, provided at the author's request for data; Statistics Canada, "Table 36-10-022-01: Gross Domestic Product, Expenditure-Based, Provincial and Territorial, Annual (× 1,000,000)," released 9 November 2021, https://doi.org/10.25318/3610022201-eng.

in such a comparison, the movement of GDP would have +1 correlation with itself.

The first three columns in table 6.2 describe "static correlation"—the correlation between the growth rate of tax bases with different ways of measuring the business cycle. The first column measures the correlation between the growth rates of tax bases with the growth rate of GDP. The second column shows the correlation coefficient between the growth rates of tax bases and the business cycle, this time measured by the output gap obtained through log-square detrending of GDP (Mendoza 1991). The third column shows the correlation coefficient between the growth rates of tax bases and the business cycle measured by the cyclical component of the HP-filtered GDP series. These correlations are consistent with the discussion of the volatility of tax bases and GDP that we already saw in table 6.1 and figures 6.4 and 6.5. All the tax bases show similar positive co-movement with the business cycle in these three scenarios.

The fourth column of table 6.2 shows the correlation coefficients for HP-filtered GDP and HP-filtered tax bases. When all variables are HP-filtered, their correlation is referred to as "dynamic correlation"

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(Croux, Forni, and Reichlin 2001). The dynamic correlation measures the relationship between the cyclical or fluctuating components of all the variables of interest. Consequently, dynamic correlation provides a much better insight than static correlation into the co-movement of different variables. The fourth column of table 6.2 shows that there is a strong positive co-movement of the cyclical components of the three tax bases with GDP. The CIT base tends to show a much stronger dynamic co-movement with GDP. This implies, as is expected, that this tax base is an unstable source of revenue in the face of the boom-bust cycle. The dynamic co-movement of the PST base with GDP, on the other hand, appears to be much weaker, indicating its stability during the business cycle.[5]

Overall, table 6.2 shows that Alberta's tax bases are procyclical: they rise and fall as the economy goes through the boom-bust cycle. However, some tax bases are more sensitive to fluctuation in GDP than others. The CIT base is most affected by changes in the business cycle, followed by the PIT base, and then the PST base.

Policy Implications

In broad terms, this analysis, based on data from Alberta, indicates that the province's CIT base has the highest volatility, and sales tax base the lowest. We also find that the CIT base is generally more responsive to the business cycle. This indicates that government tax revenue from such a base would be highly volatile during the boom-bust cycle in the province. Ultimately, this implies that when resource revenues are low, the revenue from CIT will also be low. This is not an insignificant finding for Alberta. As is well known, the Alberta government's revenue forecast is highly unpredictable because of the province's reliance on highly volatile non-renewable resource revenue. Because Alberta doesn't impose sales tax, it relies more heavily on CIT revenue than other provinces (see figure 6.2). However, because the CIT base is itself volatile relative to other tax bases, reliance on CIT serves to exacerbate Alberta's volatile revenue problem.

The opposite is true of the PST base: it is less volatile and less responsive to the business cycle than the other tax bases, and is thus a more reliable source of revenue during the boom-bust cycle. The PIT base falls

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somewhere in the middle. One policy implication of this for Alberta is clear: a revenue-neutral shift from CIT to PIT bases or (even better) to a sales tax base would lessen the volatility of the government's tax revenue sources.

In discussing the various ways of lessening the volatility of Alberta's revenue, Landon and Smith (2010) cite diversifying the province's tax bases to include sales tax base as one potential solution. However, the authors express their doubt about the effectiveness of this solution, arguing that the province relies heavily on non-renewable revenue sources, which are by nature very volatile. They conclude that the reduction in Alberta's revenue volatility that would ensue from introducing sales taxes would be minimal. The authors suggest the establishment of a resource revenue stabilization fund as the best remedy for Alberta's volatile revenue problem. While I agree with the importance of the use of such funds to smooth out volatile resource royalties, I believe it is a mistake to leave tax policies out of the discussion of possible solutions. Recurring volatility of the province's revenue requires looking at PST as an additional mechanism to combat revenue volatility. Take Norway as an example. People often refer to Norway as a resource-based economy that successfully manages its volatile oil revenue by using an oil revenue stabilization fund. However, it should be noted that Norway also relies on a value-added tax—a type of consumption tax that is similar to Canadian federal GST—of around 25 percent.

A change in Alberta's tax mix (say, through the introduction of sales tax) would have significant positive effects on the tax revenue stability of the province. Albertans would, for instance, benefit from reliance on a relatively less volatile tax base that would make budgeting and future government spending plans more predictable.[6] Generally, the less the province relies on a volatile tax base, the better. Optimal tax policy literature indicates that since the distortionary effects of taxes on society increase with the tax rate, the government needs to smooth tax rates over time.[7] Thus, if the province expands its tax bases by including PST, it will have a smoother tax policy in the face of business-cycle-triggered changes in tax bases.

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The revenue potential of the province's PST base is substantial. In fact, the province could introduce the lowest sales tax rate in the country, thereby maintaining its low-tax "Alberta Advantage" and still collect significant tax revenue. For instance, in 2016, a 4 percent HST in Alberta—a sales tax rate lower than any province in the country—would have brought in about $3.9 billion in tax revenue.[8] This is important for the economy as a whole as the private sector can operate in a reasonably predictable tax policy environment.

Sales taxes are also attractive on economic growth and tax efficiency grounds (see McKenzie 2000; Dahlby 2012; Dahlby and Ferede 2012; and Ferede and Dahlby 2012). This change in the tax mix will have wider positive effects on the province's overall economic performance and thus total government tax revenue receipts. The resource sector could also be positively impacted by such tax changes as it could increase their international tax competitiveness with a reduction of, say, corporate (or personal) income tax rates.[9]

The implications of my analysis are broadly consistent with those of previous studies such as McKenzie (2000) and Bazel and Mintz (2013). It is, however, important to highlight some of the caveats of my results. In particular, this analysis does not look at the volatility of non-renewable resource revenues, which have on average accounted for the lion's share of the province's revenue. However, one thing is clear: the less the province relies on such a revenue source (say, by diversifying into PST), the less susceptible its budget would be to the boom-bust cycle. As well, this analysis focusses only on tax base volatility and the potential for the province to improve its revenue stability through changes in the tax mix. Of course, there are distributional effects associated with changing the tax mix that are important for society and policy makers. While beyond the scope of this chapter, some of these issues are addressed by Smythe in chapter 7 and Ascah in chapter 10 of this volume.

Still, in a nutshell, if the objective of the Alberta government is to have less volatile and more predictable tax revenue sources, then diversifying its tax bases to include PST looks like a promising option. Indeed, as of the time of writing, the Alberta government has hinted that it may consider a review of its revenue mix in light of historically high deficits. Given the

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provincial government's current fiscal position, I recommend that this review be completed post haste.

Notes

1 According to my calculations using data Government of Alberta annual reports (various years), between 2000–01 and 2018–19, the average revenue shares from in Alberta were as follows: 17.3 percent from PIT, 5.3 percent from CIT, and 19 percent from non-renewable resource revenue.

2 While Alberta does not levy a provincial sales tax, it does have a sales tax base on which it could levy such a tax: all of the money spent on consumption in the province. Thus, a sales tax base exists in the province, but the tax rate on this base is 0 percent.

3 The PIT, CIT, and PST revenue shares are calculated as a share of each province's respective total own-source revenue excluding non-renewable resource revenue. In other words, non-renewable resource revenues and federal transfers are not included in the revenue share computations.

4 This method uses the trend and the square of the trend to isolate the cyclical component. In this method, the cyclical component is simply the residual obtained from the estimation of the log of each variable on trend and trend-squared.

5 An alternative way to assess the co-movement of tax bases with GDP is using a simple regression analysis. To this end, I have also investigated the response of the three tax bases to the business cycle using a simple empirical model. The analysis suggests that a one percentage point increase in GDP is associated with 1.93, 1.09, and 0.89 percentage point increase in CIT, PIT, and PST bases, respectively. These regression results are generally consistent with the correlation analyses, and they indicate that the CIT and PST bases exhibit the most and least responsiveness to the business cycle, respectively.

6 See Dahlby (2012), Dahlby and Ferede (2012), and Ferede and Dahlby (2012) for the potential economic efficiency gains from changing the tax base mix.

7 See, for example, Barro (1979).

8 Alberta's total sales tax base in 2016 was $96.8 billion. Thus, a 1 percent HST would bring in a revenue of about $0.968 billion for the government.

9 The United Conservative Party was elected in April 2019 partly on a promise of cutting the CIT rate from 12 percent to 8 percent over four years. This change was implemented in the Job Creation Tax Cut (Alberta Corporate Tax Amendment) Act in June 2019. In response to the COVID-19 pandemic,

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the government accelerated the reduction of the CIT rate from 10 percent to 8 percent, effective 1 July 2020.

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