

OFFICE OF THE  
PARLIAMENTARY BUDGET OFFICER



BUREAU DU  
DIRECTEUR PARLEMENTAIRE DU BUDGET

## **Estimating Potential GDP and the Government's Structural Budget Balance**

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The *Parliament of Canada Act* mandates the Parliamentary Budget Officer (PBO) to provide independent analysis to the Senate and House of Commons on the state of the nation's finances, government estimates and trends in the national economy. The following technical note details PBO's approach to estimating Canada's potential gross domestic product (GDP), potential gross domestic income (GDI) and the Government's structural budgetary balance.

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## **Key Points**

In its November 2009 Economic and Fiscal Assessment Update (EFAU), PBO presented its own estimates of potential GDP as well as updated estimates of the Government's structural budget balance based on an improved methodology.

Potential GDP is the amount of output that the economy can produce when capital, labour and technology are at their respective trends. PBO has recently constructed its own estimate of potential GDP for the Canadian economy by estimating trends in labour input and labour productivity. PBO's estimate of potential GDP is a key input into the construction of structural budget balances, and it will also be used to determine the rate of economic growth in our long-term economic and fiscal projections.

PBO's estimates suggest that the Canadian economy was operating significantly below its potential in 2009. More importantly, PBO's estimates also suggest that the downward trend in potential GDP growth observed since 2000 will continue over the projection horizon, averaging 1.9 per cent over the 2009 to 2014 period. The projected decline in potential GDP growth is a function of the projected decline in the growth of trend labour input, which reflects slower growth of the working age population and a decline in the trend employment rate associated with the shifting age composition of the workforce. This reduction in potential GDP growth will constrain the pace of government revenue growth going forward.

PBO's new approach to estimating the Government's structural budget balance improves upon the standard approach used by the OECD and IMF in their official estimates. Given the importance of the production of commodities to the Canadian economy, PBO further adjusts the budgetary balance to account for terms of trade or 'trading gain' effects. PBO also uses a microsimulation database to estimate tax elasticities across time, both over history and over the medium term, which is better suited to identify changes to the tax structure over time than the methods used by the OECD and IMF (i.e., based on annual data for a given reference year).

PBO is not aware of any estimates of the Government's structural budgetary balance on a Public Accounts basis, both over history and the medium term, prepared by private sector or international organizations or Government departments. Finance Canada does however provide its own estimates of the Government's structural or cyclically-adjusted budget balance on a National Accounts basis but for the historical period 1975 to 2008 only.

Despite several methodological differences, Finance Canada and PBO's estimates of the Government's structural balance track each other closely over history. However, since 2006 when the structural balance was estimated at \$8.8 billion by Finance Canada and PBO (for 2006-07), estimates of the structural balance appear to have diverged. Finance Canada estimates a structural surplus of \$13.8 billion in 2008 compared to PBO's estimate of a \$3.2 billion structural deficit in 2008-09. This divergence largely reflects differing views on the economy's potential GDP as well as the impact on structural revenues of the run-up in commodity prices over this period.

PBO's November EFAU shows that the Government's structural balance is projected to deteriorate from essentially a balanced position in 2007-08 to a structural deficit of \$18.9 billion, or 1.0 per cent of potential income in 2013-14. The decline in the Government's structural balance relative to potential income over this period is largely due to lower revenues. Despite increased EI premium and PIT revenues over the medium term, statutory corporate income tax and GST rate reductions push the projected level of structural revenues relative to potential income close to their lowest level since 1976-77.

## 1. Introduction

PBO first provided estimates of Canada's potential GDP and the Government's structural budgetary balance in December 2008.<sup>1</sup> As PBO noted at the time, its estimates were 'rough' calculations and were largely based on estimates and assumptions from Finance Canada, the Bank of Canada as well as private sector forecasters.

PBO has refined its approach to estimating potential GDP and the Government's structural balance, improving on methods used by the IMF and OECD. Estimates of potential GDP and the Government's structural balance based on this new approach were presented in PBO's November 2009 Economic and Fiscal Assessment Update (EFAU)<sup>2</sup>. The following technical note provides the details underlying PBO's approach to estimating Canada's potential GDP, potential gross domestic income (GDI) and the Government's structural budgetary balance.

## 2. Potential GDP

Potential GDP is the amount of output that an economy can produce when capital, labour and technology are at their respective trends. PBO has recently constructed its own estimate of potential GDP which will be used for two separate types of analyses. First, potential GDP is a key input into the construction of structural budget balances, the focus of this paper. Second, when preparing economic projections analysts typically assume that the gap between real GDP and potential GDP, referred to as the output gap, will close over the near to medium term and that real GDP and potential GDP will grow at the same rate once the gap has closed. Therefore, when preparing a long-term fiscal outlook, potential GDP will determine the rate at which the economy will be expected to expand in the future.

While there are a number of different ways of measuring potential GDP, PBO chose to measure potential GDP from the supply side of the economy using the following identity:

$$Y = L \times (Y/L)$$

This identity simply states that real GDP (Y) is equal to labour input (L) multiplied by labour productivity (Y/L). Therefore, PBO estimates and projects a trend for labour input and labour productivity separately and then combines their respective trends to construct its measure of potential GDP.

The remainder of this section discusses how the trends for labour input and labour productivity have been constructed. Next, potential GDP and the output gap are examined after combining the two trends together. Finally, we discuss some key advantages and disadvantages of our approach relative to other methods of measuring potential GDP.

### *Trend Labour Input*

Labour input, i.e. total hours worked, is determined by the size of the working age population (LFPOP), the aggregate employment rate (LFER) and the average number of hours worked (AHW) by an employed individual in a given week (see the identity below).

$$L = \text{LFPOP} \times \text{LFER} \times \text{AHW} \times 52$$

Therefore, in constructing its measure of trend labour input PBO has estimated and projected the respective trends for each of these three components. The method for estimating and projecting each component of trend labour input is discussed below.<sup>3</sup>

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<sup>1</sup> <http://www2.parl.gc.ca/sites/pbo-dpb/documents/CABB%20-%20E.pdf>.

<sup>2</sup> [http://www2.parl.gc.ca/sites/pbo-dpb/documents/EFAU\\_November\\_2009.pdf](http://www2.parl.gc.ca/sites/pbo-dpb/documents/EFAU_November_2009.pdf).

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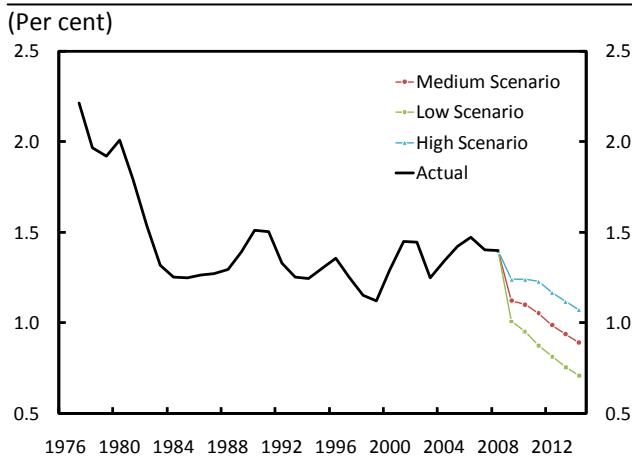
<sup>3</sup> This section provides a brief summary of the methodology discussed in Barnett (2007).

### Working age population

The working age population is defined as individuals 15 years of age and over and is taken from the Labour Force Survey, while over the projection horizon it is extrapolated using Statistics Canada's population projection.<sup>4</sup> Because the working age population evolves slowly over time and does not show any cyclical movement we treat the actual and projected size of the working age population as being equal to its trend.

**Figure 2-1**

#### Working Age Population Growth



Source: Statistics Canada

Growth in the working age population has slowed by a little more than a third in the last 30 years, falling from roughly 2.2 per cent in 1977 to 1.4 per cent in 2008 (Figure 2-1). Based on Statistics Canada's medium scenario, growth in the working age population is projected to continue to slow over the next six years averaging just 1 per cent over the 2009 to 2014 period. Since the population projection relies on a number of assumptions Statistics Canada also produces a high and low scenario based on more optimistic and pessimistic assumptions respectively. On average, the different assumptions could add, or conversely subtract, 0.16 percentage points from the growth

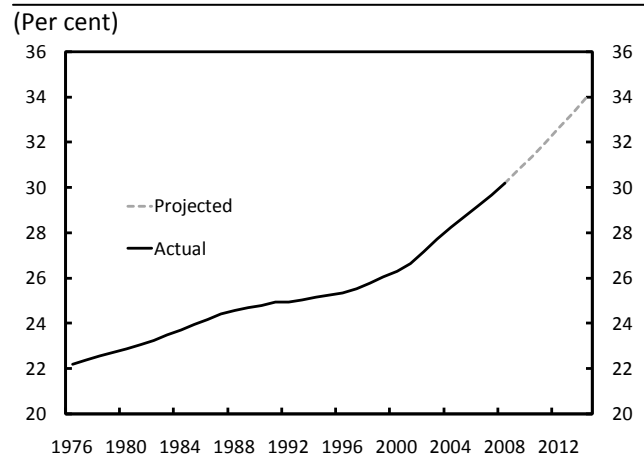
<sup>4</sup> For a more detail description of the population projections see Statistics Canada (2005).

in the working age population over the 2009 to 2014 period.

While we present the working age population statistics for the aggregate economy the data used over history and over the projection horizon are disaggregated by individual age and sex in order to capture the age and sex related impacts on the other two components of labour input. A particularly important aspect of the evolution of the working age population over the last few years and into the projection horizon is the relative size of the working age population that is 55 years of age and over (see Figure 2-2).

**Figure 2-2**

#### Share of Population 55 years of age and over



Source: Statistics Canada

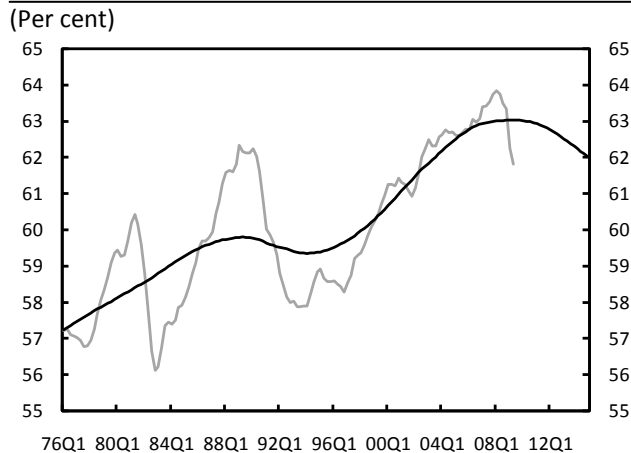
The share of the working age population 55 years of age and over has increased sharply since 2001, rising 3.6 percentage points in the last 7 years compared to an increase of 4.1 percentage points in the previous 25 years. The significant increase in the share can be attributed to the first wave of the baby-boomers, the large cohort born between 1946 and 1964, recently reaching 55 years of age. This significant increase in the share of the working age population 55 and over is expected to continue over the 2009 to 2014 period, rising 3.8 percentage points.

### Employment Rate

The second component of labour input is the employment rate, which is defined as the share of the working age population that is employed. The aggregate employment rate has been on an upward trend over the last half century, which can be mainly attributed to the steady increase in female labour force attachment (see Figure 2-3). As shown in Barnett et al. (2004), this phenomenon of increasing labour force attachment across female birth cohorts<sup>5</sup> is exceptionally important to incorporate when projecting the employment rate into the future.

**Figure 2-3**

#### Aggregate Employment Rate



Source: Statistics Canada; Office of the Parliamentary Budget Officer

PBO has estimated the trend employment rate using a hybrid method, or more specifically a model augmented filtering methodology. Because PBO also requires a projection of trend labour input for its long-term economic and fiscal analysis, a model is used to project the employment rate beyond 2008. Specifically, we have used a birth cohort model, where the employment rate is modeled as a function of cyclical, structural and cohort specific factors, to project the employment

rate for 2009 onwards using assumed paths for each of the explanatory variables.

To construct the trend employment rate, PBO then applied the Hodrick-Prescott (H-P) filtering technique to separate out the cycle and trend movements. Since a commonly cited critique of using the H-P filter is the end-of-sample problem, PBO augmented the historical data with our model projected employment rates by individual age and sex and then applied the H-P filter to the augmented series. This approach has two distinct advantages in our view. First, as noted in Mise et al. (2005) and Garratt et al. (2008), augmenting the H-P filter with forecasts helps to alleviate the end of sample problem associated with this type of filter. Second, it ensures that our historical and projected trends are consistent with one another since the trend converges relatively quickly to our model estimates over the projection horizon.

The trend aggregate employment rate is then calculated by weighting the individual employment rates, by age and sex, by their respective population shares. Because employment rates are not constant across the life cycle, but rather follow an inverted U shape, shifts in the age distribution can have an important impact on the aggregate employment rate. The life cycle path of employment rates becomes particularly important over the projection horizon as the share of the working age population 55 years of age and over increases. Because individuals over 55 years of age typically have lower labour force participation than their younger counterparts, the population shift towards older workers progressively puts greater downward pressure on the aggregate employment rate. As a consequence, after trending upwards for most of the last 30 years, the aggregate trend employment rate is projected to begin declining over the projection horizon, falling from 63 per cent in 2009 to 62 per cent by the end of 2014 (Figure 2-3). To put this decline in context, a 1 percentage point reduction in the aggregate employment rate would translate into just over 287,000 fewer Canadians working at the end of 2014.

<sup>5</sup> By cohort we are referring to individuals born in the same year as opposed to age groups where the cohorts are continuously changing from one year to the next.

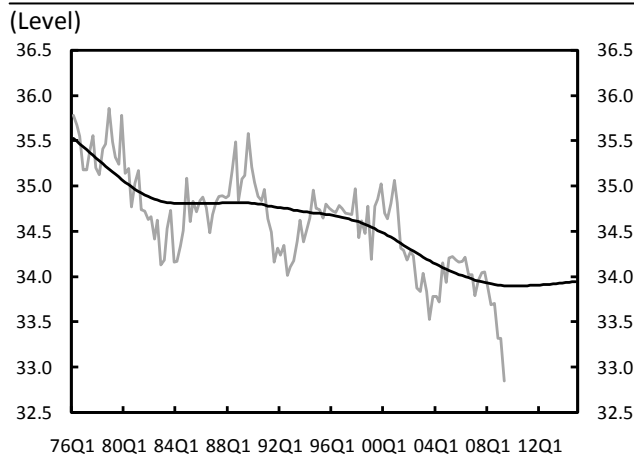
Finally, in the context of the global recession, PBO's estimate of the trend employment rate suggests that the sharp decline in the employment rate since the first quarter of 2008 was entirely a cyclical response by firms to the reduction in global demand and did not reflect a movement in trend.

#### Average Weekly Hours Worked

The third component of labour input is the average number of weekly hours worked by employed individuals. While the size of the working age population and the aggregate employment rate determine the *quantity* of workforce, average weekly hours worked is a measure of the *intensity* with which the existing workforce is used. Over the last 30 years the average length of the Canadian workweek has trended downwards, falling from approximately 35.5 hours per week on average in the mid-70s to under 34 hours over the last 2 years (Figure 2-4).

**Figure 2-4**

#### Average Weekly Hours Worked



Source: Statistics Canada; Office of the Parliamentary Budget Officer

PBO has also estimated the trend average weekly hours worked using a model augmented filtering methodology. However, because there are no discernable cohort effects in average hours worked PBO has used an age-specific fixed effects model to project average weekly hours worked beyond 2008. The historical data are augmented using the projected average hours worked series by

individual age and sex and then the augmented series are filtered using the H-P filter.

PBO estimates suggest that the trend average hours worked have declined from 35.5 hours per week in 1976 to 33.9 hours per week in 2008. This decline is mainly attributable to two factors. First, the average hours worked of younger workers, 15 to 24 years of age, declined in the early part of the sample at the same time school enrollment rates were increasing. Second, the employment share of females increased significantly through this period and because females work fewer paid hours than their male counterparts, this shift also put downward pressure on the aggregate measure. Going forward neither of these phenomenon are expected to continue to have a meaningful impact on average hours worked. Therefore, PBO projects that trend average hours worked will remain relatively stable over the 2009 to 2014 period (Figure 2-4). PBO's trend estimate also suggests that the sharp decline in average hours worked experienced since 2008 does not reflect a decline in trend average hours worked, but rather, like the employment rate, reflects firms' reduced demand for labour in response to the global recession.

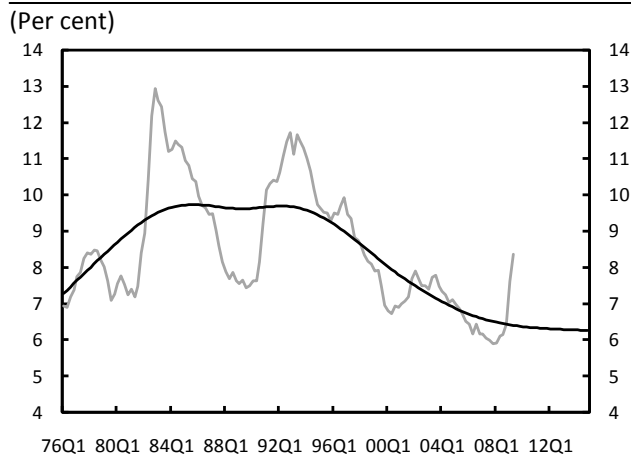
#### Trend Unemployment Rate

Lastly, although not required to estimate trend labour input, PBO does require an estimate of the trend unemployment rate when constructing its estimate of the structural budget balance. The unemployment rate has fluctuated substantially over the last 30 years reaching as high as 12.9 per cent in 1982Q2 and as low as 5.9 per cent in 2007Q4. The unemployment rate has increased significantly since the start of the current recession, rising from a historical low of 5.9 to 8.4 per cent in 2009Q2 (Figure 2-5). However, to appropriately assess the recent increase in the unemployment rate relative to previous slowdowns requires an estimate of the trend since any assessment done without abstracting from trend could lead to a misleading conclusion. For example, during the current recession it might be tempting to conclude that the labour market was less affected since the level of the unemployment

rate was lower than that observed in previous recessions. However, if there had been structural changes in the economy between recessions that would have led to a decline in the trend unemployment rate this conclusion would be incorrect since in the absence of the recession the economy could be expected to maintain a lower unemployment rate than in the past.

**Figure 2-5**

**Aggregate Unemployment Rate**



Source: Statistics Canada; Office of the Parliamentary Budget Officer

While PBO does not estimate the trend unemployment rate directly, an estimate can be constructed, or more precisely, determined residually, using our cohort methodology. Specifically, PBO has applied its cohort methodology to the labour force participation rate using the identical specification that was used to estimate the trend employment rate as described earlier. The trend unemployment rate can then be calculated using the following identity:

$$LFUR = 1 - (LFE/LFPR)$$

where LFUR is the unemployment rate; LFPR is the participation rate; and LFE is the employment rate.

Our results indicate that the trend unemployment rate was relatively stable from the mid-1980s to mid-1990s, but has since trended downward from

9.7 per cent in 1992 to 6.5 per cent in 2008.<sup>6</sup> The results also show that despite the fact that the level of the unemployment rate (8.6 per cent as of November) is well below levels reached in the 1980s and 1990s recessions, the increase relative to trend is similar to the increases in the previous two recessions (Figure 2-5).

*Trend Labour Productivity*

The final component required to estimate potential GDP is trend labour productivity. Labour productivity, measured as GDP per hour worked, is one of the most commonly used measures to assess improvements in living standards and implicitly captures increases in capital deepening (increases in capital relative to labour) as well as technological improvements (typically referred to as total factor productivity). Growth in labour productivity has fluctuated significantly over history, but the last decade can be characterized as a period of weak productivity growth, especially given the relative strength of the labour market (Figure 2-6).<sup>7</sup>

PBO estimates trend labour productivity using the model augmented filtering methodology described earlier. Since PBO does not currently have a well specified structural model of labour productivity we have chosen to estimate and project labour productivity using an autoregressive integrated

<sup>6</sup> Although we do not have a structural model of the unemployment rate, the decline in PBO's trend unemployment rate from the mid-1990s is in line with the OECD's measure of the non-accelerating inflation rate of unemployment (NAIRU) for Canada. The OECD estimates the NAIRU using a Kalman-filtering approach that embodies a reduced form Phillips curve as described in Richardson et al. (2000) and Gianella et al. (2008). Gianella et al. (2008) estimate that the major factors leading to the decline in the OECD's measure of the Canadian NAIRU, between 1994 and 2003, were declines in the average unemployment benefit replacement rate, product market regulation, union density, and long-term real interest rates, which is used as a proxy for the cost of capital.

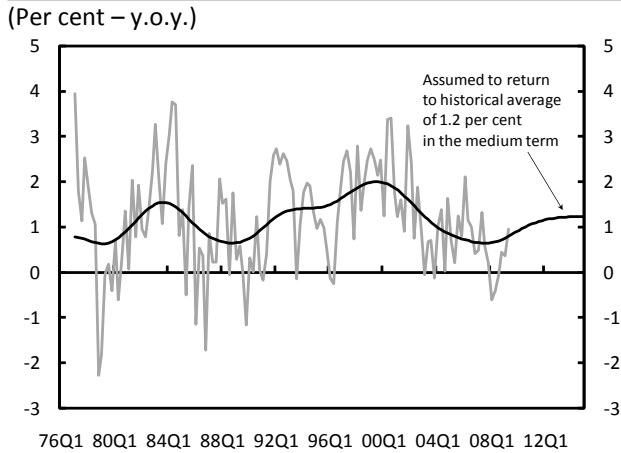
<sup>7</sup> For a detailed discussion of Canada's labour productivity performance since 1961 see Baldwin and Gu (2008) and for an analysis of Canada's weak productivity performance since 2000 see Arseneault and Sharpe (2008).



moving average (ARIMA) model.<sup>8</sup> The augmented series are then smoothed using an H-P filter.

**Figure 2-6**

**Total Economy Labour Productivity Growth**



Source: Statistics Canada; Office of the Parliamentary Budget Officer

This method of estimating trend labour productivity has a few distinct advantages. First, as shown by Garratt et al. (2008), since the data is augmented using forecasted data, the real-time measurement issues associated with data revisions are somewhat minimized. Second, since the model is re-estimated and forecasted with each release of the National Accounts, the methodology is flexible enough to ensure that the stochastic properties of the underlying series are not ignored. Third, since movements in labour productivity growth are quite volatile, taking a longer-term perspective is often suggested to assess the underlying trend of the series (Figure 2-6). PBO's methodology ensures that the growth rate of labour productivity returns to its historical average, based on the estimation sample, over the projection horizon.<sup>9</sup>

<sup>8</sup> An ARIMA model is a univariate time series (i.e. statistical) model that is often used in economics to forecast non-stationary variables and was pioneered by Box and Jenkins (1970).

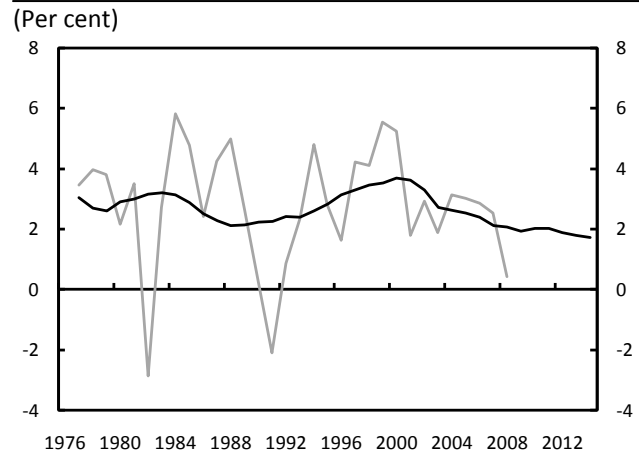
<sup>9</sup> Returning productivity growth to its longer-term historical average is consistent with Arsenault and Sharpe (2008) assessment that the slowdown in labour productivity since 2000 is temporary and that future labour productivity in Canada is likely to revert to its historical trend.

*Potential GDP*

Potential GDP is then constructed by combining the trend labour input and trend labour productivity estimates based on the identity presented earlier. PBO estimates of potential GDP growth fluctuate over history from periods of relatively high growth to periods of low growth. The periods from 1977 to 1984 and from 1995 to 2004 (the high-tech boom) can be characterized as high growth periods where potential GDP growth is estimated to have averaged 3 per cent and 3.2 per cent respectively (Figure 2-7). The period from 1985 to 1994 and more recently since 2004 can be characterized as periods of low growth with average growth of 2.4 per cent and 2.3 per cent respectively. However, it is interesting to note that PBO's estimates suggest that the current slowdown in potential GDP growth are almost entirely attributable to a slowdown in labour productivity, whereas the slowdown in the 1985 to 1994 period was the result of a slowdown in trend labour input growth.

**Figure 2-7**

**Annual Real and Potential GDP Growth**



Source: Statistics Canada; Office of the Parliamentary Budget Officer

Going forward, PBO estimates that the downward trend observed in potential GDP growth since 2000 will continue over the projection horizon. The projected decline in potential GDP growth is a function of the projected decline in the growth of trend labour input, which reflects slower growth of

the working age population and the decline in the trend employment rate associated with the shifting age composition of the workforce (Table 2-1). The decline in trend labour input growth is partially offset by a rise in trend labour productivity growth which is projected to rise gradually from 0.7 per cent in 2008 to its historical average of 1.2 per cent by 2012 (Table 2-1).

**Table 2-1**

**Potential GDP Growth**

(Percentage points)

	2008	2009	2010	2011	2012	2013	2014
Potential GDP	2.1	1.9	2.0	2.0	1.9	1.8	1.7
<i>Contribution from:</i>							
Labour Input	1.4	1.1	1.0	0.9	0.7	0.6	0.5
Population	1.4	1.1	1.1	1.0	1.0	0.9	0.9
Employment Rate	0.1	0.0	-0.1	-0.2	-0.3	-0.4	-0.5
Average Hours Worked	-0.1	0.0	0.0	0.0	0.0	0.0	0.0
Labour Productivity	0.7	0.8	1.0	1.1	1.2	1.2	1.2

Source: Office of the Parliamentary Budget Officer

**Output Gap Comparison**

The output gap, the difference between real and potential GDP as a per cent of potential GDP, is an important concept since it is a more appropriate framework for assessing the state of the economy across business cycles and is used explicitly in PBO's calculation of the government's structural budget balance. PBO estimates suggest that the Canadian economy has been operating below its potential since 2007 and, that based on the September 2009 PBO private sector outlook, will not return to its potential until the end of 2013 (Figure 2-8).

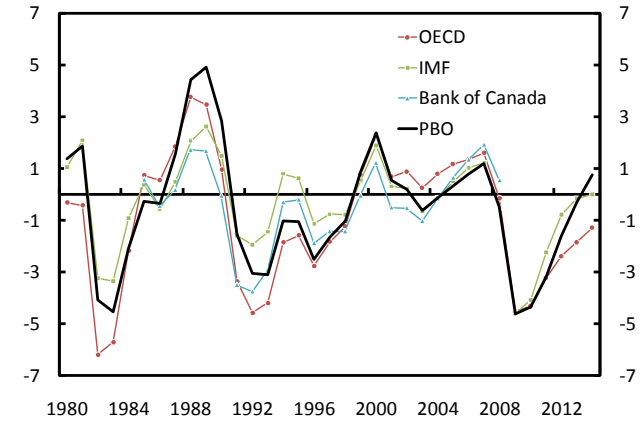
Because potential GDP is not observable it is useful to compare PBO's results with other publically available estimates. A number of organizations produce potential GDP and output gap estimates for the Canadian economy including the Bank of Canada, the International Monetary Fund (IMF) and the Organization for Economic Co-ordination and Development (OECD). Although directional movements of the output gaps of the PBO, Bank of Canada, IMF and OECD are quite similar over history, the magnitudes of the peaks and troughs

across business cycles do show some noticeable differences (Figure 2-8).<sup>10</sup> Despite the level difference across history it is interesting to note that the PBO, IMF and OECD estimates of the output gap in 2009 are almost identical. However, we would stress that this does not imply that there is a greater degree of confidence around any of these measures, but rather simply highlights that there is currently a broad agreement that the Canadian economy was operating significantly below its potential throughout 2009.

**Figure 2-8**

**Output Gap**

(Per cent)



Source: Statistics Canada; Office of the Parliamentary Budget Officer

**Advantages and Disadvantages of PBO's Approach to Estimating Potential GDP**

Because potential GDP is not observable there is no way of directly measuring whether one approach of estimating potential is superior to another. While a number of different approaches are available to estimate potential GDP, PBO believes that the main advantages of our approach outweigh its disadvantages given the types of analyses that the estimate will be used to produce.<sup>11</sup>

<sup>10</sup> The Bank of Canada's estimates are based on their conventional measure of the output gap and are therefore only available over history.

<sup>11</sup> For a thorough discussion of alternatives methods of estimating potential GDP see CBO (2004) and Dupasquier et al. (1997).

A few key advantages of PBO's approach to estimating potential GDP relative to alternative methodologies are worth highlighting. First, our approach is based explicitly on the supply side of the economy, but does not require us to make an assumption about the form of the production function, that is how the economy combines capital, labour and technology to produce output. Second, this framework also lends itself to a transparent accounting of potential GDP, both over history and over the projection horizon. Third, our approach does not rely on capital stock data that is notoriously difficult to measure and suffers from aggregation issues. Finally, augmenting the data that enters the filter using the model projections from our labour models ensures that our projection and trend estimates are consistent over the long-term projection, while being flexible enough to assign some weight to the actual data, and addresses some of the technical issues associated with using filters to estimate trends.

However, there are a couple of disadvantages to PBO's approach. First, because of its relative simplicity our approach will not be able to answer certain types of questions. For example, a more disaggregated growth accounting approach would allow for a more detailed decomposition of labour productivity growth into its underlying factors such as human capital, capital services and multifactor productivity (MFP). Second, given that there is no explicit link to inflation in PBO's approach, our estimate of potential output can be thought of more as a trend measure as opposed to the level of output that is consistent with non-accelerating inflation. This could be problematic if the output gap was to be used as a measure of inflationary pressure in the economy. However, this could also be viewed as an advantage since it does not require us to make a strong assumption about the relationship between output and inflation or the way that economic shocks are transmitted into consumer prices.

### **3. Structural Budget Balance Estimates**

The conventional measure of the structural or cyclically-adjusted budget balance (CABB) represents the budgetary balance that would be observed if the economy were operating at its potential GDP. The estimate of the output gap therefore figures prominently in calculating the structural balance since it is used to identify the cyclical components of the budget. The cyclical components are then subtracted from the observed or projected balance, which yields the structural balance.

According to the OECD,<sup>12</sup> estimates of the structural balance help to "provide a clearer picture of the government's underlying fiscal situation" and can be used "as a guide to fiscal policy analysis". The IMF notes<sup>13</sup> that failing to distinguish between cyclical and structural components of the budget "poses the risk that fiscal levers may be over- or under-adjusted in response to budgetary developments that might be reversed automatically over the course of the business cycle".

PBO presented its first set of estimates of the Government's structural balance in December 2008.<sup>14</sup> As PBO noted at the time, its estimates were 'rough' calculations and based on simple assumptions about the growth in structural revenues and expenditures. Moreover, PBO's estimates were based on Finance Canada's estimate of potential GDP and structural revenues in 2007. Structural revenues, adjusted for tax policy changes, were assumed to grow in line with potential GDP (at 2.4 per cent annually) and GDP inflation (at 2.1 per cent annually) based on estimates from the Bank of Canada's October 2008 *Monetary Policy Report* and private sector forecasters, respectively. PBO updated its estimates in early 2009 and then again in July to

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<sup>12</sup> OECD Working Paper No. 152

<http://www.oecd.org/dataoecd/32/52/1863308.pdf>.

<sup>13</sup> IMF Working Paper 99/95

<http://www.imf.org/external/pubs/ft/wp/1999/wp9995.pdf>.

<sup>14</sup> See the PBO Briefing Note <http://www2.parl.gc.ca/sites/pbo-dpb/documents/CABB%20-%20E.pdf>.

reflect changes in assumptions regarding the potential growth rate of the Canadian economy<sup>15</sup> and treatment of public debt charges.

Since the release of its July 2009 Economic and Fiscal Assessment (EFA), PBO has improved on its approach to assessing the Government's budgetary position over the business cycle. The new approach builds upon the 'standard' approach used by the OECD<sup>16</sup> and IMF in their official CABB estimates for Canada's total government sector.<sup>17</sup>

### The 'Standard' Approach

The 'standard' approach refers to a two-step procedure which first involves estimating an economy's output gap. The second step involves identifying the cyclical component of the budget by estimating the responsiveness of observed or projected revenues (T) and expenditures (G) to the output gap  $(Y - Y^*)/Y^*$ . This last step typically involves the use of tax and spending elasticities ( $\epsilon$  and  $\eta$  respectively) derived from microdata. Given observed or projected revenues and expenditures, the structural components of revenues ( $T^*$ ) and spending ( $G^*$ ) are then calculated residually.<sup>18</sup> The difference between structural revenues and expenditures is the structural balance.

$$T^* = T \cdot (Y^*/Y)^\epsilon \text{ and } G^* = G \cdot (Y^*/Y)^\eta$$

$$\text{Structural balance} = T^* - G^*$$

While the above equations express structural revenues and expenditures at the aggregated level, following OECD and IMF, PBO cyclically adjusts

revenues (i.e., personal income tax, corporate income tax, Employment Insurance (EI) premiums and excise taxes) and expenditures (i.e., EI benefits) by individual category. With the exception of temporary stimulus spending, all other revenue and expenditure – including public debt charges – are treated as structural.<sup>19</sup> Further, following the OECD methodology, PBO separates the revenue elasticities into two components:  $\epsilon_i$  the elasticity of tax revenue with respect to the relevant tax base (B) and  $\epsilon_{ij}$  the (short-term) elasticity of the tax base with respect to the output gap.<sup>20</sup>

$$\epsilon = \epsilon_i \cdot \epsilon_{ij}$$

$$\epsilon_i = \Delta T / \Delta B \cdot (B/T) \text{ [estimated from microdata]}$$

$$\Delta \ln(B/Y^*) = \alpha + \epsilon_{ij} \cdot \Delta \ln(Y/Y^*)$$

[estimated by regression analysis]

### Improving on the Standard Approach

To more precisely estimate the cyclical component of the budgetary balance, PBO has made two improvements on the standard approach used by the OECD and IMF in their official estimates.

First, given the importance of the production of commodities to the Canadian economy, PBO further adjusts the budgetary balance to account for terms of trade<sup>21</sup> or 'trading gain' effects, following research undertaken at the OECD.<sup>22</sup> In effect, this results in adjusting budgetary components by an 'income' gap, as opposed to a 'production' or GDP gap, which helps to identify

<sup>15</sup> In its April 2009 *Monetary Policy Report* the Bank of Canada revised down its estimate of potential GDP growth.

<sup>16</sup> OECD Working Paper No. 434

[http://www.oelis.oecd.org/olis/2005doc.nsf/linkto/ECO-WKP\(2005\)21](http://www.oelis.oecd.org/olis/2005doc.nsf/linkto/ECO-WKP(2005)21).

<sup>17</sup> Finance Canada's methodology (see <http://www.fin.gc.ca/wp/2003-06-eng.asp>) is similar except that the sensitivity of revenue and expenditure components to the output gap is estimated directly using regression techniques, as opposed to microdata/simulation as used by the OECD and IMF. The regression technique also adjusts for any simultaneity between economic and fiscal variables.

<sup>18</sup> The calculation of structural components are 'residually' determined because it is the cyclical components of revenues and expenditures  $(Y/Y^*)^\epsilon$  and  $(Y/Y^*)^\eta$  respectively that are estimated directly.

<sup>19</sup> The temporary stimulus spending measures are included in the cyclical balance and amount to \$17.5 billion in 2009-10, \$9.0 billion in 2010-11, \$0.4 billion in 2011-12 and \$0.3 billion in 2012-13.

<sup>20</sup> The EI expenditure elasticity is also comprised of two components: i) the elasticity of EI benefits with respect to the cyclical component of unemployment and ii) the elasticity of the cyclical component of unemployment with respect to the output gap.

<sup>21</sup> The PBO Briefing Note [http://www2.parl.gc.ca/sites/pbo-dpb/documents/Recent\\_Economic\\_Performance.pdf](http://www2.parl.gc.ca/sites/pbo-dpb/documents/Recent_Economic_Performance.pdf) highlighted the importance of assessing Canada's economic performance based on indicators that accounted for terms of trade impacts.

<sup>22</sup> This follows the adjustment made to Australia's budgetary position in [http://www.oelis.oecd.org/olis/2006doc.nsf/linkto/ECO-WKP\(2006\)47](http://www.oelis.oecd.org/olis/2006doc.nsf/linkto/ECO-WKP(2006)47) and which identified Canada as a candidate for such an adjustment.

movements in the budgetary balance due to transitory fluctuations in commodity prices. Statistics Canada notes that the trading gain captures the impact of relative price changes, primarily the terms of trade (i.e., the ratio of export prices to import prices) and represents the number of exported goods that must be given up to acquire an imported good.<sup>23</sup> Although real GDI measures the purchasing power of income generated in Canada, its fluctuations are more highly correlated with nominal GDP – the broadest measure of the Government tax base – than real GDP.<sup>24</sup> The trading gain and real GDP combine to form real gross domestic income (GDI). In nominal terms, GDP and GDI are equivalent.

The GDI (income) gap can therefore be expressed (in natural logarithms) as the output gap plus the trading gain gap.

$$\begin{aligned} \text{GDI gap} &= \ln(\text{GDI02}/\text{GDIP02}) \\ &= \ln(\text{GDP02}/\text{GDPP02}) + \ln(\text{PGDI}/\text{PGDIP}) \\ &= \text{output gap} + \text{trading gain gap} \end{aligned}$$

where,

*GDI02* is real GDI

*GDIP02* is real potential GDI

*GDP02* is real GDP

*GDPP02* is real potential GDP

*PGDI* is the GDP deflator relative to the final domestic demand deflator

*PGDIP* is the trend of the GDP deflator relative to the final domestic demand deflator.

Second, PBO uses a microsimulation model<sup>25</sup> (Statistics Canada's Social Policy Simulation Database and Model, SPSP/M) to estimate the elasticity of tax revenues with respect to their tax

bases for households across time, both over history and over the projection period (see Table A-1 in Annex A).<sup>26</sup> In contrast, OECD uses microdata-based estimates of the elasticity of tax revenues with respect to the tax base in 2003 that are imposed across both history and projection. The IMF's approach also imposes constant elasticities across time. Thus PBO's approach would be better suited to identify the structural tax policy changes as the tax base elasticities are permitted to vary over time in response to such changes, including recent legislated changes that will come into effect over the projection period.<sup>27</sup>

### Trading Gain and Real GDI Gaps

To determine the trading gain gap, an estimate of the trend of the GDP deflator relative to the final domestic demand deflator is required. In its calculations for Australia, OECD staff assumed that the trend or equilibrium is the long-run historical average of the series but note that an extreme alternative assumption would be that the [then] current (elevated) terms of trade represents a "new sustainable equilibrium".

There is of course considerable uncertainty surrounding trend estimates of the terms of trade or trading gain. PBO has therefore taken a more middle-of-the-road approach and assumed that the trend trading gain follows the broad movements in the observed trading gain, reflecting the lag in commodity production in response to changes in demand. Figure 3-1 presents the trading gain and its trend<sup>28</sup> along with the long-run historical average (1961Q1-2009Q2) for comparison. In PBO's November EFAU, the projected trend was assumed to converge toward its more recent

<sup>23</sup> For example, see the Statistics Canada research paper <http://www.statcan.gc.ca/pub/11f0027m/11f0027m2007048-eng.pdf>.

<sup>24</sup> For example, the correlation coefficient of nominal GDP growth and real GDI growth, computed over the past twenty years, is 0.94, compared to 0.73 for real GDP growth.

<sup>25</sup> According to Statistics Canada, microsimulation models are "computer models that operate at the level of the individual behavioural entity, such as a person, family, or firm. Such models simulate large representative populations of these low-level entities in order to draw conclusions that apply to higher levels of aggregation such as an entire country". More information is available at <http://www.statcan.gc.ca/microsimulation/index-eng.htm>.

<sup>26</sup> Elasticities of tax revenues with respect to tax bases were estimated using SPSP/M for personal income taxes and EI contributions over 1991-2013. Following the OECD, unit elasticities (i.e., revenue with respect to its tax base) were assumed equal to one for corporate income taxes and excise taxes, as well as for EI benefits (i.e., benefits with respect to unemployment levels).

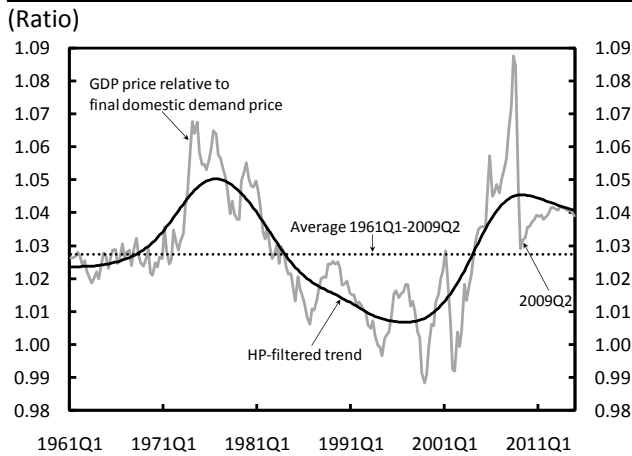
<sup>27</sup> For example, see the document *SPSP/M Release 16.1 Update* available at <http://www.statcan.gc.ca/microsimulation/spspm-bdmsps/spspm-bdmsps-eng.htm>.

<sup>28</sup> The trend trading gain is estimated using the Hodrick-Prescott filter with the smoothing parameter set to 10,000.

(2002Q1-2009Q2) average. The trading gain gap was assumed to close over the medium term as the projected trading gain gradually improved and the trend trading gain converged toward its recent average. Table B-1 in Annex B provides the output and trading gain gaps (fiscal-year basis) used to estimate the Government's structural balance over 1976-77 to 2013-14.

**Figure 3-1**

**Trading Gain: Trend and Actual**

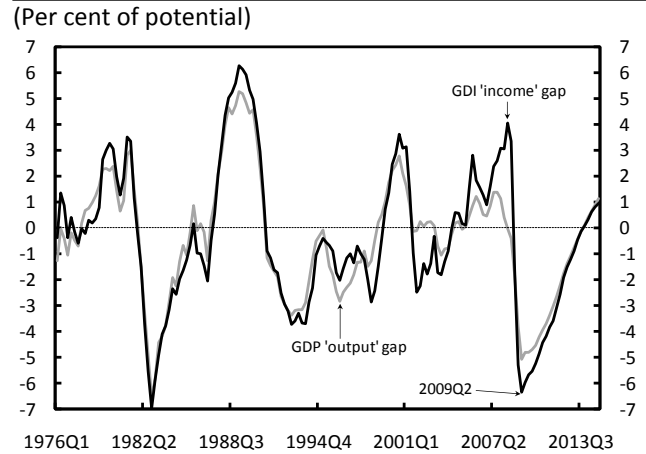


Source: Office of the Parliamentary Budget Officer

The trading gain gap combines with the output (GDP) gap to form the income (GDI) gap. Figure 3-2 presents the output and income gaps from the November EFAU. The two gaps generally track each other over history with the exception of the most recent period from 2002 to 2008, when the GDI gap improved sharply (from a low of -2.5 per cent in 2001Q4 to a peak of +4.1 per cent in 2008Q2) as a result of the run-up in commodity prices and corresponding appreciation of the Canadian dollar, while the GDP gap remained relatively stable over the same period.

**Figure 3-2**

**GDI and GDP Gaps**



Source: Office of the Parliamentary Budget Officer

**Estimation Approach**

Following the approach developed at the OECD to adjusting Australia's structural balance for the income (GDI) gap, the short-run elasticities of the output gap and the trading gain gap are estimated individually for each tax and expenditure base. At the aggregate tax and expenditure levels, this can be represented as:

$$T^* = T \cdot ((GDPP02/GDP02)^{\epsilon_2} \cdot (PGDIP/PGDI)^{\epsilon_3})^{\epsilon_1}$$

$$G^* = G \cdot ((GDPP02/GDP02)^{\eta_2} \cdot (PGDIP/PGDI)^{\eta_3})^{\eta_1}$$

where  $\epsilon_1$  ( $\eta_1$ ) is the elasticity of revenue (expenditure) with respect to its respective base and the short-run elasticities of the tax (expenditure) base to the output gap and trading gain gap are  $\epsilon_2$  and  $\epsilon_3$  ( $\eta_2$  and  $\eta_3$ ) respectively.

In addition, the sensitivity of a tax base<sup>29</sup> is estimated using the specification below (with a correction for first order AR(1) correlation in the

<sup>29</sup> The tax bases used in these calculations are based on the National Accounts concepts and measures but calculated on a fiscal-year basis. The tax base used for PIT is personal income; corporate profits (before taxes) are used for corporate income taxes; wages, salaries and supplementary labour income are used for EI premiums; and, consumer expenditure is used for excise taxes.



residuals) and fiscal-year data from 1976-77 to 2008-09 (see Table C-1 in Annex C).<sup>30</sup>

$$\Delta \ln(B/GDIP) = \alpha + \varepsilon_2 \cdot \Delta \ln(GDP02/GDPP02) + \varepsilon_3 \cdot \Delta \ln(PGDI/PGDIP)$$

where,

*GDIP* is nominal potential GDI (real potential GDI multiplied by the final domestic demand deflator).

Also following the OECD's methodology, EI benefits are assumed to be strictly proportional to unemployment. The sensitivity of unemployment (relative to trend) to the output gap and trading gain gap,  $\eta_2$  and  $\eta_3$  respectively, is then estimated based on the following specification.

$$\Delta \ln(U/U^*) = \kappa + \eta_2 \cdot \Delta \ln(GDP02/GDPP02) + \eta_3 \cdot \Delta \ln(PGDI/PGDIP)$$

where,

*U* is the level of unemployment

*U\** is the trend level of unemployment.

#### 4. Comparing Estimates of Structural and Cyclical Budgetary Balances

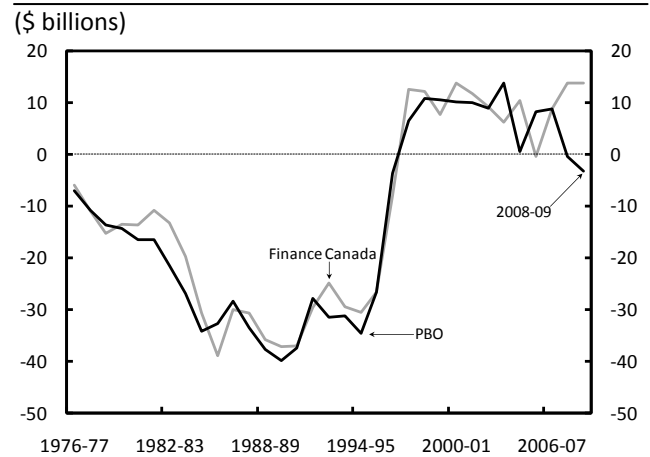
PBO is not aware of any estimates of the Government's structural budgetary balance on a Public Accounts basis, estimated both over history and the medium term (i.e., the next 5 fiscal years). Finance Canada does however present its estimates of the Government's structural or cyclically-adjusted budget balance on a National Accounts basis over history (see Tables 45 and 46 in [http://www.fin.gc.ca/frt-trf/2009/frt09\\_e.pdf](http://www.fin.gc.ca/frt-trf/2009/frt09_e.pdf)). Estimates for the total government sector (i.e., the combined balances of the federal, provincial/territorial and local governments and the Canada and Quebec public pension plans) are also provided.

Although Finance Canada and PBO's estimates of the Government's structural balance are based on different accounting frameworks it is nonetheless useful to compare the two sets of estimates,

particularly since the two measures of the Government's budgetary balance are very highly correlated over history.<sup>31</sup>

Figure 4-1 presents Finance Canada and PBO's estimates of the Government's structural balance. Finance Canada's estimates are presented on a National Accounts basis for each calendar year while PBO's estimates are presented on a Public Accounts basis for each fiscal year (i.e., in Figure 4-1, the National Accounts-based estimate for 2008 is presented alongside the Public Accounts estimate for 2008-09).

**Figure 4-1**  
**Structural Balance Estimates**



Sources: Office of the Parliamentary Budget Officer, Finance Canada

Despite the differences in accounting frameworks, calendar/fiscal years, and methodologies, Finance Canada and PBO's estimates of the Government's structural balance track each other closely over history (the correlation coefficient is 0.96). However, since 2006-07 (calendar year 2006) when the structural balance was estimated at \$8.8 billion by both Finance Canada and PBO, the structural balance estimates appear to have diverged. Indeed, in 2008-09 (calendar year 2008) Finance Canada estimates a structural surplus of \$13.8

<sup>30</sup> Additional estimation results are available upon request. The AR(1) correction is made by estimating a nonlinear version of the equation using a Marquardt nonlinear least squares algorithm in EViews.

<sup>31</sup> Over the period 1976 to 2008, without making adjustments for calendar years and fiscal years, the National Accounts measure of the Government's budgetary balance is almost perfectly correlated with the Public Accounts measure (i.e., the correlation coefficient is 0.97).

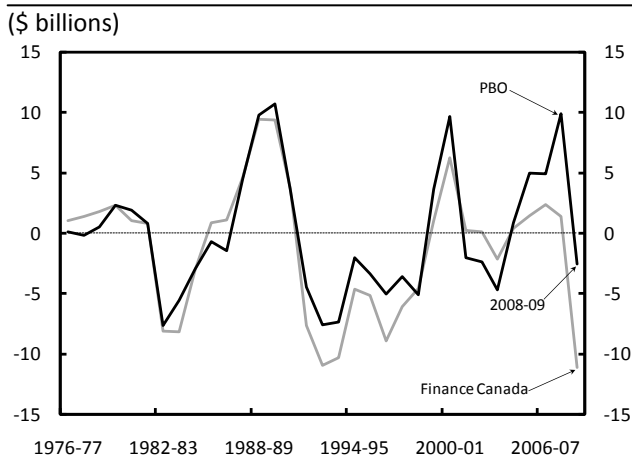
billion while PBO estimates a \$3.2 billion structural deficit.

Since the structural balance is calculated residually, this recent discrepancy could arise from differences in estimates of the cyclical balance or differences in the measures of the actual budgetary balances. The difference in structural balance estimates, however, exceeds the difference between the National Accounts and Public Accounts measures of the actual budgetary balance, which suggests that differences in Finance Canada and PBO's estimates of the cyclical budgetary balance account for most of the recent discrepancy in structural balance estimates.

Figure 4-2 compares Finance Canada and PBO estimates of the cyclical component of the budgetary balance. Again notwithstanding the differences in accounting frameworks, calendar/fiscal years, and methodologies, PBO's estimates generally track Finance Canada's over history.

**Figure 4-2**

**Cyclical Balance Estimates**



Sources: Office of the Parliamentary Budget Officer, Finance Canada

However, over the period 2003-04 to 2007-08 their trends differed significantly with the cyclical balance improving to a much greater extent based on PBO's estimates. This reflects, in part, the run-up in commodity prices and consequent improvement in the trading gain (relative to trend) observed over this period, which is not being

captured in Finance Canada's measure of the output gap and cyclical balance estimate. In addition, over 2003-04 to 2007-08, PBO estimates suggest that the economy grew faster – relative to potential GDP – than Finance Canada estimates would indicate, pushing the economy farther above its potential to reach 1.1 per cent in 2007-08. This contrasts with Finance Canada's estimate of the output gap in 2007 which appears to be essentially closed at approximately 0.2 per cent in 2007.<sup>32</sup>

While both estimates show that the Government's cyclical balance deteriorated by \$12.5 billion in 2008-09 and 2008 as real GDP (relative to potential) declined significantly, the cyclical deficit is larger based on Finance Canada's measure as it excludes the contribution from the trading gain and as a result of real GDP falling farther below potential given its lower starting point in 2007. As a consequence, this raises Finance Canada's estimate of the structural balance (in 2008) relative to PBO's estimate (in 2008-09).

**5. Structural Balance Estimates, 2009-10 to 2013-14**

In its November EFAU, PBO also provided estimates of the Government's structural balance over the current and subsequent four fiscal years (see Table B-1 in Annex B for PBO's structural balance estimates over 1976-77 to 2013-14). Table 5-1 shows that the structural balance is projected to deteriorate from essentially a balanced position in 2007-08 (i.e., a \$0.3 billion deficit) to an \$18.9 billion structural deficit in 2013-14.

<sup>32</sup> Finance Canada's 2009 Fiscal Reference Tables indicate a cyclically-adjusted budget balance of 0.9 per cent of potential (nominal) GDP or \$13.8 billion in 2007. Thus the approximate level of potential nominal GDP is \$1,530 billion. The (actual) GDP deflator is used to deflate both actual and potential nominal GDP and therefore potential real GDP in 2007 would be approximately \$1,313 billion. Real GDP in 2007 stood at \$1,316 billion and given potential real GDP of \$1,313 billion, the output gap would be 0.2 per cent.



**Table 5-1**

**Structural and Cyclical Budget Balance Estimates**

(\$ billions)

	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14
Budgetary balance	9.6	-5.8	-54.2	-43.1	-27.9	-23.2	-19.0
Structural balance	-0.3	-3.2	-12.5	-13.5	-13.1	-16.8	-18.9
Cyclical balance	9.9	-2.5	-41.8	-29.6	-14.8	-6.5	-0.1

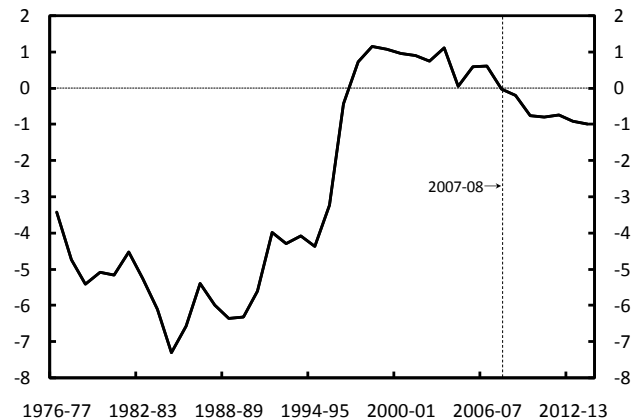
Source: Office of the Parliamentary Budget Officer

Figure 5-1 shows the structural balance relative to potential income (GDI) over 1976-77 to 2013-14. PBO projects that the structural deficit over the medium term will reach 1.0 per cent of potential income in 2013-14, significantly smaller than the structural deficits observed in the 1980s and early 1990s. To help identify the contributors to the deterioration in the structural balance from 2007-08 to 2013-14, it is useful to compare the changes in its underlying components: structural revenues, structural program spending and public debt charges.

**Figure 5-1**

**Structural Balance Relative to Potential Income**

(Per cent of potential income)



Source: Office of the Parliamentary Budget Officer

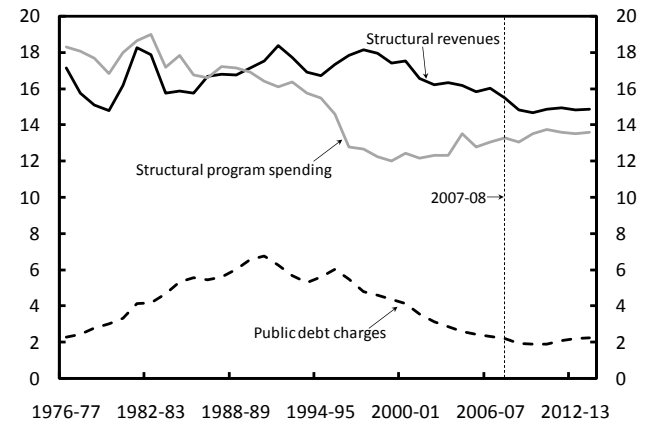
Figure 5-2 presents the components of the structural balance relative to potential income. The change (in absolute terms) in structural revenues relative to potential income from 15.5 per cent in 2007-08 to 14.8 per cent in 2013-14 is

twice as large as the increase in structural program spending from 13.3 per cent to 13.6 per cent over the same period, while public debt charges are 2.2 per cent of potential income in both 2007-08 and 2013-14. This suggests that the deterioration in the structural balance relative to potential income is largely due to lower revenues.

**Figure 5-2**

**Components of the Structural Balance**

(Per cent of potential income)



Source: Office of the Parliamentary Budget Officer

In particular, over this period structural corporate income tax revenues are projected to decline by 0.8 percentage points of potential income, reflecting reductions in the statutory tax rate from 22.12 per cent in 2007 (including the 1.12 per cent corporate surtax, which was eliminated on January 1, 2008) to 15.0 per cent in 2012. In addition, the structural component of excise taxes is projected to decline by 0.4 percentage points of potential income over 2007-08 to 2013-14 reflecting, in part, the January 1, 2008 reduction in the GST rate from 6.0 per cent to 5.0 per cent. These reductions, relative to potential income, in structural CIT and excise tax revenues are only partially offset by increased EI premium revenues (+0.4 percentage points of potential income) and PIT revenues (+0.2 percentage points of potential income). Despite these increased revenues over the medium term, the CIT and GST reductions push the projected level of structural revenues relative to potential income close their lowest level since 1976-77.

Structural program spending relative to potential income is projected to increase only moderately over the medium term but remain above the historic lows observed over the mid-1990s and early 2000s. However, it is important to note that with the exception of EI benefits, PBO has simply adopted the Government's remaining program spending projection, which by construction, represents structural expenditure. PBO's projection of structural program spending is therefore dependent on a relatively conservative projection with spending growth averaging less than 4 per cent in the last four years of the projection period, well below historical growth rates and the projected growth rate of the economy. Further, the estimates of structural spending are also conditional on the Government ensuring that none of the temporary spending stimulus measures become permanent.

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## Annex A

**Table A-1**

**Estimated and Assumed Revenue and Expenditure Elasticities**

(Per cent)

	Personal income taxes	EI contributions	Corporate income taxes	Excise taxes	EI benefits
1976-77	1.600	0.600	1.000	1.000	1.000
1977-78	1.600	0.600	1.000	1.000	1.000
1978-79	1.600	0.600	1.000	1.000	1.000
1979-80	1.600	0.600	1.000	1.000	1.000
1980-81	1.600	0.600	1.000	1.000	1.000
1981-82	1.600	0.600	1.000	1.000	1.000
1982-83	1.600	0.600	1.000	1.000	1.000
1983-84	1.600	0.600	1.000	1.000	1.000
1984-85	1.600	0.600	1.000	1.000	1.000
1985-86	1.600	0.600	1.000	1.000	1.000
1986-87	1.600	0.600	1.000	1.000	1.000
1987-88	1.600	0.600	1.000	1.000	1.000
1988-89	1.600	0.600	1.000	1.000	1.000
1989-90	1.600	0.600	1.000	1.000	1.000
1990-91	1.600	0.600	1.000	1.000	1.000
1991-92	1.601	0.601	1.000	1.000	1.000
1992-93	1.598	0.622	1.000	1.000	1.000
1993-94	1.602	0.669	1.000	1.000	1.000
1994-95	1.602	0.653	1.000	1.000	1.000
1995-96	1.595	0.679	1.000	1.000	1.000
1996-97	1.597	0.624	1.000	1.000	1.000
1997-98	1.598	0.591	1.000	1.000	1.000
1998-99	1.614	0.573	1.000	1.000	1.000
1999-00	1.620	0.547	1.000	1.000	1.000
2000-01	1.613	0.513	1.000	1.000	1.000
2001-02	1.604	0.500	1.000	1.000	1.000
2002-03	1.616	0.494	1.000	1.000	1.000
2003-04	1.619	0.486	1.000	1.000	1.000
2004-05	1.614	0.456	1.000	1.000	1.000
2005-06	1.659	0.448	1.000	1.000	1.000
2006-07	1.665	0.421	1.000	1.000	1.000
2007-08	1.732	0.413	1.000	1.000	1.000
2008-09	1.717	0.411	1.000	1.000	1.000
2009-10	1.735	0.421	1.000	1.000	1.000
2010-11	1.729	0.420	1.000	1.000	1.000
2011-12	1.719	0.419	1.000	1.000	1.000
2012-13	1.710	0.420	1.000	1.000	1.000
2013-14	1.706	0.420	1.000	1.000	1.000

Source: Office of the Parliamentary Budget Officer

## Annex B

**Table B-1**

### Real GDP, Trading Gains and Structural Budget Balance

	(\$ billions)	(\$ billions)	(Per cent)	(Index 2002=1.0)	(Index 2002=1.0)	(Per cent)	(\$ billions)
	<b>Real GDP</b>	<b>Real potential GDP</b>	<b>Output gap</b>	<b>Trading gain</b>	<b>Trend trading gain</b>	<b>Trading gain gap</b>	<b>Structural budget balance</b>
1976-77	554	557	-0.4	1.061	1.050	1.0	-7.0
1977-78	573	573	-0.1	1.048	1.049	-0.2	-10.7
1978-79	595	588	1.1	1.040	1.047	-0.7	-13.6
1979-80	618	604	2.3	1.052	1.045	0.7	-14.3
1980-81	631	621	1.5	1.048	1.041	0.7	-16.5
1981-82	645	640	0.8	1.036	1.037	-0.1	-16.5
1982-83	627	661	-5.1	1.028	1.033	-0.4	-21.4
1983-84	656	682	-3.8	1.026	1.028	-0.2	-26.8
1984-85	692	703	-1.5	1.018	1.025	-0.6	-34.2
1985-86	722	723	-0.1	1.016	1.022	-0.6	-32.7
1986-87	739	740	-0.2	1.009	1.019	-1.0	-28.4
1987-88	776	757	2.5	1.018	1.017	0.0	-33.6
1988-89	809	773	4.7	1.024	1.016	0.7	-37.7
1989-90	827	789	4.7	1.023	1.015	0.8	-39.9
1990-91	818	807	1.4	1.017	1.013	0.4	-37.5
1991-92	810	826	-1.9	1.013	1.011	0.2	-27.9
1992-93	819	846	-3.2	1.008	1.010	-0.2	-31.4
1993-94	842	866	-2.8	1.002	1.008	-0.6	-31.2
1994-95	885	889	-0.5	1.001	1.007	-0.6	-34.6
1995-96	900	915	-1.6	1.014	1.007	0.7	-26.7
1996-97	921	944	-2.4	1.017	1.007	1.0	-3.7
1997-98	963	976	-1.3	1.010	1.007	0.3	6.6
1998-99	1002	1010	-0.8	0.993	1.008	-1.4	10.9
1999-00	1060	1046	1.4	1.006	1.009	-0.3	10.6
2000-01	1109	1085	2.2	1.022	1.012	0.9	10.2
2001-02	1126	1124	0.2	1.003	1.016	-1.3	10.0
2002-03	1161	1159	0.1	1.006	1.020	-1.4	9.0
2003-04	1180	1190	-0.8	1.020	1.026	-0.6	13.8
2004-05	1221	1221	0.0	1.035	1.032	0.3	0.6
2005-06	1259	1251	0.7	1.046	1.037	0.9	8.2
2006-07	1289	1280	0.7	1.048	1.041	0.6	8.8
2007-08	1321	1307	1.1	1.062	1.044	1.7	-0.3
2008-09	1314	1334	-1.5	1.062	1.045	1.6	-3.2
2009-10	1294	1360	-4.8	1.034	1.045	-1.1	-12.5
2010-11	1331	1388	-4.1	1.038	1.045	-0.6	-13.5
2011-12	1376	1415	-2.8	1.039	1.044	-0.5	-13.1
2012-13	1424	1442	-1.2	1.041	1.043	-0.1	-16.8
2013-14	1467	1467	0.0	1.041	1.042	0.0	-18.9

Source: Office of the Parliamentary Budget Officer

## Annex C

**Table C-1**

### Estimated Short-run Output Gap and Trading Gain Gap Elasticities

(Per cent)

	<b>Personal income taxes</b>	<b>EI contributions</b>	<b>Corporate income taxes</b>	<b>Excise taxes</b>	<b>EI benefits</b>
Output gap	0.680 (0.152)	0.714 (0.170)	5.912 (1.274)	1.000 -	-4.660 (0.522)
Trading gain gap	0.238 (0.247)	0.287 (0.175)	4.934 (2.152)	1.000 -	-1.064 (1.137)

Source: Office of the Parliamentary Budget Officer

Notes: Figures in parentheses are Newey-West HAC standard errors.

Following the OECD methodology, the elasticity of excise taxes with respect to the output gap and trading gain gap are assumed equal to 1.0.