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CANADA

Selected Issues

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Approved by the Western Hemisphere Department

April 14, 2006

Content Page

Figures

I. Regional Dimensions of the Canadian Economy[1]

1. ***The Canadian economy is highly diverse across regions***. This chapter documents two aspects of this diversity—differences in the industrial structure and differences in responses to common shocks—and compares results with those across U.S. regions.

A. Industrial Structure

2. ***We first examine differences in industrial structure across regions***. Figure 1 reports the weights of five industries—agriculture, mining, construction and utilities, manufacturing, and services—across Canadian regions as deviations from the average for Canada as a whole. The regions are British Columbia, the Prairies, Ontario, Quebec, and the Atlantic provinces.[2]

3. ***Differences in industrial structure are large and persistent***. Compared to the rest of Canada, the provinces of Ontario and Québec are more heavily based on manufacturing, and mining (which includes the energy sector) plays a heavier role in the Prairies. The Atlantic provinces and British Columbia are particularly strong in services, except that offshore gas exploration has recently strengthened mining in the east.

4. ***The degree of regional economic diversity appears larger than in the United States***. The Prairies' specialization in mining is larger than in the U.S. Southwest, and British Columbia is more focused on services relative to the rest of the country than New England and the mid-eastern states in the United States (Figure 2). On the other hand, the U.S. Great Lakes region seems more concentrated on manufacturing than either Ontario or Quebec.

5. ***To quantify the degree of dispersion, we calculate the average of absolute deviations between regional and national shares in the five industries***.[3] This measure is plotted for each region in Canada and the United States (Figure 3). In addition, unweighted and weighted (by regional GDP) averages of regional dispersions for both countries are shown in Figure 4.

6. ***The charts confirm that the Canadian economy is regionally more diversified***. In addition, we observe the following:

- *The evolution over time of the national dispersion measures in the two countries is quite similar* (Figure 4). A flat trend in the 1980s gave way to a short period of

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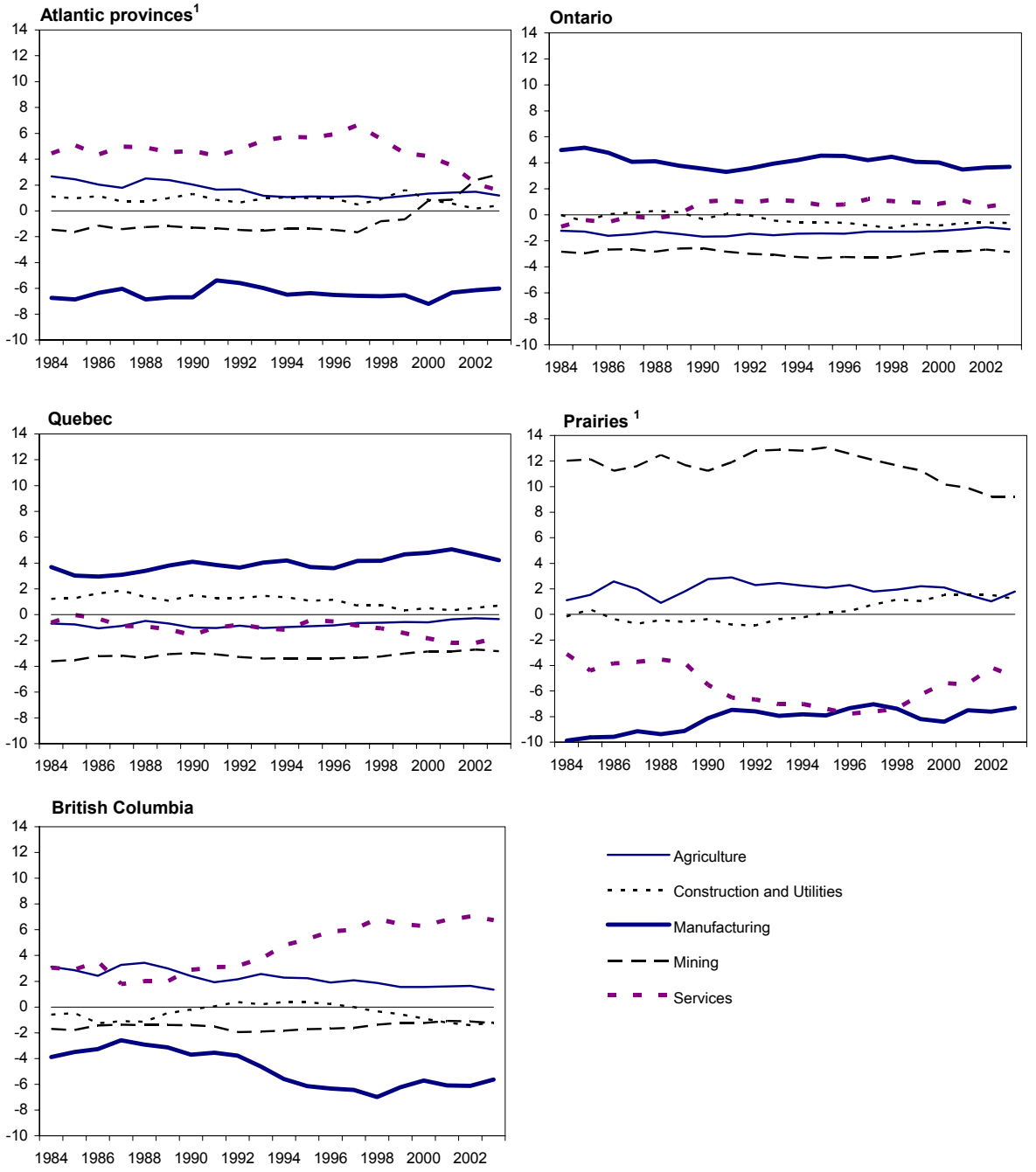
[1] Prepared by Vladimir Klyuev and Rodolfo Luzio.

[2] The Atlantic provinces comprise New Brunswick, Newfoundland and Labrador, Nova Scotia, and Prince Edward Island. The Prairie provinces comprise Alberta, Manitoba, and Saskatchewan.

[3] We also calculate the square root of the average squared deviations—a measure that gives a bigger weight to outliers than the average absolute deviation. The two measures tell essentially the same story, so we report only the latter.

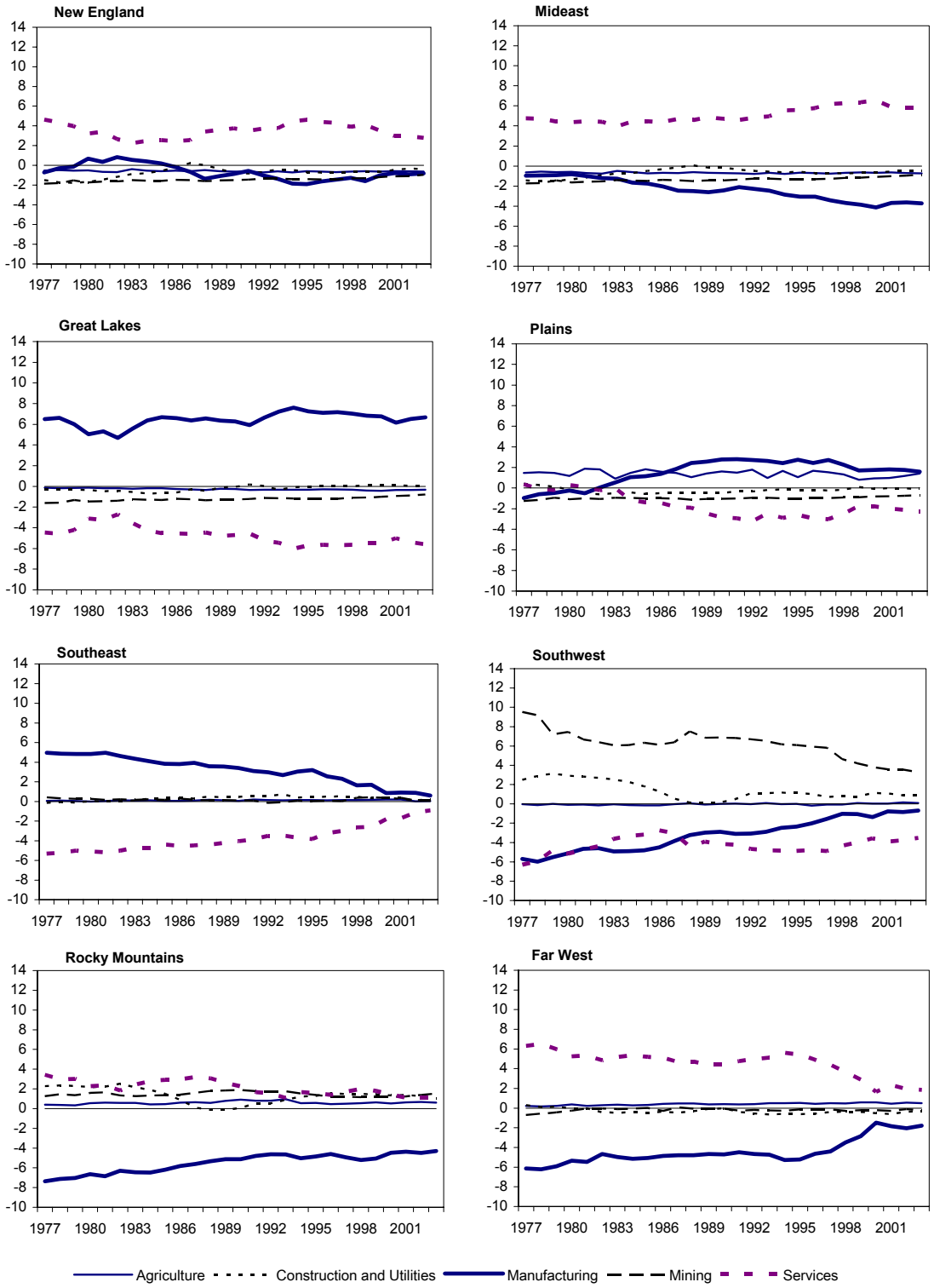
Figure 1. Canada: Difference Between Regional and National Industry Shares, 1984–2003



Sources: Statistics Canada; and Fund staff calculations.

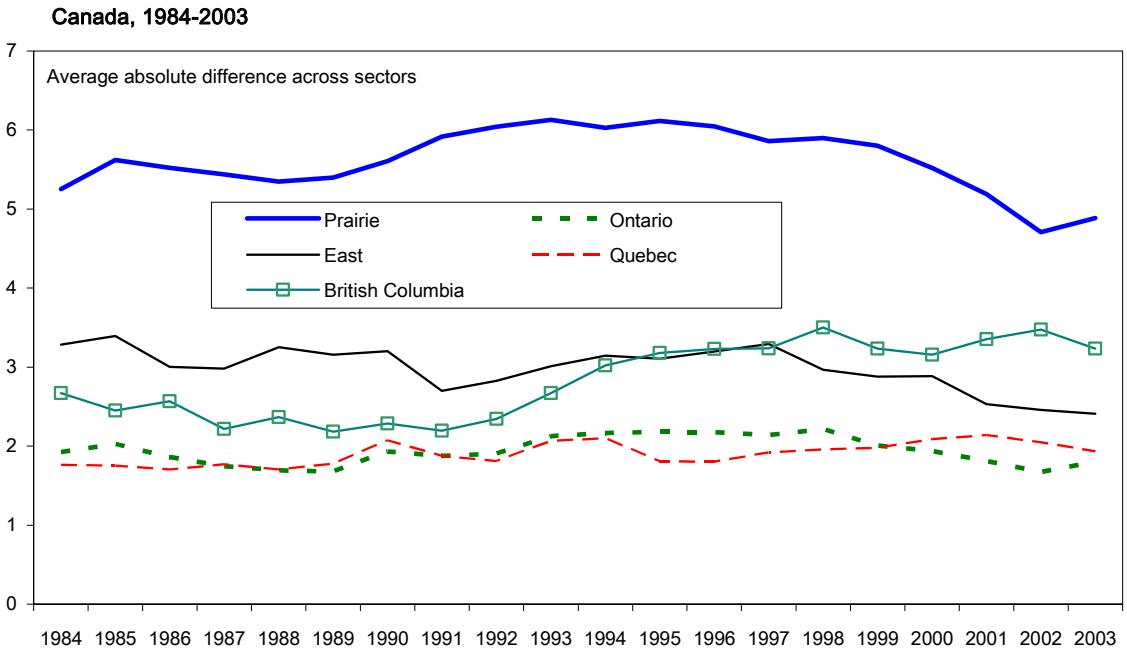
[1] Atlantic provinces include New Brunswick, Newfoundland and Labrador, Nova Scotia, and Prince Edward Island. The Prairies comprise Alberta, Manitoba, and Saskatchewan.

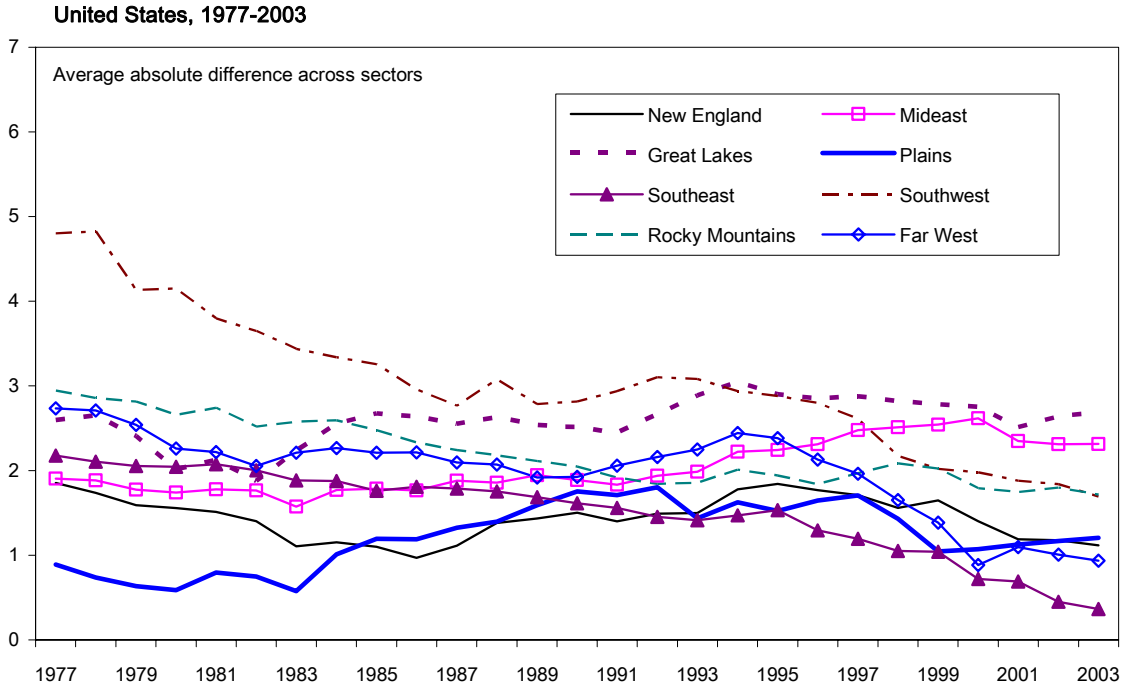
Figure 2. United States: Difference Between Regional and National Industry Shares, 1977–2003



Sources: Bureau of Economic Analysis; and Fund staff calculations.

Figure 3. Regional GDP by Sector: Divergence from Country Average



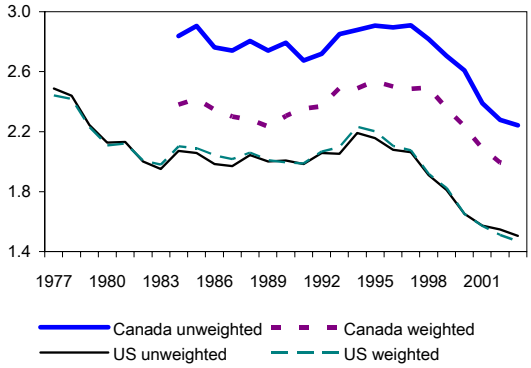


Sources: Statistics Canada; Bureau of Economic Analysis; and Fund staff calculations.

divergence in the early 1990s, followed by fairly rapid convergence coinciding with the internet and communications revolution in the mid to late-1990s.[4]

- *Unlike the United States, Canada has one main outlier in economic structure: the resource-rich Prairie region*. The U.S. Southwest region was almost as much as an outlier in United States in the 1970s, but its industrial structure has since shifted much closer to that of the rest of the country.

Figure 4. Average Regional Divergence from National Industrial Structure



Sources: Bureau of Economic Analysis; Statistics Canada; and Fund staff calculations.

- *Even excluding the Prairies, regional dispersion in Canada is higher than in the United States*. The average absolute deviation for Canada excluding the Prairie region is 2.1, which exceeds the value of 1.5 measured for the United States.[5]

B. Response to Shocks

7. ***We next examine how these differences in regional structure affect responses to aggregate shocks***. For all of Canada's regions, we study the response of real GDP growth, real private consumption, and real investment (annual data) to a set of explanatory variables that capture both domestic and external factors (Tables 1–3). These include changes in real GDP in both the United States and the rest of Canada, the real effective exchange rate, the real price of oil, and in the real short-term interest rate.

8. ***The regression results demonstrate that Canadian regions are influenced heavily by both domestic and external factors, albeit in very diverse ways***:

- *The links to the United States are particularly powerful in Ontario and the Prairies*. In these regions, U.S. growth is more important than growth in the rest of Canada, likely reflecting their concentration on exports of either manufactures or raw materials to the United States.
- *Links with the rest of Canada* are strongest in Quebec, followed by Ontario and British Columbia. The weakest links are in the resource-based Prairie and Atlantic provinces.

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[4] The United States also experienced convergence in the late 1970s—a period for which Canadian data is not available. This may contribute to the impression (in Figures 1 and 2) that some U.S. regions seem to have experienced faster convergence than their Canadian counterparts.

[5] The weighted average, however, is 1.5 for both countries. This is not surprising, given the economic size of Ontario and Quebec.

Table 1. Canada: Growth Regressions

Dependent variable: Real GDP growth in the region	British	Prairies	Ontario	Quebec	Atlantic	Canada
Lagged dependent variable	0.074	0.114	0.218	0.035	0.145	0.336 **
	(0.164)	(0.215)	(0.111)	(0.143)	(0.172)	(0.069)
Growth in Canada outside region	0.435 **	0.257	0.429	0.708 *	0.274 *	-
	(0.188)	(0.319)	(0.294)	(0.344)	(0.145)	
Growth in the United States	-	0.651 *	1.160 **	0.095	-	0.945 **
		(0.353)	(0.244)	(0.367)		(0.110)
Real interest rate (lagged)	0.154	0.084	−0.273	−0.170	−0.309 *	−0.235 **
	(0.219)	(0.222)	(0.195)	(0.121)	(0.148)	(0.094)
Change in REER (lagged)	0.017	0.018	−0.131 **	−0.123 *	−0.101	−0.126 **
	(0.069)	(0.110)	(0.063)	(0.059)	(0.062)	(0.029)
Change in oil price (lagged)	−0.005	0.042 **	−0.009	−0.011	−0.032 **	−0.003
	(0.013)	(0.016)	(0.009)	(0.007)	(0.010)	(0.005)
R-squared	0.23	0.37	0.84	0.83	0.51	0.78
Durbin-Watson statistic	2.38	2.20	1.86	2.52	1.48	2.70

Newey-West heteroscedasticity-consistent standard errors in parentheses.

* =significance at 10 percent.

**=significance at 5 percent.

Table 2. Canada: Real Private Consumption Regressions

Dependent variable: Real GDP growth in the region	British	Prairies	Ontario	Quebec	Atlantic	Canada
Lagged dependent variable	0.345 **	0.084	0.328 *	0.161	−0.013	0.370 **
	(0.081)	(0.186)	(0.181)	(0.117)	(0.208)	(0.091)
Growth in Canada outside region	0.152	0.533 **	0.345 *	0.260 *	0.534 **	-
	(0.097)	(0.171)	(0.188)	(0.127)	(0.167)	
Growth in the United States	-	−0.035	0.627 **	0.525 **	-	0.704 **
		(0.194)	(0.201)	(0.156)		(0.139)
Real interest rate	−0.029	−0.238	−0.278 **	−0.255 **	−0.082	−0.283 **
	(0.070)	(0.169)	(0.103)	(0.094)	(0.128)	(0.069)
Change in REER (lagged)	0.121	0.135	0.027	0.020	0.065	0.034 **
	(0.051) **	(0.077)	(0.092)	(0.058)	(0.087)	(0.037)
Change in oil price (lagged)	−0.025	0.017 *	−0.011 *	−0.004	−0.014	0.007−
	(0.016)	(0.009)	(0.006)	(0.004)	(0.008)	(0.006)
R-squared	0.54	0.64	0.81	0.82	0.69	0.76
Durbin-Watson statistic	2.06	2.17	1.85	1.50	1.47	2.26

Newey-West heteroscedasticity-consistent standard errors in parentheses.

* =significance at 10 percent.

**=significance at 5 percent.

Table 3. Canada: Real Private Investment Regressions

Dependent variable: Real GDP growth in the region	British	Prairies	Ontario	Quebec	Atlantic	Canada
Lagged dependent variable	0.113	0.125	0.340	0.445 *	−0.173	0.331
	(0.293)	(0.223)	(0.207)	(0.218)	(0.144)	(0.196)
Growth in Canada outside region	0.401	1.393	−0.555	−0.886 *	1.782 *	-
	(0.606)	(1.548)	(1.255)	(1.084)	(0.877)	
Growth in the United States	-	0.711	3.615 **	3.028 **	-	2.309 **
		(3.310)	(1.268)	(1.315)		(0.753)
Real interest rate	−1.035	−0.680	−1.452	−1.521 **	−1.553 *	−1.325 **
	(0.802)	(1.549)	(0.863)	(0.565)	(0.841)	(0.596)
Change in REER (lagged)	0.805	0.011	−0.075	−0.035	0.748 *	0.061
	(0.438)	(0.728)	(0.563)	(0.383)	(0.403)	(0.306)
Change in oil price (lagged)	−0.033	0.195 **	−0.030	−0.100 **	−0.058	0.002
	(0.096)	(0.088)	(0.045)	(0.042)	(0.122)	(0.053)
R-squared	0.15	0.32	0.58	0.65	0.31	0.52
Durbin-Watson statistic	1.96	1.83	2.30	1.98	2.28	2.37

Newey-West heteroscedasticity-consistent standard errors in parentheses.

* =significance at 10 percent.

**=significance at 5 percent.

- *An increase in the price of oil is beneficial for the Prairies*, but has a negative impact on all the other regions and no major impact on the country as a whole.

- *Real exchange rate appreciation and real interest rate increases are particularly negative for the eastern and manufacturing-based central provinces and for the country as a whole*. The impact of exchange rate appreciation and the real interest rate is limited in the west, but this may reflect a link between commodity prices, the exchange rate, and inflation that could not be resolved in the context of this exercise.

9. ***Regressions using real private consumption and investment show a similar pattern***. Consumption and investment in all regions are negatively affected by a contemporaneous increase in the real interest rate. Higher oil prices boost consumption and investment in the Prairies but slow them down in other regions. Exchange rate appreciation increases investment in the Atlantic provinces and consumption in British Columbia, but does not appear to affect private demand in the other provinces or in the country as a whole.

10. ***Similar regressions for the United States indicate it is more domestically integrated and less susceptible to external shocks***. In particular, real GDP growth in each region is positively and significantly correlated with growth elsewhere in the United States (Table 4). Changes in the real effective exchange rate do not have a significant impact in any region. Higher oil prices depress output in a number of regions, while the positive impact on the Southwest is not stastically significant.

Table 4. United States: Growth Regressions

Dependent Variable: Real GDP growth in the region	New England	Midwest	Great Lakes	Plains	Southeast	Southwest	Rockies	Far West
Lagged dependent variable	0.225	−0.001	−0.073	−0.123	−0.053	0.247 **	0.497 **	0.528 **
	(0.145)	(0.134)	(0.070)	(0.121)	(0.072)	(0.106)	(0.139)	(0.163)
Growth in U.S. outside region	1.265 **	0.826 **	0.999 **	0.987 **	0.766 **	1.058 **	0.661 **	0.88 **
	(0.254)	(0.196)	(0.152)	(0.231)	(0.106)	(0.290)	(255)	(0114)
Real interest rate (lagged)	0.214	0.282	−0.159	−0.251 *	−0.018	−0.536 **	−0.380	0.009
	(0.275)	(0.180)	(0.204)	(0.122)	(0.117)	(0.234)	(0.224)	(0.224)
Change in REER (lagged)	−0.023	−0.060	0.044	−0.026	0.007	0.054	0.029	0.022
	(0.060)	(0.044)	(0.053)	(0.047)	(0.026)	(0.034)	(0.036)	(0.038)
Change in oil price (lagged)	−0.006	0.009	−0.016	0.006	−0.016 **	0.028	−0.006	−0.036 **
	(0.020)	(0.010)	(0.012)	(0.009)	(0.006)	(0.018)	(0.011)	(0.014)
R-squared	0.77	0.73	0.73	0.68	0.82	0.62	0.65	0.76
Durbin-Watson statistic	1.43	1.06	1.07	1.99	1.52	1.49	1.26	1.83

Newey-West heteroscedasticity-consistent standard errors in parentheses.

* =significance at 10 percent.

**=signifcance at 5 percent.

11. ***Regional diversity underlines the importance of economic flexibility for Canada, particularly between Ontario and the western provinces***. External shocks have their biggest impact on these two provinces, reflecting their external orientation, although the adjustment needs are often diametrically opposed, given their highly different economic structures. The recent rise in oil and other commodity prices demonstrates this mechanism, boosting activity in Alberta and other western provinces while depressing conditions—through exchange rate appreciation—in the manufacturing heartland of Ontario.

C. Conclusion

12. ***Although gradually converging, Canadian provinces exhibit a considerably diverse economic structure***. This diversity contributes to differential responses to domestic and external shocks. In particular, growth in Ontario—which comprises over one-third of the Canadian economy—is closely linked to U.S. growth, and negatively affected by interest rate increases, real currency appreciation, and higher oil prices. On the other hand, growth in the west is boosted by oil price increases and appears to be less sensitive to changes in the exchange rate or the interest rate.

Data and Definition of Variables

Real interest rate	Average overnight rate adjusted for average CPI inflation.
Real oil price (U.S.)	WTI price adjusted for U.S. GDP deflator
Real oil price (Canada)	WEO oil price series adjusted for the USD/CAD exchange rate and the Canadian GDP deflator.
Real effective exchange rate	Source: JP Morgan.
Time period	1983 – 2004 (dictated by availability of Canadian GDP data by region).
Canadian regions	Atlantic provinces (NFL, NBR, NVS, PEI) British Columbia Ontario Prairies (ALB, MTB, SSK) Quebec
U.S. regions	Far West (AK, CA, HI, NV, OR, WA) Great Lakes (IL, IN, MI, OH, WI) Mideast (DE, DC, MD, NJ, NY, PA) New England (CT, ME, MA, NH, RI, VT) Plains (IA, KS, MN, MO, NE, ND, SD) Rocky Mountains (CO, ID, MT, UT, WY) Southeast (AL, AR, FL, GA, KY, LA, MS, NC, SC, TN, VA, WV) Southwest (AZ, NM, OK, TX)

II. Canadian Inflation Targeting And Macroeconomic Volatility in Retrospect and Prospect[1]

A. Introduction

1. ***Anniversaries are always a time for reflection, and the fifteenth year of Canadian inflation targeting (IT) is no exception***. It is given even greater relevance as it coincides with a renewal of the agreement on the underlying parameters of the IT framework between the Bank of Canada and the federal government. Assessing the link between IT and macroeconomic volatility is crucial to determining the importance of the framework in shaping the Canadian economy and in assessing the potential benefits and costs of change.[2]

2. ***The renewal of the IT regime provides an opportunity to determine both the desired level of inflation and the aggressiveness with which IT will be pursued***. Canada's adoption of IT was sealed in February 1991 by a formal agreement over five years between the Bank of Canada and the federal government specifying the inflation objective and the target range, an agreement that has already been renewed three times. In addition, the Bank of Canada has used these renewals as an opportunity to hone its views on the time horizon over which the target should be achieved, and the role and definition of other intermediate targets, such as measures of core inflation.

3. ***This paper uses a small estimated model to examine the link between the monetary framework and macroeconomic volatility***. Following the approach in Bayoumi and Sgherri (2004a, b), we conclude that IT reduced macro volatility primarily through "credibility" effects that lowered inertia in the Phillips curve through more forceful market responses. In light of the success of the present arrangement, the burden of proof for adopting different arrangements should be quite high.

B. The Framework

4. ***Analysts often use small models to assess the impact of monetary policy on the economy***. A typical closed economy approach might involve a three equation model such as the following:

$$\begin{aligned} y_t &= \alpha y^e_{t+1} + (0.99-\alpha) y_{t-1} + \beta r_{t-1} + \varepsilon^y_t \\ \pi_t &= \lambda \pi^e_{t+1} + (1-\lambda)\pi_{t-1} + \phi y_{t-1} + \varepsilon^\pi_t \\ i_t &= \rho i_{t-1} + (1-\rho)(\theta_0 + \theta_1 \pi^e_{t+1} + \theta_2 y_{t-1}) + \varepsilon^i_t \end{aligned} \tag{1}$$

where y is the output gap, r is the real interest rate (current nominal rate less expected inflation), π is annualized inflation, i is the nominal interest rate, ε's are error terms, superscript e represents expectations, and other Greek letters reflect parameters.

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[1] Prepared by Tamim Bayoumi and Vladimir Klyuev.

[2] See, for example, Dodge (2005).

5. ***The model comprises an IS curve, Phillips curve, and a monetary reaction function***. The first equation is a forward-backward looking IS curve, in which the current output gap depends on its past value and expected future value—with coefficients summing up to the discount rate (assumed to be 0.99 in a quarterly model)—and on the real interest rate. In the Phillips curve, current inflation likewise depends on the past and future expected price increases—with coefficients adding up to unity—and on the output gap. Finally, in the monetary reaction function the interest rate depends on a smoothing parameter, the long-term objective and equilibrium real exchange rate captured by a constant term, expected inflation and the output gap.

6. ***Modern inflation theory suggests that more predictable monetary policy can improve macroeconomic stability***. Recent theoretical work has established that inflationary expectations become more forward-looking as uncertainty about future demand is reduced.[3] Frameworks such as IT help reduce such uncertainty by imparting more predictability to monetary policy and the inflation process, with the result that economic volatility declines.

7. ***Policymakers in Canada were among the first to recognize this potential link and relied on it as a rationale for the introduction of an inflation target***. For example the then-Governor of the Bank of Canada observed in March 1995 that "by making its inflation-control objectives more explicit, the Bank hoped not only to influence inflation expectations, but also reduce uncertainty in the economy and the financial markets" (Thiessen, 1995). He went on to say that "with credible targets, inflation expectations, and therefore inflation, are less likely to react to temporary demand and supply shocks." In addition, an inflation target imposed discipline on the Bank as it made "monetary actions more predictable and less a source of uncertainty for others."

C. Empirical Results

8. ***Empirical estimates are consistent with the hypothesis that the Canadian Phillips curve has become more forward-looking after the introduction of IT***. Using quarterly data, model (1) was estimated separately for two periods, one before the inflation targeting had been introduced (1982-89), and one thereafter (1992-2005):[4]

- The results suggest that the Phillips curve coefficient on forward-looking inflation has increased significantly after the introduction of inflation targeting. The preferred specification involves a rise in the coefficient on forward-looking inflation of almost one third, from 0.54 to 0.71 (Table 1).

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[3] Mankiw and Reis (2001), Woodford (2003), Amato and Shin (2003), based on the original insights of Lucas (1979) and Phelps (1983).

[4] Variables included the annualized quarterly change in the CPI, in percent (π); the overnight interest rate, in percent (i); and the output gap calculated by the Bank of Canada in percent of potential real GDP (y). The model was estimated using GMM, with a constant term and four lags of the model variables as instruments. The transition years 1990-91 were eliminated from the sample.

Table 1. Canada: Estimates of Monetary Model[1]

	1982–89	Both Periods	1992–2005
IS Curve			
Expected output gap		0.507 (.006) *	
Lagged real interest rate		−0.008 (.001) *	
Standard error of regression	0.492		0.226
Phillips Curve			
Expected inflation	0.54 (.130) *		0.71 (.039) *
Lagged output gap		0.030 (.024)	
Standard error of regression	1.487		2.110
Monetary Reaction Function			
Lagged interest rate	0.699 (.024) *		0.833 (.026) *
Constant term	6.965 (.480) *		0.986 (.711)
Long-run coefficient inflation	0.813 (.088) *		1.532 (.317) *
Long-run coefficient output gap	0.61 (.074) *		−0.230 (.279)
Standard error of regression	1.016		0.851

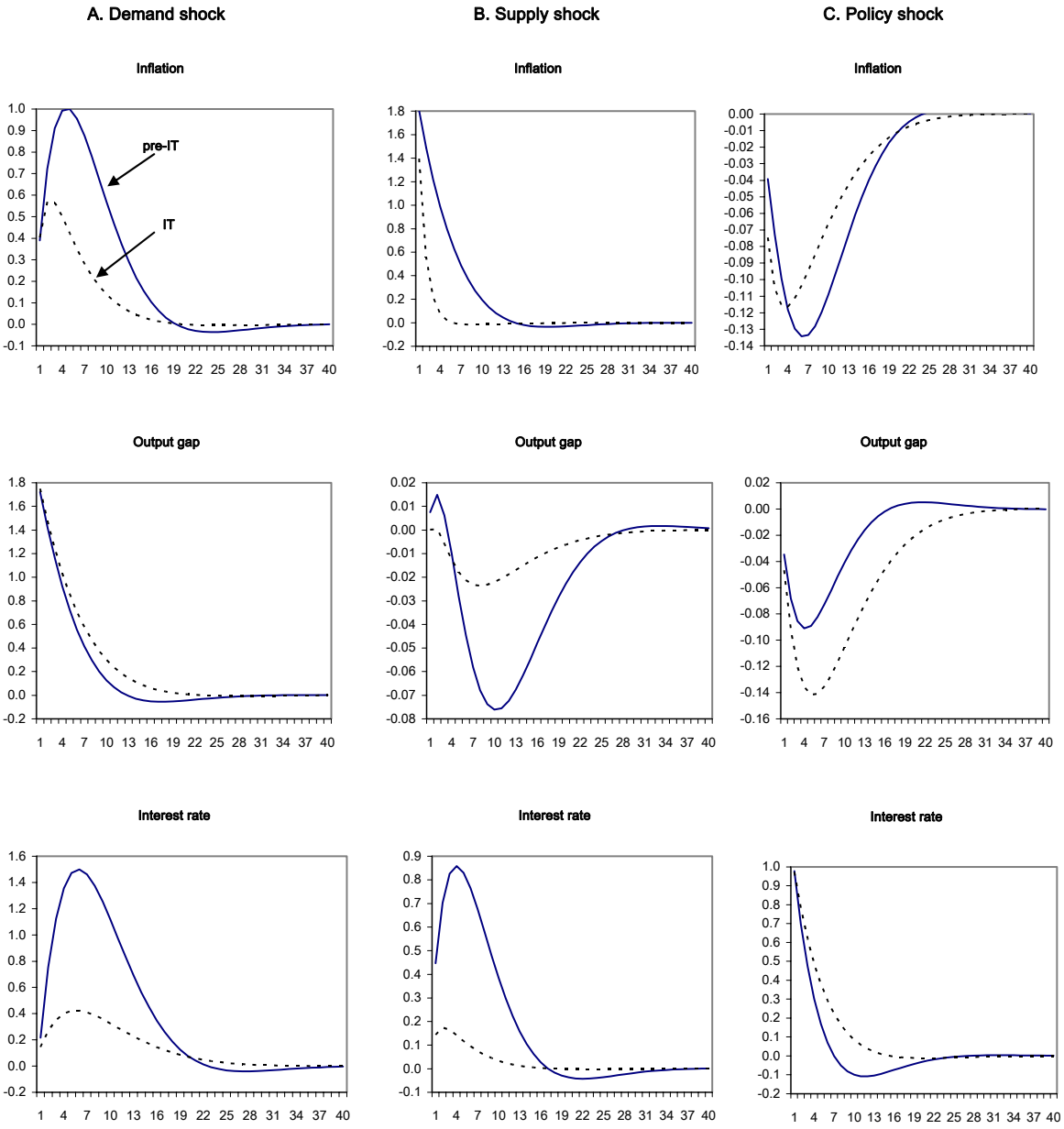
[1] Estimated using systems GMM with a constant term, the first four lags of inflation, the output gap, and nominal interest rates as instruments. Standard errors, reported in parenthesis, are robust to heteroscedasticity and to a first order moving average process. An asterisk indicates that the coefficient is different from zero at the 1 percent significance level.

- The results also suggest that the long-term response of interest rates to inflation has been more forceful in the second period, and interest rate smoothing in the monetary reaction function also increased.
- Other key economic relationships, including the IS curve and the Phillips curve coefficient of the output gap, appear largely unchanged. Overall, however, the results are consistent with Roldos' (2006) findings that the economy has reacted less strongly to monetary shocks since the introduction of the IT framework.

9. ***More forward-looking inflation expectations enhanced the expectations channel, reducing the need for aggressive responses to macroeconomic shocks***. The impulse response functions from disturbances to the output gap, inflation, and interest rates over the two samples are depicted in Figure 1.[5] The first two columns of the graph indicate the monetary response needed to stabilize the economy in response to macroeconomic shocks was smaller after the introduction of IT, reflecting the speedier impact of interest rate changes on the private sector. The increased importance of the expectations channel implied by more forward-looking inflation expectations also allowed monetary policy makers to respond to shocks in a more gradual manner.

[5] The inflation coefficient in the pre-IT monetary policy rule was estimated below one, violating the Taylor principle and making the model dynamically unstable. In simulations, a value of 1.2 was imposed on that coefficient. Moreover, the output gap coefficient in the IT monetary policy rule—which is negative but insignificant—was set to zero in the simulations.

Figure 1. Impulse Response Functions



10. ***The model's results track the decline in Canada's macroeconomic volatility since 1991 relatively well***. We compare the actual volatility of inflation, the output gap, and the interest rate before and after the introduction of inflation targeting with volatilities implied by the monetary model (Table 2, first four lines). Although the model does not replicate the actual volatilities very accurately, it does capture their reduction after the introduction of inflation targeting, including in the interest rate as IT made policy responses more predictable.

Table 2. Standard Deviation of Inflation, Output Gap, and Interest Rate Before and After Introduction of Inflation Targeting[1]

(In percent)

	Equation	Shocks	Inflation	Output Gap	Interest Rate
A	Actual	Pre-IT	2.1	2.2	2.0
B	Actual	IT	1.8	1.5	1.6
C	Pre-IT	Pre-IT	4.8	1.5	4.1
D	IT	IT	3.2	0.8	1.6
E	IT	Pre-IT	2.4	1.6	1.8
F	Pre-IT	IT	6.5	0.8	4.8
G	IT MR; Pre-IT PC	IT	6.1	1.2	4.5
H	IT PC; Pre-IT MR	IT	3.2	0.7	1.8

[1] Rows A and B: actual standard deviations in pre-IT and IT periods; C and D: asymptotic standard deviations based on estimated model (1) for the two periods; E and F: mixing estimated model parameters from one period with estimated standard deviations of shocks from the other; G and H: model-based asymptotic standard deviations assuming the structure of the economy and the shocks are as estimated for the IT period, except row G uses the pre-IT period Phillips curve and row H uses the pre-IT period monetary reaction function.

11. ***The findings are not related to changes in the magnitude or nature of economic shocks***. The lower lines in Table 2 explore the reasons behind the fall in model volatility, distinguishing between the impact of changes in the shocks, monetary policy reaction function, and private sector behavior. The fifth row shows the implied level of macroeconomic volatility had the 1990s economy been subject to shocks that prevailed in the 1980s. The following row reverses the experiment, looking at the volatility of an economy with a 1980s structure buffeted by 1990s shocks. The results suggest that the shocks in the 1990s imposed less output variability but more inflation and interest rate volatility on the economy. On the other hand, the change in the structure of the economy helped reduce variability of inflation and nominal interest rates without a noticeable effect on output volatility.

12. ***Indeed, the decline in macroeconomic variability is largely associated with more forward-looking inflation expectations***. Simply replacing the pre-IT monetary reaction function with the IT-period rule without attendant change in the forward-looking nature of the Phillips curve results in only a small reduction in inflation and interest rate volatility at a cost of higher output gap variability. By contrast, the rise in the expectations component of the Phillips curve explains almost all of the implied reduction in macroeconomic volatility.

13. ***Looking forward, a key issue is whether a modification of the framework, such as delaying or muting future response to shocks, might affect adversely credibility***. Should the markets perceive changes in the monetary reaction function as a weakening of the Bank's commitment to the inflation target, inflation inertia would likely increase as expectations became less forward-looking. As a consequence, the reduction in macroeconomic volatility seen over the past 15 years might be partially reversed as the private sector would respond more to demand and supply shocks and less to policy action.

D. Conclusion and Policy Implications

14. ***This paper suggests that the reduction in macroeconomic volatility in Canada after the introduction of inflation targeting is largely attributable to the reaction of the private sector to the establishment of a credible monetary policy framework***. With greater confidence in the central bank's commitment to price stability, the private sector started forming inflation expectations in a more forward-looking manner, reducing the degree of nominal inertia in the Phillips curve. This has attenuated private sector reaction to demand and supply shocks, thus lessening the volatility of inflation and muting the business cycle.

15. ***An implication of this analysis is that the burden of proof for refinements of the IT framework should be set relatively high so as not to compromise monetary credibility***. Potential benefits from adjusting the IT framework should be weighed carefully against the possibility that a perceived waning of the Bank's commitment to the inflation target could worsen the macroeconomic environment.

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III. Efficiency Gains from Reducing the GST Versus Personal Income Taxation in Canada[6]

1. ***We assess the efficiency gains from reducing the Goods and Services Tax (GST) versus personal income taxation using the IMF's Global Fiscal Model (GFM)***.[7] As a multi-country dynamic general equilibrium model with rigorous micro foundations, GFM is specifically designed to explore fiscal policy issues. For the purpose of this paper, we assume that Canada has fiscal space to reduce taxes as a result of a reduction in lump-sum transfers from the government to households. We assume that this space would allow for a reduction in the effective GST by 1 percentage point.[8]

2. ***A reduction in personal income taxation provides considerably larger efficiency gains than a reduction in the effective GST***.

- A reduction in the GST by 1 percentage point generates only modest gains in potential output as the increase in purchasing power leads predominantly to higher consumption (Figure 1). On the other hand, a reduction in the personal income tax (PIT) rate has a stronger effect on private saving by stimulating incentives to invest (Figure 2).
- There is also a considerable difference in timing. The effects of a GST reduction impact immediately on consumption and then decline over time, whereas the gain in potential output is larger but takes longer to materialize, given that investment is subject to adjustment costs.

3. ***The results confirm the view that the GST is a relatively efficient form of taxation***. In net present value terms, the increase in potential output could be substantially larger if other taxes were reduced (Figure 3):

- Similar to a payroll tax, the GST also affects the consumption-leisure decision. However, since accumulated savings are an implicit component of the tax base, the GST is less distortionary.
- Personal income taxes are, in turn, more distortionary than payroll taxes, since their base include dividend income in addition to wage and interest income and transfers.

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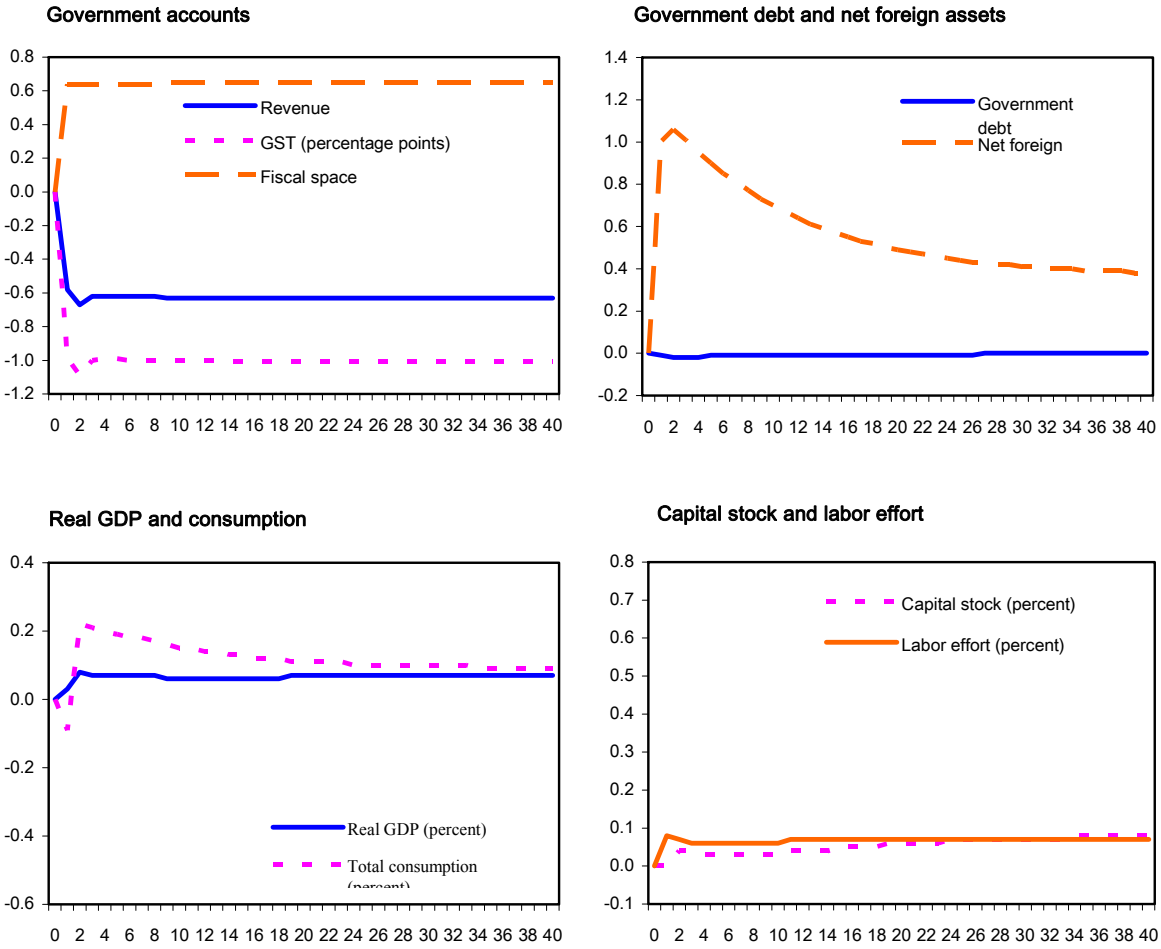
[6] Prepared by Dennis Botman (FAD).

[7] With the exception of the fraction of rule-of-thumb consumers—set equal to 25 percent—the calibration is identical to Bayoumi and Botman (2005) who analyze the macroeconomic effects of an early cut in taxes versus delaying tax cuts and reducing government debt further. GFM is discussed in more detail in Botman et al. (2006).

[8] A reduction in the effective GST by one-percentage point implies a larger reduction in the statutory rate if in practice GST exemptions are present.

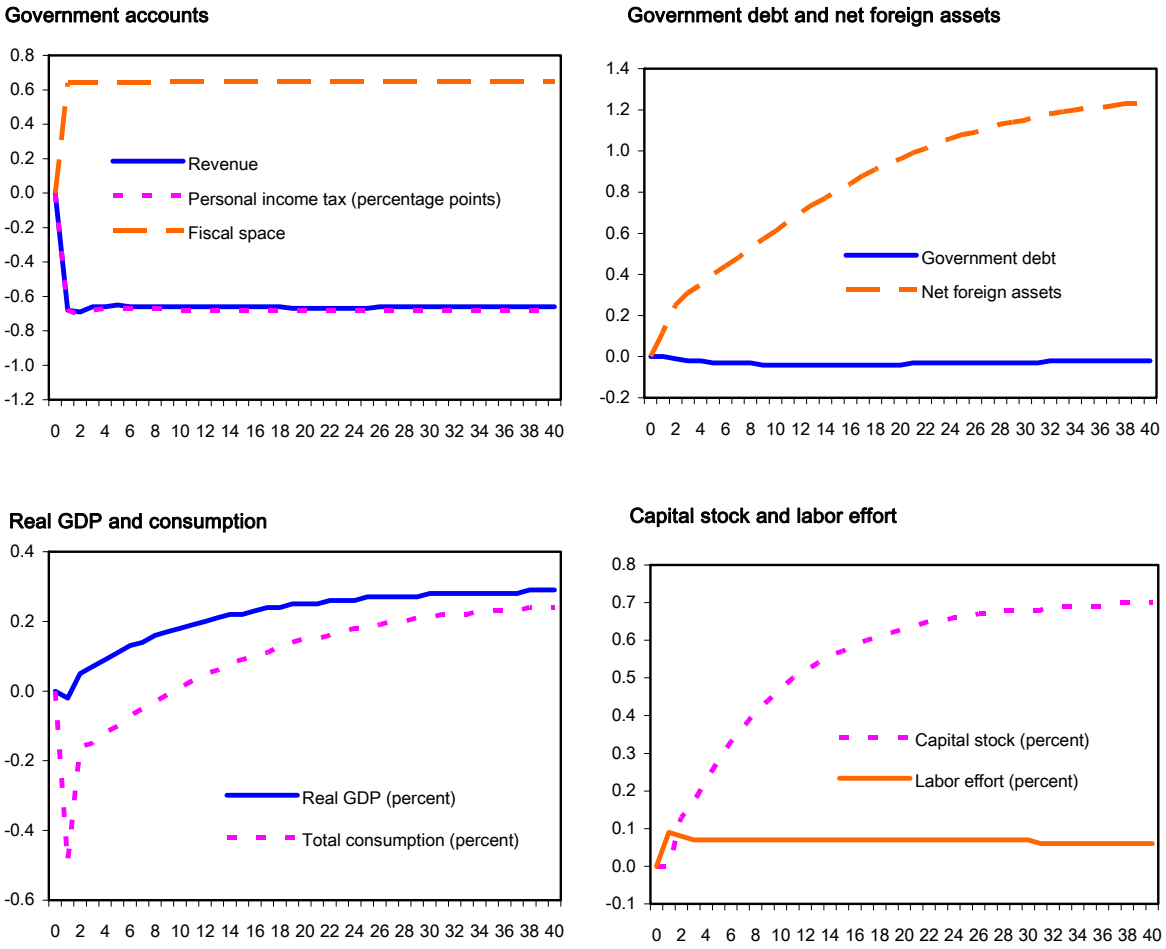
Figure 1. Macroeconomic Effects of a Reduction in the GST[1]
(Deviation from initial steady state in percent of GDP unless otherwise noted)



Source: GFM simulations.

[1] Fiscal space results from a permanent reduction in lump-sum transfers. The GST is reduced in a debt-neutral manner.

Figure 2. Macroeconomic Effects of a Reduction in Personal Income Taxation[1]
(Deviation from initial steady state in percent of GDP unless otherwise noted)



Source: GFM simulations.

[1] Fiscal space results from a permanent reduction in lump-sum transfers. Personal income taxation is reduced in a debt-neutral manner.

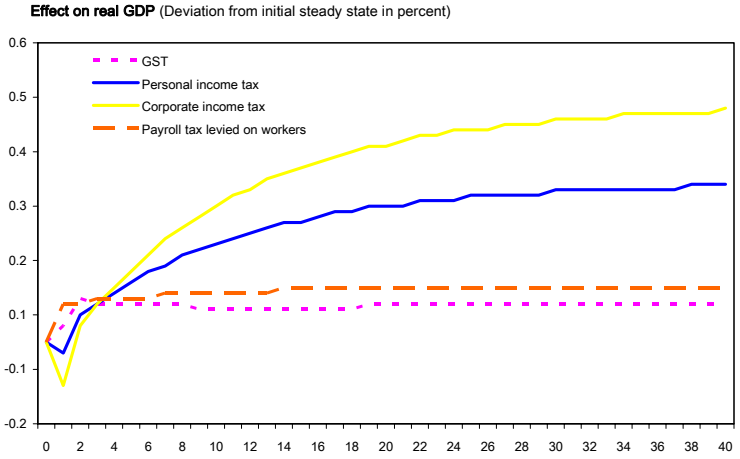
- Finally, corporate income taxation is the least efficient form of taxation, although the presence of monopolistic competition in GFM implies that part of the tax burden falls on rents rather than the return to capital.

4. ***This order of efficiency is consistent with evidence from various international studies***—see Baylor (2005) for a survey—as well as results of a general equilibrium model for the Canadian economy (Department of Finance, 2004).[1] The findings are also robust to variations in the underlying assumptions (Figure 4):

- *A longer planning horizon of consumers, a reduction in the share of rule-of-thumb consumers, or higher substitutability between capital and labor* all imply somewhat larger incentives to save and invest and therefore stronger gains in potential output from reducing either the GST or personal income taxation.

- *More elastic labor supply* implies that reducing either the GST or the PIT causes larger efficiency gains.

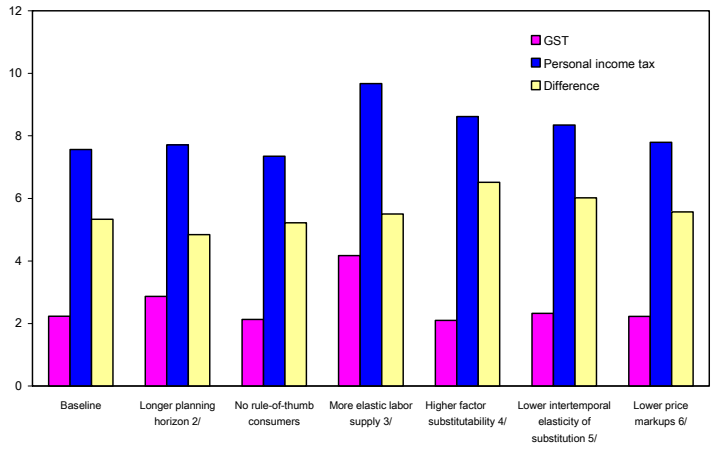
Figure 3. The Efficiency Gains from Reducing Alternative Types of Taxation[1]



Source: GFM simulations.

[1] Fiscal space results from a permanent reduction in lump-sum transfers. Taxes are reduced in a debt-neutral manner.

Figure 4. Efficiency Gains from Reducing the GST Versus Personal Income Taxation: Sensitivity Analysis 1/
(Deviation in percent of initial steady-state GDP)



Source: GFM simulations.

1/ In the baseline, the planning horizon is 10 years, the fraction of rule-of-thumb consumers is 25 percent, labor supply elasticity parameter equals 0.96 (moderately elastic; higher values correspond to less elastic supply), the elasticity of substitution between capital and labor in the production function is equal to .80, the intertemporal elasticity of substitution is .33, and the price markups are equal to 20 and 40 percent in the traded and nontraded goods sectors, respectively.
2/ Planning horizon is equal to 100 years.
3/ Labor supply elasticity parameter is equal to 0.9.
4/ Elasticity of substitution between capital and labor is equal to 1 (Cobb-Douglas case).
5/ Intertemporal elasticity of substitution is equal to .20.
6/ Price markups in the traded and nontraded goods sectors are respectively 9 and 17 percent.

[1] See Baylor and Beauséjour (2004) for a detailed description of the model and a demonstration that the conclusion is robust under alternative values for important model parameters.

- *If consumption is less sensitive to changes in the real interest rate*, efficiency gains from reducing the PIT are even larger. Higher national saving following a reduction in the PIT is followed by higher consumption in the future. The required reduction in real interest rates is larger if consumers have a lower intertemporal elasticity of substitution, leading to larger incentives to invest.
- *Lower price markups* imply larger efficiency gains from reducing taxation of dividends as a larger share of the tax burden falls on the return to capital rather than excess profits.

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