

**Federal Budget Estimates:**

**July 2005 Update**

**July 14, 2005**

**Prepared for the**

House of Commons

Standing Committee

on Finance

**Paper prepared by François Vaillancourt,  
Professor, Economics, Université de Montréal**

**Assisted by**

**Fabio Bojorquez, MSc. student**

---

**We would like to thank Benoît Perron, Professor, Economics, Université de Montréal, for his invaluable advice in the area of econometrics.**

## **Introduction**

For several years now, a number of people have questioned the accuracy of the federal government's budget forecasts following a series of unexpected and yet substantial surpluses. In response to this, the federal government has commissioned the services of an independent expert, Mr Tim O'Neil<sup>1</sup>, to review these estimates in order to improve their accuracy. In December 2004, and again in May 2005, the House of Commons Standing Committee on Finance (SCF) requested independent forecasts. This paper is intended to assist in the third round of forecasting.

More specifically, we have been mandated to:

- select a series of estimates used for the purposes of revenue and expenditure forecasting and present our findings in table format;
- use this information to produce our own version of Budget 2005 Tables 7.6 and 7.7;
- discuss any discrepancies between our estimates and those outlined in Budget 2005.

After careful consideration, we decided to produce tools which may eventually be of use to the SCF or, at the very least, its staff. They could prove useful given the SCF's concerns about the appropriateness of producing its own projections. For this reason, we have included the data, projected values, estimated equations and programs used in the compilation of this report. The paper is divided into two sections: the first provides a summary of our findings; the second, a more in-depth discussion of projections for each type of revenue source. A series of tables have been appended to the main document.

---

<sup>1</sup> See *Review of Canadian Fiscal Forecasting: Processes and Systems*, [http://www.fin.gc.ca/toce/2005/ONeil\\_e.html](http://www.fin.gc.ca/toce/2005/ONeil_e.html)

## **I. Summary of Findings**

The three tables below were explicitly requested under our mandate and provide a synthesis of the projected macro-economic and fiscal outlook. Please note, our model's forecast (in Tables 2/7.6 and 3/7.7) include the projected fiscal position for fiscal 2004-05 through 2006-07. We used the most recent Budget Estimates from the Department of Finance as the bulk of budgetary forecasting errors concern revenue<sup>2</sup>. Our tax revenue projections apply to four sources of revenue: personal income tax, corporate income tax, GST revenue, and Employment Insurance premiums. The four amounts are:

- determined according to national accounts econometric instruments;
- corrected to take into account the discrepancy between our 2004-05 projections (averaged out over four quarters) and actual measured amounts;
- converted to public accounts amounts and;
- adjusted to factor in the last budget's tax measures.

In the second section of the report, there is a more in-depth description of the estimates process. The fifth category (i.e. other revenue) is based on the Department of Finances estimates given the high number of small amounts involved and low overall variability<sup>3</sup>.

Table 1 outlines our forecast of the macro-economic indicators for the period 2005-2007. These estimates are based on a combination of recent projections carried out by the organizations listed in Appendix Table F2.

Table 2/7.6 compares budgetary revenue to expenses in order to produce a surplus. The section "program expenses" is up compared to Budget 2005 *and* our April 2005 report due to new

---

<sup>2</sup> See Jim Stanford, *Federal Fiscal Forecasting: Pre-Budget Update* (February 22, 2005).

<sup>3</sup> This category is defined as being the difference between total revenue and revenue accumulated from the first four aforementioned categories.

initiatives announced since the release of Budget 2005<sup>4</sup>. Therefore, for fiscal 2005-06 and 2006-07<sup>5</sup> the net financial costs of the new initiatives have been added to the expense forecast in Budget 2005.

For fiscal 2004-05 and 2005-06, we anticipate a positive budget balance. For fiscal 2006-07, on the other hand, a negative budget balance is expected, while the budget estimates will have a zero balance for the three years. Therefore, the surplus<sup>6</sup> will total \$0.7 billion in 2004-05, \$1.6 billion in 2005-06 and -\$2.3 billion in 2006-07. Table 3/7.7, which outlines the tax revenue for each revenue category, indicates that there is indeed a discrepancy between our findings and the Department of Finance's. For example, in the case of personal and corporate income tax and GST revenue, our estimates are, overall, higher than the Department's. The opposite is however true as far as Employment Insurance premiums are concerned. Overall, the most notable discrepancy, to the tune of about \$4 billion, is in 2005-06. In this particular instance, the Department projected tax revenue of \$200 418 million in contrast to our forecast for the same period of \$204 386 million.

---

<sup>4</sup> See relevant table in the Department of Finance May 13, 2005, 2005-035 press release under: "The Minister of Finance outlines the financial impact of recent Government of Canada initiatives", available on: <http://www.fin.gc.ca/news05/05-035e.html>

<sup>5</sup> For fiscal 2006-07: the cost of new initiatives was added, except for costs associated with the Airport Rent Reduction, which was subtracted under the section "Other Revenue".

<sup>6</sup> After subtracting the Contingency Reserve and amount for Economic Prudence.

**Table 1**  
**Macroeconomic Projections**

	2004	2005	2006	2007
	(%)			
<b>Authors' projections</b>				
Real GDP Growth	2.9	2.7	2.9	3.4
Inflation according to GDP	3.1	2.4	2.1	1.6
Nominal GDP Growth	6.1	5.1	4.9	5.0
Three Month Treasury Bill Rate	2.3	2.7	3.3	4.8
Performance of 10 Year Government Bonds	4.5	4.2	4.5	6.1
Unemployment Rate	7.2	6.9	6.9	6.8
Employment Growth	1.8	1.3	1.4	1.6
Real GDP Growth – United States	4.4	3.5	3.2	3.7
<b>February 2005 Budget</b>				
Real GDP Growth	2.7	2.9	3.1	2.9
Inflation according to GDP	3.3	2.0	1.9	1.9
Nominal GDP Growth	6.1	4.9	5.0	4.8
Three Month Treasury Bill Rate	2.2	2.7	3.5	4.6
Performance of 10 Year Government Bonds	4.6	4.6	5.1	5.6
Unemployment Rate	7.2	7.2	7.0	6.7
Employment Growth	1.7	1.4	1.5	1.4
Real GDP Growth – United States	4.4	3.6	3.4	n.a.

Sources: Projections compiled, July 1 – 5, 2005, from a variety of domestic and international private sector sources including: BMO Financial Group, BMO Nesbitt Burns Economics, TD Economics, RBC Financial Group, Institute for Policy Analyses / University of Toronto, National Bank, Desjardins Economic Surveys, Scotia Economics, Global insight, CIBC World Markets Inc., Consensus Economics. One database was developed based predominantly on annual data and another on quarterly projections (used for calculating estimates) included in Tables F-1 and F-2 of the Appendix. The average of the annual figures constitutes our annual forecast, outlined above.

Department of Finance, *2005 Budget Plan*, p.71.

**Table 2 (7.6)**  
**Summary of budgetary transactions, including February 2005 Budget measures (\$ billions)**

	Projections according to our model			Projections according to the Department of Finance		
	2004-05	2005-06	2006-07	2004-05	2005-06	2006-07
<b>Budgetary transactions</b>						
Budgetary revenue <sup>7</sup>	196.5	204.4	210.5	195.8	200.4	210.1
Total expenses						
Program expenses	158.1	163.7	172.2	158.1	161.3	169.5
Public debt charges	34.7	35.1	35.6	34.7	35.1	35.6
Total expenses	192.8	198.8	207.8	192.8	196.4	205.1
Underlying budget surplus	3.7	5.6	2.7	3.0	4.0	5.0
Prudence						
Contingency reserve	3.0	3.0	3.0	3.0	3.0	3.0
Economic prudence	0.0	1.0	2.0	0.0	1.0	2.0
Total	3.0	4.0	5.0	3.0	4.0	5.0
<b>Budget balance</b>	<b>0.7</b>	<b>1.6</b>	<b>-2.3</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>
<b>Federal debt (accumulated deficit)</b>						
Balanced budget (no debt reduction)	501.5	501.5	501.5	501.5	501.5	501.5
Use of the contingency reserve for debt reduction	498.5	495.5	492.5	498.5	495.5	492.5
<b>Percentage of GDP</b>						
Budgetary revenue	15.0	14.8	14.6	15.1	14.8	14.7
Programme expenses	12.1	11.9	11.9	12.2	11.9	11.9
Public debt charges	2.6	2.5	2.5	2.7	2.6	2.5
Federal debt (accumulated debt) <sup>8</sup>	38.3	36.4	34.7	38.8	37.0	35.2
<b>Other</b>						
Public debt charges as a percentage of revenue	17.7	17.2	16.9	17.7	17.5	16.9
Annual variation (%)						
Budgetary revenue	5.5	4.0	3.0	5.2	2.3	4.8
Program expenses	11.9	3.6	5.2	11.9	2.0	5.1
Total expenses	8.9	3.1	4.5	8.9	1.9	4.4
Nominal GDP	6.3	5.4	4.9	6.1	4.9	5.0

<sup>7</sup> In our first submission (April 2005), our budgetary revenue projections for 2004-05 to 2006-07 were \$220.7, 204.9 and 211.9 billion respectively. The main cause of this variation is the correction of Statistics Canada's databases for the period following the fourth quarter of 2000. The changes reduced our projection levels but did not affect the performance of our models.

<sup>8</sup> Without applying the debt reduction contingency reserve.

Source: Calculations based on data from Statistics Canada and Department of Finance document *2005 Budget Plan*.





**Table 3 (7.7)**  
**Revenue outlook, including February 2005 Budget measures (\$ millions)**

	Projections according to our model			Projections according to the Department of Finance		
	2004-05	2005-06	2006-07	2004-05	2005-06	2006-07
<b>Tax revenue</b>						
Income tax						
Personal income tax	91 940	98 030	102 317	89 594	94 252	100 453
Corporate tax	28 465	30 129	29 188	28 422	29 170	29 323
Other income tax	3 552	3 523	3 719	3 552	3 523	3 719
Total income tax	123 957	131 682	135 224	121 568	126 945	133 496
Excise duties and taxes						
Goods and services tax	29 490	31 820	34 349	30 237	31 544	33 264
Customs duties on imports	3 017	3 061	3 267	3 017	3 061	3 267
Energy taxes	4 491	4 679	4 787	4 491	4 679	4 787
Other excise duties and taxes	5 294	5 280	5 311	5 294	5 280	5 311
Air travellers security charge	370	340	355	370	340	355
Total excise duties and taxes	42 662	45 180	48 069	43 408	44 904	46 984
<b>Total tax revenue</b>	166 619	176 861	183 292	164 977	171 848	180 479
<b>Employment Insurance revenue</b>	16 111	16 174	15 231	17 101	17 218	17 603
<b>Other revenue</b>	13 751	11 351	11 971	13 751	11 351	12 019
<b>Total budgetary revenue</b>	196 480	204 386	210 494	195 828	200 418	210 102
<b>Percentage of GDP</b>						
Personal income tax	7.0	7.1	7.1	6.9	6.9	7.1
Corporate tax	2.2	2.2	2.0	2.2	2.2	2.1
Other income tax	0.3	0.3	0.3	0.3	0.3	0.3
Goods and services tax	2.3	2.3	2.4	2.3	2.3	2.3
Excise duties and taxes (not including GST)	1.0	1.0	0.9	1.0	1.0	1.0
<b>Total tax revenue</b>	12.7	12.8	12.7	12.8	12.7	12.7
Employment insurance revenue	1.2	1.2	1.1	1.3	1.3	1.2
Other revenue	1.0	0.8	0.8	1.1	0.8	0.8
<b>Total budgetary revenue</b>	15.0	14.8	14.6	15.1	14.8	14.7

Source: Calculations based on data from Statistics Canada and Department of Finance document *2005 Budget Plan*.

## II. Estimates

Here are the results for each main revenue stream.

The sample used for this study covers the period 1991(1) through 2005(1). Data from 1961(1) and onwards was available. However, due to structural changes (including rates, base, etc.) we opted for a sample covering a shorter period.

The four series of estimates are presented according to an AR-type error autocorrelation<sup>9</sup> model. Not including the AR(1) specification in a lagged dependent variable model in which errors are autocorrelated can lead to biases as far as estimators and projections<sup>10</sup> are concerned.

The econometric forecasting of income categories is calculated using annualized quarterly data which has been adjusted for seasonal variation<sup>11</sup>. In this study, we used two lagged variable econometric models. The first is an ARMA<sup>12</sup> model (1.0.0) autoregressive process with mobile average estimated by « Likelihood Maximum<sup>13</sup> ». The second is a lagged dependent variable model with a double lag “LDV”<sup>14</sup>. Although both models provide for a fairly high level of performance<sup>15</sup>, we opted for the model which gives a more accurate account (higher  $R^2$ ) of the variation of the dependent variable. In short, the ARMAX model has been applied to three of the revenue streams: personal income tax, corporate tax and GST. The LDV model has been used in relation to Employment Insurance tax revenue. Furthermore, having recognized a high<sup>16</sup>  $R^2$  in the

---

<sup>9</sup> We decided to use an AR (1) model on the basis of the observation of autocorrelation (acf) and partial autocorrelation (pacf) of series functions.

<sup>10</sup> Wooldridge (2000) p.317-318.

<sup>11</sup> This data was obtained from Statistics Canada and is presented in Tables A and B of the Appendix.

<sup>12</sup> Please note that the ARMA model including independent variables is often called ARMAX.

<sup>13</sup> The Maximum Likelihood estimator is a statistical method used to determine the parameters of the relationship between variables.

<sup>14</sup> See model equations in Appendix E at the end of the document.

<sup>15</sup> The performance criteria selected is the regression  $R^2$ .

<sup>16</sup> The  $R^2$  are, respectively, 0.9806, 0.9764, 0.9976 and 0.8024.

case of each regression, it is considered that the chosen model is appropriate for forecasting purposes; our criteria would be different were we wanting an explanatory model.

The following step involves the projection of dependent variable levels. By using STATA<sup>17</sup> and the correct commands<sup>18</sup>, projections are automatically obtained for the selected model for the requested period. It is worth noting that later data on independent variables is required in order to project the future levels of the four revenue streams. Quarterly projections are used in relation to interest rates<sup>19</sup> and the nominal GDP level for the period 2005(2) through 2007(1).<sup>20</sup>

Furthermore, the STATA projections were corrected to take into account the average lowballed numbers for fiscal 2004-05. For 2004-05, we calculate the mean deviation in dollar terms between the actual quarterly results for fiscal 2004-05 and the model's projections. This amount is added to the quarterly amount projected by the models. This process gives us the corrected forecast for quarters 2004(2) through 2005(1). For fiscal 2005-06 and 2006-07, the correction factor is the mean deviation in percentage terms between the actual results and the models' projections for fiscal 2004-05. This percentage is multiplied by the quarterly amount estimated according the model and added to it. This approach enables us to calculate forecast corrections for quarters 2005(2) through 2007(1).

The corrected forecasts are then converted to public accounts data. In order to do this, an average of the two ratios is used as a conversion factor. To determine the first ratio/coefficient, an historical average (1991-2004) of the ratios between national accounts and public accounts was

---

<sup>17</sup> The program *Stata* (StataCorp. 2003.) is used in the production of estimates.

<sup>18</sup> See appendix E at the end of the document.

<sup>19</sup> The Three Month Treasury Bill Rate is used.

<sup>20</sup> The Three Month Treasury Bill Rate is used.

taken for each of the dependent variables<sup>21</sup>. The second ratio was determined by following the procedure outlined in Appendix 4 of the Department of Finance's *2004 Economic and Fiscal Update*.<sup>22</sup> The averages of the two ratios are the conversion factors used. One need only multiply our national accounts projections by these factors in order to determine the public accounts projections.

To convert quarters into years, the average of the four quarters for a given fiscal year must be taken. Lastly, a final adjustment must be made in light of the tax measures announced in the 2005 Budget.

---

<sup>21</sup> See Appendix Table D.

<sup>22</sup> See [www.fin.gc.ca/ec2004/eca4e.html](http://www.fin.gc.ca/ec2004/eca4e.html) . Note that in our initial study (April 2005), we calculated conversion ratios. In this study, however, these figures were used as our second ratio.

## 2.1 An estimate of tax revenue derived from personal income tax

Generally speaking, tax revenue from personal income tax is on the rise. Chart 1 shows the trend in tax revenue derived from personal income tax from 1991(1) to 2005(1). The chart also lists projections from our statistical model through fiscal 2007 (dotted line).

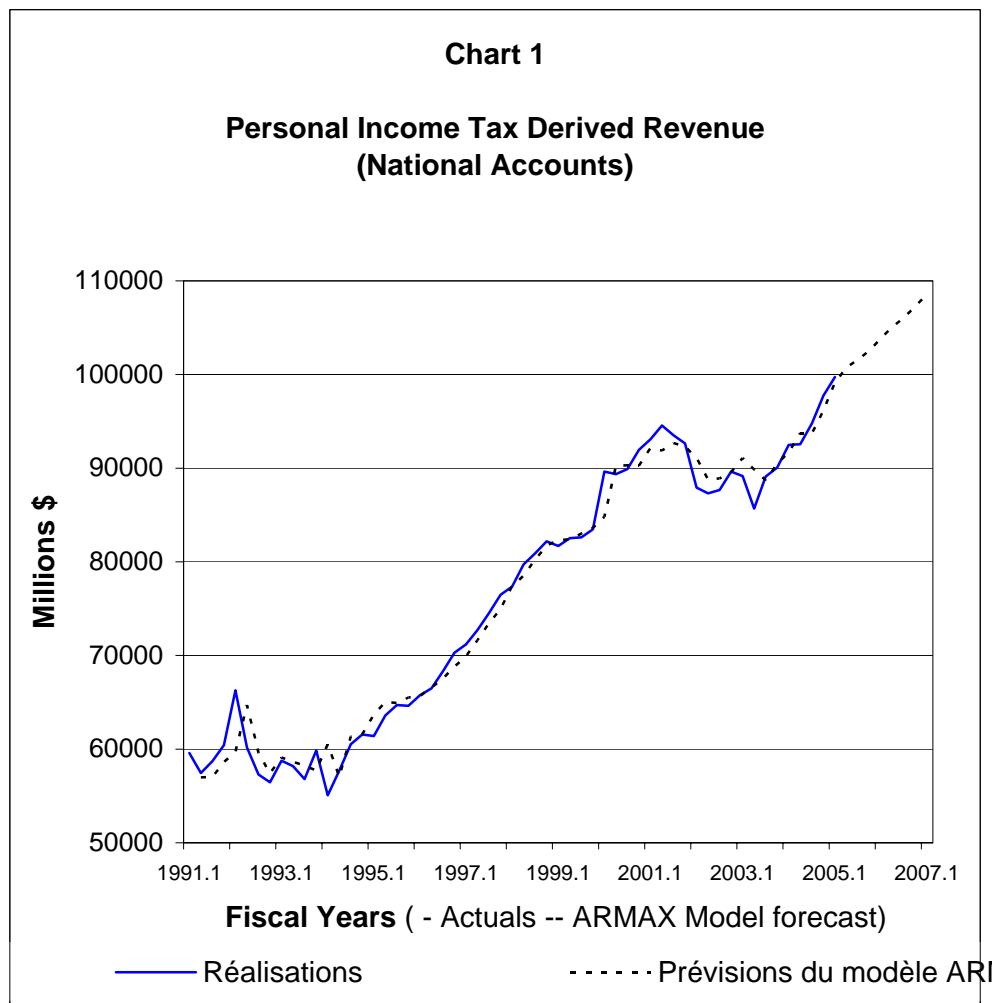
In order to make our projections comparable to the Department of Finance's, we have expressed fiscal 2004-05 through 2006-07 results in terms of public accounts and corrected them to factor in the changes to the tax<sup>23</sup> announced in Budget 2005. The gradual increase of the Basic Personal Exemption to \$10,000 announced in the February 2005 Budget effectively reduces tax revenue for this category.

**Table 2.1.1**

**Projected personal income tax revenue expressed in terms of national accounts pre-budget and public accounts post-budget  
Canada, 2004-2007 Canada (millions/today's \$)**

	2004-05	2005-06	2006-07
Model-projected amount in terms of national accounts	96 199	102 721	107 316
Amount expressed in terms of public accounts	91 951	98 168	102 726
Amount in terms of public accounts corrected after budget measures	91 940	98 030	102 317

<sup>23</sup> The cost of budget measures is subtracted according to the amount of personal income tax revenue as a proportion of the total personal and corporate income tax revenue. See section *A fair and competitive tax system* (Table 2 of "Budget 2005 in Brief" on page 24).



**Table 2.1.2**

**Results of Projected Personal Income Tax Revenue**

Regression ARMAX (1.0.0) / Dependent Variable: Ln (Personal income tax)  
1991(1) to 2005(1) sample / Sample size: 56

Independent variables	Coefficients	Standard deviations
t	0.0150196	0.0125532
t <sup>2</sup>	-0.0000725	0.0001708
GDP <sub>t</sub>	3.74E-07	6.00E-07
GDP <sub>t-1</sub>	-2.28E-07	9.63E-07
Interest rate <sub>t</sub>	0.0022096	0.0083023
Interest rate <sub>t-1</sub>	0.015433	0.0103823
Constant	10.64027	0.7271371
AR (1)	0.80213	0.0839011
R <sup>2</sup>	0.9806	
Log-likelihood	119.6669	

## 2.2 Projected corporate tax derived tax revenue

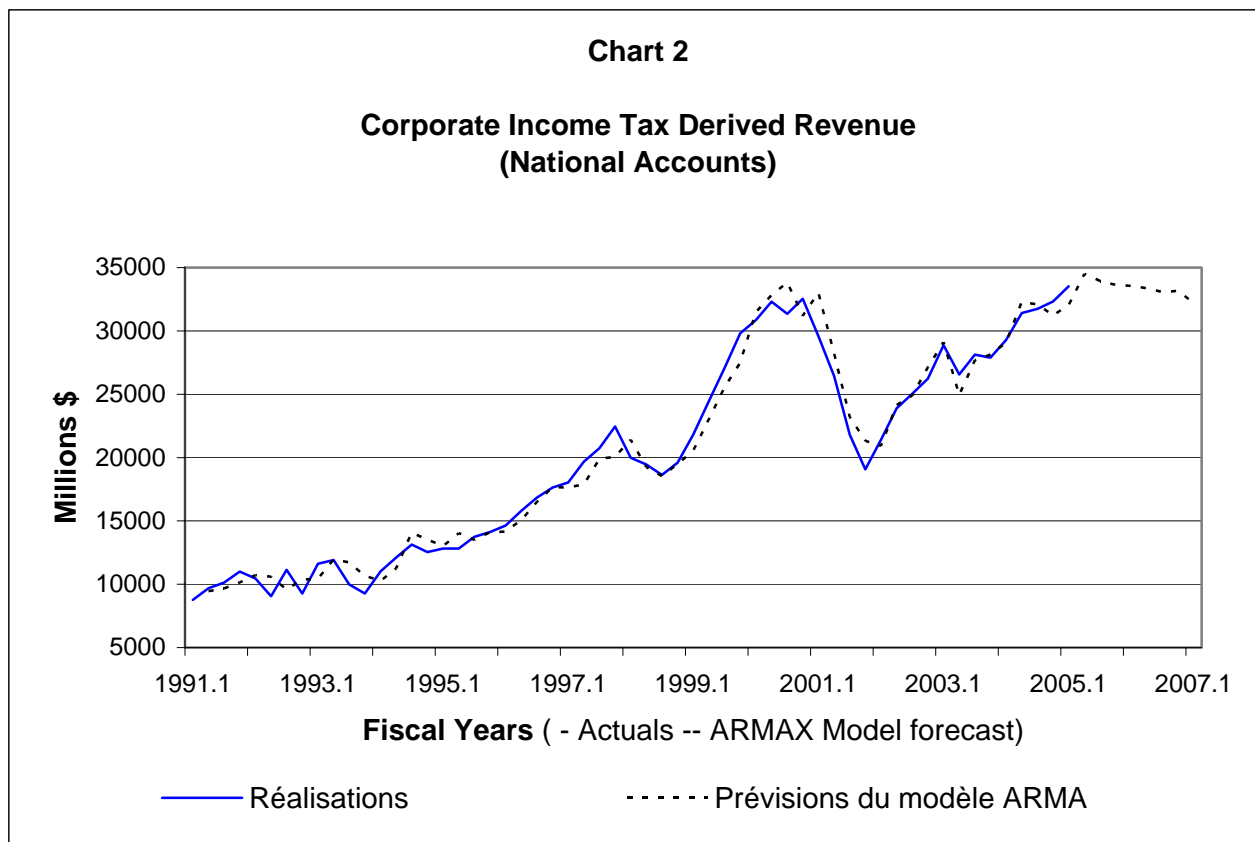
Since the late 1990s, corporate income tax revenue has fluctuated greatly. Chart 2 illustrates this. In order to make our projections comparable to the Department of Finance's, we have expressed fiscal 2004-05 through 2006-07 results in terms of public accounts and corrected them to factor in the changes to the tax<sup>24</sup> announced in Budget 2005.

**Table 2.2.1**

**Projected corporate income tax revenue expressed in terms of national accounts pre-budget and public accounts post-budget  
Canada, 2004-2007 Canada (millions/today's \$)**

	<b>2004-05</b>	<b>2005-06</b>	<b>2006-07</b>
Model-projected amount in terms of national accounts	32 251	34 238	33 273
Amount expressed in terms of public accounts	28 469	30 178	29 335
Amount in terms of public accounts corrected after budget measures	28 465	30 129	29 188

<sup>24</sup> The cost of budget measures is subtracted according to the amount of corporate income tax revenue as a proportion of the total personal and corporate income tax revenue. See section *A fair and competitive tax system* (Table 2 of "Budget 2005 in Brief" on page 24).



**Table 2.2.2**

**Results of Projected Corporate Income Tax Revenue**

Regression ARMAX (1.0.0) / Dependent Variable: Ln (Corporate income tax)  
1991(1) to 2005(1) sample / Sample size: 56

<b>Independent variables</b>	<b>Coefficients</b>	<b>Standard deviations</b>
t	0.005321	0.0184894
t <sup>2</sup>	-0.0008129	0.0002899
GDP <sub>t</sub>	6.38E-06	1.75E-06
GDP <sub>t-1</sub>	-8.41E-07	1.79E-06
Interest rate <sub>t</sub>	-0.0223068	0.0143378
Interest rate <sub>t-1</sub>	0.0234258	0.0125255
Constant	5.309669	1.062259
AR (1)	0.7757392	0.0963266
R <sup>2</sup>		0.9764
Log-likelihood		70.82976



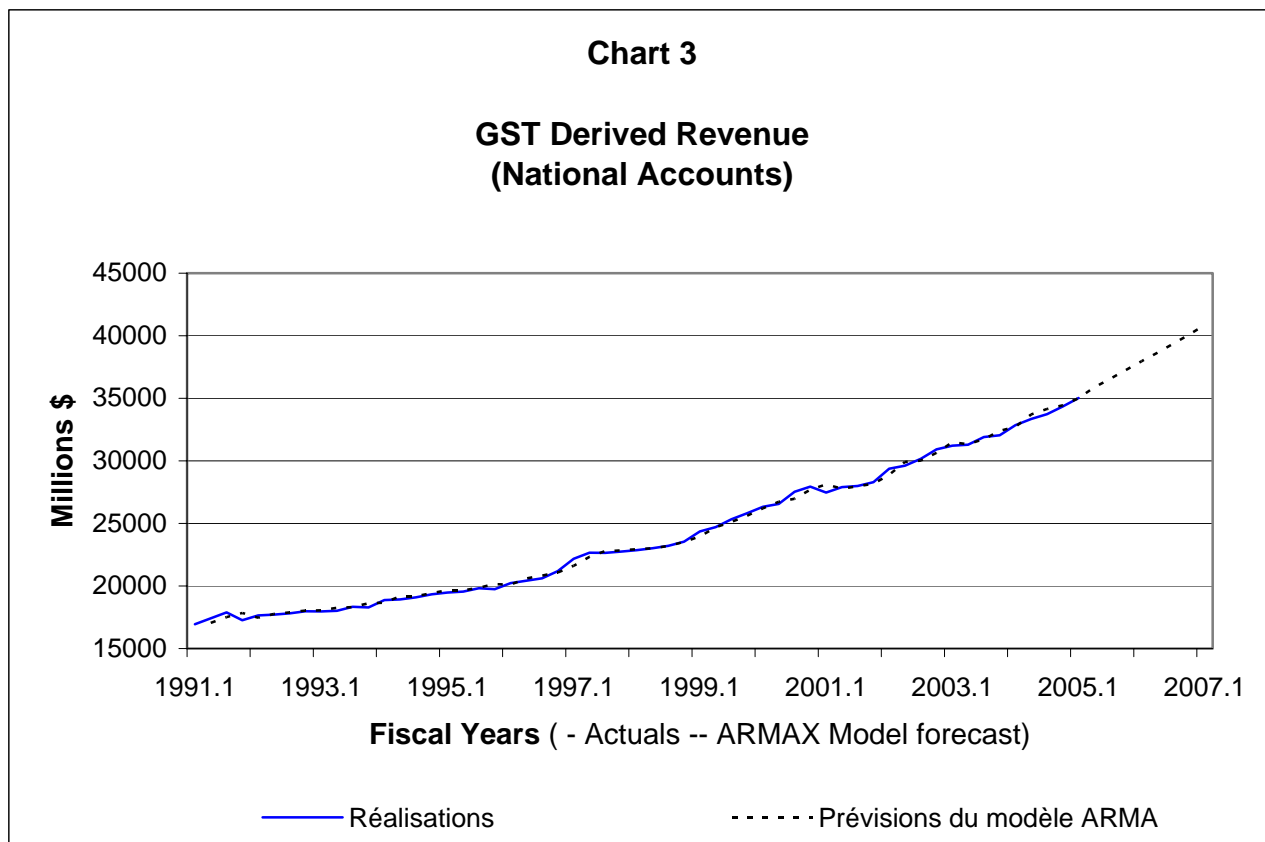
## 2.3 Projected GST-derived revenue

Since its introduction in 1991, GST-generated tax revenue has grown steadily. Chart 3 illustrates the trend in tax revenue derived from the GST since its inception through to 2004(4) (actual results). As with previous revenue streams, the economic model-based forecast is represented by a dotted line.

**Table 2.3.1**

**Projected GST generated tax revenue expressed in terms of national accounts pre-budget  
and public accounts post-budget  
Canada, 2004-2007 Canada (millions/today's \$)**

	<b>2004-05</b>	<b>2005-06</b>	<b>2006-07</b>
Model-projected amount in terms of national accounts	34 115	36 683	39 489
Amount expressed in terms of public accounts	29 490	31 820	34 349



**Table 2.3.2**

**Results of Projected GST Derived Revenue**

Regression ARMAX (1.0.0) / Dependent Variable: Ln (GST)  
1991(1) to 2005(1) sample / Sample size: 56

Independent variables	Coefficients	Standard deviations
t	0.0049334	0.0030826
t <sup>2</sup>	0.0000371	0.0000422
GDP <sub>t</sub>	4.66E-07	4.60E-07
GDP <sub>t-1</sub>	2.72E-08	3.17E-07
Interest rate <sub>t</sub>	0.0004067	0.0033275
Interest rate <sub>t-1</sub>	-0.0031206	0.0032507
Constant	9.425235	0.2248201
AR (1)	0.7248099	0.0943784
R <sup>2</sup>	0.9976	
Log-likelihood	171.6894	

## 2.4 Projected Employment Insurance derived tax

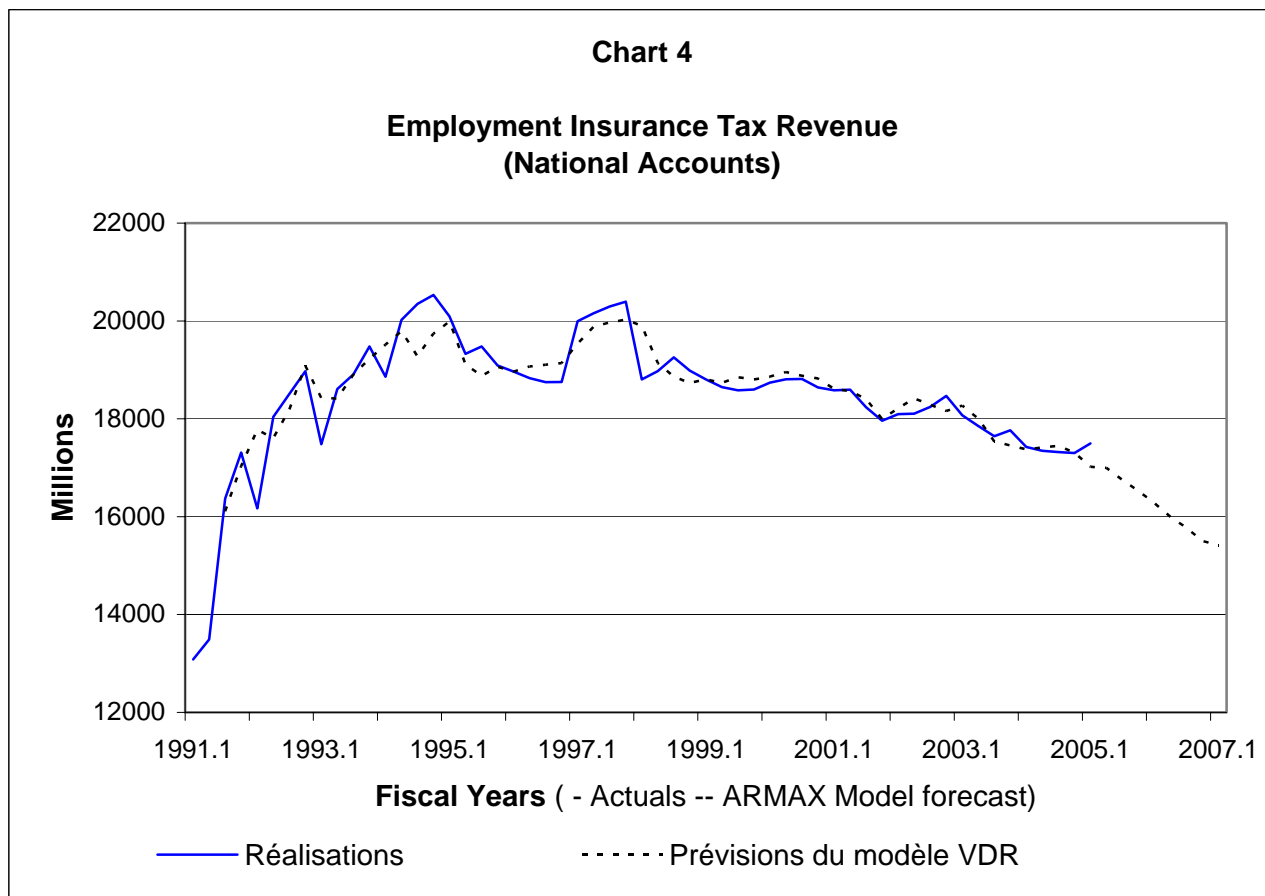
Following solid growth in the early 1990s, Employment Insurance generated revenue has now dropped slightly. Chart 4 indicates that in the later half of the 1990s, there was a small decrease in this type of revenue. The premium projections have been adjusted for the three years in question to take into account the rate reduction<sup>25</sup> (i.e. a drop from \$2.10 to \$1.98 per \$100 insured for fiscal 2004-05 and \$1.98 to \$1.95 in other years).

**Table 2.4.1**

**Projected Employment Insurance revenue expressed in terms of national accounts pre-budget and public accounts post-budget  
Canada, 2004-2007 Canada (millions/today's \$)**

	<b>2004-05</b>	<b>2005-06</b>	<b>2006-07</b>
Model-projected amount in terms of national accounts	17 366	16 701	15 732
Amount expressed in terms of public accounts	17 067	16 407	15 442
Amount in terms of public accounts corrected after budget measures	16 111	16 174	15 231

<sup>25</sup> Adjustments are proportionate to the rate reduction for the year in question.



**Table 2.4.2**

**Results of Projected Employment Insurance Derived Tax Revenue**

Regression LDV / Dependent Variable: Ln (Employment Insurance)  
1991(1) to 2005(1) sample / Sample size: 55

Independent variables	Coefficients	Standard deviations
t	-0.0005116	0.0019342
t <sup>2</sup>	-0.000141	0.0000378
GDP <sub>t</sub>	3.00E-07	2.94E-07
GDP <sub>t-1</sub>	2.81E-07	2.70E-07
Interest rate <sub>t</sub>	0.0065031	0.0045346
Interest rate <sub>t-1</sub>	-0.0185616	0.0057392
Constant	6.169002	0.9115402
ae <sub>t-1</sub>	0.2593156	0.1190866
ae <sub>t-2</sub>	0.0809918	0.0763925
R <sup>2</sup>	0.8024	

## **Conclusion**

The second component of our mandate involving revenue projection, expenditures and the federal government's budget balance focused primarily on the accuracy of the main revenue stream projections. It is important to note that while a 2 billion dollar revenue forecasting error may be negligible (1 %) as far as revenue is concerned; this certainly is not the case when it comes to projecting the budgetary balance. In our upcoming forecast in September 2005, we will be looking to see if it is possible to make direct public accounts projections. We will endeavour to provide the committee with user-friendly forecasting instruments as they become available.

## Appendix

**Table A**  
**Database (independent variables)<sup>26</sup>**

Year and Quarter	Nominal GDP (millions \$)	Interest Rate <sup>27</sup> (%)	Trend
1991.1	678172	10.30	1
1991.2	684432	9.04	2
1991.3	688568	8.59	3
1991.4	690296	7.70	4
1992.1	692940	7.21	5
1992.2	697432	6.38	6
1992.3	703808	5.32	7
1992.4	707740	7.25	8
1993.1	714776	5.97	9
1993.2	725168	4.96	10
1993.3	729744	4.45	11
1993.4	739048	4.19	12
1994.1	750696	3.99	13
1994.2	762520	6.14	14
1994.3	780060	5.61	15
1994.4	790216	5.89	16
1995.1	801904	7.89	17
1995.2	808152	7.45	18
1995.3	812888	6.54	19
1995.4	818760	6.05	20
1996.1	819976	5.23	21
1996.2	829324	4.79	22
1996.3	842356	4.22	23
1996.4	855800	3.05	24
1997.1	867828	2.93	25
1997.2	875936	3.02	26
1997.3	888920	3.09	27
1997.4	898248	3.63	28
1998.1	906904	4.42	29
1998.2	910572	4.70	30
1998.3	913592	4.99	31
1998.4	928824	4.71	32
1999.1	949136	4.75	33
1999.2	970888	4.50	34
1999.3	995260	4.69	35
1999.4	1014480	4.79	36
2000.1	1042100	5.06	37
2000.2	1069904	5.53	38
2000.3	1091628	5.60	39
2000.4	1102676	5.60	40
2001.1	1115212	4.98	41
2001.2	1116576	4.37	42
2001.3	1102200	3.83	43
2001.4	1098204	2.33	44
2002.1	1118780	2.02	45
2002.2	1148380	2.51	46
2002.3	1164288	2.80	47
2002.4	1185368	2.72	48

<sup>26</sup> Please note that the GDP variable and interest rate values are estimates based on 2005(2) data. Data dated June 29, 2005. This data varies from April 2005 projection data from 2001(1) and onwards.

<sup>27</sup> 3 Month Treasury Bill Rates. This is the unweighted mean of rates reported for the period in question.

2003.1	1212808	2.84	49
2003.2	1202620	3.16	50
2003.3	1216956	2.78	51
2003.4	1232380	2.64	52
2004.1	1252380	2.19	53
2004.2	1284268	1.98	54
2004.3	1305484	2.16	55
2004.4	1318608	2.54	56
2005.1	1331300	2.47	57
2005.2	1353940	2.61	58
2005.3	1369644	2.67	59
2005.4	1386385	2.91	60
2006.1	1403807	3.17	61
2006.2	1419977	3.23	62
2006.3	1436783	3.42	63
2006.4	1454595	3.46	64
2007.1	1472777	4.80	65

Source: Statistics Canada

Forecast based on data available to the public including various national and international private sector sources. Collected July 1 – 5, 2005.

Please note: Quarterly projections on Three Month Treasury Bill interest rates and nominal GDP are necessary for econometric analyses. In relation to this, it was noted that the annual rate as per the quarterly projections<sup>28</sup> varied slightly from the annual rate forecast in Table 1. As a result, the quarterly projections (2005.2 – 2007.1) were corrected accordingly to ensure that their mean was in line with the annual forecast. The adjustment was carried out by firstly calculating the mean of the year's quarterly projections. Then the difference between this mean and that of the annual forecast was determined and expressed as a percentage. Finally, this percentage was multiplied by each year's quarterly projections and added to the overall forecast. The mean of these corrected projections must equal the annual forecast.

<sup>28</sup> See more detail on quarterly projections in Appendix Table F-1.

**Table B****Database (dependent variables) and projections<sup>29</sup> expressed in terms of national accounts (millions \$)**

Year and Quarter	Actual Revenue				Model-Projected Revenue <sup>30</sup>			
	Personal Income Tax	Corporate Income Tax	GST	Employment Insurance	Personal Income Tax	Corporate Income Tax	GST	Employment Insurance
1991.1	59576	8760	16940	13084	n.d.	n.d.	n.d.	n.d.
1991.2	57448	9688	17420	13492	56991	9462	17049	n.d.
1991.3	58716	10124	17888	16368	57033	9667	17508	16110
1991.4	60416	10996	17268	17312	58610	10142	17834	17029
1992.1	66288	10460	17644	16168	59728	10716	17452	17776
1992.2	60180	9052	17708	18040	64712	10593	17764	17609
1992.3	57296	11144	17808	18508	59615	9588	17888	18187
1992.4	56460	9268	17984	18972	57409	10372	18031	19082
1993.1	58768	11620	17968	17480	59110	10438	18051	18421
1993.2	58180	11904	18016	18608	58645	11957	18266	18415
1993.3	56800	9992	18336	18908	58221	11736	18316	18900
1993.4	59852	9264	18292	19480	57719	10656	18619	19228
1994.1	55076	11012	18880	18860	60494	10267	18658	19513
1994.2	57712	12116	18928	20020	57033	11259	19173	19791
1994.3	60532	13132	19092	20348	61349	14066	19170	19275
1994.4	61572	12540	19332	20532	61607	13524	19437	19740
1995.1	61400	12816	19480	20092	63682	13021	19659	19989
1995.2	63600	12820	19556	19328	65028	14037	19660	19108
1995.3	64712	13736	19816	19480	64928	13502	19863	18878
1995.4	64616	14116	19748	19088	65516	14089	20152	19060
1996.1	65752	14636	20236	18964	65644	14163	20097	18962
1996.2	66484	15796	20416	18832	66571	15067	20605	19070
1996.3	68308	16836	20616	18748	67521	16492	20829	19105
1996.4	70304	17632	21184	18752	68808	17658	21069	19138
1997.1	71192	18032	22176	19996	69903	17649	21612	19537
1997.2	72728	19684	22656	20160	71628	17882	22330	19885
1997.3	74536	20740	22652	20296	73438	19895	22786	19968
1997.4	76484	22460	22752	20396	74981	20071	22836	20027
1998.1	77352	19976	22864	18804	77404	21408	22943	19897
1998.2	79724	19452	23020	18976	78511	19248	23014	19139
1998.3	80904	18628	23212	19256	80230	18536	23199	18861
1998.4	82192	19608	23540	18984	81724	19492	23518	18734
1999.1	81688	21820	24356	18804	82320	20556	23959	18806
1999.2	82524	24472	24712	18648	82385	23054	24674	18733
1999.3	82616	27092	25328	18584	83022	25564	25120	18852
1999.4	83464	29808	25816	18600	83616	27480	25620	18805
2000.1	89640	30860	26324	18740	84799	31473	26207	18859
2000.2	89368	32308	26564	18808	90224	32825	26730	18955
2000.3	89908	31348	27532	18816	90319	33824	26965	18882
2000.4	91964	32536	27940	18640	90258	31191	27699	18825
2001.1	93084	29576	27468	18584	92129	33019	28111	18609
2001.2	94548	26440	27900	18596	91892	28208	27784	18566
2001.3	93508	21804	27988	18236	92669	23193	27971	18407
2001.4	92644	19072	28304	17960	92300	21320	28168	17993
2002.1	87924	21404	29376	18096	91094	20911	28890	18215

<sup>29</sup> The computer program *Stata* (StataCorp. 2003.) is used to generate these projections.<sup>30</sup> Given that we use lag independent variables (dependent variables, GDP and interest rate), the model generates projections based on the second period for PIT, CIT and GST, but rather on the third for the double lag LDV model used with Employment Insurance premiums.



2002.2	87316	23896	29612	18104	88802	24143	29908	18415
2002.3	87668	25052	30168	18244	88909	24902	30020	18287
2002.4	89632	26232	30924	18468	89566	27136	30633	18158
2003.1	89160	28872	31220	18072	91081	29097	31480	18270
2003.2	85692	26564	31296	17852	89833	24936	31328	18003
2003.3	89104	28128	31900	17644	88697	27675	31724	17531
2003.4	90056	27892	32048	17764	90461	28134	32403	17455
2004.1	92484	29292	32856	17424	91695	29081	32714	17377
2004.2	92556	31416	33356	17348	93728	32296	33711	17415
2004.3	94772	31740	33732	17320	93716	32100	34146	17446
2004.4	97744	32328	34344	17300	96150	31215	34442	17308
2005.1	99724	33520	35028	17496	99123	32040	35001	17020
2005.2					100735	34491	35865	16998
2005.3					101589	33937	36558	16749
2005.4					102572	33630	37266	16523
2006.1					103862	33566	37966	16276
2006.2					105091	33372	38640	15993
2006.3					106090	33070	39357	15768
2006.4					107307	33166	40082	15504
2007.1					108555	32192	40870	15417

Source: Statistics Canada and the Department of Finance's 2005 Budget Plan.

**Table C**  
**Series Numbers (in CANSIM II)**

<b>Variables</b>	<b>Series Numbers</b>
Nominal GDP	v498074
Interest rate	v121778
Personal income tax revenue	v499732
Corporate income tax revenue	v499734
GST revenue	v499748
Employment Insurance premiums	v499738

Source: Statistics Canada

**Table D**  
**Public Accounts Ratios Table – National Accounts for Federal Tax Revenue**

Fiscal Year	Personal Income Tax			Corporate Income Tax			Excise Duties and Taxes			Employment Insurance Premiums		
	(1) Public Accounts	(2) National Accounts	Ratio (1) as to (2)	(1) Public Accounts	(2) National Accounts	Ratio (1) as to (2)	(1) Public Accounts	(2) National Accounts	Ratio (1) as to (2)	(1) Public Accounts	(2) National Accounts	Ratio (1) as to (2)
1991-1992	59687	60717	0.98	9215	10317	0.89	27308	30963	0.88	15338	15835	0.97
1992-1993	56975	58176	0.98	7095	10271	0.69	26771	30810	0.87	17576	18250	0.96
1993-1994	49977	57477	0.87	9098	10543	0.86	26940	31060	0.87	19298	18964	1.02
1994-1995	55326	60304	0.92	10969	12651	0.87	27457	30721	0.89	18293	20248	0.9
1995-1996	58834	64670	0.91	15372	13827	1.11	27251	31615	0.86	19089	19215	0.99
1996-1997	62557	69072	0.91	16235	17074	0.95	29204	32897	0.89	19949	19082	1.05
1997-1998	69597	75275	0.92	21179	20715	1.02	31146	35186	0.89	19242	19914	0.97
1998-1999	72179	81127	0.89	21213	19877	1.07	31717	35456	0.89	19064	19005	1
1999-2000	79070	84561	0.94	22115	28058	0.79	33298	36772	0.91	18628	18643	1
2000-01	85879	91101	0.94	28293	31551	0.9	35769	39045	0.92	18655	18715	1
2001-02	79501	91772	0.87	24242	22382	1.08	37133	41688	0.89	17637	18211	0.97
2002-03	81707	87296	0.94	22222	26180	0.85	41357	45076	0.92	17870	18260	0.98
2003-04	84895	89768	0.95	27431	30018	0.91	41365	46914	0.88	17546	17868	0.98
<b>Average of Ratio (1) as to (2)</b>	0,9234			0,9228			0,8887			0,9835		

Source for Public Accounts: See the Department of Finance's website at:

[http://www.fin.gc.ca/frt/2004/frt04\\_1e.html](http://www.fin.gc.ca/frt/2004/frt04_1e.html) (Translator's note: scroll down to Table 3)

Source for National Accounts: Statistics Canada (CANSIM II): see series numbers v499732, v499734, v499740 and v499738, in order of the Table's columns.

## Appendix E

### Econometric Models

Equation 1: ARMAX Model (1.0.0)

$$\ln(y_t) = \beta_0 + \beta_1 r_t + \beta_2 r_{t-1} + \beta_3 \text{GDP}_t + \beta_4 \text{GDP}_{t-1} + \beta_5 t + \beta_6 t^2 + \beta_7 \text{AR}(1) + e_t$$

Equation 2: Model LDV

$$\ln(y_t) = \beta_0 + \beta_1 y_{t-1} + \beta_2 y_{t-2} + \beta_3 r_t + \beta_4 r_{t-1} + \beta_5 \text{GDP}_t + \beta_6 \text{GDP}_{t-1} + \beta_7 t + \beta_8 t^2 + e_t$$

Where:  $y$  is the dependent variable (either: PIT, CIT, GST or EI)

$y_{t-1}$  is the dependent variable in period t-1

$y_{t-2}$  is the dependent variable in period t-2

$r_t$  is the Three Month Treasury Bill interest rate in period t

$r_{t-1}$  is the Three Month Treasury Bill interest rate in period t-1

$\text{GDP}_t$  is the nominal Gross Domestic Product in period t

$\text{GDP}_{t-1}$  is the nominal Gross Domestic Product in period t-1

$t$  is a time variable generated such that 1 corresponds to the observed value 1991.1, 2 corresponds to the observed value 1991.2 (1991, second quarter) and so on.

$t^2$  is t squared

**AR (1)** – autoregressive to the order of 1- is the variable generated by the ARMAX model

$e_t$  is the regression error

### Commands used in STATA 8.2 to generate projections

**tsset** t

**arima**<sup>31</sup> [name of the dependent variable] names of independent variables **arima(1.0.0)**

**predict** [name given to the projected dependent variable], **y**

**regress** [name of the dependent variable] names of independent variables

---

<sup>31</sup> Note that ARIMA (autoregressive integrated mobile average) implies a regression without additional independent variables. Nevertheless, if the names of independent variables are included in the command, STATA carries out the ARMAX regression (ARMA regression with additional independent variables).

**Table F-1****Actual Results and Quarterly Projections (Summary)**

	Actual Results				and				Macroeconomic Forecasts			
	Quarterly: quarter/quarter % annualized variation											
	2004				2005				2006			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Real GDP Growth	2.60	5.01	3.50	2.11	2.30	2.51	2.69	2.76	2.80	2.76	2.84	2.86
Inflation according to GDP	4.02	5.10	3.21	1.81	1.67	2.51	2.10	2.27	2.00	2.17	2.10	2.40
Nominal GDP Growth	6.70	10.59	6.79	4.09	3.90	5.05	4.72	4.98	4.66	4.69	4.82	5.05
Three Month Treasury Bill Rates	2.07	2.01	2.30	2.51	2.52	2.51	2.56	2.79	3.10	3.16	3.35	3.38
Ten Year Government Bond Yield	4.37	4.81	4.62	4.37	4.31	3.99	4.08	4.28	4.47	4.57	4.58	4.85
Unemployment Rate	7.30	7.20	7.10	7.10	7.00	6.82	6.90	6.92	6.90	6.90	6.90	6.88
Employment Growth	1.20	2.41	1.27	1.67	0.53	1.70	1.30	1.67	1.40	1.20	1.20	1.10
Real GDP Growth – United States	4.49	3.28	4.02	3.75	3.65	2.97	3.22	3.25	3.45	3.15	2.82	2.92

Sources: Data compiled July 1 – 5, 2005 from various national and international private sector sources. Based on the available data, we chose to use quarterly data indicating the growth ratio from one quarter to the next determined at the annual variation rate (quarter / quarter annual rate). Please note that some sources list their forecasts as a percentage of the variation from the previous period. An annualization is, therefore, necessary in order to aggregate the projections. The average of the annualized quarterly observed values constitutes our quarterly forecast.

**Table F-2**  
**Actual Results (2004) and Consulted Annual Forecasts**

Date and Source of Forecast	Real GDP Growth				Inflation / GDP				Nominal GDP Growth				Three Month Treasury Bill Rates			
	2004	2005	2006	2007	2004	2005	2006	2007	2004	2005	2006	2007	2004	2005	2006	2007
30-June-05 BMO Financial Group: North American Outlook update <sup>32</sup>	2.9	2.9	3.4										2.22	2.58	3.45	
30-June-05 BMO Nesbitt Burns Economics: Canadian Economic Outlook <sup>33</sup>	2.9	2.8	2.6		3.1	2.3	2.1		6.1	5.1	4.8		2.22	2.65	3.35	
28-June-05 TD Quarterly Economic Forecast <sup>34</sup>	2.9	2.8	2.9		3.1	2.6	2.8		6.1	5.4	5.7		2.22	2.68	3.70	
14-June-05 Policy and Economic Analysis Program: PEAP Memo 2005-4 <sup>35</sup>	2.9	2.6	2.5	3.3	3.1	2.1	1.5	1.6	6.1	4.8	4.1	5.0	2.20	2.60	3.40	4.80
June-05 National Bank: Monthly Economic Monitor <sup>36</sup>	2.9	3.0	3.2		3.1								2.46	3.17		4.37
Summer-2005 Desjardins Economic Studies: Quarterly Financial Forecasts <sup>37</sup>	2.9	2.6	3.0	3.9									2.23	2.47	3.11	
03-June-05 Scotiabank Group: Global Economic Research Forecast Update <sup>38</sup>	2.9	2.6	2.5											2.51	2.57	
29-June-05 Global insight: Canada overview <sup>39</sup>		2.6	2.8	3.0										2.52	3.06	
July-05 RBC Financial Group: Economic and Financial Market Outlook <sup>40</sup>	2.9	2.7	3.2		3.0	2.1	2.0		6.1	4.9	5.2		2.44	3.00	3.75	
22-April-05 CIBC World Markets Inc. Economics & 06-June-05 Strategy. Forecast. Monthly indicators <sup>41</sup>	2.9	2.6	2.7		3.2	2.8	2.1		6.1	5.5	4.8			2.45	2.43	
Average	2.90	2.72	2.88	3.40	3.10	2.38	2.10	1.60	6.10	5.14	4.92	5.00	2.28	2.66	3.32	4.80

<sup>32</sup> Available at: <http://www.bmo.com/economic/regular/naotab.html>

<sup>33</sup> Available at: <http://www.bmonb.com/economics/forecast/>

<sup>34</sup> Available at: <http://www.td.com/economics/qef/qef.jsp>

<sup>35</sup> Available on request. Contact: Institute for Policy Analysis on (416) 978-4182

<sup>36</sup> Available at: [http://www.bnc.ca/bnc/cda/content/0,1008,divId-2\\_langId-1\\_navCode-9012,00.html](http://www.bnc.ca/bnc/cda/content/0,1008,divId-2_langId-1_navCode-9012,00.html)

<sup>37</sup> Available at: [http://www.desjardins.com/en/a\\_propos/etudes\\_economiques/previsions/financieres\\_trimestrielles/](http://www.desjardins.com/en/a_propos/etudes_economiques/previsions/financieres_trimestrielles/)

<sup>38</sup> Available at: [http://www.scotiabank.com/cda/content/0,1608,CID8339\\_LIDen,00.html](http://www.scotiabank.com/cda/content/0,1608,CID8339_LIDen,00.html)

<sup>39</sup> Available at: <http://www.globalinsight.com/>

<sup>40</sup> Available at: <http://www.rbc.com/economics/forecasts.html>

<sup>41</sup> Available at: <http://research.cibcwm.com/res/Eco/EcoResearch.html>

**Table F-2****Annual Forecasts (Continued)**

Date and Source of Forecast	10 Year Government								Real GDP Growth							
	Bond Yield				Unemployment Rate				Employment Growth				United States			
	2004	2005	2006	2007	2004	2005	2006	2007	2004	2005	2006	2007	2004	2005	2006	2007
30-June-05 BMO Financial Group: North American Outlook update	4.58	4.18	4.83		7.2	6.9	6.9						4.4	3.6	3.4	
30-June-05 BMO Nesbitt Burns Economics: Canadian Economic Outlook	4.58	3.91	4.04		7.2	6.8	6.7		1.8	1.4	1.2		4.4	3.4	2.8	
28-June-05 TD Quarterly Economic Forecast	4.49	4.17	4.65		7.2	6.9	7.0		1.8	1.3	1.3		4.4	3.6	3.1	
14-June-05 Policy and Economic Analysis Program: PEAP Memo 2005-4	4.60	4.30	5.40	6.10	7.2	6.9	6.9	6.8	1.8	1.4	1.6	1.6	4.4	3.5	3.7	3.5
July-05 National Bank: Monthly Economic Monitor	4.30	4.37	4.69		7.2	6.8	6.7		1.8	1.3	1.2			3.6	3.4	
Summer-2005 Desjardins Economic Studies: Quarterly Financial Forecasts	4.52	3.94	4.45		7.2	6.9	6.8		1.8	1.4	1.9		4.4	3.2	3.4	4.5
03-June-05 Scotiabank Group: Global Economic Research Forecast Update		4.04	4.41		7.2	6.9	6.9		1.8	1.3	1.0		4.4	3.3	3.1	
29-June-05 Global insight: Canada overview						6.9	7.0			1.3	1.2		4.4	3.5	3.0	3.1
July-05 RBC Financial Group: Economic and Financial Market Outlook	4.30	4.50	4.45		7.2	6.9	6.8		1.8	1.3	1.8		4.4	3.7	3.0	
22-April-05 CIBC World Markets Inc.Economics & 06-June-05 Strategy. Forecast.Monthly indicators		4.13	3.90		7.2	7.0	7.2		1.8	1.2	1.2		4.4	3.5	3.2	
Average	4.48	4.17	4.54	6.10	7.20	6.89	6.89	6.80	1.80	1.32	1.38	1.60	4.40	3.49	3.21	3.70

Sources: Data compiled July 1 – 5, 2005 from various national and international private sector sources