Why Monetary Policy Matters

— A Canadian Perspective —

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Abstract

This paper provides a non-technical introduction to monetary policy—what it is, how it works, and why it matters. It discusses inflation volatility and why this is damaging to the economy, as well as why increased stability of output growth is desirable. In both cases, changes in Canadian economic performance over the past few decades are examined. The paper also provides a detailed discussion of the transmission mechanism for monetary policy and of the types of uncertainty that central banks must face in their conduct of monetary policy. Finally, the paper describes the types of information that central banks need in order to conduct monetary policy prudently.

This paper expresses my own views about monetary policy and should not be interpreted as representing the official view of the Bank of Canada. It was written while I was the visiting Special Adviser at the Bank of Canada (September 2004 to August 2005). I would like to thank the Bank for this opportunity, as well as the many individuals who gave helpful comments on successive versions of the paper. All remaining errors are mine.

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Introduction

Central banks and the conduct of monetary policy have often been viewed as impenetrable mysteries, understood only by the limited few who somewhere along the way gained access to an exclusive club. The mystique is only magnified by the attention members of the financial press devote to parsing and interpreting often cryptic remarks from senior central bankers.

This paper aims to provide answers to several key questions about monetary policy without requiring the reader to have any particular expertise in economics. First, what is monetary policy? Second, why have many central banks focused on controlling inflation rather than on other macroeconomic variables? Third, how do the actions of the central bank influence the level of economic activity and the rate of inflation? And, finally, how can monetary policy deliver genuine and significant benefits to society? Although the paper's main messages apply to central banks and monetary policy in many countries, the emphasis here is on Canadian monetary policy and the operation of the Bank of Canada.

This topic should interest non-economists for two related reasons. First, monetary policy is important to the operation of the economy. On any given day, it would be difficult *not* to see a news item discussing inflation, real output growth, changes in the exchange rate, or what the central bank is likely to do at its next interest rate announcement. Even well-informed citizens will find it difficult to think clearly about many economic issues and debates without having at least an approximate understanding of what central banks do, and why they do it.

The second reason relates to the broader benefits of such understanding. Central banks exist in most countries as government-owned institutions operating with considerable independence from the governing political structures. It is crucial, therefore, that the central bank be accountable to the people through their elected officials. Monetary policy may be sufficiently complex and technical that its implementation is left to experts who specialize in nothing else, but in a well-functioning and democratic market economy, the people must ultimately be left to judge the performance of those experts. Such judgment requires a basic understanding of the main issues.

This paper is organized as follows. Section 1 begins by explaining what monetary policy is—and also what it is not. This discussion provides a broad-brush description of monetary policy, including some explanation of why most central banks focus on low and stable inflation as their primary objective. Section 2 examines Canada's inflation performance over the past 40 years and explains why low inflation is desirable. An important benefit of low inflation is that it generates less uncertainty, interferes less with the operation of the price system, and thus imposes fewer costs on society. Section 3 examines Canada's aggregate output growth over the past few decades and shows that output growth has become more stable over time. It also explains why this stability is beneficial to the Canadian economy.

Some details about how monetary policy actually works are presented in Section 4, which describes how the Bank of Canada operates a system of inflation targeting. This discussion involves a little investment on the part of the reader in understanding the transmission mechanism of monetary policy. With this framework in place, the informational requirements for monetary policy to be conducted in a prudent manner are then outlined. Essentially, successful monetary policy requires central banks to invest in the creation, monitoring, and projection of economic information—all devoted to achieving a better understanding of developments and relationships in the domestic and world economies.

1. The Economy and Economic Policy

The economy is a collection of millions of individual consumers and firms interacting on a daily basis to determine which goods and services will be produced, which firms will supply various products, which consumers will take them home at the end of the day, and what prices will be paid for the many different products. Even in predominantly *market* economies, such as Canada and the United States, governments at all levels play an important role—they raise revenue by taxing many economic activities, and they spend these resources by providing such services as defence, health care, education, and public housing. Even when governments are not directly taxing or spending, their presence is often felt through the regulations they impose in such areas as product safety, foreign ownership, licences for television stations, quotas for milk production, and minimum wages, to name just a few.

Macroeconomics often glosses over much of the detail in markets for specific goods and services, focusing instead on the behaviour of economic aggregates such as total output, inflation, unemployment, and economic growth. Macroeconomic policy is divided into two broad types: fiscal policy and monetary policy. Fiscal policy is the set of decisions a government makes with respect to taxation, spending, and borrowing. Governments at all levels (federal, provincial, and municipal) have a fiscal policy, since they all have the ability to raise revenues through some form of taxation and to spend these resources on goods and services. There are numerous dimensions to any government's fiscal policy, especially at the federal level, because revenue can be raised through many different taxes, and spending can occur on countless products in different regions and aimed at different beneficiaries.

1.2 What is monetary policy?

Monetary policy is the set of decisions a government makes, usually through its central bank, about the amount of money in circulation in the economy. In Canada, monetary policy is conducted by adjusting very short-term interest rates to achieve a rate of monetary expansion consistent with maintaining a low and relatively stable rate of inflation.

Monetary policy in Canada has three main characteristics:

1. Monetary policy is conducted by the Bank of Canada, a government-owned Crown corporation that operates with considerable independence from the federal government but is nonetheless ultimately accountable to Parliament.[1]

2. Because financial capital can move easily within Canada, interest rates on similar assets are the same across all Canadian regions. As a result, there is only one monetary policy for all of Canada. The Bank of Canada is the sole issuer of legal tender (bank notes) in Canada.

3. Although several economic variables influence monetary policy decisions (many of which will be discussed later), the Bank of Canada has only one policy instrument.

The third point states that monetary policy can do only one thing (compared with fiscal policy, which can do many). This point is worth emphasizing, especially when thinking about what monetary policy *is not*. The Bank of Canada has no ability to set spending or taxation

priorities for any level of government in Canada. Nor does it have the ability to directly regulate labour markets or product markets, although it does play a limited role in the regulation and oversight of parts of the financial system. As important and powerful as monetary policy is, it is much more limited than fiscal policy in terms of available policy instruments.

What is the Bank of Canada's policy instrument, and how is it related to the amount of money in the economy? The Bank's policy instrument is the *target* it sets for the *overnight interest rate*.[2] In Canada, commercial banks lend funds to each other for very short periods at the overnight interest rate, a market-determined rate that fluctuates daily. By announcing a specific interest rate (25 basis points above the target overnight rate) at which it is prepared to lend unlimited amounts to commercial banks and a second specific interest rate (25 basis points below the target overnight rate) at which it is prepared to borrow unlimited amounts from commercial banks, the Bank of Canada can keep the overnight interest rate within an announced operating band. Furthermore, by *changing* its target for the overnight interest rate, the Bank of Canada can alter the actual overnight rate at which commercial banks transact.

As we will see later in the paper, such changes in the overnight interest rate lie at the heart of how monetary policy affects the economy. For now, however, the purpose is simply to illustrate how the Bank's decision to set the target for the overnight interest rate influences the amount of money in the economy. By changing the target for the overnight rate, the Bank influences the entire spectrum of market interest rates, from the yield on 30-day treasury bills to that on 30-year government bonds, and from the rate on 3-month guaranteed investment certificates (GICs) to that on 10-year home mortgages. When the Bank lowers the target for the overnight rate, these interest rates fall, firms and households increase their demand for credit, and commercial banks increase their quantity of credit supplied. (Conversely, when the Bank raises the target, interest rates rise, firms and households reduce their demand for credit, and commercial banks decrease their quantity of credit supplied.)

With an increase in the amount of credit in the economy, there is an increase in the volume of transactions for goods and services, and thus an increase in the overall demand for money with which to make these transactions. Individual firms and households can satisfy their

[1] If the Minister of Finance disagrees with the Bank's policies, he or she has the right to issue a public directive to the Governor. Such a directive has never been issued.
[2] The Bank of Canada announces a target for the overnight interest rate on eight pre-determined fixed announcement dates (FADs) during the year.

demand for money by making withdrawals from their accounts at commercial banks, often in the form of bank notes. But what do commercial banks do when they begin to run short of bank notes? They can buy them from the Bank of Canada by selling other assets—in particular, government securities. Thus, when the Bank of Canada increases the volume of bank notes in the economy, in response to the greater demand from commercial banks, it does so by purchasing government securities. Such a balance-sheet transaction for the Bank involves an increase in assets (government securities) and an increase in liabilities (newly issued bank notes).[3]

Thus, we can see the connection between the Bank of Canada's target for the overnight interest rate, the Bank's balance sheet, and the amount of money circulating in the economy. Changes in the target overnight interest rate lead to changes in other market interest rates and, hence, to changes in the demand for credit, the demand for money, and the demand for bank notes. The Bank accommodates these changes in the demand for bank notes by conducting the required balance-sheet transactions. To some observers it may appear that the Bank can influence *both* interest rates and the amount of money independently. But this independence is illusory: the Bank's policy decision to change the target overnight interest rate has a direct effect on the eventual change in the amount of money circulating in the economy. There is only one instrument for monetary policy.

This concludes a very broad outline of monetary policy. More detail will be provided later. We now go on to examine why most central banks have adopted the control of inflation as their overall policy objective, rather than the control of variables such as aggregate output, employment, or the unemployment rate.

1.2 Why focus on inflation?

The ultimate objective of the Bank of Canada is to make the best possible contribution to a well-functioning Canadian economy and to the overall well-being of Canadians. Based on a large

[3] As of December 2004, the Bank of Canada's assets (and liabilities) were $46.7 billion. The Bank's assets are almost exclusively held in the form of Government of Canada securities of various maturities. The Bank's liabilities are held predominantly in the form of the bank notes that it issues and that are circulating throughout the Canadian economy.

body of theoretical reasoning and empirical evidence, the policies of the Bank of Canada and most other central banks are grounded in two essential propositions:

- High inflation is damaging to the economy and costly for firms and individuals.
- Central banks are unable to directly influence variables other than inflation for any *sustained* period of time.

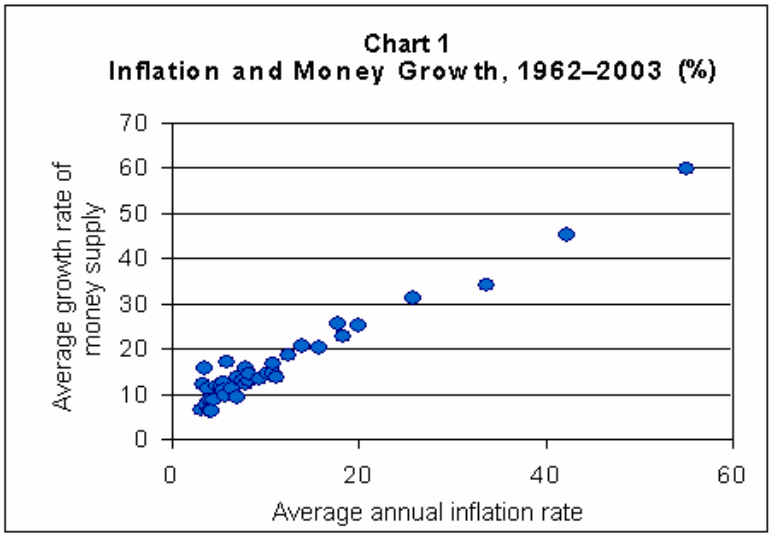
The costs associated with high inflation will be discussed in detail in the next section. Stated briefly, high inflation generates uncertainty in the economy, and this uncertainty interferes with the smooth functioning of a market economy, which relies on fluctuations in market prices to reflect changes in the scarcity of various products. The costs associated with this uncertainty explain why central banks attempt to maintain low and relatively stable rates of inflation.

But low inflation is only one of a large number of potentially desirable goals for economic policy. Central banks might also desire to keep the unemployment rate low or the rate of growth of aggregate output relatively high. After all, low unemployment and high rates of growth would mean higher real incomes and higher average living standards. This brings us to the second proposition above—the limitations on what can be achieved by monetary policy.

Arguments put forward most eloquently by Milton Friedman (1968) explain how monetary policy can influence many macroeconomic variables over short periods of time—including real output, unemployment, and investment—but can have a *sustained* influence only on the rate of inflation. In the late 1960s, these arguments were controversial and not fully accepted by the economics profession, but over the next decade they became widely accepted as more theoretical reasoning and empirical evidence emerged in their support. Central to the argument is the recognition that the changes in real wages and real interest rates that are initially generated by a monetary policy action are eventually offset by market adjustments in wages and interest rates in response to excess demands or supplies. Thus, a monetary policy action that in the short run can lead to a change in output and employment, in the long run, ends up changing only the rate of inflation. Almost 40 years later, Friedman's basic arguments regarding the limitations of monetary policy are so well entrenched in the profession's view that they appear in textbooks as core material.

Over the same few decades that Friedman's ideas were becoming widely accepted, there was another growing recognition, based on the experiences of many countries over many years,

that significant differences in inflation rates had more to do with differences in monetary policy than with any other single macroeconomic variable or policy. This is not to say that no other factors have an effect on a country's rate of inflation; only that the single largest explanation for different inflation rates across countries is the difference in monetary policies. This close empirical relationship between inflation and money is shown in Chart 1, which plots the average annual rate of inflation against the average annual growth rate of the money supply for a broad cross-section of 38 countries from 1962 to 2003.[4] The annual averages are computed over many years to emphasize the long-run trends in the data and thereby abstract from the empirical irregularities associated with short-run economic fluctuations. Obvious in Chart 1 is a clear positive correlation between inflation and money growth—in other words, countries whose money supplies grow quickly also tend to have high rates of inflation.[5] Canada appears in the lower bunching of data points, with average annual inflation of 4.6 per cent and average annual money growth of 8.5 per cent.



To summarize, central banks choose to focus on maintaining low and relatively stable inflation for two reasons. First, low inflation is beneficial for the operation of the economy. Second, both theory and evidence suggest that monetary policy *cannot* have a systematic and

[4] The data are from the International Monetary Fund's *International Financial Statistics*, and include both developed and developing countries. We exclude Argentina and Peru from the sample because their inflation and money growth rates over the sample period are so high (each at roughly 250–300 per cent) that to include them on the same diagram hides most of the interesting variations among the other countries.

[5] Chart 1 shows a positive correlation between money growth and inflation, but it does not establish causality from money growth to inflation. However, considerable evidence exists for such causality: see, for example, Lucas (1980) for evidence and McCallum (2004) for a recent review and other references.

sustained effect on macroeconomic variables other than the inflation rate. Given this limited scope for monetary policy, it would make little sense for monetary policy to adopt other long-run targets, such as the unemployment rate or the growth rate of real output. It is natural for central banks to adopt a long-run target for the one thing that they can reasonably expect to influence over the long run—the rate of inflation.[6]

That is why the Bank of Canada takes the view that its best contribution to the health of the Canadian economy is to maintain low and relatively stable inflation. To formalize this objective, the Bank, together with the Government of Canada, adopted in 1991 a system of inflation targeting that aims to keep the annual rate of inflation close to 2 per cent and within a range of 1 to 3 per cent. In such an environment of low and stable inflation, Canadian firms and households can then make spending, saving, and investment decisions that lead to steadily rising average living standards.

Given the strength of the theoretical and empirical evidence regarding the long-run effects of monetary policy, some observers may wonder why central banks failed to focus so intently on inflation much earlier—back in the 1980s or even the 1970s. Quite simply, what is now much clearer to many central banks and economists was anything but obvious at that time. Economists have learned much from the world developments and policy mistakes of the past few decades. More lessons will be learned in the future, and perhaps some events will transpire that will lead central banks to adopt different policy regimes. But, until then, our best reasoning and evidence continues to suggest that monetary policy aimed at maintaining low and stable inflation makes a great deal of sense.

We next discuss two central questions regarding the success of Canada's monetary policy. The first is how Canada's inflation performance has changed over the years, and why this matters. The second is the extent to which the growth of aggregate output in Canada is more stable in recent years, and why this greater stability is important for the well-being of Canadians. We then examine some details about how monetary policy actually works and what central banks require in order to conduct policy effectively.

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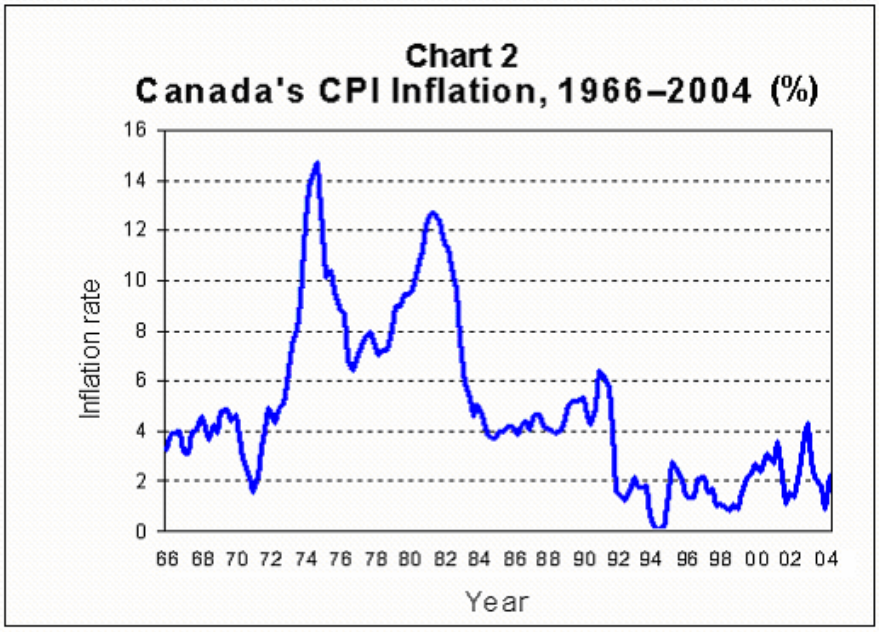
[6] That monetary policy cannot have a sustained influence on variables other than the rate of inflation in no way suggests that it cannot have some influence in terms of stabilizing the level of aggregate economic activity—that is, reducing short-run fluctuations in aggregate output. In Section 4, we examine in detail the process whereby monetary policy does influence real macroeconomic variables over short periods of time.

2. Canada's Inflation Performance, and Why It Matters

One indication of the success of Canada's monetary policy is that inflation—the rate of change of consumer prices as reflected in the consumer price index (CPI)—is much less newsworthy today than it was during the 1970s, when it was often a headline issue. Chart 2 traces the path of Canadian inflation from 1966 to 2004, showing what are often referred to as the "twin peaks" of Canadian inflation, when inflation rose to over 14 per cent in 1973 and to almost 13 per cent in 1979.[7] The chart also shows the sharp decline in inflation during the early 1980s, from over 12 per cent to 4 per cent, the modest increase from 4 per cent to 6 per cent over the balance of the 1980s, and then the reduction from just over 6 per cent in 1990 to roughly 2 per cent over the following few years. Since 1992, the rate of CPI inflation in Canada has fluctuated around 2 per cent.



For many young Canadians today, who do not remember the high rates of inflation in the 1970s and early 1980s, it is difficult to appreciate why inflation matters; they have only experienced a world of low and stable inflation—inflation so low and so stable that most probably ignore it completely. Even for those older individuals who experienced first-hand some

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[7] Several measures of inflation are commonly used. The one in Chart 2 is the rate of change in the total CPI. The Bank of Canada also emphasizes the path of "core" inflation, which strips out the eight most volatile elements of the CPI (fruit, vegetables, gasoline, fuel oil, natural gas, intercity transportation, tobacco, and mortgage-interest costs). But for our purposes here, either measure is suitable.

of the inflation-related economic disruptions in the 1970s and 1980s, inflation remains a bit of a puzzle; while they may have an instinctive appreciation of why inflation is undesirable, they find it difficult to be precise about *why* inflation is a problem. Why does inflation matter?

2.1 Inflation and uncertainty

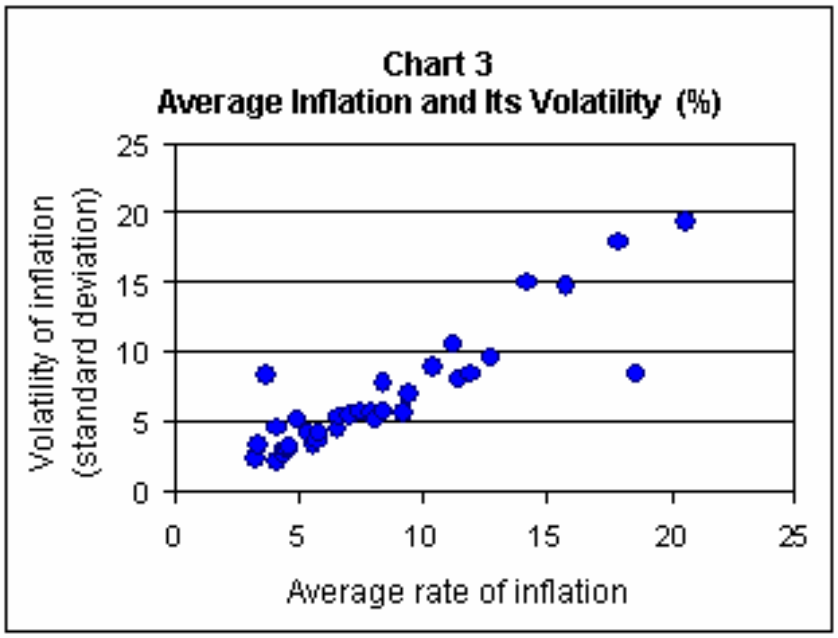
For many years, the academic literature on inflation emphasized the distinction between anticipated and unanticipated inflation, stressing that it was only the latter that created problems. The argument held, for example, that if everyone anticipated inflation of 5 per cent in the coming year, all contracts could be modified with relative ease to incorporate 5 per cent higher wages or a 5 per cent higher interest rate. In such a setting, inflation would not present much of a concern.

Among central bankers, however, this distinction has little relevance, for two reasons. First, real-world institutions are very slow to incorporate the kind of adjustment to inflation that this academic argument requires (Friedman 1977). Second, and more important, the real world rarely, if ever, displays a stable and predictable rate of inflation. Actual inflation tends to be quite unstable, as Chart 2 shows in the case of Canada, and it tends to be even less stable when its average level is higher. High inflation is typically volatile and therefore difficult to predict, and this *uncertainty* generated by inflation is the real problem because it leads households and firms to make decisions that they would be unlikely to make in a more certain, low-inflation, environment (Stuber 2001).

Chart 3 shows, for the same collection of countries as in Chart 1, the relationship between a country's average rate of inflation and inflation's variability over time.[8] Countries with higher average inflation rates also tend to be countries with more volatile inflation rates. Canada appears at the lower left in the chart, with average annual inflation of 4.6 per cent and the standard deviation of inflation equal to 3.2 per cent.[9]

[8] The measure of volatility is the standard deviation of inflation. We have removed Sudan, Chile, Mexico, and Israel from the sample. Given their very high inflation and volatility, their inclusion in the same chart would make it difficult to distinguish among the other countries.

[9] Again, correlation does not imply causality. See Longworth (2002) for a discussion of other measures of inflation uncertainty in Canada.



Given the connection between inflation and uncertainty, the only effective way to avoid the uncertainty associated with inflation is to reduce inflation itself. By reducing the average rate of inflation, the associated volatility will be reduced and so, too, will be the costs of the uncertainty.

2.2 Why inflation uncertainty matters

In an economy where the vast majority of transactions are made in private, decentralized markets, and prices are determined by the interaction between buyers and sellers, market prices play a key role in transmitting information and guiding the economy's allocation of resources. By resource allocation economists refer to the overall pattern of production and consumption—which firms produce which goods, how much of various goods are produced, what technologies are employed to produce them, and how consumers divide their scarce purchasing power among the many available goods and services. In such an economy, market prices are a signal of the relative scarcity of individual products. Increases in individual prices are a signal that specific goods are becoming scarcer. Producers are then encouraged to increase their supplies of these goods, while consumers are encouraged to economize on their use, thus alleviating the scarcity. Conversely, decreases in individual prices are a signal that specific products are becoming more abundant. In this case, firms are led to reduce their supplies of these products, and consumers are

encouraged to increase their demands. The information conveyed by prices in a market economy is therefore central to the market's ability to allocate resources in an efficient manner—leading to more production of those products that are highly valued and less production of those goods on which society places less value.[10]

The presence of inflation in a market economy—and its associated uncertainty—means that prices no longer convey this valuable information so clearly, with the result that market outcomes lack the efficiency that would be achieved in a non-inflationary world. With inflation, market prices still contain information about scarcity, but they also convey other information that has little to do with scarcity—in particular, they carry information about perceptions of the overall inflation rate. The result is that, in the presence of inflation, buyers and sellers are never quite sure what a high price means: does it mean that a specific good is becoming scarcer, or does it simply mean that all prices are rising as part of a widespread inflation? If the first is true, buyers should economize and sellers should strive to sell more. But if the second is true, this specific price is not rising relative to most other prices, and thus buying and selling behaviour should not change. The problem in the real world is that, when inflation is present, both types of changes are occurring simultaneously, and it is very difficult for households and firms to figure out what is going on. Inflation causes market participants to make mistakes—transactions they would not have made if inflation had not been clouding the environment—with the result that market outcomes are not as efficient as they would be in the absence of inflation.

The argument that inflation reduces the efficiency of the price system has been made by many central bankers over the years. Thomas Melzer (1996), the former president of the St. Louis Federal Reserve, put it this way:

> In my judgment, the number-one cost of inflation, even low inflation, is unnecessary confusion in the relative price system. It is important for the sake of efficient functioning of markets to let relative prices give the clearest possible signals in terms of credit markets, commodity markets, labor markets and in general any market where today's prices depend on perceptions of tomorrow's value of money.

We referred earlier to the idea that inflation alters the allocation of resources and reduces the efficiency of the economy. But what does this really mean? One example of a misallocation

[10] For a classic and elegant discussion of the importance of information to the operation of the price system, see Hayek (1945), especially pp. 524–28.

of resources caused by inflation is the shift in resources towards socially wasteful activities and away from producing "real things" that we care about. Axel Leijonhufvud (1977) makes the point when he says:

> [In the presence of inflation,] being efficient and competitive at the production and distribution of "real" goods and services becomes less important to the real outcome of socio-economic activity. Forecasting inflation and coping with its consequences becomes more important. People will reallocate their effort and ingenuity accordingly. . . .
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> In short, being good at "real" productive activities—being competitive in the ordinary sense—no longer has the same priority. Playing the inflation right is vital.

Imagine all the "real things" that could be done by all the clever people who, in a world of even moderate inflation, are focused instead on forecasting inflation, creating and trading financial instruments designed to retain their value in an inflationary world, and modifying or interpreting a tax system affected in significant ways by inflation. In a world of low and stable inflation, these valuable resources can instead be used to do the things we really care about—teach piano lessons, drill for oil, design computer programs, or write books.

A world without inflation does not mean a world of complete certainty or unchanging relative prices. Far from it. Relative prices are constantly adjusting—sometimes suddenly—in a world in which changes in consumer tastes and the development of new technologies are constantly occurring. But this volatility is unavoidable and is standard fare in market economies. In such a dynamic world, firms and households have a difficult enough time making their best decisions regarding the allocation of scarce resources. The problem with inflation is that it makes what is already a confusing world even more difficult to understand. Monetary policy aimed at maintaining low and stable inflation can make a real contribution to our quality of life by making the decision-making environment clearer for everyone.

Nothing has been said so far about whether low inflation contributes to higher long-run rates of real economic growth. The empirical evidence on the relationship between inflation and long-run growth is quite sensitive to changes in sampling details, and thus, economists are currently unable to provide a compelling case for the existence of any such relationship. See the Appendix for a brief discussion.

3. Stability in Canada's Output, and Why It Matters

All economies display fluctuations in the growth rate of aggregate output. These fluctuations are often referred to as *business cycles,* even though they rarely exhibit the smoothness and regularity suggested by the term.

We have discussed why the Bank of Canada focuses on maintaining low and stable inflation. What we have not said is that this policy objective embodies within it a second and related objective of providing some stability to the growth rate of output.[11] What explains this connection?

The details of how monetary policy works are discussed in the next section, but we can sketch a broad outline at this point. In order to do so, we first need to define the concept of potential output—the economy's production capacity. This is the level of output that the economy can produce in a sustained manner, without causing inflation to either rise or fall. The gap between actual output and potential output—the output gap—is an indication of the amount of *excess demand* or *excess supply* in the economy and plays a central role in explaining changes in inflation.

Suppose the Bank of Canada's best available information is that, in the near future, actual output is likely to rise above potential output and that such excess demand will lead to an increase in inflation. In that case, the Bank's objective is to reduce these emerging inflationary pressures by trying to keep output from exceeding potential. By raising its target for the overnight rate, the Bank can dampen the demand for credit in the Canadian economy sufficiently to reduce aggregate spending. This reduction in spending will, in turn, lead firms to reduce their output (or to reduce the growth rate of output). The Bank's actions in raising the target will therefore be working to pull actual output back towards potential output, thus helping to contain the inflationary pressures.

Conversely, suppose the Bank of Canada expects actual output in the near future to move below potential output, thus leading to a situation of excess supply in which inflation starts to

[11] The statement that the Bank's policies may influence the *stability* of the growth rate of output is consistent with the second proposition on p. 6 that it is unlikely to have any *sustained* influence on the growth rate itself.

fall. If the Bank wants to keep inflation relatively stable, its policy will be designed to increase output back towards potential, and it will do this by reducing its target for the overnight interest rate. The resulting easing in credit conditions will eventually increase aggregate spending and lead firms to increase their output. As the actual level of output moves back towards potential output, the downward pressure on inflation diminishes.

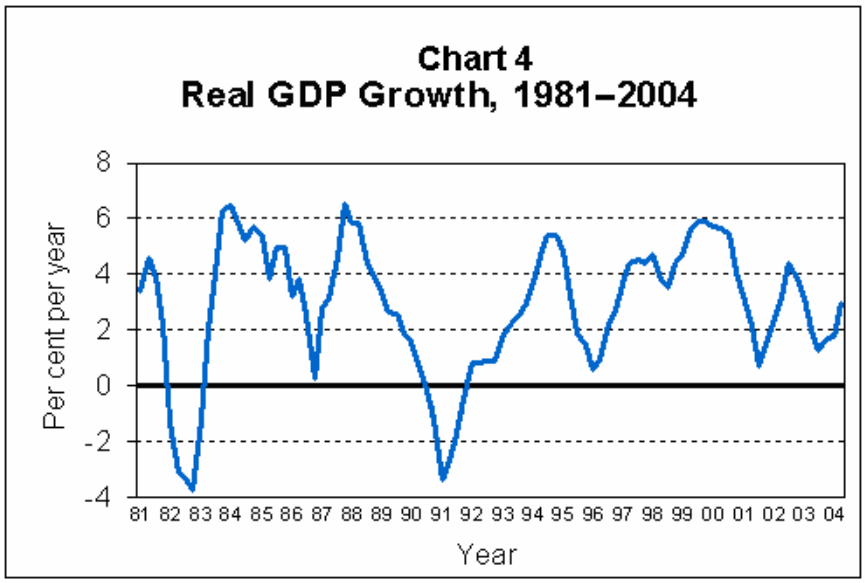
The previous description suggests that, by attempting to keep inflation close to its target, the Bank of Canada responds to significant changes in the economic environment in such a way that the growth rate of aggregate output is made more stable. When shocks are expected to cause actual output to rise above or to fall below the level of potential output, the central bank acts to offset these shocks. This is why many economists view an inflation-targeting policy as an *output-stabilizing policy*.

3.1 Has Canadian output growth become more stable?

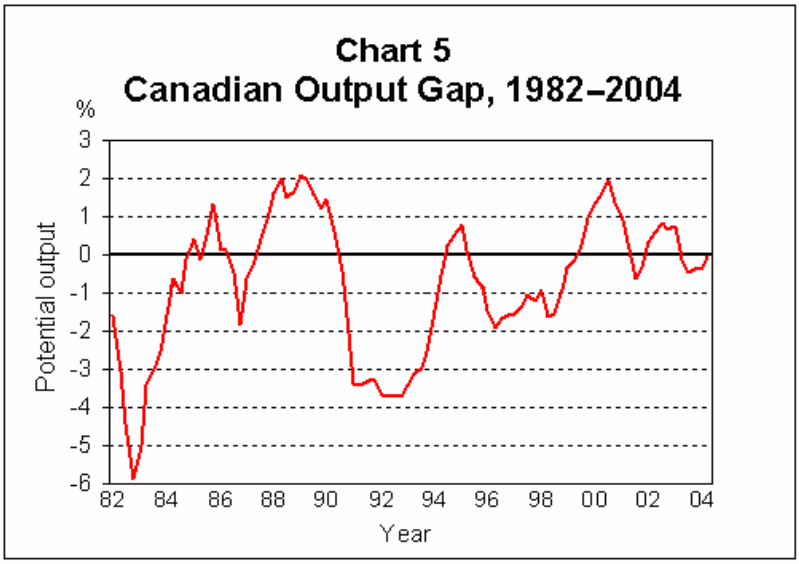
Chart 4 shows the path of real output (gross domestic product, GDP) growth in Canada from 1981 to 2004. The Bank's policy of inflation targeting began in 1991, and if this policy has indeed been a stabilizing one, real GDP growth should have been more stable in the 1990s than it was in the 1980s. This pattern is confirmed in the chart.

During the 1980s, the annual rate of output growth fluctuated between -3 per cent and +6 per cent, but on a few occasions was outside this range. Since 1992, however, output growth has always been in the narrower range of +1 per cent to +6 per cent. Thus, the stability of output growth has clearly increased following the adoption of inflation targeting.[12] We address below the important question of whether this reduced volatility was a *consequence* of better monetary policy or whether other factors might explain it.

[12] The standard deviation of output growth falls from 4.1 in the 1981–91 period to 2.1 in the 1992–2004 period.



A different way to see the increased stability of output is to examine the path of the output gap. In Chart 5, we show the output gap as a fraction of potential output. For example, in late 1982, when the Canadian economy was in the depths of a significant recession, actual output was almost 6 per cent below potential output. In contrast, when the Canadian economy was booming in 2000, actual output was almost 2 per cent above potential. It is clear in Chart 5 that the output gap has been less volatile in the past 10 years than it was in the first 10 years of the sample. In the first decade, the output gap ranged from -6 per cent in 1982 to +2 per cent in 1989; in the second decade, the output gap ranged from -3.5 per cent in 1992 to +2 per cent in 2000. The standard deviation of the output gap from 1982 to 1991 was 2.1; this measure of the output gap's volatility falls to 1.5 for the 1992–2004 period.



Two questions related to the stability of Canada's output growth remain. First, why is greater stability of output growth desirable? Second, is the greater stability that Canada experienced after 1991 a *result* of the Bank of Canada's monetary policy, or has Canada just been lucky to experience an uneventful decade during which the central bank was not faced with many significant challenges? We address these two questions in turn.

3.2 Why stable output growth is desirable

To understand why it is desirable to have relatively stable output growth (or to keep actual output relatively close to the smoothly growing level of potential output), it is necessary to understand what is going on in the economy over the course of a typical business cycle. We consider two different situations: when actual output is above potential output, and when actual output is below potential output.

Consider first the situation in which actual output is above potential output. In this case, the Canadian economy is producing more goods and services than is sustainable, given firms' current stock of productive capital and workers' willingness to work. Actual output can exceed the economy's capacity only by operating plant and machinery more intensively than is sustainable and by working employees harder than is normal—typically through overtime hours, but often by increasing part-time employment. The problem with this state of *excess demand* is that firms are generally operating so intensively that they are unable to maintain their plant and machinery in the usual manner, and workers are frequently working so intensively that they are unable to take as much leisure as they would like. Firms' profits and workers' incomes may be high in this setting, and these are notable benefits, but the situation is not sustainable—eventually the excess demand will push up wages and the prices of other inputs to the point where widespread inflationary pressures start to build. Given the Bank's objective of maintaining low and stable inflation, having actual output in excess of potential output is a situation worth avoiding.

Now consider the opposite situation, in which actual output is less than potential output. In this case, the Canadian economy is producing fewer goods and services than is sustainable. Producing less output than is sustainable typically involves using fewer machines than are currently on hand, or using the existing machines less intensively. In such a situation of *excess*

capacity, firms are typically not receiving the full rate of planned or expected returns on their investments, and their profits will typically be lower as a result. Similarly, producing less output than is typically possible involves employing fewer workers than normal, and this decision usually involves layoffs for some workers and reductions in hours for others. The excess supply generates pressures for wages and the prices of other inputs to fall (or for their rate of increase to decline), and this situation eventually causes inflation to fall. Given the Bank's objective of keeping inflation stable and within a target range, this situation should also be avoided.

Relative stability in output growth is therefore desirable for two reasons. First, by keeping actual output close to the steadily growing level of potential output, firms and workers avoid circumstances in which they are pushed to work beyond their limits, as well as those in which they are idle for considerable periods of time. Second, by avoiding such situations of excess demand or excess supply, the pressures for inflation to either rise or fall are kept to a minimum. Low and stable inflation is easier to maintain if output gaps are kept relatively small.

3.3 Good policy or just good luck?

Although it is clear from Chart 5 that output gaps have been less volatile in the years after 1991 than before, it is not clear that this reduced volatility is a *consequence* of the Bank of Canada's monetary policy. Perhaps Canadians have simply been lucky in the period following 1991, and the greater stability has had little or nothing to do with the Bank's policies.

It is often very difficult in macroeconomics, especially over relatively short periods of time, to determine cause and effect, for the simple reason that many variables are changing simultaneously. This paper will not attempt to offer a formal analysis of the effect of Canada's inflation-targeting regime on the stability of output growth. Instead, it simply reminds the reader that the past two decades have seen many shocks to the Canadian economy, and it is not obvious that the most recent decade has been less eventful than the one preceding it.[13]

The decade from 1980 to 1989 included the aftermath of the second oil shock emanating from the Organization of Petroleum Exporting Countries (OPEC), the decision to reduce inflation from very high levels, a 20 per cent depreciation of the Canadian dollar against the U.S.

[13] See Ragan (2005) for a more detailed assessment of inflation targeting, in Canada and elsewhere.

dollar, a strong economic recovery in the middle of the decade, the collapse of world oil prices in 1986, the implementation of the Canada-U.S. Free-Trade Agreement in 1989, the gradual entrenchment of fiscal deficits and the accumulation of government debt, and the beginning of the Bank of Canada's drive towards "price stability." Not a quiet 10 years.

But the next decade was no less eventful. The Goods and Services Tax (GST) was introduced, a prolonged recession occurred in the early years of the decade, and the Mexican peso crisis spilled over into Canada and highlighted the federal government's fiscal challenges. The federal government then instituted a series of budget measures to cut public spending, the Quebec referendum produced significant worries in financial markets, and the Asian crisis contributed to a significant depreciation of the Canadian dollar. A few years later, the terrorist attacks of 11 September 2001 shocked the North American economies, large increases in the world price of oil threatened to stall a global economic recovery, and a large appreciation of the Canadian dollar forced some painful adjustments within the Canadian economy.

It is difficult to look back on the past dozen years and conclude that Canada has simply been lucky in avoiding the large numbers of significant shocks of the previous decade. On the contrary, there were many shocks during that time, and the Canadian economy has been pushed in various directions. Given this recent history, it seems reasonable to conclude that at least *some part* of the greater stability in output growth has been owing to the Bank of Canada's conduct of monetary policy.

Some recent research reaches the same conclusion but with greater precision (Cecchetti, Flores-Lagunes, and Krause 2004). It empirically disentangles the combined effects—output stability and inflation stability—on macroeconomic performance that resulted from a change in the volatility of economic shocks and from a change in the success of monetary policy. The evidence suggests that the volatility of economic shocks hitting Canada after 1991 increased relative to the earlier period, but that the greater economic performance was the result of an *even greater* improvement in monetary policy. In other words, not only did the Bank's monetary policy improve following the adoption of inflation targeting in 1991, but it improved enough to *more than offset* an increase in the number of economic shocks, with the overall result being better macroeconomic performance.

Having discussed how Canadian economic performance has improved, and how these improvements may be related to the Bank's monetary policy, it is time to go into more detail about *how* monetary policy actually works. A little knowledge in this area is essential for gaining an appreciation of the difficulties involved in the successful conduct of monetary policy.

4. Monetary Policy: How It Works, and What It Takes

At the heart of the Bank's monetary policy is a commitment to maintain low and relatively stable inflation—in particular, to keep the rate of inflation close to the 2 per cent midpoint of the 1 to 3 per cent target range. The Bank's commitment is essential for influencing firms' and households' expectations of inflation. Faced with a shock that threatens to push inflation either above or below the inflation target, Canadian firms and households are confident that the Bank will act to bring inflation back to the 2 per cent target. This confidence in the Bank's policies is a result of the Bank's past record of doing what it claimed it would do—keep inflation low and stable.

When the Bank of Canada has clearly stated objectives and takes policy actions that affirm those objectives, the result is an increase in its *credibility.* This credibility, in turn, helps to keep expectations of future inflation close to the inflation target—what is sometimes called an *anchoring* of inflation expectations. The importance of well-anchored inflation expectations is best illustrated by recalling what happens when such anchoring is not present, as in the 1970s and 1980s. During those years, the inflation-control process was difficult because economic shocks led to adjustments in expectations which, in turn, led to behaviour that influenced actual inflation. An important lesson learned since the early 1990s, in Canada and elsewhere, is that keeping inflation expectations well anchored is an important part of keeping actual inflation low and relatively stable.

With these comments as background, it is now possible to examine a simple analytical framework illustrating how the policy actions of the central bank influence many macroeconomic variables and, ultimately, help to keep inflation low and relatively stable.

4.1 The transmission mechanism of monetary policy

The transmission mechanism is the complex chain of cause and effect that runs from the Bank of Canada's actions to changes in asset prices, aggregate demand, the output gap and, eventually, inflation. Among economists, there is some debate about the nature of the transmission mechanism. Engert and Selody (1998), for example, emphasize the important distinction between the "passive-money" and "active-money" views of the transmission mechanism and argue that the possibility of making policy errors can be reduced by paying attention to both views.[14] Even among those who agree on the broad nature of the mechanism, there is recognition of considerable uncertainty regarding the timing and quantitative importance of specific linkages. A collection of speeches and research papers published by the Bank of Canada (1996) provides a mainstream view of the transmission mechanism.[15] Chart 6 is a simplified illustration of the transmission mechanism. The dotted line in the chart shows how the Bank's policy commitment, and thus its acquired credibility, helps to anchor firms' and households' expectations of future inflation.

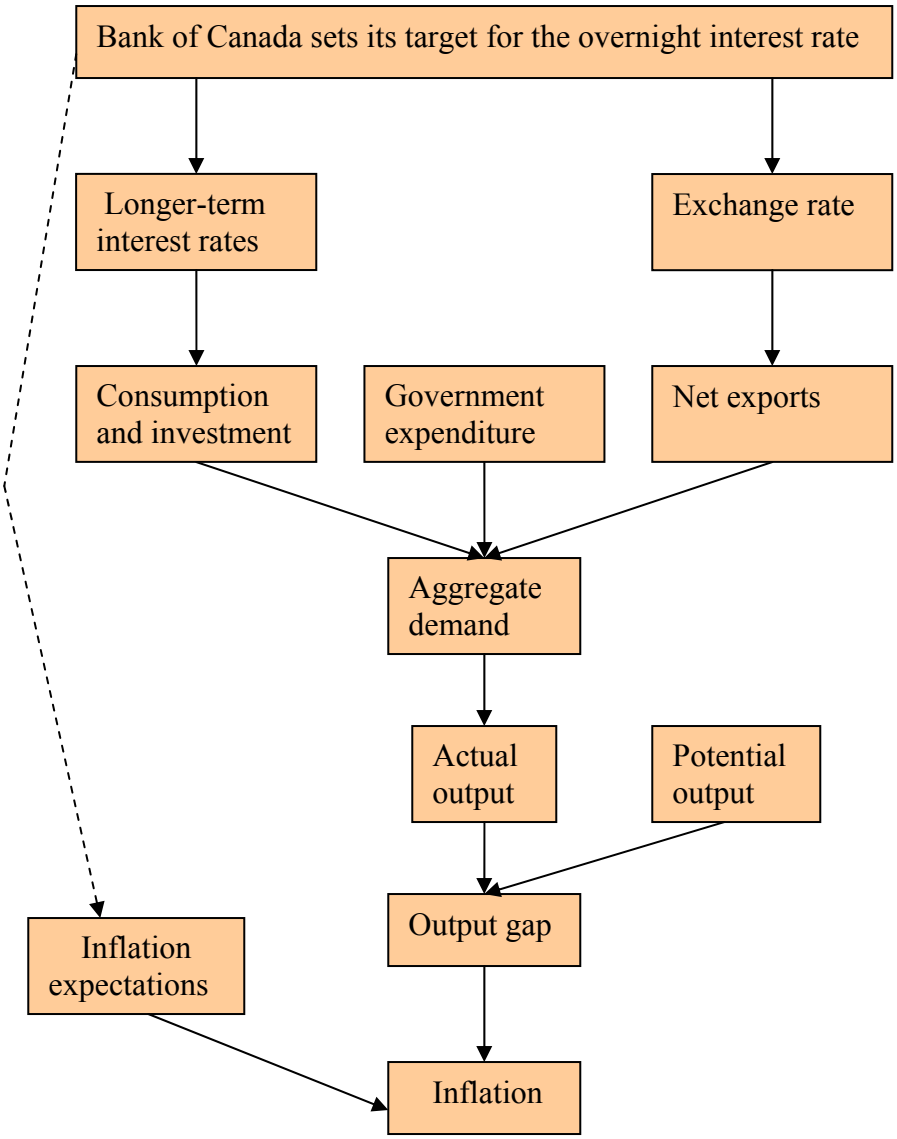
The transmission mechanism is best understood by tracing through the effects of a hypothetical policy decision. For example, consider a situation akin to that in the autumn of 2004, when the Bank had good reason to expect that the solid economic recovery occurring both in Canada and in the global economy would create pressures for Canadian inflation to rise over the coming months. In this case, the Bank's policy response was to raise its target for the overnight interest rate. How does such a policy action help to contain inflationary pressures?

Following the announcement of the Bank's policy action to increase its target for the overnight rate, the actual overnight interest rate adjusts almost instantly. As the overnight interest rate rises, two responses are observed. First, the hike in the overnight rate leads to an increase in longer-term interest rates in Canada. This increase occurs because there is an entire spectrum of financial assets, ranging from overnight loans to 30-year bonds, and their rates tend to move together. The second response is that, as Canadian interest rates rise, financial capital from around the world flows into Canada in pursuit of higher yields. This capital inflow leads to an appreciation of the Canadian dollar. At this point, the stage is set for a change in quantities, specifically investment, and net exports.

[14] Laidler and Robson (2004, especially Chapter 3) offers a balanced and very readable description of both views of the monetary policy transmission mechanism.

[15] See in particular, Thiessen (1996) for a description of the transmission mechanism and Duguay (1994) for empirical estimates.

Chart 6
The Transmission Mechanism of Monetary Policy



The rise in longer-term interest rates increases the cost of borrowing and thus tends to dampen the demand for interest-sensitive expenditures. In particular, the rise in interest rates will reduce the growth rate in firms' demand for investment goods and households' demand for residential housing and other big-ticket items such as automobiles, furniture, and appliances. The appreciation of the Canadian dollar increases the prices of Canadian products relative to foreign ones and thus leads to adjustments in spending. Specifically, the demand by foreign consumers for Canadian products will be dampened, and the demand by Canadian consumers for foreign products will be stimulated. The growth of Canadian exports will decline, and the growth of

imports from abroad will increase—a decline in the growth of Canadian net exports. Taken together, the reduced growth rates of household consumption, firms' investment demand, and net exports imply a reduction in the growth rate of Canadian aggregate demand.[16]

Over short periods of time, perhaps up to a few years, output in the economy is determined by the level of demand for all of the goods and services produced in Canada—that is, output is determined by aggregate demand. With aggregate demand now growing more slowly than before the Bank's policy action, there will soon follow a slowing of the growth rate of actual output. With some given underlying growth rate of potential output, this reduction in the growth rate of actual output implies the opening (or enlarging) of a "negative" output gap, in which actual output is less than potential output.

The final step in the transmission mechanism is the link from the output gap to the rate of inflation. The output gap is a convenient measure of the amount of excess demand or excess supply in the aggregate economy. With actual output below potential output, firms are producing below their capacity. This situation of excess supply can continue for a while, but eventually, the economic slack leads to a reduction in the growth rate of wages and the prices of other inputs. This reduction in the growth of firms' costs then leads them to be less aggressive in increasing their prices, and inflationary pressures subside.

4.2 Time and uncertainty

Thus, we see how the Bank of Canada's action to raise its target for the overnight interest rate sets in motion a complicated sequence of cause and effect that helps to keep inflation from rising above its target.[17] But how much time elapses between the Bank's policy action and the other effects, especially the final effect on the rate of inflation?

Economists usually think of the transmission mechanism as containing "long and variable lags," indicating not only that central bankers must be patient while waiting for the results of their policy actions, but also that they must be prepared to accept a few surprises while they're waiting. The workings of the economy are sufficiently complex, and our understanding of the

[16] Government purchases of goods and services are the final component of aggregate demand. In this analysis, we focus on the effects of monetary policy actions and assume that government spending (fiscal policy) is unchanged.

economy sufficiently incomplete, that the various lags in the process may turn out to be either longer or shorter than initially expected.

The Bank of Canada's policy actions relating to the overnight interest rate have almost immediate effects on the exchange rate and interest rates, but current estimates suggest that it takes between 12 and 18 months for most of the effect on aggregate output to be observed. Most of the effect on inflation is not apparent for between 18 and 24 months (Duguay 1994). And even these estimates are subject to considerable variation.

The time lags inherent in the transmission mechanism make it difficult to conduct monetary policy. In particular, these long time lags mean that central banks must be *forward-looking* in their policy decisions. Consider two examples to illustrate the point. If, on 1 January 2005, the Bank of Canada observes an event in the world economy that is likely to reduce aggregate demand beginning in June of the same year, there is nothing the Bank can do in January to fully offset that shock. Even if it responded immediately and lowered its policy rate in early January, there simply would not be enough time for its policy to stimulate aggregate demand sufficiently to offset the effects of the shock by June.

This example illustrates why the Bank places more emphasis on long-lasting shocks than on shocks believed to be short lived: monetary policy takes so long to work that it makes little sense to respond to shocks that will have disappeared by the time the policy takes effect. A related difficulty, however, is that it may take the Bank a few months to fully determine the nature of the shock, as well as its likely duration. Thus, a forward-looking central bank must do its best to *anticipate* what events are likely to occur in the future.

A second example is more familiar in recent Canadian experience. Suppose the current rate of inflation is low, but that economic developments expected to occur in the near future will create an undesirable increase in future inflation. In such a situation, a central bank that recognizes the importance of the long lags in the transmission mechanism will increase its policy interest rate now even though *current data* suggest that there is no inflation problem. This example illustrates why vigilant central bankers are often accused of fighting demons that are not present. The problem is that if central bankers delay their policy response until inflation actually

[17] The same logic, working in the opposite direction, applies to the situation in which the Bank lowers its target for the overnight interest rate in an attempt to keep inflation from falling below its target.

appears in the data, it would be too late to have the desired impact. Being forward-looking means anticipating where the demons will surface and acting in a pre-emptive manner. Although a central bank that is successful in anticipating future inflationary pressures, and also in taking the appropriate actions to prevent their full realization, can easily be accused of seeing dangers that are not genuine, the truth may be that the dangers were avoided only because of the central bank's vigilance.

Although many central bankers may do a good job of predicting future events, no central bank has a crystal ball—the future is only clearly visible once you are there. Indeed, it is actually worse than this in economics. Because of imperfect information that is often revised, even several months after the fact, economists have a difficult time knowing with precision what is happening in the current quarter until they are two or more quarters down the road. This mention of imperfect information leads us to discuss the informational requirements for monetary policy. In a nutshell, the successful conduct of monetary policy requires good information, and plenty of it.

4.3 Monetary policy faces two types of uncertainty

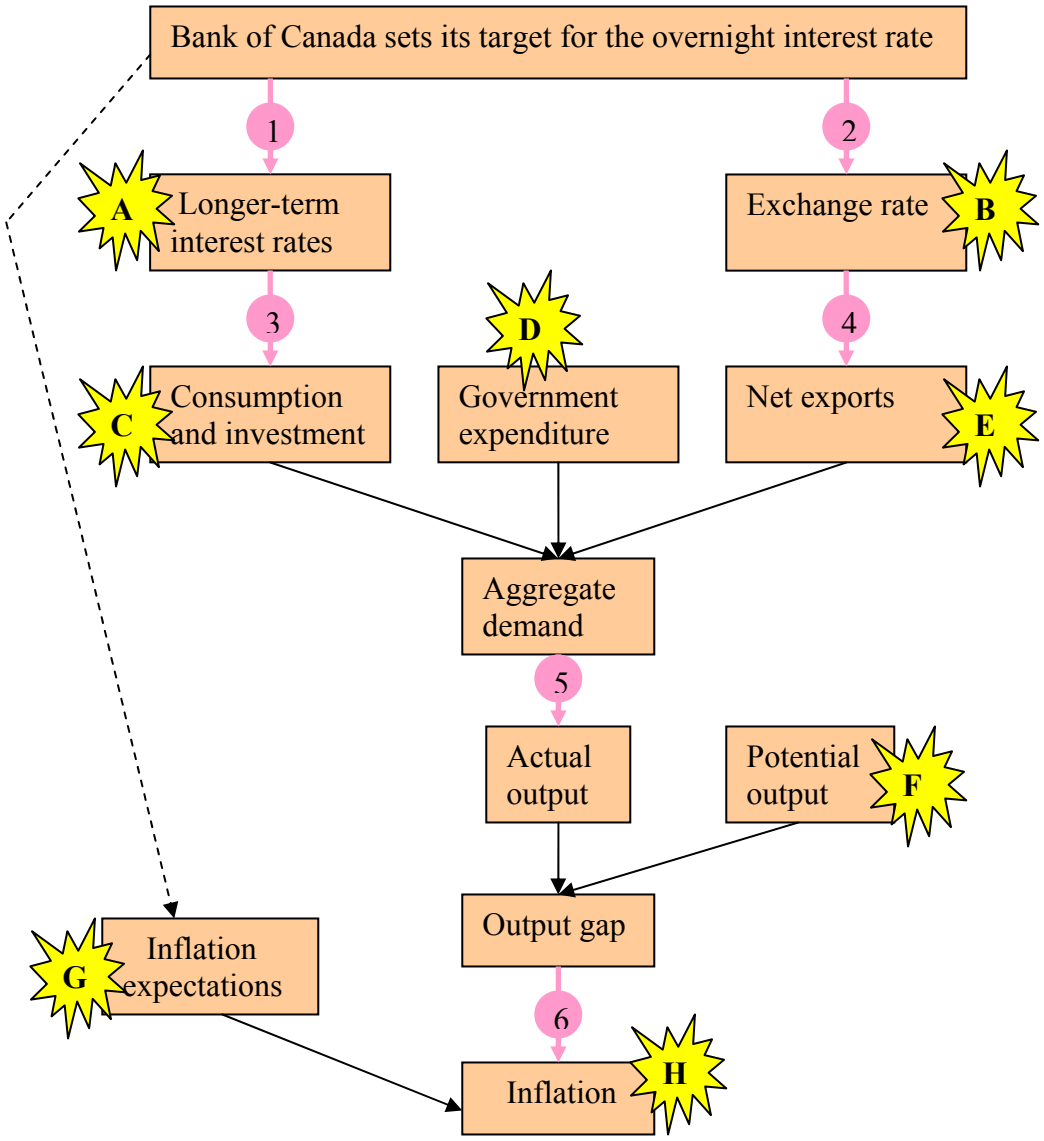
In order to understand the informational requirements for monetary policy, it is helpful to reconsider the nature of the transmission mechanism. Chart 7 shows the transmission mechanism again, but adds two types of uncertainty. The first type involves uncertainty about the details in the transmission mechanism itself; that is, uncertainty about the precise nature of the linkages between key macroeconomic variables. This uncertainty is shown by the pink numbered balloons. The second type is uncertainty about current and future economic developments in the domestic and world economies, as shown by the yellow starbursts.

Six instances of the first kind of uncertainty are shown in Chart 7, each referring to a different aspect of the transmission mechanism. The nature of the uncertainty in each case is as follows:

1. *Term structure.* How do the Bank's changes in the target overnight interest rate lead to changes in longer-term interest rates? Are the changes always in the same direction? What magnitude of changes are observed for longer-term interest rates?

2. *Foreign exchange market.* How do the Bank's changes in the target overnight interest rate lead to changes in the exchange rate? How big a change in the exchange rate typically follows a change in the policy rate by the Bank of Canada?

Chart 7
Two Types of Uncertainty for Monetary Policy



3. *Interest sensitivity of spending.* How much, and over what timeframe, do aggregate consumption and investment respond to changes in longer-term interest rates? Do different components of consumption and investment have different responses to changes in interest rates?

4. *Sensitivity of net exports.* How much do exports respond to a change in the exchange rate, and with what time lags? How quickly and in what magnitude do imports respond to the same change in the exchange rate?

5. *The multiplier.* How big is the "multiplier" that connects initial changes in aggregate demand to the overall change in aggregate output? Over what time period are the full effects on aggregate output observed?[18]

6. *Excess demand or supply.* How quickly does the excess demand or supply associated with any given output gap cause changes in the growth rate of wages and the prices of other inputs? How quickly do these changes show up in inflation?

Eight examples of the second type of uncertainty are shown in Chart 7, with the yellow starbursts each referring to a different kind of shock that can affect the economy. A brief description of each is as follows:

A. *Portfolio adjustments.* For several reasons, creditors may decide to adjust their holdings of short-term and long-term Canadian securities, leading to changes in Canadian interest rates.

B. *Foreign exchange market.* Changes in exchange rates occur daily and for many reasons, including changes in the growth of the global economy, changes in world commodity prices, and changes in international asset portfolios.

C. *Consumption and investment.* Households change their spending, and firms change their investment plans, often in unpredictable ways. Expectations regarding future economic conditions are important.

D. *Government expenditures.* Canadian governments (federal, provincial, territorial, and municipal) change their spending on an annual basis, sometimes in unexpected ways.

E. *Net exports.* Changes in foreign income lead to changes in the demand for Canadian exports. The rise of specific countries in the production of certain goods frequently leads to changes in world demand, either away from or towards Canadian goods.

F. *Potential output.* The economy's production capacity is not directly observable, and therefore must be estimated. Its growth depends on labour-force growth, the accumulation of physical and human capital, and the growth of productivity. Changes in potential output often cannot be detected until well after the fact.

[18] The "multiplier" describes how changes in aggregate demand are multiplied in size in the short run. An initial increase in demand leads to more output and income which, in turn, leads to a further increase in demand, a further increase in output, and so on.

G. *Inflation expectations.* Large and sudden changes in the prices of specific products frequently lead to changes in inflation expectations. However, the central bank's commitment and credibility help to anchor expectations in the face of such shocks.

H. *Inflation shocks.* The rate of inflation is regularly affected by changes in indirect taxes, sharp changes in the prices of specific products, and by changes in the exchange rate that alter the Canadian-dollar prices of imported products. Not every change in measured inflation is caused by excess demand or supply in the Canadian economy.[19]

This collection of uncertainties—about the economic linkages and the economic events—is crucial to the conduct of monetary policy, not least because of the long and variable lags that we discussed earlier. For the Bank of Canada to set its policy interest rate now in order to keep inflation within its target range in the future, it is necessary for the Bank to anticipate the likely changes in the economy that will occur over the next two years. It is also necessary for the Bank to anticipate how its actions will be transmitted through the economy. Since no central bank has the ability to foretell the future or has perfect knowledge of the various linkages in the economy, this is a difficult task. But knowledge of the transmission mechanism, simplified as it is in Chart 7, permits the Bank to be systematic about which questions it asks, and to be analytical about interpreting some of the answers.

This discussion underscores why monetary policy is best viewed as a problem of *policy-making under uncertainty*. Faced with such uncertainty, the Bank needs to be forward-looking, aware of many possible shocks that may occur in the near future. It must also be aware that economic developments shown to be present by current data may not persist for long, or may in the near future be revealed, through a revision of the data, never to have existed at all.[20] Thus, the Bank is forced to perform a precarious balancing act—sometimes taking action in anticipation of what is likely to happen while at other times waiting to see what new data are confirmed as genuine. Not surprisingly, good judgment based on considerable experience is an essential part of good monetary policy.

4.4 Good information, and plenty of it

[19] This is one reason why the Bank of Canada monitors movements in "core" inflation. By removing eight particularly volatile elements (see the list in footnote 7) from the measure of CPI inflation and adjusting for the effect of changes in indirect taxes, the resulting measure of inflation provides a better indication of excess demand or supply pressures in the economy. See Macklem (2001).

[20] This third type of uncertainty, uncertainty about the accuracy of data, is discussed in Bean (2005).

In addition to judgment and experience, consider what the Bank of Canada—and any other central bank—requires in order to conduct the best possible monetary policy in the face of uncertainty.

The Role of Research

To deal with the uncertainty regarding the various linkages between macroeconomic variables (the pink balloons in Chart 7), the Bank needs to conduct a significant amount of *economic research*, both theoretical and empirical, and to subject the results of this research to ongoing testing. The nature of modern economies is such that this job will never be finished, and the complete set of answers will never be known. For example, even if the collection of economic researchers were able to estimate the precise relationship between changes in longer-term interest rates and firms' planned investment spending, there is no reason to believe this relationship will be stable over time, or that factors that proved to be important in the past will remain of central importance in the future. Economic relationships depend in important ways on human behaviour, which itself depends on the specifics of time, place, and circumstance.

In short, the economic relationships that are central to the conduct of monetary policy are difficult to pin down and are constantly changing. This simple fact requires the Bank to be continuously conducting research on the nature of the transmission mechanism. To do otherwise would be to abrogate its central responsibility.

The Importance of Current Analysis

Dealing with the uncertain developments in the domestic and world economies (the **yellow** starbursts in Chart 7) requires information of a different kind. In order to know what events are occurring, and what events are likely to occur in the near future, the Bank needs to collect and analyze a great deal of current data—a process that is often called *current analysis*. Although the relatively small number of yellow starbursts in Chart 7 may suggest that the required effort in this direction is commensurately small, this suggestion would be misleading. In fact, the large quantities of variables that feed into each yellow starburst, and the inherent complexity involved in understanding each individual variable, mean that the task of current analysis for any central bank is Herculean. Thus, a great many people at the Bank are assigned the task of collecting and analyzing data on hundreds of variables, from employment and exports to commodity prices and housing starts, from government spending and exchange rate regimes to domestic steel

production and foreign crop failures. Only when the various shocks to the economy are observed and understood can the Bank hope to incorporate that information fruitfully into its overall decision-making.

A relatively new and important example of data collection and analysis that the Bank carries out in an attempt to better understand the emerging trends in the economy is the *Business Outlook Survey (BOS)*. Four times a year the Bank's regional offices survey approximately 100 firms, the overall sample chosen to be roughly representative of the Canadian economy. A number of issues are explored, including the firms' views on likely future demand for their own products, capacity pressures in their specific sectors, any emerging labour shortages, and the firms' own plans for hiring or expansion. By analyzing these data carefully, the Bank is able to better understand how Canadian firms respond to the various shocks affecting the Canadian economy.

Economic Projections

Economic research and current analysis are not independent activities. In order to conduct thorough empirical economic research, knowledge of the data is essential, and such knowledge typically comes from experience in current analysis. Conversely, the ability to interpret current data—what is going on and why?—requires a thorough knowledge of economic relationships that comes from experience in research. This ongoing interaction between research and current analysis explains why many economists at the Bank of Canada are in positions that require a regular transition between current analysis duties and research projects.

The best example of how the insights gleaned from economic research are combined with the knowledge embodied in current analysis is in the Bank's regular projection, or forecasting, exercise, based on its large and complex statistical model of the Canadian economy, the Quarterly Projection Model (QPM). Embodying the knowledge of economic relationships gained from many years of research, QPM is a mathematical representation of the interaction of the various agents in the Canadian economy—households, firms, and governments—and shows how these relationships must evolve over time to be consistent with the underlying assumptions of agents' behaviour. The model then incorporates past and current data from the Canadian and world economies and projects the most likely future path of Canadian macroeconomic variables—including output, employment, wages, and prices.

The world rarely turns out as the model projects, for two reasons. First, the model itself, though extremely complex, is nonetheless a highly simplified description of the real economy. It lacks the remarkable and changing complexity that actually characterizes any modern economy. Second, the data that are fed into the model, as good as they are, are also imperfect, and the Bank's best predictions regarding what is actually happening in the Canadian and world economies may well turn out to be wrong in some way. Nonetheless, the economic projection provides the Bank with a logically consistent and well-articulated starting point regarding the future evolution of the Canadian economy, as well as a starting point for analyzing the likely future impact of its policy actions.

These three exercises in information creation—research, current analysis, and economic projections—are imperfect and, necessarily, ongoing. Research will never be entirely "correct" and thus will never be complete. Current analysis, by its very nature, must be an ongoing process, with constant effort expended to improve data definitions and accuracy. And the art of model building and producing sensible and consistent macroeconomic projections is, perhaps unbelievably, still in its infancy. Such failings, however, in no way suggest that these activities can be forsaken. It would be impossible to conduct prudent monetary policy without the creation and provision of such information, and it is thus not surprising that central banks the world over invest considerable resources in these three key activities.

5. Final Remarks

This paper has offered an explanation of what monetary policy is, and why it matters. As a quick summary, the paper's key points are:

1. Why inflation? By maintaining low and relatively stable inflation, central banks make their best contribution to the economic health of a nation. This objective is grounded in the propositions that (1) high inflation is damaging to the economy, and (2) monetary policy is unable to have a systematic and lasting effect on macroeconomic variables other than the rate of inflation.

2. Low inflation is desirable. The biggest cost of inflation is the uncertainty that it generates and the inefficiencies it creates by distorting the information conveyed by relative prices. Cross-

country evidence suggests that countries with higher rates of inflation also tend to have more volatile rates of inflation. Canada's rate of inflation has been lower and less volatile in the years following the 1991 adoption of inflation targeting than in the preceding decade.

3. Stable output growth is desirable. Genuine benefits come from having a more stable growth rate of real output and also from having a more stable output gap. Canada's output growth and output gap have been more stable in the years following 1991 than in the preceding decade.

4. Good policy or good luck? It is impossible to determine precisely that the greater stability in inflation and output growth has been the result of better monetary policy rather than just a less volatile economic environment. There is some evidence, however, that the economic environment actually became more volatile following 1991, suggesting that some of the improved macroeconomic performance does indeed reflect better monetary policy.

5. Monetary policy is forward-looking. The transmission mechanism of monetary policy is the complex chain of cause and effect that connects policy actions by the Bank of Canada to aggregate demand, output, and inflation. Monetary policy works with long and variable lags, and monetary policy must therefore be forward-looking, anticipating events that are likely to happen in the world and domestic economies.

6. Two types of uncertainty. Two types of uncertainty complicate the conduct of monetary policy: uncertainty about the precise workings of the transmission mechanism, and uncertainty about economic events in both the global and Canadian economies. Both types of uncertainty require that the Bank of Canada invest considerable resources in research, current analysis, and projection in order to make the best-informed policy decisions.

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This paper, while providing a broad outline of what the Bank of Canada does, and why, has barely scratched the surface of Canadian monetary policy. Economies are complicated structures, and we continuously strive to learn more about them. Similarly, monetary policy works through a complex process. As we continue our theoretical research and our analysis of data, our knowledge of this complexity will grow, but so too will our questions about it. Given the importance of monetary policy to our well-being, this continued effort is well worth the investment.

Appendix

The Continuing Puzzle of the Inflation-Growth Relationship

The inflation-growth relationship has attracted much attention from economists, both in academia and in the world of central banking, for good reason. If reducing the average rate of inflation can be expected to increase a country's average annual growth rate of output by even one-tenth of a percentage point, it is a policy worth considering. Although one-tenth of a percentage point in an annual growth rate seems very small, over a period of many years even such small variations can translate into significant changes in the level of income. Consider, for example, a country that has per capita income today equal to 100 and an annual growth rate of 1.5 per cent. After 30 years, income will have grown to 156. Now imagine increasing that growth rate to 1.6 per cent; after 30 years, income will have increased to 161. Going another 30 years further into the future, the lower-growth level of income will be 244, whereas the level of income in the (slightly) higher-growth world will be 259. These may seem like small differences, but they should not be ignored. Who wouldn't want to increase their income by even a few percentage points?

As important as the possible link between inflation and growth may be, Ragan's (2000) review of the research demonstrates the difficulty in finding clear and convincing evidence that such a relationship exists. What is clear is that, in countries that have experienced very high ("hyper") inflation, there is a significant and negative effect on growth. This is not surprising. When inflation becomes very high, money is losing its value so quickly that it soon ceases to be useful as either a medium of exchange or as a store of value. In such an environment, firms and workers, borrowers and lenders are led to conduct their transactions without money—we typically observe a re-emergence of *barter* economies. But barter is so inefficient relative to money that, not surprisingly, the output generated by such economies, and thus the real income accruing to their residents, typically plummets.

What is much less clear from the empirical research is any relationship between inflation and real output growth in countries that already have low, or even moderate, inflation. For example, in a country with inflation of, say, 5 per cent per year, it is not clear from the data that a policy decision to reduce inflation to 4 per cent or 3 per cent would have any impact on that economy's long-run rate of output growth. This is not to say that there would be no benefits from the lower inflation—including the benefits that would stem from the reduced uncertainty of inflation—only that the evidence does not clearly identify a higher rate of output growth among those benefits. This is an important enough topic, however, that researchers will continue to re-examine the data in different and better ways until there appears to be a clear answer to the question.

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Glossary of Economic Terms

Aggregate demand
In Canada, aggregate demand is the demand for Canadian-produced goods and services from all sources, including households, firms, governments, and foreigners' demand for Canadian products. Aggregate demand is the sum of planned consumption, investment, government purchases, and net exports.

Aggregate output
The sum of the value of all goods and services produced in the economy during a particular period of time, usually a year. The most common measure of aggregate output is gross domestic product (GDP).

Causality
There is said to be causality in a relationship between two variables when a change in one variable *causes* the change in the other variable.

Correlation
Two variables are correlated when movements in the two variables tend to occur together. With a *positive* correlation, one variable tends to be above its average value when the other one is above its average value—that is, the two variables tend to move in the same direction. With a *negative* correlation, one variable tends to be above its average value when the other one is below its average value —that is, the two variables tend to move in opposite directions.

Expectations of inflation
The expected or anticipated value of the rate of inflation, for some specified future period. The Conference Board of Canada regularly publishes survey data showing private-sector expectations of future inflation.

Fiscal policy
The set of decisions a government makes with respect to taxation, spending, and borrowing.

Inflation
The rate of change of some general index of prices. In many countries it is common to use an index based on a collection of prices of consumer goods—such as the consumer price index (CPI). The measure of CPI inflation is then the rate of change in the CPI.

Macroeconomics
The study of the behaviour of *aggregate* economic variables, such as total output (gross domestic product, GDP), total employment, the unemployment rate, inflation, and overall economic growth. Macroeconomics abstracts from the rich detail within the markets for individual goods and services.

Monetary policy
The set of decisions a government makes, usually through its central bank, regarding the amount of money in circulation in the economy. In Canada, the Bank of Canada adjusts the target for the overnight interest rate to achieve a rate of monetary expansion consistent with keeping inflation low and relatively stable (and close to 2 per cent).

Net exports
The value of exports (products sold to other countries) minus imports (products purchased from other countries). If net exports are positive, there is a *trade surplus;* if net exports are negative, there is a *trade deficit*.

Output gap
The difference between the actual level of aggregate output (GDP) and the economy's level of potential output. A positive output gap means that actual output exceeds potential output; this is a situation of excess demand. A negative output gap means that actual output is below potential output; this is a situation of excess supply.

Policy instrument
The specific method by which a policy is implemented. Fiscal policy instruments include various tax rates and spending levels (on specific products). In Canada, the single monetary policy instrument is the target for the overnight interest rate.

Potential output
The economy's level of production capacity. This is the level of aggregate output the economy can produce on a sustained basis, without causing inflation to either rise or fall.

Relative prices
The price of one product expressed in terms of the price of some other product (or group of products). When we say that changes in market prices reflect changes in scarcity, we are referring to changes in *relative* prices.

Resource allocation
The overall pattern of consumption and production of goods and services—which firms produce which goods, and with which inputs; how much of each good is produced; and how do consumers divide their scarce resources among the many products.

Standard deviation
A measure of the volatility of a variable. If the variable tends to make large deviations from its average value, the standard deviation will be large; if it is more typical that movements are only small deviations from the variable's average value, the standard deviation will be small.

Transmission mechanism
The complex chain of cause and effect that connects the central bank's policy instrument (typically the setting of a short-term interest rate) with asset prices, aggregate demand, total output, the output gap, and, eventually, inflation.

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References

Cecchetti, S., A. Flores-Lagunes, and S. Krause. 2004. "Has Monetary Policy Become More Efficient? A Cross Country Analysis." NBER Working Paper No.10973.

Bank of Canada. 1996. *The Transmission of Monetary Policy in Canada*. Ottawa: Bank of Canada.

Bean, C. 2005. "Monetary Policy in an Uncertain World." *World Economics* 6 (1): 31–53.

Duguay, P. 1994. "Empirical Evidence on the Strength of the Monetary Transmission Mechanism in Canada: An Aggregate Approach." *Journal of Monetary Economics* 33 (1): 39–61. Also included in *The Transmission of Monetary Policy in Canada*, Bank of Canada, 1996.

Engert, W. and J. Selody. 1998. "Uncertainty and Multiple Paradigms of the Transmission Mechanism." Bank of Canada Working Paper No. 98–7.

Friedman, M. 1968. "The Role of Monetary Policy." *American Economic Review* 58 (1): 1–17.

———. 1977. "Nobel Lecture: Inflation and Unemployment." *Journal of Political Economy* 85 (3): 451–72.

Hayek, F. 1945. "The Use of Knowledge in Society." *American Economic Review* 35 (4): 519–30.

Laidler, D. and W. Robson. 2004. *Two Per cent Target: The Context, Theory, and Practice of Canadian Monetary Policy since 1991*. Toronto: C.D.Howe Institute.

Leijonhufvud, A. 1977. "Costs and Consequences of Inflation." In *The Microeconomic Foundations of Macroeconomics*. Proceedings of a Conference held by the International Economic Association, at S'Agaro, Spain, edited by H. Harcourt. London: Macmillan.

Longworth, D. 2002. "Inflation and the Macroeconomy: Changes from the 1980s to the 1990s." *Bank of Canada Review* (Spring) 3–18.

Lucas, R. 1980. "Two Illustrations of the Quantity Theory of Money." *American Economic Review* 70 (5): 1005–14.

Macklem, T. 2001. "A New Measure of Core Inflation." *Bank of Canada Review* (Autumn) 3–12.

Melzer, T. 1996. "Price Stability: An Attainable Goal for Monetary Policy." Speech to the Missouri Valley Economic Association (March).

McCallum, B. 2004. "Long-Run Monetary Neutrality and Contemporary Policy Analysis." Institute for Monetary and Economic Studies Discussion Paper No. 2004–E–18, Bank of Japan.

Ragan, C. 2000. "Should We Expect Higher Growth from Lower Inflation?" *Canadian Business Economics* 8 (2): 19–31.

_____. 2005. "The Road Ahead for Canadian Inflation Targeting." Paper prepared for the Bank of Canada conference on "Issues in Inflation Targeting" (April).

Stuber, G. 2001. "Implications of Uncertainty about Long-Run Inflation and the Price Level." Bank of Canada Working Paper No. 2001–16.

Thiessen, G. 1996. "Uncertainty and the Transmission of Monetary Policy in Canada." In *The Transmission of Monetary Policy in Canada*. Ottawa: Bank of Canada, 1996.