FISCAL POLICY AND THE BUSINESS CYCLE: A NEW APPROACH TO IDENTIFYING THE INTERACTION

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1. Introduction

As economic data released late last year pointed towards an economic slowdown, policy makers were interested in the extent to which fiscal policy might mitigate the slowdown of the Canadian economy and to what extent the ensuing slowdown may have a negative impact on the budget balance. The former refers to the impact of fiscal policy on the economy (referred to in this paper as an indicator of fiscal impact), while the latter is concerned with the budgetary position over the business cycle. Although the cyclically-adjusted budget balance (CABB) is widely used for both purposes, its use as an indicator of the economic impact of fiscal policy is inappropriate for several reasons discussed in this paper. This paper introduces a new indicator of fiscal impact, called the indicator of Fiscal Policy Stance (or FiPS), which is jointly estimated with an indicator of budgetary position (i.e.: CABB).

Changes in the budgetary balance can be decomposed into two components: one that is directly caused by the business cycle and one that is independent of the cycle. The former includes automatic stabilizers, such as the EI program, while the latter, referred to as the CABB, includes structural changes and discretionary policies that are independent of the business cycle. The intended purpose of the CABB is to isolate the discretionary and/or structural component of the budgetary balance; however, it has also been used inappropriately to infer the effects of fiscal policy on the economy.

For instance, the year-over-year change in the CABB has been used as a proxy for the impact of fiscal policy on the economy. However, using the CABB in this way introduces many assumptions that are problematic. First, the CABB imposes the same demand elasticities for revenues as

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expenditures. Second, the CABB omits cyclically-induced changes in the budget balance, which also affect aggregate demand. Lastly, if the measurement is subject to simultaneity bias, the structural budget component will be overstated, and thus, inaccurate.

The technique commonly used to identify the CABB is flawed in that it fails to address the issue of "simultaneity", whereby changes in fiscal policy affect the business cycle and vice versa. Neglecting this problem yields estimates of the coefficients of the fiscal equations that are biased towards zero, and consequently, the cyclical component of the budget balance is underestimated.[1] Previous works by Blanchard (1990) and van den Noord (2000), for example, have warned of the potentially serious problem of neglecting the simultaneity in estimating the CABB.

Numerous studies, using a wide variety of estimation techniques, have attempted to identify the impact of fiscal policy on the economy. It is generally acknowledged, however, that simple indicators cannot adequately capture the full interaction between budgetary revenues and expenditures and the business cycle and that this can only be achieved through simulations of a macroeconomic model.

In this paper, we distinguish between indicators of budgetary position and indicators of fiscal impact and pay particular attention to the terminology used to describe the CABB. In previous work, the year-over-year change in the CABB has been referred to as an indicator of fiscal stance; however, this implies that it is able to provide some sort of measure of the expansionary or contractionary effect of fiscal policy. For the reasons described in the preceding paragraphs, it is apparent that this is not an appropriate use of the CABB. Rather, we refer to the CABB as a measure of budgetary position, since the CABB is able to show from where changes in the budgetary balance arise. Therefore, we refrain from using the terms "expansionary" or "contractionary" when describing the year-over-year change in the CABB, and instead, we use only the terms "improvement" or "deterioration". Furthermore, we refer to the FiPS as a measure of fiscal impact, since it is designed with the intent to measure the effect of fiscal policy on the economy and we reserve the terms "expansionary" or "contractionary" for interpreting the FiPS.

This being said, the purpose and interpretation of the FiPS indicator is also limited. We refer to the FiPS as an indicator of fiscal impact, as it

1 An explanation of this bias towards zero is provided later in the paper.

aims to capture the very short-term direct impact of fiscal policy on the economy. As a simple indicator, the FiPS is not capable of determining the long-run, general equilibrium effects of changes in the budgetary components on economic activity, nor the transitional effects. The FiPS model considers only the aggregate demand effects and does not incorporate the supply side dynamics.

The purpose of this project is to develop an *unbiased*[2] indicator of the first round impact of fiscal policy on the economy (the FiPS). In doing so, an unbiased measure of the CABB is produced as a residual, which is therefore, model-consistent with the FiPS indicator. This procedure yields:

- An unbiased measure of the cyclically-adjusted budget balance that
  - is accompanied by an explicit measure of the uncertainty surrounding the estimate (i.e. confidence bands).
- An unbiased measure of the degree of fiscal stimulus in the economy that
  - incorporates the effect of both the cyclical and cyclically- adjusted components of the budget balance
  - allows for heterogeneous demand elasticities across the components of the budget balance
  - is accompanied by an explicit measure of the uncertainty surrounding the degree of stimulus (i.e. confidence bands).

Section two reviews previous research pertaining to indicators of budgetary position and fiscal impact. Section three describes the model and discusses the motivation for using Generalized Method of Moments to estimate the FiPS. Section four presents the empirical results of the model, while the following section graphically compares the different indicators of budgetary position and fiscal impact. The sixth section discusses the advantage of confidence intervals surrounding the indicators and the last section concludes with some remarks regarding the limitations of the FiPS methodology.

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[2] In this paper, we use the term unbiased as it is more widely recognized. Strictly speaking, our methodology yields a consistent estimate. There is no guarantee of unbiasedness in small sample.

2. Review of the Previous Studies

2.1 Indicator of budgetary position

The budgetary balance can be thought of as having two components: one cyclical and one cyclically-adjusted. The cyclical component reflects the state of the business cycle (i.e.: whether actual output is above or below potential output), while the cyclically-adjusted balance attempts to measure what the budgetary balance would be if the economy were operating at potential. The cyclical component represents the automatic stabilizers, which by definition, cause government receipts and spending to react to output shocks without the need for active government intervention. Automatic stabilizers work to dampen the fluctuations in the business cycle by increasing revenues (decreasing expenditures) during an economic expansion and by decreasing revenues (increasing expenditures) during an economic contraction. In this way, automatic stabilizers have the effect of at least partially offsetting, without any government intervention, swings in the business cycle. Fluctuations in the cyclical component originate solely from fluctuations in the business cycle, defined as the change in the output gap (actual output minus potential output as a per cent of potential output). The cyclically-adjusted component changes in response to structural changes in the economy and discretionary changes to fiscal policy.

Policy makers are particularly interested in separating the cyclically-adjusted component from the cyclical component in order to assess the budgetary position over the business cycle. This differentiation is important because cyclical balances are expected to reverse themselves over the business cycle, whereas, cyclically-adjusted balances may require government action in order to reverse. Understanding the source of changes in the budgetary balance will help guide policy makers in setting effective policies. For instance, permanent programs should not be implemented based on cyclical changes in the budgetary position. Moreover, it may be inappropriate to take fiscal measures to reverse a deficit as it may already be in the course of reversing itself as economic conditions improve. Conversely, government action may be required to reverse a widening structural deficit in order to restore financial integrity. Several different approaches have been employed to separate the different influences on budgetary balances; we discuss some of the methodologies here.

The Organisation for Economic Cooperation and Development (see Giorno *et al.*, 1995), the International Monetary Fund (see Hagemann, 1999) and Finance Canada regularly report and publish estimates of the CABB for the total Canadian government sector. The methods employed by the IMF, OECD and the Department of Finance produce relatively comparable results, despite the idiosyncrasies of their methodologies. There are essentially two steps involved in estimating cyclically-adjusted budget balances: 1) estimate an output gap and 2) obtain elasticities of the revenue and expenditure components to output. These elasticities are then applied to the output gap in order to obtain an estimate of the cyclically-adjusted component. The cyclical component, or the effect of automatic stabilizers, is the difference between the actual and cyclically-adjusted balances.

Despite its widespread use as an indicator of discretionary changes in the budgetary balance, Blanchard (1990) criticizes the CABB as being needlessly controversial as it relies on potential output, which is unobserved. Blanchard maintains that any benchmark, be it inflation, interest rates or unemployment, would be sufficient to distinguish between cyclical and discretionary changes in the budget components and suggests a new indicator of the impact of discretionary fiscal policy. Blanchard suggests a simple, arbitrary benchmark, such as the previous year's unemployment rate. This indicator answers the question, "What would the primary surplus have been had the unemployment rate remained the same as the previous year?".

Chouraqui, Hagemann and Sartor (1990) also review the use of the cyclically-adjusted balance as an indicator of discretionary changes in fiscal policy. Their paper compares the estimates of the cyclically-adjusted balances when using potential output as a benchmark to using a moving benchmark, such as the level of output consistent with the previous year's unemployment rate. The results for ten OECD countries show that, for most countries, the choice of the benchmark makes little difference to the orientation of fiscal policy. Moreover, the results appear consistent with general perceptions of the direction of fiscal policy in most countries over the estimation period.

Alesina and Perotti (1995) employed Blanchard's approach to twenty OECD countries, including Canada, and in general, found that the year-over-year change in the CABB estimated by the Blanchard and OECD methodologies produced similar results. Moreover, deflating nominal tax and expenditure variables by potential GDP, instead of actual GDP in order to purge the cyclical component of government expenditures, resulted in only a minimal difference. Kneebone and McKenzie (1999) applied Blanchard's approach to Canadian federal and provincial data covering the period from 1962 to 1996. The authors found that their estimate of the federal government year-over-year change in the CABB was comparable to the estimates published by Finance Canada.

Bouthevillain and Quinet (1999) use a structural bivariate VAR model to decompose the budgetary balance into its structural and cyclical components. Following an approach developed in Blanchard and Quah (1989), the authors impose a restriction that for every increase of one percentage point in economic activity, the budgetary balance as a share of GDP improves by 0.6 percentage points. The authors further assume that the cyclical and structural components of the deficit are not correlated. Compared to the standard two-step method described earlier, the structural VAR method provides a smoother and smaller structural deficit, which implies a larger cyclical component. The difference between the structural VAR and two-step methodologies can be attributed in part to a different interpretation of the resulting cyclically-adjusted budget balances: the two-step cyclically-adjusted budget balance corrects for the impact of the output gap, while the structural VAR cyclically-adjusted budget balance corrects for cyclical fluctuations in GDP that are not induced by fiscal policy.

Cohen and Follette (1999) analyse the cyclical component of the budgetary balance in the United States by employing two approaches: spectral analysis[3] and standard time series. The conclusions from the empirical techniques are compared to the results simulated in a macroeconomic model, FRB/US. The authors use spectral analysis to identify the cyclical component of budgetary revenues and expenditures and find a very strong relationship between taxes and unemployment-related expenditures to the tax base and the unemployment rate, respectively, over the business cycle, lending evidence to the automatic stabilizing effect of taxes and employment-related spending. While spectral analysis highlights the cyclical properties of a budget component, it cannot differentiate between the automatic and structural changes. The authors then calculate a high-employment budget balance, which is conceptually similar to the cyclically-adjusted budget balance. The authors find that additional GDP growth of 1 per cent would increase revenues by

3 A discussion of spectral analysis can be found in Granger and Newbold (1977).

approximately 0.3 per cent of GDP. Moreover, almost half of the variation in revenues stems from changes in personal income taxes, with another third of the variation explained by corporate income taxes. The findings of the spectral analysis and standard time series are partially confirmed by simulations of the macroeconomic model, FRB/US: automatic stabilizers are found to dampen the short-run effect of aggregate demand shocks on GDP by reducing the multiplier by about 10 per cent; however, very little stabilization is found in response to an aggregate supply shock.

Mélitz (2000) explores the interaction between fiscal and monetary policy regimes, the response of fiscal authorities to debt-to-output ratios and the reaction of fiscal authorities to the business cycle. The study pools annual data from the European Union countries, excluding Luxembourg, plus Australia, Canada, Japan, Norway and the United States. Using two-stage and three-stage least squares to simultaneously model the reaction functions of the monetary and fiscal authorities, Mélitz concludes that deficits provide only weak automatic stabilization, as a result of stabilizing taxes that slightly more than offset destabilizing expenditures. Expenditures first react in a destabilizing manner initially to an economic shock, before providing stabilization mainly through unemployment compensation in the following year. Mélitz explains this phenomenon by postulating that some government spending could be pro-cyclical (e.g.: health services, legal entitlements and public service promotions), while unemployment insurance payments are counter-cyclical, but react with a lag.

Bouthevillian *et al*. (2001) present a new approach to estimating cyclically-adjusted budgetary balances. This paper is innovative in that it captures the effect of compositional changes in aggregate demand and national income on various components of government revenues and unemployment-related expenditures. The authors attribute compositional effects to the fact that tax rates differ across tax bases and the revenue and expenditure bases may be in different phases of the business cycle or exhibit fluctuations of different magnitudes during the business cycle. While the compositional effect was found to be fairly small for the Euro area as a whole during the 1990s, this was not the case on a country-by-country basis.

2.2 Limitations and interpretations of the CABB

The CABB has been criticized for being misused and misinterpreted.[4] It is important to understand the definition of the cyclical and cyclically-adjusted balances and the purpose for which the CABB was designed. Regardless, caution must be used when interpreting the CABB, even when it is being used for its intended purpose.

In theory, the budget balance can be divided into its cyclical and cyclically-adjusted components. However, in practice, the distinction between the two is less obvious. For instance, tax and spending systems include an automatic stabilizing component, whereby revenues (expenditures) tend to increase (decrease) during an economic expansion and decrease (increase) during an economic contraction. Income taxes and Employment Insurance benefits are examples of such. It is interesting to note that even a flat tax can provide some automatic stabilization; however, the amount of stabilization increases when the tax rate increases or the progressivity of the tax system increases. Although these budgetary components are legislated to respond in this way to the business cycle, this may not be the only component included in the cyclical component. For instance, if policy makers take discretionary decisions in reaction to the business cycle, this may also be captured in the measurement of the cyclical component. However, we would expect that since it often takes longer than one quarter to develop and implement fiscal policies, this affect would likely be minimal in estimation.

Chalk (2002) differentiates between structural[5] and discretionary components. Since measurement techniques of the cyclically-adjusted balance cannot purge structural, or exogenous, shocks such as oil prices, inflation and exchange rates, the cyclically-adjusted budget balance may contain more than just discretionary policies.

The interpretation is further clouded when the cyclically-adjusted budget balance is decomposed into the central and state levels by the presence of intergovernmental transfers. For instance, when a central government unilaterally increases transfers to the state level, the budgetary balance of the central government is reduced, while the budgetary balance

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4 Several studies, including Buiter (1985), Blanchard (1990), Chouraqui, Hagemann and Sartor (1990) and Gramlich (1990) provide insightful discussions of the uses and abuses of the CABB.

5 The structural balance is defined as the fiscal position that would result if the economy were operating at potential.

of the state level is increased (unless the increased funding is immediately used to increase expenditures or reduce revenues). While the central government did make a policy decision that led to a deterioration of its budgetary balance, the state level of government did not make a policy decision to improve its fiscal position, yet it would appear this way.

The year-over-year change in the CABB, when expressed as a percent of GDP, should not be used in a normative sense to determine what revenues or expenditures “should be”, and in the same way, cannot be used to isolate the intent of government interventions. For instance, decomposing the year-over-year change in the CABB into its revenue and expenditure components can only show the source of the change in the budgetary balance as a per cent of GDP. It makes little sense to use this measure to determine if government actions intended to produce a stimulative or contractionary effect on the economy. A simple example demonstrates this argument. Some revenues and expenditures are assumed to have no cyclical component. In this case, any change in the actual variable as a per cent of GDP would be considered a structural change, implying that any non-adjusted variable growing at a rate different than GDP must be changing as a result of government direct intervention. This interpretation is problematic. First, there is no reason to believe that non-adjusted expenditures should grow with GDP. It is more likely that expenditures would grow in line with population, inflation and the cost of technological advancement in some sectors (e.g.: health). Even without any additional discretionary measures, most non-unemployment related expenditure programs tend to increase over time; some at a faster rate than GDP, some at a slower rate. Therefore, the year-over-year change in the CABB cannot be used to identify the intent of government policy; it can only infer whether the change in the CABB is attributed to revenues or expenditures. Just as the CABB should not be used as a normative index, the decomposition of the CABB should not be used to determine an optimal level for revenues and expenditures.

Chalk (2002) warns that even if the structural balance is accurately measured, it will never be a good proxy for the demand impact of fiscal policy. He suggests that the change in budgetary components multiplied by their respective multipliers would provide a better indicator of demand impact.

Understanding what the CABB cannot do enables us to talk about the purposes for which the CABB can be used. The CABB is designed to determine what the budgetary balance would be in the absence of fluctuations in the economy. It is able to show where changes in the cyclically-adjusted balance originate from: revenues or expenditures. With GDP as a common denominator, the relative impacts of changes in spending and revenues on the budget balance (i.e.: the so-called structural budgetary balance) can be determined. However, the CABB should not be used to determine the impact of fiscal policy on the economy or to interpret the intent of government policies.

2.3 Measuring the impact of fiscal policy on the economy

It is generally accepted that discretionary fiscal policy actions can have “Keynesian” effects in the short run. This occurs because changes in fiscal policy can directly affect aggregate demand through increased government spending and private consumption. In the longer term, output is affected by interest rates, exchange rates, labour allocation and investment decisions, which could work to offset the Keynesian effects on the economy.

Ricardian Equivalence, at the other end of the spectrum, postulates that deficit-financed tax cuts and/or increased government spending will have no important effects on consumption, capital accumulation or economic growth. The neutrality of government debt occurs because economic agents have sufficient foresight to realize that deficits today mean higher taxes tomorrow and will adjust their savings in such a way that national savings remains unchanged. Elmendorf and Mankiw (1998) provide a comprehensive literature survey of the macroeconomic impact of government debt on the economy from a conventional “Keynesian” view to the standpoint of Ricardian Equivalence. While empirical evidence is mixed concerning the existence of Ricardian Equivalence, the most widely-held view is that fiscal policy can have real affects on the economy in the short run.

Constructing an indictor to measure the impact of fiscal policy on economic growth is no new task. The OECD Monetary and Fiscal Policy Division (1978) identified four techniques that were in use by various OECD countries to estimate budget impact measures: 1) large-scale macro-econometric models, 2) weighted budget balances, 3) derivations from the full-employment balance and 4) a “mixed” approach that combines the impact of actual and/or discretionary changes. The study suggests a new indicator, the net real fiscal impulse, which weights real tax and expenditure flows. This indicator considers the first-round impact on the economy and is not intended to capture the longer-run multiplier effects. The overall impact is attained by summing the changes in real taxes and expenditures, multiplied by their respective weights, expressed as a per cent of the previous years' real GDP.

Feldstein (1982) uses instrumental variables estimation to test the impact of changes in government spending and taxation on aggregate demand. While limiting his analysis to the direct demand effects, Feldstein acknowledges that fiscal policy actions are partially offset indirectly by higher interest rates, reduced money supply balances and changes in portfolio composition in the general equilibrium. Using instrumental variable techniques, the author rejects the notion of Ricardian Equivalence, where government deficits have no impact on aggregate demand. Feldstein concludes that changes in government policies regarding taxation and expenditure can have a substantial impact on aggregate demand; however, monetary policy may limit the net effect on output.

Aschauer (1985) and Katsaitis (1987) examine the degree to which government spending on goods and services is a substitute for private consumption in the United States and Canada, respectively. Both studies find evidence that government spending is a poor substitute for private consumption, implying that an increase in government spending will tend to increase output nearly one-for-one.

Bernheim (1987) explores the theoretical underpinnings of Ricardian Equivalence and concludes that deficits could have large effects on current consumption. Reviewing several studies, the author finds that an additional dollar of deficit stimulates between 20 and 50 cents of current consumer spending. Bernheim uses these results to dispute the existence of Ricardian Equivalence.

Blanchard (1985) develops an index of fiscal policy impact whereby aggregate demand is affected by fiscal policy in three ways: the marginal propensity to consume out of debt (or wealth); the marginal propensity to consume out of labour income, which is determined by the present value of current and anticipated taxes; and directly through government spending. Blanchard (1990) develops another similar indicator in an attempt to answer the question, "What is the effect of fiscal policy on aggregate demand, while disregarding distortions induced by the tax/benefit system". However, the objective is to develop a *simple* indicator that does not rely upon forecasts, so he instead proposes three simple indicators of fiscal impact: 1) the inflation-adjusted deficit, 2) an "adjusted" deficit, defined as program spending plus debt charges minus the average of tax revenues for the current and following two years and 3) an indicator, while not developed in the paper, that could capture the effects of retirement programs on current consumption. Admitting that these measures are not as complete as the more complex index of fiscal policy impact, they do offer simplicity and ease of construction.

Following the work of Blanchard (1985), Chouraqui, Hagemann and Sartor (1990) construct two indexes to measure the impact of fiscal policy on the economy: one that assumes that individuals are myopic and another that allows for some consumer foresight. The authors also compute the deficit counterparts to the two indexes: the actual deficit and an adjusted deficit, which takes in to account potential future taxes, respectively. Overall, the results show that the indexes and deficit counterparts display similar patterns in an absolute sense; however, the myopic index and its deficit counterpart tend to overstate the impact of fiscal policy on the economy. This implies that expectations of future taxes can dampen the impact of fiscal policy.

Chand (1992) assesses the measure of fiscal impulse, which estimates the initial contribution of budgets to aggregate demand. Simply put, the fiscal impulse measure is considered expansionary when government spending increases by more than the increase in potential output multiplied by a base-year spending-to-potential output ratio or when revenue increases by less than the increase in actual output multiplied by a base-year revenue-to-output ratio. While appealing due to its simplicity, it places the same multiplier (unity) on revenues and expenditures.

Romer and Romer (1994) question the role of monetary and fiscal policy in ending the recessions that occurred in the United States since 1950. The authors measure the impact of fiscal policy on output using three methods: ordinary least squares (OLS), instrumental variables (IV) and Data Resources Incorporated (DRI) macroeconomic model. Overall, monetary policy provides the most important source of economic stimulus in the first year of recovery, followed by moderate stimulus from automatic fiscal stabilizers and weak stimulus from discretionary fiscal policies. The OLS results show that monetary policy, automatic fiscal stabilizers and discretionary fiscal policies contributed an additional 1.6, 0.6 and 0.3 percentage points, respectively, to GDP growth in the first year of recovery. This compares to 1.5, 0.9 and 0.5 percentage points, respectively, based on the DRI estimates. Due to large standard errors, the results from the IV estimation are considered to be unreliable. The authors attribute the limited role of discretionary actions in economic recovery to the fact that only small or temporary actions were taken, since Congressional approval could be circumvented or easily attained for smaller actions. Furthermore, most discretionary policies were implemented with the goal of increasing long-term growth during economically healthy periods and not with the goal of mitigating short-term fluctuations.

Blanchard and Perotti (1999) use a mixed structural VAR/event study to consider the economic impact of changes in government consumption and investment spending and taxes net of transfers. This study is an improvement over previous studies as it takes into account the contemporaneous relationship between tax, spending and output shocks. As expected, they find that a positive tax shock exerts a negative effect on output, whereas a positive expenditure shock increases output. Using a deterministic trend, a one-dollar increase in taxes net of transfers causes output to fall by an estimated 70 cents on impact, peaking with a multiplier of 0.78 in the fifth quarter after the initial shock. Conversely, a unit spending shock increases output on impact by 0.84, reaching a peak effect of 1.29 after fifteen quarters. The results are similar for stochastic trends. Furthermore, private consumption, investment, exports and imports all react negatively to a net tax increase, whereas for a spending increase, private consumption, exports and imports exhibit a positive correlation, while private investment exhibits a negative correlation.

Auerbach and Feenberg (2000) assess the effectiveness of federal taxes as automatic stabilizers in the United States between 1962 and 1995. Automatic stabilizers are measured in two steps: estimate the sensitivity of after-tax income to before-tax income and then estimate the sensitivity of consumption to changes in disposable income. Accordingly, the lower the sensitivity of after-tax income to changes in before-tax income increases the effectiveness of automatic stabilizers. Moreover, theory predicts that changes to disposable income would have a larger impact on consumption of middle- and lower-income earners who face liquidity constraints than of high-income earners as a result of a higher marginal propensity to consume at the lower income levels. The authors use individual tax returns from the NBER TAXSIM Model, which has the ability to calculate the tax impact of legislated tax changes. The authors conclude that tax-induced consumption offsets approximately 8 per cent of the initial shock to output and thereby provides some degree of automatic stabilization of aggregate demand.

James, Robidoux and Wong (2000) develop the Fiscal Conditions Index (FCI) to estimate the first-round impact of fiscal instruments on aggregate demand. The goal of this study is to propose an alternative to the use of the CABB as a proxy for the economic impact of fiscal policy, allowing for heterogeneous effects of different revenue and expenditure components on output. It also does not exclude the impact of the automatic stabilizers on output, as does the CABB. According to the FCI, a decline in taxes of 1.0 percentage point provides an additional 0.5 percentage point increase in output. Furthermore, an extra dollar of government spending provides an additional dollar of output. However, some of the multipliers are imposed rather than freely estimated and the estimated multipliers likely suffer from simultaneity bias.

This paper attempts to bridge the gap between the indicators of budgetary position and indicators of fiscal impact firstly by clarifying the appropriate role and interpretation of each indicator and secondly by employing a technique that captures the interaction between the budgetary components and business cycle. The FiPS methodology focuses upon the short-run, direct impacts of fiscal policy on aggregate demand[6], and is not able to infer any longer-run relationships between fiscal policy and output. The methodology is discussed in detail in the next section.

3. Model and Estimation

3.1 Background

The methodology employed in this paper consists of two equations: a fiscal equation (which is a set of equations represented by several budgetary components) and an output equation (which is actually an aggregate demand function). The fiscal and output equations are estimated simultaneously to capture the interaction between the fiscal and economic variables. Consider the following simple static model of the interaction between output relative to potential and the components of the government's budget balance;

6 Blanchard (1990) offers an insightful discussion on the distinction between impact effects, or the impact of fiscal policy given income, interest rates and exchange rates, and final, or general equilibrium, effects.

Fiscal equation:

$$\Delta x_t = \Delta\tilde{y}_t C + v_t \qquad v_t \sim (0, \Sigma) \qquad (3.1)$$

Output equation:

$$\Delta\tilde{y}_t = A'\Delta xt + B'\Delta zt + ut \qquad ut \sim (0, \sigma 2) \qquad (3.2)$$

where $\mathbf{x_t}$ is an n×1 vector of the components of the budget balance divided by potential output, $\tilde{y}_t$ is the output gap, $\mathbf{z_t}$ is an m×1 vector of strictly exogenous determinants of output growth and u_t is a random term that captures the effects of pure demand shocks. The n elements of $\mathbf{v_t}$ represent discretionary changes in the components of the budget balance relative to potential output that are strictly exogenous by assumption to the business cycle.

The elements of the n×1 vector **C** measure the responsiveness of the components of the budget balance to changes in output relative to potential. Those components of revenues (expenditures) with an automatic stabiliser component will have a positive (negative) correlation. This means that when output relative to potential increases, revenues will tend to increase and expenditures will tend to fall. Since some budgetary components do not vary with the business cycle, it is possible that some elements of **C** are equal to zero.

The elements of the n×1 vector **A** measure the responsiveness of output growth to the elements of the budget balance. We expect that output will decrease (increase) as revenues increase (decrease) or expenditures decrease (increase), since more resources are being withdrawn from (injected into) the economy. Therefore, we expect that the revenue components of **A** will have a negative coefficient, while the coefficients for the expenditure components will be positive. However, it is plausible that some of the elements of **A** may be indistinguishable from zero. We further expect that the expenditure coefficients will be larger, in absolute terms, than the revenue coefficients.

If the first k elements of $\mathbf{x_t}$ represent revenues and the remaining m-k elements represent expenditures, we can then define the change in the budget balance as:

$$\Delta BB_t \equiv \sum_{i=1}^{k} \Delta x_{i,t} - \sum_{j=k+1}^{m} \Delta x_{j,t} \qquad (3.3)$$

The change in the cyclically-adjusted budget balance is then defined simply as:

$$\Delta CABB_t \equiv \sum_{i=1}^{k} v_{i,t} - \sum_{j=k+1}^{m} v_{j,t} \qquad (3.4)$$

In the context of this model, the CABB is defined to be the component of the budget balance that is strictly exogenous to the output gap. As discussed below, however, this should not be taken to mean that it is uncorrelated with the output gap.

The difference between the budget balance and the CABB is simply the cyclical component of the budget balance, given as;

$$\Delta CBB_t = C^* \Delta \tilde{y}_t \quad \text{with} \quad C^* = \left(\sum_{i=1}^{k} c_i - \sum_{j=k+1}^{m} c_j \right) \qquad (3.5)$$

where c_i is the i^{th} component of C. The cyclical component literally measures the change in the budget balance that is due to movements in the output gap. This could stem from automatic stabilizers or a shift in policy that is in response to, or is at least correlated with, the business cycle. Thus, any attempt to actively conduct counter-cyclical fiscal policy will be included in this component of the budget balance.

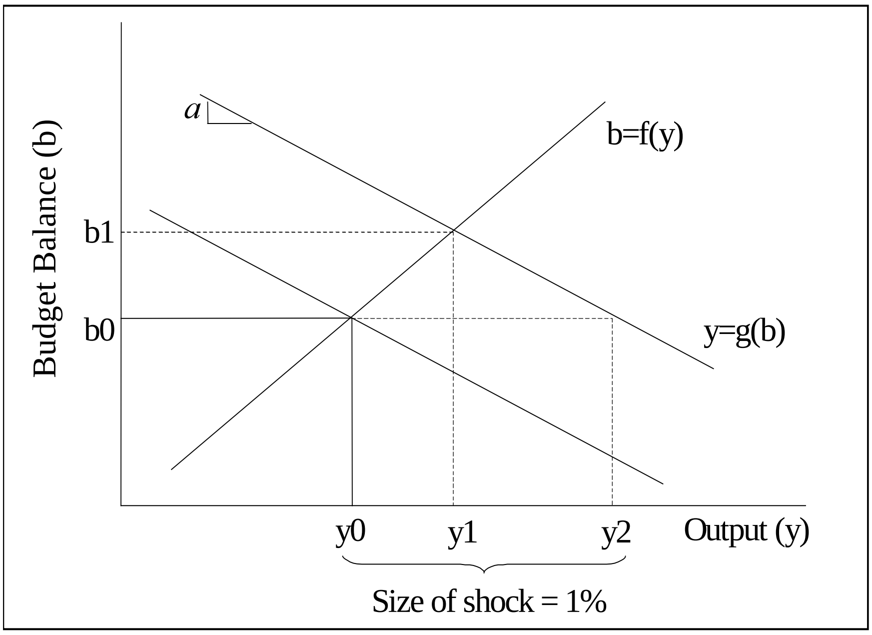
Equation 3.6 is simply the change in the indicator of fiscal impact (the FiPS), which measures the percentage point contribution of fiscal policy to output growth.

$$FiPS_t = A' \Delta x_t \qquad (3.6)$$

Here we have provided a simple model, whereby output growth relative to potential is determined by fiscal policy and a set of predetermined or strictly exogenous variables, such as the real interest rate, the real exchange rate and US output. However, the impact of a demand shock is complicated by the interaction between fiscal and economic variables. The following illustration maps out the effects of a unit shock to equation 3.2. We will assume, for the sake of simplicity, that each element of **A** equals a (Fig. 1).

Fig. 1

Effect of a demand shock on output and the budget balance



We begin in equilibrium at point {y0, b0}. The upward sloping function represents equation 3.1 (with slope equal to C*), whereas the negatively sloped function represents equation 3.2 (with slope a). A positive demand shock of 1 per cent, in the first instance, would raise output by one percent to y2. However, since the increase in income has the effect of raising tax revenues and lowering expenditures, the net impact on output is somewhat lower, at say, y1. Similarly, the net increase in the budget balance (point b0 to b1) is somewhat smaller than implied by the original shock because the balance improvement acts to lower output. The new equilibrium at {y1, b1} is a function of the relative slopes of the two functions. In the case of the preceding demand shock, a larger C* or smaller a reduces the impact of a demand shock on output.

In general, the reduced-form multipliers are given as:

$$\Delta\tilde{y}_t = \left(\frac{a}{1-aC^*}\right)\Delta CABB_t + \left(\frac{1}{1-aC^*}\right)u_t \qquad (3.7)$$

$$\Delta BB_t = \left(\frac{1}{1-aC^*}\right)\Delta CABB_t + \left(\frac{C}{1-aC^*}\right)u_t \qquad (3.8)$$

The principal distinction between $\mathbf{x_t}$ and $\mathbf{z_t}$ is that $\mathbf{x_t}$ is assumed to be endogenous to $\tilde{y}_t$ in our model, unlike $\mathbf{z_t}$, which is exogenous. This stems from the fact that output and the elements of the budget balance are assumed contemporaneously related in equations 3.1 and 3.2 (and $\sigma^2 \neq 0$). This assumption is predicated on the fact that the relationship between output and the budget balance is at least partly one of accounting, whereby the national accounts output identity includes government expenditures. Furthermore, personal income tax revenues at a given point in time are, for the most part, a function of personal income at that point in time.

This illustrates an important difference between fiscal policy and, for instance, monetary policy, which is generally assumed to affect output with a lag. The real interest rate typically enters a demand function with several lags, particularly at a quarterly frequency or higher. This distinction considerably complicates the task of estimating either equation 3.1 or 3.2. To see why, consider again equations 3.7 and 3.8. Equation 3.8 posits a linear relationship between (the change in) the budget balance, the two structural shocks and the two structural parameters. Thus movements in the budget balance and demand shocks are correlated. Similarly, equation 3.7 indicates that output growth is correlated with movements in the CABB. These correlations invalidate OLS estimates of **A** and **C** since OLS assumes that the regressors and the residual are orthogonal, and therefore, OLS imposes a correlation of zero between the regressors and the residual.

More intuitively, consider the interpretation of the coefficient in an OLS regression of the output gap on the budget balance (divided by potential). This coefficient measures the amount by which the output gap changes when the budget balance changes. However, this depends strongly on whether the underlying source of budget balance movement is a demand shock or a shock to the CABB. In the former case, the coefficient is positive, while in the latter it is negative.

In practice, the estimated reduced-form parameter will be a weighted-average of the two structural parameters. The relative weights will depend on the relative average magnitudes of the shocks (i.e.: σ^2, Σ). However, since the theoretical values of the elements of **A** and **C** always have the opposite sign, the OLS estimates of **A** and **C** will invariably be biased towards zero. Consequently, the size of the cyclical component of the budget balance and the fiscal component of output would be underestimated using OLS. It is worth noting that this problem exists independent of sample size. Thus, OLS is not only biased under these circumstances, it is inconsistent.[7]

3.2 Proposed Estimation Approach

This research project is innovative in the way Generalized Method of Moments (GMM) estimation is used to identify the fiscal and output equations and to provide consistent estimates of the coefficients in equations 3.1 and 3.2. Previous studies have employed instrumental variables estimation to eliminate the problem of inconsistency associated with OLS. As such, this section reviews instrumental variables, provides background information for those not familiar with GMM estimation and explains the motivation of GMM for this work.

An instrument is a variable that is uncorrelated with the error term, but correlated with the variable that is correlated with the error term (known as the endogenous regressor). For instance, in order to identify a in the previous example, we need a variable that causes shifts in the budget balance function that is also uncorrelated with demand shocks. Given shifts in f(y) and the resulting equilibrium levels of y and b, holding the output curve fixed, we could trace the output curve and obtain a consistent estimate of a. In this simple model, the only valid instrument is the CABB. However, knowledge of C* is required to calculate the (unobserved) CABB. Of course, identifying C* introduces precisely the same problem as identifying a.

One set of variables that fulfil these two requirements in terms of output is $\mathbf{z}_t$. The elements of $\mathbf{z}_t$ are clearly correlated with output through equation 3.2, but will not, in general, be correlated with movements in the

[7] As the sample size approach infinity, the distribution of a *consistently* estimated parameter converges to a point equal to the true value.

CABB. Consequently, it is possible to consistently estimate the n elements of **C**. Equation 3.1 can, in fact, be regarded as a system of n equations, each containing one unknown coefficient. Thus, a necessary condition for identification is the existence of at least one predetermined or strictly exogenous variable in the output function, that is m>0, but generally m>1. Thus an interesting question arises: since each variable in $\mathbf{z}_t$ represents a valid instrument, in that it will yield a consistent estimate of C, which variable should be used? In finite samples, the estimate of **C**, denoted $\tilde{\mathbf{C}}$, will depend on which instrument is selected. For instance, using US output growth as the instrument will, in general, yield a different $\tilde{\mathbf{C}}$ than real interest rates or the real exchange rate. In fact, the demand function from the NAOMI model, as described in Murchison (2001), yields up to 10 possible instruments, including lags. Ideally, one would like to somehow incorporate the information from all m instruments in the estimation of $\tilde{\mathbf{C}}$. Incorporating this entire set of information in the most efficient way possible is a fundamental principal underlying the Generalized Method of Moments (GMM) (see Hansen, 1982).

In order to explain what GMM really means, it is instructive to return to the definition of what defines an instrument. In order to be valid, an instrument for the output function cannot be correlated with demand shocks (the error term), otherwise the estimated coefficient will reflect both the effect of the independent variable on output (the desired component) and the effect of demand shocks (the bias). If the instrument is assumed valid, this information can be used to actually estimate the parameter of interest. Stated otherwise, one can choose the coefficient in the output function so as to minimise the resulting sample correlation between the instrument and the error term. Theory often suggests certain population "moment conditions"; the most notable being expectations models, whereby the assumption of rationality implies orthogonality between agents' information sets and expectational errors. GMM uses these population moment conditions to identify the parameters of the model. Moreover, the resulting parameters are consistent regardless of the distribution of the error term and regardless of whether those errors are serially correlated or heteroskedastic.

Having more instruments than parameters amounts to having more moment conditions than parameters in the GMM framework since each instrument implies exactly one moment condition. In order to address the question of what to do with this 'extra' information, it is instructive to revisit the second requirement of an instrument: i.e. it must be correlated with the endogenous regressor. In fact, a higher correlation with that variable implies a more efficient, and thus better, instrument. Therefore, a higher correlation produces a more precisely estimated parameter (a lower variance).

In this instance, there is one parameter per equation and m instruments. Instead of choosing the instrument with the highest correlation with the output gap, GMM constructs a (linear) combination of the m instruments that maximises this correlation and uses this composite instrument. In fact, in the context of a single equation model with spherical errors, it corresponds to two-stage least squares (2SLS). This illustrates another interesting point: many common estimators including instrumental variable regression (IV), non-linear IV, 2SLS, 3SLS and even OLS can simply be regarded as special cases of GMM. For instance, the OLS moment conditions require zero correlation between the regressors and the error term. Minimising the sum of squared residuals is equivalent to setting these sample correlations to zero.

Using GMM in conjunction with the set of instruments $\mathbf{z}_t$ will yield consistent and (asymptotically) efficient estimates of $\mathbf{C}$, which can then be used to solve for $\mathbf{v}_t$, the elements of the CABB. These components have the properties of being correlated with the corresponding components of the actual budget balance $\mathbf{x}_t$, but uncorrelated with u_t.

Hence the components of the CABB are suitable as instruments in equation 3.2, the output function. Thus, using this two-stage approach, it is possible to identify both the indicator of budgetary position (CABB) and the indicator of fiscal policy impact (FiPS). Indeed it possible to set this up as a particular GMM problem, whereby a subset of the instruments is a function of the estimated parameters, thereby solving for both simultaneously. Finally, it is also possible to construct an asymptotically valid measure of the uncertainty surrounding the CABB and FCI. This uncertainty stems directly from the uncertainty associated with the GMM parameter estimates (i.e. the parameter covariance matrix).

4. Constructing and Estimating the Model

In this section, we use quarterly National Income and Expenditure Accounts data from 1973Q1 to 2001Q2 to estimate the system of fiscal equations (equation 3.1) and construct the cyclical and cyclically-adjusted budget balances using the GMM approach (referred to as the FiPS-based estimates). We consider only primary balances, which exclude interest income and debt charges, in this analysis to adjust for changes in the budgetary balance induced by changes in interest rates. Next, we estimate the same fiscal equations individually using OLS estimation, which are then compared to the results from the GMM estimation. We find that the cyclical component under the GMM methodology is more than twice as large as that OLS methodology, thereby lending support to the assertion of simultaneity bias inherent in the OLS parameter estimates. Lastly, we present the estimation results from the FiPS indicator and compare them to the multipliers obtained from an OLS estimation of the output equation.

4.1 Cyclical and Cyclically-Adjusted Budget Balances

We begin by decomposing the budgetary balance into its various revenue and expenditure components following the convention of the National Income and Expenditure Accounts and arrive at a model consisting of nine categories of revenues and expenditures (Table 1). As Mackenzie (1989) points out, the decomposition of revenue and expenditure components may be important if multipliers are sufficiently different from each other and if the composition of revenue and expenditure components differs substantially from year to year. Moreover, even if the weights for the various revenue and expenditures are similar, they may not move in tandem with economic fluctuations. For this reason, we start with a relatively disaggregated model, and after a series of hypothesis tests, we accept a more aggregated model.

We begin by running a model that includes all nine budgetary components and use Hansen's D-statistic[8] to test the restrictions imposed on the fiscal equations. The D-statistic compares the criterion functions of the restricted and unrestricted regressions, similar to an LM test statistic, using the chi-squared distribution with the degrees of freedom equal to the number of restrictions. As the difference between the restricted and unrestricted models widens, it is less likely that the restrictions are valid. Therefore, a test statistic larger than the critical value would lead to a rejection of the null hypothesis that the restrictions are valid.

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8 See Newey and West (1987).

Table 1

Variable mnemonics and definitions

Mnemonic	Definition
PIT	Personal income taxes plus non-residents' withholding tax
CIT	Corporate income taxes
IND	All indirect taxes, excluding property taxes.
OREV	Other revenues comprised of natural resource revenues, transfers from persons and profits of government business enterprises
WAGE	Government spending on wages, including military
NWGS	Government spending on non-wage goods and services, net of proceeds from the sale of goods and services
SUB	Government subsidies to businesses
TOTR	Transfers to persons, net of contributions to Employment Insurance, Workers' Compensation Board, Canada Pension Plan and Quebec Pension Plan
OEXP	All other expenditures, mainly comprised of gross capital formation and military goods and services

For the fiscal equation, we first test the restriction that WAGE and SUB are equal to OEXP, given that there is relatively weak evidence suggesting that the coefficients are statistically significant from zero. Given that the test statistic is 0.58 against a critical value of $\chi^2(2) = 5.991$ at the 5 per cent level of significance, we cannot reject the null hypothesis that the restrictions are valid. We next test the joint restrictions that CIT is equal to IND and that WAGE and SUB are equal to OEXP. Given a test statistic of 0.80 against a critical value of $\chi^2(3) = 7.815$ at the 5 per cent significance level, we again fail to reject the null hypothesis that the restrictions are valid.

Next, we impose the restrictions on the fiscal equations and re-estimate the resulting six-variable model, whereby β_i represents the effect of the business cycle on the fiscal variables, $\tilde{y}_t$ is the output gap and ν_{it} is the cyclically-adjusted component. Here, TAX is the combination of corporate and indirect taxes and GOV represents the sum of spending on wages and salaries, subsidies to businesses and other expenditures. As we are ultimately interested in isolating the effect of the business cycle on these components, the budgetary components are expressed a proportion of potential output. We also take first differences to eliminate drifts from some of the fiscal ratios and ensure consistency between the fiscal and output equations. These transformations yield the following set of equations (expressed in matrix form):

$$\Delta\begin{bmatrix} pit/y^p \\ tax/y^p \\ orev/y^p \\ nwgs/y^p \\ gov/y^p \\ totr/y^p \end{bmatrix} = \Delta\tilde{y}_t\begin{bmatrix} \beta_1 \\ \beta_3 \\ \beta_3 \\ \beta_4 \\ \beta_5 \\ \beta_6 \end{bmatrix} + \Delta_t\begin{bmatrix} \nu_1 \\ \nu_2 \\ \nu_3 \\ \nu_4 \\ \nu_5 \\ \nu_6 \end{bmatrix}; \qquad v_i = \Delta\left[\frac{e_{it}}{y^p}\right] \tag{4.1}$$

Looking at the GMM estimates, we find that for every one-dollar increase in output, the budgetary balance improves by 85 cents (Table 2). As expected, revenues exhibit a positive correlation with the output gap, while expenditures exhibit a negative correlation.

For a positive economic shock, most of the improvement in the budgetary balance stems from the revenue side. The fact that revenues vary with the business cycle to a larger extent than expenditures is not surprising since government expenditures are largely discretionary in nature, and are therefore, not as highly correlated with the state of the economy. Overall, revenues have a combined GMM estimated coefficient of 0.53, implying an average elasticity of the fiscal variables with respect to output of about 1.7. This suggests that the revenue share of output is pro-cyclical, stemming almost entirely from personal and corporate income and indirect taxes.

Personal income taxes have a coefficient of 0.20 and an estimated elasticity of 1.65. An elasticity of greater than unity is due largely to the progressivity of the tax system and the only partial inflation indexation from the latter half of the 1980s to the close of the 1990s. With the

Table 2

Model estimates of the fiscal equations

	GMM			OLS		
	Coefficient	Elasticity	t-statistic	Coefficient	Elasticity	t-statistic
β_1 (pit)	0.20	1.65	2.80	0.06	0.46	0.79
β_2 (tax)	0.27	2.03	4.18	0.20	1.51	4.22
β_3 (orev)	0.06	1.07	2.47	0.04	0.68	1.91
β_4 (nwgs)	–0.06	–0.95	–2.65	0.00	–0.07	–0.19
β_5 (gov)	–0.14	–0.86	–1.85	–0.06	–0.35	–0.86
β_6 (totr)	–0.12	–1.94	–4.34	–0.06	–1.01	–2.31
	0.85			0.31		

reintroduction of full inflation indexation beginning with the 2001 taxation year in most Canadian jurisdictions, the elasticity is expected to be lower in future years.

The coefficient on corporate income and indirect taxes (TAX) is slightly larger than that of personal income taxes, implying that corporate income and indirect taxes are more cyclically sensitive than personal income taxes. In addition, the high elasticity indicates that these taxes are highly pro-cyclical.

Other revenues exhibit only a weak cyclical component. This is not surprising given that this revenue component is mainly composed of natural resource revenues and property taxes. Prices for natural resources are determined on the world market and do not necessarily fluctuate with Canada's business cycle.

As implied by a combined GMM coefficient of –0.32, government expenditures have historically behaved counter-cyclically in Canada. Most government spending components exhibit only a weak cyclical component, reflecting the fact that most government spending is largely discretionary. We would expect to see a significant cyclical component for transfers to persons, which include employment insurance benefits and social assistance, as they are more closely tied to the state of the economy.

In the preceding section, we argued that if the simultaneity between output and the budget balance were ignored, the coefficient estimates would be biased toward zero. In order to get an idea of the magnitude of this bias we reestimate the FiPS model using OLS.[9] Both the GMM and OLS estimates suggest that the budget balance has a counter-cyclical component: revenues are positively correlated with the output gap, whereas expenditures are negatively correlated. Although this is true for both the GMM and OLS estimates, the absolute size and statistical significance[10] of each coefficient is larger using GMM, particularly for personal income tax revenues and all government expenditures. Thus, the direction of the simultaneous equation bias is consistent in every case with that predicted in the previous section.

Moreover, the GMM estimate of the budgetary balance multiplier, 0.85, is more than double that of the OLS multipliers. Consequently, the GMM-based cyclical component of the budget balance is, at any point in time, double that under the OLS model. This would suggest, for instance, that the responsiveness of automatic stabilizers to the business cycle have previously been underestimated by a considerable amount.

Our estimate of an 85-cent improvement in the primary balance for a one-dollar increase in output is high by most standards, which estimate a budgetary improvement closer to 50 per cent of the size of the output shock.[11] If, in our measurement of the cyclical component, we only adjust personal and corporate income taxes, indirect taxes and transfers to persons (more consistent with other standard measures), the automatic stabilizers would cause an improvement of 60 per cent of the size of the output shock, rather than 85 per cent. Not only is this measure more consistent with the standard measures, it continues to support the assertion that when the issue of simultaneity between fiscal and economic variables is not addressed, the estimate of the cyclical component is biased toward zero.

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9 Technically, we use SUR on the fiscal equations.

10 While t-values have been included it should be noted that they are only asymptotically valid.

11 Across 20 OECD countries, van den Noord (2000) found that, on average, net lending changes by 0.52 per cent for a 1 per cent change in GDP, with a low of 0.37 in Ireland and a high of 0.76 in Sweden. Mélitz (2000) estimated the response of fiscal policy to the business cycle to be in the range of 0.31 to 0.37.

4.2 The Output Equation Specification

Turning now to the output equation, the baseline aggregate demand function is taken from the NAOMI model, a small reduced-form model of the Canadian economy (see Murchison, 2001). Output growth in NAOMI is determined primarily by some exogenous economic variables, $\mathbf{z_t}$, such as potential output growth (Δly^{p}), U.S. output growth (Δly^{US}) and the change in the slope of the yield curve ($\Delta slope$). A somewhat smaller role is played by the (change in the) real exchange rate (Δlz) and real non-energy commodity prices ($\Delta lpcne$). Formally, the equation can be written in terms of the change in the output gap:

$$\Delta\tilde{y} = \alpha_1 \Delta\tilde{y}_{-1} + \alpha_2\left(\Delta ly^{US} - \Delta ly^{p}\right) + \alpha_3 \sum_{i=3}^{4} \frac{\Delta slope_{-i}}{2} + $$

$$+ \alpha_4 \sum_{i=3}^{4} \frac{\Delta lz_{-i}}{2} + \alpha_5 \sum_{i=3}^{6} \frac{\Delta lpcne_{-i}}{4} \qquad (4.2)$$

or in terms of output growth as:

$$\Delta ly = \alpha_2 \Delta ly^{US} + (1-\alpha_2)\Delta ly^{p} + \alpha_1\left(\Delta ly_{-1} - \Delta ly_{-1}{}^{p}\right) +$$

$$+ \alpha_3 \sum_{i=3}^{4} \frac{\Delta slope_{-i}}{2} + \alpha_4 \sum_{i=3}^{4} \frac{\Delta lz_{-i}}{2} + \alpha_5 \sum_{i=3}^{6} \frac{\Delta lpcne_{-i}}{4} \qquad (4.3)$$

NAOMI's output function can be written in terms of output growth that includes a single lag of the dependent variable. As such, the long-run impact of a shock to fiscal policy will be larger than the immediate or contemporaneous impact. For the purposes of this paper, we will refer to this as a multiplier effect. It is not clear exactly what the lagged variable is picking up. It could, for instance, be a proxy for one or more omitted variables. On the other hand it could represent an approximation to a longer partial-adjustment process in one or more of the explanatory variables or a *Leontief* output multiplier.

Since the fiscal variables enter into the output function contemporaneously and given the relatively small sample size (about 110 observations), a single lagged dependent variable may simply represent a parsimonious approximation to a longer distributed lag representation in each fiscal variable. Nevertheless, the approximation is likely crude since the specification imposes the same adjustment process for every argument in the demand function. Furthermore, since there is no notion of stock equilibria in this model whatsoever, discussions of the long run impacts are somewhat inappropriate. It should also be noted that the estimated multiplier is biased down in finite samples due to its correlation with lagged residuals.[12] While we report the results of the long-run fiscal multiplier, caution is warranted in both its structural interpretation and the precision with which it has been estimated.

The value of the lagged dependent variable in NAOMI's output function, α_1, is 0.39 when written in terms of equation 4.2. Consequently, the long-run multiplier is $1/(1 - \alpha_1) = 1.64$. Since the value of α_1 is quite low, much of the adjustment takes place within a short period of time. For instance, the multiplier after one year is about 1.60. Our aim is to use a fairly traditional demand specification thereby reducing the possibility of contaminating the results of interest with model misspecification.

In order to complete the model, it is necessary to augment equation 4.3 with the fiscal variables, which are also divided by potential output and first differenced. We estimate equation 4.4, where $f(Z)_t$ represents the exogenous economic determinants listed previously and x/y^p represents components of the budgetary balance expressed as a proportion of potential output.

$$\tilde{y}_t = \delta_1 \tilde{y}_{t-1} + \delta_1 \tilde{y}_{t-2} + f(Z)_t + [a_1\ a_2\ a_3]\ \Delta[x/y^p]_t + u_t \qquad (4.4)$$

Note that this specification assumes that fiscal policy does not affect potential output. Given that potential output is exogenous in NAOMI, this restriction represents a simplifying assumption. To the extent that tax rates affect long-run labour supply or the share of government spending affects the capital stock, our model represents only an approximation of the true interaction between fiscal policy and output.

Equation 4.4 forms the output equation that is estimated using quarterly data from 1973Q1 to 2001Q2. Five specifications are tested, with the results are shown in Table 3. We again employed Hansen's D-statistic to test the different specifications for the output equation. The first specification includes all nine fiscal variables separately, and hence, this is

[12] However, this downward bias should be small given that estimated value is considerably less than one. It is well known that the bias is an increasing function of the true root.

Table 3

Output equation specifications

Variable	(1)	(2)	(3)	(4)	(5)
$\Delta \tilde{y}_{-1}$	1.39	1.28	1.27	1.40	1.38
	(10.41)	(12.94)	(13.06)	(14.90)	(14.07)
$\Delta \tilde{y}_{-2}$	–0.39	–0.28	–0.27	–0.39	–0.37
	(–2.93)	(–2.79)	(–2.74)	(–4.08)	(–3.80)
Δly^{US}–	0.68	0.64	0.62	0.57	0.60
Δly^{P}	(6.30)	(6.95)	(7.02)	(6.89)	(6.97)
Δslope	–0.32	–0.33	–0.33	–0.36	–0.36
	(–2.30)	(–2.72)	(–2.76)	(–3.02)	(–2.86)
Δlz	0.15	0.13	0.13	0.14	0.17
	(2.94)	(3.15)	(3.21)	(3.30)	(3.64)
Δlpcne	0.11	0.10	0.10	0.10	0.11
	(3.31)	(3.43)	(3.54)	(3.75)	(3.87)
PIT	–0.39	–0.35			
	(–2.77)	(–2.83)	–0.36		
CIT	–0.67	–0.62	(–2.98)		
	(–1.85)	(–2.06)		–0.30	–0.36
IND	–0.19	-	-	(–2.99)	(–3.28)
	(–0.71)				
OREV	–0.56	-	-		
	(–1.15)				
NWGS	0.78	0.76	0.80		
	(2.02)	(2.27)	(2.48)		
WAGE	0.29	-	-		0.53
	(0.82)			0.22	(2.67)
SUB	0.68	0.55	0.49	(2.20)	
	(1.64)	(1.75)	(1.65)		
OEXP	0.06	-	-		-
	(0.44)				
TOTR[1]	1.41	1.00	1.00	1.00	1.00
	(3.69)				

Note: t-statistics in brackets.
(1) In all specifications, the unrestricted multiplier is greater than, but not statistically different from 1.

the unrestricted model against which the other specifications are tested. Interestingly, the exogenous economic determinants are largely invariant to the specification chosen. From this regression, we find that IND, OREV, WAGE and OEXP are not significantly different from zero and TOTR is not significantly different from 1.0. Not all revenues impact aggregate demand to the same degree. Only PIT and CIT are significant at the 10 per cent level, and surprisingly, the coefficient on CIT would imply that investment is more sensitive than consumption. While this is a peculiar result, plotting the coefficient on CIT over time shows that it is quite unstable, which renders the point estimate less reliable.[13] In the short term, we would expect that individuals could change their consumption patterns in response to a personal income tax cut faster than businesses could change their investment plans in response to a corporate income tax cut. For this reason, we would expect that a change in personal income taxes would have a larger impact on the economy than a change in corporate income taxes in the short run.

On the expenditure side, spending on transfers to persons and non-wage goods and services adds more stimulus to the economy than any other category of government spending. Although government spending enters the aggregate demand equation directly, its impact on aggregate demand can be less than one if it is offset by lower private consumption, investment or net exports. Although the coefficient on transfers to persons is greater than one, it is not found to be statistically different from one. The results further show that wages have no significant impact on the economy. This could be the case if government employment is a substitute for private sector employment and therefore, government spending on wages could increase without any additional stimulus to the economy. However, this is not a full explanation as government spending on wages enters the aggregate demand function directly.

Interestingly, other expenditures, which include capital, non-wage defence spending and transfers to non-residents, are also not statistically significant.

In the second regression, we impose several restrictions setting IND, OREV, WAGE and OEXP to zero and TOTR to 1.0, and re-estimate. Obtaining a D-statistic of 1.63, we fail to reject the null hypothesis that the

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13 For instance, when the start of the sample is arbitrarily set to after the 1981-1982 recession, we find that the coefficient on corporate income taxes is near zero.

restrictions are valid against a critical value of $\chi^2(4) = 9.488$ at the 5 per cent level of significance. It is interesting to note that most of the coefficients on the variables, except SUB, remain largely invariant to the change in the specification.

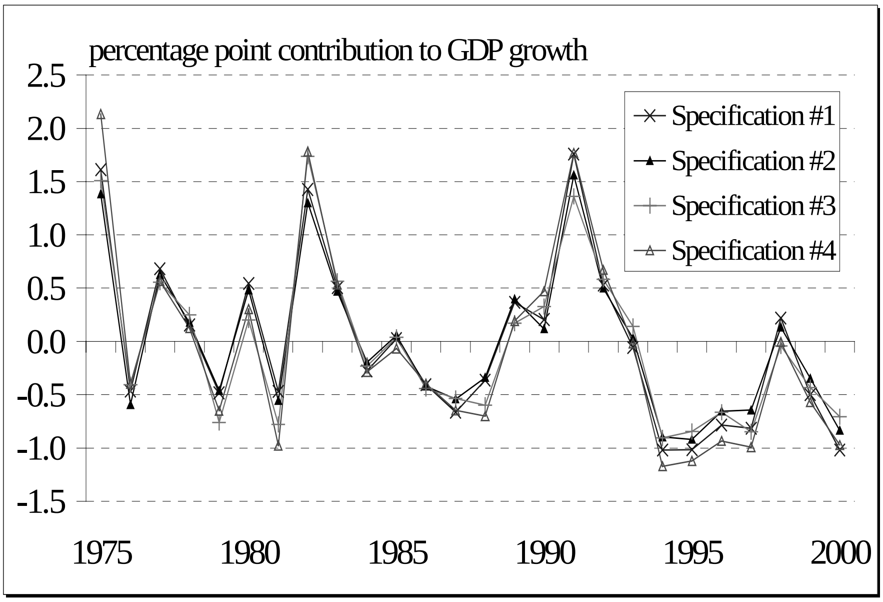
The third regression is the same as the second specification, except CIT is restricted to equal PIT. This restriction is tested because despite the fact that CIT is statistically significant, it has a relatively large standard error and a rather unstable coefficient. It is interesting to note that the joint coefficient on PIT and CIT is similar to the one for PIT alone. Again using the D-statistic, the null hypothesis that the restrictions are true cannot be rejected at the five per cent level of significance.

It is possible that some of the odd findings or lack of statistical significance may result of noisy data. We test the restriction that all revenues share the same multiplier and that all expenditures, except TOTR, exert the same impulse on output. The results are summarized in the fourth estimation. Again, with a D-statistic of 4.66, we cannot reject that the restrictions are valid, given a critical value of $\chi^2(6) = 12.59$ at a 5 per cent level of significance. Surprisingly, this specification implies that a reduction in revenues would have a larger stimulative impact on the economy than an increase in expenditures. Also of interest, adding IND and OREV does not change the multiplier on joint PIT/CIT variable. Even though these restrictions cannot be rejected at the 5 per cent level of significance, these results are puzzling and are somewhat the opposite of what is expected.

Finally, the last specification shows that the deterioration in the stimulus provided by expenditures is attributable to the OEXP variable, which is mainly comprised of spending on gross capital formation, non-wage defence and transfers to non-residents. Excluding this category from total expenditures results in a multiplier of 0.53, higher than that of revenues in absolute terms. These restrictions (PIT, CIT, IND and OREV have the same multiplier; NWGS, WAGE and SUB have the same multiplier and OEXP is zero) cannot be rejected at a 10-per cent level of significance. Irrespective of which specification is chosen, the resulting FiPS indicators are roughly similar (Figure 2).

Fig. 2

Comparison of FiPS indicators



4.3 *Results of the Indicator of Fiscal Policy Impact on the economy*

For illustration purposes, we compare the results from specification #3 to the OLS estimated coefficients and observe an even greater difference between the GMM and OLS estimated coefficients (Table 4). All three OLS estimated multipliers $\{\alpha_1 \quad \alpha_2 \quad \alpha_3\}$ are close to zero and none is significantly different from zero, suggesting substantial simultaneity bias.

The GMM estimates show that the marginal propensity to consume out of a personal income tax cut is roughly one-third, suggesting that a considerable proportion of such a tax cut is saved. This could be interpreted as suggesting that Canadians are at least partly Ricardian in their savings behaviour.

Table 4

Model estimates of the output equation

	GMM			OLS		
	Multiplier	Elasticity	t-statistic	Multiplier	Elasticity	t-statistic
α_1 (pit/cit)	–0.36	–0.06	–2.98	0.00	0.00	0.00
α_2 (nwgs)	0.80	0.05	2.48	0.31	0.02	1.02
α_3 (sub)	0.49	0.01	1.65	0.21	0.00	0.74
(totr)	1.00	0.09	-	0.20	0.02	0.67

With the GMM estimation, all revenues other than personal and corporate income tax were not found to be significantly different from zero. This implies that a reduction in indirect taxes[14] or other revenues have no short-term affect on output through the demand channel. While this result is difficult to explain, indirect taxes and other revenues show multipliers of about –0.19 and –0.56, respectively; however, the standard errors are of almost the same magnitude.

Turning to the expenditure side, the baseline GMM model suggests a high degree of substitutability for spending on items other than non-wage goods and services and transfers to persons. Specifically, a one-dollar increase in non-wage goods and services and business subsidies causes private consumption and investment to fall by 20 and 51 cents, respectively.

The GMM model finds evidence to suggest that the marginal propensity to consume out of transfers is about 1.0. While our point estimate is 1.4, 1.0 is less than one standard deviation from the point estimate. Moreover, restricting the coefficient to unity only changes the other coefficients by a small amount at the second decimal place.

[14] Retail sales taxes were isolated from indirect taxes, but were not found to be significantly different from zero.

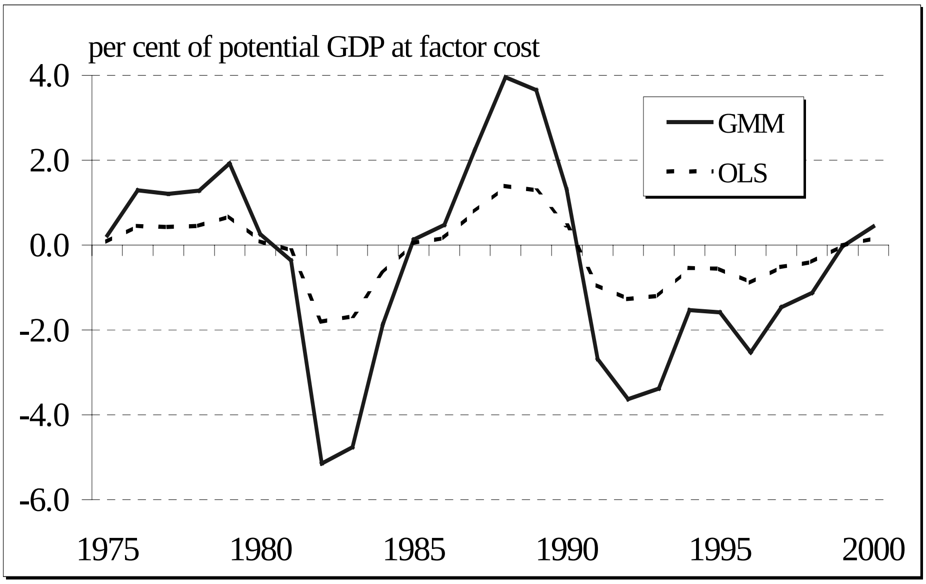
As expected, the multipliers from the OLS estimation are much smaller in absolute terms than the corresponding GMM estimates, illustrating the impact of the simultaneity bias.

5. Implications for the indicators

In comparing the GMM- and OLS-based measures of the cyclical and cyclically-adjusted balances, we find that for most years, the two indicators move in the same direction. However, the indicators diverge in years when the output gap is large. This is not surprising because when the output gap is near zero, actual output is almost equal to potential output and therefore, the cyclical component is near zero. Since it is the cyclical component that we are measuring, both models will show similar and small cyclical components. In years when the output gap is large, the cyclical component will be larger and deviations between the two models will emerge.

Fig. 3

Comparison of cyclical components

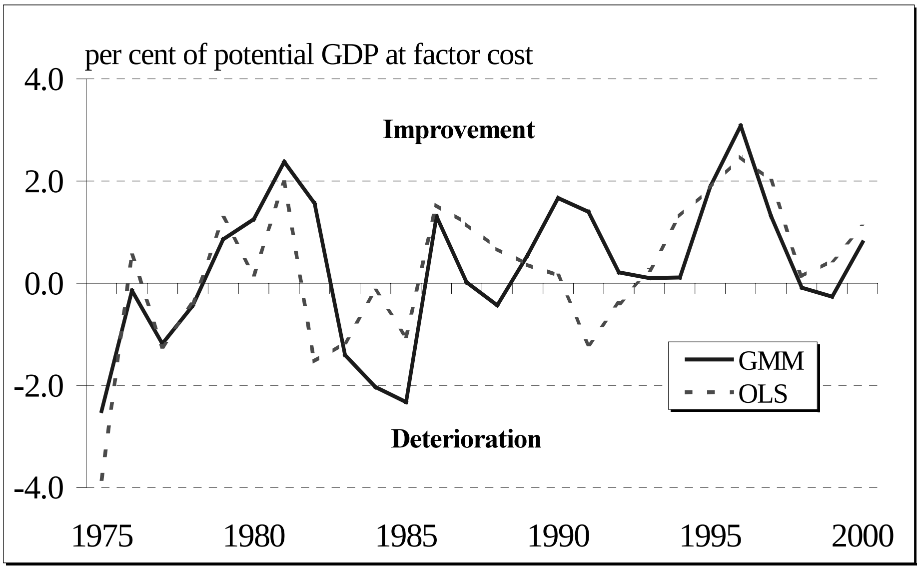


Our results support the assertion that the coefficients of the OLS estimation are biased towards zero. In every year, the cyclical component is closer to zero under the OLS-based methodology than the GMM methodology (Fig. 3).

The fact that the cyclical component is systematically larger in absolute terms under the GMM methodology than the OLS estimation sometimes causes the two measurements of the primary CABB to be of opposite signs. For instance, when the output gap is greater than zero, the cyclical component will also be greater than zero. A larger positive cyclical component implies a larger negative (smaller positive) cyclically-adjusted balance when the actual balance is negative (positive). Conversely, when the output gap is less than zero, the cyclical component is a larger negative under the GMM estimation. A larger negative cyclical balance implies a smaller negative (larger positive) cyclically-adjusted balance when the actual balance is negative (positive). This explains the divergences when comparing the year-over-year change in the primary CABB (Fig. 4).

Fig. 4

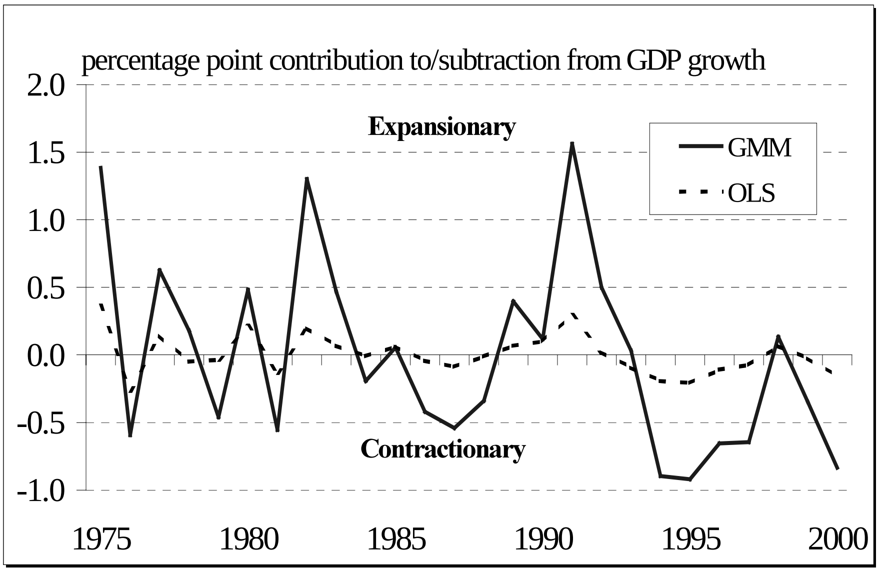
Comparison of year-over-year change in the primary CABB



In terms of the Indicator of Fiscal Policy Stance, we find that the estimate based on the OLS estimation is substantially more muted than the Comparing the GMM and OLS estimates, we, not surprisingly, find that the two indicators are similar; however, there are wide divergences when the change in the output gap is larger, such as in the early- to mid-Eighties and early-Nineties.

Fig. 5

Comparison of the FiPS indicators



GMM-based estimate, providing further evidence that the OLS coefficients were indeed biased towards zero (Fig. 5). In fact, the OLS estimate produces an indicator that appears largely neutral in most years. This is expected since the coefficients from the OLS estimation are much closer to zero.

6. Constructing confidence intervals

So far we have argued that our measure of the impact of fiscal policy and structural budget balance are unique in that they take seriously the issue of simultaneity between output and fiscal policy. As with any statistical model, however, the point estimates are really only half the story. While our methodology yields estimates of the parameters of interest that are consistent, they remain subject to sampling error. Consequently, it is somewhat misleading to discuss results based on the point estimates only while ignoring this potentially influential additional piece of information.

Alesina and Perotti (1995) calculate the degree of fiscal adjustment, whereby fiscal policy is considered to have a neutral impact on the budget if the adjustment (negative or positive) is within one-half a standard deviation away from the mean adjustment. A small fiscal adjustment is between one-half and one standard deviation away from the mean. A strong fiscal adjustment is defined as an adjustment that is larger than one standard deviation away from the mean. However, a true confidence band will vary significantly in size through time depending on the relative magnitudes of the components of the budget balance. In general, the size of the confidence band will tend to be smaller when the budget balance is close to neutral and larger when it is large in absolute value, but this need not be the case.[15]

By using the estimated parameter covariance from the GMM estimation, it is possible to construct asymptotically valid confidence intervals, both over history and the forecast periods. These confidence intervals can then be used to determine whether the government's fiscal stance is statistically distinguishable from neutral. For example, where the confidence intervals encompass zero, fluctuations in output have no significant impact on the budgetary balance (Fig. 6).

The same conclusion can be reached for the confidence bands surrounding the FiPS. For most years the confidence intervals would imply mainly neutral policy (Fig. 7). The exceptions are years surrounding recessions, such as 1982 and 1991, where policy has been stimulative. In contrast, policy was contractionary for some years during the period of fiscal consolidation (1994 to 1997).

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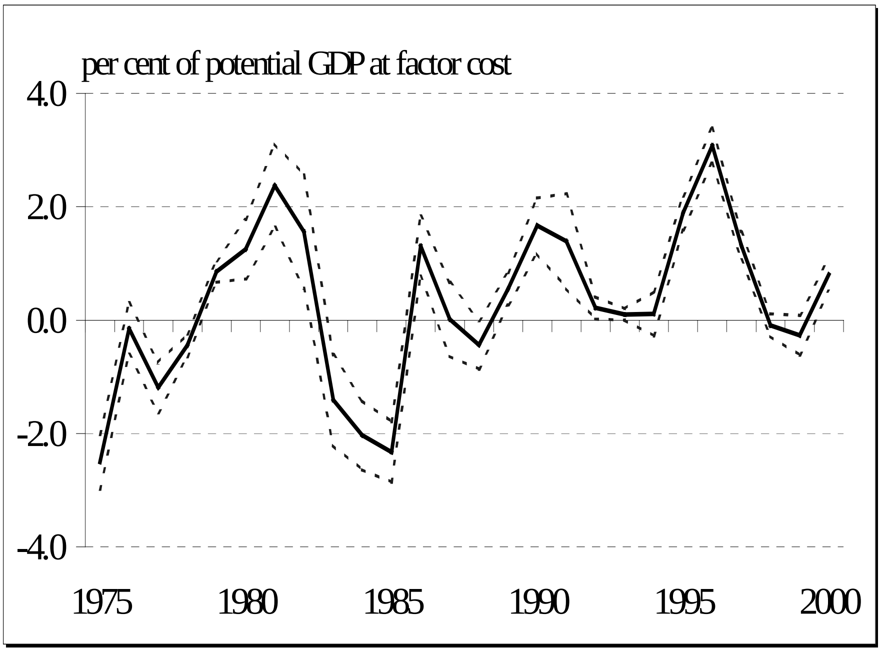
[15] Only in the case of the GMM-based CABB will the size of the confidence band be a constant function of the size of the output gap. This stems from the fact that the output gap is the only determinant of the CABB (for a given budget balance).

The purpose of this project is to build on past work that has attempted to identify the direct impact of fiscal policy on the business cycle and vice-versa by addressing one particular weakness inherent in other models, i.e. the failure to properly account for simultaneity. Generally speaking, the results suggest that the FiPS has been largely successful in this endeavour.

Fig. 6

Confidence bands surrounding the change in the primary CABB



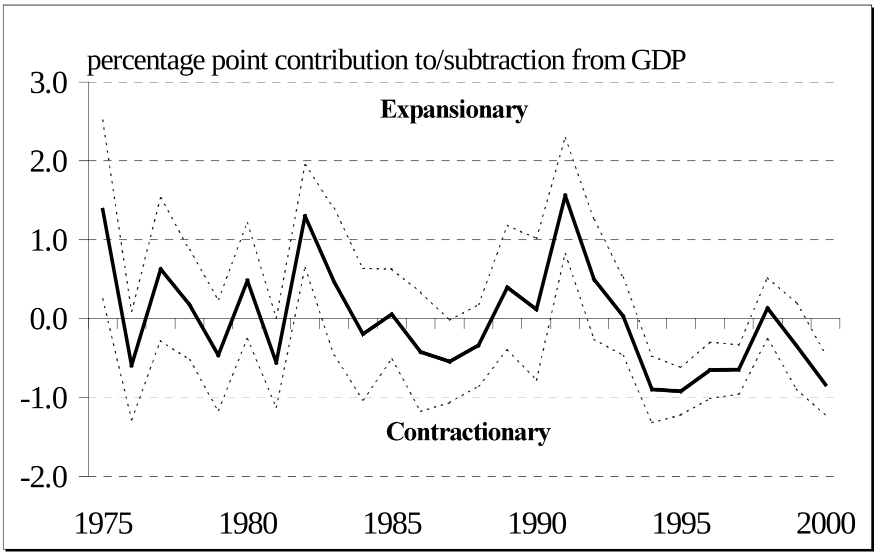
7. Conclusion

This work further clarifies the role of the cyclically-adjusted budget balance as an indicator of budgetary position and why it should not be used to measure the impact of fiscal policy on the economy. In its place, the FiPS is proposed as a measure of the impact of fiscal policy on economic activity. While the FiPS is a clear improvement, it has some limitations that need to be acknowledged.

For instance, as a model of economic behaviour, the FiPS is a vastly simplified approximation and the results should be considered with this in mind. Moreover, no account has been taken for stocks, such as level of government debt or permanent income, nor have agents' expectations of the future been modeled in a reasonable fashion.

Fig. 7

Confidence bands surrounding the FiPS



As a simplifying assumption, the FiPS treats potential output as fully exogenous, thus precluding the possibility that fiscal policy initiatives influence growth at frequencies lower than that of the business cycle. We implicitly assume, for example, that long-run labour supply is invariant to the level and type of taxation in the Canadian economy.

Finally, there could exist important non-linearities in the reduced-form relationship between fiscal policy and output not captured by our model. A highly progressive tax system should give rise to parameter non-constancy in the tax coefficients, both at business cycle frequencies and lower (resulting from long-run upward-trends in tax revenues). Thus the coefficient linking the output gap to tax revenues should be regarded more as an historical average rather than a reflection of recent behaviour.

Despite these limitations, the FiPS is a useful tool in furthering the understanding of the interaction between output and government revenues and expenditures. In addition, this work produces an unbiased measure of the CABB.

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