

Monetary Policy Rules in Canada in the 1990s

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Abstract

In the 1990's the Canadian economy experienced the "Great Slump" and a prolonged recovery while the United States economy enjoyed a continuation of the "Long Boom". These different economic performances did not reflect weak external conditions on either the supply or demand side of the two economies. Indeed growth in the Canadian export sector in the 1990's was stronger and more stable than in earlier decades or in the United States. "Monetary policy rules" estimated for each country illustrate a clear difference between Canadian and United States' monetary policies. Canadian monetary policy placed primary emphasis on inflation targets and economic performance was impaired. United States monetary policy took a balanced approach to inflation control and output stabilization and performance was strong. These findings argue for Canadian monetary policy in the future that provides much stronger support for stable output growth in addition to a continued concern for inflation control.

I. Introduction

The apparent success of monetary policy in the United States in the past 15 to 20 years stimulated a large flow of new research on the theory and practice of monetary policy. Clarida et al (1999) provide a survey of some of this work. Monetary policy is given credit for the notable increase in the stability of economic growth in United States, combined with moderate and stable inflation, from 1982 to 2000. Taylor (1998) labeled this experience “the Long Boom”. Studies of monetary policy in the United States in this time period find that policy was implemented through the Federal Reserve’s actions to set and control interest rates. More specifically short-term interest rates (the Federal Funds rate) were changed in response to observed and anticipated differences between actual and implicit target values for the inflation rate and the level of economic activity. Policy implemented by this approach was increasingly successful in stabilizing the economy because the Fed’s reactions to variations in inflation and economic activity resulted in larger changes in its interest rate policy instrument than had occurred under earlier policy regimes. Short term policy reactions to observed or anticipated fluctuations in inflation and output apparently reduced the variance in inflation and economic activity to produce a long term pattern of economic growth with moderate inflation, smoother than had been experienced in earlier time periods.

The Canadian experience with inflation, unemployment and economic growth in the 1990s was quite different than that in the United States, as was the Canadian approach to monetary policy. Although inflation had been reduced significantly in the early 1980’s, inflation control re-emerged in the late 1980’s as the primary target for monetary policy (Thiessen, 2001). Recalling a disappointing experience with inflation fighting through the control of monetary supply growth in the 1970s, the Bank of Canada searched for an alternative approach to policy through the early 1980’s. This led in 1988 to the Bank’s decision, announced in a speech by Governor Crow (1988), to pursue “price stability”. That policy objective was confirmed and given empirical content in 1991 when the Bank of Canada and the Minister of Finance, introduced formal inflation rate targets that ran until 1995, and declined over that time period. Those targets were later extended through the 1990s.

The Bank of Canada, like the Federal Reserve, implemented its monetary policy through its control and setting of the short-term interest rate, in this case the Overnight Rate. However, the weight given to the inflation rate target for monetary policy was clearly heavier than that given in the United States, or in other countries that did not adopt inflation targets and guidelines. Inflation rates in Canada did decline to the targets set, and did remain within or below the target ranges, but Canada did not

experience the stability of economic growth and the low levels of unemployment that were enjoyed south of the border. Indeed, in contrast to the ongoing Long Boom in the United States, Canada experienced what Fortin (1996) called the ‘Great Canadian Slump’. This contraction in the economy was deep enough that despite the revival of growth in real GDP in the mid 1990’s the slump, measured by the GDP gap and unemployment rates, persisted until 1999, according to estimates published by the Bank of Canada (Nov., 2001).

This paper examines the difference between Canadian economic performance and monetary policy in the 1990’s and in earlier decades, and compares the Canadian experience with that in the United States. Several questions are of interest. Did economic performance and policy in Canada in the 1990’s differ from that of earlier decades? Perhaps the experience of the 1990’s was a continuation of historical experience, or perhaps monetary policy was no different than in earlier periods, or perhaps Canada was unlucky in the 1990’s in terms of the incidence of external factors that disturbed and depressed economic performance. Similar questions and considerations arise in a comparison of the Canadian experience with that of the United States. One matter of particular interest, however, is the difference between monetary policies in the two countries, and the extent to which any difference might account for the difference in economic performance. In general terms it emerges that both countries experienced quite similar economic environments, but pursued quite different policy objectives. Canadian monetary policy, in particular the greater emphasis placed on the inflation control targets, must take a major part the blame for the lower growth, higher unemployment and greater instability in Canada in the 1990’s compared to earlier decades and compared to the United States in the 1990’s. These findings argue for a future Canadian monetary policy that takes a more balanced approach in the emphasis it places on output stabilization and inflation control.

The analysis proceeds as follows. Section II examines Canadian macroeconomic performance over recent decades and in comparison with the United States to put the experience of the 1990’s in perspective. Section III considers the sources of growth and fluctuations in economic activity in Canadian in the 1990’s in comparison with earlier decades and with the experience in the United States. These sources include conditions on the supply side of the economy through price and productivity developments, and conditions on the demand side including capital expenditures, international trade effects, government sector budget and debt developments, and conditions in financial markets. Section IV turns to indicators of monetary policy, again with comparisons to earlier time periods and conditions in the United States. Section V provides a discussion of the theory of monetary policy design and

implementation, along with empirical estimates of Canadian and United States monetary policy rules or reaction functions. Section VI provides a summary of the main findings and conclusions.

II. Macroeconomic Performance in Canada and the United States in the 1990's

Macroeconomic performance is usually evaluated in terms of three key time series rates namely: the inflation rate, the unemployment rate and the growth rate of real GDP. Times of low and stable inflation, and low and stable unemployment, and high and stable growth in real output are times of prosperity and generally rising standards of living. In other words these conditions are represent sound economic fundamentals and good economic performance. They are the ultimate objectives of stabilization policy.

Table 1 presents the empirical record on these three indicators of performance. It provides the basis for a comparison of inflation rates, unemployment rates and growth rates in Canada in the 1990's with measures of the same indicators in the three preceding decades and with the record for the United States. The data are presented as decade averages along with information on the stability or instability of the indicator measured by its standard deviation and extreme values.

These data show Canadian macroeconomic performance in the 1990's falling short of the performance in earlier decades, and the performance of the United States. The Canadian record was better in terms of inflation, at least as measured by the average inflation rate if not by its stability. But Canadian growth rates and unemployment rates did not match the performance in the United States. This was a reversal of the earlier pattern of comparative performance between the two countries. In the 1960's and 1970's Canadian unemployment rates were lower, and Canadian growth rates were higher than those in the United States. In the 1980's growth rates and unemployment rates were similar in both countries. In the 1990's Canada fell behind.

The details of this economic performance are illustrated in the table. The Canadian inflation record in the 1990's is strong. Inflation rates on average were only about one third of the inflation rates experienced in the 1970's and 1980's, and significantly lower than the inflation rates in the 1960's. Furthermore inflation rates in the 1990's were more stable than they had been in earlier decades. While inflation rates in the United States were also lower and more stable in the 1990's than in earlier decades,

they were higher than Canadian rates. Thus both countries enjoyed significant improvements in their inflation environments compared with earlier decades.

Unemployment rates and growth rates tell a different story. In Canada in the 1990's the unemployment rate was higher, on average than it had been in any of the three preceding decades. It was more volatile than in the 1960's and 1970's and reached a higher maximum value than in any of the three earlier decades. These higher unemployment rates were reflective of the inferior economic performance measured in terms of economic growth. Growth rates of real GDP in Canada in the 1990's were notably lower on average in previous decades, the minimum growth rate of -3.04 percent recorded in 1991 marked the depth of the recession early in the decade. Although this decline in the economy was not as large as that noted in the 1980's, the economy in the 1990's did not experience as strong a recovery in growth as in the earlier decade. As a result, the performance of the Canadian economy in the 1990's did not measure up to that of earlier decades in terms of employment and output.

In the United States the record was better. Unemployment rates in the 1990's on average were lower than in the two earlier decades and about one third lower and more stable than unemployment rates in Canada. This reversed the pattern of earlier decades in which Canadian unemployment rates had been quite similar, but with and Canadian rates more stable than U.S. rates. Once again the unemployment rates reflect the growth performance of the economy. In the United States, real GDP growth continued at about the same rate as in the 1980's but was more stable, while the Canadian growth rate fell. Where growth rates and variations in growth rates in Canada and the United States had been similar in the 1980's, United States performance was clearly stronger through the 1990's.

III. Sources of Growth and Fluctuations.

With reference to monetary policy, stabilization policy can be defined as central bank actions that are intended to reduce the fluctuations in output growth, unemployment rates and inflation, caused by to disturbances to the economy, Disturbances usually fall into one or the other of two broad categories. Disturbances on the supply side of the economy, or supply shocks change costs of production, producing capacity, output and prices. Positive shocks such as declines in energy or commodity prices, or improvements in technology have the desirable effects of increasing output and employment while reducing costs and inflation rates. They contribute positively to economic performance and policy objectives. Negative supply shocks, on the other hand create policy dilemmas. Negative shocks, such as increases in energy prices, raise costs of production and inflation while

simultaneously retarding growth and increasing unemployment. Monetary policy then faces a choice. It can react to the rise in inflation through restrictive policy, which will aggravate the growth and employment problem, or it can react to the growth slow down through expansionary policy, which will reinforce the inflation problem. It cannot do both at the same time. The action taken reflects the relative weights assigned to inflation versus growth and employment when policy authorities define their policy objectives.

Disturbances arising on the demand side of the economy call for policy responses in the interests of stability, but do not create similar policy dilemmas. Negative demand shocks reduce output growth, employment and inflation. Positive demand shocks raise them. An increase in export demand, for example, stimulates the economy. Output rises in response to increased markets, employment rises to increased production and stronger markets for both final product and labour inputs put some upward pressure on costs and prices. In an economy already operating at capacity the central bank can raise interest rates to offset the increased pressure on output and maintain satisfactory growth and unemployment rates, while containing inflationary pressures. Monetary policy works through its influence on the demand side of the economy and is well positioned to react in ways that offset demand side shocks, either positive or negative. There is no conflict between stabilizing inflation and stabilizing growth and employment in response to demand shocks.

In Canada in the 1990's the measures of economic performance discussed above show improved inflation performance but weaker performance in terms of growth and employment. This experience might be a result of negative shocks to the economy, instability on the supply side or the demand side or both, with sufficient magnitudes and frequencies that the monetary authorities succeeded only in containing the inflationary pressures. In other words the policy authorities were simply unlucky in terms of the turbulence they had to deal with. Alternatively, it could be that the authorities focused their policy responses exclusively on one dimension of economic performance, namely inflation, and did not attempt to stabilize fluctuations in growth rates and unemployment rates. An examination of the possible sources of growth and fluctuations is a first step to sorting this out.

III.1. Price and Productivity Shocks.

The size and variability of price shocks can be measured using the difference between the rate of inflation in the consumer price index, all items, and the rate of inflation in the consumer price index excluding food and energy. This procedure extracts the effect of food and energy price changes from

the broader price indexes. Historically, food and energy prices have been much more volatile than other consumer prices, reflecting the differences between markets for commodities and energy and those for manufactured products and services. A positive difference between the rates of inflation measured by the consumer price index all items, and the consumer price index excluding food and energy measures the price shock coming from the food and energy sector. A positive price shock, a change in the CPI all items greater than the change in CPI excluding food and energy, is a negative supply, a shock that pushes the inflation rate up while reducing output and employment. A lower rate of inflation by the consumer price index all items than by the consumer price index excluding food and energy is, by a similar argument, a negative price shock that has a positive effect on supply conditions. It lowers inflation while stimulating growth and employment. The data on price shocks in the upper panel of Table 2 illustrate conditions in Canada in the 1990's and offer a comparison with earlier decades and with the experience in the United States. They show that both countries enjoyed stable supply side conditions in the 1990's that contributed to economic growth and inflation control.

Productivity growth also enhances the economy's inflation and growth performance from the supply side. It increases output at the same time as it reduces the resource costs of production. Productivity is measured here by labour productivity, defined as output per hour of work. The lower panel of Table 2 reports average productivity growth by decade, 1960-1999, in Canada and the United States. These data show that productivity growth increased in the 1990's in both countries relative to the 1980's and was also more stable, although it did not return to the much higher levels of the 1960's and 1970's. Despite this recovery, the growth in productivity in Canada in the 1990's was lower than in the United States and made a correspondingly smaller contribution to economic performance.

In general terms supply conditions in Canada made a positive contribution to the economy's inflation and growth performance in the 1990's. Price shocks from the food and energy sector in Canada had a positive impact on supply, and were significantly more stable than in the earlier decades. However, these positive supply influences in Canada were not as strong as they were in the United States. Some small part of the difference between Canadian and U.S. economic growth in the 1990's can be explained by slightly less favorable supply side shocks in Canada as compared to the United States. However, Canadian supply conditions were more stable and thus contributed less to fluctuations in growth and inflation.

III 2. Investment, Exports, Financial Markets and Government Budgets

The observation that supply conditions were broadly stable means that the main explanations of economic performance must lie on the demand side of the economy. Several potential sources of underlying growth and fluctuations in growth warrant brief consideration. These are the developments, in terms of growth and stability observed in the investment, export, government and financial sectors of the economy. The issue of particular interest is the extent to which demand sector conditions were driven by conditions unrelated to domestic monetary policy. Table 3 provides data on these sectors.

The export sector is the single and obvious source of strength among these demand sectors. Export growth rates in the 1990's were much stronger and more stable than in the two earlier decades. Growth in Canadian exports also exceeded growth in United States' exports, although export growth there was also stronger and more stable than it had been in earlier decades. One striking consequence of the strong growth in Canadian exports was the large increase in the share of exports in GDP, which enhanced the positive impact export growth and stability had on overall performance. These observations provide extended support for Fortin's (1996) argument that the slump in the Canadian economy in the early 1990's was not a result of trade liberalization and globalization.

The investment and government sectors were by contrast sources of significant weakness in the demand side of the economy. On average growth in investment expenditures, which reflect underlying capital formation, capacity growth and new technology in the private sector of the economy was weak and volatile. It fell substantially short of investment growth in earlier decades in Canada and was less than half the growth observed in the United States in the 1990's. However, investment expenditures are clearly not independent of other conditions in the economy, and perhaps in particular the monetary conditions arising from central bank actions. Thus while it is clear that weaker and more volatile growth in investment spending was a contributor to weaker and more volatile performance in the economy, it is not clear that this is a purely external source of the problem. It may largely reflect the impact of monetary policy aimed at another aspect of the economy's operation. In that case, part of the difference between growth and stability in investment expenditures in Canada and the United States would also reflect different monetary policies in the two countries.

Evaluating the effect of the government sector on economic performance in the 1990's is similarly complicated by policy interactions. Government budget changes are traditionally considered as a part of the fiscal and monetary policy stabilization program, rather than as sources of disturbance to economic performance. However, while fiscal policy can be used to pursue different objectives, it

cannot pursue more than one objective at a time. Fiscal policy might be used, for example, to stabilize economic activity through the impact of government expenditure and taxes on aggregate demand, the growth of real GDP, and the unemployment rate. This would involve fluctuations in the government budget balance, deficits and surpluses, as require to offset external demand shocks like those arising from fluctuations in export demand or business capital expenditure. In other words the government would forgo control of its budget balance to pursue economic stability.

Alternatively, government might use its fiscal powers to control its budget balance, setting some value for that balance; positive, negative or zero, as its target and changing tax and expenditure programs to meet that target. By that choice it would give up its discretionary power to pursue stabilization. Moreover, both choices are further constrained. Budget policy must also recognize and respond to the effects that budget balances have over time on the accumulated public debt, which is the sum of past budget balances. The government cannot implement fiscal policy in a way that leads to a continuing rise in the ratio of the public debt to GDP. It is dependent on the sale of government debt in financial markets to maintain its operations, and debt markets do not like high and rising debt ratios. Thus the fiscal policy objective, either economic stabilization or budget balance must be pursued within the limitations imposed by the dynamics of the debt ratio.

Starting from an initial position of budget deficits and rising public debt ratios, suppose the ministers of finance set balanced budgets and declining public debt ratios as fiscal policy objectives, rather than stable economic growth, employment and inflation. This was the case in Canada and the United States in the 1980's and 1990's. Tax and expenditure changes were designed and introduced to achieve these results. It might be argued that the combination of tax and expenditure changes introduced to achieve these objectives will, over time, yield efficiency improvements that are positive supply side factors as discussed above. The evidence on this is at best mixed. Nevertheless, when fiscal policy is directed at budget balance and debt targets discretionary changes in government budget are made regardless of current economic circumstances, including current monetary policy. Then government budget adjustments can be important sources of demand disturbances that cause fluctuations in economic activity.

The data in Table 3 show clearly that the 1990's was a decade of fiscal adjustment aimed at raising government budget balances and reducing the government sector debt ratios. Although government sector budgets were in deficit on average and quite volatile, in both Canada and the United States, the deficits were smaller than in the 1980's. More importantly the budget balances increased

over the decade. In Canada, the largest annual deficit of 9.75 per cent of GDP, which occurred in 1993, changed to a surplus of 2.64 percent in 1999. The budget balance shift in excess of 12 per cent of GDP reflected the remarkable scale of fiscal adjustment in Canada during the 1990's. The corresponding adjustment in the United States government sector budget was just over 7 per cent of GDP.

Discretionary changes in taxes and program expenditures were implemented at all levels of government. They imposed significant fiscal restraint on both economies during the decade, and the larger degree of restraint in Canada goes some way to explain the weaker economic performance in Canada in the decade.

The scale of the adjustment required to stabilize deficits and debt ratios reflects the strong interactions between monetary and fiscal policies. Consistent with recent work by Leith and Wren-Lewis (2000) and Tanner and Ramos (2002), fiscal adjustments and monetary policy were closely connected. A monetary policy that sets hard targets for inflation dominates fiscal policy. It forces changes in the government sector's primary budget balance as required to maintain debt ratio stability and fiscal solvency. The rise in the total government sector budget deficit from just over 5 per cent of GDP at the end of the 1980's to close to 10 per cent of GDP in 1993 coincided with Canada's 1991 adoption and implementation of inflation targets for monetary policy. Monetary restraint resulted in the sharp decline in GDP growth noted in Table 1 above, induced large declines in government sector budget balances and triggered a strong rise in the debt ratio. An increase in the primary balance through increased fiscal restraint was required to offset the effects of the increased debt ratio. In the United States, by comparison, monetary policy did not have a hard inflation target, the recession in economic activity in the early 1990's was much milder and the impact on the government budget balance was smaller. The need for fiscal restraint was less. Thus as with investment, the government sector was a source of weakness in the economic performance of the 1990's, but part of that weakness in Canada was a consequence of the change in monetary policy.

The performance of stock or financial markets is another potential source of strength or weakness in the demand side of the economy. Financial market evaluations of financial assets reflect attitudes and expectations about future domestic economic growth and employment, and expectations about earnings and profit growth in domestic industry. These financial market conditions can be a powerful force driving economic fluctuations through their effects on expenditures by businesses and households. Strong assets prices in bond and equity markets may stimulate business investment expenditure by raising the evaluations of fixed assets relative to their costs of production, and lowering

the costs of financing fixed asset formation through capital expenditures. Both effects are incentives to business investment expenditures. Higher prices in stock markets also increase the financial net worth of households, making them feel richer and stimulating their expenditures on consumer goods and services. Weak or declining financial markets, or financial markets that are volatile, by similar argument reflect weaker or less confident expectations about future economic conditions and would tend to reduce the expenditure growth that underlies GDP and employment growth.

The financial market performance data are presented in Table 3. As measured by the growth and volatility of major stock market indices, Canadian equity markets offered much lower and somewhat more volatile returns in the 1990's than did equity markets in the United States. Furthermore equity markets in Canada in the 1990's did not grow as strongly as they had in the 1980's although they were less volatile than in the 1980's. The table also shows the ratios of the decade average growth rates and standard deviations in those growth rates. This is a commonly used measure of the reward provided to investors for taking on the risk of the market. While it appears that the 1990's were better than the two earlier decades for investors in Canada, markets in United States provided exceptional opportunities. However, the difficult question is whether conditions in equity markets simply reflect underlying economic conditions rather than contribute to those conditions. It seems likely that the interactions flow both ways. Slower more volatile growth in Canada in the 1990's than in earlier decades or in the United States may have impacted negatively on the growth and stability of financial asset values that in turn reduced incentives for business and household expenditure. In any case the Canadian economy in the 1990's financial market performance did not make the contribution to growth that did in the United States economy.

Based on these observations, the difference between Canadian economic performance in the 1990's as compared to earlier decades and to the United States was the result of different demand side conditions. Canadian performance was impaired by weaker and more volatile growth in investment spending and larger and more restrictive fiscal adjustments. It is arguable that both these weaknesses were related monetary policy and the focus of that policy on inflation targets. Although export markets provided an offsetting source of growth and stability it was not sufficient to sustain growth at rates comparable to those of earlier decades or rates experienced in the United States. Nor did financial markets provide a strong source of stimulus to demand growth. Thus the differences in economic performance reflect differences in monetary policy in Canada in the 1990's as compared to earlier decades and to monetary policy in the United States.

IV. The Broad Stance of Monetary Policy

There is a wide choice of indicators that might be used to measure and compare the stance of monetary policy over time and between countries. Laidler and Robson (1993) provide a discussion and application of many of these indicators in a Canadian context. Money supply growth rates and interest rates are two traditional measures of monetary policy with a long history in monetary policy analysis. Data on these are presented in Table 4a. Further information on monetary policy may also be provided by foreign exchange rates. In Canada the Bank of Canada recognizes the importance of exchange rates in the transmission of monetary policy actions to economic activity. It uses a weighted average of the change in interest rates and exchange rates from values in a base year to construct a *Monetary Conditions Index* as an indicator of monetary policy. Data on exchange rates and monetary conditions are presented in Table 4b. A brief discussion of the relationships among these indicators provides a basis for interpreting the observations in the tables.

A central bank's control over monetary conditions arises from its unique role as supplier of high-powered money or the monetary base. This is the ultimate means of payment in the economy. It takes the form of currency in circulation plus the clearing balances held by banks as deposits in the central bank. It is the foundation for the lending and deposit issuing activities of banks and other financial institutions that provide deposits to customers that can be used as means of payment. The commitment by deposit institutions to convert customer deposits to cash, together with the control of the supply of cash exercised by the central bank limit the lending and deposit issuing activities of financial institutions. As a result, the central bank can control the availability and terms of credit in the economy through its control of the monetary base.

In exercising its influence on economic activity the central bank must make a choice. It can use its control of the monetary base to control money supply as measured by a monetary aggregate such as M1 or M2, to control an interest rate such as the overnight rate, or to control the foreign exchange rate. However, it cannot control more than one of these variables at any one time. If it targets money supply and manages monetary base to control a money supply measure such as M1, it has used all its control power. It cannot at the same time control interest rates or exchange rates. It presumably chooses an immediate target for its actions based on its judgment about the strength of the linkage between its intermediate target and its ultimate objective of inflation control or income stabilization. In Canada in the period from 1960 to the present the Bank of Canada has at one time or another operated to

control exchange rates, money supply growth rates and interest rates (Thiessen, 2001). In examining the Bank's policy stance in the 1990's in comparison with earlier periods it is therefore appropriate to consider all these indicators.

Data on money supply growth rates as measured by growth in both the nominal and real (inflation adjusted) monetary base are in Table 4a. These data suggest that monetary policy in Canada the 1990's was on balance rather less restrictive and more stable than it had been in earlier decades. Real monetary base grew on average at about the same rate as it had in the 1960's, and more rapidly than it had grown on average in the 1980's. This observation suggests that the on average Canadian monetary policy in the 1990's was more accommodating to growth in real GDP than it had been in the earlier decade. Compared to the United States, however, monetary policy in Canada was more restrictive and more volatile in terms of the average growth rates of the monetary base.

The interest rate data for overnight rates in Canada and the Federal Funds rate in the United States in the lower panel of the table confirm this view. Both nominal and real interest short term rates in Canada were lower on average in the 1990's than in the 1980's, but generally higher than in the 1960's and 1970's. However real interest rates in Canada in 1990's were much higher than in the United States, with the real overnight rate in Canada averaging about twice the real Federal Funds rate the United States. So by interest rates as indicators monetary policy in Canada in the 1990's was somewhat less restrictive than it had been in the 1980's, but more restrictive than monetary policy in the United States in the 1990's.

But the description of monetary policy based on the growth of money supply or on interest rates neglects the role played by the foreign exchange rate. In the Canadian economy, with a large share of GDP involved in international trade, the exchange rate is important to expenditure decisions and aggregate demand. It changes the relative prices and traded goods and services and the profitability of exports. The exchange rate itself is strongly influenced by international flows of financial capital that respond in turn to changing interest rate differentials between countries, and expectations of future exchange rates, based in part on forecasts of economic performance. A *Monetary Conditions Index* that combines interest rates and exchange rates is used to take into account effects of both as determinants of aggregate demand. When the central bank monitors the combined influence of interest rates and exchange rates using such an index its interest rate responses to economic shocks will take into account recent and concurrent changes in exchange rates. If the economy were to experience a negative demand shock, coming from the export sector for example, and the Canadian dollar depreciated as a market

response to that shock, the Bank might see no need to add further stimulus through interest rate cuts to offset the effects of the shock. In terms of the monetary conditions index the depreciation of the exchange rate would lower the index indicating the stabilization response coming through the exchange rate. Thus the evaluation of monetary policy made on the basis of interest rates alone needs to be reconsidered in terms of a Monetary Conditions Index.

Table 4b provides data on both the exchange rate and a Monetary Conditions Index constructed using the exchange rate and short-term interest rates. By construction either a rise in the interest rate or a fall in the exchange rate (an appreciation of the Canadian dollar) increases the index indicating more restrictive monetary conditions. Furthermore, the weights used in the construction of the index are such that a unit change in the index has the same impact on expenditure if it arises from an interest rate change or an exchange rate change. As the left panel of the table illustrates the exchange rate rose through the late 1970's, the 1980's and the 1990's, as the Canadian dollar depreciated relative to the United States dollar. Combining this exchange rate data with interest rate data gives the Monetary Conditions Index in the right panel of the table. The decade averages for the index show monetary conditions that were much more expansionary on average in the 1990's than in any of the earlier decades. This result reflects the depreciation of the Canadian dollar that increased the exchange rate and lowered the index. However, in this case in particular it is important to consider the evolution of monetary conditions index over time based on the timing of the maxima and minima reported by date in the table.

The maxima /minima data reveal large shifts in monetary conditions in the 1980's and 1990's. Conditions were very restrictive in August 1980 with an index of 9.44 that reflected both higher interest rates and a lower exchange rate. Between 1980 and January 1987 conditions became much more expansionary as the index declined to -8.66 based on lower interest rates and a strong depreciation of the dollar. Then conditions tightened once more as a result of higher interest rates and a strong appreciation of the dollar that lowered the Canadian dollar price of the United States dollar to 1.1279 by late 1991, and pushed the index up to 2.59 on the way. This is the time period marked by the announced focus of monetary policy on "price stability" in 1988 and followed by the setting of inflation targets for monetary policy in Canada in 1991. Then from the peak of restraint in 1990, monetary conditions eased dramatically as interest rates fell and the exchange rate rose to push the index down to a minimum of -15.47 in 1998. Thus the average for the decade of the 1990's is strongly influenced by conditions in the

latter half of the period and does not reflect the shift to very restrictive policy that occurred in the late 1980's and the early 1990's.

In summary the decade averages of the indicators show monetary policy in Canada in the 1990's that was more supportive of growth than policy had been in earlier decades, but not as supportive as policy in the United States in the same time period. The earlier comparison of economic performance in the 1990's between Canada and the United States suggests that policy in Canada needed to be more, not less, supportive of growth than policy in the United States if the growth in Canadian output and employment was to keep pace with that in the United States. Different monetary policies and resulting differences in monetary conditions provide an important part of the explanation of different economic performances.

V. Evaluating Monetary Policy

V.1. Monetary Policy Rules 1960-1999

Most central banks, including the Bank of Canada, now implement monetary policy by setting and controlling short-term interest rates. With a few exceptions, like the period 1975-1980 in Canada and 1979-1981 in the United States, central banks have a long tradition of using interest rates as their policy instrument. Even during the time of money supply growth targets the Bank of Canada exercised control over money supply growth by using its control over interest rates, operating through the interest rate elasticity of demand for M1 (see Duguay and Longworth, 1998). In the 1990's the Bank concentrated on interest rate setting and control, specifically the overnight rate as the instrument of monetary policy using techniques explained by Clinton (1991) and the Bank of Canada (1999).

Recent work on monetary policy design, description and evaluation goes beyond the narrative approach used above to derive empirical measures of central bank responses to economic conditions. The methodology has been framed in terms of monetary policy rules, following Taylor (1993). It involves the specification and estimation of central bank reaction functions or policy rules by which changes in the policy instrument are driven by variations in inflation rates and output levels. The underlying policy objective is to minimize the loss imposed on the economy by fluctuations in rates of inflation, output growth and unemployment. Armour and Cote (2000) provide a concise example of the derivation of a policy rule based on these objectives. Estimated reaction functions or policy rules provide empirical descriptions of the policy program implemented by the central bank. There is a variety of approaches. Most focus on an interest rate as the policy instrument as illustrated, for example by Judd

and Rudebusch (1998), Clarida, Gali and Gertler(1998, 2000), Taylor (1999), Fair (2001), Ball (1999) and Hertzl (2000). A few studies consider monetary base setting rather than interest rate setting, as in the case of McCallum (1999, 2000) and Stark and Croushore (1998). Because the Bank of Canada uses short-term interest rates as its instrument a simple interest rate rule is used here to examine monetary policy in Canada in the 1990's.

Although monetary policy rules can take different specifications, simple rules often provide all the information required to make policy comparisons and evaluations. Following Mankiw (2001) considering the following variant of a simple rule as suggested by Taylor (1993):

$$i_t = c + \alpha\pi_{t-1} + \beta u_{t-1}. \quad (1)$$

Let i_t be nominal the overnight interest rate in Canada or the nominal Federal Funds rate in the United States, with the subscript t indicating the current time period. This policy rule calls for the central bank to set the current nominal interest rate based on a constant (c), the rate of core inflation (excluding food and energy) observed in the previous time period (π_{t-1}), and the unemployment rate observed in the previous time period (u_{t-1}). The parameters α and β measure the central bank's reaction to economic conditions in terms of how much it changes the interest rate in response to a change in inflation or a change in the unemployment rate, respectively. For monetary policy to stabilize the inflation rate α would need to be positive and greater than 1. Policy reactions to changes in the inflation rate would then change the real interest rate in the direction necessary to change expenditures in a way that offsets inflationary or deflationary pressures. Furthermore, to minimize the loss associated with variations in economic activity, and assuming the central bank is concerned about economic growth and unemployment, β would be negative. A rise in the unemployment rate would trigger a fall in real interest rates to stimulate expenditure. Even if inflation is the main focus of monetary policy, the central bank might still respond to changes in unemployment rates in as much as these rates also serve as indicators of future inflationary pressure.

The policy rule (1) excludes the exchange rate, monetary policy and exchange rate interactions and the role played by exchange rates in transmitting monetary actions to expenditure decisions. This might be justified on the basis of the results reported by Fung and Yuan (2000) that suggest that the overnight rate itself contains all the useful information available about the stance of monetary policy. However, Ball (1999) argues for a policy rule in terms of a monetary conditions index as discussed

above, which includes both interest rates and exchange rates. Experiments with both specifications suggest a monetary conditions index approach specified as follows:

$$\mathbf{MCI}_t = \mathbf{c} + \alpha\pi_{t-1} + \beta\mathbf{u}_{t-1}, \quad (2)$$

in which \mathbf{MCI}_t is the weighted sum of the differences in nominal overnight interest rates and exchange rates relative to their base year values. Stabilization involves the same conditions in terms of the parameters as in the interest rate policy rule. The policy response to a rise in the inflation rate must raise the nominal \mathbf{MCI} by more than the rise in the inflation rate, which means $\alpha > 1$. As in (1) the unemployment rate is included for two reasons. It is an indicator of current output and growth performance, and a leading indicator of inflationary pressure.

Table 5 provides a preliminary quantitative look at Canadian policy in the 1990's using this approach. It reports estimates of central bank responses to changes in inflation and unemployment rates derived from an ordinary least squares regression of (1) and (2) respectively, for Canada and of (1) for the United States, using monthly data for each decade.

Several general observations on these estimates are of particular note. First, as anticipated, the estimates show that Canadian monetary policy placed greater emphasis on inflation control in the 1990's than in earlier decades. The magnitude of the typical response of the Canadian overnight rate, or the monetary conditions index, to a one-percentage point increase in inflation in the 1990's (1.53 and 2.52 respectively) as compared to earlier decades illustrates this shift in emphasis. Second, the emphasis on inflation control in Canada in the 1990's was greater than it was in the United States, again based on the typical responses of interest rates or monetary conditions to inflation rates in Canada (1.53 or 2.52) as compared to the United States (1.32). Third, Canadian monetary policy in the 1990's apparently did not respond to offset unemployment, as it had in the 1970's and 1980's and as monetary policy did in the United States in the 1990's. Indeed in Canada the estimated response to a rise in the unemployment rate in the 1990's is positive and therefore perverse by these estimates.

The estimate responses to inflation and unemployment provide the details of policy actions underlying the earlier description of the stance of monetary policy, by quantifying the policy response to month-to-month fluctuations in economic conditions. The cumulative result of the short-term responses is observed in the monetary policy indicators presented above, and their impacts are reflected in the inflation, growth and unemployment performance of the economy. Earlier observations that inflation in

Canada in the 1990's was lower and more stable while unemployment rates were higher and more volatile are consistent with strong responses of Canadian monetary policy to inflation with little or no significant response to unemployment in that period. United States monetary policy in the 1990's, by contrast, responded less to inflation rate increases and more strongly to unemployment rate increases than Canadian policy.

V.2 Monetary Policy 1988-1999

Clearly a decade-by-decade examination of economic performance and policy is based on an arbitrary choice of time periods. In this case it ignores available information about policy regimes and shifts in those regimes. Historical descriptions of Canadian and United States monetary policy provided by Thiessen (2001), and Meulendyke (1998) respectively identify a change in monetary policy in both countries in 1988. In Canada, the new Governor of the Bank of Canada John Crow (1988) defined the bank's policy objective as "price stability", which signaled a clear change in the weight to be assigned to inflation control compared to the period since 1982. Following earlier disappointments with the control of money supply growth as an instrument of policy, the emphasis also shifted to the interest rate as the primary policy instrument. In the United States the Federal Reserve shifted to less expansionary policy and toward targeting the federal funds rate as the instrument, in part because alternative instruments, including borrowed reserve targets, no longer worked as expected. Thus both countries entered new monetary policy regimes in 1988 in which both were concerned about inflation control and both emphasized interest rates as the instruments of policy. Further empirical analysis of policy suggests a second policy shift in mid to late 1994. At this time, under a new Governor Gordon Thiessen, the Bank of Canada set targets for the overnight interest rate and followed this in 1996 by setting the Bank Rate at the upper level of the target range for the overnight rate (Bank of Canada, November 1995 and May 1996). Although there is no explicit mention of such a change in discussions of recent policy experience, its timing coincides with a set of international currency crises starting with the Mexican peso in late 1994. The Bank of Canada (May 1998, p.18) did note, however that Asian developments, political developments in Quebec and uncertainty in financial markets led it to raise interest rates on three occasions for a total of 125 basis points. Clearly these policy actions were not a reaction to variations in domestic inflation rates and unemployment rates and would lie outside the scope of the policy rule as specified above.

A comparison of indicators of economic performance for Canada and the United States for the 1988-1999 period is provided in Table 6. In general terms these data illustrate again the differences in performance between the countries in this time period. Overall from 1988-1999 Canada achieved a lower inflation rate, but did not match the United States performance in terms of real GDP growth or unemployment. Canadian economy was also more volatile than the United States economy by all three of these performance measures. If the time period is shortened to 1988-1994, the difference in performance persists and thus does not appear to have been related to changing international circumstances in the latter part of the longer period. Furthermore, while economic performance was better in both countries after 1994, the difference between Canada and the United States persisted. Canadian inflation rates were lower but growth and unemployment performance still fell short of the United States experience.

As before, the question of interest is whether the difference in observed performance between Canada and the United States was a result of a difference in monetary policy. Descriptions of policy in this time period indicate that monetary policies in both countries were concerned with inflation control and economic growth. However, at least in terms of the rhetoric of the central banks it appears that Canadian policy placed much higher emphasis on lowering inflation rates, and little emphasis on short term growth, as compared to the United States policy. The strong controversy in Canada over the focus of Canadian monetary policy in this period is illustrated by Fortin (1996, 1999) and Freedman and ? (1999). Estimating reaction functions or policy rules for Canadian and United States monetary policies for the 1988-1999 period provides an empirical basis for a comparison of the policies followed by the different central banks.

Once again a policy rule like (1) above, with a specification suggested by Taylor (1993) and used in many studies including Mankiw (2001), namely:

$$i_t = c + \alpha\pi_{t-1} + \beta u_{t-1} ,$$

provides a framework for such a comparison. Estimates of the Bank of Canada's and the Federal Reserve's responses to inflation and unemployment are presented in Table 7. The top panels report estimates for the entire 1988-1999 period based on monthly data. For the United States Federal Reserve the estimated responses in the upper right panel of the table are very similar to those reported by Mankiw (2001) although the sample period used here is longer. The responses for both Canada and the

United States are somewhat stronger than those found by Fair (2001) and Judd and Rudebusch (1998) using a methodology that smoothes central bank responses through partial adjustments to monthly fluctuations in economic conditions. However full equilibrium values of the responses in those studies are of the same order of magnitude as the responses estimated here.

The first important observation on the results reported in the table is that for the 1988-1999 period Canadian monetary policy, in terms of either interest rates or the monetary conditions index, placed more emphasis on inflation control and less on unemployment than United States policy did. That finding is consistent with the objectives defined by Bank of Canada in setting inflation targets, informally in 1988 and formally in 1991. In both countries the central bank response to a rise in the domestic inflation rate was to raise nominal short-term interest rates by enough to raise the real short rate and lower demand pressure on prices. The response to a rise in the domestic unemployment rate in both countries was to lower nominal and real interest rates in support of domestic demand. However, in Canada, using the monetary conditions index to measure policy, the Bank of Canada response to increased inflation was stronger than the Federal Reserve response (2.208 vs 1.596) while the response to increased unemployment rates was weaker (-0.968 vs -1.595). As reported in Table 6 above, Canada did achieve a lower average inflation rate in this time period while the Canadian unemployment rate was higher and more volatile than the United States unemployment rate.

A closer examination of the errors in the longer period (1988-1999) estimates revealed a significant break at the end of 1994. As discussed above, this break in the results corresponds in time with the beginning of a series of crises in international currency markets, which at least in Canada resulted in specific interest rate changes in response to external pressures on the Canadian dollar. Accordingly, the period 1988-1994 provides perhaps the most straightforward comparison of Canadian monetary policy with that in the United States during a period of relatively tranquil international financial conditions. The rules were then re-estimated for the periods, 1988:1-1994:12 and 1995:1-1999:12, again using monthly data.

The estimated responses of central banks to changes in inflation and unemployment in 1988:1-1994:12 again describe monetary policies that would contribute differently to economic stability. In Canada, the typical response of the overnight rate to a one-percentage point rise in inflation was not large enough to be stabilizing on its own at slightly more than one-half of one percentage point (0.547). The reaction to a rise in the unemployment rate on the other hand typically resulted in a decline in the overnight rate (-1.298) that would provide offsetting stimulus to expenditure, output and employment.

However these interest rate responses are misleading in their neglect of the response and the role played by the exchange rate, which would be included in the monetary conditions index. It may be that smaller interest rate responses are appropriate because changes in the interest rate cause changes in the exchange rate that reinforce the expenditure effects of the interest rate change. Alternatively, the disturbances that underlie the variations in inflation rates and unemployment rates may simultaneously induce changes in the exchange rate that are stabilizing and reduce the need for interest rate changes. In either case the monetary conditions index captures the changes in both interest rates and exchange rates to indicate response the central bank makes. Estimates for the monetary conditions index in Canada are included in the table.

The typical responses of the monetary conditions index for Canada to inflation and unemployment rates in 1988:1-1994:12 describe a quite different set of policy priorities than the estimated responses of the interest rate alone. The response to inflation was much more aggressive (1.779), while the response to unemployment was much weaker. This result shows that exchange rate changes contributed importantly to the changes in monetary conditions in a way that would tend to stabilize inflation, but provide much less support for growth and unemployment. The combined responses of interest rate and exchange rate changes to an increase in inflation were the equivalent of about 120 basis points larger than the response of interest rates alone. At the same time, the response to increases in unemployment rates was less than half as large as the interest rate response alone. These estimates explain about 80 percent of the variation in the monetary conditions index in this period.

Since Canadian economic performance did not match that of the United States in this period, how did U.S. monetary policy differ? The estimates in the center-right panel of Table 7, show once again that United States monetary policy placed quite a different emphasis on the stabilization of inflation and unemployment than did Canadian policy in 1988:1-1994:12 . Whereas the typical Canadian response to a one-percentage point increase in the inflation rate was to raise the monetary conditions index the equivalent of about a 180 basis points increase in interest rates, the comparable United States response was about a 130 basis points rise in the Federal Funds rate. Furthermore, United States monetary policy typically responded more aggressively to a rise in the unemployment rate with a cut in the Federal Funds rate of about 200 basis points. The comparable Canadian response was a reduction of the monetary conditions index by the equivalent of a 60 basis point cut in the overnight interest rate. It is of note that the volatility of unemployment rates in the United States was about 60 percent of that in Canada in this time period. These observations are consistent with the findings of

other studies, for example Taylor (1999) and Mankiw (2001) that have attributed a large part of the strong, stable economic performance in the United States in the 1980s and 1990s to the successful design and implementation of United States monetary policy. Mankiw's results for the 1990's, like the results found here for 1988-1999, describe a United States policy rule that put equal emphasis on inflation rates and unemployment rates. In 1988-1994, United States policy was more heavily weighted toward employment stabilization while Canadian policy placed more weight on inflation stabilization. The United States enjoyed stronger growth, lower unemployment and greater stability with only slightly more inflation than Canada. The differences in estimated parameters of the policy rules are further evidence that Canadian economic performance fell short of that in the United States because Canadian monetary policy placed too much emphasis on inflation control and provided too little support for growth and employment.

V.3 Canadian Monetary Conditions by the United States Policy Rule

An alternative way to illustrate the difference between Canadian and United States monetary policy in the 1990's is to compare a hypothetical monetary conditions index for Canada with an observed index in this period. To make this comparison both indexes are constructed on the base period January, 1988 = 0. The observed index measures actual monetary conditions in each month based on actual interest rates and exchange rates using the weights used by the Bank of Canada in the construction of its own index. This index illustrates the monetary conditions produced by the policy implemented by the Bank of Canada in this time period. The hypothetical monetary conditions index illustrates the results of an alternative set of policy actions. Its construction is based on the typical Federal Reserve responses to inflation and unemployment found in the estimated policy rule. The Federal Reserve responses are those reported in Table 7 for 1988-1994. They define a monetary policy that would adjust monetary conditions in Canada according to the following rule:

$$MCI_t = c + 1.265\pi_{t-1} - 2.026u_{t-1} .$$

A comparison of the monetary conditions index generated by this policy rule with the observed monetary conditions index for this period is presented in Figure 1.

The comparison must be interpreted cautiously. First, the observed conditions are those resulting from the actual Bank of Canada actions, while the hypothetical index reflects the outcomes of reactions

to the same conditions according to the Federal Reserve's rule. If the monetary conditions resulting from the reactions according to the Fed rule affect output and inflation were implemented, the conditions underlying the hypothetical index would change, as would its value going forward. Thus the comparison illustrates how conditions would have differed at each point in time based on different central bank policy actions, but it neglects the impacts of those policy differences on economic conditions. The more expansionary conditions generated by the Fed rule, for example would be expected to stimulate the economy and lead to conditions calling for less expansion in subsequent years. Second, and of lesser importance the policy rule used to construct the hypothetical index is naïve, particularly in its neglect of central bank concerns for smooth changes in monetary conditions. As a result it produces higher variance in monetary conditions, some of which might be appropriate and stabilizing in accordance with the larger response parameters it contains, but some undoubtedly overstates the responses to monthly changes in economic conditions. With these reservations, the comparison in Figure 1 provides an illustration of the general difference between Bank of Canada and Fed policy reactions to economic conditions.

The comparison of monetary conditions indexes leads to two basic observations on the difference between Canadian and United States monetary policies in this period. The first is that, faced with the same economic circumstances, the Fed's policy responses would have created much easier monetary conditions in Canada than the Bank of Canada's responses produced. The hypothetical MCI lies below the observed MCI until late 1995. That means policy implemented according to the Fed rule would have provided more stimulus or support for higher levels of economic activity and employment over the period from mid 1986 until late 1995, faced with the same economic conditions. The second observation is that the Fed's responses to changes in inflation and unemployment in combination would have altered the timing of changes in monetary conditions. The early part of the period gives a clear example of this difference. The MCI by the Fed rule peaks in late 1989 and then declines, while the actual MCI is higher and continues to rise until late 1990, meaning still tighter conditions for another twelve months. These differences in monetary conditions illustrate different policy responses to the same economic conditions. Policy implemented according to the Fed rule would have moderated the fight against inflation at an earlier date in response to rising unemployment rates. In the United States this policy rule yielded strong, stable growth and employment with inflation only moderately higher than that experienced in Canada.

VI Summary and conclusions.

The performance of the Canadian economy in the 1990's failed to match that of earlier decades, and fell short of the United States economy's record of stable growth in output and employment. The more colorful way to compare the performances of the two economies in the 1990's is to note that the United States economy enjoyed a continuation of the "Long Boom" while the Canadian economy experienced the "Great Slump". These differences in performance do not appear to reflect significantly different external conditions on either the supply or demand sides of these two economies. Indeed the Canadian economy benefited from stronger and more stable growth in the export sector in the 1990's than in earlier decades or in the United States' export sector. The two important areas of relative weakness in Canadian demand in the 1990's were the investment and government sectors. But weakness in these sectors was caused by domestic policy initiatives rather than external shocks. As a result, the difference between Canadian and United States monetary policies emerges as the fundamental source of the differences in economic performance.

The difference in monetary policies is evident in several ways. First, the declared objectives of policy were different in that Canada adopted hard targets for inflation control without explicit concern for growth and employment, while the United States maintained informal concern for stability in inflation, real output growth and employment. Second, the usual broad indicators of policy, real and nominal money supply growth rates and interest rates, show much tighter monetary conditions in Canada in the 1990's than in the United States. Exchange rate changes in Canada added further tightness to domestic monetary conditions in the early part of the decade. Third, the parameters of monetary policy rules estimated to provide a quantitative description of the central bank responses underlying the observed differences in monetary conditions provide a strong measure of the difference between the policies. Particularly in the 1988-1995 period, which includes the depth of the "Slump", the Canadian policy response to an increase in inflation tightened monetary conditions much more aggressively than United States policy, while the Canadian response to a rise in unemployment was much weaker than that in the United States. As a result the rise in Canadian unemployment rates in the early 1990's, in response to strong inflation driven monetary restraint, did not produce the easing of monetary conditions that would have resulted from the United States policy rule. Thus when evaluated by each of these measures, Canadian monetary policy was more narrowly focused on inflation control than United States policy, less supportive of stability and growth in output and employment, and consequently imposed tighter monetary conditions on the economy.

The differences in economic performance followed from the differences in monetary policy. Canada did achieve a lower inflation rate in the 1990's, but the monetary conditions created to that end reduced the growth in capital expenditures and forced a larger fiscal adjustment on the government sector of the economy. Lower rates of capital formation meant lower rates of capacity expansion and lower rates of implementation of the technology embodied in new capital equipment. Productivity growth lagged. The reduction in inflation required a recession and the corresponding losses in output, employment, productive capacity, technological improvement and government programs. These costs were high because monetary policy placed strong emphasis on reducing inflation and responded very weakly to the resulting decline and increased variance in growth rates and employment. While the United States economy experienced a short sharp recession in the early 1990's the stronger monetary policy response to declines in growth rates and employment quickly put the economy back on the growth path of the Long Boom. In the Canada monetary policy was tight enough for long enough that inflation was driven below the bottom of the target range established by the Bank of Canada and the Minister of Finance. The coincident slump in economic activity was of a depth and persistence that by the Bank of Canada's estimates the economy did not recovery completely until the end of the decade.

These observations on monetary policy and the performance of the Canadian economy provide strong support for the argument that economic growth and stability in the future will require a monetary policy aimed at stability in both economic growth and inflation, not a continuation of the past focus on inflation targets alone.

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Table 1: Inflation, Unemployment and Growth in Real GDP by Decade, Canada and the United States: 1960-1999

	Canada				United States			
	1960s	1970s	1980s	1990s	1960s	1970s	1980s	1990s
Inflation Rate (%)								
Average Inflation	2.87	7.38	6.51	2.20	2.60	7.09	5.57	3.01
Std Dev	1.31	2.89	3.18	1.68	1.51	2.71	3.52	1.13
Maximum Inflation	5.38	12.33	12.93	6.90	5.93	13.25	14.59	6.37
Unemployment Rate (%)								
Average Unemployment	5.65	4.94	7.93	8.48	4.69	6.22	7.27	5.67
Std Dev	1.24	0.88	1.39	1.27	1.09	1.16	1.48	1.05
Maximum Unemploy	8.10	6.30	10.40	10.90	7.10	9.00	10.80	7.80
Growth in Real GDP (%)								
Average Annual Growth	5.65	4.43	2.96	2.29	4.94	3.28	3.02	3.03
Std Dev	1.64	1.76	2.76	2.18	1.78	2.77	2.68	1.56
Maximum	8.75	8.62	6.46	5.47	8.51	7.78	8.65	4.96
Minimum	2.71	1.17	-3.91	-3.04	1.92	-2.65	-2.68	-1.26

Notes: Inflation rates are calculated on an annual basis as the per cent change in the CPI over the previous twelve months. Decades run from the first month or quarter of the decade to the last month or quarter of the decade except for the 1960s where data start from the first month or quarter of 1961.

Unemployment rates are from monthly data. Decade averages are computed from the first month to the last month of the decade (eg January 1970 to December 1979). Canadian data are for males aged 25 years and older to reduce the effects of demographic and social policy changes. A comparable series was not available for the U.S. U.S. data are for total labour force.

Annual growth rates for real GDP are calculated from quarterly data, seasonally adjusted at annual rates. Growth rates are measured quarterly as the percent change over four quarters (eg $[(1970Q1/1969Q1)-1]*100$). Decade averages are computed from the first quarter of the decade to the last quarter, except for the 1960s where the data start from 1961Q1.

Sources: Canada: Statistics Canada, CANSIM data base series P100000, D980749, and D14872 and *Labour Force Statistics*.

United States: Federal Reserve Bank of St Louis FRED data base.

Table 2: Food and Energy price Shocks and Productivity Growth by Decade, Canada and the United States: 1960-1999

	Canada				United States			
	1960s	1970s	1980s	1990s	1960s	1970s	1980s	1990s
Price Shocks (%)								
Average Shock	-0.09	1.05	-0.01	-0.04	-0.12	0.60	-0.52	-0.22
Std Dev	0.67	1.69	0.87	0.43	0.48	1.40	0.96	0.50
Maximum shock	1.28	4.26	2.48	0.99	1.34	4.64	2.17	1.02
Labour Productivity Growth (%)								
Average Growth	3.60	2.45	0.98	1.35	3.00	1.96	1.38	1.83
Std Dev	1.58	2.29	1.20	0.99	1.79	2.11	1.63	1.04

Notes: Food and energy price shocks are measured as the twelve month change in the CPI all items minus the change in the CPI excluding food and energy.

Labour productivity is measured as the four quarter percentage change in the index of non farm business output per hour.

Sources: Canada: Statistics Canada, CANSIM data base series P100000, P100285, I61002 and United States: Federal Reserve Bank of St Louis FRED data base.

Table 3: Investment, Exports, Financial Assets And Government Finances by Decade Canada and the United States, 1960-1999

	Canada				United States			
	1960s	1970s	1980s	1990s	1960s	1970s	1980s	1990s
Investment								
Avg Growth (%/yr)	5.80	5.52	4.81	2.90	7.27	5.38	3.28	6.17
Std Dev	5.47	4.86	8.39	8.36	6.66	12.0	13.70	7.62
Exports								
Avg Growth (%/yr)	9.63	5.80	5.47	8.19	6.33	8.03	6.03	7.00
Std Dev	5.04	6.66	6.46	4.25	6.42	7.91	7.50	3.84
Share of GDP (%)	17.2	19.2	23.9	41.3	4.2	6.5	8.2	12.2
Stock Market Index								
Avg Growth (%)	6.66	5.50	11.34	7.19	4.69	0.89	13.13	15.79
Std Dev	11.15	16.60	21.64	13.31	11.85	15.82	18.45	11.35
Ratio: Avg /Std Dev	0.60	0.33	0.52	0.54	0.40	0.06	0.71	1.39
Total Government Budget Balance								
Avg Bal (%GDP)	-0.97	-1.92	-5.98	-4.45	1.14	-1.14	-3.02	-1.98
Std Dev	1.35	2.10	2.10	3.99	0.66	0.62	1.19	2.02
Maximum	1.58	2.46	-2.37	2.64	2.30	0.62	-0.73	1.97
Minimum	-3.17	-6.40	-9.57	-9.75	-0.30	-6.18	-5.40	-5.10
End of Decade	1.58	-2.94	-5.08	2.02	1.27	0.31	-2.30	1.97
Total Government Gross Debt/GDP Ratio (%)								
Average	66.0	57.1	78.1	112.7	56.3	47.0	56.1	71.6
Std Dev	4.6	3.4	12.8	8.8	4.9	1.9	8.1	3.7

Notes: Annual growth rates in real investment and real exports are calculated each quarter as the four-quarter percent change in quarterly data, seasonally adjusted at annual rates. Decade averages cover the first quarter of the decade to the last quarter, except for the 1960s when the data start at 1961Q1.

Annual growth in stock market indexes is calculated as the four-quarter percent change in the TSE 300 and the Dow Jones Industrial Average respectively. Decade averages cover the first quarter of the decade to the last quarter, except for the 1960s when the data start at 1961Q1.

Nominal government budget balances for the total government sector as a percent of nominal GDP are calculated from quarterly data. Decade averages cover the first quarter of the decade to the last quarter, except for the 1960s when the data start at 1961Q1.

Sources: Canada: Statistics Canada CANSIM data base series B51100, D14816, D15075 and Department of Finance, Fiscal Reference Tables, September 2001, Table 57. GDP and budget data are quarterly, seasonally adjusted at annual rates. Debt/GDP data are annual.

United States: Federal Reserve Bank of St Louis, FRED database.

Table 4a: Money Supply Growth and Interest Rates by Decade, Canada and the United States: 1960-1999

	Canada				United States			
	1960s	1970s	1980s	1990s	1960s	1970s	1980s	1990s
Nominal Monetary Base								
Avg Growth (%)	6.50	12.22	4.75	4.52	4.30	7.70	7.64	7.59
Std Dev	2.95	3.30	3.10	2.75	1.17	1.12	1.62	2.62
Real Monetary Base								
Avg Growth (%)	2.92	3.89	-0.98	2.94	2.15	0.62	2.08	4.46
Std Dev	2.49	3.29	3.41	2.89	1.05	2.28	3.85	2.66
Nominal Interest Rates								
Avg RON, RFF	4.31	6.96	11.43	6.23	4.29	7.10	9.97	5.15
Std Dev	1.29	2.35	3.40	2.81	1.83	2.54	3.38	1.39
Real Interest Rates								
Avg RON, RFF	1.67	-0.42	4.92	4.03	1.98	0.01	4.40	2.14
Std Dev	0.84	2.34	2.16	1.91	0.60	1.77	2.32	1.24

Notes: Annual growth rates in the monetary base are calculated from monthly data as the per cent change from twelve months earlier, for example from January 1970 to January 1971, and averaged by decade. Nominal money supply is changed to real money supply using the GDP deflator.

The shortest nominal interest rate for Canada is the overnight rate (RON), for the United States the Federal Funds rate (RFF). For Canada in the 1960's and 1970s the day-to-day rate is used in place of the overnight rate. Real rates are calculated ex post as nominal rates minus inflation as measured by the annualized change in the consumer price index, all items.

Sources: Canada: Statistics Canada, CANSIM data base series B14002, B140444, B14060, P100000 and D15612.

United States: Federal Reserve Bank of St Louis, FRED data base.

**Table 4b: Exchange Rates and Monetary Conditions in Canada,
by Decade 1960-1999**

	Exchange Rate (CDN\$/US\$)				Monetary Conditions Index (1970:06=0)			
	1960s	1970s	1980s	1990s	1960s	1970s	1980s	1990s
Average	1.0697	1.0402	1.2625	1.3267	-2.98	0.74	-2.24	-8.90
Std Dev	0.0223	0.0659	0.0754	0.1180	1.34	2.37	4.55	5.26
Minimum	0.9873	0.9621	1.1515	1.1279	-5.08	-2.77	-8.66	-15.47
Date of min	Mar /61	May /74	Jun /80	Oct /91	May /62	Jun /71	Jan /87	Dec /98
Maximum	1.0879	1.1955	1.4066	1.5450	0.73	6.80	9.44	2.59
Date of Max	Jan /62	Feb /79	Jan /86	Oct /98	Dec /69	May /74	Aug /80	Apr /90

Note: The Monetary Conditions Index is constructed using the formula used by the Bank of Canada adapted to the base period June 1970 and the exchange rate defined as the Canadian dollar price of the United States dollar, as follows:

$$MCI = (RCP90 - 7.31) - (100/3) * (\ln ER - 0.0377032)$$

RCP90 = yield on 90 day prime commercial paper

ER = exchange rate.

Source: Statistics Canada, CANSIM data base series B3400, B14017 and author's calculations.

Table 5: Estimated Monetary Policy Rules for the Bank of Canada and the United States Federal Reserve by Decade: 1960-1999.

	1960s	1970s	1980s	1990s
CANADA: Overnight Rate				
α Typical response to a 1 percentage point increase in core inflation	0.78	0.77	1.08	1.53
β Typical response to a 1 percentage point increase in unemployment rate	0.31	0.73	0.46	--
CANADA: Monetary Conditions Index				
α Typical response to a 1 percentage point increase in core inflation	0.79	0.41	1.00	2.52
β Typical response to a 1 percentage point increase in unemployment rate	--	-1.71	-1.14	0.69
UNITED STATES: Federal Funds Rate				
α Typical response to a 1 percentage point increase in core inflation	0.76	0.77	0.88	1.32
β Typical response to a 1 percentage point increase in unemployment rate	-0.39	-1.65	--	-1.38

Note: The responses are estimated using 120 months of data for each decade and an ordinary least squares regression of the interest rate or the monetary conditions index respectively on a constant, the core inflation rate over the previous twelve months and the unemployment rate in the previous month (-- indicates no significant response).

The Monetary Conditions Index was constructed using the formula used by the Bank of Canada adapted to the base period June 1970, and the exchange rate defined as the Canadian dollar price of the United States dollar as follows:

$$MCI = (RCP90 - 7.31) - (100/3) * (\ln ER - 0.377032)$$

RCP90 = yield on 90 day prime commercial paper
ER = exchange rate.

Sources: Tables 1, Statistics Canada. CANSIM database series B3400 and B14017 and author's calculations.

Table 6: Inflation, Unemployment and Growth in Real GDP, Canada and the United States: 1988-1999, 1988-1994 and 1995-1999.

	Canada 1988-1999	United States 1988-1999	Canada 1988-1994	United States 1988-1994	Canada 1995-1999	United States 1995-1999
Inflation Rate (%)						
Annual Average	2.59	3.24	3.28	3.87	1.62	2.36
Std Dev	1.77	1.17	2.00	1.08	0.59	0.57
Maximum	6.90	6.37	6.90	6.37	2.96	3.31
Minimum	-0.20	1.36	-0.20	2.29	0.59	1.36
Unemploy Rate (%)						
Annual Average	8.07	5.70	8.42	6.25	7.59	4.94
Std Dev	1.32	0.97	1.46	0.83	0.90	0.54
Maximum	10.90	7.80	10.90	7.80	8.90	5.80
Minimum	5.60	4.10	6.40	5.00	5.60	4.10
Growth Real GDP (%)						
Annual Average	2.60	3.19	2.12	2.74	3.31	3.85
Std Dev	2.19	1.47	2.51	1.64	1.39	0.84
Maximum	6.46	4.96	6.46	4.49	4.19	4.96
Minimum	-3.04	-1.26	-3.04	-1.26	0.76	2.16

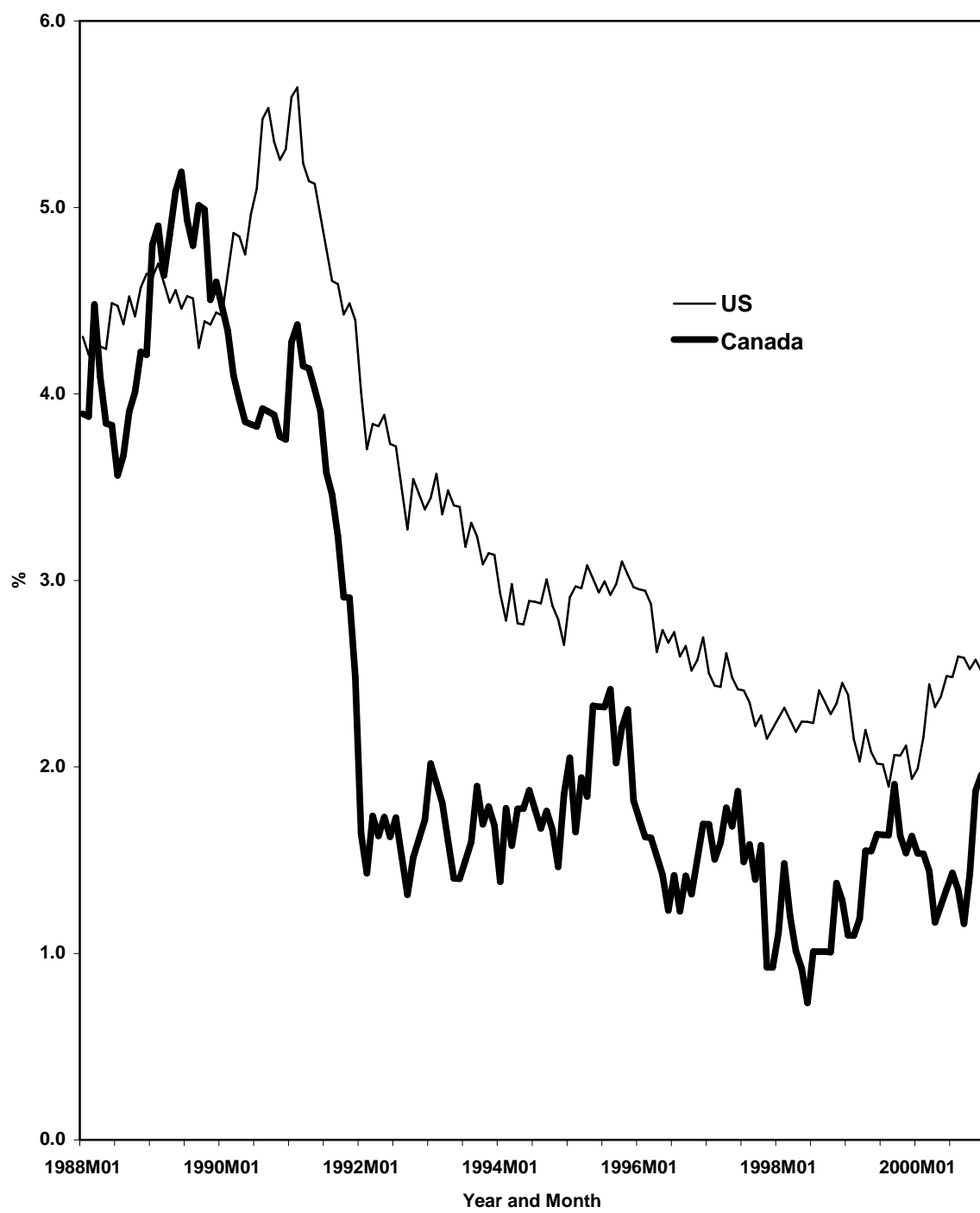
Note: See Table 1 for methods and sources.

Table 7: Estimated Monetary Policy Rules for the Bank of Canada and the United States Federal Reserve: 1988-1999

	Canada		United States
	Overnight rate	MCI	Federal Funds Rate
1988:01-1999:12			
α Typical response to a 1 percentage point increase in core inflation	1.247 (14.53)	2.208 (15.4)	1.596 (26.0)
β Typical response to a 1 percentage point increase in unemployment rate	-0.367 (3.00)	-0.968 (16.8)	-1.595 (24.3)
Adj'd R²	0.65	0.63	0.86
1988:01-1994:12			
α Typical response to a 1 percentage point increase in core inflation	0.547 (5.37)	1.779 (17.81)	1.265 (14.46)
β Typical response to a 1 percentage point increase in unemployment rate	-1.298 (9.26)	-0.585 (12.02)	-2.026 (23.96)
Adj'd R²	0.78	0.78	0.93
1995:01-1999:12			
α Typical response to a 1 percentage point increase in core inflation	0.344 (1.01)	0.575 (0.89)	0.186 (0.65)
β Typical response to a 1 percentage point increase in unemployment rate	0.162 (0.79)	-1.01 (7.19)	0.265 (1.48)
Adj'd R²	0.03	0.35	0.31

Note: Estimates for the overnight interest rate or the federal funds rate, respectively, are based on monthly data for each time period using an ordinary least squares regression on a constant, the core inflation rate over the previous twelve months and the unemployment rate in the previous month. Estimates for the monetary conditions index use an ordinary least squares regression of the MCI (1988:01=0) on the core inflation rate over the previous twelve months and the unemployment rate in the previous month. (t statistics are presented in brackets).

Figure 1: Core Inflation in Canada and the United States: 1988-2000
(monthly at annual rates)



Source: Canada, Statistics Canada CANSIM series B3323
United States: Federal Reserve Bank of St.Louis FRED data base.

Figure 2: Observed MCI vs MCI by U.S. 1988-94 Rule

