Monetary Transmission in Canada:
A Small Open Economy Adaptation of the Romer Model

by

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Introduction

There is always an amount of uncertainty when institutions responsible for the well being of the domestic economy attempt to create policy aimed at certain key stabilizing objectives. This uncertainty stems from incomplete information and the possibility that myriad other effects may come into play in economic growth or decline. As most monetary economists will argue, money is a key factor in the determination of real GDP growth rates in any economy; that is, monetary policy is the most important stabilizer. In this spirit, over the last twenty years the Bank of Canada has attempted to control economic fluctuations through interest rate adjustments. These policies have been especially important during the recessions of the early 1980s and 1990s. There has been some debate, however, as to the magnitude of these effects; did the behaviour by the Bank of Canada help to decrease the severity and length of the recessions experienced in Canada, or did it simply exacerbate an already precarious situation? This study will attempt to answer that question, first through a qualitative analysis of the history of the central banks' actions during the period 1970 to 2000, with specific emphasis on the recessions of the early 1980s and 1990s, and then through a simple empirical analysis of possible causality, using methods developed for the United States by Romer and Romer.[1] It will be shown that key indicators of the Bank of Canada have moved in a synchronous fashion with economic fluctuations, indicating the responsiveness of the bank to the economy. Also, regardless of the type of measure used, monetary policy is empirically shown to have real, significant effects on the growth rate of the Canadian economy, although whether these effects have caused or cured recessions is another matter.

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[1] Romer, Christina, and David Romer. "What Ends Recessions?" *NBER Macroeconomic Review* 9, pp. 13-57.

Literature Review

The strength of monetary transmission in Canada has been a relatively widely researched topic in the literature, although the scope is incomparable to that available for the United States. In fact, much of the research has been conducted upon the decision-making process of the Bank of Canada, including the models of economic forecasting in use, as well as its economic objectives (i.e. stabilizing inflation). As to the actual effects of these policies, the body of work is somewhat smaller. Duguay examined first the relationship between tools of the Bank of Canada and main interest rates, and that relationship's subsequent effect upon growth in the aggregate economy. His findings indicate that there is indeed a strong relationship between interest rates and exchange rates (his proxies for monetary policy) and growth of Canadian GDP.[2] Other work on the relationship between Canadian growth and the Bank of Canada has tended to focus only upon key periods; specifically the two major recessions in the last 30 years. For example, Racette and Raynauld completed fairly specific work on the actions of the Bank of Canada between 1989 and 1993, the last major Canadian recession. They find that the Bank may have indeed made certain mistakes in the conduct of monetary policy in 1990 by restricting money supply and thus constraining the economy at a time when expansion was necessary. This relates to the work at hand in an important way: by determining the strength of money's real effects upon the Canadian economy, we can also determine the extent of the negative effects possible with an ill-advised policy move by the central bank. It is important to keep in mind that although the Bank of Canada may have the power to effect real change in the growth of GDP, that change can occur either positively or negatively.

[2] Duguay, Pierre, "Monetary transmission mechanism in Canada," *Journal of Monetary Economics*. 33, pp. 39-61.

Most important to this study is the work completed by Romer and Romer concerning the effects of economic policy on real GDP growth in the United States. Using first a qualitative examination, the actions of the federal government and the Federal Reserve are examined to determine their responsiveness, or lack thereof, to changes in economic conditions in the United States. To complete the analysis, they employ three different types of estimation, including an OLS regression equation, in order to determine the strength of the effects of both fiscal and monetary policy on growth rates. The OLS equation used in the study is given below:

$$realGDP = \beta_0 + \beta_1 fedrate_t + \beta_2 fedrate_{t-1} + \beta_3 fedrate_{t-2} + \beta_4 fedrate_{t-3} + \beta_5 fedrate_{t-4} + \beta_6 fedrate_{t-5} + \beta_7 fedrate_{t-6} + \beta_8 fedrate_{t-7} + \beta_9 fedrate_{t-8} + \pi_1 empsurp_t + \pi_2 empsurp_{t-1} + \pi_3 empsurp_{t-2} + \pi_4 empsurp_{t-3} + \pi_5 empsurp_{t-4} + \pi_6 empsurp_{t-5} + \pi_7 empsurp_{t-6} + \pi_8 empsurp_{t-7} + \pi_9 empsurp_{t-8} + \eta_1 1973prod_t + u \quad (1)$$

where *fedrate* is the federal funds rate, used as a measure of monetary policy action from the Federal Reserve Bank, *empsurp* is the high employment surplus to GDP ratio, and indicator of fiscal policy, and *1973prod* a dummy variable for the years after 1973 to signify the productivity slow down. Each indicator is lagged for eight periods in order to capture delayed effects of policies. Through this empirical analysis, it was determined that monetary policy had a significant effect upon changes in economic growth; in fact, that most of the recoveries experienced by the United States in the period of study could be almost directly attributed to the actions of the central bank.[3] This study will employ the above OLS regression model, and adapt the American model appropriately to the Canadian experience, creating a measure of effectiveness different than the one initially employed by Duguay.

Qualitative Analysis

In order to fully examine the actions of the Bank of Canada during the period 1970 to 2000, it is important to identify periods of recession and recovery to provide a time frame for policy changes. Figure 1 shows GDP growth rates over the entire period in question, and highlights the two main periods of recession. The first slowdown, from the end of 1981 to mid-1983, saw seven quarters of below average or negative growth. This was followed by a period of strong, well above average growth through most of the later 1980s, save a quick drop (though not to negative rates) in 1986. The second occurred in the early 1990s, from 1990 through 1992, although below average growth was detectible well before and after this period. Unlike the recession of the 80s, which was more abrupt and drastic, the 90s
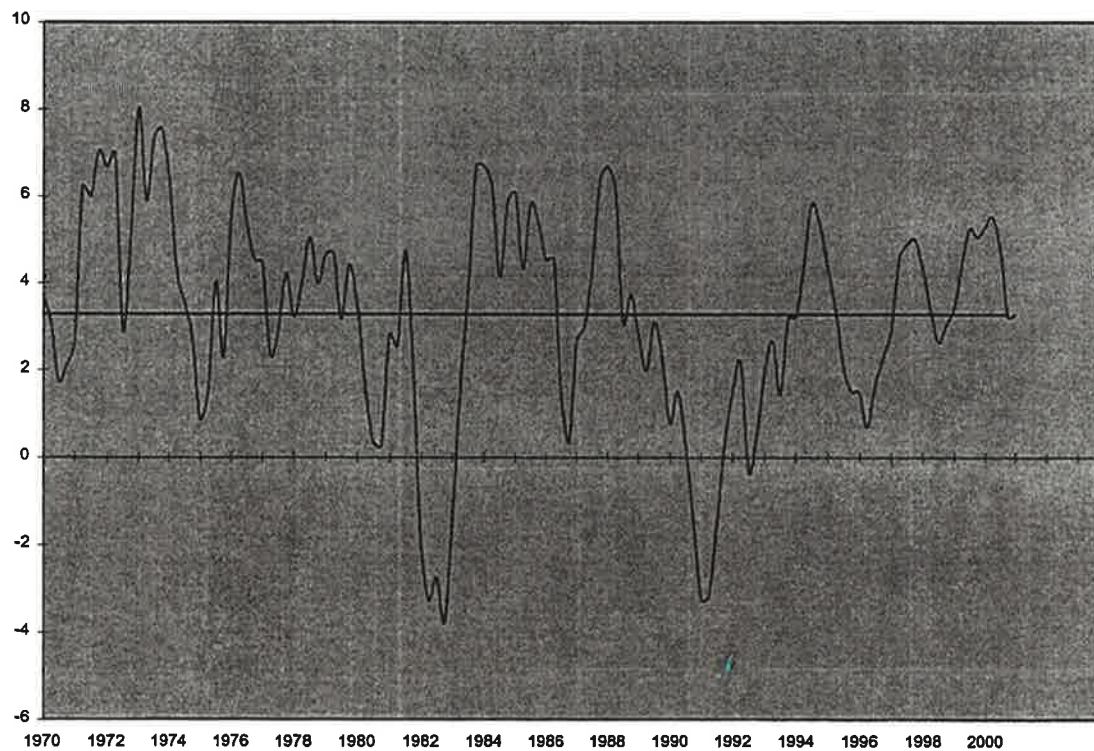
Source: CANSIM Statistics Canada Database; horizontal line indicates average growth rate over period.

Figure 1: Canadian Real GDP Growth Rates, 1970 – 2000

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[3] Romer, C. and D. Romer, "What Ends Recessions?" *NBER Macroeconomic Review*, 9, pp. 13-57.

recession was marked by a slow, steady decline and rise in growth rates. Although the trough of both periods was fairly similar in magnitude, in the 1990s the slowdown was clearly more persistent. Analysis of government and central bank policies in these periods gives some indication of the reasons behind this.

Prior to the recession of 1981-82, the Canadian economy experienced a short-term dip in real GDP growth to about .5% around 1980. This accompanied with inflation as high as 11.5% and unemployment levels between 7.5 and 10% by 1981 left the government in a quandary as to the correct course of action.[4] In the climate of investment uncertainty, the federal government felt increases in public spending were appropriate. However, due to worries about the financing of such programs, in November of 1981 the government actually increased taxes. The following program expenditures could not be made up by these taxes as revenues were down due to the recession, thereby causing a significant deficit. By 1983, the economy continuing to flounder, the government again increased spending, but this time accompanied by a plan for future taxation.[5] Despite the attempts to finance increases, the actions of the government in this period resulted in the emergence of a nearly unmanageable debt burden that would come into play in the recession of 1991. From this cursory analysis, the conclusion that the recession may have been *caused* by inappropriately restrictive fiscal policy comes to mind; while this is plausible, the role of the Bank of Canada must also be questioned.

Prior to the slow down in the early 1980s, the Bank of Canada had been pursuing a policy whereby the actual money supply, not interest rates, was controlled. Furthermore, the Bank kept as a top priority the stabilization of the Canada-U.S. exchange rate and restriction

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[4] Lamontagne, Maurice, Business Cycles in Canada, Ottawa: Canadian Institute for Economic Policy, pp. 86-89.
[5] Purvis, Douglas D. and Constance Smith, "Fiscal Policy in Canada: 1963-84," Fiscal and Monetary Policy, John Sargent, Ed., Toronto: University of Toronto Press, pp. 26-30.

of M1, in line with objectives of the Federal Reserve in the same period.[6] The beginning of the inappropriate response of the Bank of Canada came during the brief slowdown in 1980; despite obvious macroeconomic indicators of problems in the economy, the Bank actually further constricted the money supply in an effort to curb inflation. In fact, during this period the commercial paper rate reached record levels of over 20%. This indeed had a stabilizing effect on the devaluation of the exchange rate, to the detriment of other economic variables. However, the Bank was very vague on exactly what level it was targeting for the inflation rate: from 1982-1983, there was virtually no publication of the stated objectives of the institution. This led to improperly formed expectations and thus further issues hindering rapid recovery. Admittedly, policy was somewhat eased by the end of 1983, but without cohesive aims the effect was minimal. It was therefore the case that in 1981, with a significant economic slow down pending, both the Bank of Canada and the federal government employed policies of strict restriction on money supply and spending, seemingly causing the recession the policies were aiming to stop.

Cursory analysis of the recession of the early nineties could lead to numerous conjectures about its causes; some explanations given include increased globalization, technological change, overly-generous social policy and so forth.[7] In fact, closer examination reveals problems closely associated with the implementation of fiscal and monetary policy. Again, both the federal government and the Bank of Canada seem to take inappropriate measures to provide a counter-cyclical force to the economy. On the fiscal side, the government of Canada had practiced a policy of fiscal restraint since 1986, with an announcement of strict measures to attempt to restrain the quickly rising deficits of the federal government, resulting in continual decreases in program spending and increases in

[6] Howitt, Peter, Monetary Policy in Transition, Toronto: C.D. Howe Institute, 1994, p. 91-94.
[7] Fortin, Pierre, "The Great Canadian slump," *The Canadian Journal of Economics*, 29:4(1994): 761-787.

tax levels. Despite this, the government budgets were in crisis; during this period, simply servicing interest payments upon the debt required payments of approximately 5.7% of total Canadian GDP. Though the signs of a slowdown were present as early as 1990, including increased unemployment and decreased capital investment, the government was both unable and unwilling to change their fiscal stance.[8] Even if the government had wanted to loosen fiscal policy, there was simply no money with which to do so.

On the monetary side, expecting a slow down, the Bank of Canada actually eased money in the late 1980s. Recall that until this point, tight money had been the rule for Bank of Canada policy-making, save a few minor exceptions. Because of this surprising turnaround and subsequent expectations adjustment, the decrease in overnight rates in 1989 caused a quick depreciation of the Canadian dollar and increased the possibility of inflation. Spooked by the quick and brutal adverse reaction to their new policy, the Bank responded by severely tightening throughout the spring and summer of 1990. This caused already flagging indicators like credit demand and business fixed investment to sink even further.[9] Money supply reached a trough, and by 1991 inflation was all but eradicated. Oddly, once the Bank had achieved this long-stated policy objective, fear at undoing the work led to the continuation of an iron grip upon money supply, which may have been a contributing factor to the persistence of the 1991-1992 recession.

From this qualitative background analysis, it is clear that unlike Romer and Romer's work on the ability of the Federal Reserve to speed the recovery of the United States economy after a slow down, Canadian work for the period 1970-2000 must approach the topic from a different position. That is, the possibility exists that the actions of the central

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[8] Kneebone, Ronald, and Kenneth McKenzie, Past (In)Discretions: Canadian Federal and Provincial Fiscal Policy, Toronto: University of Toronto, pp. 23-28.
[9] Laidler, David, and William Robson, The Great Canadian disinflation, Winnipeg: C.D. Howe Institute, 1993.

financial entities of the country are the *cause* of recessions; establishing a causal link between monetary policy indicators and real GDP growth, rather than provide insight into the stimulating power of the central bank, may shed more light on the potential damage it may inflict. Quantitative analysis will highlight the effect of monetary indicators upon real GDP growth, and through this we can understand how the stance of the Bank of Canada affects the real growth rate of GDP in the Canadian economy.

Empirical Analysis

In the spirit of Romer and Romer (1994), OLS estimations were performed on real Canadian GDP growth against independent variables including budget balances of the federal government as a percent of nominal GDP (a fiscal policy indicator), the real GDP growth rate in the United States, U.S.-Canadian direct exchange rate, and of course monetary policy indicator variables. For completeness, three separate indicators of monetary policy were employed in three separate regressions: monetary conditions index, M1 gap and yield spread. These equations are given below:

Model 1: Yield Spread

$$rgdp = \beta_0 + \beta_1 ys_t + \beta_2 ys_{t-1} + \beta_3 ys_{t-2} + \beta_4 ys_{t-3} + \beta_5 ys_{t-4} + \pi_1 usrgdp_t + \pi_2 usrgdp_{t-1} + \pi_3 usrgdp_{t-2} + \pi_4 usrgdp_{t-3} + \pi_5 usrgdp_{t-4} + \theta_1 bb_t + \theta_2 bb_{t-1} + \theta_3 bb_{t-2} + \theta_4 bb_{t-3} + \theta_5 bb_{t-4} + \eta_1 xrg_t + \eta_2 xrg_{t-1} + \eta_3 xrg_{t-2} + \eta_4 xrg_{t-3} + \eta_5 xrg_{t-4} + u \quad (2)$$

Model 2: M1 Gap

$$rgdp = \beta_0 + \beta_1 m1gap_t + \beta_2 m1gap_{t-1} + \beta_3 m1gap_{t-2} + \beta_4 m1gap_{t-3} + \beta_5 m1gap_{t-4} + \pi_1 usrgdp_t + \pi_2 usrgdp_{t-1} + \pi_3 usrgdp_{t-2} + \pi_4 usrgdp_{t-3} + \pi_5 usrgdp_{t-4} + \theta_1 bb_t + \theta_2 bb_{t-1} + \theta_3 bb_{t-2} + \theta_4 bb_{t-3} + \theta_5 bb_{t-4} + \eta_1 xrg_t + \eta_2 xrg_{t-1} + \eta_3 xrg_{t-2} + \eta_4 xrg_{t-3} + \eta_5 xrg_{t-4} + u \quad (3)$$

Model 3: Monetary Conditions Index

$$rgdp = \beta_0 + \beta_1 mci_t + \beta_2 mci_{t-1} + \beta_3 mci_{t-2} + \beta_4 mci_{t-3} + \beta_5 mci_{t-4} + \pi_1 usrgdp_t + \pi_2 usrgdp_{t-1} + \pi_3 usrgdp_{t-2} + \pi_4 usrgdp_{t-3} + \pi_5 usrgdp_{t-4} + \theta_1 bb_t + \theta_2 bb_{t-1} + \theta_3 bb_{t-2} + \theta_4 bb_{t-3} + \theta_5 bb_{t-4} + u \quad (4)$$

where *ys*, *m1gap* and *mci* are the three monetary policy indicators, yield spread, M1 gap and Monetary Conditions Index, *bb* is budget balances as a percent of nominal GDP (a fiscal policy indicator), *usrgdp* is the rate of growth of U.S. real GDP, and *xrg* is the Canada/U.S. exchange rate growth. Unlike the model upon which this work is based, a variable for exchange rate growth has been included; this reflects the difference between the United States economy, which the initial study was performed upon, and the smaller Canadian economy that is reliant upon its larger neighbour for an export market. Note that each variable has been lagged over four quarters in order to capture any delayed effects the variable might have upon the regressand. For consistency's sake, the decision to limit the number of lags and keep them constant over each model was made; this may therefore provide some insight not only into the strength of the tools of the Bank of Canada, but the delay on their full fruition. Finally, effects of the monetary policy variables will be calculated simply through adding up each beta value. This will yield a cumulative coefficient that explains the entire effect of the variable over time. Before presenting regression results, a discussion of these variables, their calculation (if applicable), and potential directions should give a frame of reference when judging overall accuracy.

As per the discussion above, fiscal policy has not been a major source of stimulation for the Canadian economy. Most fiscal policy objectives since 1980 have been aimed at reducing the size and cost of the public sector and controlling the national debt burden. As seen in Figure 2, the federal government has been in a position of yearly deficits for the majority of the years under study. Before the 1981 recession, public deficits were convincingly negative; this despite very limited counter-cyclical fiscal policies. These deficits continued and in fact worsened in the period between the two major contractions, again despite fiscal tightening. It is probable, therefore, that continuing budget deficits and lack of public sector spending were detrimental to the Canadian economy and a possible causal

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factor in both recessions. In OLS estimations, the direction of the coefficient is somewhat ambiguous; if fiscal spending is targeting job and thus output growth effectively, a decrease in bb (a more negative budget balance) should still see increases in output growth, and therefore the (lag-cumulative) coefficient should be negative. However, high government deficits can also be a drag on growth of the economy, hence increasing bb (moving toward a surplus) may increase economic growth, and in that case the (lag-cumulative) coefficient would be positive. Empirical analysis will reveal which of the two effects is more pronounced in the Canadian economy.
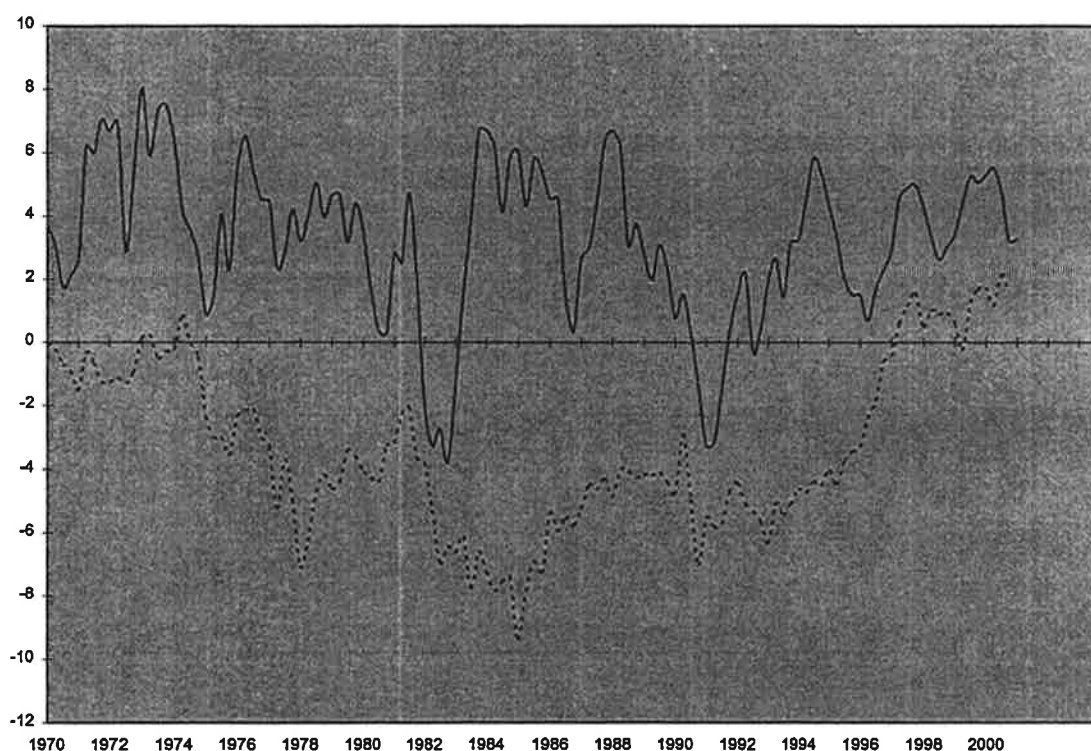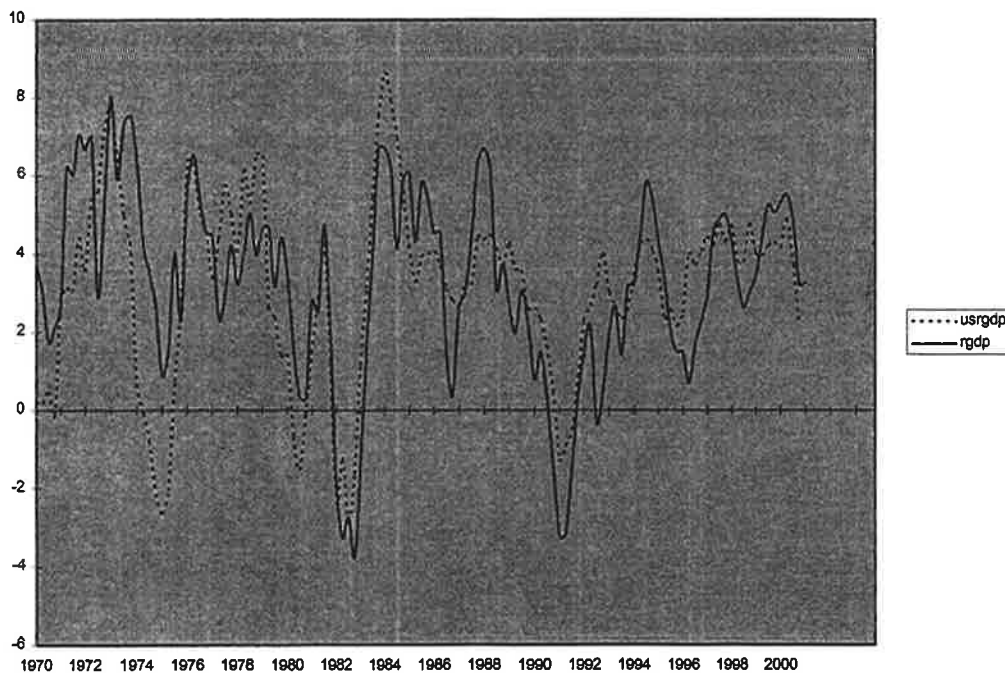

Source: CANSIM Statistics Canada Database

Figure 2: Budget balance as a percent of GDP and real GDP growth in Canada

The next explanatory variable, U.S. real GDP growth, is likely one of the most important in the determination of domestic economic growth. Not only are the markets for

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Canadian commodities and consumer goods highly dependent upon U.S. demands, monetary policy decisions are usually highly correlated with the actions of the Federal Reserve. From Figure 3, by simple inspection, it is clear that the growth rates of Canadian and U.S. economies are highly correlated, and that the U.S. tends to be the leader in economic fluctuations. In the case of both the 1981 and 1991 recessions, the U.S. began decline and subsequent recovery at least a quarter before Canada (although it is somewhat ambiguous in the latter case). This conclusion is an intuitive one: as the U.S. recovers, demand for exports recovers as well, allowing an export-led recovery of certain Canadian industries. This correlation should be expressed in OLS estimations as a positive coefficient on *usrgdp* and its quarterly lags: as the growth rate of the neighbour to the south increases, Canada's follows suit.

Source: Statistics Canada, DRI Basic Economics Database

Figure 3: Growth of Real GDP in Canada and the United States

Closely linked to the relationship between U.S. real GDP growth and Canadian growth is the movement or growth of the direct exchange rate between the two nations. As the Canadian dollar loses value vis-à-vis the greenback, Canadian exports become less expensive for U.S. buyers. While this does not represent an outward shift in the demand for Canadian products in the U.S., it does entail movement down the demand curve, at a lower price and higher quantity. To meet these demands, Canadian producers should ostensibly increase production to supply more at a lower price level; profits should also increase as these producers are now receiving payment in the more valuable U.S. dollar, which has greater purchasing power in domestic markets. In the regression estimation, *xrg* should take a positive cumulative coefficient; growth in the direct exchange rate, or depreciation of the Canadian dollar should increase foreign export demand and therefore domestic production.
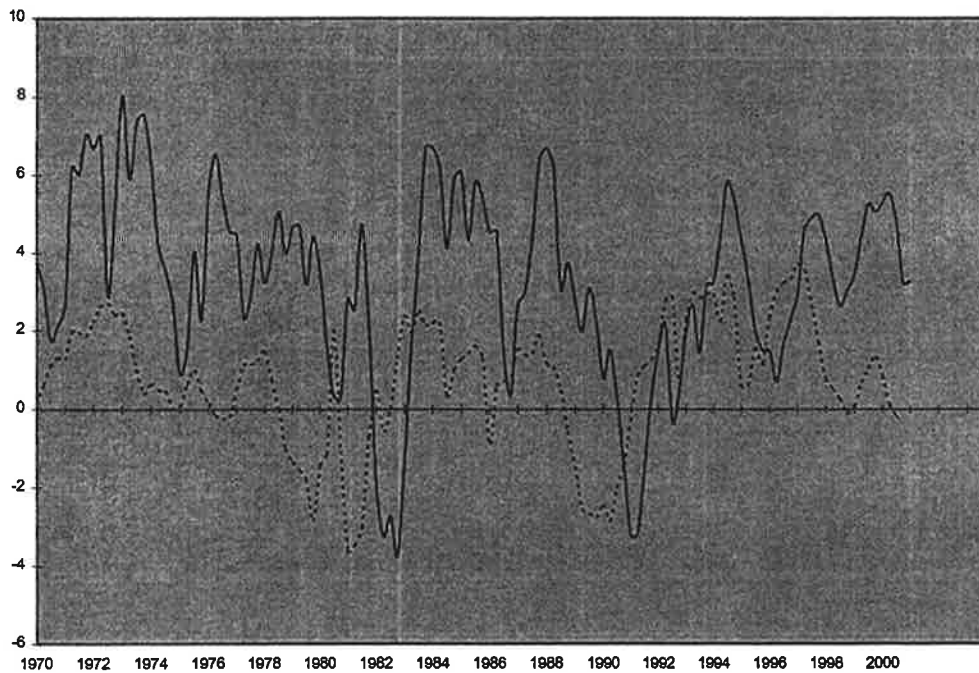

Source: Statistics Canada database

Figure 4: Yield Spread and Real GDP Growth for Canada, 1970-2000
(Dotted line represents monetary indicator)

The first indicator of monetary policy employed, yield spread, is a measure of interest rate activity in the economy. For each quarter between 1970 and 2000, the spread was calculated between the rate on a 10-year treasury bill and the Bank of Canada's published overnight rate. This measure is preferred to a simple regression involving overnight rate because it includes some pricing of future expectations of the interest rate and uncertainty in the market. As seen in Figure 4, in some cases the spread was in fact negative: short-term rates were higher than long term. This may reflect a sudden change in the level of restrictiveness of Bank of Canada policy, or it may simply be an indication of the expected future movement of interest rates; that is, although policy is restrictive now, significant loosening is expected given the state of the economy. Unsurprising given the qualitative analysis above, yield spread is significantly negative before each of the two major contractions in question. In other words, the Bank increased the overnight rate so significantly as to be greater than the interest earned on a long term treasury bill at two rather inopportune moments. Furthermore, prior to the 1991 recession, yield spread was negative for an extended period of time; from Figure 4 it is also clear that the recession was more persistent than it predecessor, indicating that perhaps the spread was contributing factor. In the OLS estimation equation that employs yield spread as its indicator variable, one would expect a positive cumulative coefficient: as the difference between long term and short term interest rates becomes increasingly positive, it likely means that short term rates are decreasing (or conversely that long term rates are increasing). A decrease in short term rates should stimulate capital investment and growth, and therefore positively affect the growth rate of Canadian GDP.

The second regression employed the M1 gap, calculated as the difference between the quarterly annualized growth rates of M1 and nominal GDP. This is a direct measure of the elasticity of the money supply in the Canadian economy, and is depicted in Figure 5.

Note that prior to each of the contractions in question, the M1 gap was a negative value, or that nominal GDP was growing at a rate faster than the money supply. One would assume that the slower growth of money supply would have a braking effect on the growth rate of the economy: the growth of nominal GDP can only continue so long as consumers and
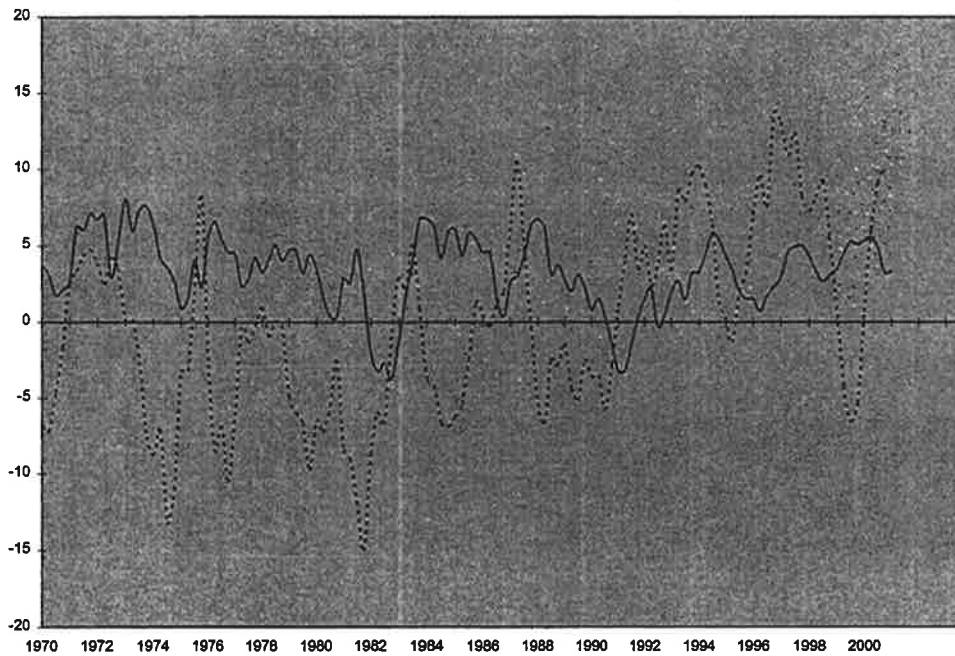
Figure 6: M1 Gap and Real GDP Growth in Canada, 1970-2000

business hold sufficient cash to complete transactions. It is logical, therefore, that the slower the growth of M1, or the more negative the value of M1 gap, the slower the growth of real GDP. This is of course assuming that money has real effects in the economy. Hence, we expect a positive value for the cumulative coefficient on *m1gap*: highly negative values of the indicator should result in decreased levels of real GDP growth. However, there is one caveat; the correlation of nominal GDP and real GDP growth could mean that a decrease in the value of M1 gap (or the convergence of money supply and nominal GDP growth) is associated with an increase in real GDP growth. In this case, the expected coefficient would

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be negative, even if M1 growth was having positive effects upon the growth of the real economy.
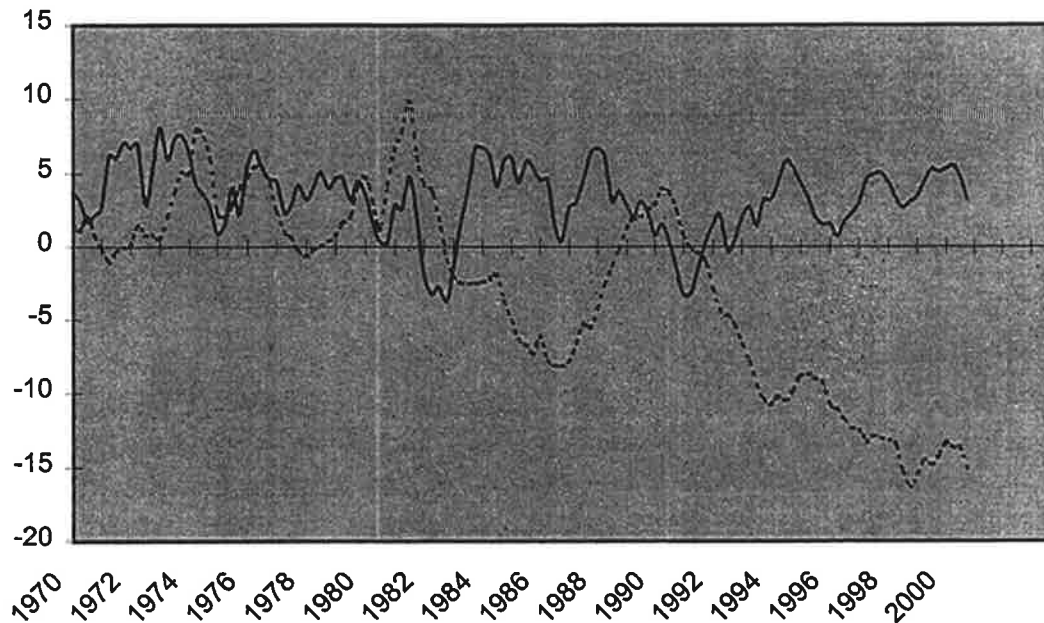
Figure 5: Monetary Conditions Index and Real GDP growth in Canada, 1970-2000

The final regression utilized a monetary conditions index (MCI) with the first quarter of 1969 as the base period. The MCI measures the degree of ease or tightness in monetary conditions in the Canadian economy through interest rates (in this case the 90 day corporate paper rate) and the direct exchange rate with the United States dollar. Interest rates are given a weight of one, while exchange rates take one-third, as an approximation of the relative effect each has upon economic output. The calculation was given by the formula:

$$MCI = (R_t - R_{1969Q1}) - (100/3)(E_t/E_{1969Q1} - 1) \qquad (5)$$

Theoretically, the larger the value of MCI, the greater the level of tightness in the economy, and thus the greater the downward pressure upon real GDP growth. However, as seen in Figure 6, the relationship between MCI and the growth of the Canadian economy is not clear. It seems as though in the 1980s high values of MCI simultaneously corresponded to

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peaks in real GDP growth. Of course, in the regressions lagged variables may pick up causality in subsequent years. Another interesting point is the period after 1994; as can been seen from the graph, the Bank of Canada had a very clear expansionary stance, given by a highly negative value of MCL However, the GDP growth rate does not seems to be greatly stimulated. In fact, the rates seem to keep to a pattern similar to that seen before. Therefore, while we would expect the cumulative coefficient on the ma variable to be negative, or the higher the MCI (tighter the monetary policy) the lower subsequent GDP growth rates, the relationship may not be expressed in regression results.

Empirical Results

Regression analysis should shed some light on the actual degree by which a change in monetary policy affects the growth rate of the Canadian economy. Results are presented in tabular form in Tables 1, 2 and 3; each equation was tested at the 10% significance level. Because a fiscal policy indicator is included in the equation, it is likely that some conclusions may be drawn as to the relative effectiveness of these policies in the economy. Each regression included the variables listed above at current levels, and lagged four separate times. For all three unique regressions, marginal effects of monetary policy indicators revealed a strongly significant equilibrium effect of the variables upon real GDP growth rates, although coefficient directions were not always as expected. Results are presented in tabular form; the final column of each shows the significance level for the variable as a whole (i.e. inclusive of all lags), and hence should be taken as the significance of the marginal effects presented.

The initial equation that employed yield spread found significant equilibrium marginal effects of both the monetary policy indicator and the growth of U.S. real GDP. A one-point increase in the value of yield spread results in a subsequent increase of 0.374% in the real GDP growth rate of Canada. Considering that average growth for the period in

question was approximately 3%, this represents a 10% increase in real growth with a 1% reduction in the overnight rate. However, this effect is not immediate; breaking the results down into each lagged period reveals that the total effect does not occur until at least 4 quarters after the action on the part of the back. In fact, in the short term a decrease in the overnight rate may actually cause a minor decrease in real growth, until the economy fully incorporates the action into its expectation formation. As expected, US real GDP growth took a very significant positive marginal equilibrium effect; a 1% increase in U.S. growth

Variable	Coefficient	Standard Error	T-Value	Cumulative Marginal Effects	Significance for set of lagged vars. (t value)
β_0	1.522211	0.391783	3.89		
ys_t	-0.15575	0.204574	-0.76		
ys_{t-1}	-0.04671	0.303107	-0.15		
ys_{t-2}	0.053045	0.304392	0.17		
ys_{t-3}	0.240008	0.297605	0.81		
ys_{t-4}	0.284002	0.21666	1.31	0.374595	Significant (2.68)
bb_t	-0.04733	0.203888	-0.23		
bb_{t-1}	0.075611	0.244776	0.31		
bb_{t-2}	0.033074	0.244825	0.14		
bb_{t-3}	0.01339	0.245767	0.05		
bb_{t-4}	0.107335	0.19876	0.54	0.182081	Insignificant (1.77)
$usrgdp_t$	0.402534	0.157047	2.56		
$usrgdp_{t-1}$	0.337451	0.203473	1.66		
$usrgdp_{t-2}$	-0.13221	0.204321	-0.65		
$usrgdp_{t-3}$	-0.06635	0.206087	-0.32		
$usrgdp_{t-4}$	0.142807	0.147145	0.97	0.684228	Significant (11.01)
xrg_t	-0.15379	0.07784	-1.98		
xrg_{t-1}	0.062628	0.114166	0.55		
xrg_{t-2}	-0.0352	0.115389	-0.31		
xrg_{t-3}	0.029387	0.11664	0.25		
xrg_{t-4}	0.04144	0.081153	0.51	-0.05554	Insignificant (1.87)

Table 1: Results of Regression 1. ($R^2 = 0.5993$)

leads to a 0.68% increase in Canadian growth in this model. The fiscal policy variable, *bb*, took a positive but insignificant marginal effect value; this seems to indicate that the

potential ambiguity of fiscal policy effects is reflected well in this model. Unexpectedly,
exchange rate growth took a negative value, indicating that devaluation of Canadian currency
has a negative effect on real growth. However, as in the vase of the fiscal policy variable,
this cumulative marginal effect was insignificant in this model, and therefore the direction of
the variable is inconsequential.

The second model, employing M1 gap, revealed that this indicator is cumulatively
significant, with a one point decrease in the value leading to a 0.088% increase in real GDP
growth. In line with expectations, it did take a negative coefficient value, indicating that the
model was somewhat accurate in its estimation. It is important to note that M1 gap seemed
to have its most significant effect in the very short term, not only in terms of magnitude of

Variable	Coefficient	Standard Error	T-Value	Cumulative Marginal Effects	Significance for set of lagged vars. (t value)
β_0	1.397633	0.386051	3.62		
$m1gap_t$	-0.14202	0.05519	-2.57		
$m1gap_{t-1}$	0.019802	0.081032	0.24		
$m1gap_{t-2}$	0.078215	0.078197	1		
$m1gap_{t-3}$	0.041608	0.076434	0.54		
$m1gap_{t-4}$	-0.08613	0.057243	-1.5	-0.08852	Significant (3.10)
$usrgdp_t$	0.654901	0.154109	4.25		
$usrgdp_{t-1}$	0.157442	0.209768	0.75		
$usrgdp_{t-2}$	-0.10729	0.213596	-0.5		
$usrgdp_{t-3}$	-0.0075	0.215181	-0.03		
$usrgdp_{t-4}$	0.189069	0.147687	1.28	0.886626	Significant (18.98)
bb_t	0.175652	0.199336	0.88		
bb_{t-1}	0.065201	0.235502	0.28		
bb_{t-2}	0.098011	0.235362	0.42		
bb_{t-3}	-0.07802	0.236891	-0.33		
bb_{t-4}	0.011371	0.199481	0.06	0.272217	Significant (3.85)
xrg_t	-0.05949	0.074413	-0.8		
xrg_{t-1}	0.029973	0.103914	0.29		
xrg_{t-2}	-0.03285	0.104709	-0.31		
xrg_{t-3}	0.012033	0.108524	0.11		
xrg_{t-4}	0.048108	0.079489	0.61	-0.00222	Insignificant (0.50)

Table 2: Results for Regression 2. (Adjusted R^2 = 0.6066)

the coefficient, but also through statistical significance. Again, U.S. real GDP growth showed a strong causal relationship with Canadian growth; its marginal effect increased to 0.88% in this model as compared with the previous. Unlike the initial model, the effect of fiscal policy, independently insignificant in each time lag, showed strong cumulative significance. As in the previous model, the coefficient was strongly positive. This seems to indicate that Canadian economic growth seems to respond well to a policy of fiscal contraction: high deficits are not conducive to growth despite the stimulation effects they imply. Also as in the first model, equilibrium marginal effect of exchange rate growth was strongly insignificant. Therefore, although the sign on the coefficient is again not in line with expectations, we can safely assume that this effect is not important in the model and therefore does not jeopardize the validity of the results.

Variables	Coefficient	Standard Error	T-Value	Cumulative Marginal Effects	Significance for set of lagged vars. (t value)
β_0	1.57526	0.384904	4.09		
mci_t	0.270378	0.150412	1.8		
mci_{t-1}	-0.05571	0.252979	-0.22		
mci_{t-2}	-0.13496	0.259252	-0.52		
mci_{t-3}	-0.05661	0.252649	-0.22		
mci_{t-4}	0.019746	0.161349	0.12	0.04284	Significant (2.77)
$usrgdp_t$	0.481636	0.159196	3.03		
$usrgdp_{t-1}$	0.362381	0.20871	1.74		
$usrgdp_{t-2}$	-0.11579	0.208645	-0.55		
$usrgdp_{t-3}$	-0.09016	0.207877	-0.43		
$usrgdp_{t-4}$	0.19655	0.147398	1.33	0.834615	Significant (19.43)
bb_t	0.141398	0.199313	0.71		
bb_{t-1}	0.06533	0.23615	0.28		
bb_{t-2}	0.072434	0.234523	0.31		
bb_{t-3}	-0.02337	0.238641	-0.1		
bb_{t-4}	-0.03067	0.196016	-0.16	0.225125	Significant (2.49)

Table 3: Results of Regression 3. (adjusted R^2 = 0.5975)

The final model, employing monetary conditions index, yields results that are significant, but produce unexpected coefficient directions. Upon first inspection of the model, it was thought that perhaps increasing the number of lags on this specific variable could lead to a negative coefficient. However, even when lagged for over two years, the cumulative coefficient on the *mci* variable was consistently small and positive. While this is unexpected, it is possible that a relationship simply does not exist for Canada; surely from Figure 7 it was apparent that the relationship between the indicator and growth levels was at best unclear. Part of this may have to do with the incorporation of exchange rate in the measurement; both model 1 and 2 have convincingly shown that exchange rate does not have a significant impact on the growth rate of the Canadian economy. While the two monetary policy indicators separate from exchange rate have shown significant, predictable effects, MCI does not. That being said, this problem surely requires further study to determine whether it is an actual pattern in the data or an error on the part of the author. Besides these strange effects however, other variables show consistent results. As in the first two models, budget balances reveal a fairly modest magnitude of causality, and are only somewhat significant in the model. Also, U.S. real GDP continues to show its importance in Canadian GDP determination, this time with a correlation of a 0.73% increase in Canadian GDP growth for every 1% increase in American growth.

While effects of each of the monetary policy variables chosen vary, it is clear from the above results that each indicator of the stance of the Bank of Canada has real and significant effects on the growth of the economy. This can be seen not only through the signficance of each variable separately, but the promisingly high adjusted R^2 values for each equation. It is also interesting to note that R^2 are almost equal for each equation, perhaps signifying that the type of monetary indicator used is not important in describing the movements of the Canadian economy. The significance of the monetary policy variables

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seemingly validates the hypothesis that the policy is truly is the most powerful weapon in the battle for economic stability. That being said, the difference between the effects of each indicator has important implications for the relative effectiveness of the tools available to the Bank of Canada for monetary control.

Policy Implications

From a cursory analysis of regression results, it is clear that the magnitude of the effect of a change in yield spread upon the growth of GDP is much greater than that of a change in M1 gap. This would seem to indicate that the multiplier effect of a monetary policy that targets interest rates is greater than one that targets money supply. In fact, the Bank of Canada seemed to realize this when the switch in the early eighties abandoned monetary control for interest rate manipulation. In that respect the Bank seems to be on target in terms of maximizing the effectiveness of monetary control.

Another variable of major concern in the early eighties was the Canadian-U.S. exchange rate; one of the banks stated policies was its stabilization and control. However, it is clear from the results of this study that the equilibrium effect of changes in exchange rate is not only insignificant in determination of levels of GDP growth, but may in fact be detrimental. Therefore, using exchange rate targeting as a method for controlling monetary conditions is likely ineffective in either stimulating or impeding economic growth. Again, the Bank seems to have heeded this message; since the late 1980s exchange rate has been essentially allowed to float against the U.S. dollar while other tools are used in its place.

As mentioned above, from the analysis conclusions can be drawn concerning the relative effectiveness of fiscal and monetary policy. Initially looking at only Model 1 and 2, monetary expansion has the potential for significant and positive effects on the growth rate of the economy. However, expansionary fiscal policy is not quite as promising. Firstly, its significance between models is questionable, perhaps indicating that its effects are not always

expressed in growth rates. Furthermore, since the coefficient on *bb* was consistently positive, around the magnitude of 0.2, the Canadian economy seems to respond well to fiscal *restraint*, not expansion. In other words, when the government keeps the budget balance to GDP ratio positive (i.e. runs a surplus), the economy responds very favourably. And since 1986, the federal government seems to have understood this and pursued an active policy of debt and deficit reduction. This conclusion implies that any efforts at stimulating the growth of the Canadian economy must be undertaken exclusively by the Bank of Canada.

While not closely linked to monetary policy, mention should be made of the most consistently important variable in each equation. Movement in the growth rate of the United States have the both the highest significance and magnitude of any indicator variable. In times of American economic prosperity, this would of course work to Canadian advantage. However, any protracted period of U.S. decline would have serious repercussions upon Canadian prosperity. While short-term costs may be prohibitive, it should be a policy of Canadian government to encourage diversification of Canadian trade industries to overseas markets in order to insulate the economy against the negative effects of this correlation. This is no easy task, as the two economies have historically been closely intertwined. However, in light of the current uncertain political and economic climate in which the U.S. finds itself, now may be the best time to consider a policy of this sort.

Conclusion

Through regression analysis, it is clear that expansionary monetary policy from the Bank of Canada can have real effects upon the economic growth of Canada. However, it is also clear from a qualitative analysis of actions of the Bank thus far that this power has not been exploited, often to the detriment of the Canadian economy. OLS estimations have also made clear the importance of the growth trends of the United States in the determination of the economic health of Canada, as well as the lack of importance of the exchange rate.

Policy implications for these findings include favouring monetary policy for expansionary measures, the problems with exchange rate targeting by the central bank, and the need for decreased dependency on the American economy. Further research into this topic may first entail the further testing of the monetary conditions index in this context to determine whether consistent results can be gleaned from available data. Furthermore, a broader sample, perhaps incorporating monthly data, could give further insight into the length of the lag of indicator variables and its relative importance. However, it is fairly clear that the Romers' model for determination of monetary transmission is applicable to the Canadian experience, and therefore may be useful in the study of other small open economies.

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