Macroeconomic Effects of Discretionary Tax Changes in Canada: Evidence from a new narrative measure of tax shocks

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Abstract

In this paper we study the macroeconomic effects of changes in federal taxes for the Canadian economy for the time period 1961:1 - 2014:4. We employ the narrative methodology of Romer and Romer (2010) and Cloyne (2013) to identify exogenous changes in federal taxes. In particular, we study, in detail, all the budget documents for the Canadian economy and document all legislated tax changes and the motivations behind them. We then isolate those tax changes that were not motivated by contemporaneous movements in the economy and classify them as exogenous tax changes. Our main empirical result shows that an exogenous tax cut of 1 percent of GDP leads to a significant but short-run increase in output. Our analysis of disaggregated measures exogenous tax changes shows that 1) tax hikes associated with deficit consolidation have the biggest (contractionary) effects on output, 2) changes in personal income taxes have larger effects than changes in other types of taxes, 3) anticipated tax changes have strong expansionary announcement effects, 4) tax increases tend to have bigger (contractionary) effects on output than the (expansionary) effects of tax decreases, and 5) the effectiveness of tax policy has drastically decreased over time.

JEL Classification: E32, E62, H20, H3, H61.
Key Words: Tax Shocks, Narrative Accounts, Canada.

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1 Introduction

The financial crisis of 2008-09 and its aftermath has renewed academic and policy makers' interest in the macroeconomic effects of fiscal policy changes. However, despite its importance for policy making, there it a surprising lack of consensus over the macroeconomic effects of tax changes. This lack of consensus is in part due to the difficulty that arises identifying exogenous tax changes - changes that are uncorrelated to contemporaneous movements in the economy. The problem that arises in study of effects of tax changes is that of simultaneity - while there is no doubt that tax changes affect GDP, but at the same time GDP affects variables that are used to measure tax revenues.

This identification problem has been tackled by two different ways in literature. The first of these approaches uses structural vector autoregression techniques to identify those tax policy shocks that are uncorrelated with other economic shocks hitting the economy. The seminal work in literature using this technique was that of Blanchard and Perotti (2002) who identify exogenous shocks to tax revenues by restricting the response of spending to contemporaneous movements in output and tax and other shocks. They find that for US, a tax cut of 1 percent of GDP leads to a peak increase in output of around 1.4 percent after eight quarters of the initial shock. Perotti (2005) used the same identification scheme to study the effects of fiscal policy shocks for all OECD countries. Mountford and Uhlig (2009) used sign-based restrictions to identify tax revenue and government spending shocks. They find that the tax multiplier can be as high as 5 if the tax cuts are deficit financed.

The other approach to solve the identification problem is the narrative approach. The narrative approach uses policy documents to identify those movement in policy variables that are contemporaneously uncorrelated with other shocks in the economy. Romer and Romer (1989) and Romer and Romer (2004) used this approach to identify monetary policy shocks. Ramey and Shapiro (1998), Ramey (2011), Owyang et al. (2013), and Hussain and Liu (2018) use this approach to identify government spending shocks. Finally, a number of papers have used this approach to identify tax policy shocks starting with the work of Romer and Romer (2010) who constructed a narrative measure of tax policy shocks for the US. Mertens and Ravn (2012) and Mertens and Ravn (2013) used the Romer and Romer (2010) data set to study the disaggregated effects of changes in corporate and labor income tax changes and also the effects of anticipated and unanticipated tax changes. Hussain and Malik (2016) used the same data set to study asymmetric effects of tax increases and tax decreases.

The narrative approach was extended to other countries including UK (Cloyne, 2013; Hussain and Liu, 2017), Germany (Hayo and Uhl, 2013), Spain (Gil et al., 2018), and Portugal (Pereira and Wemans, 2015). In this paper, we add to this literature by constructing a novel

data set of all federal tax changes enacted in Canada for the 1961:1-2014:4 period.[1] Canada is an interesting case study to extend this literature for various reasons. First, Canada, like the UK, has a centralized budget process where most of the fiscal policy changes are saved for the budget speech. This makes it easier to find the dates when tax changes are announced.

Second, budget secrecy has traditionally been an important tradition of the Canadian Budget process which ensured that no important information about upcoming policy changes was leaked to the outside. This makes it easier for us to document the *announcement* dates of tax changes as it can reasonably be argued that these announcements represented the first credible news about upcoming policy changes. Finally, Canada went through a major monetary policy shift in 1991 where to moved to the inflation targeting policy.

The main result of this paper is that a tax cut of 1 percent of GDP results in a increase in GDP of 0.54 on impact which rises to 2.5 percent after 5 quarters of the initial shock. However, the expansionary effect of the tax cut disappears at longer horizons. These results are different from those obtained for the US, UK, and Germany by Romer and Romer (2010), Cloyne (2013), and Hayo and Uhl (2013).

To conduct our analysis, we first collect all legislated tax changes from various budget documents. We then use the Romer and Romer (2010) and Cloyne (2013) methodology to classify tax changes as exogenous or endogenous. Exogenous tax changes are those that are not taken in response to contemporary fluctuations in the economy. Endogenous tax changes are the ones taken in response to other shocks hitting the economy or in response to concerns about contemporaneous performance of other variables. Exogenous tax changes are further classified into three categories. These include tax changes made in response to concerns about long-run debt of the economy (deficit consolidation), changes made due to ideological or philosophical reasons (ideological), and those made to boost long-run growth of the economy (long-run). Similarly, endogenous tax changes are further classified as demand management (those designed to affect aggregate demand), supply stimulus (changes that are designed to aid the supply side), spending driven (changes made to finance a spending increase), and deficit reduction (changes made in response to concerns about current deficit).

We also document some interesting results by analyzing the effects of disaggregated measures of exogenous tax changes. First, we find that tax hikes associated with deficit consolidation have the biggest (contractionary) effects on output. Second, we find that changes in per-

[1]We began work on this paper in 2015. In 2016, we became aware of similar work by Lopes (2016) who constructs a narrative data set of discretionary tax changes for Canada. We informed the author of our work and decided to continue on our projects separately. Compared to his study, our paper utilizes a much longer data series. Furthermore, we document important differences in results compared to his analysis. Wherever relevant, we compare our work to his in this paper.

sonal income taxes have larger effects than changes in corporate income taxes or changes in other types of taxes. Third, we find that anticipated tax changes have strong expansionary announcement effects. Fourth, we document that tax increases tend to have bigger (contractionary) effects on output than the (expansionary) effects of tax decreases. Finally, we also find that the effectiveness of tax policy has drastically decreased over time.

The remainder of the paper is organized as follows: section 2 describes the construction of the exogenous tax series. Section 3 discusses the empirical methodology and the baseline results. Section 4 discusses some extensions of the baselines results and section 5 concludes the paper.

2 Data

Data for all macroeconomics variables, except the exogenous tax series, is easily available from various sources like Statistics Canada.Table 2 provides a details of the variables used in this paper along with their sources. In this section, we focus our discussion on the construction of the exogenous tax series.

2.1 Overview of the Federal Budget Process

We begin by describing the procedure we followed to construct the series of exogenous tax changes. Our source of information used to construct this series is the budget speech and other budget documents that accompany the budget speech. Every year, the government of Canada presents the federal budget to the house of commons through the finance minister of Canada. The government uses the budget to analyze the implications of its current and proposed programs.

The budget itself can be thought of divided into two parts. The first part, the revenue budget, is prepared by the ministry. This process culminates with the budget speech of the finance minister in front of the house of commons. The finance minister, in the speech to the house of commons, reviews the current and projected state of the economy, presents the financial health of the government at the end of the previous fiscal year, and announces any planned changes in taxation or fiscal policy. Typically, the preparation of the revenue budget is done in secrecy by the finance ministry without letting out a lot of information even to the cabinet members. Budget secrecy is a long-standing tradition of keeping the contents of the budget hidden till the finance minister presents in the house. The logic behind this secrecy is that some individuals might unfairly benefit from prior news about announcements to be made in the budget speech. The second part, the expenditure budget (official called the

"Estimates" and unofficially called the "blue book") contains detailed information regarding the financial requirements of individual departments for the upcoming year in order to carry the tasks that they are responsible for.

The house of commons then votes on the budget. The vote is a matter of confidence for the government and if the house of commons rejects the proposed budget then the government may fall as happened to the government of Prime Minister Joe Clark in 1979 when his minority government of the Progressive Conservative party failed to have to its budget passed by the house of commons. In most years, the federal budget is presented in February or March.

In addition to the annual budget, government of Canada has also announced changes to its fiscal policy at other times. While typically the most important policy changes are reserved for the budget, at certain times the prevailing economic and political conditions necessitate the announcement of new measures outside the annual budget. Over the years, these statements have been called different names including Financial Statement, Mini-Budget, Supplementary Budget, and Economic and Fiscal Update. These statements are put forward typically in the middle of the fiscal year.

2.2 Construction of Tax Series

To construct the exogenous tax series, we begin by documenting all discretionary tax changes at the federal level. For each tax change, we document a number of different characteristics.[2] First, we document the tax change itself. This consists of a brief description of the tax changes. For the year prior to 1975, we had to rely upon the budget speeches alone to find these tax changes. For the years after 1975, we relied upon both the budget speeches and budget documents to document all tax changes. Second, we document the size of the tax change which is simply the forecasted revenue effect of the tax change. For the years prior to 1975, we included only those tax changes that were announced in the budget speech and had their estimated revenue effects mentioned in the speech too. For the years after 1975, we used either the budget papers or the budget report to document the size of a tax change. For the later years of our sample, we also documented the tax changes and their sizes announced in the *Economic and Fiscal Updates* and *Economic Statement and Budget Updates*. Thus, wherever available, we used different types of budget papers to document the size of the tax changes.

[2]The online appendix contains the details of all documented tax changes

Third, we documented the motivation for each tax change. For the tax measures announced in the budget speech, we used the language used by the Finance minister to identify the motivation of each tax change. For others, we relied upon the budget papers to document the motivation. For most tax changes, the motivation was explicitly given either in the speech or the budget papers. Fourth, we document the announcement and implementation dates for the tax changes. We take the budget speech date to be the announcement date and document the implementation date from the budget speeches and budget papers. For a few temporary tax changes, instead of stating a particular date of implementation, the Finance minister would use terms like "...for two years". In such case we take the implementation date to be the same as announcement date.

Fifth, we document the nature of a tax change i.e. whether a tax change was intended to be permanent or temporary. Information in the budget speeches and budget papers was adequate to collect this information. For permanent tax changes, following Romer and Romer (2010) and Cloyne (2013), we use the full year revenue effect mentioned in the budget documents as the size of the measure. For the temporary changes, we use the full year revenue effect if the change was implemented for a year or we adjust the size accordingly if the change was implemented for less than a year. At the expiration of a temporary tax changes, we enter the negative of the temporary tax change in the data set. Finally, we document the type of a tax measure i.e. whether it was a change in personal income taxes, corporate income taxes, or other types of taxes. Changes in personal income and corporate income taxes were spread throughout the sample period that we study. Examples of changes in personal income taxes include changes in income tax rates as well as other changes, like changes in deductibles or changes in tax credits, that affected individual incomes. Example of changes in corporate income taxes include changes in corporate income tax rates and other changes, like changes in depreciation write-off rates and tax incentives for research and development, that affected corporate incomes. Other taxes include different types of changes in sales taxes and excise taxes.

A few specific issues regarding the data set deserve a brief discussion. First, we drop those tax changes for which we could not find any size from either the budget speeches or budget reports. Second, for tax measures with retroactive components, we assign the full year effect of the tax change to the date of announcement. Third, some tax changes were to be implemented in steps. For such tax measures, we assign to the relevant size to the date of implementation of each step.

2.2.1 Classification of Motivation

We now briefly describe the most important part of the construction of the exogenous tax series. Having collected all the relevant information about tax measures, we classify them

as exogenous or endogenous by looking at the motivation put forward for each one of them. Exogenous tax changes are those are not taken in response to contemporary happenings in the economy. Endogenous tax changes are those that are taken to offset other macroeconomic shocks. We follow the methodology of Cloyne (2013) as our classification scheme to categorize various tax changes.

Endogenous tax measures are divided into four categories. The first type of endogenous tax changes that we consider are the *demand management* changes. A tax measure is classified as demand management if it was taken with a view to affect aggregate demand or inflation. Demand management tax changes include all those measures that were taken to offset a downturn in the economy. Examples include changes in personal income tax rates in the aftermath of the 1973 recession and the reduction in goods and services tax rate in 2008. The second type of endogenous tax measures are the *supply stimulus* changes that were taken with a view to help the production side of the economy in the aftermath of a negative shock to the economy. Examples of supply stimulus measures would include the reduction in sales tax on construction materials in 1974 and reduction in corporate income tax rates between 2008 and 2012. Collectively, these two types of endogenous tax changes correspond to the *counter-cyclical* tax measures recorded by Romer and Romer (2010).

The third category of endogenous tax changes include the measures taken in response to reduce current deficit in the economy. Tax measures in this category are thus called *deficit reduction* measures. Examples of such changes would include the temporary 5 percent surtax on corporations in 1979 and the increase in federal sales tax on some good in 1989. In classifying tax changes in this category, we carefully read the motivation of each tax change to ensure that only those measures that were designed to offset current deficit are included in this category. The final category of endogenous tax measures include the *spending driven* changes that were motivated by an increase in current spending of the government. For example, the government imposed a new tax of 8 percent on revenue from oil and gas production in 1981 to raise revenue to fund federal spending in the field of energy.

We divide exogenous tax measures into three categories. First, *deficit consolidation* tax measures were the ones taken in response to concerns about fiscal health of the economy and long run debt. For example, in 1989, the government made it clear that it was concerned about the long-run debt which stood at $320 billion at the time. Hence it enacted a number of measures to raise revenue to reduce this debt. The second category includes *ideological* tax measures that were taken for political or philosophical reasons. Examples of ideological changes would include the introduction of a new system for child tax benefit to improve the efficiency and fairness of the tax system and the changes in the tax code resulting in common-law couples being treated the same way as married couples. Both of these changes are from the 1992 budget.

2.2.2 A Quarterly Data Set of Tax Changes

To convert our data set on tax measures into a quarterly time series, we assign each tax change to the quarter in which it was implemented. Here, we use the methodology followed by Romer and Romer (2010) and Cloyne (2013). In particular, if a tax change was to be implemented in the second half a quarter, we assign it to the following quarter. We then normalize the series by nominal GDP of that quarter.

The first panel of figure 1 shows the quarterly data set on exogenous tax changes that we have constructed. The mean of the exogenous series is 0.003 percent of GDP with considerable variation as can been seen by looking at the standard deviation which is 0.18 percent of GDP. There were 47 quarters with exogenous tax increases and 67 quarters with exogenous tax decreases. The single largest exogenous tax change took place in 1991 when the introduction of the new Goods and Services tax resulted in a revenue increase of over 2 billion dollars. However, this change was largely offset by the simultaneous elimination of the manufacturer's sales tax. The second panel shows the endogenous tax series which has a mean of -0.007 percent of GDP with a standard deviation of 0.16 percent of GDP.

Figure 2 shows the different categories of exogenous tax changes. The first panel shows the deficit consolidation tax measures. Most of these measures were tax increases. The only decreases that can be seen in the plot correspond to the reversal of temporary tax increases. Most of the deficit consolidation tax measures took place in the 1980's when the government was concerned about the debt situation of the country. The second panel shows the ideological tax measures. These measures were spread through out the sample period with the largest change taking place in 1991 in the form of increased tax on cigarettes. The final panel shows the long run tax measures. The long-run measures were also spread out with some significant reduction in corporate and personal income tax rates taking place in the late 1990's.

Figure 3 show the categories of endogenous tax changes. The first panel shows that the demand management tax measures are normally clustered around times of recession. Most of these tax changes were taken in the 1970s and 1980s in the aftermath of the 1973 and 1979 oil price increases. Some major tax cuts were also enacted after the financial crisis of 2008. The second panel shows the supply stimulus tax measures. The graph shows that like the demand management measures, supply stimulus changes were also mostly made in the aftermaths of recessions. The third panel shows the deficit reduction tax measures were mostly taken in the 1980s. The final panel shows that most of the spending driven tax changes were also taken in the 1980s with some of the largest of these being taken in the early 1980s. These measures were designed to collect more revenue to finance government spending on new energy related projects.

3 Effects of Exogenous Tax Changes

3.1 Tests of Predictability

We begin our empirical analysis by testing the predictability of our exogenous series. Following Mertens and Ravn (2012) and Cloyne (2013), we test the predictability of our exogenous series through two tests. First, we perform the granger causality test. We estimate a VAR which includes 4 lags of output, government spending, interest rate, inflation, and unemployment together with the exogenous tax series.[3] The results of this test are given in table 1. The p-value of 0.756 shows that we cannot reject the null hypothesis that all coefficients in the tax equation are jointly zero. When we conduct the same test for the counter-cyclical series, which is the sum of demand management and supply stimulus tax series, we get a p-value of 0.084 which allows us to reject the null-hypothesis.

The second test that we conduct checks whether the timing of announcement of the exogenous tax changes can be predicted on the basis of past information. For this, we construct the exogenous tax series according to the dates when each of these tax changes were announced.[4] We then define a dummy variable ω_t such that

$$\omega_t = \begin{cases} 1 & \text{if } \tau_t > 0 \\ 0 & \text{if } \tau_t = 0 \\ -1 & \text{if } \tau_t < 0 \end{cases}$$

where τ_t is the exogenous tax series according to announcement date. We then conduct an ordered probit regression using the same variables as the ones used in the first test as the regressors. The results from this test show that we cannot reject the null-hypothesis that the announcement of exogenous tax series cannot be predicted on the basis of past information. The p-value for the same test for the counter-cyclical series comes out to be 0.056 which allows us to reject the null hypothesis of no predictability. The results of these tests provide credibility to the classification methodology that we have used.

3.2 Empirical Methodology

Our baselines methodology involves estimating the following vector autoregression model (VAR) model

[3] We use the HP-filtered versions of all of these variable. The qualitative results do not change with other methods of detrending these variables.

[4] For this series, we drop the cancellation measures corresponding to the temporary tax changes.

$$X_t = A_0 + A_1 t + A_2 t^2 + B(L)X_{t-1} + C(L)d_t + \epsilon_t, \tag{1}$$

where X_t is a vector of endogenous variables and d_t is a the exogenous shock - the exogenous tax series in our case. $B(L)$ and $C(L)$ are lag polynomials with P and $Q+1$ lags respectively. Following Cloyne (2013) and other papers in literature, we choose $P = 4$ and $Q = 12$.

We include 5 variables in our baseline VAR. These variables include log of real GDP, log of real government spending, log of real federal revenues, short-term interest rates, and inflation. We choose these variables based on Favero and Giavazzi (2012) who recommend using these variables in order to fully recover the debt-deficit dynamics. This specification is similar to the ones used by Hayo and Uhl (2013) and Lopes (2016). Leigh et al. (2011) discuss the important of including monetary policy variables in the VAR as the monetary authorities may react to the tax shocks thereby affecting the magnitude of elasticity of output. Our sample period is 1961:1 - 2014:4 since data for most variables is not available before 1961.

3.3 Baseline Results

Figure 4 shows the results for our baseline case. Since most tax changes in our data set are tax decreases, we show the responses of variable to a 1 percent cut in taxes as percent of GDP. The first panel shows that output shows an immediate positive response to a cut in taxes of 1 percent of GDP. Output increases by 0.54 percent on impact although the effect is insignificant at conventional significance levels. Output continues to rise for the next several quarters. The impact on GDP is 1.43 percent one quarter after the initial tax cut and the effect is significant. The peak response of output takes place 5 quarters after the initial shock and is equal to 2.5 percent. The response of output then starts to taper off although the significant positive response persists for around 10 quarters.[5]

Figure 4 also shows the response of other variables in the VAR to a tax cut of 1 percent of GDP. The figure shows that government spending tends to rise after a tax cut but only after 4 quarters. This increase in government spending may represent government's intention to reinforce the expansionary effects of tax cuts. Inflation shows an erratic response to a tax cut although it does show some significant increase in the long run. Unsurprisingly, interest rate also does not show any short run response to a tax cut and only increases significant in the long run which may be in response to rising inflation.

[5]It is standard in literature to use one standard error bands. Using one standard error bands, it can be claimed that the effect on output persists for much longer (around 15 quarters).

Figures 5 - 7 show the response of the same variables to tax cuts made for different motivations. Figure 5 shows that a tax change motivated by concerns about deficit consolidation has large and significant effects on output. Since all tax changes in this category are tax increases (except for the cancellation measures associated with temporary increases), we show the effect of an *increase* in taxes motivated by deficit consolidation concerns. The figure shows that a one percent increase in tax as a percentage of GDP results in a decrease of output by up to 4.8 percent after 5 quarters of the initial shock. Even though the estimates become insignificant at longer horizon, they are numerically big enough for us to conclude that deficit consolidation tax hikes result in significant and long last contractionary effects on output.

Leigh et al. (2011) document that interest rates tend to decrease when taxes motivated by deficit consolidation are increased. Their explanation for this result is that tax hikes motivated by deficit consolidation can often be in the form of increases in indirect taxes which can result in an increase in inflation. In the case of Canada, however, the vast majority of tax hikes in this category were direct taxes on individuals or corporations. We find that these tax hikes result in a decrease in inflation that lasts for up to 12 quarters after the initial shock. Hence, it is not surprising that we find the interest rates also decreasing by up to 2.1 percentage points.

Firgure 6 shows the effects of a tax cut motivated by ideological reasons. The maximum increase in output takes place 3 quarters after the initial shock and is equal to 2.5 percent. The point estimates in the impulse response beyond the first few quarters are large enough to help us infer that tax reductions made for ideological reasons do not have any long-run effect on the economy. Figure 7 shows the effect of tax cut motivated by concerns about long run performance of the economy. Output starts to increase 3 quarters after the initial tax cut and the increase persists for another 6 quarters after the which output returns to its pre-shock levels. Interestingly, we find that interest rates decrease after a long run tax cut. Earlier we found that interest rates move in the same direction of the tax change when taxes are changed because of concerns about deficit consolidation.[6] These results suggest that the central bank may be more accommodating when taxes are changes for long run reasons than when they are changed for deficit consolidation reasons.

Thus, our baseline results show that an exogenous tax cut results in significant expansionary effects on output but that effects only lasts in the short-run. This result is consistent with the results of Lopes (2016) but is in contrast to what Romer and Romer (2010), Cloyne (2013), and Hayo and Uhl (2013) find for the US, UK, and Germany respectively. These studies all find the peak response of output taking place 8-12 quarters after the initial shock.

[6]Recall that for deficit consolidation category, we report the results a tax hike.

Another interesting result is the difference in response of output and interest rates to different categories of tax changes. Lopes (2016) and Hayo and Uhl (2013) find similar responses to shocks in various categories whereas we find that the deficit consolidation tax changes have the biggest effect on output followed by the effects of long-run and ideological tax changes.

3.4 Different Model Variations

We motivated our choice of the baseline model by appealing to the concerns and recommendations made in various studies. In this section, we use some of the other model specifications that have been used in literature. First, we estimate a single equation similar to the one estimated by Romer and Romer (2010) and Leigh et al. (2011). In particular we estimate

$$\Delta y_t = a_0 + a_1 t + a_2 t + \sum_{t=1}^{P} \Delta y_t + \sum_{t=0}^{Q} \tau_t + \epsilon_t, \tag{2}$$

where Δy_t is the growth rate of real GDP and τ_t is the exogenous tax series. We include 4 lags of growth rate of GDP ($P = 4$) and 12 lags (plus the contemporaneous value) of the tax variable ($Q = 12$).

The second variation of the baseline model considers different number of lags of the shock variable in equation 1. Hayo and Uhl (2013) uses 8 lags of the tax shock whereas all other studies 12. Here, we experiment with 8, 10, and 12 lags of the shock variable. The final variation that we consider involves changing the variable in the baseline VAR. In particular, we estimate equation 1 by including real GDP, real consumption expenditure, and real investment expenditure in the vector of endogenous variables.

Figure 8 shows the response of output estimated through these variations in the estimation methodology along with the response of output estimated through the baseline model. The figure shows that the variations in the model considered here do not significantly affect the response of the output. The peak response for all specification is in excess of 2. We only observe two minor differences in the responses of output across these variations: first, we find that the peak response takes place after 9 quarters when we include 8 or 10 lags of the exogenous tax series in the baseline model. Second, the decline in output after reaching its peak is steep in the case of the single equation framework. Nonetheless, our result that exogenous tax cuts have significant short-run effects on output remains robust to the choice of the estimation methodology.

4 Extensions

In this section we extend our analysis from the previous section along several dimensions. We begin by looking at the macroeconomic effects of various types of tax shocks. These types include changes in personal and labor income tax changes, tax increases and decreases, and anticipated and unanticipated tax changes. We also look at the effects of the tax shocks on other macroeconomic variables of interest.

4.1 Personal and Corporate Tax Changes

While constructing our data set, we kept a track of whether a tax change was intended to affect personal income tax liabilities, corporate income tax liabilities, or whether it was any other type of tax. In this section we look at the effects of each of these types of tax changes. Figure 9 shows the data for changes in personal and corporate income and other taxes. Changes in personal and corporate income tax changes have been normalized by pre-tax personal income and pre-tax corporate profits respectively. The changes in other taxes have been normalized by nominal GDP. Changes in personal income taxes were spread through out the sample with most of these taking the form of changes in marginal tax rates. Changes in corporate income tax rates were also spread out with some of the biggest changes taking place in the 1980's. These changes were motivated by concerns about long-run debt of the economy and long-run performance of the economy. There were also some substantial cuts to the corporate income tax rates in the late 1990's. The figure also shows that the biggest tax changes in the other category also took place during the 1980's with a lot of these being motivated by concerns about long-run debt of the economy.

To estimate the effects of these types of tax changes, we re-estimate the baseline VAR and include all three of these tax changes as exogenous variables.[7] The first panel of the figure shows that a one percentage cut in personal income taxes have a significant but short-lived effect on output. Output increases by up to 3.1 percent 4 quarters after the initial shock. The response remains significant for 8 quarters. This result is in contrast to the result found by Lopes (2016) who finds that personal income tax changes have a long-run effect on output.

The second panel shows that corporate income taxes have expansionary but small effects on output. The maximum response of output takes place after 3 quarters of the initial shock which is equal to 0.13 percent. While this number is small, it converts to a multiplier of around 1.4 when multiplied by the inverse of the ratio of pre-tax corporate profits and nominal GDP. Finally, other taxes seem to have a long-run expansionary effect on output. The peak response of output takes place after 11 quarters of the initial shock and is in excess of

[7]The results do not change if we include these changes one by one.

3. The point estimates remain above 2 even at longer horizons. However, it must be noted that none of the point estimates are significant at conventional significance levels and only the short-run coefficients are significant when considering the one standard error bands.

Thus, we conclude that changes in personal income taxes have large yet short-lived expansionary effects on output. Changes in corporate income taxes have small short-run effects whereas changes in other taxes only have marginally significant effects in the short-run.

4.2 Anticipated and Unanticipated Tax Changes

In this section, we look at the effects of anticipated and unanticipated tax changes. We begin by documenting the lag, in number of days, between the announcement and implementation dates of tax changes. This information is summarized in figure 10. The figure shows that most of the tax changes are implemented within 30 days of the announcement. Yet there are also a high number of tax changes that have an implementation lag of more than 90 days. Given that the about half of tax changes are either side of the 90 day mark, we choose to define a tax change as anticipated if the implementation lag between the announcement and implementation dates is more than 90 days. This is the same definition that has been used by Mertens and Ravn (2012) and Hussain and Liu (2017).

We follow the methodology of Mertens and Ravn (2012) to estimate the effects of anticipated and unanticipated tax changes. In particular, we estimate the following model

$$X_t = A_0 + A_1 t + A_2 t^2 + B(L)X_{t-1} + C(L)\tau_t^u + D(L)\tau_{t,0}^a + \sum_{i=1}^{K} G_i \tau_{t,i}^a + \epsilon_t \tag{3}$$

where X_t is the vector of same endogenous variables as before. τ_t^u is the series of unanticipated tax changes. $\tau_{t,0}^a$ is the series of implemented anticipated tax changes. $\tau_{t,i}^a$ represents the sum of anticipated tax liability changes known at date t to be implemented at date $t+i$. The anticipation effects are captured by the terms G_1-G_K. $B(L)$, $C(L)$, and $D(L)$ are polynomials of P and $Q+1$ lags respectively. Consistent with the baseline model, we choose $P = 4$ and $Q = 12$. Mertens and Ravn (2012) choose $K = 6$. However, in our data set, this choice of K would not be feasible since we have very few tax changes with an anticipation lags of 6 quarters. The median anticipation lag is of 3 quarters and the mean is 3.5. We choose $K = 4$ which is what Hussain and Liu (2017) chose for the UK for a similar distribution of the anticipation lags.

Figure 11 shows the effects of anticipated and unanticipated tax changes. The first panel shows that there is an immediate increase in output when a tax cut is announced. This

expansionary effect of the announcement of the tax cut does not disappear and the implementation of the anticipated tax cut further increases output. The maximum effect on output of an anticipated tax cut is a surprisingly large (9.1 percent). The response of output also shows the effects of anticipated tax cuts persist in the long-run. The second panel shows that unanticipated tax cuts have effects that closely resemble the effects of the overall exogenous tax series. The maximum response of output is equal to 2.4 percent and it takes place after 5 quarters of the initial tax cut.

Earlier studies like Poterba (1988) and Heim (2007) use household level data to study the effects of announced tax changes. These studies could not find conclusive evidence in favor of the anticipation effects of announced tax changes. Parker (1999) and Souleles (2002) also find that consumption plans only change when tax changes are implemented. Our results, however, confirm the findings in Mertens and Ravn (2012), that anticipated and unanticipated tax changes have very different effects on the economy. However, unlike Mertens and Ravn (2012), we do not find a contractionary effect of an announcement about a tax cut. Mertens and Ravn (2012) rationalize their result by suggesting that firms delay their investment decisions when a tax cut is announced. Our results are consistent with those found by Hussain and Liu (2017) for the UK. Hussain and Liu (2017) that a standard life-cycle would predict that anticipated tax cuts should have expansionary announcement effects unless consumers are credit constrained and cannot borrow to increase their spending.

4.3 Tax Increases and Tax Decreases

In this section we look at the effect of exogenous tax increases and decreases. Hussain and Malik (2016) and Jones et al. (2015) study the asymmetric effects of tax changes for the US and find that while tax decreases have significant expansionary effects on output, tax increases do not seem to effect output. Hussain and Malik (2016) rationalize this result by constructing a business cycle model with asymmetric consumption adjustment costs. Hussain and Liu (2017) on the other hand find that for the UK, these asymmetric effects are in the opposite direction: tax increases have significant contractionary effects whereas tax cuts do not seem to stimulate the economy. Their results, however, are sensitive to some of the biggest changes in taxes.

To estimate the effects of tax increases and decreased for Canada, we modify our baseline specification and enter the series of exogenous tax increases and decreases separately. The results from this exercise are shown in figure 12. The figure shows that tax increases in Canada have large, significant, and long lasting effects on output. Output falls by as much as 3.6 percent 8 quarters after the initial shock. The response of output remains negative and significant even at longer horizons.

The same figure shows that tax decreases have expansionary effects on output but these effects only last for a few quarters after the initial shock. Furthermore, the point estimates are smaller than the responses of output to tax increase and are only marginally significant in the short-run. Therefore, we conclude that while both tax increases and decreases have significant effects on output, these effects are bigger and longer term for tax increases than tax decreases.

4.4 Effects of Tax Changes Overtime

In this section, we look at how the effects of tax changes have varied over time for Canada. Romer and Romer (2010) conduct a similar exercise for the US and find that the effectiveness of tax policy has become somewhat smaller in the post 1980 period. Their explanation for this result is that the Federal Reserve bank became more reactive to fiscal policy changes in the post 1980 period thereby muting the effect of the tax policy changes. Keeping their discussion in mind, we look at the effect of the tax changes in Canada for the pre 1991 and post 1991 periods. We choose 1991 to break the sample because Bank of Canada moved the policy of inflation targeting in 1991. Ex-ante, we would expect the effectiveness of tax policy to be smaller in the post 1991 period because a tax cut theoretically boosts aggregate demand and hence results in an increase in inflation which would result in interest rate hikes under an inflation targeting scheme.

We estimate our baseline model for these two subperiods. The results are shown in figure 13. The figure shows that in the pre 1991 period, tax cuts had significant and large expansionary effects on output. The same figure shows that in the post 1991 period, the response of output to a tax cut is insignificant in the short run and surprisingly moves in the *wrong* direction for some quarters in the long run when it decreases.

Except for the anomalous response of output for a few quarters in the post 1991 period, the results are what we expect before conducting the exercise. However, when we look at the response of interest to a tax cut in these two sub-periods, shown in figure 14, we realize that the behavior of interest rate is not what we expected. In the pre 1991 period, interest rates increase by up to 3 percentage points in response to a tax cut. In the post 1991 period, however, interest rates decrease by up to 3.3 percent. These responses of interest rates are against what we expected and do not seem consistent with the responses of output.

While we leave a detailed discussion of this result for future research, here we present three possible explanations of why tax policy might have lost its effectiveness in the post 1991 period. First, its possible that the expectations of the economy altered significantly once the

Bank of Canada moved towards the policy of inflation targeting. Since the economy expects that a tax cut would be accompanied by an interest rate hike, it does not respond in the same way it would have with a more accommodating central bank. Gordon Thiessen, in one of his lectures in 2000, mentioned that the inflation targeting scheme was not going to be adopted as early as 1991. However, it was brought forward as a way to counter the fears that had arisen about high inflation rates resulting from the introduction of the new Goods and Services tax by the government in 1991. Hence it is possible that the economy learned that the central bank will not be responding to fiscal policy changes which muted the effects of these changes even before the central bank actually reacted.

Second, its possible that the change in effectiveness of the tax policy is due to the way the government used it other fiscal policy - government spending - in the two sub-period. Figure 15 shows the response of government spending to tax cuts in the two sub-periods. In the pre 1991 period, government spending increased in response to a tax cut. Whereas government spending decreased in the post 1991 period after a tax cut. Thus, the results show that government spending was reinforcing the expansionary effects of a tax cut in the pre 1991 period whereas they countering these effects in the post 1991 period.

There is some evidence that the government of Canada indeed changed its spending policy across these two sub-periods. Di Matteo (2017) discusses that in the 1960's, 1970's and 1980's, the government of Canada was following a Keynesian framework where it would use its spending policy to boost employment and growth. However, these spending increases resulted in deficits for the government which were further worsened by the recessions of the 1970's. By the late 1980's the government had become concerned about the long-run fiscal health of the economy. Thus the government started following a policy of balanced budget from the early 1990's. This may explain the results seen in figure 15 since a tax cut can give rise to a budget deficit which may result in government spending decreasing with a lag of a few quarters.

Finally, the change in the response of output to tax changes may be explained by looking at the composition of tax changes for the two subperiods. In the pre 1991 period, there were an equal number of tax increases and tax decreases. In the post 1991 period, however, there were far greater number of tax cuts than tax increases. It has already been documented that tax increases have a bigger negative effect on output than the positive effect of tax cuts. Furthermore, most of the tax increases in the pre 1991 period were due to concerns about deficit consolidation. And it was shown earlier that the deficit consolidation tax hikes have significant long-run contractionary effect on output. Thus, it is possible the composition of tax changes is what explains the change in effectiveness of tax policy across these two time periods.

5 Conclusion

This paper adds to growing literature on macroeconomic effects of exogenous tax changes identified through the narrative approach. We use various budget documents to document all legislated federal tax changes for the Canadian economy for the time period 1961:1 - 2014:4. We then use the motivation behind each tax changes to classify it as exogenous or endogenous.

The main result of this paper is that a tax cut of 1 percent of GDP results in a increase in GDP of 0.54 on impact which rises to 2.5 percent after 5 quarters of the initial shock. However, the expansionary effect of the tax cut disappears at longer horizons. We also document some interesting results by analyzing the effects of disaggregated measures of exogenous tax changes. First, we find that tax hikes associated with deficit consolidation have the biggest (contractionary) effects on output. Second, we find that changes in personal income taxes have larger effects than changes in corporate income taxes or changes in other types of taxes. Third, we find that anticipated tax changes have strong expansionary announcement effects. Fourth, we document that tax increases tend to have bigger (contractionary) effects on output than the (expansionary) effects of tax decreases. Finally, we also find that the effectiveness of tax policy has drastically decreased over time.

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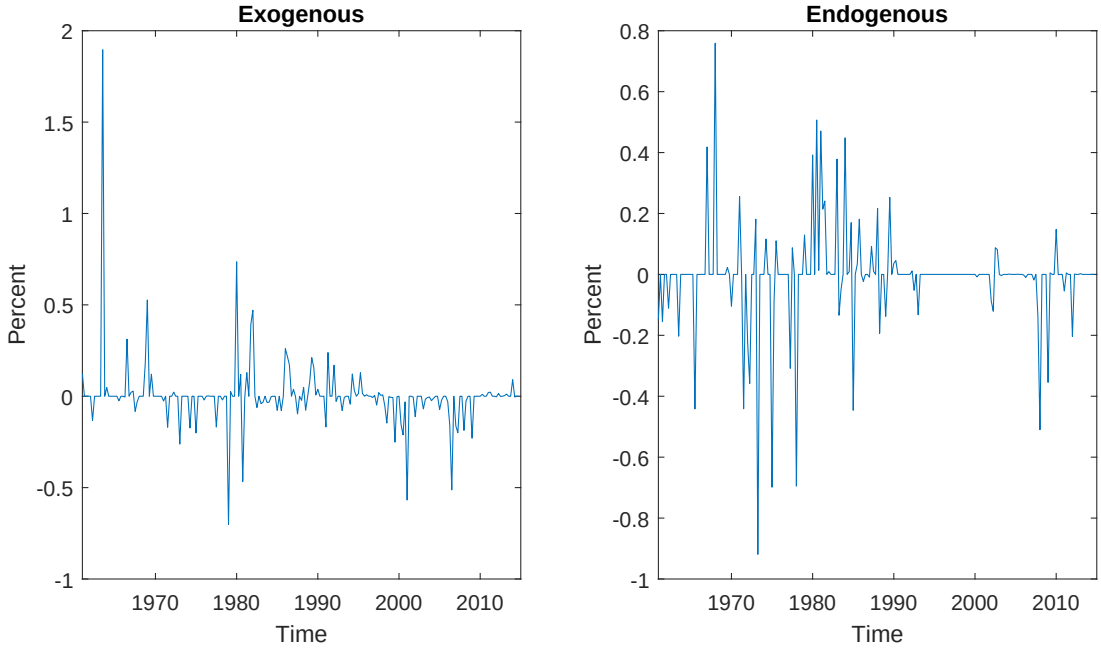

Figure 1: All Exogenous and Endogenous Tax Changes

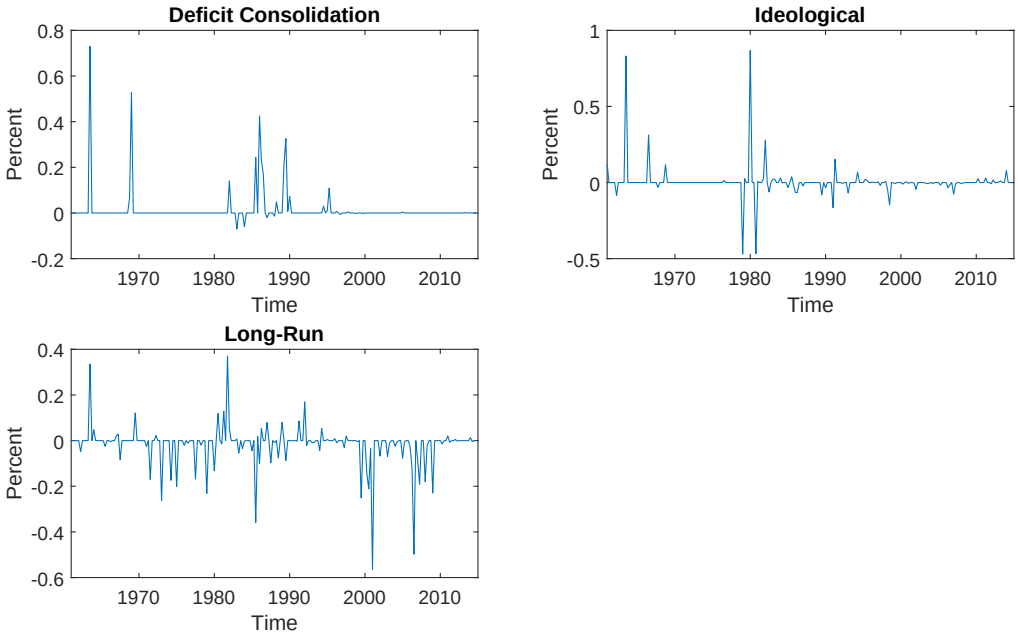

Figure 2: Categories of Exogenous Tax Changes

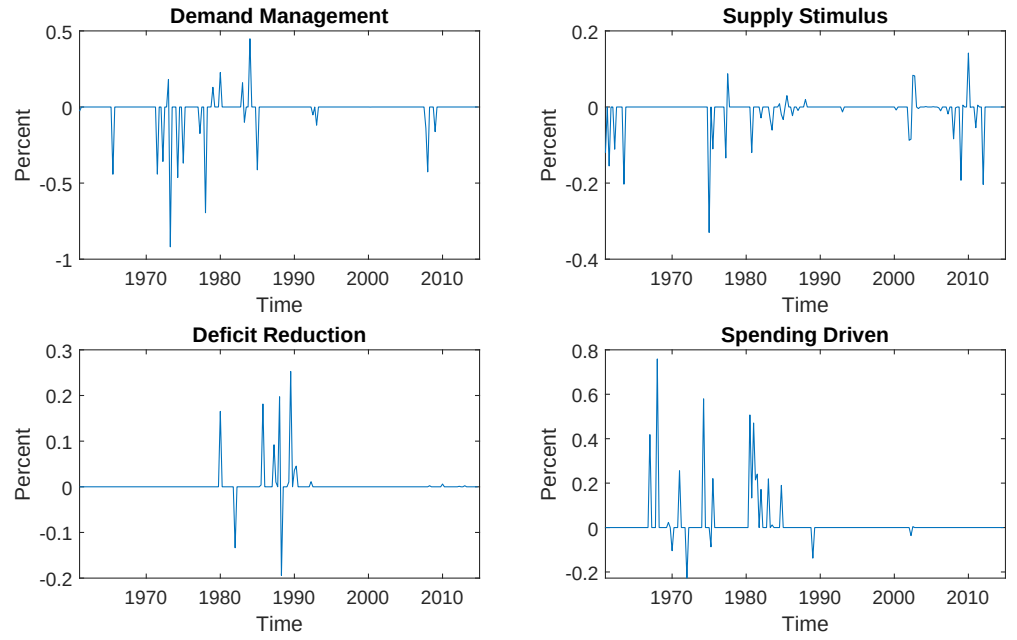

Figure 3: Categories of Endogenous Tax Changes

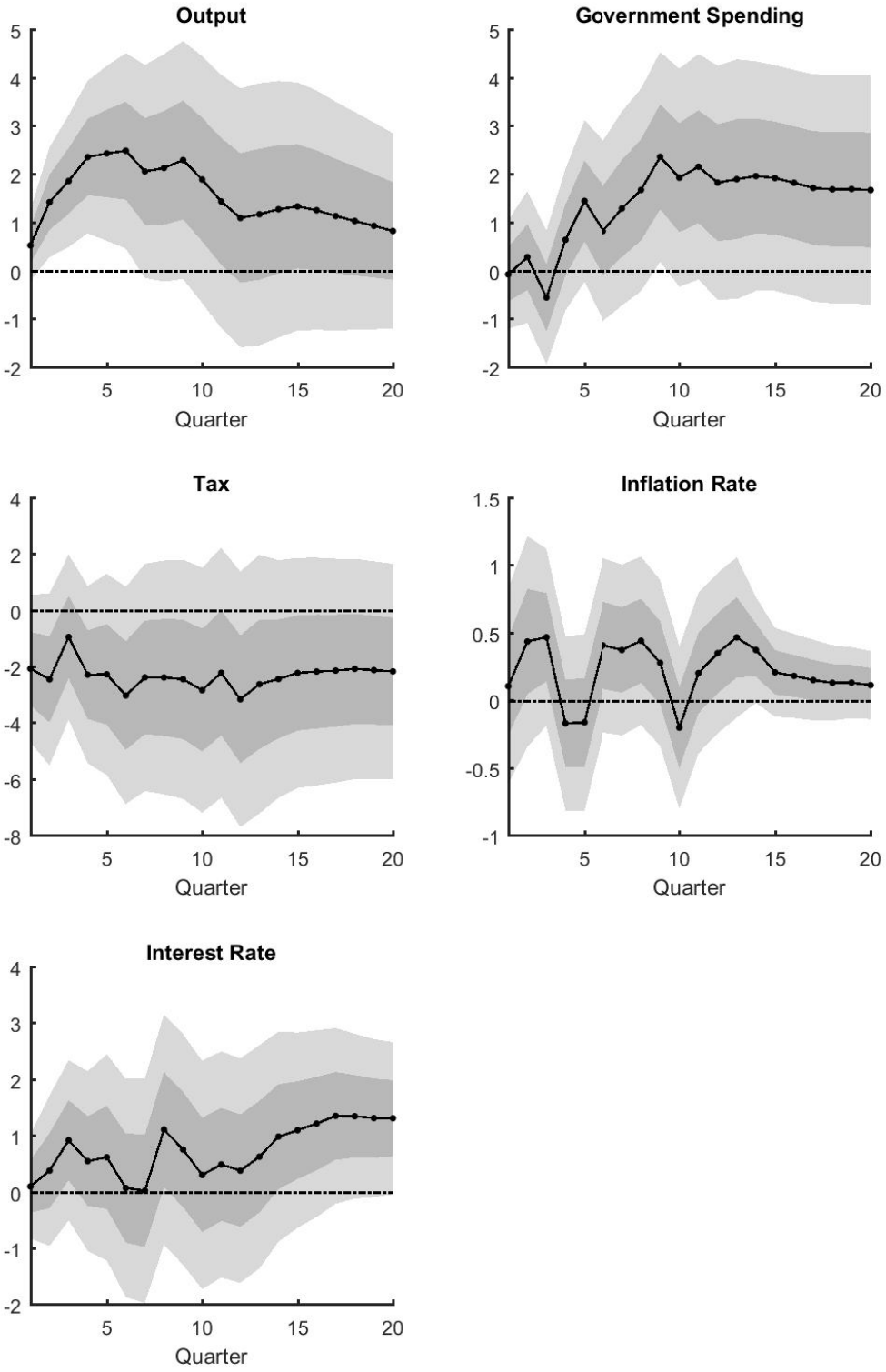

Figure 4: Effects of Tax Cuts using all Exogenous Changes

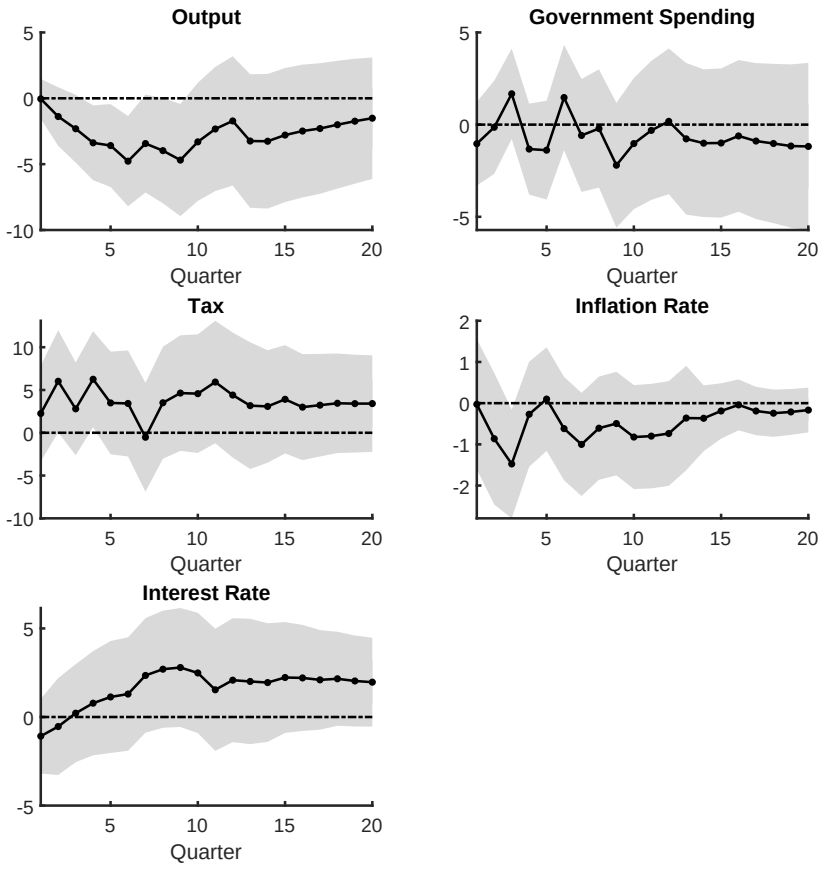

Figure 5: Effects of Tax Cuts using Deficit Consolidation Changes

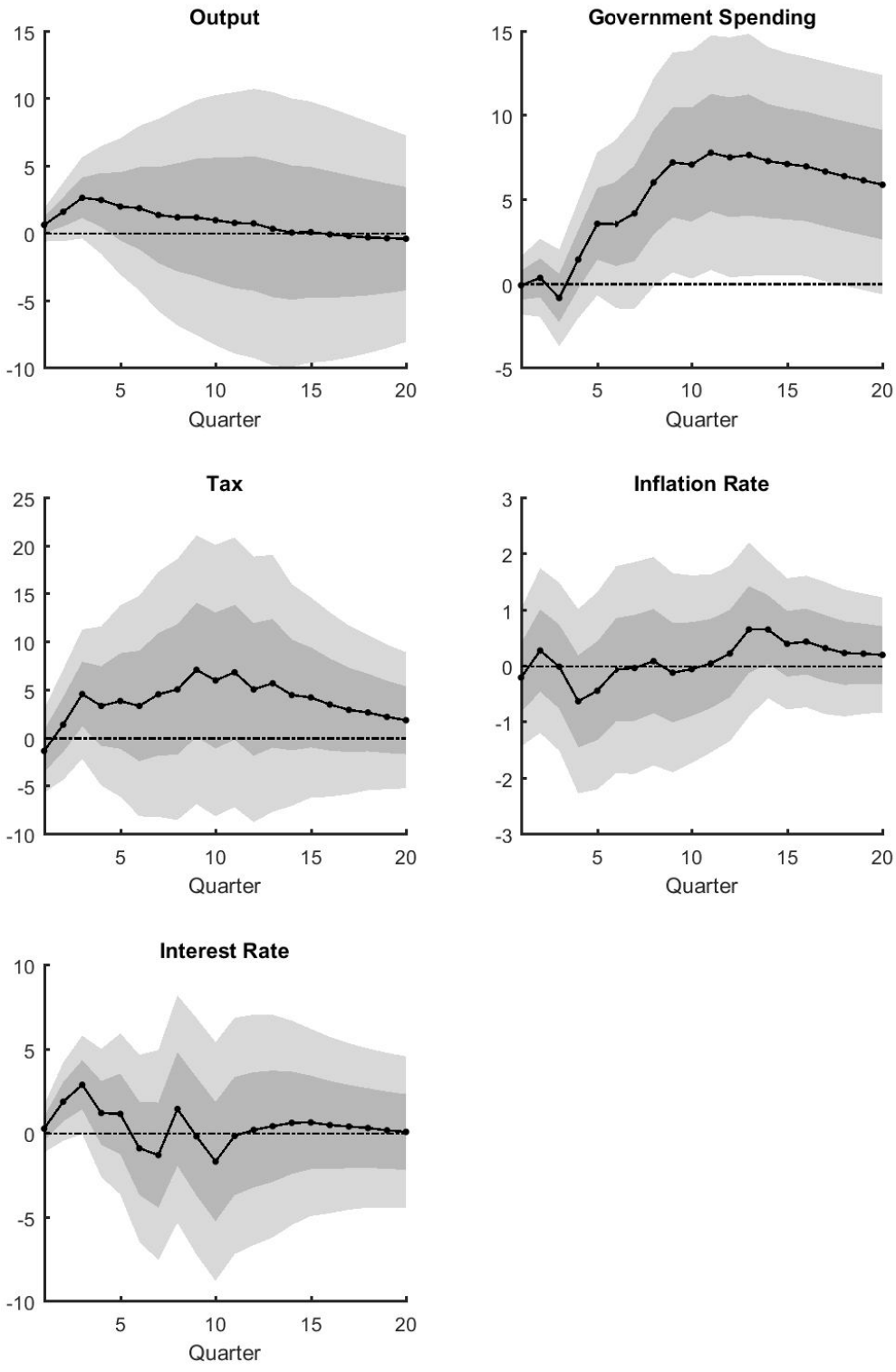

Figure 6: Effects of Tax Cuts using Ideological Changes

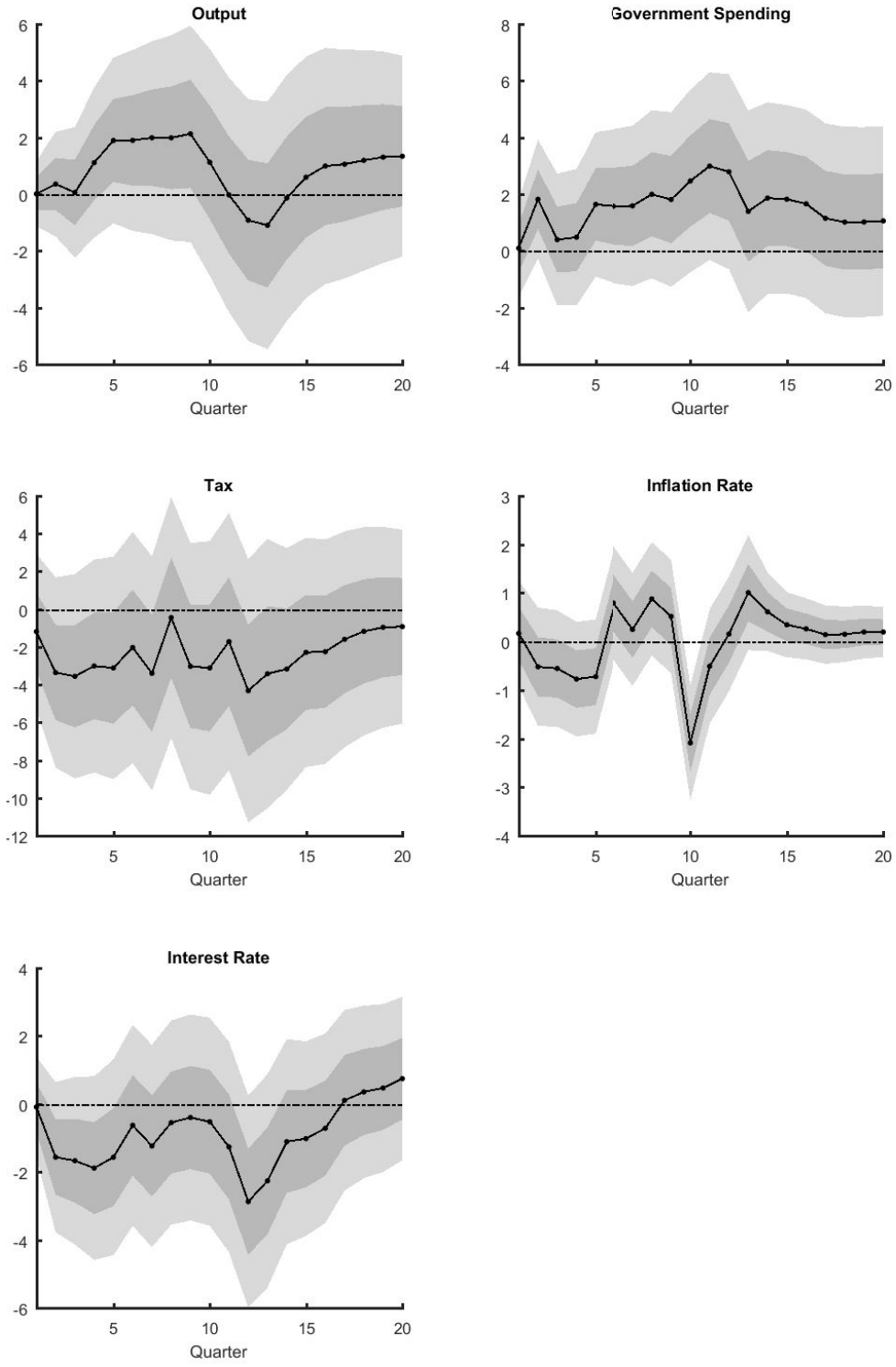

Figure 7: Effects of Tax Cuts using Long-Run Changes

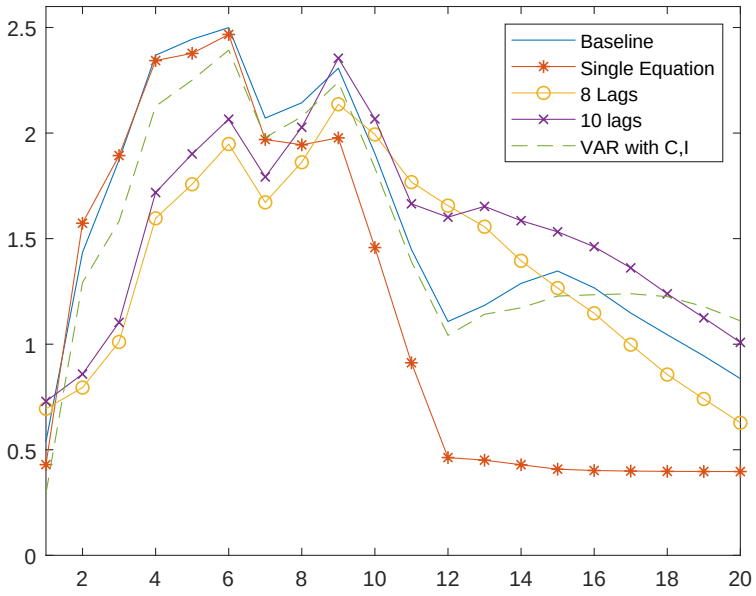

Figure 8: Effects of all Exogenous Tax cuts using different specifications

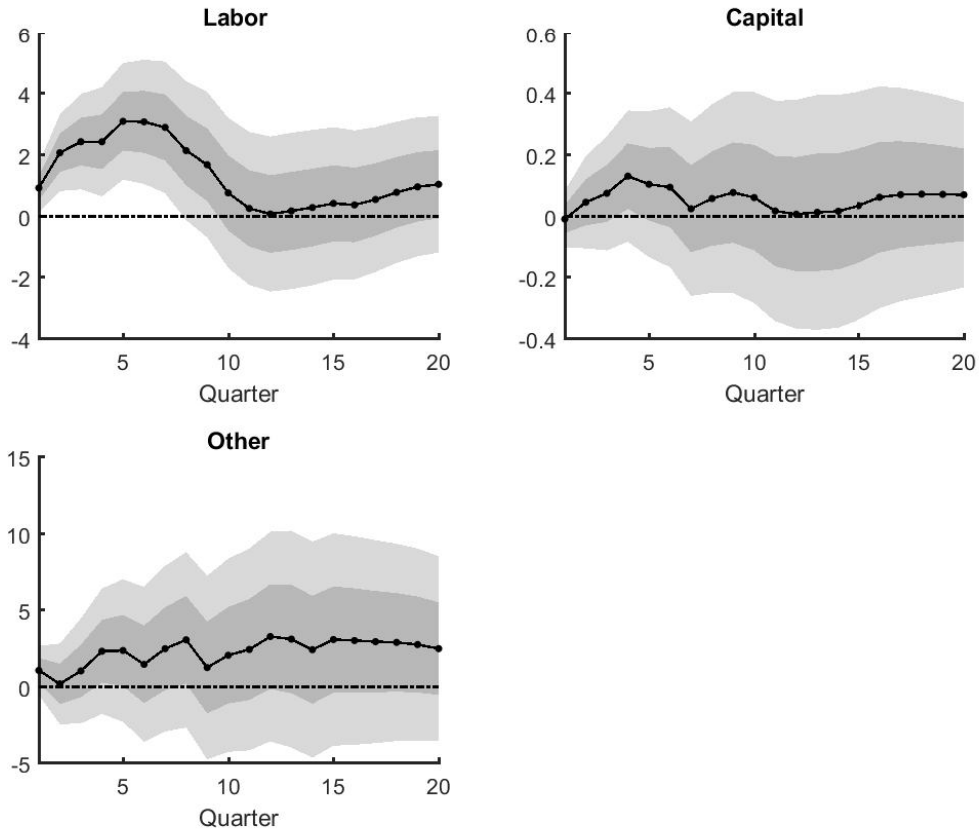

Figure 9: Effects of Personal and Corporate Income Tax Cuts

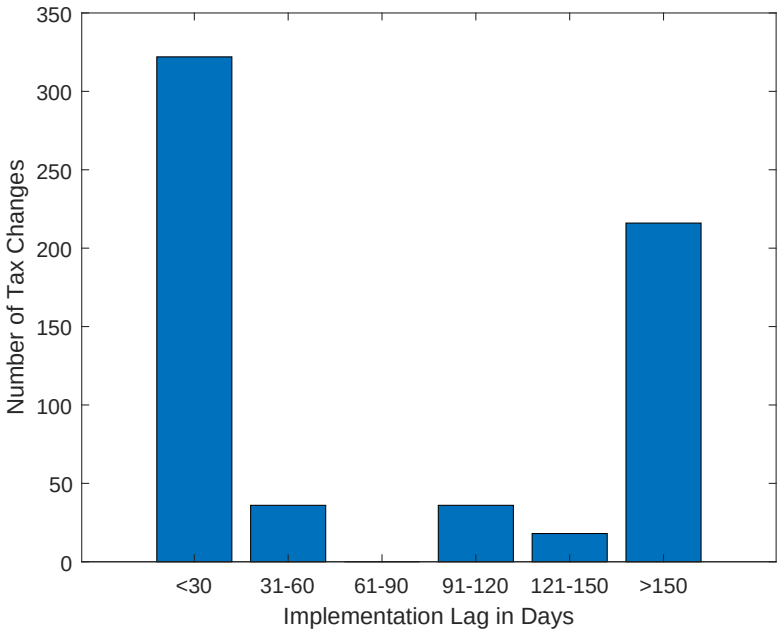

Figure 10: Distribution of Implementation Lags

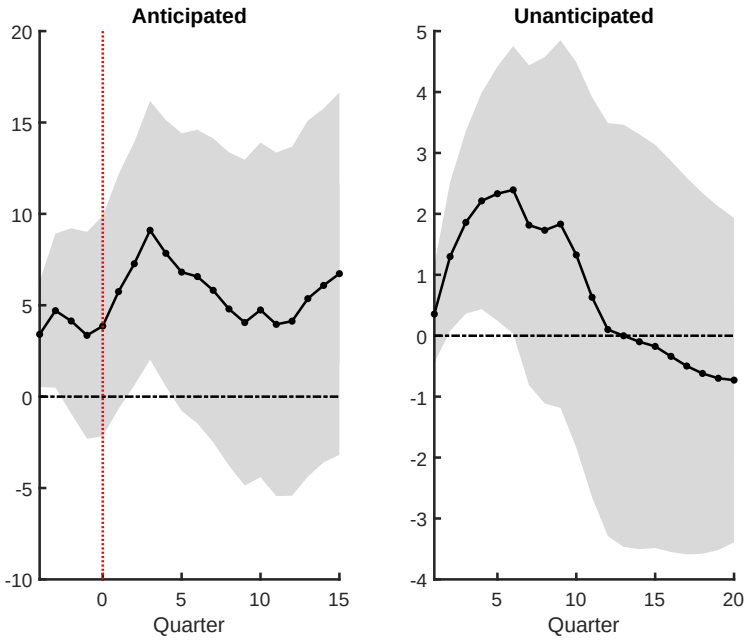

Figure 11: Effects of Anticipated and Unanticipated Tax Cuts

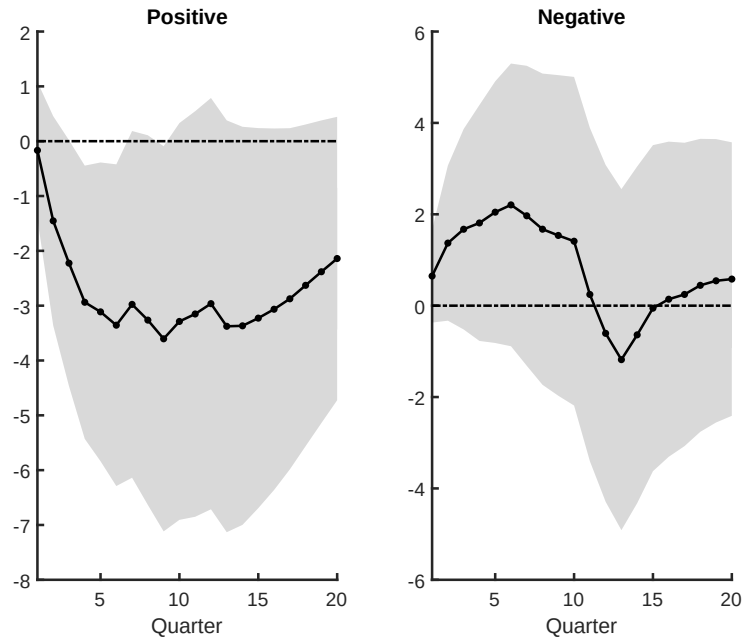

Figure 12: Effects of Tax Increases and Tax Decreases

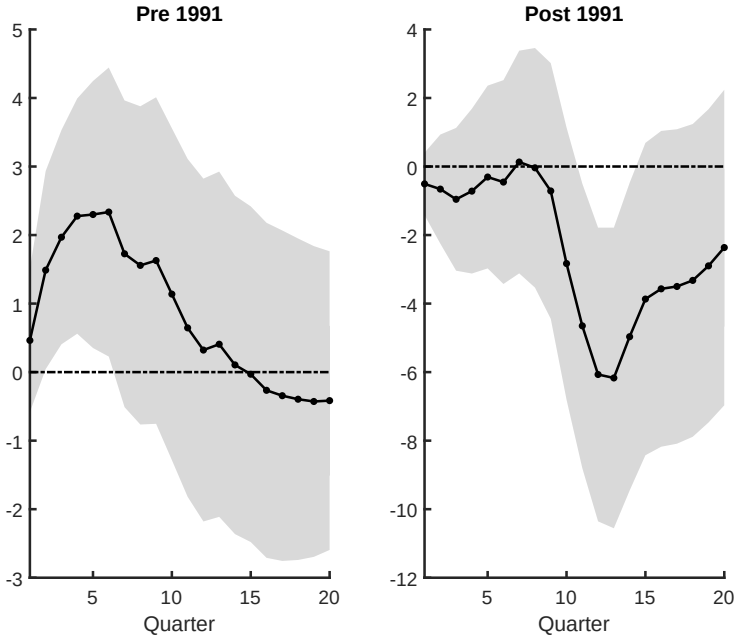

Figure 13: Overtime Response of GDP to an exogenous tax cut

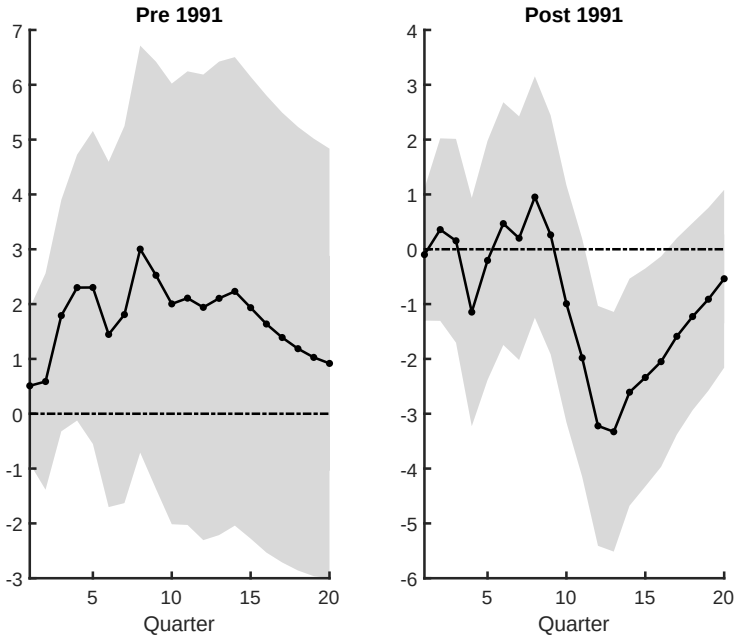

Figure 14: Overtime Response of Interest Rate to an exogenous tax cut

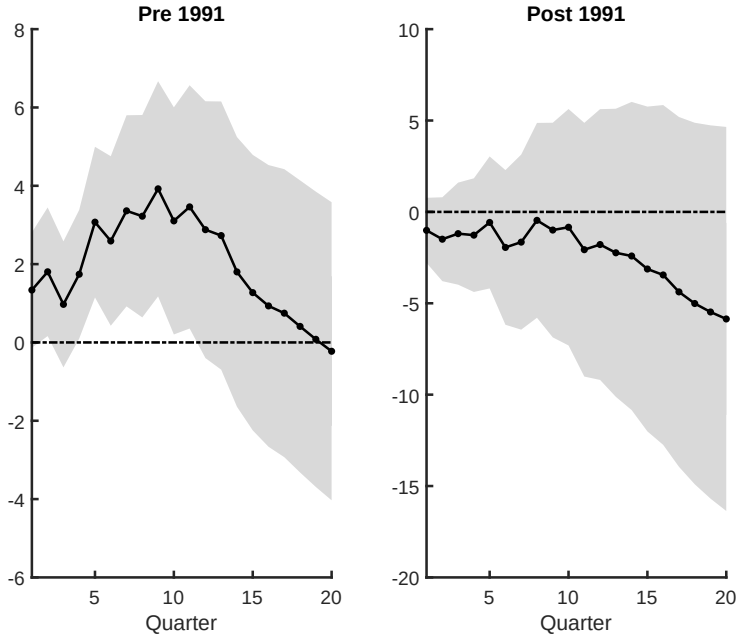

Figure 15: Overtime Response of Government Spending to an exogenous tax cut

Table 1: Tests of Predictability

Series	Test Statistic	P-value
Exogenous Series		
Granger Causality	15.35	0.75
Ordered Probit	23.03	0.28
Counter-Cyclical		
Granger Causality	29.217	0.084
Ordered Probit	30.94	0.05

Table 2: Data Sources

Variable	Source
Nominal GDP	Statistics Canada; Table: 36-10-0104-01
Real GDP	Statistics Canada; Table: 36-10-0104-01
Disposable Income	Statistics Canada; Table: 36-10-0112-01
Personal Income Tax	Statistics Canada; Table: 36-10-0112-01
Corporate Disposable Income	Statistics Canada; Table: 36-10-0116-01
Corporate Tax	Statistics Canada; Table: 36-10-0116-01
Real Consumption	Statistics Canada; Table: 36-10-0104-01
Residential Investment	Statistics Canada; Table: 36-10-0104-01
Non-Residential Investment	Statistics Canada; Table: 36-10-0104-01
Business Inventory Investment	Statistics Canada; Table: 36-10-0104-01
Population	Statistics Canada; Table: 17-10-0009-01
Wages	Statistics Canada; Table: 36-10-0114-01
Export	Hussain and Liu (2018)
Import	Hussain and Liu (2018)
Hours	Hussain and Liu (2018)