



UNIVERSITY OF ALBERTA
DEPARTMENT OF ECONOMICS
Institute for Public Economics

INSTITUTE FOR PUBLIC ECONOMICS POLICY SERIES 2013-1

The response of tax bases to the business cycle: the case of Alberta

Ergete Ferede

Grant MacEwan University, Edmonton, and Fellow, Institute for Public Economics
March, 2013



Abstract

One major concern that policy makers face is whether they can plan their future tax receipts and spending in a predictable manner. In the absence of tax rate changes, tax revenue volatility arises due to volatility of tax bases. In the face of fluctuations in economic activity, the amount of tax revenue that a provincial government collects depends on how the various tax bases respond to the business cycle. We investigate the relationship between the business cycle—measured by the deviations of Gross Domestic Product from its long-run trend—and Alberta’s major tax bases for the period 1976–2008. Our analysis indicates that the Alberta’s corporate income and sales tax bases show the most and least responsiveness to the business cycle. The policy implication of this is that, if the objective of the Alberta government is to have less volatile and somewhat reasonably predictable tax revenue sources, diversifying its tax bases to include sales tax looks promising.

Contact

Ergete Ferede

Email: FeredeE@macewan.ca

Phone: +1-780-633-3647

Fax: +1-780-497-4781

I would like to thank Bev Dahlby for his very helpful comments and discussions. I am also grateful to Stuart Landon and an anonymous referee for their suggestions. All remaining errors are my own.



INTRODUCTION

Resource-dependent economies, such as Alberta, heavily rely 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. Although the largest source of revenue for Alberta's government comes from non-renewable resources, personal income and corporate income tax also provide the second and third major sources of revenue for the government. The amount of tax revenue that a provincial government collects depends on both its tax rates and tax bases. In the absence of tax rate changes, the stability of government tax revenue during the boom-bust cycle depends on how the tax bases respond to the business cycle. Thus, the business cycle poses an important challenge to policy makers and budget planners as it can have a significant effect on the tax bases and hence government tax revenues. How volatile are Alberta's tax bases? How responsive are the province's major tax bases to the business cycle? Can the provincial government lessen the adverse impacts of revenue volatility by changing the tax base mix? These and related issues have been important points of discussion among academics and policy makers in the province.

It is widely known that Alberta government's revenue from resource royalties are highly volatile and pose a huge challenge to the government's budgeting process—an issue extensively discussed in previous studies such as Landon and Smith (2010). However, more than two-third of Alberta government's revenue comes from taxes implying that the overall volatility of the province's revenue also depends on the stability of its tax revenue. Thus it is important to broaden the discussion surrounding government revenue volatility to encompass tax policies. Tax revenue changes can be due to changes in tax bases or tax rate changes by the government. As tax rate changes occur less frequently, changes in tax revenue are predominantly due to changes in tax bases. Thus it is important to focus on tax bases rather than tax revenues. Furthermore, analysis based on tax revenues has to focus only on currently existing tax systems which is very limiting for policy discussions.

The main objective of this paper is to assess the volatility of Alberta's major tax bases and how the tax bases respond to the business cycle. As is common in the literature, we define the business cycle as cyclical fluctuations in Gross Domestic Product (GDP) that are deviations from its long-run trend. One stylized feature of business cycles is that most macro economic variables, including tax bases, tend to fluctuate together. While previous studies such as Landon and Smith (2010) focus on the analysis of Alberta's revenue volatility and a discussion of possible solutions, we instead focus on the three tax bases: corporate income tax (CIT), personal income tax (PIT), and sales tax (PST).



We first assess the co-movement and volatility of Alberta's three major tax bases and GDP over the period 1976-2008. The results indicate that Alberta's tax bases are pro-cyclical—they rise and fall as the economy goes through the boom-bust cycle. Furthermore, while all the three major tax bases are generally more volatile than GDP, the corporate income tax base shows the highest volatility. The sales tax base is the least volatile. In fact, the CIT base is about four times as volatile as GDP and about twice as volatile as the sales tax base. This is broadly consistent with the general perception that sales taxes are relatively more stable than other tax bases. However, Alberta is currently the only province in the country that does not rely on sales taxes.

We have also investigated the response of the three tax bases to the business cycle using a simple empirical model. Our preferred regression estimates suggest that a one percentage point increase in GDP is associated with 1.87, 0.93, and 0.81 percentage point increase in corporate income, personal income and sales tax bases, respectively. The results generally show that the corporate income tax base and the sales tax bases show the most and least responsiveness to the business cycle, respectively. These short-run elasticity estimates are robust to the use of alternative methods and well within the range of estimates obtained in similar previous studies. See Sobel and Holcombe (1996), Holcombe and Sobel (1997) and Bruce et al (2006).

The results have also an important policy implication. Our analysis indicates that tax base volatility (and hence tax revenue volatility) is the highest when Alberta uses corporate income tax and the lowest when it uses sales tax bases. Thus Alberta—a province with no sales tax—would potentially gain in terms of tax revenue stability from changing its tax base mix. These benefits are of course in addition to efficiency gains that previous studies such as Dahlby and Ferde (2011a, 2011b) and Dahlby (2012) have indicated.

The remainder of the paper is organized as follows. Section 2 provides brief background information about the tax bases in Alberta. In Section 3, we discuss the volatility of tax bases and GDP. We also examine the response of tax bases to the business cycle. Section 4 highlights the policy implications of our results for Alberta. Section 5 concludes.

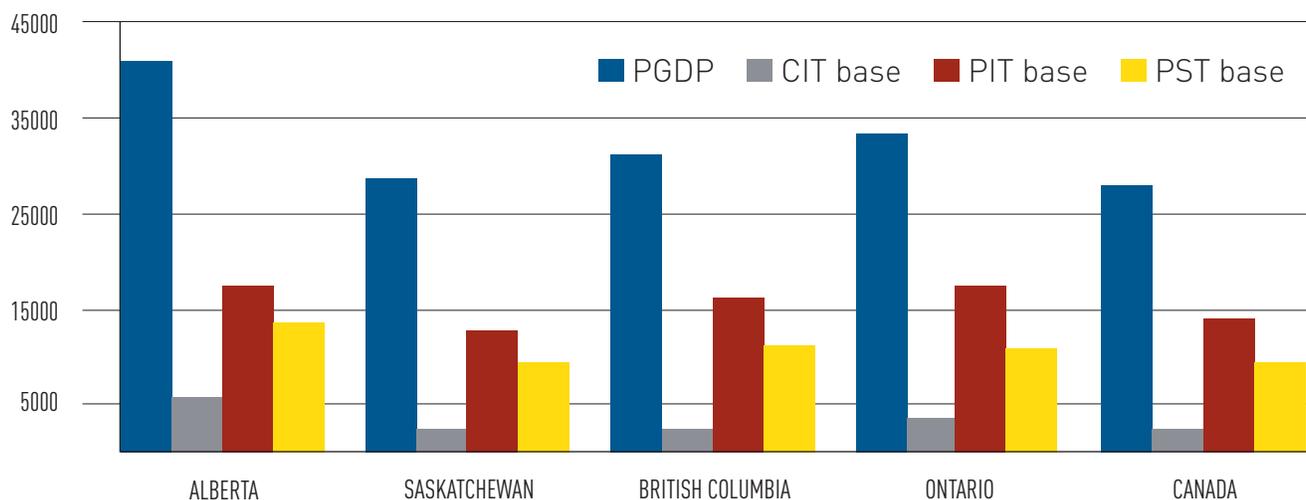


TAXATION IN ALBERTA: BACKGROUND

The Alberta government spends on various essential public services such as healthcare, education, infrastructure, and so on. The sources of funds for these services come from both tax revenue and non-renewable resource royalties. Alberta's economy, like other economies, is generally characterized by ups and downs ultimately affecting the government's budget. During economic down turn, as tax bases fall, tax revenue shrinks and government spending rises. That is the government budget partly absorbs the effects of economic volatility. Thus the government budget can provide an automatic stabilization role and lessens the adverse impacts of economic shocks. The government also plays a role of risk sharing in the economy. During economic down turns, normally wages and profits fall. This results in lower tax liability for individuals and businesses and as a result part of the risk of loss in wage income and profits is shared by the government.

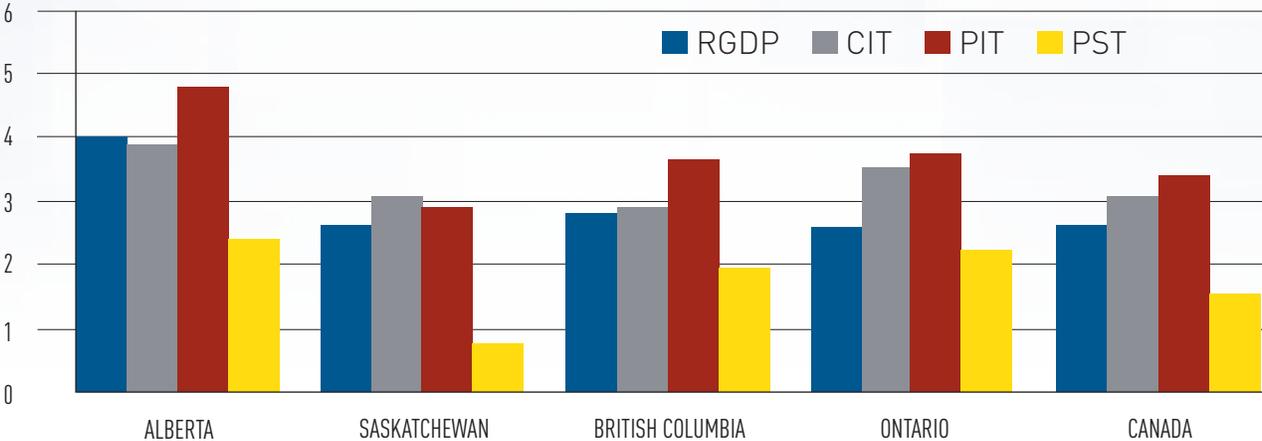
All Canadian provinces impose corporate and personal income taxes on tax bases that are generally consistent with the tax base definition of the federal government. Furthermore, all provinces with the exception of Alberta impose sales tax. On a per capita basis, Alberta has the highest corporate income tax base, followed by Ontario and Quebec. Alberta also has the largest sales tax base, even though the province does not levy a general sales tax. When we look at the personal income tax base, Ontario has the largest tax base, followed by British Columbia and Alberta. Figure 1 below shows this stylized fact for Alberta, other selected provinces, and Canada. We include British Columbia (BC), Saskatchewan (SK), Ontario (ON), and Canada for comparison purposes.

FIGURE 1: Average Per Capita PGDP and Tax Bases (2002 dollars), 1976-2008



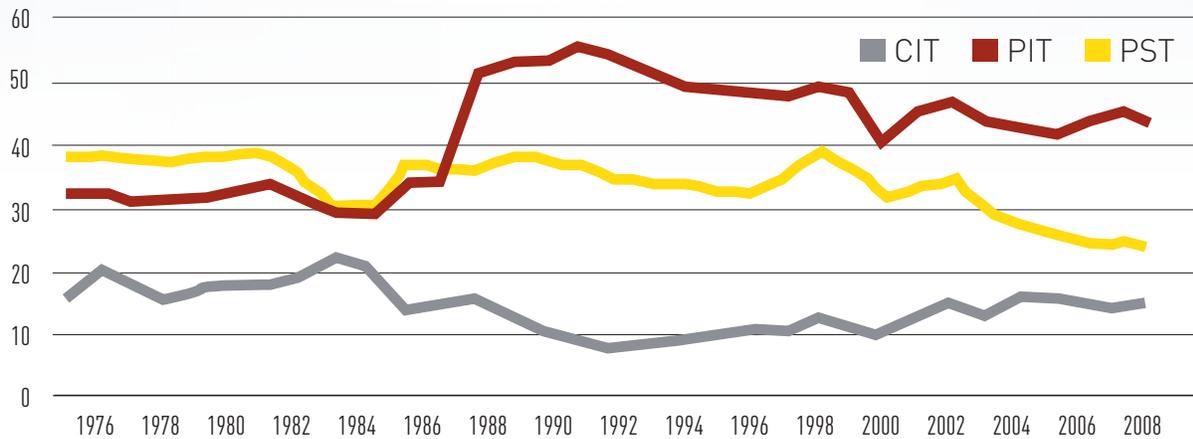
Another stylized fact about Alberta is that the province has the highest average annual growth rates of GDP over the period 1976-2008. Relative to other provinces, tax bases have also grown at a significantly higher rate over the same period. The following figure shows this.

FIGURE 2: Average Annual Growth Rates (in percent) of real GDP (RGDP) and Tax bases, 1976-2008



The personal income tax accounts the largest share of Alberta's tax revenue. Over the period under consideration, it accounts about 40 per cent of the province's tax revenue.¹ The comparable figures for British Columbia, Saskatchewan, and Ontario over the same period were 33.5, 33.1, and 38 percent respectively. The corporate income tax accounts the second largest share of the province's tax revenue. The average share for the period 1976-2008 was 15 percent and this is the highest in the country. As we have seen above, the province's tax bases and GDP show a remarkable growth during the period under consideration. Since we are interested in how tax bases respond to changes in economic activity, it is better to look at how the tax bases evolve over time relative to GDP. Figure 3 below shows the three tax bases as a share of GDP in Alberta over time.

FIGURE 3: Tax Bases as a share of GDP (in percent), Alberta, 1976-2008



¹ Note that the total revenue refers to total tax revenue and does not include resource royalties or non-resource revenue.



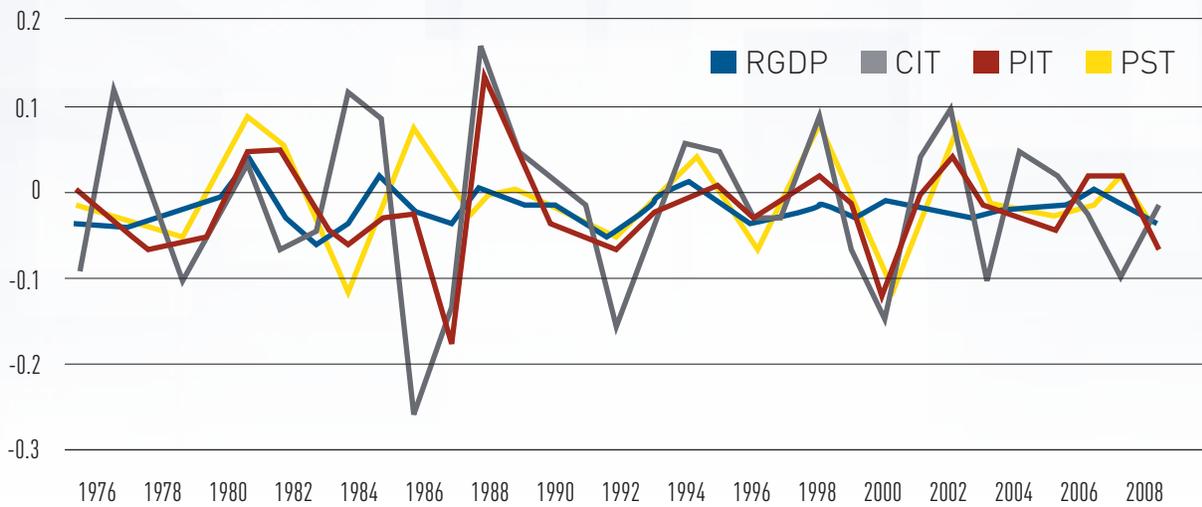
We can glean the following facts about Alberta's tax bases and GDP from the figure. First, although there are temporary up and downs, in general the share of tax bases in GDP are somewhat stable. Throughout the period under consideration, the share of corporate income tax base in GDP is the lowest. Prior to 1988, the PST Base had the highest share. However, since 1988 the personal income tax base is the largest of the three tax bases. The dramatic jump in the PIT base in 1988 was due to the major federal income tax reform that occurred in that year. The federal tax reform of 1988 significantly expanded the personal income tax base by eliminating a number of exemptions and deductions. The reform also affected the personal income tax bases of all provinces including Alberta as the provinces' tax rates at that time were given as a percentage of the federal rate. Thus the expansion of the federal income tax base definition also expanded Alberta's PIT base.

As we have mentioned before, we are interested in examining the short-run response of the province's tax bases to business cycle rather than their long-term trend. In the short-term, tax bases and GDP usually show a lot of fluctuations even though they trend upward over the long-run. Thus we are interested in the cyclical component of tax bases and GDP as is the case in most business cycle literature. Studies that focus on business cycle generally use the cyclical components of economic variables. First, economic variables can be decomposed into two components: the trending and the cyclical (or detrended) component of the variables using appropriate methods. The simplest approach is to use exponentially detrending of the series. Exponentially detrending can help us decompose the variables into their cyclical and trend components. There are also other relatively more sophisticated methods of filtering time series data. See for example Stock and Watson (1999), Orphanides and Norden (2002) and Sancak et al. (2010). We use the recent Christiano-Fitzgerald (2003) (CF) filter method for our analysis. We choose the CF filter as its end-of sample properties are generally considered to be better than the commonly used Hodrick-Prescott (1997) (HP) filter.



Figure 4 below shows the cyclical nature of Alberta's tax bases and GDP over the period 1976-2008.

FIGURE 4: Business Cycle and Tax Base Changes, Alberta, 1976-2008 (CF-filtered)



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 its resulting effects on the tax base. Generally an increase in a tax rate results in the shrinkage of the tax base. Similarly when governments lower tax rates, there will be more economic activity and the tax base can expand. See Dahlby and Ferde (2012) and the references contained therein. The Alberta government introduced the flat-rate income tax system in 2001 which significantly lowered the progressivity of the personal income tax system in the province. Other things remaining the same, such tax rate changes obviously results in less volatility in the personal income tax revenue. The tax base however can still continue to be volatile as there are factors other than the tax rate that affect tax base changes. Thus it is important to see how the tax bases vary over time. Figure 4 shows that the three tax bases show more cyclical nature than GDP. Furthermore, the corporate income tax base shows more cyclical nature than the other tax bases



TAX BASES AND THE BUSINESS CYCLE

Fluctuations in tax bases and GDP

How volatile are Alberta's tax bases? Do tax bases and GDP move together? In this section, we look at the volatility and co-movement of the province's tax bases and GDP. Since tax bases and GDP generally trend upwards overtime, we focus only on the cyclical component of the variables as extracted using the CF filter. As is common in the literature, the volatility of the variables is measured using the standard deviation of the cyclical components of real GDP and tax bases.² We also measure the co-movement using the correlation coefficient between the CF-filtered series of the variables.³ Table 1 shows the co-movements and volatility of Alberta's tax bases and GDP.

TABLE 1: The co-movements and volatility of real GDP and tax bases, Alberta, 1976-2008

	Co-movement	Volatility (in percent)
Real GDP	1.00	2.0
Corporate income tax base	0.32	9.3
Personal income tax base	0.38	5.6
General sales tax base	0.33	4.7

NOTES: The co-movement of the variables of interest (all CF-filtered) is measured by their correlation coefficient. The correlation coefficients are statistically significant at least at 10 and 5% levels. Volatility is measured by the standard deviation (in percent) of the CF-filtered tax bases and real GDP.

² Another common way of measuring volatility is using the coefficient of variation (i.e. standard deviation divided by the mean) of economic variables as in Landon and Smith (2010). This, however, is not feasible in our case since the filtered series are centered on zero by construction.

³ Using exponential detrending or other time-series filtering methods provide basically similar results.



While the sign of the correlation coefficient tells us whether tax bases and GDP move in the same direction, the numerical magnitude shows the strength of the correlation between the variables. Note also that the higher the standard deviation, the more volatile the variable is. Table 1 shows that Alberta's tax bases are pro-cyclical, i.e., they rise and fall as the economy goes through the boom-bust cycle. Furthermore, while all the three major tax bases are generally more volatile than real GDP, the corporate income tax (CIT) base shows the highest volatility. In fact, the CIT base is about four times as volatile as GDP and about twice as volatile as the sales tax base. This is broadly consistent with the general perception that the sales taxes are relatively more stable than other tax bases.

The above analysis focuses on the entire period 1976-2008. However, as one may expect, the volatility of tax bases and GDP can vary overtime. We explore this issue by computing the measure of volatility over two different time periods (1976-1992 and 1993-2008) and for the last five years of the period. The results are shown in Table 2 below.

TABLE 2: Volatility of Alberta's real GDP and tax bases, 1976-2008

(Standard deviation in percent of CF-filtered series)

	1976-1992	1993-2008	2004-2008	1976-2008
Real GDP	2.5	1.4	1.3	2.0
Corporate income tax base	11.1	7.3	5.4	9.3
Personal income tax base	6.8	4.2	3.6	5.6
General Sales Tax base	4.9	4.6	1.8	4.7

NOTE: This volatility is measured using the standard deviation of the cyclical or detrended series of the variables.

Table 2 shows that the volatility of Alberta's GDP and tax bases in the later periods are smaller than in the earlier periods. However, the relative volatility of tax bases to GDP does not show a significant change. In all periods, the corporate income tax base shows the highest volatility. In both the first and the second half of the period under consideration, the CIT base was about four to five times as volatile as GDP and more than twice as volatile as the sales tax base.



How volatile are Alberta's tax bases and GDP relative to other provinces? To shed light on this we provide the volatility of per capita tax bases and GDP for Alberta's two neighbouring provinces (British Columbia and Saskatchewan) and Ontario. Since provinces vary in size, we focus on the volatility of per capita (rather than level) tax bases and GDP. This facilitates comparison between provinces. The result is shown in Table 3 below.

TABLE 3: Volatility of real per capita GDP and Tax Bases, Selected Provinces 1976–2008.

	(Standard deviation in percent)			
	Alberta	Saskatchewan	British Columbia	Ontario
Real GDP	2.1	2.4	1.5	1.5
Corporate income tax base	9.4	9.1	11.9	7.5
Personal income tax base	5.6	5.9	4.7	4.8
General Sales Tax base	4.5	3.2	2.2	2.1

NOTES: Standard deviation of CF-Filtered per capita tax bases and Real GDP series.

For the period under consideration, Alberta's GDP is more volatile than that of British Columbia and Ontario but less volatile than that of Saskatchewan. Table 3 shows that Alberta's per capita corporate income tax base is more volatile than that of Saskatchewan and Ontario. The per capita sales tax base is less volatile than per capita corporate and personal income tax bases in all of the four provinces. Relative to the other provinces, Alberta's per capita sales tax base shows the highest volatility.



Response of tax bases to the business cycle

We have previously seen that there is a strong positive co-movement of Alberta's tax bases and GDP. Although one cannot easily conclude causality of tax bases and GDP from such findings, it is clear that the tax bases are pro-cyclical. In order to see better how the business cycle affects tax bases, in this section we estimate our measure of business cycle on the cyclical components of tax bases. To this end, we specify a simple empirical model for Alberta's three major tax bases: corporate income tax (c), personal income tax (p) and general sales tax (s). The empirical model is specified as:

$$\Delta \ln B_{jt} = \alpha_{0j} + \eta_{jy} \Delta \ln Y_{jt} + X + u_{jt} \quad (1)$$

where $j = c, p, s$. In equation (1), $\ln B_{jt}$ is the log of tax base j in year t , and $\ln Y_{jt}$ is the log of the provincial GDP. X includes a vector of other control variables. The tax bases and GDP are all in 2002 dollars. We use the GDP deflator to transform nominal tax bases into real so that any effect of GDP on the tax bases is not distorted by different movements in aggregate price level and sector-specific price levels.

We estimate equation (1) separately for the three tax bases using aggregate annual time series data from Alberta for the period 1976–2008. The dataset on provincial personal taxable income, which is our measure of the personal income tax base, was obtained from various issues of Income Statistics (formerly Tax Statistics on Individuals) published by the Canada Revenue Agency. The business income tax and general sales tax bases are those used by the federal government in its equalization payment calculations and were obtained from Finance Canada. The business income tax base is used as a corporate income tax base. All the tax bases were converted in to real using GDP deflator (2002 = 100). Data on GDP and GDP deflator are obtained from CANSIM.

In equation (1), we are interested in coefficient estimate, η_{jy} , which shows the percentage response of the tax base j due to a one percentage point change in real GDP. Thus the coefficients of the log of GDP in the above regression provide the short-run elasticity of the tax base with respect to income (real GDP). We expect the elasticity, η_{jy} , to be positive implying that an increase in the real GDP raises the tax base. If the coefficient is greater than one, it indicates that the tax base responds more proportionately to changes in real GDP. Our basic specification uses actual tax bases and real GDP. However, since we are interested in the response of tax bases to the business cycle we also use cyclical components of tax bases and real GDP in place of actual values. When we use detrended series in the above specification, our coefficient of interest shows the response of tax bases to the business cycle (measured by the deviation of real GDP from its trend).



TABLE 4: Response of Tax Bases to business cycle, Alberta, 1976-2008

	(Dependent Variable Changes in the log of real tax bases)			
	Short-run Elasticity			
	OLS^a	OLS^b	OLS^c	OLS^c
Dependent variable	(1)	(2)	(3)	(4)
Corporate income tax base	1.909**	2.447***	1.467**	1.865***
	(0.788)	(0.854)	(0.649)	(0.534)
Personal income tax base	1.049**	0.986***	1.033**	0.927***
	(0.493)	(0.165)	(0.447)	(0.334)
General sales base	0.866**	0.884***	0.765*	0.810*
	(0.386)	(0.233)	(0.408)	(0.450)
No. of Observations	32	32	32	32

NOTES: Robust standard errors in parentheses. Asterisks denote 1 % (***), 5 % (**), and 10 % (*) significance levels. In column (4) statutory provincial and federal corporate and personal income tax rates are included.

^a The change in the log of real tax bases is regressed on the change in the log of real GDP.

^b The variables are deviations from the exponentially-detrended series (cyclical components).

^c The variables are deviations from the Christiano-Fitzgerald Filter (CF)-filtered series (cyclical components).

Table 4 above reports the regression results. For the sake of brevity, we report the coefficient estimate of interest only. We begin in column (1), by regressing the change in log of real GDP on the change in the log of tax bases separately. That is the dependent variables are the growth rate of real tax bases and the explanatory variable is the growth rate of real GDP. Since we use actual growth rates of tax bases and GDP, this approach provides the familiar short-run income elasticity of tax bases. Standard unit-root tests show that first-differences of the log of the relevant variables are all stationary and hence the results are not affected by spurious regression. Our results indicate that a one percentage point increase in GDP is associated with a 1.9, 1.1, and 0.87 percentage point increases in CIT, PIT and PST bases, respectively. Thus the corporate income tax base is the most responsive to the business cycle. That is, it fluctuates more proportionately than GDP during the boom-bust cycle. These results are well within the range of estimates obtained for U.S. states. See Dye (2004).

In column (2), instead of the log changes of actual real GDP and tax bases, we estimate the exponentially detrended series of real GDP on similarly obtained tax base series. These variables are again all stationary and hence the results are not driven by spuri-



ous relationships. While the coefficient estimate of income in the personal income and sales tax bases are close to what we found before, the elasticity estimate in the corporate income tax base regression is now much higher. Thus our results indicate again that the corporate tax base is more responsive to the business cycle than personal income and sales tax bases.⁴

In column (3) we rely on the more commonly used method in the recent business cycle literature. Our measure of business cycle is based on the Christiano-Fitzgerald (2003) (CF) filter. We choose the recent CF filter as its end-of sample properties are generally considered to be better than those of Hodrick-Prescott (HP). That is we use the CF filter to extract the cyclical components of the relevant variables. The business cycle is now measured by the CF filtered real GDP and the dependent variables are the similarly filtered tax bases. In fact, the results indicate that the coefficients of our measure of business cycle is statistically significant in all the three tax base regressions suggesting that these tax bases are responsive to the business cycle. While the numerical magnitude of the elasticity estimate is now lower than what we obtained in columns (1) and (2) for the corporate income tax base, the corresponding estimates for the personal income and sales tax bases are close to what we obtained before. The results yet again confirm that the corporate income tax base is much more responsive to the business cycle than personal income and sales tax bases.

So far our tax base regressions did not control for the relevant tax rates. However, tax rates are important determinants of tax bases. See for example Dahlby and Ferde (2012). Thus, in column (4), we include provincial and federal statutory corporate income and top personal income tax rates to check the robustness of our results. Since Alberta does not impose sales tax rate, we use only corporate and personal income tax rates. Furthermore, since there is little variation in the federal Goods and Sales Tax (GST) rate during the period under consideration, we exclude the GST from our analysis. As discussed in Dahlby and Ferde (2012), a tax base can be affected not only by its own tax rate but also by other tax rates. Thus we include the corporate and personal income tax rates in all the three tax base regressions.

As column (4) includes both tax rates and GDP, the main determinants of tax bases, it is our preferred result. The results suggest that a one percentage point increase in GDP results in about 1.87, 0.93 and 0.81 percentage point increase in corporate income, personal income, and sales tax bases, respectively. Thus the results indicate that the corporate income tax base is still the most responsive and the sales tax base is the least responsive to the business cycle. How do our results compare with those of previous studies? These short-run elasticity estimates are also broadly comparable to those of previous studies. For example Holcombe and Sobel (1997) obtained mean short-run elasticity of personal income and sales tax bases for U.S. states of about 1.19 and 0.97, respectively. See also Dye (2004).

⁴ The long-run tax base elasticity with respect to income estimates for the three tax bases are lower than their corresponding short-run values. For example for the corporate income tax base, the long-run elasticity estimate is less than half of its corresponding short-run elasticity estimates suggesting the volatility of this tax base. The long-run elasticity estimates are available upon request from the author.



POLICY IMPLICATIONS FOR ALBERTA

In broad terms, our analysis indicates that corporate income tax base had the highest and sales tax base the lowest volatility. We also find that corporate income tax base is generally more responsive to changes in GDP. It is in fact four to five times more responsive than GDP during 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. On the other hand, our analysis indicates that the sales tax base is less volatile and less responsive to the business cycle than other tax bases. In other words, given tax rates, provincial government corporate income tax revenue is unstable and highly susceptible to the boom-bust cycle. This is important for Alberta as it has the highest corporate income tax revenue share in the country.

In fact, previous studies on the volatility of Alberta's tax revenue show exactly this; See Landon and Smith (2010). For Alberta this has important implications. First, as is well known the province relies heavily on non-renewable resource revenue which is very volatile in response to changes in world commodity prices. This makes the provincial government's revenue forecast much harder and unreliable. Second, unlike other provinces which impose sales taxes, the province relies relatively heavily on corporate income tax. Again as our analysis shows, the corporate income tax base (and hence tax revenue) is in itself very volatile exacerbating the overall volatility of the provincial government's revenue. Of course, generally the smaller the share of a tax base in the government's tax revenue, the less susceptible would be the government's revenue receipt to the volatility of the particular tax base.

The policy implication of our computations for Alberta is straightforward: a revenue-neutral shift from corporate income to personal income tax base or (even better) to 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 tax revenue, Landon and Smith (2010) cite diversifying the province's tax bases to include sales tax base as one of potential solutions. However, the authors express their doubt on the effectiveness of this solution arguing that the province relies heavily on non-renewable revenue sources which are very volatile by their very nature. They conclude that the reduction in Alberta's revenue volatility from introducing sales taxes would be minimal. The authors suggest the establishment of a resource revenue stabilization fund as the best remedy for the problem. While we agree on the importance of the use of such funds to smooth out volatile resource royalties, we believe that we need to broaden our discussion to include tax policies. Recurring volatility of the province's revenue requires looking at sales taxes

as an additional mechanism to combat revenue volatility. Often people make reference to Norway as a resource-based economy that successfully manages its volatile oil revenue. But it should be noted that, in addition to using oil revenue stabilization fund, Norway also relies on Value Added Tax (VAT) of around 25 percent. In fact, over the period 1976-2008, revenue from VAT accounts about 19.5 percent of Norway's total tax revenue.

Thus our view is that a change in the tax base mix (say through the introduction of sales tax) would have a non-negligible effect on the tax revenue stability of the province for two main reasons. First, Albertans can benefit from a reliance on a relatively less volatile tax base that would make budgeting and future government spending plans more predictable.⁵ Generally, the less the province relies on the 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.⁶ Thus if the province expands its tax bases, it will have a greater ability to have a smoothed tax policy in the face of changing tax bases. This is important for the economy as a whole as the private sector can operate in a reasonably predictable tax policy environment.

Second, there are additional benefits associated with such a change in the tax base mix which will have a positive impact on the overall revenue stability of the province. Sales taxes are 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 can also be positively impacted by such tax changes as it increases their international tax competitiveness.

In a nutshell, if the objective of the government is to have less volatile and somewhat reasonably predictable tax revenue sources, in addition to strengthening the existing Sustainability Fund for resource revenue, diversifying its tax bases to include sales taxes looks attractive (promising). Of course, such a reform would obviously create other social and distributional consequences which are not addressed in this paper.

⁵ See Dahlby (2012) and Dahlby and Ferede (2011a, 2011b) for the potential economic efficiency gains from changing the tax base mix.

⁶ See for example Barro (1979).



CONCLUSIONS AND CAVEATS

In this paper we examine the volatility of Alberta's tax bases and GDP. We also investigate the relationship between the business cycle—measured by the deviation of GDP from its long-term trend—and Alberta's three major tax bases. Our analysis indicates that Alberta's tax bases are pro-cyclical i.e., they rise and fall with the boom-bust cycle of the economy. While all the three major tax bases are generally more volatile than GDP, the corporate income tax and the sales tax bases show the highest and the lowest volatility, respectively.

We have also investigated the response of the three tax bases to the business cycle using a simple empirical model. Our preferred regression estimate suggests that a one percentage point increase in GDP is associated with 1.87, 0.93 and 0.81 percentage point increase in corporate income, personal income and sales tax bases, respectively. The results generally show that the corporate income and sales tax bases show the most and least responsiveness to the business cycle, respectively. These results are consistent with findings in previous studies.

The results have also an important policy implication. Our analysis indicates that tax base volatility (and hence tax revenue volatility) is the highest when Alberta uses corporate income tax and the lowest when it uses sales tax bases. Thus Alberta—a province with no sales tax—would potentially gain in terms of tax revenue stability from changing its tax base mix. These benefits are of course in addition to potential efficiency gains that previous studies have indicated.

While the implications of our analysis are broadly consistent with those of previous studies, it is important to highlight some of the caveats in our results. First, our analysis does not look at the volatility of the non-renewable revenue source which accounts the lion's share of the province's revenue. However, one thing is clear; the less the province relies on such revenue source (say by diversifying into sales tax), the less susceptible its budget would be to the boom-bust cycle. Second, our analysis focuses only on tax base volatility and the potential gains in terms of revenue stability from possible changes in the tax base mix. Of course, there are distributional effects associated with changing the tax base mix that are important for society and policy makers. These issues are however beyond the scope of this paper and interesting issues to explore in future studies.

References

- Barro, Robert. 1979. "On the Determination of the Public Debt." *Journal of Political Economy*, 87(6): 940-971.
- Bruce, D., W. Fox and M. Tuttle (2006), "Tax Base Elasticities: A Multi-State Analysis of Long-Run and Short Run-Dynamics", *Southern Economic Journal* 73 (2), 315-341.
- Christiano, L. J. and T. J. Fitzgerald (2003). "The band pass filter," *International Economic Review* 44, 435-465.
- Dahlby, B. (2012). "Reforming the tax mix in Canada." The School of Public Policy, University of Calgary, Vol. 5, Issue 14.
- Dahlby, B. and E. Ferede (2011a). "What does it cost society to raise a dollar of tax revenue? The Marginal Cost of Public Funds." C.D. Howe Institute *Commentary* No. 324.
- Dahlby, B. and E. Ferede (2011b). "The Marginal Cost of Raising Tax Revenue: Implications for Tax Policy Options in Alberta." Working Paper, Department of Economics, University of Alberta.
- Dahlby, B. and E. Ferede (2012). "The Effects of Tax Rate Changes on Tax Bases and the Marginal Cost of Public Funds for Provincial Governments." *International Tax and Public Finance*, 19, 844-883
- Dye, R. (2004), "State Revenue Cyclicalilty", *National Tax Journal*, 57 (1), 133-145.
- Dye, Richard F., and Therese J. McGuire (1991). "Growth and Variability of State Individual Income and General Sales Taxes." *National Tax Journal* 44, 55-66.
- Ferede, E. and B. Dahlby (2012). "The impact of tax cuts on economic growth: evidence from Canadian provinces." *National Tax Journal*, 65, 563-594.
- Hodrick, R., and E. Prescott (1997). "Post-war Business Cycles: An Empirical Investigation," *Journal of Money, Credit, and Banking* 29, 1-16.
- Holcombe, Randall G., and Russell S. Sobel (1997). *Growth and Variability in State Tax Revenue: An Anatomy of State Fiscal Crises*. Westport, CT: Greenwood Press.
- Landon, S. and C. Smith (2010). Energy Prices and Alberta Government Revenue Volatility. C.D. Howe Institute *Commentary* No. 313.
- McKenzie, K.J. (2000). "Replacing the Alberta Personal Income Tax with a Sales Tax: Not Heresy but Good Economic Sense." Canada West Foundation.



Orphanides, A. and S.V. Norden (2002). The unreliability of output-gap estimates in real time. *Review of Economics and Statistics* 84(4), 569-583.

Sancak, C., R. Velloso and J. Xing (2010). Tax revenue response to the business cycle. IMF Working Paper, WP/10/71.

Seyfried, W., and L. Pantuosco (2003), "Estimating the Sensitivity of State Tax Revenue To Cyclical and Wealth Effects", *Journal of Economics and Finance*, 27, pp. 114-124.

Sobel, R., and R. Holcombe (1996), "Measuring the Growth and Variability of Tax Bases over the Business Cycle", *National Tax Journal*, 49 (4), 535-552.

Stock, James H., and Mark, W. Watson (1999). Business cycle fluctuations in U.S. macroeconomic time series. *Handbook of Macroeconomics*, Volume 1, Part A, 3-64.



UNIVERSITY OF ALBERTA
DEPARTMENT OF ECONOMICS
Institute for Public Economics

RELEVANT · INFORMED · DEBATE

Institute for Public Economics

Department of Economics

8-14 H.M. Tory Building

University of Alberta

Edmonton, Alberta

T5G 2H4

www.ipe.ualberta.ca