Provincial Responses to Budgetary Shocks

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Foreword

I would like to thank Professor Jean-Francois Tremblay for his time, and commitment in assisting me with this paper. His excellent suggestions guided me throughout the process.

Table of Contents

1. Introduction

In June of 1992, Standard & Poor lowered the Province of Saskatchewan's credit rating from AA+ to BBB+ due to rapid debt accumulation. As a result of this downgrade, Saskatchewan faced difficulty in finding investors to buy Saskatchewan bonds. This marked the beginning of a period of fiscal austerity at the provincial level. Many provinces began drastic deficit elimination programs in the 1990s for example, the Progressive-Conservative government in Ontario led by Mike Harris ran the "Common Sense Revolution" program which focused on deficit reduction by cutting government programs while at the same time lowering taxes. In Saskatchewan, Roy Romanow eliminated the annual budgetary deficit by closing hospitals, cutting services and raising taxes. Lucien Bouchard reduced Quebec's annual budgetary deficit by cutting health care spending.

Budgetary shocks such as reduced own-source revenues, unexpected spending or forecast errors in federal grants could cause these deficit reduction plans to miss their targets. This paper analyzes how governments adjust own-source revenues and spending when faced with budgetary shocks from own-source revenues, spending and federal grant shocks. This paper also studies whether government responses to these budgetary shocks are symmetric or asymmetric, in other words, do governments respond to positive budget shocks in the same manner as negative budget shocks, if they do, the response is said to be symmetric, if the responses are different, it is said to be asymmetric. The study focuses on a panel data of seven provinces who received grants from the Federal equalization program, the Canada Health and Social transfer (CHST) program, the Canada Health Transfer (CHT) and the

Canada Social Transfer (CST) from 1996-2009. The Provinces studied are: Newfoundland, Prince Edward Island, Nova Scotia, New Brunswick, Quebec, Manitoba and Saskatchewan.

Results from empirical studies on whether government reaction to budgetary shocks is symmetric or asymmetric have been mixed. Snoddon (2003) using panel data from seven Canadian provinces, found that these governments respond symmetrically to past own-source revenue shocks. However in response to past grant shocks, Snoddon found the response to be asymmetric while reaction to past spending shocks were mixed. Lago-Peñas (2008) used a data set corresponding to Spanish municipalities and found asymmetric responses to increases and decreases in grants on total spending. Lago-Peñas included political and financial factors as possible explanations for these responses and found in a specific case that recipients compensate part of the loss in grants by increasing other revenues. Deller and Maher (2009) using Wisconsin as a test subject, found that 94% of Wisconsin municipalities replaces the loss of grants with own-source revenue. They also found that the lower the dependency on grants, the higher the odds that the municipality will replace lost grant with own-source revenues. Poterba (1994) added fiscal institutions as possible explanations for government responses and found that states in the U.S. with rules such as "no-deficit-carryover" rules and tax and expenditure limitations have a more rapid fiscal adjustment to unexpected deficits compared to states with more relaxed rules. Symmetric responses have been found by Gamkhar (2000) who studied whether states and localities, when faced with cuts in federal highway grants, attempt to maintain spending on existing highway projects with own-source revenues.

In addition to studying the behaviour of provinces during times of fiscal austerity, our paper hopes to contribute to the literature by using two different types of Canadian grants, an unconditional grant (equalization), and a conditional grant (CHST, CHT, CST). We hope to gain a better understanding of how governments treat these two different types of grants by analyzing how they adjust their budgets due to past shocks originating from these grants.

This paper is divided into seven sections. In section two, we briefly discuss the history and the importance of equalization transfers and the CHST, CHT and CST grants. Section three is a literature review of studies that have examined government responses to fiscal shocks. Section four describes the model used to explain fiscal responses to budgetary shocks. Explanation of the data and the required manipulation is discussed in section five. The empirical results are discussed in section six and section seven concludes.

2. Equalization Grants and the Canada Health and Social Transfer

In Canada, there are many different federal grants which are transferred to the provinces to achieve different objectives. In this paper, we focus on federal transfers which represent the four largest transfers for the provinces which are the equalization grants, the CHST, the CHT and the CST.

Equalization is a transfer program which addresses the problem of fiscal disparities amongst provinces in order to provide comparable levels of public services to all Canadians. According to the Canadian Constitution in 1982:

> "Parliament and the government of Canada are committed to the principle of making Equalization payments to ensure that provincial governments have

> sufficient revenues to provide reasonably comparable levels of public services at reasonably comparable levels of taxation." (Subsection 36(2) of the Constitution Act, 1982)

Money received through equalization are unconditional and can be spent in any way the provincial government sees fit. Entitlements are determined by measuring a provinces' ability to raise revenues, which is known as "fiscal capacity". Prior to any adjustments to a province's equalization entitlement, a province's per capita equalization entitlement is equal to the amount by which its fiscal capacity is below the average fiscal capacity of all provinces (10 province standard).

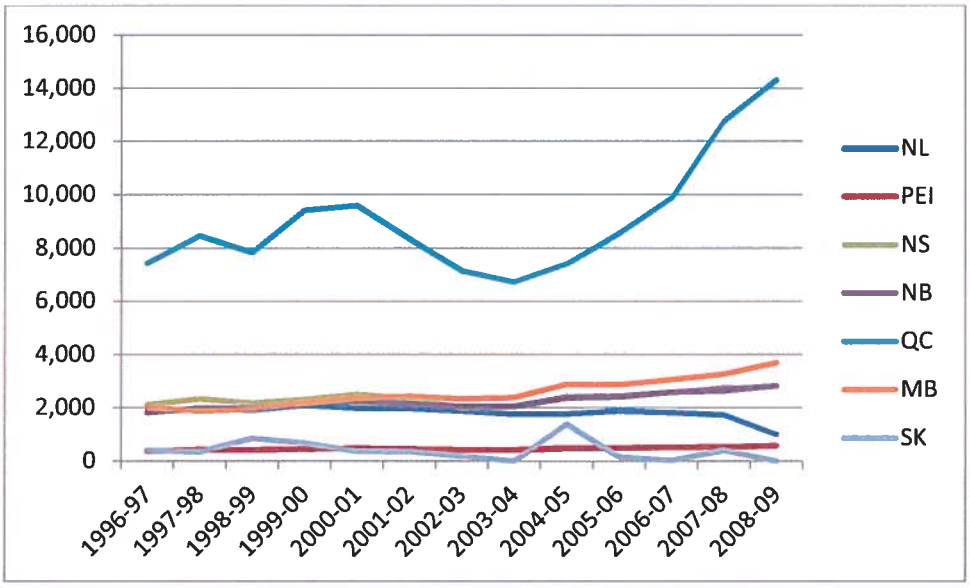
Equalization is adjusted to keep the total program payout growing in line with the economy. The growth path is based on a three-year moving average, lagged two years, of gross domestic product (GDP) growth. The use of the moving average helps to ensure stability and predictability while still being responsive to economic growth.

Equalization also maintained the benefits of the Atlantic Accords for Newfoundland and Labrador and Nova Scotia, of most importance is the 100 per cent protection from equalization reductions resulting from the inclusion of offshore resource revenues in the equalization program. In 2007, the two provinces were given the choice to continue to operate under the existing equalization system or to permanently opt into a new offshore program. Having chosen the new program, Nova Scotia benefitted from a guarantee that it will do at least as well, on a cumulative basis, as it would have under the formula agreed to at

the time the Accord was signed. For our purposes, amounts transferred via the offshore accord after 2007 are treated as equalization.

Graph 1 shows the total amount of equalization paid per capita to the seven sample provinces during the sample period. The offshore accords transfers are included as well for fiscal years 2007/2008 and 2008/2009 as mentioned before.

Graph 1: Equalization payments (dollars per capita)



Source: Department of Finance

Equalization is a significant revenue source for all the provinces we study with the exception of Saskatchewan. In the Maritime provinces, the percentage of equalization revenues to total revenues ranges from 23% to 26% over our sample period. In Quebec, the percentage of equalization to total revenues fluctuates between 8% and 13%. While in Manitoba and Saskatchewan, the percentage ranges from 15% to 20% and 1% to 10% respectively. Due to the complicated methodology and data requirements of the equalization formula, forecast errors are common and would cause considerable shocks to a province's budget.

The CHST was a block transfer payment program which operated from the 1996-1997 fiscal year until the 2004-2005 fiscal year. Unlike the equalization program where provinces can spend the money anywhere it sees fit, money from the CHST could only be spent on health and education programs.

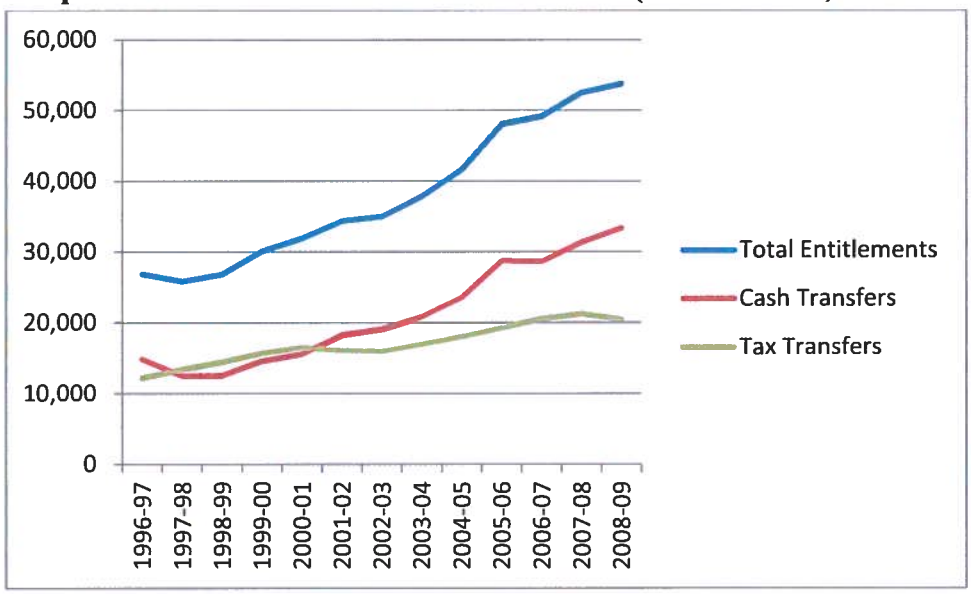
The CHST was a result of the merging of the Established Programs Financing program (EPF) and the Canada Assistance Plan program (CAP) in February of 1995. The reason for merging the two programs was so that provinces would have more discretion over how funds were to be divided amongst health care, post-secondary education and public assistance. For the 1996-1997 fiscal year, total CHST entitlements were set at $26.9 billion. From the 1997-1998 to 1999-2000 fiscal years, total CHST entitlements were frozen at $25.1 billion. Moving forward, total CHST entitlements were set to increase according to an escalator which was equal to the average GDP growth for the three proceeding years, less a predetermined coefficient. Once total entitlements were set, the provinces received equal per capita entitlements.

The structure of the payments of the CHST was carried over from the structure developed for the EPF program. The federal government transferred 13.5 percentage points of personal income tax and one percentage point of corporate income tax to the provinces. Additional cash payments were made to the provinces in order to bring their entitlements up to the national average (equal per capita entitlements).

However unlike the EPF, the CHST had a floor for cash transfers to provide protection against unexpected economic fluctuations which could reduce total entitlements, or significantly increase the value of the tax transfer which would significantly reduce cash transfers to the provinces. The floor was originally set at $11 billion. The floor would be raised to $12.5 billion for the 1997-1998 fiscal year. However in 1999, the floor was discontinued as Bill C-71 provided a level of cash transfer over and beyond the $12.5 billion limit.

In 2003, due to concerns of transparency and accountability, the federal government divided the CHST into two distinct transfers: the CHT and the CST which took effect in the 2004-2005 fiscal year. Around 62% of the ending CHST tax transfer was allocated to the CHT while the remaining portion was allocated to the CST. The cash portion for both the CHT and the CST were set at a fixed level from 2004-2005 to 2007-2008. Graph 2 shows payments made under the CHST, for simplicity, CHT and CST were summed to display the graph as one continuous grant.

Graph 2: Canada Health and Social Transfer (All Provinces, millions of dollars)



Source: Department of Finance

To show the importance of these grants as a source of revenues for the provinces, Table 1 below shows how much equalization and the CHST[1] (total entitlements including cash and tax transfers) represent as a percentage of total revenues for our sample provinces.

[1] The Canada Health and Social Transfer was broken up into two separate grants (Canada Health Transfer and Canada Social Transfer) at the beginning of the 2004-2005 fiscal year. For simplicity, the two separate grants are summed together since the structure of the two grants is similar if not identical to the CHST

Table 1: Percentage of Total Revenues (Equalization and Canada Health and Social Transfer)

	NL	PEI	NS	NB	QC	MB	SK
1996-97	43%	42%	45%	38%	31%	37%	20%
1997-98	40%	45%	48%	40%	32%	35%	20%
1998-99	42%	42%	44%	40%	28%	35%	24%
1999-00	46%	43%	46%	40%	31%	37%	24%
2000-01	43%	43%	47%	42%	29%	37%	19%
2001-02	43%	42%	45%	39%	29%	39%	22%
2002-03	41%	40%	41%	38%	27%	37%	19%
2003-04	38%	39%	39%	37%	26%	32%	18%
2004-05	39%	41%	41%	38%	28%	31%	27%
2005-06	34%	41%	41%	39%	31%	31%	19%
2006-07	33%	41%	40%	39%	30%	31%	17%
2007-08	25%	39%	37%	38%	32%	30%	19%
2008-09	16%	39%	38%	39%	34%	31%	13%
Average	37%	41%	42%	39%	30%	34%	20%

Source: Department of Finance

In most of the provinces studied, equalization and the CHST transfer represent over a third of total revenues to the provinces making the grants a significant source of revenues. It can be seen from the above table that some provinces have seen large decreases in grants, for example, Newfoundland who have seen grants decrease from 43% during the 1996-1997 fiscal year to 16% during the 2008-2009 fiscal year. For other provinces such as Quebec, their share of grants have remained relatively stable throughout our sample period. Grant instability and unpredictability can have significant ramifications on a province's budgetary process. For provinces trying to balance their budget, a shortfall in expected grants could cause deficits to occur which would require them to raise taxes or reduce spending in their next budget in order to balance their books.

3. Literature Review and Preliminary Analysis

3.1 Asymmetric responses to intergovernmental grants in the United States

Deller and Maher (2009) tested for asymmetries in the treatment of intergovernmental grants in the United States. Using a dataset from 1,779 Wisconsin municipalities during the period from 1990 to 2000, Deller and Maher wanted to find out if local government officials treat intergovernmental grants differently during periods of grant certainty and uncertainty.

Empirical studies have shown that when grants are stable and somewhat certain, local governments treat grants as a permanent source of revenue and build it into their budget. This effect is known as the flypaper effect, i.e. "money sticks where it lands". On the other hand, if grants become more unstable and uncertain, the local government may treat the funds differently, i.e. by reducing government expenditures due to the fact that the source of revenue is no longer certain. According to the authors, Wisconsin provides an interesting test subject because of its shared revenues program which is a pure grant program meaning that the grants have no restrictions on how it can be used.

To test for symmetry in the flypaper effect, the authors estimated the following model:

$$PCE = \beta_0 + \beta_1 \Delta SRPC + \alpha_1 PCI + \gamma_0 SRPC + \gamma_1 \Delta SRPC \cdot SRPC + \sum_{i=1,\dots,m} \delta_i X_i + \varepsilon$$

where *PCE* is per capita expenditure, *PCI* is per capita income, *SRPC* is shared revenues per capita (the grant), and X is a vector of control variables.

What the authors were searching for is the sign of the partial derivative term $\beta_1 + \gamma_1 SRPC$. If it is equal to zero, then the treatment of intergovernmental grants is symmetric and the local government treats increases in grants the same as decreases in grants. If it is a negative number, then the local government will substitute own-source revenues for the loss of grants, which is termed fiscal replacement. If the term is positive, then declines in grants will induce further declines in spending. The authors also segregated per capita total expenditures (*PCE*) into three different categories: Per capita quality of life services expenditures, per capita waste disposal expenditures and per capita road expenditures. In all cases, the authors found the sign for the above noted partial derivative term to be negative thus suggesting fiscal replacement in their sample.

Similar to the empirical literature, the Deller and Craig paper found the flypaper effect to be asymmetric with the local government responding to increases and decreases in grants differently. They also find that local governments are more likely to respond to decreases in intergovernmental grants by substituting local dollars, and lastly, they find that this substitution is more likely when the services affected are considered to be more vital. Therefore, symmetry in the flypaper effect depends on the nature of the service.

3.2 Responses to budgetary shocks by different Fiscal institutions and political factors

Poterba (1994) uses data from 50 states in the United States during the 1988-1992 period to study how fiscal institutions and political factors affect taxes and spending. Studying the effects of unexpected fiscal shocks on tax and expenditure adjustments in the United States

provides perspective on how governments react to these shocks when faced with balanced-budget rules.

Prior to the time period studied, State governments ran balanced budgets and in some cases, ran large surpluses. However by the late 1980s, the economic environment changed: the recession slowed revenue growth for many states, coupled with a reduction in real federal grants, this caused great stress on state revenues. Along with reduced revenues, states saw rising spending needs during the late 80s and early 90s. An aging population, combined with real increases in health care costs caused expenditures in health care to rise dramatically. The unexpected shocks in revenues and expenditures caused many states to go into deficits.

In the United States, most state constitutions do not allow state governments to run deficits. With the exception of five states, the governor must submit a balanced budget each fiscal year. However as in the case in the late 80s and early 90s where state governments experienced unexpected revenue and expenditure shocks, expectations of revenue and expenditure diverged from the passed budget and deficits occurred. The speed at which states eliminate their deficits varied from state to state as some states are allowed to have deficits carried over to the next fiscal year, whereas some do not require the deficit to be eliminated in the following fiscal year.

To analyze how expenditure and revenue shocks affect state spending and taxes, Poterba ran the following regressions:

$$\Delta SPEND_{it} = a_0 + a_1 DEFSHOCK_{it} + a_2\, WKDEF_i \cdot DEFSHOCK_{it} + \varepsilon_{it}$$

$$\Delta TAX_{it} = \beta_0 + \beta_1 DEFSHOCK_{it} + \beta_2 WKDEF_i \cdot DEFSHOCK_{it} + \varepsilon_{it}$$

Where $DEFSHOCK_{it}$ is the difference between the expected expenditures from the current period and expected revenues from the current period. Positive values of $DEFSHOCK_{it}$ correspond to deficits that are larger than expected, while negative values correspond to deficits that are smaller than expected. $WKDEF_i$ represents "weak anti-deficit rules" which were determined by The Advisory Commission on Intergovernmental Relations (1987) based on a score between 1 and 10, 1 being weak rules, and 10 being stringent rules. By estimating these equations, Poterba hoped to provide insight into two issues: The first is how flexible state budgeting rules are? In other words, do deficit shocks cause a dollar for dollar change in the level of taxes and spending? The second is if the relative use of tax increases and spending cuts in reducing state deficits are different.

What Poterba found was that states with strict anti-deficit rules experience more rapid fiscal adjustment when revenues fall short of expectation or when spending exceeds expectations. His regression results suggested that an unexpected deficit increase of $100 per capita in the current period resulted in a $17 per capita reduction of expenditures in the current period for a state with weak anti-deficit rules, whereas a state with strong anti-deficit rules saw a $44 per capita cut in expenditures in the current period. Poterba did not find any evidence that anti-deficit rules affect tax changes.

3.3 Asymmetric responses to budgetary shocks in Spain

Lago-Peñas (2008) tests asymmetries in the effects of increases and decreases in grants on total spending of Spanish Municipalities. The hypothesis set out by Lago-Peñas is that asymmetries may be explained by political factors and by the financial situation of governments. Lago-Peñas theorized that responses to a cut in grants may be different depending on the proximity of elections, the incumbent's ideology, the political support for the current government, and the current levels of taxes and debt. For example, right wing governments tend to reduce expenditures when faced with a decrease in grants while a left wing government would prefer to increases taxes to compensate for the loss in grants. However, if local elections are near or if political support for the current government is low, cutting expenditures or raising taxes may be delayed until after the election to gain support. If on the other hand municipalities are fiscally stressed, these municipalities might not be able to soften the effects of cuts in grants on expenditures relative to municipalities with lower levels of taxes and debt.

In order to test his hypothesis, Lago-Peñas used data from 313 Spanish Municipalities in Galicia during the period from 1985 to 1995. The specification used by Lago-Peñas took the following form:

$$E_{it} = \beta_{0i} + \beta_{1i} + \beta_2 G_{it} + \beta_3 (G_{it} - G_{it-1}) D_{it} + \sum_{h=1}^{p} \lambda_h Y_{hit} + \sum_{h=1}^{q} \gamma_h W_{hit} (G_{it} - G_{it-1}) D_{it} + \varphi E_{it-1} + \varepsilon_{it}$$

Where E_{it} denotes total expenditures at time t. G_{it} is total grants and are divided into two categories: current grants and capital grants. Current grants are mostly general-purpose grants

while capital grants are earmarked grants with matching requirements in some cases. Y and W are two noncoincident sets of variables with Y incorporated to explain the level of variable E. W is used to explain asymmetries. Variables for Y include the following:

- Household per capital income (I)
- Incumbent's ideology ($LEFT$), equal to 1 for left-wing governments and equal to 0 otherwise
- Election years (CY), equal to 1 in years with local elections and 0 otherwise
- Electoral support (MA) enjoyed by the incumbent party, equal to 1 when $N \geq N^*$ and 0 if $N < N^*$, where N is the number of seats of the incumbent party. N^* is the seats required for a majority government.
- Relative taxes (RT) which is defined as $RT = \frac{T}{I} - \left(\frac{1}{n} \cdot \sum_{i=1}^{n} \frac{T_i}{I_i}\right)$, where T is local tax collection per capita, I is household income per capita, and n is the number of municipalities in the same bracket of population.
- Relative debt (RD) which is defined as $RD = \frac{IP}{CR} - \left(\frac{1}{n} \cdot \sum_{i=1}^{n} \frac{IP_i}{CR_i}\right)$, where IP is interest payments for the debt, CR is local current revenues, and n is the number of municipalities in the same bracket of population.

It was theorized by Lago-Peñas that fiscally stressed municipalities might have less capacity to soften the effects of cuts in grants on expenditures than municipalities with lower levels of taxes and accumulated debt. D is a dummy variable which takes a value of 1 when total grants rise and 0 otherwise.

Estimating this model, Lago-Peñas finds that an increase in grants of one euro per capita in the current period increases expenditures by 0.951 euros per capita in the same period while the same increase in private income increases expenditures by 0.01 euros per capita in the current period. The estimated coefficient for capital grants is 0.910 suggesting a one euro increase in capital grants per capita in the current period leads to a 0.91 euro increase in spending per capita in the same period. For current grants, the estimated coefficient is 0.768 suggesting a smaller increase in expenditures from an increase in this form of grants. However if capital grants decrease by one euro per capita in the current period, the estimated results suggest spending will decrease by 0.603 euros per capita in the same period while a decrease in current grants of one euro per capita in the current period will lead to a decrease in spending of 0.684 euros per capita in the same period.

As for the political variables, the variables for a majority government and election year are not statistically significant. However the variable for left-wing government is statistically significant and has an estimated coefficient of 0.323 suggesting that left-wing governments spend more than a non left-wing government.

The estimated coefficient for relative taxes is not statistically significant however the estimated coefficient for relative debt is significant at the 5 percent level. The estimated coefficient suggests that a government with higher relative debt enjoys less capacity to compensate for cuts in grants.

The author goes on to analyze the financial instruments (taxes or debt) used by leftist governments to maintain expenditures when grants drop. To analyze how taxes react to these budgetary shocks, Lago-Peñas estimates the following equation:

$$T_{it} = \alpha_{0i} + \alpha_1 I_{it} + \alpha_2 G_{it} + \alpha_3 (G_{it} - G_{it-1}) D_{it} + \sum_{h=1}^{n} \delta_i X_{hit} + v_{it}$$

Where X is a vector of explanatory variables (*CY, LEFT*). A similar equation is used when deficit is used as the dependent variable where the deficit is given by:

$$Deficit = Expenditures - Taxes - Grants$$

The results show that the higher per capita income is, the higher taxes and deficits are given by the estimated coefficients of 0.0092 and 0.0012 respectively. Grants are only statistically significant under the deficit regression and suggests that an increase in grants by one euro per capita in the current period will reduce the deficit by 0.0062 euros per capita in the same period. When faced with a decrease in grants by one euro per capita in the current period, the deficit increases by 0.238 euros per capita in the same period. Similarly, the election year variable is only significant under the deficit regression and suggests that during election years, the deficit rises by 4.76 euros per capita in the same year.

The variable for left-wing government was not statistically significant. However the author also tested each independent variable between-groups differences for leftists and non-leftist governments. Under the deficit regression, the author finds that when faced with an increase in grants, the variable is significant only under a non-leftist government with an estimated coefficient of -0.080 suggesting that an increase in grants of one euro per capita in the current

period under a non-leftist government decreases the deficit by 0.08 euros per capita in the same period. Alternatively when faced with a decrease in grants, the variable is not significant under a non-leftist government but significant under a left-wing government. The estimated coefficient suggests that for a left-wing government, a decrease in grants of one euro per capita in the current period will lead to an increase in the deficit of 0.328 euros per capita in the same period. In the case of election years, the variable is only significant under a left-wing government and would increase its deficit by 5.90 euros per capita in the same election year.

Under the own-source revenue regression, the income variable is significant for both forms of government with an estimated coefficient of 0.010 for the left-wing government and 0.009 for the non-leftist government which suggests an increase in household income of one euro per capita in the current period will lead to an increase in taxes by 0.010 and 0.009 euros per capita in the same period respectively. The only other variable that was statistically significant in this regression was when grants decrease for a left-wing government. The estimated coefficient for this variable suggests that when faced with a decrease of grants of one euro per capita in the current period, own-source revenues will increase by 0.058 euros per capita in the same period.

What the results show is that while the net effect of ideology on deficits is not very significant, ideology matters when explaining deficits. Leftist governments increase their deficits more when grants are cut to maintain expenditures; they increase expenditures and deficits in election years more than non-leftist governments and they do not use increase in grants to cut deficits as non-leftist incumbents do.

Thus according to the results obtained by Lago-Peñas, an incumbent's ideology and the stock of debt in relative terms are enough to explain asymmetries. However, electoral support, electoral cycle, and previous levels of taxes do not provide any information. Left-wing governments with a stock of debt below the average are more prone to maintain expenditures when faced with a decrease in grants.

These results have important implications for policy design. Lago-Peñas suggests that grantors should take into account the incumbent's ideology and the stock of debt in relative terms when modifying grant policy.

3.4 Symmetric responses to government grants in the United States.

Gamkhar (2000) studied state expenditure responses to decreases in federal highway grants. Gamkhar stated that she used federal highway grants as the case study for three reasons: First, federal highway grants represent a significant proportion of state and local government spending on highways. Second, federal highway grants fluctuated significantly during the test period (1980s), and third, highways are an important part of the infrastructure supporting economic development for the state and local governments.

In her model, she uses real per capita state and local government highway expenditures as the dependent variables. Her explanatory variables are: real per capita federal highway grants with different lags and a vector of other determinants of state and local government highway

expenditure (per capita personal income, ratio of federal non-highway grants to state and local non-highway expenditure, per capita motor vehicles registered, light automobiles as a fraction of motor vehicles registered, fraction of population that is resident in metro areas, population per square miles of land area and fraction of total population unemployed). The dataset used is a panel data set for 45 states in the United States during the period from 1976 to 1990.

When expenditures are regressed on current federal highway grants (no lag), the results suggests that when current federal highway grants decline by one dollar per capita, current state and local government highway spending declines by $0.33 per capita. However an increase in federal highway grants has no statistically significant effect on spending. When lagged grants are used, the results suggests that state and local government highway expenditures increase/decrease by $0.53 per capita in the current period if federal highway grants increase/decrease by $1 per capita using one-period lagged highway grants. When using two-period lagged highway grants, spending will increase/decrease by $0.34 per capita in the current period for every increase/decrease of $1 per capita in federal highway grants.

The results of this paper suggests that when faced with reductions in federal highway grants, state and local governments will replace more of the lost funds if the reductions are lagged instead of current. In order to replace the lost funds, they would have to increase own-source revenues. As explained by Gamkhar, because highway projects extend over multiple years, replacing lost federal funds on projects that are further along is likely to minimize the cost of funding shortfalls on highway projects.

3.5 Budgetary shocks and revenue adjustments in Canada

Snoddon (2003) examines how Canadian provinces adjust own-source revenues in response to past budget shocks over the period 1980 to 1996. Snoddon disaggregates the budget shocks into expenditure and own-source revenue shocks and shocks to equalization grants. Since provincial governments in Canada can incur deficits and borrow relatively freely, Snoddon suggested that "the short run effects of budget shocks on own-source revenue decisions cannot be inferred from the estimated expenditure responses", therefore Snoddon only considers revenue responses in the paper.

To study the effects of budget shocks on provincial governments' own-source revenue decisions, Snoddon uses the following model:

$$\Delta OR_{it} = a_0 + a_1 E_{it-1}\Delta GDP_{it} + a_2 E_{it-1}\Delta UN_{it} + (\alpha_1 + \alpha_2 D^{S}_{it-1})FE^{S}_{it-1} + (\beta_1 + \beta_2 D^{OR}_{it-1})FE^{OR}_{it-1} + (\gamma_1 + \gamma_2 D^{EQ}_{it-1})\, FE^{EQ}_{it-1} + v_{it}$$

This equation says that planned changes in own-source revenue in period t depends on expectations regarding tax base growth and potential adjustments to past budget shocks which is measured by the difference between actual and expected values. The error term v_{it} captures any shocks not captured by the independent variables.

The dependent variable ΔOR_{it} is the change in real, observed own-source revenue per capita in province i from period *t-1* to *t*. E_{it-1} is the expectations operator conditional on information available at the end of period *t-1*. Given this, $E_{it-1}\ \Delta GDP_{it}$ is the expected change in real, per capital gross domestic product and $E_{it-1}\ \Delta UN_{it}$ is the expected change in the unemployment rate and is an indicator of expected changes in program spending. Since

the provinces do not provide a forecast for GDP and UN, Snoddon forecasts these values using an autoregressive process. *FE* represents budgetary shocks where FE^{S}_{it-1} is the spending shock in period *t-1*, FE^{OR}_{it-1} is own-source revenue shock in period *t-1* and FE^{EQ}_{it-1} is the shock in equalization grants in period *t-1*. Using the spending shock variable as an example, the shock variable is calculated by taking the difference between the actual expenditures in period *t-1* and the expected expenditures in period *t-1*. The variable D_{it-1} is a Dummy variable which allows for asymmetric responses to past shocks. The dummy variable takes on a value of one when the shock is negative and zero otherwise.

The table A.1 in Appendix A shows the estimation results obtained by Snoddon on seven provinces who received equalization from the period 1980 to 1996:

Equations (1) and (2) remove the dummy variables to allow for symmetric results while equations (3) and (4) include the dummy variables to allow for asymmetric responses. The additional trend variable in equations (1) and (3) measures any systematic change on own-source revenue changes over time that is not captured by the other variables.

In all four equations, the estimated coefficients of the expected change in GDP and UN are statistically significant. The negative coefficient for UN suggests that anticipated changes in the unemployment rate contains information about the evolution of the tax base rather than as an indicator of spending and revenue requirements in the short term. The trend variable in equations (1) and (3) are both negative and significant which suggests there has been a systematic decline in the annual increases in own-source revenue as budgeted for by provincial governments. Given that the trend variable is significant and the relative small

number of negative spending shocks in Snoddon's sample, Snoddon's preferred specification is (3).

The results obtained from specification (3) suggests that when provincial governments receive an unexpected increase of one dollar per capita in equalization in the previous period, own-source revenues decrease by $0.87 per capita in the following period. When the provincial government experiences a shock of an unexpected decrease of one dollar per capita in equalization in the previous period, own-source revenues increase by $0.18 per capita in the following period which shows an asymmetric response. The estimated coefficients for spending shock is insignificant at the 5% level and the 10% level which suggests that spending shocks does not affect own-source revenue decisions in the next period. The estimated coefficient for a positive shock of one dollar of own-source revenue is statistically significant however the estimated coefficient for a negative shock of one dollar of own-source revenue is statistically insignificant. The estimated coefficient of -0.25 for FE_{it-1}^{OR} along with the insignificant result of the dummy variable suggests that a provincial government responds symmetrically to past own-source revenue shocks by either increasing or reducing own-revenue by $0.75 per capita for every unexpected per capita dollar shock in own-source revenue in the last period.

To find out if the model presented by Snoddon still provide insight into the question of asymmetric and symmetric responses to budgetary shocks, we run her model over the time period 1996-2009 using the same seven provinces. The results of the Snoddon model using the period from 1996-2009 is presented in Table 2 below:

Table 2: Dependent Variable ΔOR_{it}

	(1)	(2)	(3)	(4)
$E_{t-1}\Delta GDP_{t-1}$	0.19*	0.19**	0.17*	0.17*
	(0.05)	(0.06)	(0.08)	(0.08)
$E_{t-1}\Delta UN_{t-1}$	-171.86	403.04	-219.35	331.66
	(406.48)	(309.43)	(426.71)	(309.89)
Trend	39.02		38.95	
	(24.72)		(27.88)	
FE^{S}_{it-1}	-0.37**	-0.34*	-0.36	-0.33
	(0.15)	(0.16)	(0.19)	(0.20)
FE^{OR}_{it-1}	0.18	0.28	0.12	0.22
	(0.19)	(0.18)	(0.19)	(0.19)
FE^{EQ}_{it-1}	0.39	0.31	0.20	0.04
	(0.32)	(0.33)	(0.40)	(0.28)
$FE^{S}_{it-1}D^{S}_{it-1}$			-0.25	-0.28
			(0.57)	(0.58)
$FE^{OR}_{it-1}D^{OR}_{it-1}$			0.38	0.33
			(0.73)	(0.77)
$FE^{EQ}_{it-1}D^{EQ}_{it-1}$			(0.38)	0.04
			(1.35)	(0.28)
Adj. R^2	0.13	0.13	0.13	0.13
F-Statistic	4.33	4.72	3.07	3.15

* and ** indicate statistical significance at the 10% and 5% level respectively
Robust standard errors in parenthesis.

After regressing Snoddon's model on the same seven provinces during the period 1996-2009, we can see that the model does not provide us with statistically significant results. In all four specifications, the GDP variable is statistically significant and suggests that an expected increase in GDP of $1 per capita would cause own-source revenues to increase by between $0.17 per capita and $0.19 per capita in the next period. The unemployment rate variable is statistically insignificant with a very large standard error suggesting that this variable should be removed from the model. The positive spending shock is statistically significant in

specifications one and two; however the negative sign for the estimated coefficient does not make theoretical sense. For example, in specification one, the estimated coefficient suggests that a positive shock of one dollar in spending per capita in the previous period will lead to a decrease of $0.37 per capita in own-source revenue in the current period.

Since the Snoddon model regressed against own-source revenue no longer provides any meaningful results, we test Snoddon's model again during the period from 1996-2009 however we replace the own-source revenues dependent variable with provincial expenditures. Our theory is that instead of adjusting own-source revenues due to past budgetary shocks, provincial governments prefer to keep tax rates relatively the same each period and adjust spending instead to keep their budgets balanced. We believe this theory to have some merit based on the behaviour of governments during the 1990s, many who reduced spending to balance their budgets while at the same time reduced taxes. Table 3 below shows the regression results using the same seven provinces during the period from 1996-2009:

Table 3: Dependent Variable ΔEXP_{it}

	(1)	(2)	(3)	(4)
$E_{t-1}\Delta GDP_{t-1}$	-0.08**	-0.08**	-0.05**	-0.05**
	(0.02)	(0.02)	(0.02)	(0.02)
$E_{t-1}\Delta UN_{t-1}$	-273.44	269.34	-185.29	417.65
	(263.67)	(221.87)	(317.48)	(321.90)
Trend	36.84**		42.62**	
	(15.14)		(17.38)	
FE^{S}_{it-1}	-0.19**	-0.16**	-0.18**	-0.15**
	(0.03)	(0.04)	(0.04)	(0.05)
FE^{OR}_{it-1}	0.04	0.13	0.03	0.15
	(0.09)	(0.07)	(0.10)	(0.08)
FE^{EQ}_{it-1}	0.01	-0.07	0.65*	0.48
	(0.18)	(0.20)	(0.29)	(0.35)
$FE^{S}_{it-1}D^{S}_{it-1}$			0.26	0.28
			(0.19)	(0.22)
$FE^{OR}_{it-1}D^{OR}_{it-1}$			-0.48	-0.11
			(0.25)	(0.27)
$FE^{EQ}_{it-1}D^{EQ}_{it-1}$			-1.43*	-1.21
			(0.61)	(0.74)
Adj. R^2	0.08	0.07	0.18	0.15
F-Statistic	3.17	3.19	3.97	3.47

* and ** indicate statistical significance at the 10% and 5% level respectively
Robust standard errors in parenthesis.

Once again in all four specifications, the GDP variable is statistically significant. Using specification 3 as an example, the negative coefficient for the GDP variable suggests that an expected increase in GDP of $1 per capita will lead to a decrease of $0.05 per capita in spending in the current period. This result gives evidence of provincial governments reducing spending to balance their budgets. However the trend variable suggests the opposite. The positive and statistically significant coefficient suggests that there has been a systematic increase in the annual increases in provincial spending as budgeted for by provincial

governments. The variable for equalization shock is also significant. A positive shock of $1 of equalization per capita in the previous period will lead to an increase of $0.65 in provincial spending per capita in the current period while a negative shock of $1 of equalization per capita in the previous period will lead to an increase of $0.78 in provincial spending per capita in the current period. This result implies that shocks in equalization do not affect spending behaviour. The shock variable for spending is also significant and suggests that an unexpected spending increase of $1 per capita in the previous period will cause provinces to increase spending by $0.82 per capita in the current period which contradicts the behaviour of a government trying to reduce its deficit.

Given the conflicting results of this model, we are led to believe that there are other determinants that could be added to Snoddon's model to provide us with results that make more sense intuitively. This leads us to our modified model.

4. The Model

As mentioned in the introduction, the purpose of this paper is to find out how governments adjust own-source revenues and expenditures when faced with budgetary shocks. The budgetary shocks we focus on are expenditure shocks, own-source revenue shocks and shocks from conditional and unconditional grants. Since Snoddon's original model does not provide us with results that match the behaviour of governments trying to eliminate its deficits, we use a modified model based on the one used by Snoddon (2003) which includes

shocks from equalization and CHST[2] and other explanatory variables which we believe are determinants to spending and own-source revenues:

$$\Delta OR_{it} = a_0 + a_1 X_{it-1} + (\alpha_1 + \alpha_2 D_{it-1}^{Exp}) FE_{it-1}^{Exp} + (\beta_1 + \beta_2 D_{it-1}^{OR}) FE_{it-1}^{OR} + (\gamma_1 + \gamma_2 D_{it-1}^{EQ}) FE_{it-1}^{EQ} + (\delta_1 + \delta_2 D_{it-1}^{CHST}) FE_{it-1}^{CHST} + \varepsilon_{it} \quad (1)$$

$\Delta OR_{it} = OR_{it} - OR_{it-1}$ is the change in real, per capita observed own-source revenue in province *i* from period *t-1* to *t*. Own-source revenue includes items such as taxes, investments, fees & services, licenses & permits and sales. Own-source revenue does not include Government of Canada transfers.

X_{it-1} is a vector consisting of other explanatory variables. It contains the change in the unemployment rate per capita in the previous period, the change in GDP per capita in the previous period, the change in the population under the age of 18 in the previous period, the change in the population over the age of 65 in the previous period, and the change in provincial debt per capita in the previous period. The assumption is that provinces adjust own-source revenues and expenditures in period *t* based on observed changes in the previous period *t-1*. This methodology differs from the methodology applied by Snoddon (2003) and Kneebone (1993) in which they apply an autoregressive model to forecast the expected change in GDP and the unemployment rate for period *t*. We attempt this alternative methodology due to insignificant results obtained when applying Snoddon's (2003)

[2] The Canada Health and Social Transfer was broken up into two separate grants (Canada Health Transfer and Canada Social Transfer) at the beginning of the 2004-2005 fiscal year. For simplicity, since the structure of the two grants is similar if not identical to the CHST, the two separate grants are summed together to show a continuous CHST grant.

methodology. The other explanatory variables such as the change in the composition of the population is expected to have effects on own-source revenues and spending, for example, an increase in the population of those under the age of 17 and over the age of 65 is expected to increase expenditures in education and health care.

FE_{it-1}^{Exp} , FE_{it-1}^{OR} , FE_{it-1}^{EQ} , FE_{it-1}^{CHST} are the budget shocks for spending, own-source revenue, equalization and CHST in province *i*. For the spending and own-source revenue shock variables, the shock is calculated by the observed value in period *t-1* subtracted by the forecasted value for period *t-1* in period *t-2*, and is specified as follows:

$$FE_{it-1}^{Exp} = EXP_{it-1} - E_{it-2}EXP_{it-1} \quad (2)$$

Using dummy variables in equation (1) allows for asymmetric responses to past shocks. D_{it-1}^{Exp} takes on a value of one if the shock in period *t-1* is negative and zero if positive or zero. Using the expenditure shock as an example, α_1 measures the effect of an unexpected increase of a dollar in spending from the previous year whereas $\alpha_1 + \alpha_2$ measures the effect of an unexpected decrease of a dollar in spending from the previous year.

The budget shocks for equalization and the CHST are calculated differently from expenditure shock and own-source revenue shock. Prior to the 2005-2006 fiscal year, equalization payments were estimated by the Department of Finance eight times over a period of four years starting just prior to the beginning of the fiscal year in question. Under this methodology, a province would not know the final payment some three and one-half years after the start of the fiscal year. In order to improve predictability and stability, post 2005-

2006, the Department of Finance switched over to a single estimate system in which the estimated equalization payment is known to the province just before the start of the fiscal year. In order to measure the equalization shock, we use the equation:

$$FE_{it-1}^{EQ} = E_{it-1}EQ_{it-1} - E_{it-2}EQ_{it-1} \quad (3)$$

Where $E_{it-1}EQ_{it-1}$ is the province's updated expectation of its *t-1* grant and $E_{it-2}EQ_{it-1}$ is the province's initial expectation of its *t-1* grant. Since the province does not provide an updated expectation of its *t-1* grant, we use the federal government's most updated estimation just before the end of period *t-1*, in the case of the old methodology; this would be the third estimate in February.

As previously mentioned in Section 2.0, total CHST entitlements was set to increase according to an escalator which was equal to the average GDP growth for the three proceeding years, less a predetermined coefficient. The methodology is based on past data which has the possibility of being updated at any given moment which could cause estimation errors. Therefore the shock variable is calculated using equation (3), where *EQ* is replaced with *CHST*. $E_{it-1}CHST_{it-1}$is the province's updated expectation of its *t-1* grant and $E_{it-2}EQ_{it-1}$ is the province's initial expectation of its *t-1* grant. Similar to equalization, the province does not provide an updated expectation of its *t-1* grant. Therefore we use the federal government's most updated estimation just before the end of period *t-1*.

To analyse the how provinces adjust spending due to past budgetary shocks, we use the following formula:

$$\Delta EXP_{it} = a_0 + a_1 X_{it-1} + (\alpha_1 + \alpha_2 D_{it-1}^{Exp}) FE_{it-1}^{Exp} + (\beta_1 + \beta_2 D_{it-1}^{OR}) FE_{it-1}^{OR} + (\gamma_1 + \gamma_2 D_{it-1}^{EQ}) FE_{it-1}^{EQ} + (\delta_1 + \delta_2 D_{it-1}^{CHST}) FE_{it-1}^{CHST} + \varepsilon_{it} \quad (4)$$

Where $\Delta EXP_{it} = EXP_{it} - EXP_{it-1}$ is the change in real, per capita observed expenditures in province *i* from period *t-1* to *t*. Expenditures include items such as recurrent expenditures, capital expenditures and debt payments. All remaining variables are calculated the same way as above.

4.1 Symmetric Budget Responses

The estimated coefficients of the spending, own-source revenue, equalization shocks and CHST shocks can tell us how provincial governments respond to budget shocks. There are many factors that determines how governments respond to budget shocks, one of which is whether or not the shock is perceived to be persistent or not as discussed in Snoddon (2003). If a shock is perceived to be temporary, a government would not expect that any or part of the shock would continue or occur again in the next period. In order to present the different reactions of the government, we let p, where $0 \leq p \leq 1$, represent the fraction of a $1 shock that the government expects to persist in the following year. For example, a temporary shock would be represented by $p = 0$.

In the case of a temporary shock where $p = 0$, a government would have zero expectations of the budgetary shock continuing into the next period. If the government is not targeting deficit or debt targets, we would not expect the government to adjust their own revenues nor their

expenditures in the next period. This is given by $\alpha_1 = \alpha_2 = \gamma_1 = \gamma_2 = \delta_1 = \delta_2 = \beta_2 = 0$ and $\beta_1 = -1$ in equation (1) and $\alpha_2 = \gamma_1 = \gamma_2 = \delta_1 = \delta_2 = \beta_1 = \beta_2 = 0$ and $\alpha_1 = -1$ in equation (4). To comprehend why $\beta_1 = -1$ in equation (1), if a positive shock of one dollar occurs in own-source revenue in period *t-1*, this shock would also be included in observed own-source revenue for *t-1* (the dependent variable). If the government is not targeting deficit or debt targets, then the dependent variable will fall by one dollar. We apply the same reasoning for why $\alpha_1 = -1$ in equation (4).

If the shock is believed to be persistent such that $0 < p \leq 1$, then it is possible that the government may adjust their budget in future periods. For example, consider the case where the government experiences a shock of an extra dollar in own-source revenue in period *t-1*, if the government perceives this shock as persistent, then theory would suggest the government response would be to increase public expenditures and cut taxes. The coefficients which reflect these expectations in equation (1) are $-1 < \beta_1 < p - 1$ and $-p < \gamma_1 < 0$. If we expected the tax cuts to fully offset the increase in revenue in period *t*, we would expect $\beta_1 = -1$ or $\gamma_1 = -p$. In equation (4), the coefficient that represents the above noted expectation is $\beta_1 > 0$. If the government experiences a positive and persistent spending shock in period *t-1*, perhaps due to an increase in the demand for services, the government would increase government spending and raise own-source revenue for period *t*. Accordingly, α_1 is expected to be greater than zero in equation (1) and (4).

During the past decade, governments have persistently promised to reduce their deficit and debt. If provinces are engaging in deficit and debt targeting behavior, then even temporary

budget shocks may cause governments to adjust their budget path. Consider a temporary increase in own-source revenue in period *t-1* where $p = 0$ creates a lower than expected deficit. Then the government may respond by lowering own-source revenue or increasing expenditures in period *t* to take into account the present value of the reduction in their debt. In such a case, we would expect $\beta_1 < -1$ in equation (1) and $\beta_1 > 0$ in equation (4). If this increase in own-source revenue was persistent $0 < p < -1$ rather than temporary, we would expect an even greater reduction in own-source revenue or increase in expenditures in period *t*.

We would expect the same behaviour by governments given a temporary increase $p = 0$ in equalization/CHST payments in period *t-1*. The temporary increase in equalization/CHST payments creates a lower than expected deficit, in response, the government may lower own-source revenue in period *t* to take into account the present value of the reduction in their debt. In this case, we would expect $\gamma_1 < 0$ and $\delta_1 < 0$. Similarly, if the shock was persistent such that $0 < p < -1$, we would expect the reduction in own-source revenue in period *t* to be greater. Alternatively the government could increase expenditures in period *t* to once again take into account the present value of the reduction in their debt which would be given by $\gamma_1 > 0$ and $\delta_1 > 0$.

The last case to consider is a spending shock in period *t-1*. If the government experiences a temporary ($p = 0$) unexpected extra dollar in spending in period *t-1*, then in order to keep its deficit and debt targets, the government would increase its own-source revenue in period *t* to reflect the increase in the present value of their debt or alternatively it could decrease its

expenditures. If instead the increase is perceived to be persistent rather than temporary, an even greater increase in own-source revenue or decrease in expenditures in period *t* is expected. Therefore we would expect α_1 in equation (1) to be positive and $\alpha_1 < -1$ in equation (4).

4.2 Asymmetric Budget Responses

The first case to be considered is a temporary shock with loss aversion where $p = 0$. A loss averse government is one who exhibits a greater sensitivity to losses in welfare compared to welfare gains. For example, for a loss averse government, the perceived cost of a spending decrease is greater than the perceived benefit of an equivalent spending increase. Similar to the case discussed in the symmetric case, because the government does not expect the shock to continue to the next period, the government would not make any adjustments to its budget.

The second case to be considered is a persistent shock with loss aversion. If the government experiences a persistent negative equalization/CHST shock in period *t-1*, given that the government perceives a greater cost associated with an increased tax rate to compensate for the loss in equalization/CHST revenue, the government's response is expected to be smaller in absolute terms given a negative equalization/CHST shock. The coefficients which represent this case in equation (1) would be $\gamma_2 > 0$, $\gamma_1 + \gamma_2 \leq 0$ and $\delta_2 > 0$ and $\delta_1 + \delta_2 \leq 0$. By the same token, reduced revenues from equalization/CHST combined with loss aversion would result in an expenditure response smaller in absolute terms than in the symmetric case. The coefficients which represent this case in equation (4) would be $\gamma_2 < 0$, $\gamma_1 + \gamma_2 \geq 0$ and $\delta_2 < 0$ and $\delta_1 + \delta_2 \geq 0$.

Similarly, if the government experiences a persistent negative revenue shock in period *t-1*, the loss averse government would be reluctant to raise taxes or reduce spending. The coefficients which represent this case would be $-1 < \beta_1 < p\text{-}1$, $\beta_2 > 0$ and $\beta_1 + \beta_2 \leq 0$ in equation (1) and $\beta_1 \geq 0$ and $\beta_2 > 0$ in equation (4). With a persistent positive spending shock, we would expect a loss averse government to have coefficients of $\alpha_1 \geq 0$ and $\alpha_2 > 0$ in equation (1) and $-1 < \alpha_1 < p\text{-}1$, $\alpha_2 > 0$ and $\alpha_1 + \alpha_2 \leq 0$ in equation (4).

The final case is a loss averse government who is targeting their deficit/debt facing a persistent shock. In this case, since the government is loss averse, we would expect the same behaviour as in the cases discussed above since loss aversion increases the costs of responding to shocks requiring a tax increase or a spending decrease. Therefore we would expect the coefficients to be the following for equation (1): $\gamma_2 > 0$, $\gamma_1 + \gamma_2 \leq 0$, $\delta_2 > 0$, $\delta_1 + \delta_2 \leq 0$, $\alpha_1 \geq 0$ and $\alpha_2 > 0$ and for equation (4) we would expect $\gamma_2 < 0$, $\gamma_1 + \gamma_2 \geq 0$, $\delta_2 < 0$, $\delta_1 + \delta_2 \geq 0$, $\beta_1 \geq 0$ and $\beta_2 > 0$. Similarly, a loss averse province who experiences an unexpected shortfall in own-source revenue in period *t-1* would perceive an extra cost to increasing the tax rate in the next period. Since the cost of the tax hike is perceived to be greater than the benefit of an equivalent tax cut, the response to a shortfall in own-source revenue is expected to be smaller than the symmetric case. Thus for equation (1), we would expect $\beta_1 < -1$, $\beta_2 > 0$ and $\beta_1 + \beta_2 \leq -1$. By the same reasoning, a loss averse province who experiences an unexpected increase in spending in period *t-1* would perceive an extra cost to decreasing spending in the next period. Under this hypothesis, we would expect $\alpha_1 < -1$, $\alpha_2 > 0$ and $\alpha_1 + \alpha_2 \leq -1$ in equation (4).

5. The Data

Data on expected provincial revenue, spending and equalization were obtained from each respected province's budget speeches. Expected population was obtained from Statistics Canada. Observed provincial revenue and spending was obtained from the Department of *Finance's Fiscal Reference Tables*. The population under the age of 18 and over the age of 65 were obtained from Statistics Canada. The federal government's final forecasted value for equalization and the Canada Health and Social transfer is not available publicly however it was obtained from the Department of Finance. The above data were deflated using provincial price indices from Statistics Canada and were converted to per capita values using observed or expected population. Data on the observed unemployment rate was obtained from Statistics Canada. Annual data was converted into fiscal year data based on the equation (using GDP and the 2006/2007 fiscal year as an example): $GDP_{2006/2007} = 0.75*GDP_{2006} + 0.25*GDP_{2007}$. Sources for our data are presented in the Data References table in the references section of our paper.

6. Estimation Results

Before running the regressions, several estimation issues must be addressed. First, the hypothesis of equal variance of the residuals from each cross section can be rejected. Therefore, equations (1) and (4) are estimated correcting for cross section heteroskedasticity by using robust standard errors. Second, province fixed effects are included to account for unobserved differences across provinces that may influence own-source revenue or spending decisions. The models are also estimated with and without a linear trend. The purpose of the trend variable is to measure any systematic change in the dependent variable that is not captured by the other variables.

We also tested for autocorrelation using the method suggested by Wooldridge (2002,282-283). The null hypothesis given by this test is there is no first-order autocorrelation or AR(1) process. After running this test, we cannot reject the null hypothesis of no first-order autocorrelation. Our models are estimated using the fixed effects model with robust standard errors.

Table 4 below presents the results after regressing equation (1).

Table 4: Dependent Variable ΔOR_{it}

	(1)	(2)	(3)	(4)
ΔGDP_{t-1}	0.17**	0.27**	0.19**	0.28**
	(0.04)	(0.02)	(0.04)	(0.02)
ΔUN_{t-1}	-118.37	-68.45	-157.38	-110.57
	(84.24)	(123.84)	(88.92)	(127.59)
$\Delta DEBT_{t-1}$	0.13*	0.05	-0.09	0.17
	(0.03)	(0.05)	(0.05)	(0.03)
$\Delta UNDER17_{t-1}$	-0.02	-0.07	-0.03	-0.09
	(0.07)	(0.06)	(0.06)	(0.05)
$\Delta OVER65_{t-1}$	-0.38**	-0.04	-0.35**	-0.01
	(0.11)	(0.09)	(0.10)	(0.12)
Trend	80.11**		77.29**	
	(23.39)		(27.65)	
FE^{S}_{it-1}	-0.50**	-0.35**	-0.40*	-0.30
	(0.13)	(0.13)	(0.18)	(0.17)
FE^{OR}_{it-1}	0.38	0.41	0.19	0.22
	(0.20)	(0.27)	(0.16)	(0.20)
FE^{EQ}_{it-1}	0.64**	0.05	0.60	-0.04
	(0.15)	(0.24)	(0.56)	(0.31)
FE^{CHST}_{it-1}	-2.26*	-0.15	-1.78	1.44
	(0.96)	(1.31)	(1.37)	(1.81)
$FE^{S}_{it-1}D^{S}_{it-1}$			-3.40	-0.60
			(5.49)	(5.49)
$FE^{OR}_{it-1}D^{OR}_{it-1}$			1.26*	1.39*
			(0.58)	(0.55)
$FE^{EQ}_{it-1}D^{EQ}_{it-1}$			-2.88	-0.08
			(1.12)	(0.89)
$FE^{CHST}_{it-1}D^{CHST}_{it-1}$			-0.28	-4.24
			(2.45)	(2.14)
Adj. R^2	0.33	0.43	0.44	0.52
F-Statistic	6.63	6.53	6.32	6.05

* and ** indicate statistical significance at the 10% and 5% level respectively
Robust standard errors in parenthesis.

Since the trend variable is statistically significant in specifications (1) and (3), we focus our analysis on those specifications. In the symmetric case of specification (1), the GDP variable is statistically significant at the 5% level; the estimated coefficient suggests that an observed increase in GDP from period *t-2* to period *t-1* of $1 per capita increases provincial own-source revenue in the next period by $0.17 per capita. The estimated coefficient for the debt variable is statistically significant at the 10% level and suggests that an increase in the provincial debt per capita of $1 from period *t-2* to period *t-1* will cause provinces to increase own-source revenues by $0.13 per capita in the following period. This result is in line with our hypothesis that provinces are trying to eliminate their deficits/debts. The estimated coefficient for the Over 65 variable suggests that an increase in the population of those over the age of 65 by one person will decrease own-source revenues by $0.38 per capita.

Turning our focus to the budgetary shock variables, a positive shock in spending of $1 per capita in the previous period will cause provincial own-source revenues to decrease by $0.50 per capita in the following period. This result contradicts our expected outcome of a positive coefficient in the case of a persistent and non-persistent shock. One explanation for this is that the population could be very sensitive to tax increases, knowing this, the province due to a spending shock, would prefer to decrease spending in the next period rather than increasing taxes to balance its budget. We will see if this hypothesis is true later on with the estimation of equation (4).

A positive shock in equalization grants in the previous period causes provincial own-source revenues to increase by $0.64 per capita in the following period while a positive shock in the

CHST in the previous period decreases provincial own-source revenues by $2.26 per capita in the following period. Once again the results do not follow our expectations as described in sections 4.1 and 4.2. While we expected a downward adjustment to own-source revenues due to a positive shock in grants, we did not expect the adjustment to be greater than -1 which is the case for the CHST variable. One explanation for this could be that provinces do not differentiate between conditional and unconditional federal grants and treat the revenues from these sources as one source. We attempted to run a regression by summing the equalization variable and CHST variable together however the estimated coefficient for this variable was not statistically significant.

In the asymmetric case of specification (3), the GDP variable is statistically significant at the 5% level once again and suggests that an increase in GDP from period *t-2* to period *t-1* of $1 per capita increases provincial own-source revenue by $0.19 per capita in the following period. The estimated coefficient for the Over 65 variable is also statistically significant at the 5% level and suggests that an increase in the population of those over the age of 65 by one person in the previous period will decrease own-source revenues by $0.35 per capita in the following period. Once again the estimated coefficient for a positive spending shock is negative (-0.40) which does not follow expectations however we will reserve conclusion until we regress equation (4) for it may provide an explanation for this anomaly. While the estimated coefficient for a positive shock for own-source revenues is not statistically significant, the estimated coefficient for a negative shock is significant at the 10% level and suggests that if the province experiences a negative shock of $1 per capita in own-source

revenues in the previous period, it will decrease its own source revenue in the next period by $0.26 per capita.

The estimated results in both specification (1) and (3) suggests that due to a positive spending shock in the previous period, the government's response would be to decrease own-source revenue in the following period. In section 4.1 and 4.2, it was predicted that the estimated coefficients of this variable would be greater than zero, however our results suggests otherwise. Even if the shock was determined to be not persistent, our theory suggested that there would be no response to own-source revenue in the next period. It is our belief that governments perceive the population to be extremely sensitive to tax increases due to spending shocks and is not concerned by period-by-period balance but rather, to intertemporal balance. Therefore in order to balance its budget due to a spending shock, it must decrease its spending in the following period. In order to see if this hypothesis is true, we estimate equation (4) and present the results in Table 5 below.

Table 5: Dependent Variable ΔEXP_{it}

	(1)	(2)	(3)	(4)
ΔGDP_{t-1}	-0.03	0.02	0.02	0.09
	(0.06)	(0.07)	(0.04)	(0.06)
ΔUN_{t-1}	16.95	41.82	69.64	100.40
	(59.72)	(71.73)	(72.41)	(76.42)
$\Delta DEBT_{t-1}$	-0.07**	-0.11**	-0.05	-0.10**
	(0.02)	(0.02)	(0.03)	(0.02)
$\Delta UNDER17_{t-1}$	0.04	0.01	0.04	-0.01
	(0.05)	(0.05)	(0.05)	(0.05)
$\Delta OVER65_{t-1}$	-0.04	0.13*	-0.08	0.16*
	(0.06)	(0.05)	(0.10)	(0.07)
Trend	40.87**		56.08**	
	(8.47)		(15.28)	
FE^{S}_{it-1}	-0.20**	-0.12*	-0.19**	-0.12**
	(0.05)	(0.05)	(0.05)	(0.04)
FE^{OR}_{it-1}	0.03	0.05	0.02	0.05
	(0.07)	(0.05)	(0.10)	(0.10)
FE^{EQ}_{it-1}	0.12	-0.17	1.07**	0.61*
	(0.20)	(0.22)	(0.24)	(0.50)
FE^{CHST}_{it-1}	-0.35	0.72	-2.90	-0.57
	(1.67)	(1.35)	(2.15)	(1.70)
$FE^{S}_{it-1}D^{S}_{it-1}$			2.50*	4.47**
			(1.19)	(1.59)
$FE^{OR}_{it-1}D^{OR}_{it-1}$			-0.29	-0.19
			(0.28)	(0.32)
$FE^{EQ}_{it-1}D^{EQ}_{it-1}$			-2.11**	-1.94
			(0.82)	(1.09)
$FE^{CHST}_{it-1}D^{CHST}_{it-1}$			5.43	2.61
			(3.00)	(2.41)
Adj. R^2	0.14	0.16	0.29	0.30
F-Statistic	2.34	2.40	3.09	2.78

* and ** indicate statistical significance at the 10% and 5% level respectively
Robust standard errors in parenthesis.

Once again the trend variable is statistically significant at the 5% level, because of this we focus on the results produced by specifications (1) and (3). In the symmetric case of

specification (1), we obtain a value of -0.07 for our debt variable. This result suggests that an increase in the provincial debt per capita by $1 in the previous period will cause spending in the current period to decrease by $0.07 per capita.

The estimated coefficient of the spending shock variable suggests that a spending shock of $1 per capita in the previous period will cause spending in the current period to increase by $0.80 per capita. Once again the estimated coefficient does not correspond to what is expected of a government trying to reduce its deficit but corresponds to a government who believes this shock to be persistent without any deficit targeting. When we regressed equation (1) we found that a spending shock of one dollar per capita in the previous period caused a decrease in own-source revenues of $0.50 per capita in the current period. Coupled with the adjustment to spending due to a spending shock, the net increase to a province's debt is $2.30 per capita as a result of this shock.

In the asymmetric case which is represented by specification (3), a spending shock of $1 per capita in the previous period results in an increase in spending in the current period by $0.81 per capita which is similar to the result obtained in the symmetric case. If the provinces experience a negative shock in spending in the previous period of one dollar, the response would be a decrease in spending of $3.31 per capita in the current period. One explanation for this behaviour is that a positive shock in spending is expected to be persistent and vital thus requiring the provinces to continue the spending into the next period. When there is a negative spending shock, the provinces perceive a reduction in demand for services thus reducing spending further.

For the equalization shock variable, we obtain a result of 1.07 which suggests a positive shock of $1 per capita in equalization in the previous period will result in the provinces increasing their spending by $1.07 per capita in the following period. On the other hand if the provinces experience a negative equalization shock of one dollar per capita in the previous period, they will adjust their expenditures in the next period by increasing expenditures by $1.04 per capita. Recalling our results from Table 6, the shock variables for equalization had no effect on own-source revenue. Thus positive or negative shocks to equalization increases the debt of the provinces. The shock variables for own-source revenue and CHST were statistically insignificant.

We also attempted running our models using different lag periods for the shock variables. It is our hypothesis that provinces may not be able to react to shocks in the next period for different reasons such as planned or committed expenditures, income tax promises to their population, or not knowing the magnitude of the shock at time of planning the budget for the next period.

The results of running the models using different lag periods are presented in Appendix B. Table B.1 and B.2 presents the results of lagging the shock variables in equations (1) and (4) respectively by two periods rather than one period. The results of lagging the shock variables by two periods on equation (1) are significant based on the F-Statistic and the R-square ranges from 40% to 42%. The trend variable is no longer significant. Based on the results presented in specification (4), an increase in GDP from the previous period by one dollar per

capita will increase own-source revenues by $0.28 per capita in the following period. An increase in the debt by one dollar per capita in the previous period will increase own-source revenues by $0.12 per capita in the following period. With respect to the shock variables, only the estimated coefficient for a positive shock to own-source revenues was statistically significant however the positive coefficient does not make theoretical sense. The estimated coefficient suggests that a shock of one dollar per capita in own-source revenues from two periods ago would cause the province to increase own-source revenue in the current period by $0.47 per capita.

Table B.2 presents the results of lagging the shock variables by two periods in equation (4). From specification (3), a shock of one dollar in spending per capita from two periods ago will cause the province to decrease spending in the current period by $0.24 per capita. A negative shock of one dollar in per capita spending from two periods ago will cause the province to decrease spending by $0.67 per capita in the current period. The estimated coefficient for a positive shock in equalization does not make theoretical sense as it suggests that a positive shock of one dollar per capita from two periods ago would decrease spending in the current period by $0.51 per capita.

Table B.3 and B.4 presents the results of lagging the shock variables by three periods on equations (1) and (4) respectively. Specification (4) in Table B.3 suggests that the provinces react symmetrically due to past spending and own-source revenue shocks however the estimated coefficient for a past spending shock does not make theoretical sense as it suggests that a positive shock of one dollar per capita in spending from three periods ago will cause

own-source revenues to decrease by $0.27 per capita in the current period. However what table B.4 specification (3) shows is that a positive spending shock of one dollar per capita from three periods ago will cause spending to decrease in the current period by $0.30 per capita. The net result is that a spending shock of one dollar per capita from three periods ago will cause the provincial debt to increase by $1.97 per capita.

We also attempted different lags on different shock variables with the hypothesis that governments receive information on different budget items at different times. The specification which gave us reasonable results is one which we lagged all shock variables by one period with the exception of the shock variable for CHST which was lagged by three periods. The results of this model are presented in Table B.5 with own-source revenues as the dependent variable and Table B.6 with expenditures as the dependent variable. As can be seen in Table B.5, the majority of the explanatory variables are statistically insignificant which gives evidence once again that the provinces do not adjust own-source revenues due to past budgetary shocks. The results presented in Table B.6 show that the provinces react symmetrically to a one dollar per capita shock in spending from the previous period by increase or reducing expenditures in the next period by $0.81 per capita. For the CHST shock, the results suggest that the reaction to a shock from three periods ago is symmetric where a shock of one dollar per capita in CHST would cause the province to adjust spending by $2.04 per capita in the current period. A positive shock of one dollar in equalization per capita in the previous period would increase expenditures in the current period by $0.94 per capita while a negative shock of one dollar in equalization per capita in the previous period would also increase expenditures by $0.97 per capita in the current period. Once again the

reaction to a negative shock in equalization does not make theoretical sense however one possible explanation for this reaction could be based on planned or committed expenditures.

In another attempt to improve our results, we add a dummy variable to our shock variables representing provinces with weak anti-deficit rules which follows the specification presented by Poterba (1994). Our expectation is that provinces with strong anti-deficit rules would react stronger to budgetary shocks compared to provinces with weak anti-deficit rules. It could be possible that the provinces with weak anti-deficit rules are causing our model to present insignificant results. The X_{it-1} vector consisting of other explanatory variables in Models (1) and (4) were also dropped from the modified models as Poterba stated that because fiscal institutions are endogenous, if variables such as those found in the X_{it-1} vector are included in the specification, the study may fail to describe the effects of imposing new fiscal institutions on provinces that have not already chosen to adopt them. Therefore our modified specification looks like this:

$$\Delta OR_{it} = a_0 + \left(\alpha_1 + \alpha_2 D_{it-1}^{WeakRules}\right) FE_{it-1}^{Exp} + \left(\beta_1 + \beta_2 D_{it-1}^{WeakRules}\right) FE_{it-1}^{OR} + \left(\gamma_1 + \gamma_2 D_{it-1}^{Weakrules}\right) FE_{it-1}^{EQ} + \left(\delta_1 + \delta_2 D_{it-1}^{Weakrules}\right) FE_{it-1}^{CHST} + \varepsilon_{it} \quad (1a)$$

$$\Delta EXP_{it} = a_0 + \left(\alpha_1 + \alpha_2 D_{it-1}^{WeakRules}\right) FE_{it-1}^{Exp} + \left(\beta_1 + \beta_2 D_{it-1}^{WeakRules}\right) FE_{it-1}^{OR} + \left(\gamma_1 + \gamma_2 D_{it-1}^{Weakrules}\right) FE_{it-1}^{EQ} + \left(\delta_1 + \delta_2 D_{it-1}^{Weakrules}\right) FE_{it-1}^{CHST} + \varepsilon_{it} \quad (4a)$$

Where $D_{it-1}^{WeakRules}$ is a dummy variable that takes on a value of 0 if the province has strong anti-deficit rules and a value of 1 if the province has weak anti-deficit rules. In addition, we

allow for positive and negative values for each shock variable. In order to determine which provinces have strong anti-deficit rules or weak anti-deficit rules, we use the summary table produced by Millar (1997) and assign a score of 1 for each satisfied category. The table is presented below:

Table 6:

	Existence of anti-deficit law	Apply to realized deficits	Concrete debt elimination	Single-year budget period	Penalties for not achieving	Referendum requirement for tax	Total
Manitoba	1	1	1	1	1	1	6
Quebec	1	1	0	1	0	0	3
Nova Scotia	1	0	0	1	0	0	2
New Brunswick	1	1	0	0	0	0	2
Saskatchewan	1	0	0	0	0	0	1
Newfoundland	0	0	0	0	0	0	0
PEI	0	0	0	0	0	0	0

Given the scores above, we classify Manitoba and Quebec as provinces with strong anti-deficit rules and we classify Nova Scotia, New Brunswick and Saskatchewan as provinces with weak anti-deficit rules. Table C.1 in Appendix C present the results of regressing models (1a) and (4a).

Unfortunately model (1a) does not provide a statistically significant regression as we cannot reject the null hypothesis that all the coefficients are equal to zero based on the F-statistic. Similarly, when we apply different periods of lags (two lags are presented in Table C.2 and three lags are presented in Table C.3) we obtain the same results.

Alternatively model (4a) does provide us with a statistically significant regression. In column (3) of Table C.1, we obtain an R-Square of 44% and the trend variable is statistically significant. The results suggest that a spending shock of one dollar per capita in the previous

period would cause a province with strong anti-deficit rules to increase spending by $0.84 per capita in the current period while a province with weak anti-deficit rules has no reaction. The reaction suggested by the results does not conform with our intuition as we would expect a spending shock would cause a province with strong anti-deficit rules to decrease spending. Lagging the models by two and three periods does not provide better results as they both suggest a spending shock in previous periods would cause a province with strong anti-deficit rules to increase spending in the current period.

One explanation for the poor results obtained above could be the inclusion of Quebec as a strong anti-deficit rules province. Although Quebec has many rules for eliminating a deficit, the rules do not appear to be followed. For example, one rule states that overruns of less than $1 billion must be offset with an equivalent surplus in the subsequent fiscal year, however reviewing the historical data shows that from 2002/2003 to 2005/2006, Quebec ran consecutive deficits of under $1 billion. Therefore it is our opinion that Quebec should have been classified as a weak anti-deficit rules province. Unfortunately we could not run the model with just one province classified as a strong anti-deficit rule province as our time period does not provide enough observations to run the regression.

Since it appears that Quebec's rules are not strong enough to avoid or eliminate deficits, we attempt a new specification which includes a dummy variable representing provinces which have no anti-deficit rules in an attempt to observe any differences between the reactions of provinces with anti-deficit rules and those that do not have anti-deficit rules.

Our modified specification is presented below:

$$\Delta OR_{it} = a_0 + \left(\alpha_1 + \alpha_2 D_{it-1}^{NoRules}\right) FE_{it-1}^{Exp} + \left(\beta_1 + \beta_2 D_{it-1}^{NoRules}\right) FE_{it-1}^{OR}$$

$$+ \left(\gamma_1 + \gamma_2 D_{it-1}^{Norules}\right) FE_{it-1}^{EQ} + \left(\delta_1 + \delta_2 D_{it-1}^{Norules}\right) FE_{it-1}^{CHST} + \varepsilon_{it} \qquad (1b)$$

$$\Delta EXP_{it} = a_0 + \left(\alpha_1 + \alpha_2 D_{it-1}^{NoRules}\right) FE_{it-1}^{Exp} + \left(\beta_1 + \beta_2 D_{it-1}^{NoRules}\right) FE_{it-1}^{OR}$$

$$+ \left(\gamma_1 + \gamma_2 D_{it-1}^{Norules}\right) FE_{it-1}^{EQ} + \left(\delta_1 + \delta_2 D_{it-1}^{Norules}\right) FE_{it-1}^{CHST} + \varepsilon_{it} \qquad (4b)$$

Where $D_{it-1}^{NoRules}$ is a dummy variable that takes on a value of 0 if the province has some sort of anti-deficit rules and a value of 1 if the province has no anti-deficit rules. Once again we allow for positive and negative values for each shock variable. Based on table 8, provinces which have some sort of anti-deficit rules are Manitoba, Quebec, Nova Scotia, New Brunswick and Saskatchewan whereas Newfoundland and Prince Edward Island do not have any anti-deficit rules in place. The results of estimating equations (1b) and (4b) are presented in Table D.1 in Appendix D.

As can be seen from Table D.1, the regression results are poor, although the regressions are statistically significant and the R-Squares are reasonable, ranging from 29% to 45%, they do not provide enough statistically significant coefficients to offer any insight into whether provinces with anti-deficit rules behave differently from provinces without anti-deficit rules. Lagging the shock variables by two and three periods which are presented in Table D.2 and D.3 respectively also does not provide any useful results. In order to provide an explanation for these results, we must review the anti-deficit rules in greater detail.

Turning first to the Province of Saskatchewan, the Balanced Budget Act which was passed in 1995 requires the government after each election to prepare four-year fiscal plans in which forecasted expenditures cannot exceed revenues. Any surpluses after a fiscal year must be applied to the province's debt-reduction account. Despite these rules, there are no penalties in place if these rules are not met.

Manitoba legislated the Balanced Budget, Debt Repayment and Taxpayer Protection and Consequential Amendments Act which prohibits budget deficits for any year in 1995. These plans commenced at the beginning of the 1995/1996 fiscal year. With respect to the seven provinces that we study in this paper, Manitoba has the most stringent rules. Any deficits that occur must be offset in the following fiscal year. Penalties for not adhering to the rules include reductions of salary for cabinet members of 20 per cent the year after a realized deficit and by 40 per cent if successive deficits occur. However these requirements are void if the deficits are a result of natural disasters, the threat of war, or a revenue decline of at least 5 per cent. The act also specifies mandatory payments to a fund for the purposes of reducing the debt after 1996/1997. Payments from the fund must be made at least once every five years to reduce the Province's debt. The legislation also includes taxpayer protection by requiring a referendum to increase income, sales, or payroll taxes.

Quebec enacted their anti-deficit rules in December of 1996. The legislation that was passed set decreasing limits on deficit levels between 1996/1997 and 1998/1999. For years after, the province was required to balance its budget for each fiscal year. Similar to Manitoba,

Quebec's legislation had contingencies that allowed them to run deficits of $1 billion or more which included events such as a disaster having a major impact on revenues or expenditures, a significant deterioration of economic conditions, or a substantial reduction in federal transfer payments. Any overruns as a result of these events would be required to be eliminated within five years. Overruns of less than $1 billion must be offset with an equivalent surplus in the next fiscal year.

In Nova Scotia, the province legislated an Expenditure Control Act commencing in 1994/1995 and would be in effect for four years. This legislation established declining targets for net operating expenditures and net capital expenditures which were targeted to decrease by 10 percent and 20 percent respectively over the four year period. This brought on additional rules in 1996 via the Financial Measures Act which required the province's appropriated budget expenditures not to exceed forecasted revenues by more than one percent for any year. If a deficit does occur, the government must obtain an offsetting surplus in the following fiscal year. If a surplus occurs, the province is required to use the surplus to pay down the existing debt or may be used to reduce taxes. However, the province's legislature can pass a resolution to override any of these rules for any year.

In 1993, New Brunswick set in its legislation its "objective" of achieving an operating account balance on a cumulative basis from 1993/1994 to 1995/1996 and for every four year period thereafter. However the operating account excludes net capital expenditures and net special purpose account expenditures. Additionally, the impact of any decrease in federal

transfers occurring within the last half of the four year period would not have to be offset within the same four year period.

Based on the acts/rules listed above, it appears that none of the acts clearly restrict the ability of the provinces to create new debt. For example, the restrictions imposed by Saskatchewan and Nova Scotia apply to forecasted rather than realized budget balances. In addition, in all cases, the rules allow the provinces to run a deficit during the current fiscal year, with the rule requiring them to eliminate or offset the deficit the following fiscal year.

Despite these rules being in place, based on the historical data, the rules are not being followed as mentioned before in the case of Quebec. Other provinces have also been guilty of not adhering to the rules. Nova Scotia for example is required to offset its deficit with an equivalent surplus in the following fiscal year however from 1996/1997 fiscal year to the 1999/2000 fiscal year. Therefore although some provinces have anti-deficit rules in place, it appears to be nothing more than false promises to appease investors or their electoral base.

7. Conclusion

Our paper attempted to find out how provinces react to budgetary shocks during a period of fiscal austerity. We also attempted to find out if provinces react to shocks from unconditional and conditional grants differently. We found that provinces do not react to shocks using own-source revenues despite attempting different model specifications along with different lags for our shock variables.

Using expenditures as the dependent variable provided some insight on how provinces react to budgetary shocks. Reactions to spending shock is asymmetric, while a positive shock in spending of a dollar per capita in the previous period would cause the province to increase spending by $0.81 per capita in the next period, a negative shock of one dollar per capita would cause the province to decrease spending by $3.31 per capita in the next period. One explanation for this is that during times where the demand for services is high, the government will continue to spend, whereas during times of declining demand, the government would adjust its spending to cover any positive shocks in spending from previous years.

With the grant variables lagged by only one period, there was not enough evidence to determine whether or not provinces react to the shocks from grants differently. In our original model, we obtained a statistically insignificant result for our CHST shock variable. For our equalization shock variable, an extra dollar per capita shock of equalization would result in an adjustment of $1.07 per capita in spending whereas a negative shock of a dollar per capita in equalization would result in an adjustment of $1.04 per capita in spending. Although we expected a negative shock in equalization to result in a negative adjustment in spending, our result could be caused by planned expenditures or committed expenditures which must be completed despite not receiving the required revenues for the project.

We were able to get a statistically significant result if we lagged the CHST variable by three periods while keeping all other shock variables lagged by one period. Since total CHST entitlements was set to increase according to an escalator which was equal to the average

GDP growth for the three proceeding years, less a predetermined coefficient. Accurate GDP data from the three proceeding years may not be available to the provinces during budget planning. Based on the results of this model, it is suggested that the reaction to shocks in CHST is symmetric. A shock of one dollar in CHST per capita three periods ago would cause the province to adjust their spending in the current period by $2.04 per capita. Reactions to equalization is asymmetric where a positive dollar shock per capita would cause an adjustment of $0.94 per capita and a negative dollar shock per capita would cause an adjustment of $0.97 per capita. The difference in reaction to the conditional grant (CHST) and unconditional grant (equalization) shock occurs for a negative shock. In the case of the unconditional grant, the province ignores the shock and adjusts their spending upwards whereas in the case of the conditional grant, the province adjusts their spending downwards. Our explanation for this difference could be that the provinces do not spend the money from the CHST until they receive it whereas the provinces will commit to a project before receiving money from equalization. Any shortfall in equalization must be added to the province's deficit.

We also analyzed whether anti-deficit rules had any effect on the reactions of the provinces. We first attempted to study the different reactions of provinces with strong anti-deficit rules and those with weak anti-deficit rules. We then attempted to study the different reactions of provinces with anti-deficit rules and those without anti-deficit rules. In both cases, we were unable to acquire enough reasonable results to offer any sort of comparison. Upon reviewing the anti-deficit laws of the provinces, we believe the poor results are a result of poor anti-deficit rules. In almost all the provinces, the rules include contingencies that allow the

provinces to continue to run deficits year after year which lead us to believe that the rules set in place are ineffective at controlling deficits. If the provinces are serious about eliminating their deficits, the rules in place now must be overhauled with greater accountability and penalties.

The results of this paper offer two important implications for policy makers. The first is that the current set of anti-deficit rules are ineffective and must be strengthened. The second is that the accuracy of the forecasts of equalization is important as any unexpected shortfall in equalization only adds to a province's deficit.

Appendix A

Table A.1: Dependent Variable ΔOR_{it}

	(1)	(2)	(3)	(4)
$E_{t-1}\Delta GDP_{t-1}$	0.04*	0.07**	0.06**	0.10**
	(0.02)	(0.03)	(0.02)	(0.03)
$E_{t-1}\Delta UN_{t-1}$	-81.32**	-73.32**	-86.20**	-77.80**
	(15.84)	(14.41)	(16.57)	(14.88)
Trend	-7.27*		-7.32*	
	(4.00)		(3.95)	
FE^{S}_{it-1}	0.17*	0.23**	0.13	0.17**
	(0.09)	(0.09)	(0.08)	(0.08)
FE^{OR}_{it-1}	-0.29**	-0.26**	-0.25**	-0.21**
	(0.07)	(0.06)	(0.10)	(0.09)
FE^{EQ}_{it-1}	-0.23	-0.27*	-0.87**	-0.80**
	(0.15)	(0.14)	(0.32)	(0.33)
$FE^{S}_{it-1}D^{S}_{it-1}$			0.54	0.81*
			(0.44)	(0.46)
$FE^{OR}_{it-1}D^{OR}_{it-1}$			-0.01	-0.02
			(0.16)	(0.16)
$FE^{EQ}_{it-1}D^{EQ}_{it-1}$			1.05**	0.89*
			(0.49)	(0.49)
Adj. R^2	0.15	0.14	0.16	0.15
F-Statistic	2.54	2.57	2.30	2.27

* and ** indicate statistical significance at the 10% and 5% level respectively
Standard errors in parenthesis.

Appendix B

Table B.1: Dependent Variable ΔOR_{it}

	(1)	(2)	(3)	(4)
ΔGDP_{t-1}	0.26**	0.27**	0.27**	0.28**
	(0.04)	(0.02)	(0.04)	(0.03)
ΔUN_{t-1}	9.87	15.23	56.06	59.00
	(132.89)	(137.38)	(148.98)	(150.40)
$\Delta DEBT_{t-1}$	0.10**	0.09**	0.13**	0.12*
	(0.04)	(0.04)	(0.05)	(0.06)
$\Delta UNDER17_{t-1}$	0.00	0.01	0.00	0.00
	(0.01)	(0.01)	(0.01)	(0.01)
$\Delta OVER65_{t-1}$	-0.02*	-0.02	-0.05*	-0.05*
	(0.01)	(0.01)	(0.03)	(0.02)
Trend	5.98		4.82	
	(12.32)		(18.95)	
FE^{S}_{it-2}	-0.14	-0.13	-0.15	-0.14
	(0.16)	(0.13)	(0.17)	(0.14)
FE^{OR}_{it-2}	0.38**	0.38**	0.47**	0.47**
	(0.13)	(0.12)	(0.19)	(0.19)
FE^{EQ}_{it-2}	-0.14	-0.18	-0.37	-0.42
	(0.45)	(0.41)	(0.67)	(0.52)
FE^{CHST}_{it-2}	-0.15	-0.07	0.93	1.04
	(0.65)	(0.71)	(1.46)	(1.41)
$FE^{S}_{it-2}D^{S}_{it-2}$			0.71	0.69
			(0.56)	(0.47)
$FE^{OR}_{it-2}D^{OR}_{it-2}$			-0.35	-0.35
			(0.23)	(0.24)
$FE^{EQ}_{it-2}D^{EQ}_{it-2}$			0.65	0.69
			(0.92)	(0.74)
$FE^{CHST}_{it-2}D^{CHST}_{it-2}$			-2.33	-2.39
			(1.71)	(1.64)
Adj. R^2	0.40	0.40	0.42	0.42
F-Statistic	5.81	6.54	4.18	4.56

* and ** indicate statistical significance at the 10% and 5% level respectively
Robust standard errors in parenthesis.

Table B.2: Dependent Variable ΔEXP_{it}

	(1)	(2)	(3)	(4)
ΔGDP_{t-1}	0.02 (0.06)	0.04 (0.06)	0.02 (0.06)	0.03 (0.07)
ΔUN_{t-1}	100.08* (47.84)	127.58* (54.14)	136.71** (52.39)	152.59** (56.30)
$\Delta DEBT_{t-1}$	-0.08 (0.04)	-0.12** (0.05)	-0.07 (0.04)	-0.11** (0.04)
$\Delta UNDER17_{t-1}$	-0.02* (0.01)	-0.01 (0.01)	0.00 (0.01)	0.01 (0.01)
$\Delta OVER65_{t-1}$	0.00 (0.01)	0.01 (0.01)	-0.03 (0.02)	-0.02 (0.02)
Trend	30.82** (8.91)		25.95** (7.67)	
FE^{S}_{it-2}	-0.22** (0.06)	-0.15** (0.04)	-0.24** (0.07)	-0.18** (0.06)
FE^{OR}_{it-2}	0.10 (0.13)	0.10 (0.12)	0.08 (0.11)	0.07 (0.10)
FE^{EQ}_{it-2}	0.24 (0.15)	0.01 (0.13)	-0.51* (0.24)	-0.82** (0.27)
FE^{CHST}_{it-2}	-1.17 (1.23)	-0.75 (1.05)	-1.50 (1.84)	-0.92 (1.63)
$FE^{S}_{it-2}D^{S}_{it-2}$			0.91** (0.33)	0.76** (0.31)
$FE^{OR}_{it-2}D^{OR}_{it-2}$			-0.20 (0.24)	-0.18 (0.24)
$FE^{EQ}_{it-2}D^{EQ}_{it-2}$			2.05** (0.48)	2.33** (0.50)
$FE^{CHST}_{it-2}D^{CHST}_{it-2}$			0.64 (2.02)	0.37 (1.70)
Adj. R^2	0.33	0.29	0.42	0.39
F-Statistic	3.01	3.13	3.10	3.27

* and ** indicate statistical significance at the 10% and 5% level respectively
Robust standard errors in parenthesis.

Table B.3: Dependent Variable ΔOR_{it}

	(1)	(2)	(3)	(4)
ΔGDP_{t-1}	0.29**	0.29**	0.30**	0.30**
	(0.07)	(0.07)	(0.09)	(0.09)
ΔUN_{t-1}	110.46	128.81	100.91	92.91
	(96.12)	(98.06)	(95.28)	(86.44)
$\Delta DEBT_{t-1}$	-0.00	-0.02	-0.03	-0.02
	(0.04)	(0.02)	(0.06)	(0.04)
$\Delta UNDER17_{t-1}$	0.01	0.02**	-0.04*	-0.03
	(0.01)	(0.01)	(0.02)	(0.02)
$\Delta OVER65_{t-1}$	-0.00	0.00	0.07	0.07
	(0.02)	(0.02)	(0.05)	(0.06)
Trend	11.49		-6.06	
	(24.89)		(29.09)	
FE^{S}_{it-3}	-0.30**	-0.28**	-0.23**	-0.27**
	(0.07)	(0.05)	(0.08)	(0.05)
FE^{OR}_{it-3}	-0.12	-0.12*	-0.25*	-0.24**
	(0.07)	(0.06)	(0.12)	(0.09)
FE^{EQ}_{it-3}	-0.15	-0.22	-0.36	-0.31
	(0.25)	(0.19)	(0.54)	(0.39)
FE^{CHST}_{it-3}	1.15	1.34	3.20	3.01*
	(1.62)	(1.65)	(1.84)	(1.59)
$FE^{S}_{it-3}D^{S}_{it-3}$			-2.34*	-2.25
			(1.15)	(1.23)
$FE^{OR}_{it-3}D^{OR}_{it-3}$			0.28	0.25
			(0.27)	(0.21)
$FE^{EQ}_{it-3}D^{EQ}_{it-3}$			-0.09	-0.11
			(0.87)	(0.82)
$FE^{CHST}_{it-3}D^{CHST}_{it-3}$			-1.44	-1.38
			(3.43)	(3.30)
Adj. R^2	0.38	0.37	0.41	0.41
F-Statistic	4.73	5.33	3.44	3.77

* and ** indicate statistical significance at the 10% and 5% level respectively
Robust standard errors in parenthesis.

Table B.4: Dependent Variable ΔEXP_{it}

	(1)	(2)	(3)	(4)
ΔGDP_{t-1}	0.05	0.06	0.04	0.06
	(0.07)	(0.07)	(0.07)	(0.07)
ΔUN_{t-1}	85.14	158.67**	80.18	144.56**
	(54.12)	(56.50)	(56.12)	(59.08)
$\Delta DEBT_{t-1}$	-0.07	-0.13**	-0.06	-0.13**
	(0.04)	(0.03)	(0.05)	(0.04)
$\Delta UNDER17_{t-1}$	-0.01	0.00	-0.01	0.00
	(0.01)	(0.01)	(0.02)	(0.01)
$\Delta OVER65_{t-1}$	0.00	0.03**	-0.01	0.03
	(0.01)	(0.01)	(0.03)	(0.02)
Trend	46.07**		46.77**	
	(13.47)		(15.45)	
FE^{S}_{it-3}	-0.29**	-0.21**	-0.30**	-0.21**
	(0.05)	(0.05)	(0.05)	(0.06)
FE^{OR}_{it-3}	0.20*	0.19*	0.22*	0.12
	(0.09)	(0.10)	(0.11)	(0.14)
FE^{EQ}_{it-3}	0.41	0.12	0.31	-0.11
	(0.27)	(0.18)	(0.50)	(0.37)
FE^{CHST}_{it-3}	0.10	0.87	0.33	1.63
	(0.39)	(0.57)	(1.17)	(1.29)
$FE^{S}_{it-3}D^{S}_{it-3}$			0.33	-0.36
			(0.47)	(0.50)
$FE^{OR}_{it-3}D^{OR}_{it-3}$			-0.08	0.10
			(0.13)	(0.12)
$FE^{EQ}_{it-3}D^{EQ}_{it-3}$			0.27	0.53
			(0.68)	(0.66)
$FE^{CHST}_{it-3}D^{CHST}_{it-3}$			-0.58	-0.94
			(1.59)	(1.82)
Adj. R^2	0.43	0.36	0.43	0.37
F-Statistic	4.16	3.89	2.79	2.54

* and ** indicate statistical significance at the 10% and 5% level respectively
Robust standard errors in parenthesis.

Table B.5: Dependent Variable ΔOR_{it}

	(1)	(2)	(3)	(4)
ΔGDP_{t-1}	0.25**	0.28**	0.23**	0.24**
	(0.03)	(0.03)	(0.03)	(0.03)
ΔUN_{t-1}	-35.81	32.56	-44.95	15.95
	(102.26)	(120.84)	(104.54)	(114.30)
$\Delta DEBT_{t-1}$	-0.04	-0.09	0.02	-0.03
	(0.09)	(0.08)	(0.01)	(0.02)
$\Delta UNDER17_{t-1}$	0.03*	0.04**	0.02	0.03*
	(0.01)	(0.01)	(0.01)	(0.02)
$\Delta OVER65_{t-1}$	-0.03**	-0.01	-0.04**	-0.03
	(0.01)	(0.01)	(0.01)	(0.02)
Trend	35.85		37.85	
	(24.48)		(22.09)	
FE^{S}_{it-3}	-0.39	-0.32	-0.39	-0.33
	(0.25)	(0.24)	(0.25)	(0.26)
FE^{OR}_{it-3}	-0.46	-0.44	-0.25	-0.23
	(0.28)	(0.28)	(0.37)	(0.36)
FE^{EQ}_{it-3}	0.20	0.07	0.49	0.14
	(0.23)	(0.16)	(0.37)	(0.24)
FE^{CHST}_{it-3}	0.93	1.17	3.48**	3.77**
	(0.89)	(1.08)	(1.10)	(1.02)
$FE^{S}_{it-3}D^{S}_{it-3}$			-0.18	-0.33
			(0.63)	(0.80)
$FE^{OR}_{it-3}D^{OR}_{it-3}$			-0.66	-0.65
			(0.41)	(0.39)
$FE^{EQ}_{it-3}D^{EQ}_{it-3}$			-0.17	0.32
			(0.55)	(0.48)
$FE^{CHST}_{it-3}D^{CHST}_{it-3}$			-3.70*	-3.67*
			(1.94)	(1.70)
Adj. R^2	0.53	0.51	0.57	0.54
F-Statistic	6.56	7.32	5.24	5.53

* and ** indicate statistical significance at the 10% and 5% level respectively
Robust standard errors in parenthesis.

Table B.6: Dependent Variable ΔEXP_{it}

	(1)	(2)	(3)	(4)
ΔGDP_{t-1}	-0.02	0.00	0.01	0.03
	(0.07)	(0.07)	(0.04)	(0.04)
ΔUN_{t-1}	69.28	131.56*	64.66	136.73
	(76.05)	(56.50)	(95.95)	(84.62)
$\Delta DEBT_{t-1}$	-0.04	-0.09	-0.05	-0.11*
	(0.06)	(0.05)	(0.06)	(0.05)
$\Delta UNDER17_{t-1}$	0.00	0.01	-0.02	0.00
	(0.01)	(0.01)	(0.01)	(0.01)
$\Delta OVER65_{t-1}$	0.02**	0.03**	0.01	0.03
	(0.01)	(0.01)	(0.01)	(0.02)
Trend	32.69**		44.90**	
	(6.91)		(7.91)	
FE^{S}_{it-1}	-0.20**	-0.14**	-0.19**	-0.12**
	(0.05)	(0.05)	(0.07)	(0.05)
FE^{OR}_{it-1}	0.15	0.16	0.05	0.08
	(0.11)	(0.10)	(0.12)	(0.11)
FE^{EQ}_{it-1}	0.10	-0.02	0.94**	0.53
	(0.23)	(0.27)	(0.31)	(0.55)
FE^{CHST}_{it-3}	1.21	1.42	2.04*	2.38*
	(0.71)	(0.81)	(0.89)	(1.16)
$FE^{S}_{it-1}D^{S}_{it-1}$			0.44	0.27
			(0.33)	(0.34)
$FE^{OR}_{it-1}D^{OR}_{it-1}$			0.29	0.30
			(0.18)	(0.21)
$FE^{EQ}_{it-1}D^{EQ}_{it-1}$			-1.91**	-1.33
			(0.67)	(1.01)
$FE^{CHST}_{it-3}D^{CHST}_{it-3}$			-2.21	-2.17
			(1.31)	(1.75)
Adj. R^2	0.39	0.35	0.47	0.40
F-Statistic	3.60	3.77	3.50	3.17

* and ** indicate statistical significance at the 10% and 5% level respectively
Robust standard errors in parenthesis.

Appendix C

Table C.1:

	(1) Own-Source Rev	(2) Own-Source Rev	(3) Expenditures	(4) Expenditures
Trend	-0.02		49.07**	
	(0.07)		(8.41)	
$FE^{S}_{it-1} > 0$	-0.47**	-0.47*	-0.16*	-0.15
	(0.20)	(0.23)	(0.07)	(0.10)
$FE^{S}_{it-1} < 0$	-9.63	-6.77	1.47	3.70
	(11.68)	(14.41)	(0.94)	(2.54)
$FE^{S}_{it-1} > 0$ Weak Rules	0.27	0.50*	-0.08	0.11
	(0.19)	(0.23)	(0.07)	(0.10)
$FE^{S}_{it-1} < 0$ Weak Rules	9.68	7.08	-1.17	-3.18
	(11.62)	(14.41)	(1.09)	(2.61)
$FE^{OR}_{it-1} > 0$	-0.23	-0.11	0.16	0.27**
	(0.15)	(0.15)	(0.10)	(0.10)
$FE^{OR}_{it-1} < 0$	-0.50*	-0.38*	0.09	0.19
	(0.22)	(0.18)	(0.16)	(0.15)
$FE^{OR}_{it-1} > 0$ Weak Rules	0.53	0.20	-0.07	-0.34**
	(0.84)	(0.61)	(0.20)	(0.10)
$FE^{OR}_{it-1} < 0$ Weak Rules	0.16	0.19	0.56**	0.59*
	(1.77)	(1.44)	(0.17)	(0.28)
$FE^{EQ}_{it-1} > 0$	0.61	-0.23	1.10**	0.41
	(0.48)	(0.43)	(0.20)	(0.46)
$FE^{EQ}_{it-1} < 0$	1.57**	1.84**	-0.73	-0.52
	(0.58)	(0.55)	(0.82)	(0.93)
$FE^{EQ}_{it-1} > 0$ Weak Rules	-0.13	-0.28	-0.04	-0.15
	(0.64)	(0.49)	(0.66)	(0.59)
$FE^{EQ}_{it-1} < 0$ Weak Rules	-2.93	-3.51	-1.02	-1.50
	(1.77)	(2.21)	(2.83)	(3.21)
$FE^{CHST}_{it-1} > 0$	0.26	1.11	-2.45	-1.74
	(2.01)	(0.81)	(1.44)	(2.13)
$FE^{CHST}_{it-1} < 0$	-5.05**	-4.59*	2.24	2.63
	(1.23)	(2.11)	(1.95)	(1.52)
$FE^{CHST}_{it-1} > 0$ Weak Rules	0.19	1.29	-2.23	-1.34
	(1.48)	(1.08)	(1.74)	(2.35)
$FE^{CHST}_{it-1} < 0$ Weak Rules	6.64**	5.11**	-1.90	-3.15*
	(1.20)	(2.12)	(1.88)	(1.51)
Adj. R^2	0.36	0.24	0.44	0.27
F-Statistic	1.62	1.07	2.90	1.74

* and ** indicate statistical significance at the 10% and 5% level respectively
Robust standard errors in parenthesis.

Table C.2:

	(1) Own-Source Rev	(2) Own-Source Rev	(3) Expenditures	(4) Expenditures
Trend	15.87 (23.46)		32.97* (14.86)	
$FE^{S}_{it-2} > 0$	0.25 (0.33)	0.26 (0.33)	-0.34* (0.17)	-0.32** (0.14)
$FE^{S}_{it-2} < 0$	-0.65 (13.67)	-0.20 (14.23)	2.64 (5.04)	3.49 (2.98)
$FE^{S}_{it-2} > 0$ Weak Rules	-0.64 (0.39)	-0.59 (0.33)	0.02 (0.14)	0.10 (0.14)
$FE^{S}_{it-2} < 0$ Weak Rules	1.13 (13.63)	0.75 (14.23)	-2.50 (5.02)	-3.21 (2.97)
$FE^{OR}_{it-2} > 0$	0.17* (0.07)	0.20* (0.10)	0.19 (0.16)	0.25 (0.17)
$FE^{OR}_{it-2} < 0$	0.04 (0.38)	0.06 (0.39)	0.09 (0.20)	0.13 (0.23)
$FE^{OR}_{it-2} > 0$ Weak Rules	-0.19 (0.19)	-0.26 (0.16)	-0.18 (0.21)	-0.33 (0.24)
$FE^{OR}_{it-2} < 0$ Weak Rules	0.76 (0.54)	0.84 (0.49)	-1.57** (0.53)	-1.41** (0.44)
$FE^{EQ}_{it-2} > 0$	-0.23 (1.37)	-0.44 (1.25)	-0.13 (0.23)	-0.59** (0.16)
$FE^{EQ}_{it-2} < 0$	0.50 (0.62)	0.57 (0.65)	1.41** (0.44)	1.55** (0.45)
$FE^{EQ}_{it-2} > 0$ Weak Rules	-3.54** (1.28)	-3.57** (1.27)	-5.31** (1.02)	-5.36** (0.88)
$FE^{EQ}_{it-2} < 0$ Weak Rules	-1.02 (0.84)	-1.17 (0.96)	1.04 (0.75)	0.73 (0.55)
$FE^{CHST}_{it-2} > 0$	0.65 (2.16)	1.06 (1.41)	-2.12 (1.32)	-1.27 (0.75)
$FE^{CHST}_{it-2} < 0$	-1.70 (8.33)	-1.78 (8.63)	-5.26** (2.04)	-5.42 (2.93)
$FE^{CHST}_{it-2} > 0$ Weak Rules	6.29** (1.45)	6.44** (1.44)	11.39** (1.73)	11.69** (1.62)
$FE^{CHST}_{it-2} < 0$ Weak Rules	3.85 (8.44)	3.65 (8.63)	7.95** (2.29)	7.54** (2.96)
Adj. R^2	0.14	0.14	0.55	0.49
F-Statistic	0.79	0.85	3.66	3.37

* and ** indicate statistical significance at the 10% and 5% level respectively
Robust standard errors in parenthesis.

Table C.3:

	(1) Own-Source Rev	(2) Own-Source Rev	(3) Expenditures	(4) Expenditures
Trend	10.33 (35.44)		55.87** (13.07)	
$FE^{S}_{it-3} > 0$	0.30 (0.20)	0.30 (0.19)	-0.16** (0.03)	-0.14 (0.09)
$FE^{S}_{it-3} < 0$	-4.62 (9.86)	-4.43 (9.53)	-5.01 (3.48)	-4.14 (6.97)
$FE^{S}_{it-3} > 0$ Weak Rules	-0.61* (0.28)	-0.58** (0.20)	-0.24** (0.09)	-0.09 (0.10)
$FE^{S}_{it-3} < 0$ Weak Rules	3.64 (9.94)	3.48 (9.53)	4.99 (3.46)	4.33 (6.94)
$FE^{OR}_{it-3} > 0$	-0.21 (0.28)	-0.20 (0.31)	0.31** (0.08)	0.35* (0.18)
$FE^{OR}_{it-3} < 0$	-0.11 (0.38)	-0.10 (0.12)	-0.02 (0.16)	0.04 (0.10)
$FE^{OR}_{it-3} > 0$ Weak Rules	0.45 (0.26)	0.41 (0.33)	-0.35 (0.23)	-0.56** (0.20)
$FE^{OR}_{it-3} < 0$ Weak Rules	-1.34** (0.30)	-1.26** (0.49)	1.63** (0.39)	2.08** (0.33)
$FE^{EQ}_{it-3} > 0$	-0.17 (0.79)	-0.44 (1.25)	0.33 (0.58)	-0.35 (0.49)
$FE^{EQ}_{it-3} < 0$	-0.97** (0.32)	0.57 (0.65)	0.60 (0.43)	0.49 (0.56)
$FE^{EQ}_{it-3} > 0$ Weak Rules	-1.56 (1.12)	-3.57** (1.27)	0.55 (0.53)	0.32 (0.53)
$FE^{EQ}_{it-3} < 0$ Weak Rules	1.74** (0.43)	-1.17 (0.96)	0.30 (0.97)	0.13 (0.73)
$FE^{CHST}_{it-3} > 0$	4.62 (4.06)	1.06 (1.41)	-0.42 (1.22)	1.89 (1.78)
$FE^{CHST}_{it-3} < 0$	7.20* (3.19)	-1.78 (8.63)	0.01 (1.41)	0.90 (1.91)
$FE^{CHST}_{it-3} > 0$ Weak Rules	3.71 (3.80)	6.44** (1.44)	4.58** (0.78)	4.58** (1.77)
$FE^{CHST}_{it-3} < 0$ Weak Rules	-6.45* (2.76)	3.65 (8.63)	0.61 (1.56)	-1.08 (1.91)
Adj. R^2	0.18	0.18	0.47	0.33
F-Statistic	1.11	0.85	2.77	1.73

* and ** indicate statistical significance at the 10% and 5% level respectively
Robust standard errors in parenthesis.

Appendix D

Table D.1:

	(1) Own-Source Rev	(2) Own-Source Rev	(3) Expenditures	(4) Expenditures
Trend	43.23 (28.94)		51.29** (12.42)	
$FE^{S}_{it-1} > 0$	-0.03 (0.15)	0.16** (0.06)	-0.25** (0.10)	-0.03 (0.04)
$FE^{S}_{it-1} < 0$	0.00 (0.21)	0.19 (0.11)	-0.14 (0.20)	(0.08) (0.27)
$FE^{S}_{it-1} > 0$ No Rules	0.15 (0.14)	0.08 (0.13)	0.01 (0.15)	-0.07 (0.11)
$FE^{S}_{it-1} < 0$ No Rules	-38.97** (4.80)	-42.76** (6.71)	3.51 (2.58)	-0.85 (0.60)
$FE^{OR}_{it-1} > 0$	-0.44 (0.37)	-0.57 (0.35)	0.24 (0.19)	0.09 (0.24)
$FE^{OR}_{it-1} < 0$	-0.19 (0.51)	-0.03 (0.17)	0.08 (0.10)	0.27 (0.16)
$FE^{OR}_{it-1} > 0$ No Rules	0.67 (0.36)	0.94* (0.42)	-0.20 (0.23)	0.12 (0.24)
$FE^{OR}_{it-1} < 0$ No Rules	0.11 (0.77)	-0.46 (1.53)	0.71 (0.74)	0.05 (1.90)
$FE^{EQ}_{it-1} > 0$	1.30** (0.51)	0.89 (0.58)	1.24** (0.33)	0.75 (0.51)
$FE^{EQ}_{it-1} < 0$	-0.37 (0.78)	-0.52 (0.59)	0.01 (0.88)	-0.16 (0.84)
$FE^{EQ}_{it-1} > 0$ No Rules	-0.15 (0.62)	-0.43 (1.33)	-0.23 (0.54)	-0.56 (1.13)
$FE^{EQ}_{it-1} < 0$ No Rules	0.72 (1.36)	1.05 (1.59)	-1.22 (0.93)	-0.83 (1.25)
$FE^{CHST}_{it-1} > 0$	1.02 (1.58)	2.22** (0.82)	-3.84** (0.79)	-2.41** (0.88)
$FE^{CHST}_{it-1} < 0$	1.17* (0.57)	0.33 (0.19)	0.62 (0.47)	-0.37 (0.26)
$FE^{CHST}_{it-1} > 0$ No Rules	-18.32 (16.96)	-15.43 (20.68)	6.83** (1.86)	10.12* (4.26)
$FE^{CHST}_{it-1} < 0$ No Rules	-3.95** (1.47)	-2.34** (0.77)	0.35 (2.50)	2.26 (3.25)
Adj. R^2	0.45	0.39	0.46	0.29
F-Statistic	3.43	3.03	2.94	1.93

* and ** indicate statistical significance at the 10% and 5% level respectively
Robust standard errors in parenthesis.

Table D.2:

	(1) Own-Source Rev	(2) Own-Source Rev	(3) Expenditures	(4) Expenditures
Trend	0.13 (25.16)		29.71** (11.88)	
$FE^{S}_{it-2} > 0$	-0.10 (0.17)	-0.10 (0.16)	-0.22** (0.06)	-0.09 (0.07)
$FE^{S}_{it-2} < 0$	0.20 (0.32)	0.20 (0.24)	0.16 (0.10)	0.31** (0.09)
$FE^{S}_{it-2} > 0$ No Rules	1.24** (0.18)	1.24** (0.18)	-0.10 (0.16)	-0.14 (0.17)
$FE^{S}_{it-2} < 0$ No Rules	-37.13** (2.90)	-37.15** (1.09)	10.39** (3.97)	7.31 (4.55)
$FE^{OR}_{it-2} > 0$	0.06 (0.16)	0.06 (0.10)	-0.11 (0.20)	-0.23 (0.24)
$FE^{OR}_{it-2} < 0$	0.38 (0.27)	0.38 (0.30)	0.13 (0.17)	0.24 (0.17)
$FE^{OR}_{it-2} > 0$ No Rules	0.21 (0.27)	0.21 (0.18)	0.28 (0.21)	0.50 (0.29)
$FE^{OR}_{it-2} < 0$ No Rules	-7.99** (3.14)	-7.99** (3.07)	-2.38** (0.35)	-2.78** (0.86)
$FE^{EQ}_{it-2} > 0$	0.45 (0.79)	0.47 (0.71)	-0.73 (0.70)	-1.10 (0.71)
$FE^{EQ}_{it-2} < 0$	-0.37 (0.98)	-0.37 (0.81)	0.87** (0.23)	0.62* (0.32)
$FE^{EQ}_{it-2} > 0$ No Rules	-3.48* (1.55)	-3.48* (1.53)	-0.35 (0.75)	-0.37 (1.05)
$FE^{EQ}_{it-2} < 0$ No Rules	3.72 (3.65)	3.72 (3.49)	2.54** (0.26)	3.00** (0.65)
$FE^{CHST}_{it-2} > 0$	0.62 (1.72)	0.63 (0.78)	0.02 (2.42)	1.35 (1.94)
$FE^{CHST}_{it-2} < 0$	0.05 (0.66)	0.05 (0.82)	0.56 (0.46)	0.04 (0.57)
$FE^{CHST}_{it-2} > 0$ No Rules	1.09 (11.59)	1.08 (10.91)	-5.12 (4.57)	-7.92 (6.52)
$FE^{CHST}_{it-2} < 0$ No Rules	11.25** (3.82)	11.26** (3.74)	-3.57** (1.43)	-2.74 (1.52)
Adj. R^2	0.31	0.31	0.46	0.42
F-Statistic	1.88	2.03	3.07	2.98

* and ** indicate statistical significance at the 10% and 5% level respectively
Robust standard errors in parenthesis.

Table D.3:

	(1) Own-Source Rev	(2) Own-Source Rev	(3) Expenditures	(4) Expenditures
Trend	20.36 (50.16)		40.42** (14.30)	
$FE^{S}_{it-3} > 0$	-0.31 (0.23)	-0.24* (0.10)	-0.23* (0.11)	-0.08 (0.11)
$FE^{S}_{it-3} < 0$	-0.93** (0.28)	-0.82** (0.18)	0.10 (0.12)	0.31** (0.07)
$FE^{S}_{it-3} > 0$ No Rules	0.31* (0.14)	0.31* (0.13)	0.29 (0.17)	0.29 (0.18)
$FE^{S}_{it-3} < 0$ No Rules	30.67** (6.24)	27.55** (2.81)	-16.34** (5.53)	-22.24** (4.31)
$FE^{OR}_{it-3} > 0$	-0.12 (0.23)	-0.20 (0.11)	0.15 (0.09)	-0.01 (0.08)
$FE^{OR}_{it-3} < 0$	-0.18 (0.24)	-0.11 (0.16)	0.13 (0.19)	0.26 (0.15)
$FE^{OR}_{it-3} > 0$ No Rules	0.99** (0.28)	1.11** (0.26)	0.18 (0.48)	0.43 (0.54)
$FE^{OR}_{it-3} < 0$ No Rules	-3.23 (2.22)	2.02 (1.68)	-0.03 (1.88)	-0.53 (2.54)
$FE^{EQ}_{it-3} > 0$	-0.71 (1.18)	-0.92 (1.11)	-0.15 (0.85)	-0.57 (0.58)
$FE^{EQ}_{it-3} < 0$	0.05 (0.75)	-0.18 (0.34)	0.17 (0.21)	-0.30 (0.24)
$FE^{EQ}_{it-3} > 0$ No Rules	2.21 (1.50)	2.19 (1.54)	0.77 (1.88)	0.74 (1.98)
$FE^{EQ}_{it-3} < 0$ No Rules	-3.23 (2.22)	-2.91 (1.86)	1.09 (2.24)	1.70 (2.78)
$FE^{CHST}_{it-3} > 0$	5.24 (3.58)	6.32* (3.31)	1.94 (1.70)	4.09** (1.40)
$FE^{CHST}_{it-3} < 0$	0.60 (0.97)	0.28 (0.38)	0.56* (0.29)	-0.06 (0.23)
$FE^{CHST}_{it-3} > 0$ No Rules	-11.61* (5.63)	-12.91** (3.45)	-11.21 (8.49)	-13.94 (11.01)
$FE^{CHST}_{it-3} < 0$ No Rules	3.29 (2.77)	3.90** (1.58)	-1.25** (0.44)	-0.04 (0.24)
Adj. R^2	0.29	0.28	0.46	0.40
F-Statistic	1.77	1.88	3.00	2.53

* and ** indicate statistical significance at the 10% and 5% level respectively
Robust standard errors in parenthesis.

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Data References

Variable	Source
Actual Provincial Own-Source Revenue and Expenditures	Data on provincial spending and own-source revenues from 1996/1997 to 2009/2010 are taken from *Fiscal Reference Tables 2011*, obtained from the Department of Finance
Expected Provincial Own-Source Revenue and Expenditures	Various provincial budget documents are used to obtain data on expected revenues and expenditures.
Provincial GDP	Statistics Canada Cansim Table 384-0002
Provincial Unemployment Rate	Statistics Canada Cansim Table 282-0086
Provincial Population	Statistics Canada Cansim Table 051-0001
Equalization	Forecasts are obtained from various provincial budget documents. Data for the revised forecast are taken from the federal government's interim estimate of Equalization closet to the end of the fiscal year in question.
Canada Health and Social Transfer	Forecasts and actual entitlements are obtained from the Department of Finance
Provincial CPI Index	Statistics Canada Cansim Table 326-0021
Provincial Debt	Data on provincial debt from 1996/1997 to 2009/2010 are taken from *Fiscal Reference Tables 2011*, obtained from the Department of Finance