The Transmission of Monetary Policy in Canada

Bank of Canada

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INTRODUCTION

In response to an invitation from Glendon College to deliver the 1995 HERMES lecture, Governor Thiessen decided to use the occasion to set out the Bank of Canada's view of the transmission mechanism for monetary policy. The transmission mechanism is the chain of developments that begins with the Bank's actions in adjusting the supply of settlement balances to financial institutions, traces the effects of these actions on financial markets, and works through the resulting changes in spending, production, employment and prices. The widespread interest in the subject matter of the HERMES lecture inspired this volume.

Although over the past few years researchers at the Bank have published a number of papers on various stages in the transmission mechanism, this is the first time they have been gathered together in an effort to make the subject more accessible. The focus here is primarily on the early part of the transmission mechanism – that is, on the path between the actions of the Bank of Canada and financial market outcomes, since this is less researched and less widely understood than the links between financial market outcomes and spending and inflation.

In the HERMES lecture, the first paper in this volume, Governor Thiessen describes all the stages in the transmission mechanism, with an emphasis on the uncertainty at each stage and on the initiatives taken by the Bank to lessen this uncertainty by increasing the transparency of its objectives and the way it implements policy.

Bruce Montador provides an overview of the various instruments through which the Bank of Canada implements monetary policy. More detailed discussions of these instruments are presented in the article by Kevin Clinton on cash management techniques and in the article by Clinton and Fettig on buyback techniques. Clinton and Howard examine the effect of eliminating reserve requirements on the linkages between the one-day interest rate, over which the Bank has the most influence, and other rates of interest.

The first article by Charles Freedman sets out the rationale for use of the monetary conditions index (MCI), a construct that combines interest rate and exchange rate movements. Freedman's second article analyses the way in which strategic and tactical elements enter into the Bank's decisions regarding the MCI path. This is followed by Pierre Duguay's assessment of the empirical evidence on the links from interest rates and exchange rates to total spending in Canada and from total spending and the exchange rate to inflation. In another article, Duguay and Poloz discuss the role of economic projections in the formulation of Canadian monetary policy. The final text, by Tim Noël, describes some important changes

that the Bank of Canada has recently made in the way it implements monetary policy and intervenes in financial markets.

This volume details the arrangements in place in the first half of the 1990s. Over the next couple of years there will be further important changes in the way monetary policy is implemented as a result of the expected introduction in the first half of 1997 of the Large Value Transfer System (a system for transferring large value payments currently under construction by the Canadian Payments Association). Articles describing and analysing these and other developments affecting the transmission mechanism will appear periodically in the *Bank of Canada Review*. Interested readers may also wish to refer to the Bank of Canada's forth-coming conference volume, *Money Markets and Central Bank Operations*.

Uncertainty and the transmission of monetary policy in Canada

by Gordon G. Thiessen

Just over seven years ago, my predecessor, John Crow, delivered the Hanson Memorial Lecture at the University of Alberta. In it, he discussed a number of issues relating to the conduct of Canadian monetary policy, including the goal of monetary policy, the transmission mechanism, the use of monetary aggregates as policy guides, financial market uncertainty, and the role of the exchange rate. Seven years later, all of these matters remain topical.

What I want to do today is to focus on the inter-relationships of two of these themes – uncertainty and the transmission of monetary policy to the economy. How do the various types of uncertainty influence the behaviour of economic actors? And how does uncertainty affect the transmission of monetary policy through the economy? In the first part of this lecture I will outline the Bank of Canada's view of the transmission mechanism, paying considerable attention to the role of uncertainty. In the second part, I will set out the various ways in which the Bank has tried to reduce uncertainty.

Before launching into the main part of the lecture, I want to spend a few minutes discussing the various kinds of uncertainty that impinge on the economy and on the policy process. One type of uncertainty arises because of the possible occurrence of events that are largely unexpected. Such shocks can be international or domestic in origin. A recent example was the rise in U.S. long-term interest rates through the first half of 1994. Other sources of shocks can be events that are certain to occur, but whose precise nature or outcome is as yet unknown, for example, a budget, or the upcoming referendum in Quebec.

A second type of uncertainty arises because the private sector may be unsure about the longer-run objectives of economic policies. To complicate the issue further, there can be an interaction of these two types of uncertainty when the markets are unsure about how to interpret the response of the authorities to a shock. Do the actions of the central bank reflect a change in its long-run objectives or simply a response to the shock with no change in objectives? One of the reasons why markets may be unsure about how to interpret the central bank actions is that they may view the shock differently than the central bank does. In particular, there may be differences of view as to whether the shock is likely to be long-lived or short-lived and as to its implications for the economy.

In deciding on its policy actions, the central bank is in turn faced with an uncertainty about how the financial community and the public will respond to its pronouncements and actions. Will the response be the same as in the past, or will economic relationships be different on this occasion? For example, how will aggregate demand be affected by central bank actions leading to changes in interest rates and the exchange rate? And how will inflation and inflation expectations react to these actions?

What can the central bank do to reduce uncertainty? First, it can try to reduce the uncertainty of the public and of financial markets about its responses to the various shocks. It can do this by making clear the longer-run goal of monetary policy, the shorter-term operational targets at which it is aiming in taking policy actions, and its own interpretation of economic developments. Moreover, by committing itself to a longer-term goal and sticking to it, as well as by lessening uncertainty about its own responses to shocks, the central bank may be able to lessen the effect of the shocks on private sector behaviour.

In sum, uncertainty of various kinds is pervasive. Given its importance, uncertainty deserves much greater prominence than it typically receives in textbook discussions of monetary policy, where it is too often neglected. In my discussion in the rest of this lecture of the transmission mechanism and the initiatives taken by the Bank to reduce uncertainty, I will try to remedy this neglect.

THE TRANSMISSION MECHANISM

When central banks take monetary policy actions, they set in motion a series of consequences that starts with an influence on financial markets, works through changes in spending, production and employment, and ends with an effect on the price level or, more specifically, the rate of inflation in the price level. Economists call this chain of developments the "transmission mechanism."

The instrument that the central bank has at its disposal in taking monetary policy actions is its control over the issuance of a crucial financial asset – typically referred to in the economics literature as "base money." Base money, which is composed of bank notes issued by the central bank and deposits at the central bank held by financial institutions, is important because it provides the ultimate form of liquidity in the financial system. Financial institutions hold such a liquid instrument – one that involves no risk of default and no delay in obtaining value – in order to settle among themselves the net flows from payments that take place in the economy every day.

Fundamentally, monetary policy is about the pace of monetary expansion. The rate at which the central bank allows base money to expand over time will either encourage or restrain the financial system in its expansion of money and credit. This in turn will influence the demand for goods and services in the economy. And it is the level of demand relative to the ability of the economy to produce goods and services that eventually determines the rate of inflation.

However, in practice, the relationship of base money to aggregates of money or credit or to measures of aggregate demand in the economy is not stable enough for the Bank of Canada to operate by expanding base money at a given rate. Instead, as you will see from the description of the transmission process that follows, we rely on the linkage from base money to interest rates and the exchange rate, and from these financial market prices to aggregate demand and then to infla-

tion, as the basis for making monetary policy decisions in Canada.

These linkages from monetary actions through to the rate of inflation have been a subject of intense scrutiny over many years. Some parts of the transmission mechanism, such as the effect that changes in interest rates have on aggregate demand and inflation, have received a great deal of attention. Other parts, such as the linkages from central bank actions to movements in interest rates and the exchange rate, have received less attention outside central banks. What I want to do in this part of the lecture is to focus on the role of financial markets in the transmission mechanism and on the influence of various kinds of uncertainty on the response of these markets to economic developments and to monetary policy actions.

First stage: From central bank actions to very short-term interest rates

The first step in the transmission process takes place when the central bank adjusts the size of its balance sheet to alter the supply of base money in the financial system. Traditionally, commercial banks held a certain amount of base money because of legally imposed reserve requirements. However, since the elimination of reserve requirements in Canada, a demand for base money by the major banks and certain other important financial institutions exists because they settle the net outcome of the daily clearings of payments directly on the books of the Bank of Canada. Hence, such institutions are called direct clearers. And "settlement balances" is now the appropriate term to describe the deposits of the direct clearers at the Bank of Canada.[1]

Central banks can adjust the supply of settlement balances available to the direct clearers in a number of ways. While textbooks typically focus on open market operations, in Canada we rely

mainly on a technique involving daily transfers of government deposits between the direct clearers and the Bank of Canada. The precise way in which the amount of settlement balances is increased or decreased by the Bank is essentially a technical matter.[2] What is central to the process is that the Bank of Canada is able to provoke a reaction from the direct clearers by confronting them with an excess or shortfall of settlement balances. They act promptly to eliminate the imbalance because of cost considerations. Excess balances are costly because no interest is paid on them to financial institutions, while shortfalls have to be covered by overdraft loans from the Bank of Canada at a penalty rate of interest.

In essence, we use our control over settlement balances to influence the interest rate most relevant to transactions by financial institutions aimed at adjusting these balances. This is the rate on one-day loans, sometimes called the overnight rate of interest. Movements in the overnight rate in turn influence other interest rates and the exchange rate.

On a typical day, after the previous day's payment items have cleared, some direct clearers will end up with a surplus of settlement balances and others with a shortfall. It is only if the Bank of Canada acts to create an overall shortfall or surplus for the group as a whole relative to their desired balances at the Bank, that it can alter the overnight interest rate. Faced with a shortfall, the direct clearers will call one-day loans to security dealers, sell very short-term liquid assets from their portfolio, or bid more aggressively for very

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1. *Financial institutions also hold notes and coins to meet the public's demand. But whereas supplying bank notes allows the Bank of Canada to acquire assets that it can use in its market operations, the supply is passively adjusted to the demand for notes and is not part of the monetary policy process as such. The central instrument of monetary policy is the Bank's supply of settlement balances to direct clearers.*
2. *See K. Clinton, this volume.*

short-term wholesale deposits. All three actions tend to put upward pressure on the one-day rate of interest and other very short-term rates. Conversely, when the direct clearers as a group have a surplus of settlement balances, they will tend on balance to extend more one-day loans to dealers, buy very short-term liquid assets, and be less aggressive in bidding for very short-term deposits, thereby putting downward pressure on the one-day rate and other very short-term rates.

However, even at this initial stage of the transmission process the Bank is faced with an element of uncertainty, since the desired settlement balances of direct clearers cannot be forecast with precision. Hence, at times, there may be a lag of a day or two before the Bank's actions have the desired effect on very short-term rates.

Second stage: From very short-term interest rates to the rest of the term structure and to the exchange rate

The actions of the Bank of Canada to alter the one-day rate will in turn influence the rest of the term structure of interest rates as well as the exchange rate, but that influence is not a precise one. It depends very much on the expectations and reactions of the financial markets.

The level of money market rates beyond the very short term is closely related to the market's expectations of the future path of one-day rates. If the Bank has just taken action to push up the one-day rate, say because of the release of new information about the strength of demand pressures in the Canadian economy, the impact of this increase on interest rates for one month, three months and so on will depend on how long market participants expect the central bank to maintain the higher one-day rate. The less uncertain the market is about the Bank's intentions, the smoother will be the response of other short-term rates.

In interpreting the movements of interest rates further out on the maturity spectrum, it is best to think of medium- and longer-term rates in Canada as depending on expectations of the future path of real interest rates (including risk premiums) and that of the rate of inflation. Expectations of real interest rates over the long term (apart from risk premiums) are likely to be related mainly to international factors.[3] These include expected world-wide movements in aggregate demand over the next few years and the expected profile over the longer run of the supply of saving (net of government dissaving) and of the demand for investment around the world. Risk premiums in interest rates will reflect such factors as the expected path of fiscal policy and political developments in Canada. Expected inflation, for its part, depends mainly on the market's expectations about monetary policy in Canada. Given the uncertainty surrounding all of these expectations, it is not surprising that markets at times react strongly to the release of information which changes their views about any of these factors. With financial markets around the world becoming much more open in recent years, the size of international financial flows has increased considerably. Thus, a major shift in expectations in one market can have a substantial effect on interest rates elsewhere in the world.

The effect of a change in very short-term interest rates on the exchange rate for the Canadian dollar is also a function of market expectations. The longer a new level of very short-term rates encouraged by the Bank's actions is expected to prevail, the greater the effect on the exchange rate. So the clearer the basis for the Bank's actions, the more predictable will be the

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3. Divergences between the expected patterns of aggregate demand in Canada and abroad will also have some impact on the real interest rate, and on expected movements in the real exchange rate for the Canadian dollar. But those factors become less important the further out one goes on the maturity spectrum.

effect on the exchange rate. However, the exchange rate is also affected by factors other than Bank of Canada policy actions. For example, the Canadian dollar-U.S. dollar exchange rate is also influenced by U.S. monetary policy, by the stance of fiscal policy in both countries, by the relative positions of the economic cycle in Canada and the United States, by the standing of the U.S. dollar relative to overseas currencies, as well as by political events. Once again, the release of new information can change expectations about future developments in any of these factors in a major way and thus have a significant influence on the exchange rate.

To illustrate the importance of market expectations, let us look at what would happen if the Bank acted in a way that the market viewed as inappropriate to the circumstances.

Suppose, for example, that the Bank acted to ease the one-day rate of interest in response to new information suggesting there was less inflation pressure in the economy than had been anticipated. What if the market did not share the Bank's interpretation of this new information and felt that the Bank's actions involved taking excessive risks on the side of higher inflation? Investors would immediately become more reluctant to hold Canadian dollar instruments at current interest rates, because of their expectation of higher inflation in the future. Moreover, investors' uncertainty about the future would increase because, at higher rates, inflation tends to be less predictable. There would thus be upward pressure on interest rates beyond the shortest term, both because of the higher expected rate of inflation and because of the higher risk premiums that investors would require in order to compensate for the increased uncertainty. Moreover, with the increased reluctance of investors to hold Canadian dollar instruments, the exchange rate would come under downward pressure. If the market began to

extrapolate the downward movement of the currency, it would intensify the upward pressure on interest rates as investors moved out of Canadian dollar investments to avoid a potential capital loss.

In the end, while actions by the Bank to bring about a decline in one-day rates in the face of a market that thought that such a change was inappropriate might still force a decline in interest rates at the very short-term end of the money market, perhaps even out to 30 days, they would result in a rise in rates further along the yield curve because of increased fears of inflation and a declining currency.

Investors in long-term bonds have become much more sensitive over the last 20 years to any hint of inflation or to any suggestion that a central bank has become more willing to take risks with inflation and therefore with a depreciating currency. This heightened sensitivity is the result of the high rates of inflation that prevailed in Canada and abroad during the 1970s and 1980s. Similarly, long-term bond markets now respond to fiscal concerns quickly and directly, presumably because of their concern that countries may act to monetize the debt when it becomes too burdensome.

There are also times when markets become particularly nervous and volatile because of economic shocks or concerns about policies, and central bank actions have to be directed to coping with disorderliness in markets. For example, there have been a number of occasions in the past decade when downward momentum in the Canadian dollar undermined confidence and encouraged extrapolative expectations of further declines in the Canadian dollar, which then fed back on interest rates, pushing them sharply higher. In such circumstances, the Bank's immediate task was to calm markets by helping them to find new trading ranges with which they were comfortable. Once the markets settled down, the

Bank was able to focus attention on the underlying economic situation, which typically had become lost to view during the turmoil.

Third stage: From interest rates and the exchange rate to aggregate demand

We have now discussed in some detail how actions taken by the Bank of Canada influence interest rates and the exchange rate and how the particular outcomes depend in an important way on the views and expectations of financial markets. The next stage in the process involves the transmission from interest rates and the exchange rate to aggregate demand. Here I can be brief as this part of the process has been widely studied and the views we take in the Bank are very much in the mainstream of the economics literature.

Changes in interest rates affect aggregate demand through a number of channels – the cost of capital, the incentive to save rather than to spend, and the effects on wealth and cash flow. The main components of demand that are affected are housing, consumer spending on durables, business investment in fixed capital and inventory investment. The extent of the response of spending will depend in part on how long the changed level of interest rates is expected to persist. This will be an important factor for those entities that borrow at the shorter end of the market.

The way in which the exchange rate affects demand is also relatively straightforward. A change in the value of the Canadian dollar will initially change the prices of those goods and services produced in Canada that are traded internationally and whose prices are set in world markets, vis-à-vis those whose prices are not, or at least not entirely, determined in world markets. These changes in relative prices will set in train a series of demand and supply responses that will affect the output of Canadian-produced goods, largely through their impact on exports and imports.

Of course, these responses do not take place overnight. And their size is dependent on whether the markets expect the change in the exchange rate to be transitory or long-lasting. Take, for example, a situation in which a sharp downward shock to aggregate demand in Canada leads to a decline in interest rates and to a significant depreciation of the Canadian dollar. The Canadian dollar price of those Canadian products whose prices are determined in world markets, such as most raw materials, will rise, making their production more profitable and inducing producers to exploit existing sources of production more intensively. Over time, suppliers will be induced to increase their capacity to produce such goods. How strong the investment response will be, and how soon it will begin, will depend importantly on expectations about the duration of the lower value of the Canadian dollar. If the decline were expected to be transitory or if there were a great deal of uncertainty about its persistence, producers would hesitate to expand their productive capacity.

All in all, the conclusion from this brief review of the third stage of the transmission mechanism is that there will typically be a significant response of spending to interest rate and exchange rate movements but that neither the extent nor the timing can be pinned down with precision. Expectations of future developments and the uncertainty surrounding the likely outcomes can have an important effect on how much and how quickly various entities change their expenditure patterns in response to changes in interest rates and in the Canadian dollar. In other words, the lags are long and subject to uncertainty.

Fourth stage: From aggregate demand to inflation

The final link in the long chain is from movements in aggregate demand to the rate of inflation. In our view, underlying inflation is affected primarily by the level of slack in the economy and by the expected rate of inflation.

The driving force behind inflation over time is, thus, the cumulative effect of the pressure of aggregate demand on capacity. Moreover, in the years of high inflation, there was a particularly close link between the prevailing rate of inflation and expected inflation. Thus, a period of excess aggregate demand resulted in an increase in the rate of inflation, which, in turn, fed quickly into expected inflation, putting further upward pressure on inflation in a process that eased only when the excess demand was eliminated.

However, to go back to my general theme, the world is a more uncertain and unpredictable place than this brief description of the linkages from interest rates and the exchange rate to aggregate demand and inflation would imply. Both aggregate demand and prices are in practice frequently subject to shocks. Demand shocks can be external or domestic in origin. The latter includes fiscal actions as well as sudden shifts in desired investment by companies or purchases of consumer durables by households. There are also supply shocks, which typically affect prices directly. These are events such as those leading to the increases in oil prices in the 1970s, natural disasters that affect the supply and prices of agricultural products, and changes in technology and shifts in world trade which can affect the availability of goods and their prices.

Such shocks will make demand and prices more uncertain, and they can also make it very difficult to estimate how much pressure aggregate demand is putting on the rate of inflation. Supply shocks can shift potential output in the economy. Potential output is in any case very difficult to pin down empirically and one must therefore be cognizant of the uncertainties surrounding any measure of slack.

The role of money and of credit

You may have noted that as yet I have not discussed the roles of the money holdings of the general public and of credit in the monetary transmission process. This is not to say that we think that such monetary and credit aggregates are unimportant; in fact, we follow their movements very closely. But we use them primarily as indicators of future developments, rather than as links in the long causal chain from Bank of Canada actions to the rate of inflation.

Our research indicates that the growth of real M1 (i.e., the narrow monetary aggregate, M1, deflated by prices) provides useful information on future real output growth, while the growth of the broader monetary aggregates is a good leading indicator of the rate of inflation. The monetary aggregates thus provide a useful cross-check on other projections of output and inflation, and rapid growth in these aggregates that is inconsistent with the economic situation and cannot be accounted for by specific financial developments can be an early warning signal of the need to tighten monetary conditions.

Credit has, until recently, been ignored in most of the mainstream literature about the transmission mechanism. Implicitly, economists have treated it as determined by the demand for funds by borrowers and passively accommodated by financial institutions. A more recent literature has focussed attention on the granting of credit, both as a microeconomic phenomenon and as an element in the transmission mechanism. And it has been given a more practical bent in the United States by the debate over the "credit crunch" of the early 1990s.

The aspect of the analysis of credit markets that is of particular interest to the Bank is whether its monetary policy actions lead to a systematic adjustment by financial institutions of their non-price terms and conditions of lending. If there were such adjustments that were not correlated with interest rate movements, the Bank would need to track them closely in assessing the effects on the economy of its policy actions. It is also important to determine whether there are autonomous credit market shocks, such as "credit crunches," that have broad macroeconomic implications and that need a response by the monetary authority.

Although considerable research has recently been done on these issues in the United States, the credit literature in Canada is still in its infancy. A number of papers on the subject were presented at a conference held at the Bank of Canada this past November. While not definitive, these papers did throw some light on several of the issues raised by the credit approach. Most notably, it would appear that credit is not particularly helpful as a factor explaining the economy-wide growth of nominal spending nor particularly useful as an indicator of changes in the trend of such spending.

INITIATIVES TAKEN BY THE BANK TO REDUCE UNCERTAINTY

The principal theme of the first part of this lecture has been that because of uncertainty of various kinds, the impact on the economy of monetary policy actions is not closely predictable. In this part, I want to discuss the initiatives that we at the Bank have taken to reduce one kind of uncertainty – the uncertainty that may exist about the Bank's behaviour – with the objective of improving the operation of financial markets and of the economy more generally. I will discuss five initiatives.

1. Establishing price stability as the goal of monetary policy

The Bank has discussed the benefits of price stability on many occasions, most fully in the *Annual Report* for 1990. I do not propose to repeat that discussion here, but I want to underline that one of the benefits of price stability is the increased certainty it brings to the economy. The inflationary process is always an uncertain one and it adds immeasurably to the difficulties facing savers and investors, borrowers and lenders, and employers and employees when they are making economic decisions that involve judgments about the future.

Some people object to this focus on the control of inflation as the final objective of monetary policy because they worry that it might encourage central banks to ignore the level of economic activity and employment. There is no question that monetary policy has a short-term influence on demand, production and employment, but surely the notion of a long-run inverse trade-off between inflation and unemployment has been widely discredited. In the long run the impact of monetary policy is on inflation, and the central bank must set its objective in terms of the variable it can expect to influence.

I hasten to add that the goal of price stability is not at odds with the achievement of economic growth and expanding employment. Because price stability is helpful in making investment decisions that will improve productivity, it is good for growth. Moreover, following a steady path aimed at maintaining price stability means that monetary policy will operate as a sort of automatic stabilizer for the economy. Excessive demand pressures that could lead to inflation are

dampened by such a monetary policy while weak demand that could result in price deflation leads to more stimulative monetary conditions. By contrast, a monetary policy that accommodates inflation will lead to cycles of boom and inflationary excesses, followed by recessions made more difficult by the need to correct inflation-related distortions. Price stability will thus contribute to overall economic stability.[4]

2. Inflation-control targets

When a country is suffering from inflation, the mere announcement or reiteration by the central bank of the goal of price stability will not suddenly persuade the public to shift their expectations and begin planning on the basis of price stability. The notion of price stability is somewhat vague and may leave questions in the minds of participants in the economic process. What does price stability mean in terms of the actual change in the price index? Over what time period will it be achieved?

This is the kind of situation we faced in Canada after our experience over the 1970s and 1980s, and it indicated to us that the general commitment by the Bank to move gradually to price stability still left too much public uncertainty about the objective of monetary policy. In other words, after two decades of inflation the credibility of such a general commitment by the Bank of Canada to price stability was not sufficient by itself to contribute to bringing about the changes in behaviour and expectations which would facilitate a decline in inflation.

In response, the Bank of Canada and the government of Canada introduced in February 1991 a set of explicit targets to help make the path to price stability more concrete. The infla-

tion-reduction targets aimed at bringing the rate of inflation down to 2 per cent (or a band of 1 to 3 per cent) by the end of 1995, to be followed by a further downward movement to price stability. In December 1993, a further set of inflation-control targets was jointly announced by the Bank and the government, which extended the band of 1 to 3 per cent inflation through 1998. This is to be followed by a movement to price stability, to be defined operationally by 1998.

By making its inflation-control objectives more explicit, the Bank hoped not only to influence inflation expectations but also to reduce uncertainty in the economy and in financial markets. Moreover, with credible targets, inflation expectations, and therefore inflation, are less likely to react to the temporary demand and supply shocks described earlier. The targets also act as a form of discipline on the Bank by making it more accountable for its actions. And that in turn makes monetary policy actions more predictable and less a source of uncertainty for others as they make economic decisions.

How have the targets worked out in practice? As you know, inflation has declined significantly over the years that the targets have been in place and, at about 2 per cent at present, is near the centre of the target band. However, I would not argue that the targets were single-handedly responsible for that decline. Other international and domestic factors have also been at work since the targets were first announced. Nonetheless, my assessment is that the targets have made a useful contribution to the achievement and maintenance of a low rate of inflation in Canada over the last four years. For example, it is likely that the prediction of very low inflation now being used by many Canadian firms in their medium-term planning is to an important extent attributable to the commitment of the Bank and the government to the targets.

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4. *A number of issues related to the behaviour of the economy under price stability were discussed at a conference on price stability held at the Bank of Canada in October 1993.*

3. The use of intermediate targets and indicators

The long lags and uncertainties in the transmission process leave everyone, including central banks, in a rather unsure and unsettled position while awaiting the effects of monetary policy actions on inflation. As a result, central banks have made use of various intermediate indicators and have at times set targets in terms of those indicators in order to assist in the conduct of policy and to provide more information and more comfort to observers that monetary policy was on track.

Following the abrupt rise in inflation and its persistence in most countries in the 1970s, central banks shifted their focus from operational targets for short-term interest rates to intermediate targets for quantitative variables expressed in nominal terms. Thus, many central banks established intermediate targets in terms of monetary aggregates. These were expected to provide an anchor for monetary policy and to avoid the type of policy which inadvertently accommodated the accelerating inflation of the late 1960s and early 1970s.

The Bank of Canada adopted such a target, expressed in terms of the narrow aggregate, M1, during the period between 1975 and 1982. As it turned out, this target, although useful initially, did not enable the Bank to hold down the rate of inflation when demand pressures built up in the late 1970s. Part of the problem was that M1 was much more responsive to the Bank's actions on very short-term interest rates than were aggregate demand and inflation.[5] Moreover, extensive financial innovation made interpretation of the aggregate increasingly difficult,[6] and it was finally dropped as a target in 1982.

While the Bank has examined other aggregates to use as possible intermediate targets in the period since 1982, none of them turned out to be sufficiently reliable. As a result, for some years we again had to rely upon operational targets for short-term interest rates.

On the face of it such a policy approach might seem to have all the same problems and uncertainties encountered in the late 1960s and early 1970s when operational targets for interest rates did not provide an anchor against accelerating inflation. What was different this time was a much closer focus on the objective of price stability and, more recently, the adoption of inflation-control targets.

A further important evolution in recent years has been the use by the Bank of monetary conditions rather than short-term interest rates as its operational guide to policy. When we use the term monetary conditions we mean the combination of short-term interest rate and exchange rate movements. And we aim at a path for monetary conditions which would bring about a path for aggregate demand and prices consistent with the control of inflation.

The Bank of Canada adopted monetary conditions as an operational guide because we recognized that, as described earlier, under a flexible exchange rate regime monetary policy operates through both interest rates and the exchange rate. Hence, when the central bank is acting to ease or tighten its policy stance (in response to new information) it must take into account developments in both channels through which its actions influence aggregate demand. Similarly, when there is an exogenous shift in the exchange rate, for example, a depreciation resulting from political concerns, the monetary conditions concept would clearly indicate the

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5. Gordon Thiessen, *"The Canadian Experience with Monetary Targeting,"* in Paul Meek (ed.) Central Bank Views on Monetary Targeting *(New York: Federal Reserve Bank of New York, 1983).*

6. Charles Freedman, *"Financial Innovation in Canada: Causes and Consequences,"* American Economic Review *73 (May 1983).*

expansionary nature of the shock and the need to tighten interest rates to offset it.

The Bank constructs an index of monetary conditions (the MCI) by weighting short-term interest rates and the effective exchange rate by the relative size of their estimated effects on aggregate demand. Hence, a movement in the MCI is a short-hand measure of the effect on aggregate demand of the changes in both channels through which monetary actions have their principal effect.

Now, I want to be careful not to oversell the MCI. It is not used in a mechanical way to set policy. For example, we do not respond to every exchange rate wiggle by trying to adjust interest rates. But if some development caused the exchange rate to move to a new trading range and it appeared to be ready to remain there for some time (and if there were no other shocks affecting aggregate demand), the Bank would try to offset its effect on aggregate demand by encouraging an offsetting movement in interest rates.

It is also worthy of note that the Bank has no direct control of the "split" of its actions between interest rates and the exchange rate. At times, because of the uncertainties in financial markets described earlier, an easing in the stance of monetary policy will result in a small decline in interest rates and a sizable depreciation of the Canadian dollar. At other times, the same action might lead to a larger decline in interest rates and little depreciation of the dollar. In this context, let me underline that the Bank does not control and does not attempt to control the level of the exchange rate. It is the market's interpretation of what the central bank is trying to do, in the context of the economic environment, that determines what happens to the exchange rate in response to central bank actions.

While we use monetary conditions as an operational guide, it is not possible to set a target path for the MCI which remains unchanged over time. Rather, monetary conditions must constantly be re-evaluated and adjusted to respond to shocks of one sort or another to ensure that the economy remains on track to the inflation-control objective.

4. Target ranges for the overnight rate

With the use of monetary conditions, the linkage goes from our actions in adjusting settlement balances to changes in the overnight rate and then to the desired change in the index of monetary conditions. As I noted earlier, this is the stage in the transmission mechanism that has tended to receive the least study, and our actions and intentions have not always been clearly understood in the financial sector.

To provide more transparency to its actions the Bank decided in the middle of last year to change its operating tactics in order to be more explicit about the range into which it wanted the one-day rate of interest to fall. Since that time, there has been a target range of 50 basis points for the one-day rate. The Bank has intervened actively through its operations in the money market to hold the one-day rate within the range and to make the limits of the range clear to the market. The target range is changed when economic or market conditions require it, but the use of such a target implies that changes would not typically be frequent. Nonetheless, there may be occasions, such as in January of this year, when market conditions necessitate a series of movements in the target range in a very short period of time. When the Bank decides to change the target range, the market learns of the change very quickly from the rates at which the Bank intervenes in the overnight market. By making the target range for the overnight rate explicit the Bank hopes to reduce the uncertainty about its intentions that sometimes has interfered with the

transmission of monetary policy actions to interest rates further out along the yield curve and to the exchange rate.

5. *More information on the Bank's operations*

The final initiative of the Bank of Canada to reduce uncertainty about monetary policy that I want to mention is the provision of more public information on our monetary policy operations and on our interpretation of economic and financial developments. Many of you may already be familiar with the published excerpts of the report on monetary policy provided to the directors of the Bank at the regular meetings of the Board. These excerpts have been released since 1987. We have also included a discussion of monetary policy in each issue of the Bank's quarterly *Review* since early 1993.

We are about to supplement that information with a more detailed account of inflation developments and our conduct of monetary policy in a semi-annual *Monetary Policy Report*. This report will provide an account of our stewardship of monetary policy and will be useful for those who want to know more about monetary policy for their own decision-making. The first such report will be available in early May of this year.

CONCLUDING REMARKS

There are three important conclusions for monetary policy that I draw from this discussion of uncertainty and the monetary policy transmission process.

The first has to do with the role that monetary policy can play in the economy. The widespread existence of uncertainty makes it evident that monetary policy cannot be conducted in some sort of mechanistic way. But neither should one go to the other extreme and conclude that it is almost impossible to carry out a coherent policy in the face of all the uncertainty.

Because the effects of monetary policy are spread over time in a way that is not readily predictable, the conduct of monetary policy must have a stable, medium-term focus. That rules out trying to fine-tune the economy in such a way as to avoid cyclical swings in production and employment. In contrast, the goal of maintaining price stability over time is well suited to the monetary policy instrument. To put it another way, price stability is the contribution to the effective operation of the economy that monetary policy is capable of delivering.

My second conclusion has to do with the importance of financial markets and expectations about the future in those markets to the transmission of monetary policy. The description of the transmission process in this lecture does not correspond to the widely held view that the Bank of Canada controls the spectrum of interest rates in Canada. That view is a holdover from the days when financial markets here and elsewhere were subject to controls and restriction of various sorts, and the pressures in markets tended to show up in limitations on the availability of funds rather than in interest rates. These days, markets are more open, more international and, as a result, much more efficient. But it does mean that interest rates are more variable, and rates in Canada will move around in response to international events or domestic developments that alter market expectations.

However, this does not imply that the market controls interest rates and the Bank has no capacity to pursue a monetary policy geared to Cana-

dian requirements. I would summarize my views as follows. The Bank has a direct effect on very short-term rates and through them an influence on the exchange rate. Our main effect on longer-term rates occurs indirectly through our influence on market expectations regarding inflation. These influences are sufficient for the Bank to carry out an independent monetary policy to control inflation. However, the clearer our commitment is to inflation control and price stability, the more effective our monetary policy will be.

That brings me to my third conclusion. In the uncertain world that I described in this lecture, subject to shocks and with financial markets more open and international than they used to be, it is important not only that the ultimate objective of monetary policy be clear but also that the implementation of policy be as transparent as possible. And that is why the initiatives by the Bank to provide more information that I have described involve every stage of the transmission process, from our operations to influence the one-day interest rate to our ultimate effect on inflation.

Information is of course useful only if it is credible. With respect to our commitment to the achievement and maintenance of price stability, credibility is something that must be earned through performance over time. But if you look at economic history, there can be no question that once a monetary policy geared to price stability gains credibility, the objective is easier to maintain and becomes a powerful force for sustained good economic performance.

The implementation of monetary policy in Canada

by Bruce Montador

This paper discusses the various instruments through which the Bank of Canada implements monetary policy, with some reference to the changes that have taken place with the move to a system without required reserves. At the outset, an important distinction to bear in mind is that between the longer-term objective of monetary policy – price stability – and the setting of monetary conditions required to achieve the objective, which can vary depending on the economic environment.

   After briefly describing how the Bank decides on the appropriate setting of monetary conditions, the paper looks at the regular daily drawdown or redeposit, the central mechanism through which monetary policy is implemented, and then discusses the Bank's use of open market operations.

DECIDING ON MONETARY CONDITIONS

The Bank of Canada's stated goal of monetary policy is price stability, and it has a fairly standard view of the transmission mechanism.[1] In implementing policy the Bank assesses the extent to which monetary conditions (by which it means the combined impact of interest rates and the exchange rate on aggregate demand in the economy) need to be tightened or eased.[2] It bases this on a forward-looking view of the evolution of the economy and its judgement about the impact of short-term interest rates and the exchange rate on spending. The path of spending expected in consequence is one that meets the inflation reduction goals of Canadian monetary policy. The Bank makes use of economic projec-

1.   *Inflation-reduction targets were announced jointly by the Minister of Finance and the Governor of the Bank of Canada in February 1991 and were extended in a joint statement by the government and the Bank in December 1993. The broad policy implementation framework described in this paper would be applicable to alternative policy targets such as the rate of growth of a monetary aggregate or of nominal income.*
2.   *For a discussion of monetary conditions as seen by the Bank of Canada see C. Freedman, this volume.*

tions and other indicators of economic and financial developments to arrive at these assessments (see Duguay and Poloz 1994).

A given path of monetary conditions is compatible with many different combinations of exchange rates and interest rates. If the currency appreciates because, for example, of portfolio shifts that, in and of themselves, have no immediate consequences for aggregate demand, interest rates could be eased to maintain the same overall level of monetary conditions. (In effect the expansionary impact on spending of lower interest rates would offset the contractionary impact of a higher Canadian dollar.) However, if the currency strengthens because of an increase in the demand for Canadian exports, then it may not be appropriate to let interest rates come down, because the extra pressure on Canada's productive capacity could work against the goal of achieving and maintaining price stability.

In general, the Bank would anticipate a reaction of exchange markets to its efforts to change interest rates, and would factor this endogenous response into its view of the appropriate change in short-term interest rates. If the exchange market did not react, a larger change in interest rates than originally thought would be required to achieve a desired setting for monetary conditions. If the exchange rate reacted more strongly than expected to an initial interest rate move, the appropriate overall change in interest rates would be less. To some extent this may occur without explicit action by the Bank as the money market often reacts directly to changes in the exchange rate. A fall (rise) in the dollar can push short-term rates up (down).

In discussing the impact of interest rates on the economy the reference is of course to the whole yield curve. However, the central bank does not directly determine longer-term interest rates, which are influenced by a number of factors, including inflation expectations, a risk pre-

mium and the strength of overall demand in the economy. Because the Bank of Canada's control of high-powered money is exercised through its control of the supply of settlement balances to the directly clearing members of the Canadian Payments Association (twelve banks and non-bank financial institutions with accounts at the Bank of Canada), its direct influence is on the overnight financing rate, as changes in these balances tend to lead to changes in the rates on one-day (or overnight) funds. Other short-term rates are affected by movements in the overnight rate. In particular, because banks and securities dealers need to finance an inventory of money market instruments, and rely to a considerable extent on the overnight market to do so, the Bank of Canada's actions to influence the cost of overnight funds will affect the treasury bill and other money market rates, as well as the weekly treasury bill tender results. (Bank Rate is set 25 basis points above the tender average for three-month bills.)

Given an objective for overall monetary conditions, the Bank of Canada will seek to keep the overnight rate within a range (in 1994 this was generally about 50 basis points wide) that it believes will produce the desired level of short-term money market interest rates (including the three-month treasury bill rate).[3] Decisions about appropriate action to achieve the desired results are then taken on a continuous basis.

The particular relationship between the overnight financing rate and the general level of money market rates will vary according to the sentiment prevailing in money markets. If participants are very bullish, and short-term rates as a result start to come down faster than the Bank views as appropriate (taking into account

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3. *The frequency of institutional changes and the number of daily, weekly, averaging period, monthly, quarterly and yearly factors affecting the money markets have meant that, to date and despite the abundance of data, the Bank of Canada has not been able to rely on formal models of this or some other relationships discussed in this paper.*

Chart 1   3-month treasury bills and overnight financing costs
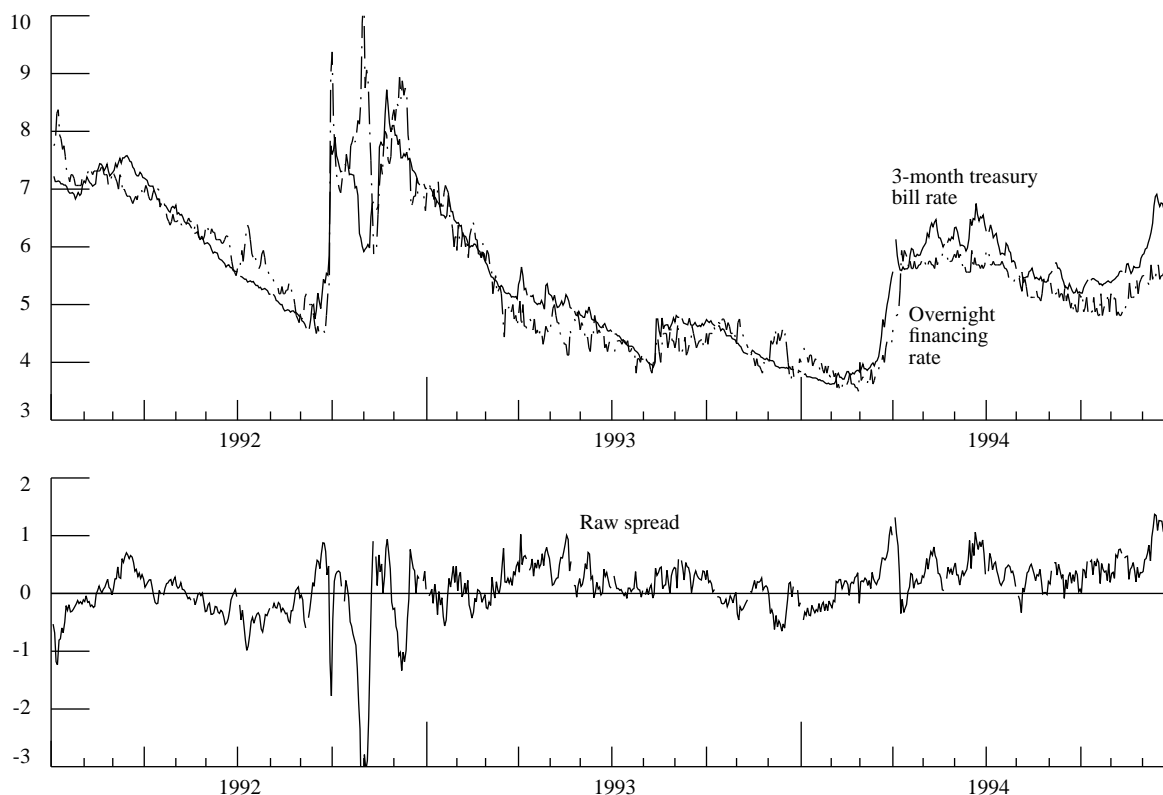
exchange rate movements as well),[4] overnight rates may need to be above the three-month treasury bill rate. This would impose a running cost on financial intermediaries and other investors holding treasury bills that are funded in the overnight market, offsetting part of the capital gain that they expect to make as interest rates fall. In contrast, if interest rates are rising, and

4. *The Bank believes that steady movements in interest rates are more likely to be sustained than are sharper movements, which do not give investors – including foreign investors – time to adjust their views about the appropriate level for interest rates given economic circumstances and the outlook for inflation. See the* Bank of Canada Annual Report of the Governor, 1992*, p.10.*

such a movement is deemed inconsistent with the desired level for monetary conditions, the Bank would provide the overnight market with additional liquidity in order to temper the rising rate sentiment. Under these circumstances the overnight rate will typically be below the three-month treasury bill rate. Between 1992 and late 1994 there were examples of both situations (see Chart 1).

The next two sections discuss, first, the daily decision to inject or withdraw funds from the financial system, and, second, the use of open market operations during the trading day.

THE DRAWDOWN/REDEPOSIT MECHANISM

The Bank of Canada's ability to influence monetary conditions depends on the fact that settlement of transactions among financial institutions occurs on its books, and that the Bank can alter the total amount of settlement balances available to the institutions on a retroactive basis.

The directly clearing members of the Canadian Payments Association maintain accounts with the Bank in order to be able to settle transactions among themselves. If, at the end of a given day, the net of all transactions between customers of institution A and customers of other institutions is a $20 million total debit from the accounts of customers of A then the following morning $20 million will be removed from the account of A at the Bank of Canada, with effect retroactive to the previous day. In order to be able to meet that obligation the institution must either have at least $20 million on deposit with the Bank or have access to credit from the Bank of Canada. If the net transaction is in favour of A's customers the amount will be added to A's account, again retroactively to the day before. Since accounts at the Bank do not pay interest, the direct clearers have an incentive to minimize their deposits and to rely on central bank credit if they can do so at a cost that is not prohibitive. Historically, and this is still true in many other countries, access to central bank credit has typically been limited by rationing or moral suasion when financial institutions' demand for it would otherwise be too strong.

However, the new operating procedures for implementing monetary policy in Canada are designed to lead direct clearers to adjust their level of settlement balances simply on the basis of relative costs.[5]

In the past the demand for settlement balances was linked to a system of required reserves for banks. Required reserves have traditionally been justified by a desire to influence the size of the money multiplier and by prudential concerns. However, central banks' views about money supply determination have for a long time been that the money stock is demand determined, and a function of income (and/or wealth) and interest rates. Views regarding the prudential reasons for reserves have also changed. If solvent banks have access to central bank credit they do not need reserves to protect themselves from runs, and if one is concerned about their profitability or solvency, forcing them to keep part of their assets in a non-income generating form is counter-productive. The Canadian government's decision to eliminate reserve requirements for chartered banks can thus be seen as simply removing a tax on the banks. The need to do so was the result of concerns about a level playing field within the financial community, as legislation was being changed to give some competitors of banks, which were not obliged to hold non-interest bearing reserves at the Bank of Canada, lending powers similar to those of banks. Eliminating reserves does not affect the Bank of Canada's ability to implement monetary policy because the Bank continues to determine the availability of the means of final settlement.

Under the framework introduced in June 1992, shortly after proclamation of the new leg-

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5. *Before the recent changes to reserve requirements, moral suasion was used to discourage direct clearers from borrowing excessively from the Bank of Canada. However, the system was in increasing need of change, especially given the role of non-bank clearers, which did not have reserve requirements (or the benefit of "averaging"), and the decline in banks' required deposits as their note holdings had grown (because of ATMs) while their reservable deposits stagnated. The growth in reservable deposits was limited by the fact that banks did not have to hold reserves against deposits in their mortgage loan subsidiaries in order to allow them to compete in this area with the trust companies, which had no reserve requirements.*

islation on financial institutions, which *inter alia* abolished reserve requirements, direct clearers continue to maintain accounts with the Bank of Canada, but exclusively for purposes of settling transactions.[6] If the result of a day's operations leaves a direct clearer with a negative clearing balance greater than the funds it has in its account, the clearer can get an overdraft loan from the Bank of Canada. The interest rate charged on this overdraft is Bank Rate. Since Bank Rate is typically very close to the overnight rate and the financial institution will be earning a similar rate on the asset implicitly being financed by the overdraft, the overdraft charge alone would provide little deterrent to borrowing from the central bank. In order to ensure that the demand for central bank credit is limited, clearers must satisfy an additional constraint. Over a calculation period of four or five weeks ending the third Wednesday of each month their cumulative position (the sum of their daily positions) at the Bank of Canada, the impact of overdrafts excluded, must be zero or positive. If it is not they are assessed a charge equivalent to a one-day loan at Bank Rate on the deficiency. Central bank credit thus imposes a second cost on direct clearers: they will have to offset overdrafts with a positive balance on which the opportunity cost will be the market rate of interest (roughly Bank Rate), or pay an equivalent charge. The effective cost is less than twice Bank Rate, however, because "averaging," the ability to offset positive and negative balances, provides the clearer with greater flexibility during the rest of the calculation period.[7]

Work done at the Bank of Canada suggests that the direct clearers' demand for settlement balances will be well defined (see, for example, Longworth 1989). This means that if the Bank of Canada wants to raise overnight rates it can cut back on the amount of such balances to which the clearers as a group have access, and vice versa when it wants to lower rates. How does it adjust the level of these balances? The Bank takes advantage of the fact that it is also the government's banker.

The federal government maintains an account at the Bank of Canada. It also has other demand balances, shares of which are auctioned off each week among the direct clearers. The government's receipts and disbursements (including, for example, the impact of foreign exchange intervention conducted by the Bank of Canada on the government's behalf) flow to its account at the Bank of Canada. These transactions would tend to decrease or increase the balances available to the financial system. This would add unnecessary volatility to financial markets, so the Bank of Canada routinely neutralizes (or sterilizes) these transactions by offsetting the dollar amount of the funds that they drain from or add to the system. This is done by shifting balances between the government's account at the Bank of Canada and its accounts at the direct clearers. (One consequence of this is that foreign exchange intervention is automatically sterilized.) The Bank either draws down the settlement balances that would have been gained by the clearers as a result of government disbursements or makes a redeposit of the balances that would otherwise have been lost by the clearers as a result of net government receipts. It also

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6. *In fact until July 1994 the chartered banks had to maintain a declining level of required reserves in the form of vault cash or deposits with the Bank of Canada but these were lined to the historical (July 1991 – June 1992 average), not the current, level of deposits at these banks. The basic elements of the present system were introduced in November 1991, before the legislation was proclaimed.*

7. *This can be seen by noting that once a clearer has a negative cumulative excess balance position, subsequent non-interest-bearing excess balances during the averaging period do not have an opportunity cost at market rates of interest, as they reduce the size of the end-of-period fee. A symmetric argument about overdrafts holds when the clearer has a positive cumulative position.*

does this to offset the unwanted impact on settlement balances of its own transactions (including open market operations). This neutralization is one purpose of the so-called drawdown/redeposit mechanism.[8]

However, in addition to neutralizing these flows, the Bank of Canada also uses the drawdown-redeposit mechanism to effect changes to the overall supply of settlement balances for monetary policy purposes, i.e., to influence overnight rates. Every night, after the markets are closed, the staff of the Securities Department advise senior management of the outlook for the next day's markets. The information assessed includes the direct clearers' target positions for their spot balance at the Bank of Canada and their expectations about the redeposit or drawdown. In addition, there are forward quotes on the overnight rates for effect the next day, as well as information about the funding positions of the major direct clearers (the large banks). On some days these institutions need to raise short-term money, on others they will be net lenders. The size of the inventories that investment dealers have to finance the next day is also a factor. If the Bank of Canada has done repurchase operations (discussed below) during the day it will know that participants will either need to finance the unwinding of those transactions the next day, or that they will receive the funds that had been taken from the system. In addition, the government auctions off any funds in excess of its daily working requirement to the direct clearers every day in the form of very short-term deposits, and they will serve as a source or use of funds to the direct clearers as a group depending on the net change in the amount of such balances outstanding.[9] Of course, in many cases changes in these balances reflect bond and treasury bill deliveries net of maturities, or heavy government receipt flows (e.g., income tax collections) or disbursements (e.g., social security payments).[10] All of these factors may have a bearing on the probable level of overnight financing costs the next day. It is worth remembering that most of the overnight financing comes from off-street sources (corporations, provincial governments and agencies), but the marginal funds will typically come from the direct clearers and thus be influenced by the level of settlement balances provided by the Bank of Canada.

The Bank constantly reviews its objective for the overnight rate to ensure that it is still appropriate for achieving the desired level of money market rates (and of the weekly treasury bill tender in particular). Each evening it then decides by how much to adjust the neutralization component of the drawdown/redeposit transaction, providing additional settlement balances or reducing the amount available, in order to generate the desired overnight rate within the target range.[11] The adjustment is thus based on an implicit estimate of the elasticity of the overnight rate to a change in the supply of settlement balances. The existence of the monetary policy component of the transaction adds of course to the complexity of the direct clearers' estimation problem. The transaction occurs every morning at about 8:30 eastern time and affects the direct clearers' balances as of the day before. When the financial institutions are deciding on their money market operations, which are aimed at generating the amount of settlement balances they wish to have on deposit with the Bank of Canada, they

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8. *For further details see Clinton (1991).*
9. *For further details see O'Connor (1991).*

10. *The impact of any open market operation or government transaction on settlement balances is in principle neutralized by the drawdown/redeposit transaction. However, the institutions affected by the redeposit or drawdown may not be those needing to reinvest funds or refinance positions or those involved in the government transactions.*
11. *On occasion the Bank may be constrained by the size of government balances in the amount it can draw down. However, such a constraint is purely technical and, if necessary, open market operations can be used to achieve the desired result.*

have to form a view of their likely position the next morning, so they form expectations about the drawdown/redeposit transaction, at the same time as they track their regular transactions. (As part of this process they typically require major accounts to advise them of large transactions where possible.) When the drawdown/redeposit transaction is effected it is too late for the clearers to do anything to adjust their position for the previous day. Any extra balances provided will mean that they have more funds to lend on that day, putting downward pressure on the overnight rate, and vice versa for reductions in settlement balances. Because the direct clearers do not know with precision the outcome of the daily clearings they have to make an allowance for clearing "surprises," as these are costly for them.[12]

In order to give an idea of the types of decisions that are taken every evening, Tables 1 and 2 summarize the type of information used to make them. The names for the direct clearers are fictitious. The tables show the previous day's spot and cumulative excess settlement balance position for each clearer, their targeted spot and cumulative positions for that day, and system positions. In addition the tables show current overnight rates, the rate expected by the market for the next day, and the ranges of clearers' expectations about the drawdown/redeposit transaction. They also indicate if any of the clearers have large amounts to lend or to raise in

the overnight markets. (Note that a clearer can have a positive cumulative position and still need to raise money the next day. Funding needs or lending capacity are a function of the clearers' decisions concerning the management of their overall balance sheet, not just their position vis-à-vis the Bank of Canada).[13] Finally they show the system spot positions implied by different drawdown/redeposit transactions, given the extent of government and central bank transactions that require neutralization.

In the example in Table 1, two of the direct clearers have unusually heavy funding needs the next day. This will tend to put upward pressure on the overnight financing rate. The drawdown that would give the clearers their targeted level of settlement balances is bigger than the clearers expect (-300 versus a range of -100 to +100). This could reflect an underestimate by them of flows to the government and central bank, which have to be neutralized. The Bank would in this situation probably act to set the system spot above the level targeted by the clearers in aggregate, as it in fact wants the overnight rate to fall rather than back up as suggested by the quotes for the next day's funds. For example, the Bank might decide to aim for a system spot of -300 (rather than the -500 targeted by the direct clearers), which would imply a drawdown of 100.[14] Effectively, the overall transaction (-100) is equivalent to a redeposit of 351 to offset net

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12. *During the transition to zero reserves some bank clearers still had significant required deposits. Although these deposits represented a tax on those banks, they also provided them with greater flexibility in cash management, as they could lend up to the amount of their required deposits on any given day without requiring an overdraft. On occasion this added some stickiness to the responsiveness of overnight rates to the level of settlement balances. If banks with significant required deposits had a large positive excess cumulative balance late in the period as a result of clearing surprises, they could continue to lend for a while even if the Bank of Canada moved to withdraw funds from the system, which at times delayed the system's response in producing a tighter overnight rate.*

13. *In consequence the financial institutions shown in Tables 1 and 2 to have large funding needs or amounts to invest are chosen for illustrative purposes – there is no link to other information shown in the tables. Examples of factors that do influence the banks' funding or lending positions are: a number of term deposits coming due within a short period, creating large funding needs; an investment decision to wait before acquiring a large position in treasury bills or bonds, allowing free funds to be invested in the overnight market.*
14. *The absolute magnitude of drawdowns or redeposits is not meaningful in terms of understanding what monetary policy is doing. It is the difference between the transaction and what market participants are expecting that is significant.*

Table 1		A need to inject funds into the system			
Excess settlement balances					
	Previous position		Target		Funding position*
Clearer	Spot	Cumulative	Spot	Cumulative	
AB Bank	322	-111	-111	-222	
Bank of Winnipeg	-87	-130	-119	-249	☐
Banque du St. Laurent	-107	-23	-178	-201	
Manufacturers Bank	32	161	-58	103	
Maritime Bank	-63	192	-73	119	
Traders Bank	93	506	52	558	☐
Ontario Trust	-8	34	-13	21	
Merchant Trust	-52	85	12	97	
Co-op Credit of BC	21	168	-12	156	
System	151	882	-500	382	

Range of direct clearers' drawdown redeposit (DD/RED) transaction forecast   -100 to +100
(a drawdown is negative and a redeposit is positive)

Possible system spot	Possible change in system spot**	DD/RED transaction	Of which: Neutralization of government and central bank operations
-500	-651	-300	351
-300	-451	-100	351
0	-151	+200	351

Bank rate	5.25%
Today's Overnight (O/N) rate	5.00%
Indicated next day O/N rate	5.25%
Target O/N rate	4.75%

*   ☐ large funding needs   ▮▮▮▮ large amounts to invest.
**Difference between the system spot and the previous system spot.

Table 2	A need to withdraw funds from the system

Excess settlement balances

Clearer	Previous position		Target		Funding position*
	Spot	Cumulative	Spot	Cumulative	
AB Bank	322	-111	40	-71	
Bank of Winnipeg	-87	-130	-101	-231	▆▆▆▆▆▆
Banque du St. Laurent	-107	-23	70	47	
Manufacturers Bank	32	-161	60	-101	
Maritime Bank	-63	192	-75	117	
Traders Bank	93	-506	90	-416	▆▆▆▆▆▆
Ontario Trust	-8	34	5	39	
Merchant Trust	-52	-85	10	-75	
Co-op Credit of BC	21	168	1	169	
System	151	-622	100	-522	

Range of direct clearers' drawdown redeposit (DD/RED) transaction forecast   -100 to +100
(a drawdown is negative and a redeposit is positive)

Possible system spot	Possible change in system spot**	DD/RED transaction	Of which: Neutralization of government and central bank operations
250	+99	400	301
100	-51	250	301
-150	-301	0	301

Bank rate	5.25%
Today's Overnight (O/N) rate	5.00%
Indicated next day O/N rate	4.75%
Target O/N rate	5.125%

* [   ] large funding needs   ▆▆▆▆▆▆ large amounts to invest.
**Difference between the system spot and the previous system spot.

flows to the government and Bank of Canada and a drawdown of 451 for monetary policy purposes (which would reduce the spot position from 151 to -300). The example in Table 2 is one where the neutralizing redeposit is bigger than expected, two of the banks have unusually large amounts available to lend, and the next-day quotes would see the overnight rate falling while the Bank would like it to go up slightly. In this case the Bank would probably set the system spot below the targeted level. For example, the Bank might aim for a system spot of -150, which would require no transaction, equivalent to a combination of a redeposit of 301 for neutralization of net flows to the government and the Bank and a drawdown of 301 for monetary policy purposes.

It is important to note that, in looking at the drawdown or redeposit transaction, it is not the level of balances provided that should be interpreted as generous or restrictive, but where that level is relative to the direct clearers' targeted level.

While the drawdown/redeposit mechanism is the primary technique used to implement policy, open market operations also play an important complementary role in monetary policy implementation, particularly during periods of interest rate volatility.

OPEN MARKET OPERATIONS

Open market operations in the treasury bill market are a supplementary technique used by the Bank of Canada in its conduct of monetary policy.[15] Because the Bank's objective for overall monetary conditions is cast in terms of short-term money market rates, the desired range for the overnight rate is only a means to that end, and can in fact turn out to have been inappropriate. In either case the drawdown/redeposit mechanism may therefore need to be supplemented through open market operations involving temporary or outright sales or purchases of treasury bills.

In broad terms, the Bank has two techniques for open market operations: repurchase operations,[16] which affect the overnight market, and outright purchases or sales of treasury bills, which affect the money market more generally. During the day the current trades in the overnight market and the amount of overnight financing money market participants still need to raise give the authorities a sense of where that market is going. An indicator of the likely outcome for the next treasury bill auction (and thus of the probable movement in money market rates generally) is the current quotation for the when-issued three-month treasury bill.[17]

If the Bank chooses to intervene in the overnight market it uses repurchase techniques: doing Special Purchase and Resale Agreements (SPRA or "specials")[18] to put a ceiling on rates or Sale and Repurchase Agreements (SRA or "reverses")[19] to put a floor under them. When the

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15. *For more information about the treasury bill market see Fettig (1994).*

16. *For further details see Clinton and Fettig (1989).*

17. *The when-issued market is a forward market in the treasury bills that will be auctioned on the coming Tuesday, which begins to operate with the announcement the previous Tuesday of the size of the upcoming auction. It is used primarily by the direct clearers and the major securities market participants as a way of preselling or hedging the treasury bills that they expect to take on at the next tender. The yield on the when-issued bill tends to be a good predictor of the upcoming auction yield. For more information on the when-issued market see Pugh (1992).*

18. *They are called specials because regular PRA is a form of financing available up to a predetermined limit to designated money market dealers (dealer jobbers) at Bank Rate and at the initiative of the dealers.*

19. *They are called reverses or reverse repos because they are the opposite transaction to SPRA or PRA, which are also called repos.*

Bank offers to do SPRA it announces to the job-bers (designated banks and investment dealers) that it will buy treasury bills from them and agree to sell them back the next day at a specific price. The difference in price between the two transac-tions is the interest rate at which the Bank is pro-viding financing to the jobbers. Although there are lines of credit that provide notional upper limits to the amount of such credit each jobber can receive, the Bank can choose to offer SPRA more than once on the same day. It can thus put a ceiling on the overnight rate. The level at which the Bank chooses to offer SPRA can also be an important policy signal to the market. However, if SPRA is offered at the current Bank Rate this would generally indicate that the operation is technical, designed to help the market conduct its business in an orderly fashion. SRA is precisely the opposite transaction and is in practice offered to the major direct clearers (i.e., the large banks), the main sources of overnight financing at the margin, as it is intended to mop up excess cash in order to limit declines in the overnight rate. Again, the level at which SRA is offered can be an important policy signal. When both SPRA and SRA have recently been offered the market may thus have an explicit view of the Bank's desired range for overnight rates. However, as market conditions evolve this range will change. The Bank has not to date made explicit use of either instrument just to signal a change in the target range, reserving them for times when it wishes to limit movements in the overnight rate itself. In some cases, particularly for SRA, the simple fact that the Bank has offered to engage in repurchase operations may have the desired effect on the overnight rate without any transac-tion taking place. Table 3 provides some indica-tion of the frequency and magnitude of repurchase techniques during the period from January 1993 to October 1994. August 1993,

December 1993 and April 1994 were months in which SRA was offered but not transacted.

The Bank may instead feel it needs to oper-ate directly in the treasury bill market in order to influence the result at the next tender. The Bank of Canada holds a portfolio of government secu-rities, a large portion of which are treasury bills.[20] At each week's tender it buys additional bills, primarily but not exclusively the three-month bill, as some of its portfolio matures. Dur-ing the following week it will, if necessary, inter-vene in the cash treasury bill market, the market in the newly issued three-month bill, to influence the outcome at the next tender (and thus overall short-term money market rates) in a way consist-ent with the Bank's monetary conditions objec-tive. In practice it has sold bills more often than it has bought them. If the Bank wishes to limit the decline in the Bank Rate it may decide to sell the cash (current) three-month bill when the when-issued bill trades close to the desired level, if the market looks ready to push through it. Depending on the strength of the market, the Bank may have to sell more than once on a given day, or on several days during the week. If the market is very strong and the Bank has few of the current three-month bills left, it can sell "back-dated" bills, those that have maturities somewhat less than three months. The Bank has not to date intervened directly in the when-issued market, although there is nothing in principle to prevent it from doing so. However, in cases where the downward pressure on rates is particularly intense, the Bank has sold on tender morning (and, less often, on the day before the tender) coincident-to-when-issued treasury bills from its

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20. *The proportion has been growing over time as the size of the money market, which the Bank seeks to influence, has been growing faster than the demand for notes, the principal item on the liability side of the Bank's balance sheet. The phase-out of required reserves has accelerated the rise in the proportion of treasury bills by reduc-ing the size of the Bank of Canada's balance sheet. The result has been a decline in the proportion of bonds in the Bank's portfolio.*

portfolio. These are bills that had original terms to maturity of six months or one year and that will mature on the same date as the three-month bill to be auctioned that week.

The Bank of Canada does from time to time purchase bills in order to limit increases in the treasury bill rate. It also does "switches" of bills of different maturities with the market, generally to rebalance the structure of its portfolio. (For example, if it sold all the three month bills it had bought at the auction in open market operations the following week, then three months later it would have a very small amount of maturing bills, which would limit its ability to take on bills without blowing up its balance sheet. Switches can allow it to adjust the pattern of its portfolio to eliminate this problem.) Table 3 gives an indication of the size of the Bank of Canada's operations in the treasury bill market from January 1993 to October 1994. It does not distinguish between purchases or sales to influence rates and those that are part of switches, but, since switches are by definition symmetric, the difference between total sales and total purchases gives a sense of the direction of the Bank's operations. It also does not separate sales of bills in the cash market and sales of the coincident-to-when-issued bill. The amounts involved in the latter category are typically small as it is the signalling effect that is important. As can be seen, open market operations are used a good deal, but not all the time, nor always with the same intensity. During 1993 the Bank sold bills in the cash market in 43 of the 52 between-tender periods and made use of the coincident-to-when-issued market on 3 occasions (all on tender mornings). In the first ten months of 1994 such sales were less frequent (occurring in 13 of 44 between-tender periods, with 3 uses of the coincident-to-when-issued bill) and as a result net purchases at tender were smaller.

Table 4 shows the evolution of repurchase operations since SPRA was introduced in 1985 and SRA was first offered in 1986. Their use grew rapidly after they were first introduced, particularly in the case of SPRA. In 1993 the use of such techniques, and especially that of SPRA, fell sharply, reflecting the fact that the call loan rate was generally in line with the Bank's desired outcome. In the first ten months of 1994 repurchase techniques were used much more often, reflecting volatility in financial markets and a somewhat more explicit approach by the Bank of Canada in signalling its target range for the overnight rate.[21] Table 5 gives an indication of the importance of treasury bill purchases and sales over time by showing how they have evolved relative to the size of the treasury bill market. It is important to note that open-market operations are used to complement and often to moderate the impact of the drawdown-redeposit mechanism on Canada's short-term interest rates. It is not correct to look at their impact in isolation in assessing the direction of monetary policy at any point in time. Thus in 1988 and 1989, when the Bank of Canada was encouraging short-term rates to rise, sales of treasury bills were used relatively less, while they were used quite frequently in 1991, 1992 and 1993, as the Bank sought to ensure that the decline in short-term rates occurred in a measured fashion. In 1994 treasury bill sales by the Bank declined, as the downward pressure on short-term rates in the money markets had largely dissipated.

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21. *The target ranges were noted explicitly in "Recent economic and financial developments,"* Bank of Canada Review*, Autumn 1994.*

Table 3   Bank of Canada transactions

Millions of dollars

	Sale and Repurchase Agreements (SRA)		Special Purchase and Resale Agreements (SPRA)		Treasury bills		
	Number of days offered	Average amount outstanding per business day	Number of days offered	Average amount outstanding per business day	Market sales	Market purchases	Purchases at tender net of maturities and transactions with clients
1993							
January	2	10.0	0	0.0	3,956.4	52.4	2,856.2
February	0	0.0	0	0.0	3,476.0	0.0	2,550.2
March	1	29.3	0	0.0	3,729.0	480.0	3,947.1
April	3	42.9	0	0.0	3,221.0	267.0	5,141.8
May	3	85.5	0	0.0	3,681.0	545.0	2,724.2
June	0	0.0	1	11.6	2,815.0	0.0	3,770.5
July	2	19.0	0	0.0	5,692.0	0.0	5,202.3
August	1	0.0	1	15.0	2,665.0	0.0	3,655.6
September	2	22.6	0	0.0	3,495.0	1,220.0	3,582.7
October	0	0.0	0	0.0	4,523.0	48.0	3,266.6
November	1	26.2	0	0.0	3,630.0	0.0	3,470.4
December	1	0.0	0	0.0	4,610.0	775.0	4,179.0
1994							
January	0	0.0	0	0.0	1,512.0	602.0	2,176.1
February	0	0.0	1	27.8	140.0	140.0	832.8
March	0	0.0	2	14.9	225.0	0.0	1,057.4
April	2	0.0	1	35.3	2,376.0	0.0	922.8
May	0	0.0	0	0.0	485.0	0.0	1,001.7
June	2	9.1	2	37.3	335.0	335.0	776.6
July	0	0.0	2	57.7	1,235.0	75.0	266.9
August	3	15.2	3	108.4	1,200.0	0.0	-472.9
September	5	137.4	5	144.3	375.0	0.0	243.5
October	1	19.5	7	225.0	0.0	0.0	889.8

Table 4   SPRA and SRA

	SPRA Millions	SPRA / Average stock of treasury bills %	SRA Millions	SRA / Average stock of treasury bills %
1985	874.70	1.53	0.00	0.00
1986	5,410.90	8.30	150.00	0.23
1987	19,619.30	25.15	525.00	0.67
1988	22,955.00	26.67	3,885.00	4.51
1989	10,756.30	9.71	600.00	0.54
1990	20,168.80	16.00	4,598.00	3.65
1991	10,190.00	13.26	2,015.00	1.39
1992	10,310.00	6.57	6,795.00	4.33
1993	585.00	0.35	4,910.00	2.97
1994*	13,236.00	7.95	3,825.00	2.30

* 1994 figures are based on data up to and including October 31st.

Table 5   The relative importance of direct open market operations in the treasury bill market

	Ratio of annual purchases to average stock of treasury bills %	Ratio of annual sales to average stock of treasury bills %
1985	3.88	14.69
1986	1.65	17.64
1987	5.80	8.04
1988	3.15	5.15
1989	0.95	3.42
1990	1.85	11.30
1991	3.76	20.80
1992	2.21	18.85
1993	2.05	27.55
1994*	0.69	4.73

* 1994 figures are based on data up to and including October 31st.

CONCLUSION

The implementation of monetary policy in Canada has remained broadly unchanged in recent years despite a number of regulatory and market-driven changes. The Bank of Canada has been able to maintain the same degree of influence on very short-term interest rates as in the past, despite the abolition of reserve requirements, the growth of the absolute size of the money market (reflecting in particular the much larger stock of treasury bills outstanding) and many innovations in financial markets (including some very sophisticated financial derivatives).

The basic drawdown/redeposit mechanism is still the main tool, and the only major change has been the introduction of buy-back techniques to supplement direct open-market purchases and sales of treasury bills.[22]

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22. *The creation of a Large Value Transfer System (LVTS) for electronic payments with same day settlement in order to ensure finality of payment, which would eventually eliminate surprises except for those coming from small cheques and from the drawdown/redeposit system itself, could have a significant impact on the way the drawdown and redeposit mechanism is used. For an overview of two possible alternatives to the present system see Longworth and Muller (1991).*

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Bank of Canada cash management: The main technique for implementing monetary policy

by Kevin Clinton

THE POLICY BACKGROUND

This article describes the technical procedures by which the Bank of Canada implements monetary policy on a day-to-day basis through its control over the quantity of cash balances used by banks and near-banks for settlement of payments, and explains how some structural features of the Canadian financial system, including the functions of the central bank as fiscal agent for the government, influence these procedures. At the end of the article, the glossary explains some specialized terms and provides a list of previous Bank of Canada publications relating to cash management.

The basic short-run technique is the transfer of Government of Canada deposits. A transfer from the banks and other clearing institutions to the Bank of Canada is called a drawdown; a transfer to the clearers, a redeposit. Although the cash setting procedure involves numerous details reflecting institutional factors, the principle is simple: a drawdown drains cash balances from the system, while a redeposit injects balances.[1]

The Bank of Canada makes a daily decision on the cash setting and is able to control the supply of clearing balances via the drawdown/redeposit mechanism with considerable precision day to day. However, this technique will not provide for an expansion in the Bank's balance sheet in line with a growing economy. Cash management operations are therefore supplemented by periodic acquisitions of Government of Canada securities, usually at the time new securities are issued, in order to permit the Bank to determine the rate of growth of its balance sheet through time.

The proximate objective of the cash management exercise is to ensure that short-term interest rates adjust in line with the goal of non-inflation-

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1. *The technical details could be adapted without difficulty to two significant structural changes now on the horizon: the removal of reserve requirements from the chartered banks and the introduction of an automated, same-day, settlement system for large-value items by the CPA. Modifications that might be appropriate under these conditions are outlined in : "Implementation of Monetary Policy in the Absence of Reserve Requirements," Discussion Paper No. 1, September 1987; and "The Implementation of Monetary Policy in a System with Zero Reserve Requirements," Discussion Paper No. 2, February 1989.*

ary pace of monetary expansion. An ample supply of cash from the central bank reduces interest rates for a while and boosts money growth, whereas a tight supply does the reverse. In this context cash means the liabilities of the Bank of Canada that can be used for ultimate settlement of payments obligations. Directly clearing members of the CPA – large chartered banks and other deposit-taking financial intermediaries that account for a dominant share of chequing and other payments services in Canada – discharge claims among themselves after the daily clearing of cheques and electronic transfers by debits and credits to their deposits at the Bank of Canada. Since the latter deposits serve as clearing balances within the CPA, they are an essential hub for the machinery of exchange in the economy. While the direct clearers must maintain adequate clearing balances to perform their payments functions, they are quick to lend out any surplus to their perceived needs since deposits at the Bank of Canada pay no interest. For this reason, changes in the quantity of clearing balances influence the shortest-term money market – that for overnight funds – quite quickly.

The Bank's reliance on the cash setting stems from a preference for an instrument that gives broad play to market forces. If the provision of balances does not correspond to the overall level desired by the clearers, their attempts to adjust will immediately affect the cost of overnight funds. The influence of the Bank of Canada's cash management on interest rates is nevertheless indirect, and it becomes weaker relative to market forces at longer terms to maturity. In contrast, central bank sales and purchases in the securities markets have a direct impact on interest rates at a particular term. The Bank therefore uses open market operations not to control the supply of cash, but as a supporting instrument on occasions when a specific effect on the structure of rates is sought. For example, buy-

back transactions might be used to influence directly the overnight rate, or outright transactions in treasury bills to influence the three-month rate. In each case any unwanted impact on the level of cash in the system is subsequently neutralized by a transfer of government deposits.[2]

CASH SETTING PROCEDURES

The supply of clearing balances to the payments system is for all intents and purposes determined by the requirements of monetary policy. Although a variety of official transactions potentially affects the supply of cash, the Bank of Canada can neutralize any such effect from day to day, and hence control the supply of clearing balances quite closely. To understand the practical steps that this involves, it is useful to start with a list of all the potential sources of change in cash, as presented in Table 1. This list has four categories of payments items, all which concern transactions between the federal government or the central bank on the one hand and the rest of the economy on the other.

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2. *Aspects of Bank of Canada open market intervention are discussed in more detail in K. Clinton and K. Fettig, this volume.*

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Table 1   Daily increase in direct clearers' deposits at the Bank of Canada equals the sum of:

Federal government items

    regular net disbursements of the federal government
minus
    net new issues to public of federal government debt
plus
    official purchases of foreign exchange (or *minus* sales)
plus
    net increase in Receiver General (RG) term deposits with direct clearers

Monetary items not directly controlled

    net increase in Bank of Canada advances to direct clearers
plus
    net increase in regular Purchase and Resale Agreements (PRA)
minus
    direct clearer withdrawals of bank notes from the Bank of Canada

Open market operations

    Bank of Canada outright open market purchases of securities (or *minus* sales)
plus
    net increase in special PRA
minus
    net increase in Sale and Repurchase Agreements (SRA)

Cash management of the Bank

    redeposit (increase) or drawdown (decrease) of RG demand deposits with direct clearers.

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To clarify this list of items, some brief comments may be helpful:

First category: Federal government items are quantitatively very important, since each component shows wide variance over time. Net disbursements are the difference between outlays and receipts. The RG holds deposits on behalf of the federal government. Disbursements by the federal government are drawn on its deposits at the Bank of Canada, creating claims on the Bank in favour of recipients. Other things being the same, this would imply an increase in the supply of cash to the system, since these claims are invariably deposited in accounts with the clearing institutions and cleared against the central bank. Conversely, receipts of the government (e.g., from taxes and debt issues) would drain deposits at the central bank from the clearers. In the absence of offsetting actions by the Bank of Canada, any net outlay by the federal government will be reflected in an increase in clearing balances, and a net receipt by a decrease.

Second category: The monetary items that are not under the direct, day-to-day control of the Bank involve three quite different activities. *Advances to direct clearers* are extended to meet any shortages of balances that may arise at the end of a daily clearing cycle, or to maintain bank cash reserves at the minimum statutory level at the end of a reserve averaging period. While the Bank sets the terms and conditions for its advances, extensions on any day depend heavily on the random losses experienced in the clearings by the direct participants. *Regular PRA* are a source of funds available to authorized investment dealers up to a limit set beforehand by the Bank, and *withdrawals of bank notes* from the central bank are made as needed by the clearing institutions.

Third and fourth categories: These cover the monetary policy instruments used at the discretion of the Bank of Canada itself.

The Bank makes its drawdown/redeposit decision shortly after 5 p.m. each business day.

By this time, virtually all other relevant transactions have been completed and the Bank can estimate quite accurately all items in Table 1, with the exception of advances to direct clearers which alone are not predetermined. As fiscal agent for the government, the Bank of Canada is able to observe all government receipts and outlays before they proceed through the CPA clearings, and it arranges any change in RG term deposits in consultation with the government. The cash flows from new issues of marketable debt and foreign exchange dealings are known at least a day ahead owing to the dating of delivery in such business. In addition, it goes without saying that the Bank knows the amounts of its own transactions.

However, Bank of Canada advances are an unknown quantity at the cash setting, as they are not extended until the settlement of the day's payments, which takes place the next day.[3] Later sections of this article return to the topic of borrowing from the Bank of Canada; here it need only be noted that the availability of advances does not in any serious way loosen the influence of the cash setting over monetary conditions.

The drawdown/redeposit mechanism

Once the cash setting has been decided, the allocation of government demand deposits between individual directly clearing institutions is made on the basis of a given set of ratios. Each direct clearer is informed of the transfer from or to its own RG demand account at 8:30 a.m. on the business day following the Bank's cash setting decision. Under the system of retroactive settle-

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3. *Settlement within the CPA is retroactive such that entries of transactions with clients on the balance sheets of the clearing institutions and the related change in deposits at the Bank of Canada are booked for the same date. The timing of settlement is explained in James F. Dingle, "Technical note: Introduction of retroactive settlement for the daily clearing of cheques and other payment items,"* Bank of Canada Review, *August 1986.*

ment, any change in deposits on the Bank of Canada balance sheet is dated as of the preceding business day. From the point of view of the clearers, this means that the drawdown/redeposit occurs too late for any subsequent readjustments of their balance sheets for that day.

Each drawdown/redeposit has two components: (i) *the neutralization component*, which is designed to offset the effect on total clearing balances of all predetermined items, and is thus equal to the negative of the estimated net cash impact of these items; and (ii) *the monetary policy component*, which is equal to the change in balances desired by the Bank. A feature unique to Canadian central banking is that open market operations, as well as the other items, are routinely neutralized: such operations are directed towards interest rates at the moment of intervention, rather than towards the eventual supply of clearing balances at the end of the day.

Since the Bank possesses an accurate estimate of the predetermined items in Table 1, the neutralization component of the drawdown/redeposit offsets their overall cash impact quite precisely. The actual change in clearer deposits at the Bank therefore is usually close to the intended policy component of the cash setting – most deviations of any size from the target are due to advances.

The drawdown/redeposit of itself does not reveal the change, and may not even correctly indicate the direction of change, in the total supply of clearing balances to the system. Although any direct clearer can readily calculate the aggregate drawdown or redeposit at 8:30 a.m. on the basis of its own RG demand deposit allocation ratio, it does not know exactly the net value of the items that the Bank has neutralized. As the net amounts neutralized daily are large – often over $500 million in absolute value – the policy component of the cash setting can be quite difficult for the direct clearers to isolate. For exam-

ple, if government disbursements have been heavy on a particular day, a drawdown need not be associated with a reduced supply of clearing balances.

Public sector balance sheets

The Bank of Canada balance sheet, published for Wednesdays (or the nearest preceding business day in the case of a holiday) and month-ends, shows the deposit holdings of the direct clearers, distinguishing between the chartered bank group (thereby disclosing the aggregate reserve position of the banks), and the other clearing institutions. Publication gives money market participants a regular glimpse at the supply of clearing balances in the system.

It is not readily apparent from the movements in government deposits on the central bank's balance sheet that drawdowns and redeposits are the main instrument for implementing monetary policy. The range of movement in government deposits at the Bank of Canada, which in recent years have usually been maintained at a level below $20 million, has been very much less than the range of transfers of government deposits with the direct clearers, which sometimes exceed $1 billion. Instead, on the Bank's balance sheet, short-term foreign-currency investments acquired from the federal government's Exchange Fund Account under resale agreements (EFA swaps) most often mirror the drawdown/redeposit. When the Bank redeposits government balances with the direct clearers, it usually has first to augment government deposits on its own books. It does this by arranging an EFA swap. In the case of a drawdown, such swaps can be reversed.[4]

Two hypothetical numerical examples

To illustrate the operation of the cash setting in more concrete terms, a couple of simple numerical examples are presented in Table 2 in the form of T-accounts. Both assume that the monetary policy component of the cash setting is an increase in clearing balances of $100. Furthermore, both assume that the normal transactions with the EFA are employed.

Example 1 supposes that there is nothing to neutralize. For ease of exposition the relevant transactions are presented as two distinct steps, even though in practice the balance sheet changes would be recorded simultaneously. A $100 redeposit is required. To effect this, the Bank obtains foreign currency assets to the value of $100 from the EFA, crediting government deposits on its own books in payment (the first row of T-accounts). This deposit is then immediately transferred to the direct clearers (the second row); the counterpart on the asset side of their balance sheet to this increase in liabilities is a $100 increase in holdings of deposits at the Bank of Canada.

Example 2 supposes instead that net government disbursements of $300 are made. To achieve the target increase in clearing balances the Bank has to draw down $200, which is equivalent to a neutralization component of -$300 plus a monetary policy component of $100. It is supposed that government demand balances at the direct clearers are sufficient to allow this reduction (in actual practice demand balance constraints on the drawdown are infrequent). The T-account for the direct clearers shows the drawdown of government deposits of $200 and a $300

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4. *Since these transactions are between official entities only, of themselves they have no impact on financial or foreign exchange markets. Frank Faure in "Technical note on temporary Bank of Canada-Exchange Fund swaps,"* Bank of Canada Review, *July 1977, provides an analysis of this technique.*

Table 2   Cash setting to provide an increase of $100 in clearing balances

Example 1: No neutralization

EFA Swap

Bank of Canada		Government of Canada	
Assets	Liabilities	Assets	Liabilities
Foreign currency + $100	Government deposits + $100	EFA - $100

Deposits at the bank + $100 | |

Redeposit

Bank of Canada		Direct clearers	
Assets	Liabilities	Assets	Liabilities
	Government deposits - $100

Direct clearer deposits + $100 | Deposits at the Bank + $100 | Government deposits + $100 |

Example 2: Neutralization of $300 government disbursement

Drawndown

Bank of Canada		Direct clearers	
Assets	Liabilities	Assets	Liabilities
	Government deposits - $100

Direct clearer deposits + $100 | Deposits at the Bank + $100 | Government deposits - $200

General public deposits + $300 |

increase in deposits of the general public (received as government disbursements). Direct clearers' total liabilities rise by $100, matching their increase in cash at the Bank of Canada. The central bank balance sheet shows the same changes as in the second step of Example 1, so that in this case too an EFA swap may be required: from the viewpoint of the government, the swap would maintain its deposits at the central bank constant, taking into account the joint impact of the disbursement and the drawdown. The T-accounts for this EFA swap would be exactly as in Example 1.[5]

Management of Government of Canada deposits with direct clearers

Since 1986, the Government of Canada has been able to place money for fixed terms of one or more days with the direct clearers at yields more attractive than those on demand deposits. As fiscal agent for the federal government, the Bank assists in the allocation of RG deposits with the direct clearers between demand and term tranches. This activity is not designed to affect the supply of clearing balances, but to improve the returns on financial assets of the government. In view of the low yield on demand deposits, any surplus to current cash requirements is auctioned for terms that coincide with forecasted needs in the days ahead.

RG demand balances are maintained at a level sufficient on average to cover unpredictable needs for cash arising from the business of government as well as possible drawdowns for monetary policy purposes. Unanticipated net outlays create unforeseen cash requirements; conversely, unexpected net receipts produce unforeseen cash inflows. The error in forecasting cash requirements one day ahead can be in the hundreds of millions of dollars in either direction.[6] As a result, although the demand balance with the direct clearers has averaged $750 million or more in recent years, the available balance has nevertheless sometimes been less than the desired drawdown on occasions of exceptionally high unexpected net disbursements. In consequence, the cash setting has from time to time been easier than the Bank would have otherwise chosen. Occasional inconvenience of this kind has been accepted because the maintenance of larger demand deposits would impose an interest cost on the government. In any event, the bank has been able to prevent any undue downward movement in interest rates that might subsequently emerge by outright bill sales or by SRA.

Drawdowns and redeposits used to be allocated among the directly clearing members of the CPA by a formula based on total Canadian dollar deposits. However, in August 1989 a twice-monthly auction was instituted for the RG demand tranche. Since that date, allocation ratios for government demand deposits have reflected the results of competitive bids. This change has had no substantive implications for the conduct of monetary policy.

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5. *The Bank has frequently built up sizable amounts of foreign exchange assets as a consequence of repeated use this technique over a run of weeks. When this occurs, the Bank's portfolio is considered "underbought," in that advances plus security holdings are less than Canadian dollar liabilities. To rebalance the portfolio, the Bank periodically buys Government of Canada debt, allowing outstanding EFA swaps to unwind. Such technical purchases are made at the time of issue to avoid confusion with open market operations designed to affect interest rates.*

6. *The relevant forecast, which has a horizon of at least one day ahead, should not be confused with the estimate of actual government transactions for the current day. As emphasized in the context of the cash setting, the latter estimate is typically very accurate.*

CASH SETTING AND THE DIRECT CLEARERS

Clearing balances and chartered bank primary reserves

Cash management by the banks focusses on excess reserves, which are equal to their deposits at the Bank of Canada in excess of those implied by the primary reserve requirement.[7] The Bank Act obliges chartered banks to hold each half month an average level of deposits at the Bank of Canada at least equal to a requirement calculated from their deposit liabilities and currency holdings over a preceding 4-week period. Since the change in the level of required deposits for any calendar month is set well before the month starts, it is a simple matter for the Bank to neutralize any effect on excess reserves from the once-a-month changes in statutory requirements.

Table 3	Direct clearers' deposits at the Bank of Canada are equal to:

required primary reserves of chartered banks
plus
   excess reserves of chartered banks
plus
   clearing balances of non-bank clearers

Demand for clearing balances by the directly clearing institutions, including the demand for excess reserves by the chartered banks, stems from uncertainty about the results of any day's clearing outcomes. Since settlement if effected with a lag, a clearer does not know the exact effect of today's transactions on today's cash

position until tomorrow. Divergences between anticipated and actual transactions of clients cause unintended fluctuations in settlement balances.

Clearers' cash management strategies are heavily influenced by the large-value transactions of their clients. These are usually related to securities market trades, to the foreign and domestic business of large corporate and government entities, to government tax receipts and disbursements, and to Bank of Canada transactions. Although the clearers put much effort into tracking large-value payments items, every day there are surprises in the clearings owing to omissions in monitoring, late-in-the-day deposits or withdrawals, technical mishaps in the clearings, and so on, as well as the drawdown/redeposit of the Bank of Canada.

As regards the last item, the clearers are uncertain about both the neutralization component and the policy component of the cash setting. Although a given clearer will have a good estimate by the close of business of the value of its own transactions for the day vis-à-vis the government and the central bank, it must gauge the aggregate value of official transactions with the system as a whole on the basis of much less comprehensive information, and hence cannot tell with precision what the neutralization component of the drawdown/redeposit will be. Neutralized transactions thus create uncertainty for the clearers with respect to their daily cash positions, even though they have no effect on the quantity of cash in the system as a whole. With respect to the policy component of the cash setting, the clearing institutions must rely on their perception of the stance of monetary policy to predict the Bank of Canada's target for the change in clearing balances.

To avoid excessive borrowing from the central bank, each clearer has to hold a buffer of clearing balances large enough to cover most

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7. *The primary reserve regulations are summarized in the glossary.*

unexpected clearing losses. This said, the chartered banks have a fair range of latitude in their cash management, since the averaging feature of the reserve requirement leaves open a wide variety of paths of adjustment, especially early in the twice-monthly averaging periods. The requirement will be satisfied if a bank achieves a positive cumulative sum of daily positions with respect to the reserve requirement (daily surpluses minus deficits) at the end of each half month. This permits sizable variations in the targeted reserve positions of the banks on any day. For example, they can tolerate deficits as long as there are enough days left in the averaging period to accumulate offsetting surpluses. On the other hand, the banks can deliberately build up a surplus if they see a risk of reserve shortages later in the period; and they have traditionally established large cumulative surpluses at the end of October, the chartered bank fiscal year-end, to reduce the risk of having to show a central bank advance in their annual reports.

The demand for clearing balances is somewhat responsive to interest rates. This reflects: first, that uncertainty about the results of the clearings creates a precautionary demand to hold reserves in excess of minimum requirements; and second, that reserve averaging allows the banks some flexibility to respond to expected changes in overnight rates. For example, a decrease in overnight rates reduces the income foregone by holding deposits at the Bank of Canada and hence encourages the clearers to hold somewhat higher balances as a precaution against clearing losses. The increase in demand for reserves by the banks will be larger if they speculate that the decrease in rates will not last throughout the averaging period because by increasing excess reserves today they will be able to lend more at the higher rates that they expect in the days ahead. In addition, the averaging feature means that banks do not have to adjust their cash positions at once to any unexpected change in reserves. All this tempers the abruptness of the response of interest rates to policy-determined changes in the supply of cash.[8]

Bank of Canada advances

The Bank makes advances to the direct clearers to meet two types of temporary deficit:[9]

(i) a shortfall in the settlement balances of any clearer at the end of a daily clearing cycle (Banks have needed such overdrafts less often than other direct clearers, since reserve requirements and reserve averaging provide a buffer against unexpected one-day clearing losses.)
ii) a cumulative reserve deficit of a bank clearer at the end of an averaging period.

The Bank of Canada charges Bank Rate for borrowings within a line of credit pre-authorized for each institution, up to once per averaging period for banks and twice per month for non-banks. Advances beyond theses limits are priced at the discretion of the Bank of Canada at a margin over Bank Rate. As an institution takes successive advances of this kind within a period, the

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8. *The structural changes mentioned in footnote 1 will lessen the elasticity of the demand for cash at the central bank: a large-value transfer system will greatly reduce the precautionary demand for clearing balances while the elimination of obligatory reserves will effectively remove any speculative demand, since the interest foregone by holding cash on a given day will not then be recoverable. Also, with zero requirements, an averaging formula provides the banks with less cushion for containing shocks to the supply of reserves. The alternative arrangements for implementing monetary policy outlined in the two Discussion Papers take account of these effects.*
9. *Advances are also sometimes made on an extended basis to institutions with severe liquidity problems. The Bank of Canada's balance sheet still contains a small amount of advances resulting from the failure of two small banks in 1985. Such assistance has no special implications for the short-run monetary policy questions discussed in this article.*

charge is stepped up – on some recent occasions it has gone above twice Bank Rate.

Even so, the interest cost incentive for the clearers to refrain from taking advances is rather limited, since the net cost of an overdraft is just the difference between the rate charged and the yield received by the clearer on lending financed by the overdraft. In contrast, the cost of holding clearing balances, which carry no interest, is the entire yield foregone. It is therefore usually cheaper for the clearers to risk an additional advance at the margin than to increase their average settlement balances an equivalent amount. Despite this, borrowings from the central bank have been quite restrained in total, since a clearer using them extensively might give the impression of liquidity problems, especially as the Bank of Canada's "Rules Governing Advances to Financial Institutions" state:

> While the Bank of Canada is conscious of its responsibility as the lender of last resort, it expects potential borrowers to make every effort to adjust their cash positions through the money market and to use their lines of credit at the central bank sparingly.

CASH SETTING AND THE MONEY MARKET

The Bank's cash management affects interest rates through various market linkages. Since the release of the drawdown/redeposit at 8:30 a.m. does not reveal clearly the implied change in cash in the system, it does not systematically exert an "announcement effect" on rates. Instead, the cash setting influences interest rates through the market transactions of the direct clearers as they reassess, and then set about

adjusting, their cash positions. This impact is typically first evident in the markets for overnight funds. Although overnight loans – such as call loans and interbank deposits – are used by a relatively small number of institutions in the economy, changes in overnight rates, if sustained for any length of time, will be reflected in the structure of rates in general. For example, treasury bill yields are heavily influenced by overnight borrowing costs as investment dealers and banks finance their trading inventories of bills largely with overnight money. In turn, market arbitrage ensures a close link between bill rates and other short-term yields, including those on term deposits at financial intermediaries. Therefore, administered rates, such as the banks' prime loan rate, which are to a large extent determined by term deposit costs, also respond over time to significant changes in the level of overnight rates.

Because the chartered banks are so large, and since they often have considerable room to vary their cash positions, they play an especially important role in the money market. Their day-to-day cash management strategies are influenced by a number of factors: their daily (or "spot") reserve positions at the end of the previous day, the cumulative sum of their daily excesses or deficits from the start of the averaging period, and expectations about the Bank's cash settings for the rest of the period. Also, early in an averaging period some banks may speculate on anticipated movements in interest rates – either accumulating reserves on expectations of higher lending rates later, or lending aggressively to run spot deficits on expectations of rate declines. More commonly, the aggregate demand for excess reserves can be raised by an uneven distribution among the banks. This most often occurs as a result of unusual clearing swings on a Friday, or on a day before a bank holiday, when deposits at the Bank of Canada are

multiple-weighted in the reserve-averaging calculation.[10] A chartered bank with unexpectedly large receipts may be stuck with a large cumulative excess if spot deficits large enough to eliminate it over the rest of the averaging period would imply an excessive risk of exhausting its clearing balance and having to seek advances from the central bank.

At times, a heightened scale and volatility of payments flows, together with expectations of rising interest rates and uneven distributions of cash among the direct clearers, cause an increase in demand for excess reserves and hence a reduced flow of overnight lending. When such conditions are encountered, extreme tightness might be felt in the money market despite settings of excess cash much above normal levels. In contrast, in periods when money markets are calm, or when interest rates are expected to decline, demand for reserves may drop, and monetary conditions may loosen, despite modest cash settings.

In view of these varying circumstances, Bank of Canada staff communicate daily with the banks' cash managers to form an estimate of their aggregate reserve target. The actual cash setting will be more or less accommodative in relation to this estimate, according to whether monetary policy seeks a decrease or an increase in short-term interest rates. Cash management more often than not succeeds in establishing desired rate levels, as evidenced by the fact that over the past several years market intervention – in the form of either buy-back or outright transactions – has been employed on just one day in three on average.

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10. *The daily weighting of reserves is summarized in the glossary. Detail is given in "Revisions to the reserves regulations: Introducing weighted averaging,"* Bank of Canada Review, *September 1983.*

DECLINING REQUIREMENTS FOR DEPOSITS AT THE BANK OF CANADA

Over the past decade, there has been a steady drop in chartered bank deposits at the Bank of Canada, reflecting a decline in legal requirements (Chart 1). While this has not weakened the effectiveness of the Bank's policy instruments, at times it has had implications for the cash setting and for the interpretation of published data on chartered bank excess reserve positions.

Primary reserve requirements declined after 1980 for three reasons:

(i) strong increase in non-reservable deposits at mortgage loan subsidiaries and in registered retirement savings plans

(ii) slow growth of demand deposits (These have a higher statutory primary reserve ratio than other deposits; their slow growth relative to the latter reflects less attractive interest rates.)

(iii) modest reductions in requirement ratios in the 1980 Bank Act revision.

The ratio of required reserves to total Canadian dollar assets of the chartered banks thus fell from about 4 per cent in 1980 to about 1 1/2 per cent in 1990. At the same time currency inventories at the chartered banks have been rising strongly (Chart 1), stimulated in part by the need to provide notes to the public through automatic teller networks. Since vault cash counts as primary reserves, these increased inventories have reduced legally required deposits at the central bank.

In certain months of recent years, following seasonal peaks in their currency holdings, sev-

Chart 1   Cash reserves of chartered banks
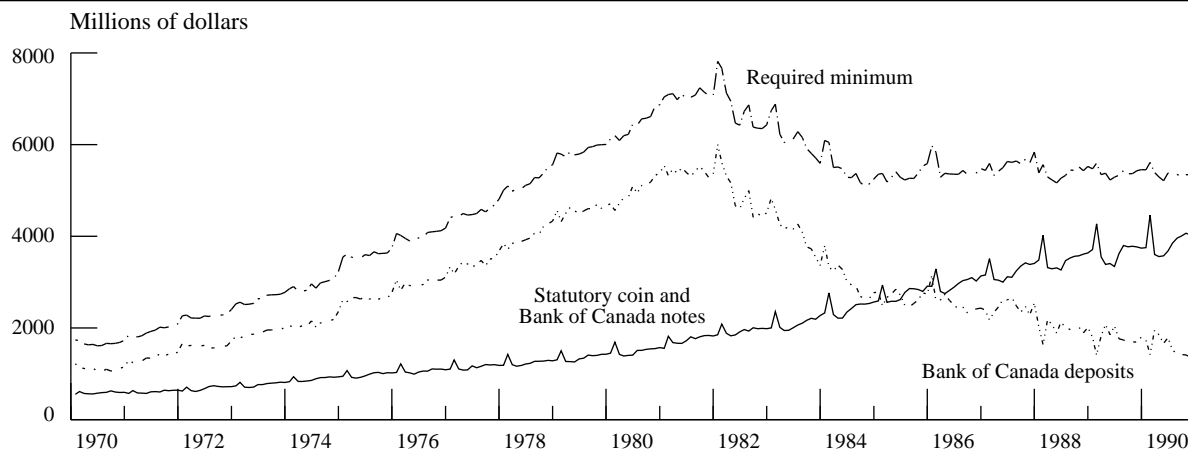
eral banks have seen their required deposits at the cental bank drop to levels barely larger than the normal range of random daily clearing losses.[11] When required deposits are this low, they provide the banks with little protection against the daily risk of having seed an advance from the central bank. Furthermore, the opportunity to offset surpluses with respect to reserve requirements on one day against deficits on some other day within a reserve averaging period is much reduced. Clearing balances cannot be less than zero, because a Bank of Canada advance would maintain the balance at least at zero. Therefore the largest possible spot deficit in the calculation of a chartered bank's cumulative position is equal to its required balance with the Bank of Canada.   This implies that when required deposits are very low relative to normal random clearing swings there is a tight constraint on reductions of cumulative surpluses.

Not surprisingly then, when deposit requirements drop, there tend to be more frequent chartered bank advances at the central bank and

greater excess cumulative reserves. Such an outcome was evident in February 1989 and again in February 1990, following large increases in currency holdings at the year-end holiday season. Despite substantial increases in excess reserves during these months, overnight markets tightened sharply.

With respect to the interpretation of the published data on chartered bank primary reserves, it should be clear that a movement in the cumulative excess from one month to another need not of itself signify any change in monetary policy. To assess properly the stance of the Bank of Canada's cash setting, it is necessary to take into account the factors that affect the demand for excess reserves by the chartered banks, including the levels of their deposit requirements at the central bank. More generally, the impact of a given cash setting on monetary conditions depends on the clearing institutions' aggregate target for clearing balances. Since this target is by no means constant over time, a given quantity of clearing balances, or a given quantity of excess reserves with respect to the chartered banks, might imply a quite different degree of monetary restraint from one set of circumstances to another.

11. Because of the time lag in the reserve regulations, a change in vault cash influences required deposits at the Bank of Canada with a delay of around one calendar month. For example, large currency holdings in late December and early January reduce the required deposit in February.

GLOSSARY

Averaging period: twice monthly period during which the weighted average of a chartered bank's cash reserves must not be less than a statutory minimum; either the first 15 days, or the remaining period, of a calendar month.

Balances, clearing balances, settlement balances: deposits of directly clearing members of the CPA at the Bank of Canada.

Bank of Canada advance: borrowing from the central bank; either an overdraft to meet a deficiency of clearing balances or an end-of-averaging-period borrowing by a chartered bank to meet a deficit with respect to the minimum legal reserve requirement.

Buy-back transactions of the Bank of Canada: Purchase and Resale Agreements, Special Purchase and Resale Agreements, and Sale and Repurchase Agreements. (*Bank of Canada Review,* July 1989.)

Canadian Payments Association (CPA): the agency that supervises the clearing and settlement of cheques, other paper items and electronic transfers between member institutions; these institutions include the Bank of Canada, other directly clearing members, and indirectly clearing members. The last group of institutions employ direct clearer agents.

Cash management, cash setting: with respect to the Bank of Canada, the control of the supply of clearing balances by means of drawdowns and redeposits of federal government deposits with direct clearers.

Clearing cycle, clearing round: a single business day's clearings and settlement.

Clearing gain and loss, clearing swing: a net transfer of Bank of Canada deposits to or from a direct clearer at the close of a clearing round; often refers just to the unexpected component of such a transfer.

Clearing institutions: financial institutions offering chequable deposits and other means of payment to the general public; more specifically, members of the CPA, and in some contexts just the directly clearing members.

Cumulative position: the cumulative sum of daily reserve excesses less deficits relative to the minimum legal requirement of a chartered bank.

Deficit position of a chartered bank: position where actual reserves are less than required reserves on a spot or cumulative basis, or where a Bank of Canada advance is necessary.

Deficit position of a non-bank direct clearer: position that necessitates a Bank of Canada advance.

Directly clearing members of the CPA, direct clearers: direct participants in the CPA clearing mechanism; a CPA member must generate at least 1/2 per cent of the total volume of clearings to be an eligible direct clearer. The Bank of Canada is a direct clearer, although the common use of the term usually implicitly excludes the central bank. There are currently 8 chartered bank and 5 non-bank direct clearers. These institutions have a clearing account, with access to advances, at the Bank of Canada. Institutions accepting chequable deposits and which are not direct clearers – i.e., indirect clearers – must engage a directly clearing agent.

Drawdown/redeposit: transfer of federal government deposits from/to direct clearers to/from the central bank.

Excess reserves, excess balances: chartered bank deposits at the central bank in excess of the statutory minimum.

Exchange Fund Account (EFA) swap: temporary purchase, with an agreement to resell, by the Bank of Canada of foreign exchange assets from the federal government's EFA. *Bank of Canada Review*, July 1977.

Large-value transfer system: automated same-day clearing and settlement system for payments items in excess of a threshold (e.g., $50,000). Clearing balances at the central bank would be recorded in "real time" – i.e., on a continuous basis with immediate updates as transfers are completed.

Non-bank clearers: clearing institutions other than chartered banks; primarily trust and mortgage loan companies, credit unions and caisses populaires.

Neutralization: monetary policy action that just offsets the potential impact on total clearing balances of a set of transactions; in particular, that component of the drawdown/redeposit that offsets the estimated net cash impact of prior transactions on the day.

Open market operation: discretionary Bank of Canada intervention in the domestic securities market. Since 1985 such transactions have mostly involved repurchase agreements, but outright purchases and sales of treasury bills have remained quite common. The securities involved are almost always treasury bills or short-term federal government bonds. *Bank of Canada Review*, July 1989.

PRA: Bank of Canada purchase of securities with a resale agreement, at the initiative of an authorized investment dealer.

Primary reserves, reserves: currency and central bank deposits held by banks.

Receiver General (RG) demand deposit auction: twice monthly auction among directly clearing members of the CPA for proportions of federal government demand deposits. *Annual Report of the Governor*, 1989, chapter on "Bank of Canada Operations."

RG deposit auction: auction among direct clearers of federal government deposits for fixed terms of one or more days. (*Annual Report of the Governor*, 1986, chapter on "Bank of Canada operations")

Required primary reserves: statutory minimum holdings of currency plus Bank of Canada deposits imposed on chartered banks. These are calculated as ratios of statutory chartered bank deposits. The latter are defined as averages of the four consecutive Wednesdays ending with the second Wednesday of the previous month. Since 1984 the required ratios have been: 10 per cent on demand; 2 per cent on notice deposits less than $500 million; 3 per cent on notice deposits more than $500 million; and 3 per cent on Canadian residents' foreign currency deposits. *Bank of Canada Review,* Notes to the Tables, C10.

Retroactive settlement: inter-clearer settlement backdated one business day on the books of the central bank. The convention used by the Bank of Canada for settlement within the CPA. *Bank of Canada Review*, August 1986.

Required deposits at the Bank of Canada: required primary reserves less currency holdings. The latter are measured on the same basis as statutory deposits.

Spot position: a bank's reserve position for a given day with respect to the legal reserve requirement.

Special purchase and Resale Agreement SPRA: Bank of Canada purchase of securities with a resale agreement, at the initiative of the Bank; has been transacted with investment dealers and chartered banks; sometimes called a "repo."

Sale and Repurchase Agreement SRA: Bank of Canada sale of securities with an agreement to repurchase at the initiative of the Bank; has been transacted with chartered banks; sometimes called a "reverse repo."

Underbought Bank of Canada portfolio: a portfolio with holdings of government securities plus advances below Canadian dollar liabilities; characterized by low government deposits on the liability side of the balance sheet and EFA swaps outstanding on the asset side. In contrast, an overbought portfolio would have sizable government deposits and no swaps.

Weighted averaging: the weighting of daily deposits at the Bank of Canada for the calculation of statutory reserves. Weights correspond to the number of days for which a bank could earn interest by reducing its reserves by a single business day – i.e., unity except on Friday or before holidays. For example, on a Friday before a normal 2-day weekend the weight is 3, while on a Thursday before a Friday holiday the weight is 4. *Bank of Canada Review*, September 1983 and August 1986

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Buy-back techniques in the conduct of monetary policy

by Kevin Clinton and Kevin Fettig

Since mid-1985, the Bank of Canada has frequently initiated transactions with designated money market participants which are automatically reversed the next day, with the intent of bringing very short-term interest rates in line with the underlying objectives of monetary policy. The most common of these reversible transactions are Special Purchase and Resale Agreements (SPRA), which are purchases of short-term securities by the Bank bought back by the counterparty the next business day. SPRA are undertaken to relieve transitory and undesired upward pressure on money market interest rates. The term "special" indicates that the Bank of Canada has complete discretion over their use, in contrast to regular Purchase and Resale Agreements (PRA), which are arranged within specified limits at the initiative of eligible investment dealers (money market jobbers). Over the past couple of years the Bank has also on occasion arranged the reverse of SPRA, Sales and Repurchase Agreements (SRA), to offset undesired downward pressure on rates.

These market intervention techniques[1] are secondary to the main instrument of monetary policy, the daily adjustment of cash reserves of the chartered banks and of other directly clearing members of the Canadian Payments Association (CPA).[2] The "cash setting" is effected each evening by transferring federal government deposits either to or from the books of the direct clearers, to inject or remove reserves. Most often this technique of redeposits and drawdowns of government deposits, which is unique to Canada, achieves the money market conditions sought by the Bank for the following day without further intervention. Sometimes, however, short-run borrowing costs do not develop in the way the Bank had intended. In such a situation, SPRA and SRA can be employed to influence financial conditions through their immediate impact on the financing of the investments dealers' inventories of securities.[3]

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1. *Equivalent operations in the United States by the Federal Reserve are known as "repos" and "reverse repos."*
2. *A broad review of the Bank's operating techniques is available in the Governor's speech, "The Bank of Canada and the Money Market," reprinted in the* Bank of Canada Review, *May 1989.*
3. *Treasury bills, short-term bonds, commercial paper and bankers' acceptances comprise the bulk of investment dealers' inventories of short-term money market instruments.*

The dealers' inventory financing is comprised mainly of borrowings on an overnight basis, i.e. either for one day, or across a weekend or a weekday holiday. Special call loans are an important source of funds provided by the chartered banks; in addition, the dealers borrow substantial sums from other lenders, known as "offstreet lenders," who include many large financial and non-financial corporations as well as various governmental agencies.[4] In monitoring money market activity, the Bank of Canada gives special attention to interest rates on these overnight borrowings. The decision to intervene with a repurchase or resale operation is usually prompted by a movement in overnight rates that appears at odds with the monetary conditions sought by the Bank.

Intervention might also take the form of conventional open market operations, i.e. outright purchases or sales of treasury bills. Indeed, until 1985 this was the only technique used by the Bank to intervene in market trading. In recent years, as the Bank has directed its influence as much as practicable to overnight rates, SPRA and SRA have become the most commonly used intervention instruments for the Bank. However, the Bank Rate is linked to the yield on three-month treasury bills at the weekly auction, and outright purchases and sales of bills are still used as a more direct means of influencing the treasury bill market, when that is deemed to be necessary.

THE EVOLUTION OF SPRA AND SRA

The SPRA facility developed out of the regular PRA arrangement introduced in 1953 to encourage the development of the money market by providing short-term Bank of Canada assistance to money market jobbers.[5] Jobbers temporarily unable to find sufficient private-sector financing at reasonable cost for their inventory of short-term Government of Canada securities may use the PRA facility to sell such assets to the Bank of Canada, up to an assigned limit, with an agreement to repurchase.[6] Repurchase by the jobbers must be within fifteen days, but in practice repurchase is normally set for the following day. To discourage habitual use, the cost of PRA has invariably been set at a premium over the most recent three-month treasury bill auction rate. Since 1980, the charge has been equal to the Bank Rate, which in turn has been set at the average tender rate plus one-quarter of one per cent.

During the mid-1980s, acute transitory tightness in the overnight loan market occasionally developed as a result of technical factors. This was particularly prone to happen on Fridays, when the chartered banks tended to be cautious in their cash management because their deposits at the Bank of Canada were given a triple weight in the calculation of average reserve positions.[7]

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4. *Outlines of the main features of the overnight market are to be found in "Overnight financing in Canada: Special call loans,"* Bank of Canada Review, *May 1983, and "The interbank deposit market in Canada,"* Bank of Canada Review, *February 1986.*

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5. *For further discussion of the origins of this market, see "The Bank of Canada in 1953 and 1954: A further stage in the evolution of central banking in Canada,"* Bank of Canada Review, *January 1976.*
6. *Since traditional PRAs are initiated by the jobbers, they are not an instrument of monetary policy in the usual sense of the term. Indeed, use of PRA in circumstances where the demand for credit is expanding rapidly might constitute an undesired leakage of liquidity into the financial system. If so, the Bank of Canada, at the end of the day, would offset it through a drawdown of government balances with the direct clearers, as described later on in the context of discretionary Bank operations.*

The situation was sometimes exacerbated when the Friday was the last day in a reserve-averaging period, since the banks then took great care to establish a cushion of excess reserves, rather than incur the risk of falling short of the statutory requirement and of taking an obligatory advance from the Bank of Canada at Bank Rate or more. This created conditions in which banks were likely to recall their special call loans to dealers and to compete vigorously for other funds obtainable within the day, such as interbank deposits. In such instances, jobbers could be faced with costly financing options: to some extent they might negotiate PRA with the Bank of Canada, but if their needs were at all large they would have to go to considerably more expensive sources including less customary "offstreet" borrowing.[8] If they were still short of funds late in the day they would ultimately face the prospect of drawing on their credit lines with banks, which often involve a charge at or above the prime lending rate. In this way, technical money market tightness could cause dealers to bid aggressively for funds, and hence give rise to sharp increases in overnight borrowing rates.

The SPRA facility was introduced in 1985 to alleviate this sort of temporary tightness. Under the facility, the Bank offers to buy treasury bills or other short-term Government of Canada securities and to resell them to the counterparty on the following business day; the interest rate for such assistance is set by the Bank. The counterparty is nearly always a money market jobber, although on some rare occasions it has been a chartered bank. This reflects the role of the jobbers as users of short-term funds, whereas other financial institutions have traditionally been suppliers of such funds. The Bank of Canada has the option of rationing the amount involved or leaving the amount open to the counterparty. The Bank also has the option of entering the market more than once in a trading day if the initial intervention proves insufficient.

In a similar fashion, SRA were introduced the following year to give the Bank a flexible instrument for tempering undesired downward pressure on overnight financing costs. They offer the same discretion to the Bank of Canada as SPRA but work in the opposite direction: the Bank of Canada selling short-term Government of Canada securities under an agreement to repurchase them on the next business day. Since an excessive supply of overnight money usually means that some banks are strenuously trying to lend off cash reserves surplus to their perceived needs, to date SRA have been offered only to banks.

The way in which SPRA have a *potential* impact on the central bank's reserve provision is illustrated in Table 1 by means of schematic balance sheets for the Bank of Canada, the investment dealers and the direct clearers. The Bank may in fact neutralize the cash reserve impact of such market intervention – whether it does so or not will depend on a reassessment of the situation at the evening's cash setting.[9] The T-accounts in Table 1 show the step-by-step changes that might correspond to an operation designed to insulate dealer financing from a temporary recall by the direct clearers of loans

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7. *Similar situations can arise before weekday holidays, where again the weight on deposits at the Bank of Canada to calculate official reserves will exceed unity. Reserve averaging procedures are described in "Revision to the reserve regulations: Introducing weighted averaging,"* Bank of Canada Review, *September 1983, and "Technical note: Introduction of retroactive settlement for the daily clearing of cheques and other payment items,"* Bank of Canada Review, *August 1986.*

8. *Originally PRA access limits were about the same size as the jobbers' money market inventories, but in recent years they have been less than $600 million, compared to a jobber inventory often over $6 billion.*

9. *The redeposit or drawdown is made after trading for the day has closed. Therefore, despite retroactive settlement, its influence on the market is not felt until the next business day, and the Bank reaches its decision on the cash setting in the light of its objectives for the following days.*

Table 1 Hypothetical changes in balance sheets: SPRA and subsequent drawdown

IMMEDIATE EFFECT

Bank of Canada

Assets		Liabilities	
(A) Treasury bills	+100	Deposits:	
		Government of Canada	0
		(C) Potential deposits by	+100
		direct clearers	
Total	+100	Total	+100

Investment dealers*

Assets		Liabilities	
Treasury bills	0	(B) Call loans	-100
		(A) Securities sold under	+100
		agreement to repurchase	
Total	0	Total	0

Direct clearers

Assets		Liabilities	
(C) Potential deposits at the		Deposits:	
Bank of Canada	+100	Government of Canada	0
(B) Special call loans	-100	General public	0
Total	0	Total	0

EFFECT AT THE END OF THE DAY

Bank of Canada

Assets		Liabilities	
Treasury bills	+100	Deposits:	
		(X) Government of Canada	+100
		Direct clearers	0
Total	+100	Total	+100

Investment dealers*

Assets		Liabilities	
Treasury bills	0	(B) Call loans	-100
		(A) Securities sold under	+100
		agreement to repurchase	
Total	0	Total	0

Direct Clearers

Assets		Liabilities	
Deposits at the		Deposits:	
Bank of Canada	0	(X) Government of Canada	-100
(B) Special call loans	-100		
Total	-100	Total	-100

* The investment dealers follow the convention of recording PRA and SPRA as a liability on their balance sheets. No change in the quantity of treasury bills or in total liabilities is thus recorded. Under an alternative convention, the dealers' balance sheet would show "treasury bills - 100." "special call loans -100" and "total liabilities -100"; this would correspond directly to the changes shown in the Bank of Canada's accounts.

worth 100. It can be supposed that the recall is provoked by an anticipation by the direct clearers of reserve losses confined to the day in question. Since this anticipation is not expected to continue into the following day, the illustration assumes that the Bank draws down government deposits by 100 to keep cash in the system constant. In the table, the Bank of Canada purchases treasury bills with a value of 100 from the dealers (transaction A), who then pay down the loans called by the clearers with the credits received from the Bank (transaction B). This would potentially allow the direct clearers to increase their deposits with the central bank (item C), but the drawdown (transaction X) ensures that no net change in cash occurs over the day. On the following business day the clearers, finding themselves with the same excess reserves as initially, but no longer anticipating reserve losses, would want to extend their loans again, restoring the normal financing environment in the overnight market.

ACTIVE USE OF SPECIAL REPURCHASE AND RESALE TECHNIQUES

Although SPRA and SRA were originated to fill a need for flexible instruments to cope with purely technical same-day money market disturbances, they were soon found to be useful in a more active role. Whereas in 1985 and 1986 SPRA were used most often on Fridays, over the past couple of years they have been almost as frequent on Mondays, Tuesdays and Thursdays (Table 2).[10] This may reflect increased experience with the weighted-averaging formula for required reserves on the part of both money market participants and the Bank of Canada. But the

main factor has been the greatly increased use of SPRA as an active tool of monetary policy, which has led to a much higher frequency of use on all days. SPRA were offered 8 times in 1985, 40 times in 1986, about 70 times in both 1987 and 1988, and 18 times in the first half of 1989; SRA were offered once in 1986, twice in 1987, 15 times in 1988, and 5 times in the first half of 1989.

This increase in active use is best understood against the background of the daily procedures for implementing monetary policy. It has already been stressed that short-run adjustments in the provision of cash reserves to the financial system are made primarily through redeposits or drawdowns of Government of Canada deposits with the direct clearers.[11] At the close of each business day, the Bank of Canada decides on its cash setting, which implies a given change in reserves. The necessary redeposit or drawdown is then executed by a transfer of federal government deposits between the Bank itself and the direct clearers, who are informed of the amounts involved early the following morning, in time for the retroactive settlement of their clearings for the preceding business day. Although the daily change in reserves in the banking system is influenced by a number of items outside the control of the Bank – for example clearing gains and losses with non-bank financial institutions and Bank of Canada advances – the Bank is nevertheless able to control the change in reserves for the day with considerable precision.

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10. *However, the Wednesday frequency of SPRA has been very low since their inception. Since bank deposits create legal reserve requirements only on Wednesdays, the Banks often bid less aggressively for funds, causing an easing in the money market. This "Wednesday effect" is also apparent in the relatively high number of Wednesday offerings of SRA in 1988.*
11. *Over longer periods of time, growth in the Bank of Canada's portfolio is maintained principally by purchasing portions of new issues of government debt. See "Cash reserve management,"* Bank of Canada Review, *June 1975.*

	SPRA					SRA			
Table 2	Daily distribution of offers of SPRA and SRA								
	Jun-Dec 1985	1986	1987	1988	Jan-Jun 1989	Jun-Dec 1986	1987	1988	Jan-Jun 1989
Monday	1	7	15	17	3	0	1	2	2
Tuesday	1	9	19	14	6	0	1	3	1
Wednesday	0	7	9	7	2	0	0	7	1
Thursday	2	3	13	14	3	0	0	2	1
Friday	4	14	17	18	4	1	0	1	0
Total	8	40	73	70	18	1	2	15	5

A major element of uncertainty exists, however, since the effect of a given reserve setting on short-term interest rates depends heavily on the chartered banks' aggregate demand for excess reserves. At times the banks are likely to seek additional cash reserves by recalling loans and by bidding aggressively for overnight deposits as described above. In addition, the overall demand for reserves may increase as a result of a very uneven distribution of excess and deficient positions among the members of the CPA. At other times – less frequently in fact – overnight rates may suddenly drop if the chartered banks and other clearing institutions perceive their cash positions as excessive. Such money market volatility is most often associated with unsettled expectations about the future level of short-term interest rates, especially over the remaining days of the reserve-averaging period. For example, when the chartered banks and other overnight lenders feel that a rise in overnight rates is imminent, they may be reluctant to lend, creating immediate upward rate pressures that go further than the Bank had intended in its cash setting.

In such circumstances, an offer of SPRA by the Bank of Canada can act as a catalyst to free-up overnight lending; as well as opening an actual source of financing to the jobbers, it also reduces the prospect that the lenders might gain from higher rates later on. Therefore, the offer of SPRA (or in the case of undesired ease, SRA), even when quite modest amounts are actually taken up, can effectively forestall an undesired tendency in overnight borrowing costs. The rate at which such intervention is offered can give market participants a useful indication of central bank objectives regarding the direction and level of overnight financing costs.

SOME PRACTICAL EXAMPLES

Some actual examples help to illustrate how special repurchase techniques have been employed, both to handle short-lived technical disturbances and to reinforce the thrust of monetary policy.

In Chart 1, showing transactions in PRA, SPRA and SRA, and in more detailed form in Tables 3 and 4, several periods of heightened activity stand out. The first is March-April 1986. This period followed heavy speculative selling of the Canadian dollar in the exchange market, which had pushed the currency to a historical low in February of 69 cents (U.S.). The monetary authorities had responded aggressively to this disturbance with a package that included large official sales of foreign exchange and a sharp tightening of monetary policy. As

Canadian interest rates rose steeply (Chart 2), short-term differentials against the United States widened, and remained at more than 5 percentage points for several weeks. However, after mid-March, as the exchange rate settled around 72 cents (U.S.), and as evidence came in of weakening domestic economic activity, the Bank adopted a more accommodative stance by increasing the excess reserves of the banking system. Treasury bill rates fell rapidly, and as this implied rising capital values of bill inventories, the demand for overnight money was high. Under these circumstances overnight rates declined relatively slowly, and for a while Bank Rate represented a low cost for dealer borrowing, so that jobbers drew heavily on their PRA lines. To encourage the easing of financial conditions and a further decline in overnight rates, the Bank extended SPRA to jobbers and on several occasions to banks as well.

This 1986 episode illustrates the most obvious active use to which SPRA may be put: providing immediate support to a less restrictive money policy stance. This was also the case in the period following the October 1987 stock market collapse, when the Bank sought to avoid any risk of a liquidity crisis by giving exceptionally large short-run assistance to the money market. The provision of excess reserves was sharply increased, causing the rate on overnight money market financing to fall quickly from 8 1/8 per cent in the week preceding the collapse to lows of about 7 3/8 per cent. Repeated offerings of SPRA were made, including successive record extensions of $1.2 billion on Friday 30 October and $1.3 billion on Monday 2 November. This period might otherwise have seen some tightness arising from some unusually heavy payments flows, weekend effects, and technical factors associated with the final day of a reserve-averaging period and the fiscal year-end for the chartered banks. Later in 1987, as it became clearer that the damage caused by the stock market crash had been surprisingly limited, the Bank started to absorb excess liquidity through less generous reserve settings, and in mid-December, SRA was offered on two occasions.

Chart 1   Monthly par value of transactions in PRA, SPRA, and SRA[1]
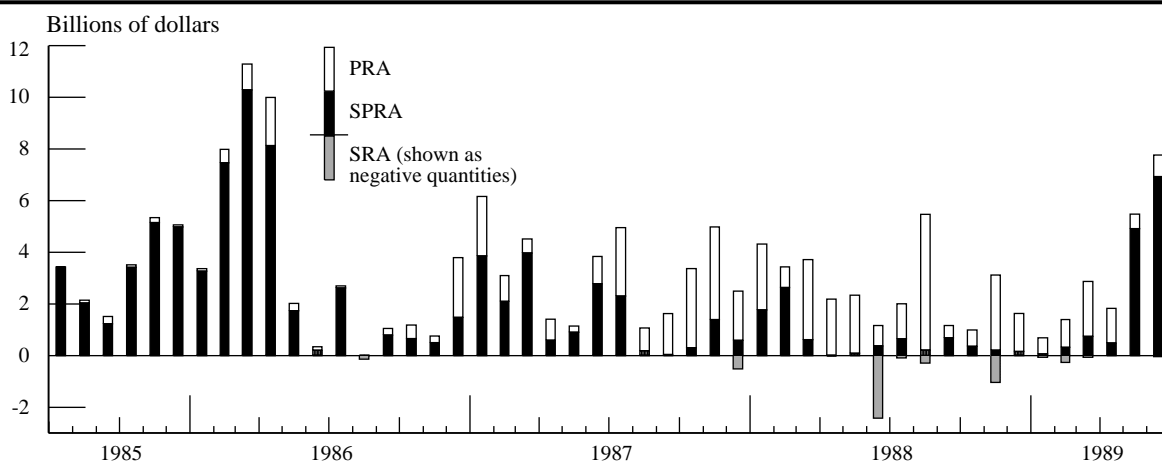
1. Monthly figures are the sum of the daily outstanding amounts at the close of business for regular PRA, SPRA and SRA respectively. No adjustment has been made to weight the daily amounts for transactions that extend over weekends or weekday holidays.

Chart 2   Monthly interest rate averages: Bank rate and overnight money market financing
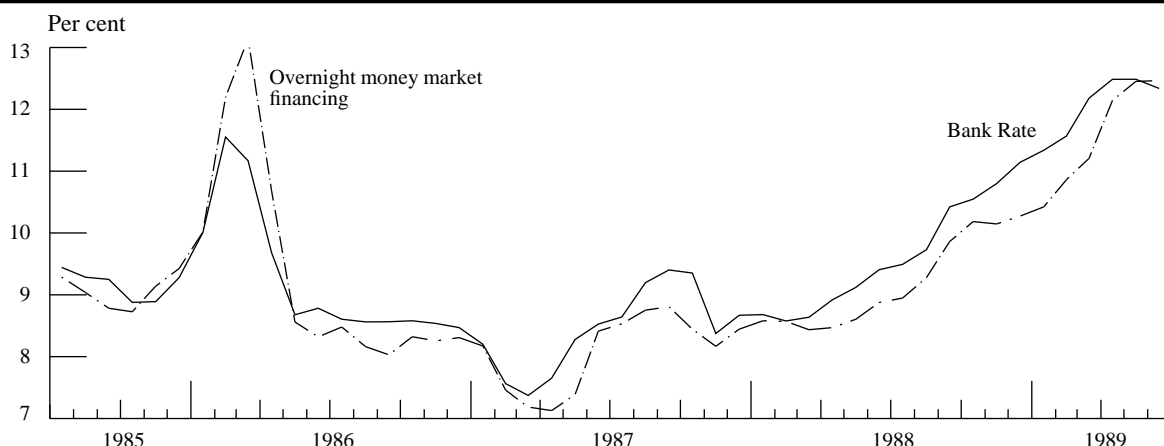
The use of special repurchase techniques in more normal circumstances can be illustrated by certain policy actions in 1988. As the Bank sought to bring the rate of expansion of total spending in the economy down to a more sustainable rate, monetary conditions were kept quite firm. In early summer, SRA were used extensively in support of restrictive cash settings to indicate to the financial markets that an increase in short-term interest rates was necessary. Stepped-up frequency of SRA began on 31 May, when the offer rate of 8 7/8 per cent, which was significantly higher than the special call loan rate of 8 3/4 per cent earlier in the day, provided a signal of the desired direction of overnight credit costs. In June, SRA were arranged on six occasions, for a total value of around $2.4 billion.

In all the situations described so far the buy-back operations directly bolstered the thrust of the cash setting – SPRA to support easing, SRA to help tighten. However, in 1988, although the Bank of Canada policy resisted the increased demands for credit, there were nevertheless frequent offerings of SPRA – indeed, from March through December 1988 there were as many as in the same period a year earlier. In this case SPRA were used as a safety valve to prevent overly steep increases in overnight borrowing costs as interest rates rose. The tactic of setting cash tightly, and then relieving excessive pressure through SPRA when necessary, raised the profile of the announced cost of SPRA in the money market. This at times increased the influence of monetary policy on the course of overnight lending rates, by clarifying the Bank's intentions about interest rates in periods when choosing the right cash setting was problematic.

These episodes show clearly that the offer of SPRA or SRA is not related in any simple way to the stance of policy. In general, increased frequency of intervention corresponds to unsettled market conditions and to consequent difficulties in judging the appropriate cash setting. Since market uncertainty more often results in undue tightness than in excessive ease, SPRA is called into action much more frequently than SRA. This means that SPRA, although in principle a device that eases monetary conditions, might be observed quite frequently during periods of tightening in monetary policy, as has been the case in the past year and a half.

Table 3	Monthly offerings and interest rates of SPRA			
	Total SPRA[1] Millions of dollars	Offerings of SPRA[2]		Average of offered rates[3] %	Overnight money market financing rate[4]
		Accepted	Declined		
		Number of days			
1985					
June	115.0	1	0	9.58	9.75
July	–	–	–	–	–
August	110.0	1	0	9.20	9.13
September	282.5	2	0	9.00	9.00
October	96.5	1	0	9.75	8.88
November	191.0	2	0	9.38	9.69
December	97.7	1	0	11.00	9.75
1986					
January	100.0	1	0	10.50	10.75
February	520.0	2	0	12.88	12.50
March	999.6	7	0	12.96	12.73
April	1,864.8	8	3	10.62	10.56
May	238.0	1	0	8.38	8.50
June	135.0	1	0	8.38	8.50
July	80.0	1	0	8.50	8.50
August	–	–	–	–	–
September	255.5	1	0	8.75	8.75
October	525.0	2	1	8.59	8.46
November	256.0	2	0	8.56	8.44
December	2312.3	9	1	8.36	8.34
1987					
January	2,301.0	3	0	8.19	8.17
February	998.0	2	0	7.44	7.38
March	542.7	3	0	7.38	7.31
April	815.8	6	2	7.30	7.27
May	241.0	3	1	8.08	7.83
June	1,051.0	4	0	8.58	8.59
July	2,648.5	8	1	8.67	8.69
August	882.0	4	3	8.82	8.81
September	1,586.7	5	0	9.03	9.05
October	3,060.9	11	1	8.34	8.20
November	4,851.2	7	1	8.16	8.31
December	1,905.5	7	1	8.56	8.54
1988					
January	2,550.2	4	0	8.65	8.69
February	797.9	4	3	8.59	8.61
March	3,100.0	8	1	8.50	8.47
April	2,189.0	8	1	8.53	8.52
May	2,248.3	5	1	8.54	8.56
June	786.0	3	1	9.13	9.16
July	1,354.3	3	0	9.13	9.13
August	5,252.8	12	0	9.32	9.44
September	475.0	2	0	9.88	9.88
October	633.0	2	0	10.25	10.28
November	2,908.6	6	0	10.25	10.28
December	1,917.9	6	0	10.41	10.28
1989					
January	621.6	3	0	10.54	10.44
February	1,075.0	1	0	11.13	11.00
March	2,127.3	6	0	11.63	11.45
April	1,339.2	3	0	12.04	12.17
May	560.8	2	0	12.46	12.56
June	835.0	3	0	12.35	12.54

1. Par value of securities transacted.
2. Days where multiple rounds of SPRA were offered are counted as a single event. As such there are instances where a second or third round was refused, but the day is recorded as an acceptance.
3. This simple average includes the rates at which additional rounds of SPRA were offered.
4. Simple average of the daily average special call loan rate on days when SPRA were offered.

Table 4	Monthly offerings and interest rates of SRA				
	Total SPRA[1] Millions of dollars	Offerings of SPRA		Average of offered rates[2] %	Overnight money market financing rate[3] %
		Accepted	Declined		
		Number of days			
1986					
August	150	1	0	7.25	7.63
1987					
December	525	2	0	8.00	8.16
1988					
January	0	0	1	8.00	8.25
February	0	0	1	8.00	8.38
March	–	–	–	–	–
April	–	–	–	–	–
May	–	–	1	8.88	8.88
June	2,435	6	0	8.75	8.65
July	100	1	0	8.75	8.81
August	300	1	2	9.04	9.17
September	–	–	–	–	–
October	–	–	–	–	–
November	1,050	2	0	9.75	9.97
December	–	–	–	–	–
1989					
January	75	1	0	10.38	10.56
February	275	1	1	10.69	10.72
March	75	1	0	11.00	11.06
April	–	–	–	–	–
May	–	–	–	–	–
June	50	1	0	11.75	11.88

1. Par value of securities transacted.
2. Simple average of the offered rates.
3. Simple average of the daily average special call loan rate on days when SRA was offered.

From monetary policy instruments to administered interest rates: The transmission mechanism in Canada

by Kevin Clinton and Donna Howard

INTRODUCTION

In Canada the influence of the central bank over the economy stems from its control over the supply of settlement balances to the banking system, which consist of the deposits of bank and non-bank clearing institutions – the direct clearers – at the Bank of Canada. Technical Report 69 traces the steps from the provision of settlement balances (the cash setting) to money market interest rates, and thence to the posted interest rates of financial institutions. The most important of these administered rates are the chartered bank prime lending rate, savings deposit rates, and mortgage and guaranteed investment certificate (GIC) rates. At each step the report assesses how stable the key relationships have been in recent years.

With respect to the link between the cash setting and money market rates, the primary issue considered is whether the new framework, introduced in November 1991 and designed to maintain control of settlement balances in anticipation of the elimination of reserve requirements, has

delivered a satisfactory degree of influence over the overnight rate. This question is addressed through a descriptive analysis of the behaviour of the system, which focusses on a turbulent period in late 1992.

The links between interest rates are investigated with econometric techniques. In particular, econometric models are used to shed light on the determination of the medium-term bond rate and on the dynamics of the administered interest rate settings. The parameters of the models, which are estimated with weekly data from the 1980s, are tested for stability on data from 1990 to 1993.

INFLUENCE OF POLICY ON MARKET RATES

Tools of monetary policy

The Bank of Canada affects the supply of settlement balances through transfers of the demand deposits of the federal government between its own balance sheet and those of the clearing institutions.

Under the new framework, any negative balance at the Bank of Canada must be covered with an overdraft loan at Bank Rate, and in addition must either be offset with a positive balance at some later point in the monthly averaging period or an additional charge of Bank Rate at the end of the period. Since Bank Rate varies weekly at a 25 basis-point margin over the 3-month treasury bill rate, it follows quite closely the level of short-term rates in the market. These factors together imply that the cost of a deficit and the opportunity cost of holding a deposit at the central bank, which pays no interest, are almost equal.

An essential point of the framework is that it implies a determinate cost-minimizing settlement position each day at the central bank for each direct clearer. For example, as a result of the symmetry of costs of deficits and surpluses, in the absence of reserve requirements the cost-minimizing balance of each clearer at the central bank would be zero for every day through an averaging period. In practice, the demand for balances by the banks has generally been positive throughout the period studied, because of reserve requirements.[1] A number of other factors also influence the daily demand for settlement balances by the clearers, notably the large cumulative positions that have arisen in some averaging periods.

Because of the complexity of these factors, the Bank monitors the target levels of the direct clearers daily through direct communication with the institutions. The Bank then uses judgment to set cash at the level most likely to achieve the desired overnight interest rate. During bouts of market volatility this can be difficult. The autumn of 1992 was a case in point, but it is important to stress that the new operating frame-

work did not add to the difficulties experienced. Indeed the main surprise from the viewpoint of monetary policy was the sluggish response of the direct clearers to high levels of excess balances. This was partly due to the remaining reserve requirements, which allowed the banks to run surpluses at no cost, since they could be offset later in the averaging period by deficits without provoking an overdraft loan from the Bank of Canada. The recent elimination of these requirements should make the response of the banks in the overnight money market prompter and more predictable.

FROM MONEY MARKET RATES TO 5-YEAR BOND RATES

Short-term bond yields play an important role in determining mortgage and GIC rates. To investigate the influence of money market rates on these yields, a model for the 5-year bond rate is estimated, based on the "expectations theory," which relates bond yields to expected future short-term interest rates. The estimates imply that while current short-term interest rates in Canada have some impact on domestic bond rates, the effect of U.S. interest rates is dominant in the long run. This is consistent with the view that changes in domestic monetary conditions in Canada can only cause temporary changes in real interest rates, and that with the passage of time real interest rates in Canada follow closely those in the United States. The inflation performance of Canada and the United States did not differ systematically enough in the estimation period to allow the model to pick up the potential for nominal interest rates to diverge on account of differing inflation trends.

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1. Reserve requirements were phased out gradually over a two-year period following proclamation of the Bank Act in June 1992 and were reduced to zero in July 1994.

Out-of-sample prediction errors of the equation are neither large nor biased in one direction. Thus, on these estimates, the yield curve has not been unusually steep over the last few years, given the levels of short rates in Canada and of the term structure in the United States. This would suggest that the success of the inflation-reduction targets announced in 1991 by the Bank of Canada and the federal government has roughly offset the negative events that have tended to affect the Canadian bond market since 1990, which include the constitutional impasse, deteriorating government finances, a large external deficit, and downgrades by credit rating agencies. From this perspective, it would appear that pursuit of the disinflation targets has had some useful effect on expectations and on helping to hold down long-term rates.

PRIME LOAN RATES

In setting their prime loan rate, banks pay close attention to their own cost of funds, and to the competing interest rates available to their clients in the markets for bankers' acceptances (BAs) and corporate paper. Empirically, it is found that the 30-day BA rate and especially the 90-day commercial paper rate have had a strong influence on the level of the prime rate; the differentials of these rates against the prime rate have had a distinct tendency to revert to the historical mean of about 1 1/4 per cent. Movements in the Bank Rate often act as a trigger for changes in the prime rate, but they have no permanent effect.

Statistical tests show that the estimated equation shifted between the 1980s and the 1990-93 period, which saw a steep decline in interest rates. This shift can be traced to large prediction errors in 1991-92, when the banks' intermediation spread was unusually narrow in conse-

quence of a rivalry among the banks to be first to announce rate cuts. When banks had reason to think that market rates were close to reaching a floor, the banks stopped reducing prime rates in anticipation of future rate declines and allowed the spreads against prime to return to the normal historical range.

Savings deposit rates

Rates on high balance deposit categories, introduced in 1986, have been reset weekly in line with 3-month treasury bill rates, allowing the deposit-taking institutions to meet growing competition from treasury bills and money market mutual funds. At the same time lower rates, about 1/2 per cent since mid-1993, have been offered on small deposits, which are less interest sensitive.

MORTGAGE AND LONG-TERM DEPOSIT RATES

Financing of mortgage loans comes primarily from GICs. To reduce interest rate risk, the lending institutions have traditionally matched maturities as closely as possible across the balance sheet, although nowadays they also use derivative instruments to the same end. The most common maturities are from 1 to 5 years, with the 1-year predominating since the early 1980s.

Two sources of interest rate risk in the industry are somewhat more difficult to hedge. The first stems from the practice of fixing the interest rate on a mortgage loan at the time of approval, which is usually one to three months before the loan is disbursed, without committing the borrower to take the loan. The second is that a large drop in interest rates encourages borrowers to

pre-pay existing loans and to refinance at a lower rate with a competing institution, prepayment penalties notwithstanding. In both cases borrowers are presented with options that will be costly to lenders in the event of a decline in rates, given the fixed interest obligations of the lenders. Since the industry spread has to cover this cost, it widens when high and volatile rates mean that the risk of a large rate drop is higher.

Thus, in the early 1980s, when mortgage rates were around 20 per cent, the spread between 1-year mortgage and GIC rates exceeded 250 basis points. It declined to around the more normal level of 180 basis points for the rest of the 1980s, then backed up again, to around 215 basis points between July 1990 and August 1993. The renewed widening may be attributed to several factors: an increase in the potential cost to lenders of the interest rate options, as interest rates were on a downward trend; measurement error, as better-than-posted rates were increasingly offered to valued clients; losses on commercial real estate lending, which caused severe difficulties for some trust companies, and hence less competition for the banks; and relatively strong demand for mortgages, as households switched from consumer credit to get longer amortization periods and lower costs.

As a result of these developments, the industry spread has not exhibited stable long-term behaviour since 1980. However, statistical tests do suggest that the spread had a tendency to vary within a stable range over the abbreviated period between 1983 and 1990. Econometric models successfully explain mortgage and GIC rates over this period. On the liability side, the 12-month treasury bill rate is assumed to be the main competing instrument for 1-year GICs, and the 5-year federal government bond rate for 5-year GICs. The estimates imply that the long-run intermediation spread is about 180 basis points at both terms, and that the mortgage rate and the GIC rate adjust

together to eliminate any unusual gap between them within a week or two. However, in simulation experiments of shocks in market rates, full adjustment of the level of both mortgage and GIC rates takes many weeks.

The model does not manage to explain the widening of the spread outside the estimation period; between 1991 and 1993, GIC rates were lower than predicted and mortgage rates, a little higher. Given the changes in option costs and in measurement error discussed above, these errors are not very surprising.

CONCLUSIONS

- The Bank of Canada has broadly achieved its objectives for short-term interest rates just as well under the new operating framework as under the old framework. The transition to zero reserve requirements in mid-1994 helps further in this regard, by making the hoarding of excess balances more expensive for the banks.

- The prime lending rate of the banks reacted unusually quickly to rate declines in the period 1991-92, so that the spread between the prime rate and the wholesale borrowing costs of the banks touched unusually low levels. However, this seems to have been just a short-run phenomenon, since when rates stopped their strong downward trend, prime rate differentials were restored to a more traditional range. These developments are reflected in the prediction errors of the estimated prime rate equation, which show some large, but transitory, increases in these years.

- The medium-term bond rate has exhibited fairly stable empirical correlations. Although

for some years the differential vis-à-vis short rates has been quite wide, the estimated equation suggests that this is in line with previous experience, given the levels of U.S. rates and short rates in Canada. The absence of a visible effect on the yield curve from the inflation-reduction program may indicate that it is taking a long time to build up monetary credibility, but it also suggests that the well-known political uncertainties and debt problems in Canada have tended to offset the beneficial effect on the bond market that the success of the program might otherwise have had.

- The simultaneous equation model of the mortgage and GIC rates performs quite well. But the widening of the posted intermediation spread in the early 1990s is due to several factors that have not been included in the model, notably the heightened interest rate risk that mortgage lenders face when rates are declining.

The use of indicators and of the monetary conditions index in Canada

by Charles Freedman

In the process of formulating and implementing monetary policy, central banks focus on a series of variables, ranging from the ultimate target of policy, at one end, to the instrument of policy, at the other end, with operational targets, intermediate targets, and indicators or information variables in the middle. This paper first examines from a general perspective the way in which the different types of variables fit together in the making of policy. Next it sets out the role of the different variables in the Canadian policy framework. It then focusses on the use of the monetary conditions index (MCI), a combination of the short-term interest rate and the exchange rate, as the operational target of policy in Canada (in place of the short-term interest rate). Particular attention is paid to the reasons for the increased emphasis on the MCI, various ways in which it can be constructed, and some caveats about its use.

A FRAMEWORK FOR CONDUCT OF MONETARY POLICY

In conducting monetary policy, central banks typically make use of a wide variety of variables that play very different roles. In schematic terms the general approach to policy in most countries can be characterized as follows:

$$instrument(s) \rightarrow \begin{array}{c} operational \\ target \end{array} \rightarrow \begin{array}{c} intermediate \\ target \end{array} \rightarrow \begin{array}{c} ultimate \\ target \end{array}$$

$$\begin{array}{c} indicators \\ (or\ information\ variables) \end{array}$$
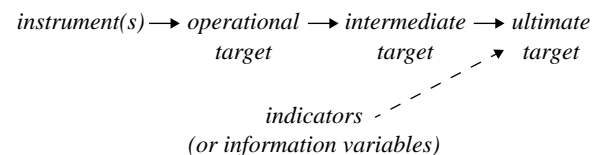
At one end of the spectrum is the ultimate target of policy (e.g., a path to price stability,[1] perhaps reflected in a target range for the rate of increase in a specific price index), while at the

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1. *In a fundamental sense price stability is not the ultimate target but a means to an end, the end being a well-functioning economy, with high levels of employment and rising standards of living. For a succinct statement of the benefits of price stability and costs of inflation and the way in which price stability leads to an improvement in the functioning of the economy, see Bank of Canada (1990). For ease of exposition in this paper, however, price stability is referred to as the ultimate target of policy.*

other end is the instrument or instruments by which policy is implemented (e.g., the size of the balance sheet of the central bank, the discount rate and, in some countries, controls on the growth of certain components of commercial bank balance sheets). Because of the long lags and very indirect connections between the instrument and the ultimate goal, most central banks have found it helpful to make use of other variables that stand between the instrument and ultimate goal. These can be classified as intermediate targets, operational targets, and information variables or indicators.[2]

An intermediate target is a variable that is closely linked to the ultimate target of policy and that is influenced by changes in the instrument of policy. Examples of potential intermediate targets include monetary aggregates or credit aggregates, the exchange rate, and the rate of growth of nominal gross domestic product (GDP). The key perceived advantage of an intermediate target is that it enables the central bank to move its instrument settings more quickly and more accurately in response to a shock to the system than it could if it focussed solely on current values of the ultimate target.[3] Thus, for example, since an aggregate demand shock normally results in a change in the demand for a monetary aggregate before it affects the rate of inflation, targeting a monetary aggregate enables the central bank to respond more quickly than it could if it had to wait for the ultimate target variable to be affected. Of course, as discussed further below, if the response of the central bank is not to actual movements of the ultimate target variable but to projected movements in this variable (where the projection is based in part on movements in vari-

ous information variables or indicators), use of an intermediate target may or may not speed up the policy response. Thus, whether or not an intermediate target improves the policy process is an empirical question.

The movement by central banks away from the use of monetary aggregates as intermediate targets in recent years resulted in the main from changes in the financial structure that weakened the link between monetary aggregates and the ultimate target variable. In the end, whether a variable would or would not be helpful as an intermediate target is a matter of judgment and rests principally on how close and how stable is the empirical relationship between the intermediate target variable and the ultimate target. Of course, to be useful, an intermediate target must also respond to changes in the central bank instrument.

It is helpful to think of a central bank operating fairly directly upon an operational target when it changes the settings of its instrument variable. The operational target in most countries is a short-term interest rate. However, as I will argue later, in the case of a country with a floating exchange rate, it is preferable to use a monetary conditions index as the operational target for policy rather than the short-term interest rate.[4]

There are two main distinctions between the operational target and the intermediate target. The first distinction rests on how quickly and how directly an instrument change impinges on the targeted variable – for example, the effect on short-term interest rates shows up almost immediately whereas the effect on monetary aggregates tends to be spread out over a much longer period of time. The second distinction follows

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2. *See Freedman (1990); Friedman (1990); and Crockett (1994) for detailed discussion of these concepts.*
3. *There are two possible reasons. Either the intermediate target variable leads the ultimate target variable in the economic process, or the two are contemporaneous but data on the intermediate variable are published earlier.*

4. *It is also worth noting that the operational target is often treated as the instrument of policy in academic writings – for example, Poole (1970). Although this variable is typically very close to the instrument (in terms of responsiveness to changes in the instrument), in reality it is not itself an instrument, in the sense that the central bank does not control it directly.*

from the nature of the targets. The intermediate target is typically a nominal variable that can function as a nominal anchor to the system while the operational target (such as the short-term interest rate) will typically not be able to serve as the nominal anchor to the system.

While a monetary authority must have an instrument and an ultimate target, it need not have an intermediate target or an operational target.[5] Many countries have conducted policy in recent years without an intermediate target and some have dispensed with an operational target (e.g., the United States between 1979 and 1982).

An indicator variable or information variable provides leading or contemporaneous information about potential movements in the ultimate target variable (or a variable linked to the ultimate target variable) but is normally not itself treated as an object to be controlled. For example, certain interest rate spreads (e.g., the spread between short-term rates and long-term rates) appear to contain information about future movements in real output growth, which, in turn, are a leading indicator of inflation. These spreads have not, however, themselves been used as an objective of policy.

The links between indicator variables and ultimate target variables can be based on either structural models or astructural models. The former are preferable, in the sense that policy-makers are more comfortable with relationships that are based on a theoretical foundation and that are more likely to remain unchanged when there is a change in policy regime. In recent years, however, there has been increased reliance on astructural models, such as reduced-form models, information content models, and vector autoregression models.[6]

THE CANADIAN POLICY FRAMEWORK

The ultimate target of policy in Canada is the achievement and maintenance of price stability. To make this goal more concrete, in February 1991 the Government of Canada and the Bank of Canada jointly announced targets for reducing inflation, which aimed at bringing the rate of inflation to a range of 2 to 4 per cent by the end of 1992 and 1 to 3 per cent by the end of 1995. In December 1993, the government and the Bank extended the 1 to 3 per cent target band to the end of 1998. On the basis of the experience with low inflation over the period, a decision will be made by 1998 on the target range for the price index that is consistent with price stability.[7]

Between 1975 and 1982 the Bank used the narrow monetary aggregate, M1, as its intermediate target variable. Mainly because of innovations by financial institutions, the demand for M1 became much less stable in the early 1980s and M1 was withdrawn as a target in November 1982. Since then the Bank has conducted policy without an intermediate target.

For many years the short-term interest rate was the operational target of monetary policy actions. More recently, the monetary conditions index (MCI), a combination of the short-term interest rate and the exchange rate, has become the operational target of policy. The next section of this paper will discuss in considerable detail the reasons for focussing on the MCI, the way in which it is constructed, and some caveats regarding its use.

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5. See McCallum (1988) for a model in which the instrument (monetary base) is directly linked to the ultimate target of policy (nominal gross national product in his setup).

6. There is a risk that the usefulness of these models may diminish or even disappear if there is a regime shift. This might be the case if, in responding to shocks, monetary policy tried to exploit the information in these equations, which were themselves based on the earlier monetary policy reaction function.

7. For further discussion of the experience with inflation-reduction targeting see Freedman (1994).

The principal instrument used by the Bank of Canada to influence monetary conditions is changes in the supply of settlement balances provided to directly clearing financial institutions.[8] From time to time the Bank also uses Special Purchase and Resale Agreements (SPRA) and Sale and Repurchase Agreements (SRA) to influence the one-day rate, and outright purchases and sales of treasury bills to influence three-month interest rates.[9]

To understand the role of indicators in Canadian monetary policy, it is necessary to set out in somewhat more detail the way in which policy is conducted in Canada. The key point to be noted is that Bank of Canada actions to achieve a rate of inflation within the target bands are directed to an inflation outcome between six and eight quarters in the future. The reasons for the forward-looking nature of policy is, of course, the long (and variable) lags between monetary policy actions (i.e., changes in instrument settings) and their effects on the rate of inflation.[10]

Even in simple theoretical models, the achievement of price stability or a specific rate of inflation quarter by quarter is usually not possible or leads to instrument instability. And recognition of the difficulty of achieving a target inflation rate in the short run lay behind the decision to set the first guidepost for the inflation-reduction targets at the end of 1992, 22 months after their announcement. Moreover, in the background note issued at the time the targets

were introduced, it was explicitly noted that monetary policy actions could not be expected to reverse immediately the effects on inflation of unexpected shocks to the demand for, or supply of, goods and services. Rather, the monetary policy actions would set in motion a process of adjustment that over time would return the trend rate of inflation to its target path.

Given the forward-looking nature of the policy process, projections and indicators obviously have to play an important role. Indeed, the Bank of Canada staff prepare a series of projections, reassessments and monitoring updates through the year, having a time horizon ranging between two quarters and seven years.[11] The projections are developed on the basis of a formal model projection, which also incorporates the input of sectoral specialists. The role of the latter is most important in the near-term outlook while the model itself plays the greater role in the outlook for the medium and longer term as well as for simulations of alternative scenarios.

All factors affecting aggregate demand and supply influence the inflation projection directly or indirectly. The elements feeding directly into the price determination process are the current and projected output gaps, the expected rate of inflation (which is based partly on past inflation and partly on forward-looking measures), indirect taxes, and the level of the exchange rate. The question of whether the latter two factors, and other supply shocks (such as shocks to energy prices), affect the level of prices or the rate of inflation remains open. If such shocks affect only the level of prices and not the ongoing inflationary process, they have only transitory effects on the rate of inflation and hence play less of a role beyond the short run than do

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8. *More precisely, changes in settlement balances provided by the Bank of Canada initially affect the one-day interest rate. Changes in the latter feed into short-term interest rates and the exchange rate, thereby affecting monetary conditions.*

9. *Details of the way in which the Bank's instruments are linked to the operational target are not needed for purposes of the analysis in this paper. An account of this part of the policy process can by found in Clinton (1991) or Montador (1994).*

10. *The Bank of Canada uses a framework in which monetary policy operates through a traditional type of transmission mechanism. See Duguay (1994) for details.*

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11. *See Duguay and Poloz (1994) for a detailed account of the role of economic projections in the decision-making process.*

the more fundamental factors such as the cumulative slack in the economy.[12]

In addition to the factors that enter directly into the model projection of future rates of inflation, there are a number of other variables that are monitored carefully for their information content. For example, certain measures of wages can assist in the analysis of the extent of inflationary pressures in the economy. Most useful in this regard are the collective wage settlements data because they are primarily forward-looking (although they too may incorporate a backward-looking element of catch-up).

The Bank of Canada also makes considerable use of financial aggregates to aid in its analysis of current and anticipated economic developments. These aggregates are typically interpreted from two perspectives. First, are they growing faster (slower) than would be expected on the basis of their demand functions? This would be a signal either of somewhat faster (slower) growth of current nominal spending than expected or of a disturbance in the relationship between the financial aggregates and their determinants. The judgment of financial sector specialists is an important input in the determination of which of these hypotheses is the more likely. Second, and more important in recent years, has been the use of astructural models linking financial aggregates to other variables further out the process. Thus, real M1 has proved to be a good leading indicator of output growth one to two quarters out. Similarly, broader monetary aggregates (such as M2 and M2+) are good leading indicators of the near-term rate of inflation.[13] And recent research has indicated that M2+ and even broader monetary aggregates have good forecasting properties for

the rate of inflation four to eight quarters out. This property, if confirmed by further study, would make them extremely useful, given that the objective of policy actions is to influence the rate of inflation over four to eight quarters.[14]

These leading indicator measures are both of intrinsic interest and, as well, can provide alternative short-term projections that influence the judgment of sectoral specialists in the model-based projection exercises. Moreover, they provide a direct cross-check against the staff's projection exercise and may give an early indication of errors in the projection.

THE MONETARY CONDITIONS INDEX AS AN OPERATIONAL TARGET

The role of the operational target

As just explained, the Canadian authorities have information from a variety of sources on demand and supply developments in the economy and on the inflationary implications of such developments over the near-term to medium-term horizon. They also have a target for the rate of inflation six to eight quarters out.

To achieve this target, given anticipated inflationary pressures, may well imply adjustments in the instruments of policy over that horizon. Rather than trying to set a target path for the instrument itself (i.e., changes to the Bank of

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12. Another open question concerns the linearity or nonlinearity of the response of inflation to demand shocks. See Laxton, Rose and Tetlow (1993) for the view that inflation responds more strongly and faster to excess demand than to excess supply.

13. See Muller (1992) for a summary of the Bank of Canada's research on the usefulness of financial aggregates as leading indicators. More recently we have also been examining the potential usefulness of interest rate spreads (particularly the spread between long and short rates) as leading indicators of output. See Cozier and Tkacz (1994).

14. Credit aggregates have typically fared less well than monetary aggregates as indicators of future output and inflation. See Muller (1992) for a full account.

Canada balance sheet), it is much easier and more useful to set a provisional path for the operational target over the projection horizon that would be consistent with the achievement of the targeted outcome for the rate of inflation. In the main, this is because the standard macroeconomic model links changes in aggregate demand and inflation to changes in interest rates and the exchange rate and not directly to changes in the instrument variable. Also, because of the complex relationship in the Canadian system between the instrument and the operational target variable, it is not useful to calculate a path for the instrument variable beyond the very short run.

For most central banks, and for the Bank of Canada until a few years ago, the operational target of policy is the short-term interest rate. Thus, in terms of the above discussion, the staff would calculate a provisional target path for the short-term interest rate (as well as for many other variables, including the exchange rate) that would be consistent with the achievement of the ultimate target[15] if the path for the predetermined variables turned out as projected and if the assumed relationship between the operational target variable and the ultimate target variable used in setting the provisional path turned out to be accurate. In practice, because of such considerations, the provisional target path for the short-term interest rate in the projection was not taken literally by senior management. However, the process of generating it provided a useful basis for discussion of policy as well as a benchmark for judging the implications of unforeseen economic developments and for providing a framework for reconsideration of interest rates following such developments.

When a shock hit the system (or, indeed, when there was a change in view regarding the economic situation), action was taken to change the path for the operational target in order to offset the effect of the shock on the ultimate target. The size of the needed change was based on both model results and the judgment of the management of the central bank. As time passed, the effects on a variety of variables of the shock, and of the monetary policy action taken in response to the shock, were monitored very closely and further changes in the operational target were made as necessary. Of course, the process was far from mechanical. Typically, the shocks were not clear-cut events that could be calculated to have a precise effect on aggregate demand and inflationary pressures. Hence it was not possible to calculate with precision the change in the operational target needed to offset the shock.[16]

Thus, for example, in the latter part of the 1980s, the Bank of Canada (and virtually every other forecaster) underestimated the strength of aggregate demand in the Canadian economy. As new information arrived that indicated the presence of more demand pressures than had previously been expected, tightening monetary policy actions were taken progressively. In such circumstances, instead of a once-and-for-all increase in interest rates to offset a given shock, there was a sequence of increases in interest rates (with some pauses in between the jumps) that reflected the periodic reinterpretation of the strength of aggregate demand and inflationary pressures. A similar sequence occurred on the downside of the cycle in the early 1990s as the economy turned out to be weaker and more disinflationary than anticipated by the Bank or by private forecasters.[17]

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15. *If the central bank focussed on an intermediate target, this would be used in place of the ultimate target in setting the path for the operational target.*

16. *This uncertainty was, of course, compounded by the lack of certainty regarding the precise linkages between changes in the operational target variable and changes in aggregate demand and inflationary pressures.*

17. *Both on the upside and the downside of the interest rate cycle, the Bank also acted to smooth the short-term interest rate movements. On the downside, in particular, there was a perceived need to act in such a way as to increase the likelihood that the decline in short-term interest rates would be durable and that it would be reflected in interest rates all across the maturity spectrum.*

Reasons for using a monetary conditions index

As indicated earlier, the operational target in Canada for many years was the short-term interest rate. Several years ago, however, the Bank of Canada began to focus increasingly on a broader concept of monetary conditions as the operational target, using a construct that included both the short-term interest rate and the exchange rate. The broadening of the concept of monetary conditions to include the exchange rate was based on two main considerations. First, in a flexible exchange rate regime monetary policy operates through two channels – the interest rate and the exchange rate. Since the relative movements of the two variables will depend on market responses to central bank actions, they can differ appreciably in different circumstances. Second, if there are exogenous shocks to the exchange rate, monetary policy actions should typically offset their effects on aggregate demand.

The role of the MCI as a way of capturing the effects of both short-term interest rates and the exchange rate in the transmission mechanism of monetary policy can best be illustrated by the case of a shock to aggregate demand, which leads to a change in the target path for the operational target and to the need for central bank actions to achieve the revised path. Consider, for example, a situation in which the central bank, in response to an expansionary demand shock, decides that a less stimulative path for monetary conditions would be appropriate. Typically, restrictive monetary actions following a decision to tighten monetary conditions would lead to both a rise in short-term interest rates and an appreciation of the domestic currency. The particular "split" between the change in short-term interest rates and the change in the exchange rate following restrictive actions by the central bank[18] would be determined by the markets and would depend on such factors as the length of

time the market expected the higher interest rates to last and how sensitive movements in the expected exchange rate were to movements in the actual exchange rate.

For example, if short-term interest rates rose by 1 percentage point and the increase was expected to last one quarter, and if the expected exchange rate remained unchanged, the exchange rate would appreciate by 0.25 percent.[19] In reality, of course, there would be considerable uncertainty about the duration of the interest rate change. As well, the expected exchange rate tends to adjust in response to a change in the actual exchange rate. Hence, the exchange rate response to an interest rate change can vary widely.

Tightening actions by the central bank could thus result in a small increase in interest rates and a significant appreciation of the currency, or a substantial increase in interest rates and a small appreciation of the currency. Although both of these outcomes would have similar overall effects on aggregate demand, the former would affect mainly the exchange-rate-sensitive sector (i.e., traded goods) while the latter would affect mainly the interest-rate-sensitive sector (i.e., investment in machinery and equipment, construction, and spending on durable consumer goods).[20] If the central bank focussed only on interest rate changes, it might tighten excessively

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18. *In the Canadian case the Bank of Canada would reduce the supply of settlement balances available to directly clearing financial institutions, which would have a direct effect on the one-day rate of interest and then feed out to short-term interest rates and the exchange rate. This type of action is equivalent to reducing the supply of reserves in a system where reserve requirements are imposed on financial institutions. In Canada such requirements are in the process of being eliminated and will disappear completely in mid-1994.*
19. *Purchasers of the domestic asset following the interest rate change would thus earn a higher rate of interest but would lose a corresponding amount on the expected depreciation.*
20. *The lags with which spending would be affected might also be different.*

in the case where most of the initial reaction to the change in the instrument occurred through an appreciation of the exchange rate, since it was not taking sufficient account of the downward pressure on aggregate demand that was taking place through the currency appreciation. By focussing on a combination of interest rate changes and exchange rate changes, the central bank can avoid the potential error of injecting or removing too much or too little stimulus to the economy through ignoring one of the key channels through which monetary policy operates.[21]

A second set of circumstances in which the concept of monetary conditions is helpful is that in which there is an exogenous shock to the exchange rate. Here, the target path for monetary conditions is assumed to be unchanged while the actual MCI has moved as a result of the exchange rate shock. Suppose, for example, that there is a loss of confidence in the domestic currency (say, for political reasons) and that a sharp depreciation takes place as a result of a desire by investors to shift out of assets denominated in the domestic currency. The depreciation, in itself, is expansionary. If the central bank was previously satisfied with the setting of monetary conditions in the economy, it would now be faced with a overly expansionary situation and hence should take action to return monetary conditions to their previous level. If the bank focussed on a monetary conditions index, the need for tightening action would show up directly since the index would show the easing resulting from the currency depreciation.[22] In the absence of such a construct, there is a greater likelihood that the central bank would not take timely action to off-

set the expansionary effect of the depreciation and hence monetary conditions might be inappropriately eased until a more complete assessment of the exchange rate change is done in the next staff economic projection.

This is not to say that the central bank would always fail to react when it was appropriate to do so following an exogenous exchange rate change. Rather the lack of a direct mechanism signaling the need to take action to offset the easing of monetary conditions resulting from the depreciation would make it more likely that action would be delayed.

In both sets of circumstances in which the MCI helps to ensure that appropriate attention is paid to the exchange rate change, its usefulness is greatest in the period between formal projections. Presumably, the staff would capture appropriately the effect of an exchange rate change at the next quarterly projection exercise. But, between projections, the MCI provides a continual reminder to policy makers to take account of changes in the exchange rate when considering adjustments in short-term interest rates.[23]

The construction of the MCI

The MCI is the combination of the short-term interest rate and the exchange rate, less their values in a base period. Thus it measures the degree of ease or tightening in monetary conditions from some (arbitrary) date. There is thus no meaning to be attached to the measure of the

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21. *This does not, of course, mean all errors will be avoided. The difficulty of assessing the effects of shocks on aggregate demand remains, as does the difficulty of assessing the precise effect on demand of changes in interest rates and the exchange rate. But the potential error of ignoring the exchange rate channel of monetary policy will be avoided by focussing on monetary conditions rather than just on interest rates.*

22. *The direction of response (i.e., tightening actions by the authorities) is the same as would be needed in the case where the depreciation was taking place in the context of a disorderly exchange market and the authorities wished to calm the market. The magnitude of the change and the duration of the period of tightness would typically not be the same, however.*

23. *In countries where projections are done less frequently than in Canada, the usefulness of the MCI would be even greater.*

level of the MCI, since it is constructed as a change from the base date.

There are a variety of conceptual ways in which the MCI could be measured. Thus, the MCI could be constructed in terms of the effect of the interest rate and exchange rate changes on either aggregate demand or prices. It could also be calculated in real terms or in nominal terms. Consider, first, an MCI in real terms which is based on the effects on aggregate demand of changes in interest rates and the exchange rate. This version of the MCI is measured as a weighted sum of the change (in percentage points) in the short-term real interest rate (defined for purposes of this construct as the three-month commercial paper rate less a measure of the expected rate of inflation over the three months)[24] relative to the base period and the percent change in the real effective exchange rate relative to the base period.[25] Note the use of the percentage point change in the interest rate and the per cent change in the exchange rate in the calculation. These reflect the ways in which the two components of the MCI affect aggregate demand.

The relative weights on the components of the MCI are based on a number of empirical studies that estimate the effect on real aggregate demand over six to eight quarters of changes in real interest rates and real exchange rates.[26] In deciding on the weights, use was made of structural models, vector autoregression (VAR) models and reduced-form models. Although these models give quite different answers on the separate effects of interest rate changes and exchange rate changes on aggregate demand, they give reasonably similar results on the relative sizes of the effects. Roughly speaking, there appears to be about a 1:3 ratio of effects. That is, a 1 percentage point change (100 basis points) in the real interest rate has about the same effects over time on real aggregate demand as a 3 per cent change in the real effective exchange rate.[27]

The units of measurement of the MCI being in terms of real interest rate changes, this version of the MCI is defined as:

MCI = [Real interest rate – real interest rate at base period] + (1/3) [(Real effective exchange rate index/real effective exchange rate index at base period) - 1] (100)

Thus, one can interpret the MCI most simply as the percentage point change in real interest rates equivalent to the combined change in real interest rates and the real exchange rate since the base period.[28] Moreover, since the MCI is always measured relative to a given base period, subtracting the MCI at two points of time gives a measure of the degree of tightening or easing between those two points of time.

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24. There are, of course, a variety of ways of measuring expected inflation. Currently, in constructing the MCI, the Bank of Canada uses a model-based measure, which has both backward-looking and forward-looking components.

25. Note that it is not the bilateral exchange rate but the effective or multilateral exchange rate that enters into the calculation. The latter is the appropriate measure since it captures the movement in the Canadian dollar versus the currencies of Canada's major trading partners, appropriately weighted for their importance in Canadian trade. (The weight of the U.S. dollar in the effective exchange rate is about 0.82.)

26. Movements in real interest rates and the real exchange rate were not so collinear over the estimation period as to preclude estimation of their separate effects on aggregate demand. Indeed, the correlation coefficient of the changes in the quarterly averages of the two variables over the 1980 to 1993 period was - 0.22.

27. See Duguay (1994).

28. Other normalizations are also possible but the interpretation of the MCI in terms of interest rate equivalents has an intuitive appeal.

Chart 1   Monetary conditions index

January 1987 = 0
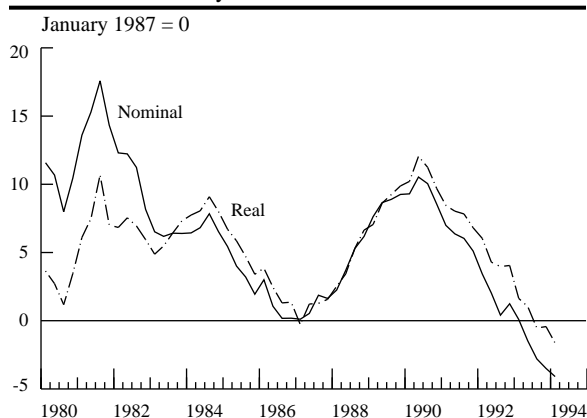
In practice, the Bank of Canada focusses much more on the nominal MCI than on the real MCI over the short term.[29] The main reason is the lag in calculating the real MCI over this horizon because of the need for price measures from Canada's major trading partners in calculating the real effective exchange rate. Moreover, for the relatively short horizon for which the MCI is most useful (i.e., between the quarterly projection exercises),[30] the nominal MCI serves almost as well as the real MCI, since the price measures that underlie the real MCI change much more gradually than do the nominal interest rates and the nominal exchange rate. Thus, while there is some drift over time between the levels of real and nominal MCI, they tend to move together in the shorter term (see Chart 1). The correlation coefficient of the levels of the quarterly averages of the real and nominal MCI over the period 1980-Q1 to 1993-Q4 is 0.74 while the correla-

tion coefficient of changes in the quarterly averages of the two series over the same period is 0.88.

The construction of the two measures of MCI discussed thus far is based on the relative longer-term effect on real aggregate demand of changes in short-term interest rates and the effective exchange rate. An alternative approach focusses on the effects of changes in the two variables on changes in prices over six to eight quarters. Because the exchange rate has a direct effect on prices in addition to its indirect effect via aggregate demand, it has a greater weight when the focus is on prices rather than on aggregate demand. Empirically, the best estimate of the relative weights in this case is 1:2 rather than the 1:3 in the earlier construct. That is, a 2 per cent change in the effective real exchange rate has the same effect on prices as a 1 percentage point change in real interest rates. Once again, the MCI can be constructed in terms of changes in real interest rates and the real exchange rate from a base period or in terms of their nominal counterparts.

Under what circumstances would one use the MCI constructed on the basis of relative effects on aggregate demand and under what circumstances would one use the MCI constructed on the basis of relative effects on prices? In Canada we tend to focus on the former because it is the output gap, along with expected inflation, that is the principal driving force behind increases and decreases in inflationary pressures and it is changes in aggregate demand that are a key determinant of changes in the output gap. Of course, as just noted, exchange rate changes also have direct effects on the level of prices in the economy, but these will likely not turn into an ongoing wage/price spiral unless they take place at times in which inflationary expectations are strong. We thus distinguish between develop-

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29. *It would be more appropriate to use the real MCI if one was analyzing policy actions over a longer term.*

30. *The desired or provisional target path of the MCI is also calculated as part of the medium-term projection exercise. And it is this target path that is used as the basis for assessing developments in monetary conditions between projection exercises. Of course, as noted earlier, there is less risk of making an error by ignoring the aggregate demand effects of changes in the exchange rate in the course of a projection exercise than in the period between projections.*

ments that affect the price level once and for all and those that affect the process of inflation.

That said, it is important not to overstate the distinction. There are times when the markets will have difficulty disentangling the level effect on prices from an ongoing rate of inflation. Nonetheless, for purposes of analysis, we use the MCI that is based on aggregate demand and, where necessary, take into account the direct effect on prices of exchange rate changes.

Some caveats on the use of the MCI

Like all aids to policy, the MCI must be used with care and not treated as a mechanical means of making policy. There are also a number of specific reasons why one must use the MCI with care.

(1) Although the MCI is better conceptually than short-term interest rates as the operational target for policy, it remains an operational target and it should not be treated in any sense as a fundamental measure of monetary policy. For one thing, neither the interest rate nor the MCI provides a nominal anchor for the system. Moreover, monetary policy's ultimate concern is the rate of monetary expansion and the way it impinges on inflation.

(2) In the very short run, one has to avoid the temptation to use the MCI in an overly mechanical fashion – that is, a central bank should not try to maintain a precise MCI target as the exchange rate moves up and down on a day-to-day basis. First of all, the operational target for the MCI should itself not be taken as a very precise measure, given the uncertainties about assessments of the economy and about the links between changes in the MCI and changes in aggregate demand or inflation. Second, the exchange rate can be quite volatile on a day-to-day basis and it would be inappropriate to try to offset the effect on the MCI of every slight move in the exchange

rate by adjusting short-term interest rates. Only if the market has found a new trading range for the exchange rate that is different from the earlier trading range and that appears likely to last for some period of time, would action be taken to offset the effect on the MCI of the exchange rate change.

(3) At times, central bank actions in the very short run cannot be devoted to achieving the desired MCI because they are needed to cope with disorderly markets. For example, suppose that there was a sharp loss of confidence in the Canadian dollar and the latter began to fall in such a way as to generate extrapolative expectations and snowballing movements. In order to help stabilize market expectations, the bank might well have to encourage (or validate) a rise in short-term interest rates that was considerably larger than the rise needed to offset the effect of the exchange rate depreciation on the MCI. Over time, of course, as expectations of further weakening of the currency dissipate, short-term rates could decline to levels more consistent with the desired MCI.

4) There were two examples used above in establishing the case for using the MCI as an operational target for policy. In the first, an expansionary demand shock led to a tightening in desired monetary conditions while actual monetary conditions remained unchanged, thereby requiring restrictive action by the central bank. In the second case, the shock (a change in market sentiment about the currency) resulted in an easing of the actual monetary conditions while desired monetary conditions remained unchanged. In response, the central bank had to take restrictive actions. There are also cases in which a shock leads to changes in the same direction of both actual and desired monetary conditions. The central bank would have to take little or no action in such cases.

There are two examples of particular interest in this regard. When world prices of raw materials increase, the rise involves an expansionary shock to the Canadian economy and is usually accompanied by an increase in the value of the Canadian dollar. Typically, such a terms-of-trade improvement has direct effects on employment and profits in the industries in question. It also has significant indirect effects on the economy, as the boom in prices of raw materials spills over into industries that supply the raw materials industries and, more generally, into higher real wages and a generalized positive economic environment. In such circumstances, it is appropriate for the real exchange rate to rise (both because the equilibrium real exchange rate appreciates as the terms of trade improve and because the appreciation helps to choke off inflationary pressures set off by the boom). Hence the rise in the actual MCI (as the Canadian dollar appreciates) would be associated with a rise in the desired or target path for the MCI. Of course, the increase in the desired MCI following the terms-of-trade improvement need not be exactly the same as the rise in the actual MCI that the market itself might generate. Hence some further adjustment of the actual MCI might be necessary. Nonetheless, the key point is clear – the rise in the actual MCI in these circumstances is associated with a rise in desired or targeted MCI and does not automatically require action by the central bank. The reverse scenario holds for falling export prices.[31]

Another case where the desired MCI rises along with the actual MCI occurs when the market responds directly to new information regarding the strength or weakness of aggregate demand.[32] Suppose, for example, that a data release indicates that the economy is expanding

at a more rapid rate than anticipated. In recent years, such an announcement has tended to lead to upward pressure on the currency, in part because of the increased likelihood of an increase in interest rates. However, given that the faster growth will tend to lead to higher desired MCI, in this case as well there may be no need for action in response to the tightening of the MCI. Nonetheless, as in the earlier case, the market-generated movement in the actual MCI might not be exactly the same as the rise in the desired MCI and some further adjustment might be necessary.

CONCLUDING COMMENTS

The MCI has proved to be a very useful conceptual and practical tool in the conduct of policy. Most importantly, it ensures that exchange rate changes are taken into account appropriately when policy decisions are being made. But its importance should not be overrated. Many other shocks hit the economy besides exchange rate changes and these must be taken into account in the policy-making process.[33] And the MCI must be used with care because of the various caveats set out above in this paper. Nonetheless, properly used, the MCI can help policymakers to steer through a very uncertain world.

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31. *For a detailed discussion of terms-of-trade effects on policy stance in an economy with inflation targets, see Archer (1993). For an empirical analysis of the effect of terms-of-trade changes on the exchange rate, see Amano and van Norden (1993.)*

32. *This can be contrasted with the first example discussed above, where the expansionary shock is not associated with market pressure on the exchange rate.*

33. *For example, the MCI, as presently constructed, does not take explicit account of changes in long-term interest rates. Hence, when these behave in an atypical way, the desired MCI should be adjusted to take such movements into account.*

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The role of monetary conditions and the monetary conditions index in the conduct of policy

by Charles Freedman

In the last few years, the Bank of Canada has used the concept of monetary conditions (the combination of the movement of interest rates and the exchange rate) as the operational target of policy, in much the same way as short-term interest rates were used in the past. The major reason for this focus is that under a flexible exchange rate regime, monetary policy actions have their effect through both interest rates and the exchange rate. Indeed, the market response to a given central bank action can lead to quite different movements of the two variables in different circumstances. Another reason for the emphasis on monetary conditions is that there can be exogenous movements in the exchange rate (for example, because of a shock to confidence), and the monetary conditions index (MCI) clearly points out the need to take action to offset the effect of such movements on aggregate demand.[1]

Technically, the index is defined as the combination of the changes in short-term interest rates (typically the 90-day commercial paper

rate) and the multilateral exchange rate (the G-10 rate) from some arbitrary base period. Since the objective is to obtain an estimate of the effect of movements in these two variables on aggregate demand over time, the particular measures used are the percentage point change in interest rates and the per cent change in the exchange rate, with the latter weighted by a factor of 1/3. This is based on empirical work that indicates that a 1 percentage point change in interest rates has about the same effect on aggregate demand over time as a 3 per cent change in the exchange rate. The measure is thus calculated as the equivalent of percentage point changes in interest rates. And while the real MCI (based on the real interest rate and the real exchange rate) is the theoretically relevant measure, for practical purposes, we focus on the nominal MCI (based on the nominal interest rate and nominal exchange rate) for the short periods over which the MCI is most useful. (See Charts 1 and 2.)

Let me now take you through the ways in which the MCI enters into the Bank's thinking and actions. The objective of monetary policy over the next three years or so is to maintain the rate of inflation within a band of 1 to 3 per cent. The quarterly Bank of Canada staff projection

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1. *For a detailed discussion of the MCI, see Freedman (1994).*

Chart 1   Monetary conditions index

January 1987 = 0
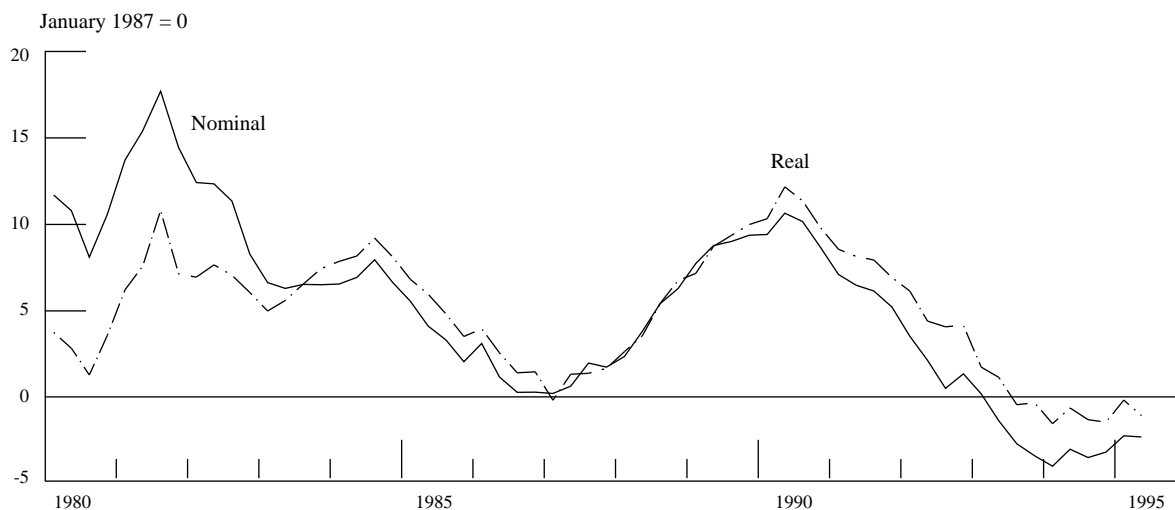
takes into account such factors as the movements in foreign variables and domestic exogenous variables as well as the momentum of the economy, and sets out a path for monetary conditions that will result in the rate of inflation six to eight quarters ahead being within the Bank's target band. This assumes that there are no further shocks and that the relationships in the model reflect the economy reasonably accurately. One can think of this path as the desired or target path for monetary conditions. The forward-looking focus of the analysis is, of course, related to the relatively long lags between monetary policy actions and their effect on the rate of inflation.[2]

This is not to suggest that the process of assessing the prospects for the economy and for inflation is a mechanical one. A lot of judgment goes into it, and there is a lot of cross-checking against important information variables such as the rate of growth of the monetary aggregates. Moreover, alternative or "risk" scenarios give us a feeling for the sensitivity of the output and

inflation projections, and the resulting desired track for the MCI, to various alternative assumptions for certain key variables. Nonetheless, the staff projection gives the Bank management a useful starting point for organizing its views.

As new information arrives, views will change, and the desired path for the MCI will change. For example, as we noted in the Bank's first *Monetary Policy Report*, which was issued in early May, the upward adjustments in the economic outlook for Canada throughout 1994 led to periodic reconsideration of the desired track for monetary conditions, with the outcome being a desired path that was less stimulative (i.e., tighter monetary conditions). More broadly, shocks or new information that result in expectations of a weaker economy, and consequently less inflation pressure than was previously expected, would lead to a revision of the target path in the direction of easier monetary conditions, while expectations of a stronger economy and more inflation pressure would lead to a revision of the target path in the direction of tighter monetary conditions.

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2. *See Thiessen (1995) for a detailed discussion of these lags.*

Chart 2   The monetary conditions index and its components

Monetary conditions index (January 1987 = 0)

90-day commercial paper rate

G-10 exchange rate index (1981 = 100)
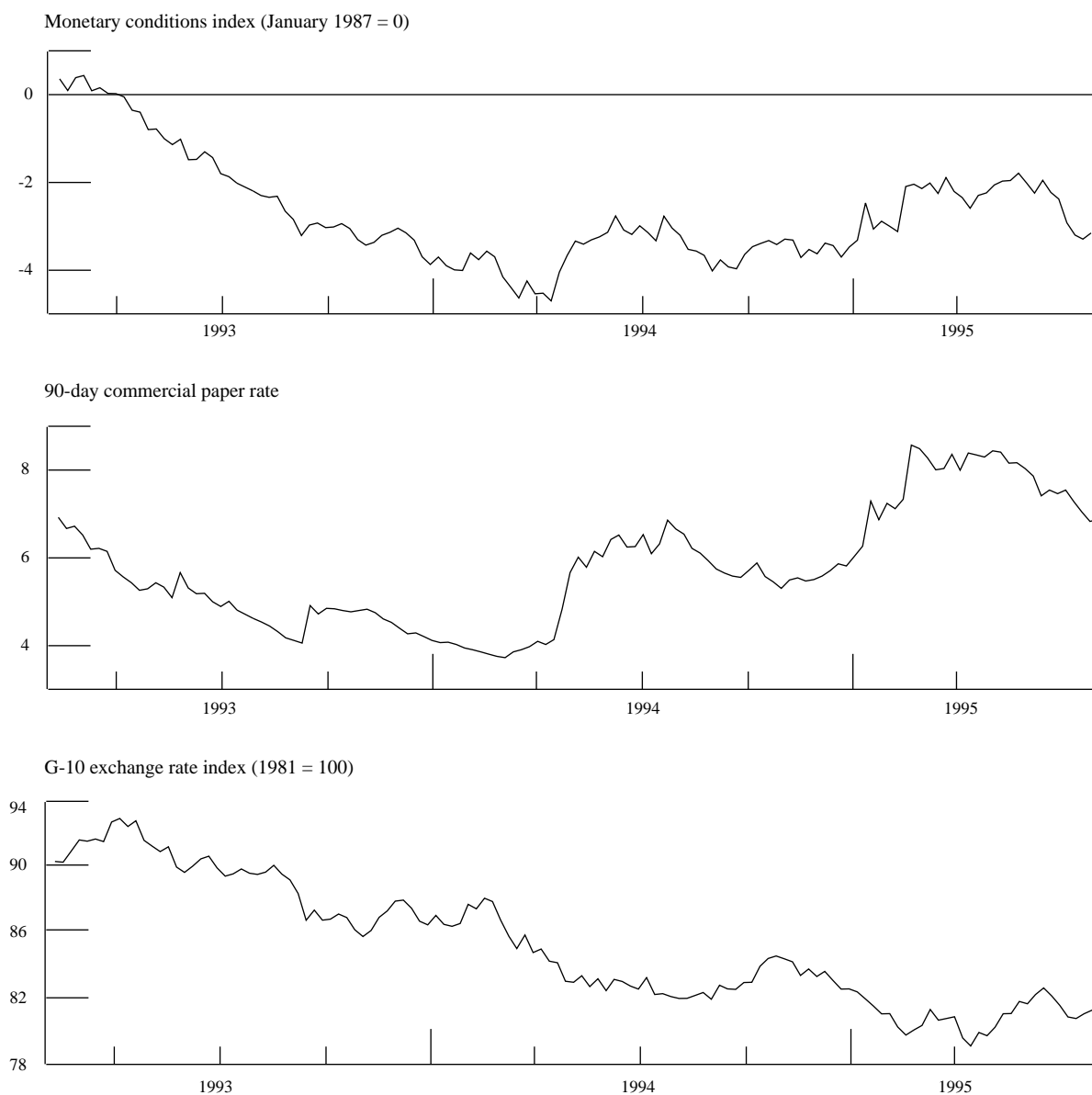
There are three kinds of shocks that I would like to analyse in some detail:

The first is a shock that changes the desired level for monetary conditions but leaves the actual level unchanged initially. In such circumstances, the Bank will take action in financial markets to encourage monetary conditions to move towards the desired level. Suppose, for example, that there is an aggregate demand shock to the economy and that the market does not respond by moving the interest rate or the exchange rate. The Bank will then encourage an adjustment in monetary conditions by changing the target band for the overnight rate.

The second type of shock affects both the desired and actual level of monetary conditions. For example, it may well be the case that the market will recognize the need for an adjustment in monetary conditions in response to an aggregate demand shock and may act in advance of any action by the Bank of Canada by moving market interest rates (such as the 90-day rate). In such a case, the Bank would ratify the movement with a corresponding movement in the band for the overnight rate (as it has done on a number of occasions in the recent past).

As another example in which both actual and desired monetary conditions respond to a shock, consider a situation in which the prices of raw materials strengthen. As this is a stimulative shock, a tightening in monetary conditions would be appropriate. Typically, however, such a shock is accompanied by an appreciation of the exchange rate, which does tighten actual

monetary conditions. Depending on the extent of tightening brought about by the exchange market and the amount needed to offset the stimulative shock, the Bank may or may not have to take further action to adjust interest rates.

The cases discussed thus far involve shocks that change the desired track for monetary conditions, with or without an accompanying change in actual monetary conditions. The third type of shock that requires analysis is an exogenous shock to the exchange rate (for example, because of political or fiscal developments) at a time when the desired track of monetary conditions is unchanged. In such a case, the Bank will aim at adjusting interest rates in order to offset the effect of the exchange rate change on aggregate demand. We call this adjustment a "rebalancing."

At various times, over the last couple of years, we have been faced with shocks, mainly as a result of fiscal debt and deficit concerns, that have led to higher risk premiums in interest rates and a lower value for the Canadian dollar. While the changes in interest rates and the exchange rate had roughly offsetting effects on aggregate demand, the change in the mix of monetary conditions was unfavourable for the functioning of the Canadian economy. Higher interest rates result in less capital investment than would otherwise take place and in higher interest payments to non-residents. A very low exchange rate leads to a higher level of prices, somewhat weaker terms of trade, lower real incomes and perhaps a risk of inappropriate investments in response to a temporarily weak dollar. Thus, while the mix of monetary

conditions is largely the outcome of market expectations and actions and is not determined by the Bank, some mixes of monetary conditions are not as good for the economy over time as others. And the mix we have seen in the past year or so, with a low dollar and relatively high interest rates, was certainly not a desirable one.

A recent example of a favourable change in the mix of monetary policy conditions took place on 8 May, when the range for the overnight rate was lowered by 25 basis points following an appreciation of the Canadian dollar.

While the Bank attempts to achieve the desired MCI path over time, we do not try to maintain a precise MCI target as the exchange rate moves up and down on a day-to-day basis. First of all, the operational target for the MCI should not be taken as a very precise measure, given the uncertainties about assessments of the economy and about the links between changes in the MCI and changes in aggregate demand or inflation. Second, the exchange rate can be quite volatile on a day-to-day basis, and it would be inappropriate to try to offset the effect on the MCI of every short-term move in the exchange rate by adjusting short-term interest rates. Action to offset the effect of the exchange rate on the MCI would be taken only if the market had found a new trading range for the exchange rate that differed from the earlier trading range.

Thus far, I have focussed on what might be called "strategic" issues in the adjustment of monetary conditions. There are also "tactical" considerations in the timing of such decisions, which have to take into account the situation in financial markets. Suppose an easing of monetary conditions was appropriate, but there was a great deal of uncertainty and nervousness in the exchange market. The problem here is that if the expected exchange rate is not well anchored, movements in the actual exchange rate could cause significant movements in the expected exchange rate. In such circumstances, the Bank would delay any decision to ease monetary conditions because of the risk that an action to reduce the overnight rate could result in significant weakness in the exchange market and lead to the buildup of extrapolative expectations in that market, followed, as we have so often seen in Canada in recent years, by an increase in interest rates in the money market and the bond market. In effect, an attempt to ease monetary conditions could, via the interaction of developments in the exchange market and domestic financial markets, result in an outcome where monetary conditions ended up tighter and not easier. Thus, the tactical aspect involves choosing the timing of changes to avoid undesired market-driven outcomes. At the same time, we would try to make clear to the markets (through speeches and the *Monetary Policy Report*) our interpretation of developments, so that they understood the direction in which the Bank was trying to move and the reasons why.

To illustrate this point I would note that there have been times, such as early this year, when precedence has been given to the need to steady nervous financial markets. The Bank is keenly aware that a loss of credibility in its approach to implementing policy can be costly in terms of developments in interest rates and the exchange rate. While the desired path for monetary conditions remains the operational target over time, in the face of nervous markets it is appropriate to postpone the achievement of that target in the short run until uncertainty diminishes and markets become more stable.

Let me sum up as follows. After considering its projection of economic developments, the Bank staff recommends a target or desired track

for monetary conditions that will result in the trend of inflation being within the target band six to eight quarters ahead. Although the monetary conditions path in the projection involves point estimates for monetary conditions, both the staff and management think of it as a range. While the path recommended by the staff is a crucial input into the views of senior management on the desired path for monetary conditions, senior management may also incorporate into its thinking the possible effects of a broad range of outcomes with respect to the movements of exogenous variables or the momentum of the Canadian economy. Indeed, the staff prepares alternative "risk scenarios" that incorporate some

of these factors. Management may also decide in which direction to take or avoid risks (e.g., that it is appropriate to be especially vigilant about a resurgence of inflation). If, following this type of analysis, there is a divergence between actual and desired monetary conditions, the Bank will look for the right time to make adjustments. Among the factors that enter into the timing decision are market uncertainty and market nervousness. Clearly, the more closely the interpretation of economic developments by the markets resembles that of the Bank of Canada, the easier it will be to effect the desired adjustment of monetary conditions.

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Empirical evidence on the strength of the monetary transmission mechanism in Canada: An aggregate approach

by Pierre Duguay

INTRODUCTION

This paper presents a view of the transmission of monetary policy which emphasizes the interest rate and exchange rate channels rather than the monetary and credit aggregates. It shows that strong linkages can be estimated from interest rates and the exchange rate to total spending in Canada, and from total spending and the exchange rate to inflation. These linkages support the notion that a temporary tightening in monetary conditions, an increase in real interest rates and in the real exchange rate sustained for a year or two, would produce a transitory decline below trend in real output and a permanent reduction in the rate of inflation, thereby resulting in a permanent reduction in nominal interest rates. Estimation of these linkages is important to the conduct of monetary policy because central bank actions show a much more direct link to short-term interest rates and to the exchange rate than to monetary aggregates. However, it does not preclude the use of monetary and credit

aggregates as indicators of total spending in the conduct of monetary policy.

The paper is organized as follows. Initially, the transmission mechanism is discussed under three headings: the influence of central bank actions on short-term interest rates and the exchange rate, the effect of interest rates and the exchange rate on aggregate demand and supply, and the adjustment of prices and costs to changes in demand and supply. In the next section, some of these effects are quantified: estimates of the effect of interest rates and the exchange rate on total spending are presented, and a price Phillips curve is estimated. Some implications of these structural equations for the dynamic effects of monetary policy are then explored through a simulation analysis. The final section provides a brief summary and statement of conclusions.

AN OVERVIEW OF THE TRANSMISSION MECHANISM

Although it is customary to describe the transmission mechanism of monetary policy by trac-

ing the economic implications of a change in the level or growth rate of the money supply, it is more useful to begin with the tools and instruments actually available to the central bank. These generally relate to the central bank's balance sheet and show a much more direct link to short-term interest rates and to the exchange rate than to monetary aggregates. Accordingly, this review of the transmission mechanism starts with the influence of monetary actions on interest rates and the exchange rate and from there goes on to the effect on aggregate demand and supply and to the adjustment of prices and costs.

The pace of monetary and credit expansion plays undoubtedly an important role in the process, complementing and even shaping the influence of interest rate movements on total spending. For example, increased consumer borrowing may be a necessary catalyst to turn realized or unrealized capital gains into cash and thereby permit an increase in wealth to increase spending.

Influences of monetary actions on interest rates and the exchange rate

The influence of monetary policy actions on interest rates and the exchange rate stems from the central bank's ability to control the supply of settlement balances to financial institutions. Clearing and settlement arrangements will influence the details of the process, but not its essence (Longworth and Muller 1991). By adjusting its supply of liquidity to financial institutions, the central bank can induce them to bid more or less aggressively for overnight loans or deposits, and thus exert a relatively direct influence on the overnight rate. Institutions with surplus liquidity will bid rates downward in their attempts to find outlets for funds, while those with a shortage will bid rates up as they scramble for funds.

Changes in the overnight rate trigger portfolio shifts which elicit a response from rates of return on a broad range of assets and liabilities, and from the exchange rate. That response is shaped predominantly by expectations about future interest rate and exchange rate developments. These in turn depend on market perceptions of what monetary policy is attempting to achieve and how successful it is likely to be.

The distinctive feature of interest rate determination in an open economy is the linkage between interest rate and exchange rate developments. Under a high degree of substitutability between domestic and foreign currency assets, international interest rate differentials must be matched by the expectation of a compensating gain or loss on the exchange rate. As a result, the real exchange rate would move in response to a change in monetary actions by an amount equal to the integral of the shift in the vector of expected future real interest rates[1] (Dornbusch 1976, Frankel 1979).

Exchange rate changes thus permit nominal and real interest rates along the whole maturity spectrum to respond to changes in monetary policy actions in much the same way in an open economy characterized by sticky prices and high asset substitutability as they would in a closed economy (Murray and Khemani 1989). The price effect of exchange rate movements may speed up the adjustment of domestic prices relative to what it would be in a closed economy, however, and world real interest rates may provide a firmer anchor to domestic long-term real rates than would expectations in a closed economy. Monetary policy may thus have somewhat less room to influence real interest rates, particularly longer-

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1. Lenders and borrowers are not directly concerned with inflation abroad. When they invest or borrow in foreign currency, they evaluate nominal interest rate differentials against the expected change in the nominal exchange rate. Inter-country differences in inflation only matter insofar as they influence expectations of changes in exchange rates.

term rates, in an open than in a closed economy (Boothe et al. 1985).

Because it embodies the shift in the whole yield curve of real interest rates, which is not directly observable, the exchange rate could in principle provide a good summary indicator of the ease or tightness of monetary policy. However, the use of the exchange rate in this role is limited by virtue of the fact that it is also influenced by numerous factors other than monetary policy. In addition, expectations may not be so firmly held by a majority of lenders and borrowers that they may be prepared to entertain the possibility of taking open positions. As a result, exchange rate movements can be much more volatile than might be expected on the basis of changing international interest rate differentials. Empirical evidence on the validity of uncovered interest parity has been rather disappointing in that regard.[2]

The effect of interest rates and the exchange rate on aggregate demand and supply

Interest rates and the exchange rate play a critical role in equilibrating demand and supply in the economy. At the risk of oversimplification, it is probably fair to say that from a general equilibrium perspective the world real interest rate must adjust to eliminate disequilibrium between world savings and world investment, while real exchange rates, the relative price of domestic and foreign production, must adjust in the long run to eliminate excess demand or supply in individual countries.[3] Domestic real interest rates also play an important supporting role in the short to

medium run owing to the linkage between real exchange rate movements and real interest rate differentials.

Interest rate influences on aggregate demand

Interest rates influence spending through the same channels in an open economy as in a closed economy. These include a cost of capital effect on purchases of durable goods, investment in housing, business investment on plant and equipment and inventory holdings; a wealth effect on household spending; an intertemporal substitution effect on consumer spending; and a cash flow (or liquidity constraint) effect.

A rise in real interest rates increases the cost of capital and reduces the demand for real assets. This lowers the production and sales of these assets. It also lowers their value. Changes in the value of real assets (equity and real estate for example) occur early in the transmission process, both because there are fewer impediments to the adjustment of asset prices than to the adjustment of the prices of goods and services, and because asset prices are inherently more sensitive to changes in interest rates and to changes in expectations by virtue of assets being held for the purpose of substituting consumption across time. As a result, they carry information about future developments. Like the exchange rate, however, they are also influenced by factors other than monetary policy.

More generally, the rise in real interest rates reduces the present value of any expected income stream (including labour income) and it thereby tends to lower present consumption. The reaction of spending and wealth to a change in short-term real interest rates will increase with the expected duration of the change; i.e., it depends on the whole term structure of real interest rates. These effects are spread over time and amplified by the induced multiplier and accelera-

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2. *For a review of the Canadian evidence, see Longworth, Boothe and Clinton (1983), Boothe (1983) and Boothe and Longworth (1986).*
3. *This real exchange rate adjustment will occur regardless of how the nominal exchange rate is managed. In a fixed exchange rate regime, it would occur through changes in prices and wages.*

tor effects. As pointed out above, credit expansion would generally be required to transform an increase in wealth into an increase in spending, and such credit expansion would be accompanied by monetary or financial-asset expansion.[4]

It is customary to caution that the above effects may be in part offset by the income effect of interest rate changes. Higher interest income would tend to increase spending, while lower interest income would reduce it. But while this may be the case for individuals, it would not be so for the economy as a whole. A rise in interest rates would not raise GDP, the ultimate source of national income. The positive effect on the income of lenders is offset by a negative effect on the income of borrowers. It is thus more appropriate to speak of an income redistribution effect. And there is a widespread presumption that the income redistribution effect would reinforce, not offset, the wealth and substitution effects, particularly as borrowers are the ones who tend to be liquidity constrained.

There are two qualifications to that statement. One is that in an open economy, a net income effect might arise from a redistribution of income between residents and non-residents. The income effect would be negative for net debtor countries and positive for net creditors. The second qualification, one which has attracted a great deal of attention in Canada and abroad lately, relates to government debt. The rapid rise in government debt and, in Canada, the shortening of the average term to maturity of the debt have magnified the effect that short-term interest rate changes exert on disposable incomes through the government debt service.[5] However, a number of

factors would limit the effect on spending. Sooner or later, governments would have to adjust taxes and spending in response to changes in debt service. Doing otherwise would violate government solvency requirements. Therefore, even if the government did allow its (inflation-adjusted) deficit to rise in response to an increase in (real) interest rates, the effect on consumer spending would be muted to the extent that individuals expect the increase in the deficit to be reflected in higher taxes later.[6] If agents are not Ricardian, the fact that the rise in interest rates would also channel income to pension funds would act as a substantial offset to the rise in disposable income resulting from the higher government debt service. In Canada, where interest on mortgage and consumer debt is taxable income to the lender but not a tax deductible expense to borrowers, a rise in household debt service provides a further offset to the rise in the government debt service by producing a net increase in taxes.

Interest rate influences on aggregate supply

Since most firms are net debtors, higher interest rates raise the financial cost of their operations. To many commentators, this is the most obvious effect of monetary tightening. But as long as higher interest rates, if maintained, eventually cause demand to fall more than supply, any adverse level effect on the costs of production will be of secondary importance compared with the cumulative pressure building on prices and costs from the disequilibrium between supply

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4. *Credit market imperfections may cause spending of liquidity constrained agents to be more responsive to changes in nominal interest rates than to changes in real rates.*

5. *Indeed, it is not uncommon to find that in large-scale econometric models which lack strong interest rate linkages to spending, consumer expenditures rise with interest rates as a result of this effect.*

6. *At an empirical level, efforts to quantify the extent to which the Ricardian equivalence holds have yielded very mixed results. See Barro (1989) and Bernheim (1989) for two alternative interpretations of the empirical evidence. For some Canadian evidence, see Johnson (1986), Carroll and Summers (1987). In addition, empirical tests of the sustainability of fiscal policies themselves have not always been very reassuring. See Smith and Zin (1991), for example.*

and demand. Put differently, since monetary policy cannot keep real interest rates and the real exchange rate arbitrarily tighter or easier than warranted by the equilibrium between demand and supply for an indefinite period, the rise in interest rates and the resulting level effect on costs are transitory, while the cumulative adjustment of prices and costs to the disequilibrium between supply and demand is permanent.

It is easy to see that if the net rate of return on capital is greater than the rate of growth of the economy, the reduction in potential output which would result from an increase in the cost of capital would exceed the steady state contraction in investment spending. This means that a requirement for stable equilibrium in a closed economy is that higher real interest rates reduce consumer spending through wealth and substitution effects by at least as much (Masson 1983, Duguay 1982).

The intertemporal substitution effect predicts that households will lower their demand for leisure and increase their supply of labour in response to a rise in real interest rates, hence contributing to a temporary rise in potential output.

Exchange rate influences on aggregate demand and supply

Real exchange rate movements influence economic activity primarily through their effect on the international competitiveness of domestic production. A rise in the real exchange rate would shift demand away from domestic goods towards foreign products. But the effect is more widespread than the immediate impact on exports and imports. Competitive pressures would tend to produce relative price changes between the traded good and non-traded good sectors of the economy, thus broadening the influence of the real exchange rate change across

all sectors of the economy. Competitiveness would also influence the location of investment by multinational corporations.

Exchange rate changes may also produce an offsetting income effect to the extent that they alter the country's terms of trade. This would happen if the economy had some latitude to influence the price of its exports while being a price taker for its imports. Over time, however, the substitution effect must dominate. For a net importer of capital goods like Canada, an appreciation would also reduce the price of investment goods, thus providing a stimulus to investment. This stimulus is constructive, for it increases capacity without exerting pressure on domestic resources.

Finally, exchange rate changes will produce valuation effects on net holdings of foreign currency assets and the income flowing from them. An appreciation would reduce the wealth and income of a country with a net foreign currency asset position but raise the wealth and income of a country with a net foreign currency liability position.[7]

The effect of monetary policy on prices and costs

What gives monetary policy some influence over real variables is the gradual adjustment of prices in markets for goods and services, which allows aggregate demand to deviate temporarily from long-run aggregate supply. Gradual price adjustment results from the presence of adjustment costs, these costs being higher for monopolistic competitors for whom reputational considerations are important. Contractual commitments also contribute to slow the adjustment of prices and costs. Wages and salaries adjust even more slowly, owing to the prevalence of explicit or

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7. *The effect on **real** income would cancel, however, if the net foreign currency asset position merely hedged a net import position.*

implicit contracts. As well, wages tend to be less responsive than prices to firm-specific or industry-specific developments. This too tends to slow their adjustment.

A reduction in aggregate demand will put downward pressures on prices and encourage business to lower their costs of production, while an increase in demand will make it easier for producers to raise prices and bid for resources. These same influences operate in labour markets, where producers' bids for labour have the effect of pushing up wage increases whereas the fear of unemployment acts to moderate wage demands. Wages and prices also feed upon one another. Lower rates of wage increases help curb the rise in prices and slower advances in (consumer) prices make it easier for labour to accept lower increases in nominal wage rates. Thus, the process is cumulative and expectations feature prominently in it. Indeed, the adjustment of inflation expectations precludes the persistence of a permanent trade-off between inflation and unemployment.

Exchange rate changes introduce an important direct influence of monetary policy on prices, in addition to the indirect influences coming from changes in real spending. An appreciation, for example, lowers the costs of imports fairly immediately. It also exerts a fairly direct downward influence on the price of exports and import-competing goods. In the case of Canada, some exports, notably exports of primary commodities, are priced in U.S. dollars, with the result that their Canadian dollar price will move immediately with the exchange rate. In other sectors, however, the exchange rate influence on the prices of exports and import-competing goods would tend to be felt more gradually. The pass through of lower import costs to final demand prices would also tend to be spread over time. Lower prices in the tradable goods sector will put pressures on producers to reduce costs, including

labour costs, while lower consumer prices will moderate wage demands.

QUANTIFYING THE EFFECT OF MONETARY POLICY

We have found that while an aggregative approach may not provide much insight into the channels of transmission of monetary policy, it yields much more robust and more significant estimates of the overall influence of monetary policy on spending and prices than does a disaggregated approach. Large-scale econometric models have been particularly unreliable in quantifying the effect of monetary policy, generally underestimating the effect of interest rates on spending and the strength of supply-demand imbalances on the inflation process. For example, as late as 1982, it was not uncommon to find in such models that a permanent reduction in nominal interest rates would produce only a small increase in the rate of inflation even after 10 years, or that reducing the rate of growth of money supply required nominal interest rates to continue to rise after 10 years because the decline in inflation had not yet caught up to the lower rate of monetary expansion.[8]

By contrast, casual observation shows strong interrelationships between growth in money (M1 or M2), growth in total spending and the rate of inflation (Charts 1 and 2). Some of these interactions have been successfully exploited in econometric estimates of St. Louis-type reduced-form models (Andersen and Jordan 1968, Duguay 1979).

A formal statistical analysis of the information content of monetary aggregates for nominal spending and prices in Canada shows that growth
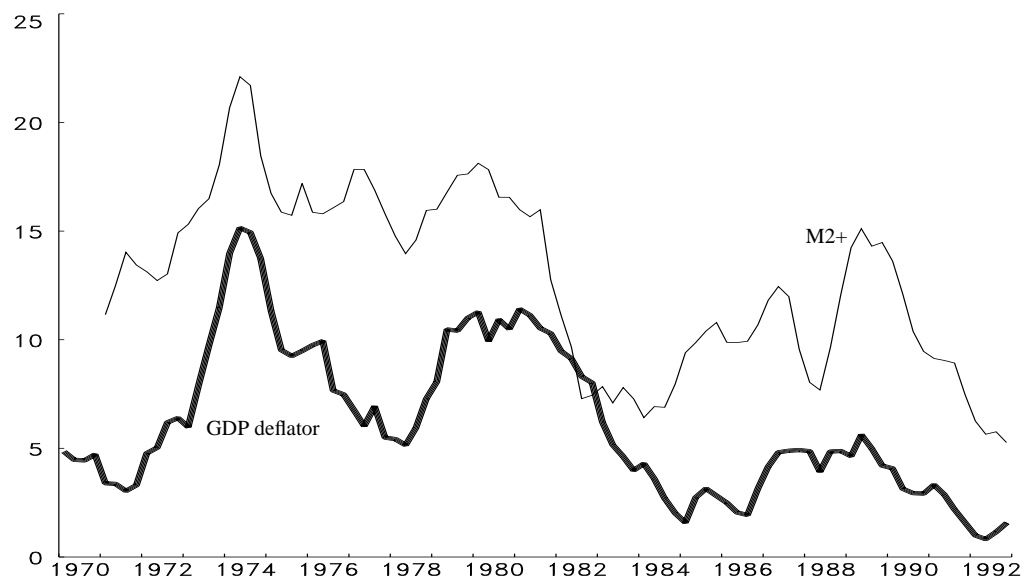
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8. *See O'Reilly, Paulin and Smith (1983).*

Chart 1   Growth in M1 (lagged 2 quarters) and nominal GDP

Four-quarter growth rates
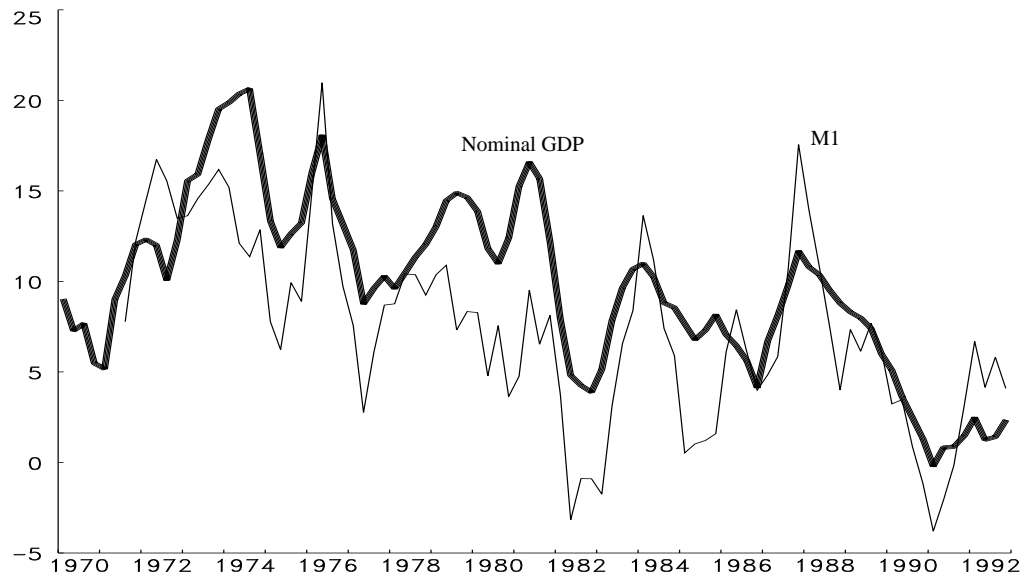
Chart 2   Growth in M2+ and GDP deflator

Four-quarter growth rates

in real M1 is the best leading indicator of growth in real spending and that growth in M2 or M2+ are coincident indicators of growth in nominal spending and good leading indicators of inflation.[9]

Casual observation also reveals strong relationships from interest rates to M1 (Chart 3) and from interest rates to real spending (Chart 4). The shorter mean lag from interest rates to M1 (2 quarters) than from interest rates to real spending (4 quarters) is consistent with M1 being a good leading indicator of real spending.

Estimation of the effect of interest rates and exchange rates on total spending

Estimates of the effect of real interest rate changes and real exchange rate changes on total spending are presented in Table 1. The estimates are from the single equation:

$$\Delta y = a_0 + a_1 \Delta y^* + a_2 \Delta y^*_{-1} + a_3 \Delta r + a_4 \Delta s + a_5 \Delta q + a_6 \Delta fisc + \mu$$

where Δy = quarterly growth rate of Canadian real GDP
Δy^* = growth in U.S. real GDP
Δr = 8-quarter moving average of quarterly changes in real short-term interest rates (the 90-day commercial paper rate minus the four-quarter growth rate in the GDP deflator, lagged one quarter)[10]
Δs = 12-quarter moving average of the rate of growth in the real exchange rate between Canada and the United States (based on GDP deflators)

Δq = 12-quarter moving average of the rate of growth in real commodity prices[11]

and $\Delta fisc$ = 8-quarter moving average of the change in fiscal stance, defined as the ratio of cyclically and inflation-adjusted government surplus to potential output

and μ = a random disturbance.

The equation is expressed in first differences so that the influence of supply shocks are subsumed under the random disturbance term.[12] Charts 5 and 6 illustrate the fit of the equation in growth rate and in level (based on a dynamic simulation starting in 1975Q1). The performance is quite respectable and the coefficients are relatively stable over time. The equation is interpreted as an aggregate demand equation, but it is not strictly possible to identify the parameters of the aggregate demand curve from a single reduced-form equation. However, there is a presumption that the interest rate and exchange rate effects captured by the equation reflect mainly demand influences given the evidence that labour supply is relatively inelastic to interest rates and the real exchange rate (see McCallum 1990).

It can be seen from Table 1 that the effect of interest rate changes on total spending is estimated with rather more precision than that of exchange rate changes. Estimates of the latter are particularly sensitive to the specification of the equation and to the moving average representation of the data. Two features are particularly noteworthy. The first is that the significance of the exchange rate effect only emerges once the influence of commodity prices on total spending is captured by the equation. Given the behaviour

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9. *See Hostland, Poloz and Storer (1988), Muller (1992).*
10. *Preliminary investigation with a free lag structure suggested that specification. Defining real interest rates in terms of the CPI reduced significantly the explanatory power of the equation.*

11. *Defined as an index of U.S. dollar commodity prices based on each commodity's weight in Canadian production, deflated by the U.S. GDP deflator.*
12. *Similar results are obtained when the equation is expressed in deviations from a Hodrick-Prescott filter rather than in first differences, and when the term spread between 90-day and 30-year bond rates is used instead of the real interest rate.*

Chart 3   Growth in real M1 and lagged four-quarter change in 90-day commercial paper rate
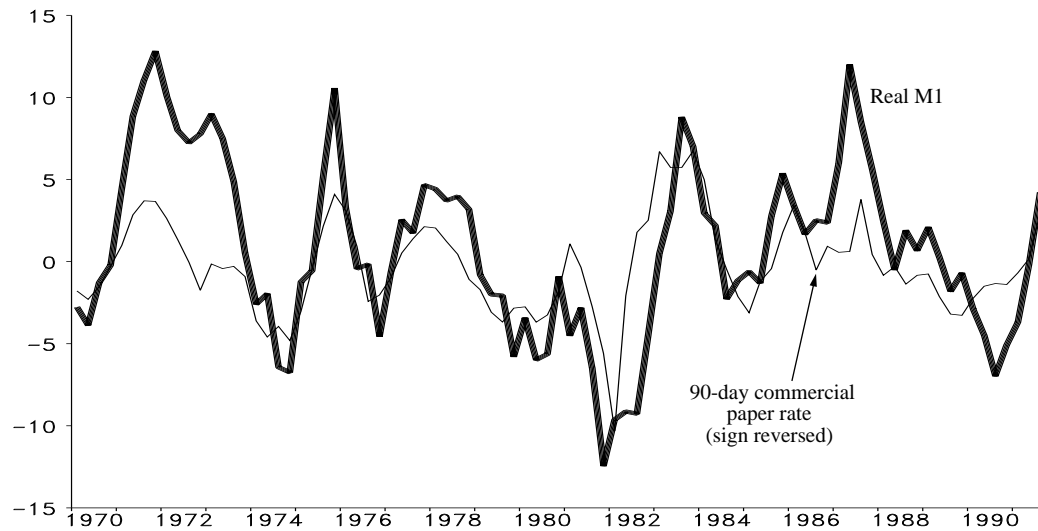
Four-quarter growth rates

Chart 4   Growth in real spending and lagged change in real short-term interest rate
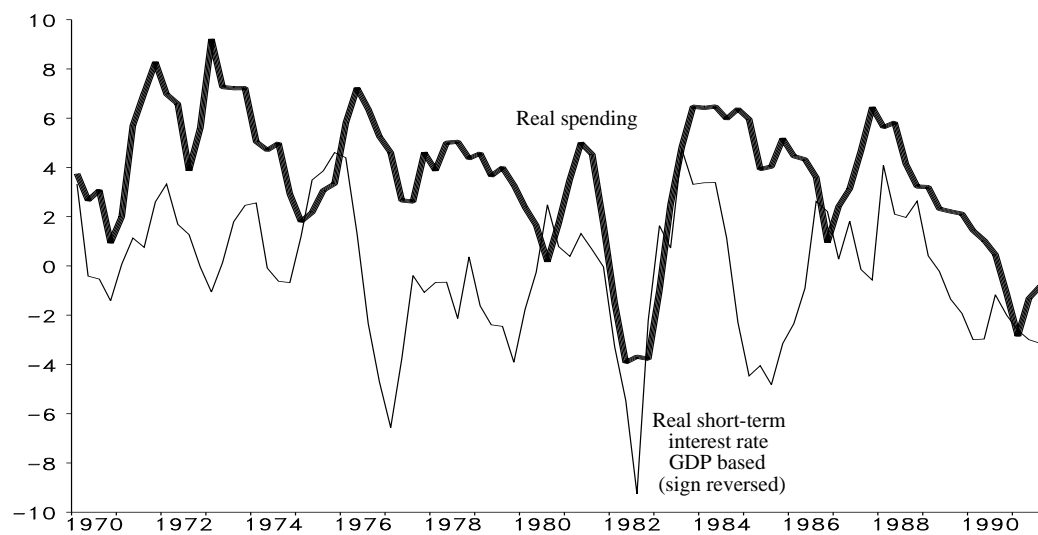
Four-quarter growth rates

Table 1   Estimation results for aggregate demand equation (dependent variable: quarterly growth rate of real GDP), t-statistics in parentheses.

	1975Q1-1990Q4			1980Q1-1990Q4		
Constant	0.40	0.32	0.31	0.30	0.21	0.13
	(3.8)	(3.0)	(2.8)	(2.1)	(1.6)	(1.0)
Growth in U.S. GDP						
- current	0.41	0.44	0.42	0.53	0.55	0.52
	(5.0)	(5.1)	(4.8)	(5.0)	(5.2)	(4.8)
- lagged	0.37	0.41	0.38	0.44	0.49	0.45
	(4.4)	(4.8)	(4.4)	(4.1)	(4.6)	(4.2)
Real interest rate[1]	-0.77	-0.60	-0.57	-0.67	-0.48	-0.40
	(4.1)	(3.2)	(3.0)	(2.7)	(2.2)	(1.8)
Real exchange rate[2]	0.20	0.17	0.11	0.28	0.29	0.15
	(2.1)	(1.8)	(1.1)	(2.2)	(2.2)	(1.3)
Real commodity prices[3]	0.16	0.12	-	0.21	0.16	-
	(2.6)	(1.8)		(2.4)	(1.9)	
Fiscal stance[4]	- 0.77	-	-	- 0.48	-	-
	(2.8)			(1.5)		
$\overline{R}^2$	0.59	0.55	0.53	0.67	0.66	0.64
SEE	0.60	0.63	0.65	0.59	0.60	0.62
DW	2.03	1.86	1.79	2.10	2.07	1.96

1. Eight-quarter moving average of the quarterly change in short-term real interest rate, defined as 90-day commercial paper rate minus a one-quarter lag of the four-quarter growth rate in the GDP deflator.
2. Twelve-quarter moving average of the quarterly growth rate in the real Canada-U.S. exchange rate, defined in terms of the relative GDP deflators (a positive change representing an improvement in competitiveness).
3. Twelve-quarter moving average of the quarterly growth rate in real commodity prices, defined as an index of U.S. dollar commodity prices (based on Canadian production weights) deflated by the U.S. GDP deflator.
4. Cyclically and inflation-adjusted government surplus as a per cent of potential GDP.

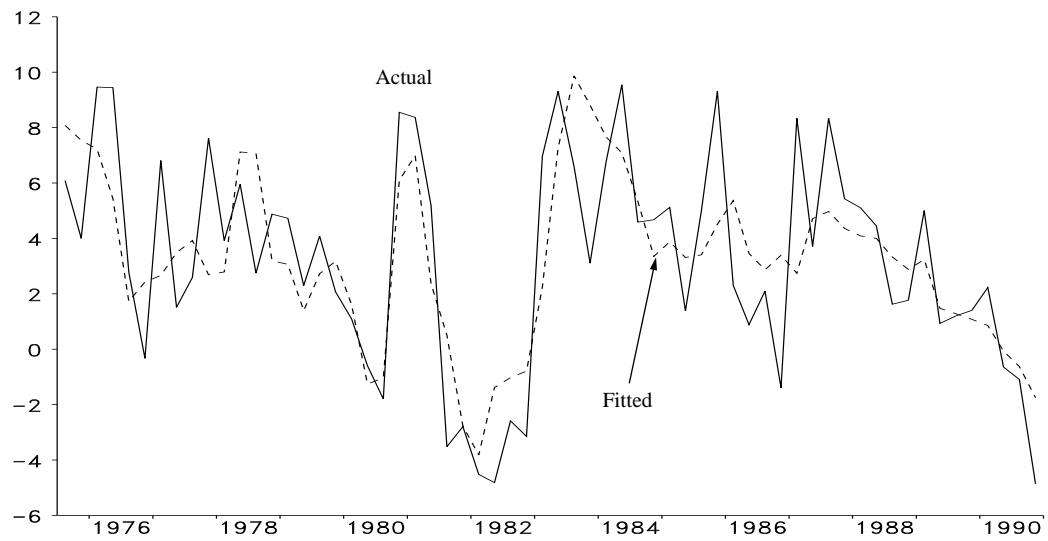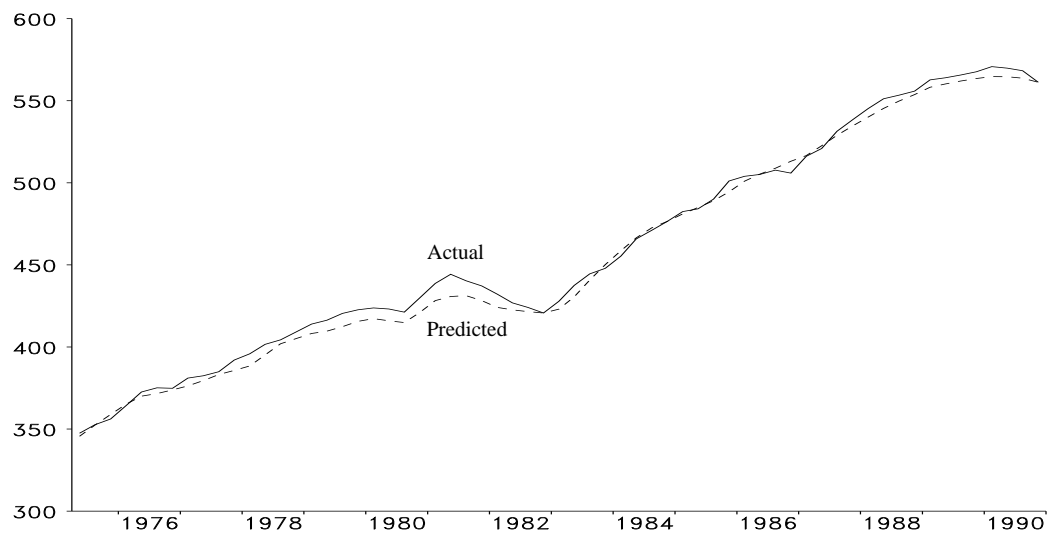Chart 5   Actual and fitted real GDP growth

Chart 6   Actual and predicted GDP (dynamic simulation)

Billions of constant dollars

of the Canadian dollar, this is not surprising. The real value of the Canadian dollar has risen and fallen with commodity prices over the last 20 years (see Amano and Van Norden 1993). Because a rise in commodity prices improves Canada's terms of trade and exerts a strong expansionary influence on incomes and domestic demand, a real appreciation is required to restore equilibrium between supply and demand. To the extent that exchange rate movements have served to cushion swings in commodity prices, their influence cannot be measured independently from that of commodity prices. The same can be said for any shock to demand which triggers an offsetting movement from interest rates or the exchange rate. This explains why these coefficients are more precisely determined when the fiscal variable is included among the explanatory variables of the equation.

The second noteworthy feature is that considerable smoothing of exchange rate changes is required before a significant effect on spending can be obtained. One interpretation of this is that in the presence of adjustment costs it might not be worthwhile for agents to respond to real exchange rate disturbances that are perceived to be transitory.

These results are quite different from those obtained from large-scale models. The latter typically have considerable difficulty finding significant interest rate effects, but no problem identifying exchange rate effects. This is because the interest rate effect on individual components of spending is either lost in the noise that surrounds disaggregated data or already embodied in the endogenous explanatory variables when the model is estimated equation by equation without regard for the simultaneous equation bias, though missing in fact from the structure of the model. By contrast, explicit and implicit identifying restrictions are imposed when trade equations are estimated individually, and these

contribute to the estimation of a significant exchange rate effect on aggregate spending.

A perplexing characteristic of the estimated equation is the strong coefficient on the U.S. output variable. This suggests that the coefficient could capture the influence of common disturbances (including supply effects) affecting the Canadian and the U.S. economies, rather than only the effect of U.S. demand for Canadian products. To the extent that Canadian and U.S. interest rates have moved broadly together, the large coefficient on U.S. output may come in part at the expense of the interest rate coefficient.

Attempts to identify the source of the response of aggregate demand by fitting the regression to the various components of GDP reveal that the interest rate effect comes mostly from consumer spending although, as expected, the response of business investment and housing are large relative to the size of these components. The exchange rate effect seems to come mostly from business investment, with an appreciation curbing the expansion of investment spending and the associated imports of machinery and equipment. Commodity prices also exert a strong influence on investment (and related imports), as well as having a significant (income) effect on consumption. Finally, the strong effect of U.S. activity shows up in large part in inventory accumulation, which tends to increase the suspicion that this variable captures the influence of common (supply) disturbances.

Estimation of an aggregate Phillips curve

The process of price adjustment is the key in determining how much influence monetary policy exerts on real variables. Accordingly, it has received the greatest attention.

The process is typically represented by an expectations-augmented Phillips curve, although in practice expectations tend to be prox-

ied by a fixed autoregressive lag structure, making it impossible to separate intrinsic from expectational dynamics. Much of the empirical debate has centred on whether or not the inflation process is accelerationist, i.e., characterized by a unit root. From a theoretical perspective this debate is clearly too narrow. But from a practical perspective, it remains a good start. Typically, the sort of conceptual experiments that we like to describe continues to involve changes in the rate of inflation rather than changes in the price level.

In an accelerationist model, a rise in inflation will be triggered by a period of excess demand, but it will be sustained by the adjustment of inflation expectations. The process also works in reverse: a reduction in inflation will be initiated by a period of excess supply, but the excess supply can vanish gradually as inflation expectations fall.

An important issue, in an open economy, is the role of exchange rate changes in the inflation process. As indicated above, exchange rate changes speed up the influence of monetary policy on prices. However, they would not alter the sacrifice ratio, i.e., the amount of cumulative gap required in an accelerationist model to bring inflation down permanently. This is because the positive contribution associated with a (real) appreciation of the domestic currency is reversed when the exchange rate returns to its equilibrium value. The net contribution of the temporary appreciation is nil on the final outcome for inflation. As Buiter and Miller (1982) pointed out, exchange rate movements merely distribute the output cost of disinflation through time.

The question of the propagation of exchange rate movements on inflation is nonetheless important. The issue is whether a permanent rise or reduction in the real exchange rate, as could result, say, from a change in world real interest rates or a permanent shift in aggregate demand, would ease or worsen the short-term trade-off between inflation and the unemployment rate.

The issue boils down to whether price changes associated with a change in the exchange rate feed into the wage-price spiral. In large scale disaggregated models the issue is already resolved when the structure of the model is written down. In the typical model of the inflation process based on an expectations-augmented wage Phillips curve and mark-up price equations, a permanent real depreciation will worsen the short-term trade-off, such that if the model exhibits accelerationist properties,[13] a transitory rise in unemployment will be required to prevent a permanent rise in the rate of inflation. The logic is that the rise in unemployment is required to signal to workers that they must take the reduction in real income associated with a lower real exchange rate.

Large scale structural models impose numerous restrictions of this type. Any relative price shock which would lower real wages (including an indirect tax shock)[14] would be similarly stagflationary.[15]

Single equation representations of the inflation process using an aggregate price Phillips curve do not impose such restrictions. They are better suited to testing the hypothesis. The permanent real depreciation need not be stagflationary if, for example, agents regard exchange-rate-induced price changes as price level changes rather than changes in the rate of inflation. The same argument applies to changes in the relative price of food and energy, for example, or to changes in indirect tax rates.

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13. *This requires in addition to an accelerationist Phillips curve that all prices, including the exchange rate, be endogenous and homogeneous of degree one in prices and costs.*
14. *The stagflationary consequences of an indirect tax shock are discussed in Okun (1977).*
15. *See Parkin (1984) for an excellent criticism of the relative price shock explanation of inflation.*

Recent research into the interactions between prices, wages and unit labour costs in Canada (Cozier 1992) suggests that nothing is lost by concentrating on an aggregate price Phillips curve. The persistence in the inflation process is well captured by lags of price inflation. Wages or unit labour cost variables make no significant independent contribution. They merely follow prices, with a lag. This may not seem very surprising in an open economy like Canada where numerous traded goods prices, notably those of commodity exports, are set on world markets. However, similar results have also been reported by Gordon (1988) for the United States.

Estimates of the price adjustment process using a relatively simple version of the expectations-augmented Phillips curve where expectations are assumed to be formed adaptively are presented in Table 2 for the CPI excluding food and energy.

The estimated equation takes the form:

$$\Delta p = \; a(L)\Delta p_{-1} + b(L)(\Delta s + \Delta p^*)_{-1}$$
$$+ \, c(L)\Delta t + d(L)\Delta p_{oil} + e(y\text{-}y^*)_{-1}$$
$$+ \, f\Delta (y\text{-}y^*)_{-1} + \eta$$

where Δp = the quarterly rate of growth in the CPI excluding food and energy

Δs = 8-quarter moving average of the rate of change in the Canada-U.S. exchange rate (defined as the Canadian dollar price of the U.S. dollar)

Δp^* = rate of growth in the U.S. CPI excluding food and energy

t = effective indirect tax rate

Δp_{oil} = rate of change in the relative price of oil[16]

$y\text{-}y^*$ = ratio of actual to potential output,[17] and where

$a(L), b(L), c(L)$ and $d(L)$ are polynomial lag operators with the constraint $a(1) + b(1) = 1$ imposed.

The unit root restriction is not rejected by the data, although it is not the preferred outcome.[18]

With the constraint $a(1) + b(1) = 1$ imposed, the price equation can alternatively be written as

$$\Delta^2 p = \; a'(L)\Delta^2 p_{-1} + b(L)\Delta s'_{-1} + c(L)\Delta t$$
$$+ \, d(L)\Delta p_{oil\text{-}1} + e(y\text{-}y^*)_{-1}$$
$$+ \, f\Delta (y\text{-}y^*)_{-1} + \eta$$

where $a'_i = -\sum_{j=i+1} (a_j + b_j)$

and $s' = s + p^* - p$ is the real exchange rate (based on the relative CPIs).

This allows the sacrifice ratio to be readily calculated as $(1\text{-}a'(1))/e$.

The parameter estimates presented in Table 2 give a value of 1.7 to the sacrifice ratio in Canada. Thus, a 1.7 percentage point gap maintained for one year or a 0.85 percentage point gap maintained for two years (given the assumed linearity of the Phillips curve) or any other equivalent combination would produce a one percentage point reduction in inflation. This is lower than most so-called structural model estimates. In part, the low estimate reflects the short lag length on past inflation, but that lag length has proven quite robust.[19] This suggests that the higher sacrifice ratio obtained from large-scale disaggregated models may come in part from

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16. *We experimented with the food and energy components of the CPI as well as with a non-energy commodity price index. The only relative price with any significant influence on the inflation process was the real price of crude oil. Its main contribution is to help capture the rise in inflation in 1974-75.*

17. *Potential output was derived by combining the Hodrick-Prescott filter methodology with judgment on the NAIRU in Canada (see Rose 1988, Laxton and Tetlow 1992).*

18. *Rose, Ricketts and Laxton (1993) show that a purely statistical model of expectations formation using a regime-switching regression model would adopt the unit-root restriction only on those few occasions over the sample period when inflation changes rapidly.*

Table 2	Estimation results for inflation equation (dependent variable: quarterly growth rate in CPI ex food and energy), sample period: 1968Q4-1990Q4, t-statistics in parentheses					
	Standard form				Alternative form in second differences	
Constant	- 0.05	(1.3)	- 0.03	(0.9)	- 0.03	(0.9)
Lagged GDP gap	0.08	(3.6)	0.07	(3.4)	0.07	(3.4)
Δ GDP gap$_{-1}$	0.05	(1.1)	0.05	(1.2)	0.05	(1.2)
Lagged inflation:						
-1	0.66	(4.6)	0.66	(4.6)	- 0.34	(2.3)
-2	0.01	(0.1)	0.16	(0.1)	- 0.32	(2.2)
-3	0.18	(1.0)	0.20	(1.1)	- 0.12	(0.9)
-4	0.04	(0.3)	0.02	(0.1)	- 0.10	(1.0)
-5	0.11	(1.1)	0.10	(1.0)		
Δ real exchange rate						
-1	0.29	(3.3)	0.26	(3.0)	0.26	(3.0)
-2	- 0.17	(1.4)	- 0.18	(1.6)	0.07	(0.9)
-3	- 0.02	(0.2)	- 0.03	(0.2)	0.05	(0.6)
-4	- 0.03	(0.3)	- 0.05	(0.6)		
Δ real oil prices						
-1	0.006	(2.0)	0.006	(2.0)	0.006	(2.0)
-2	0.004	(1.0)	0.003	(0.9)	0.003	(0.9)
-3	0.005	(1.4)	0.005	(1.3)	0.005	(1.3)
-4	0.001	(0.4)	0.001	(0.4)	0.001	(0.4)
Δ indirect taxes						
0	0.40	(4.7)	0.40	(4.7)	0.40	(4.7)
-1	- 0.26	(2.6)	- 0.27	(2.5)	- 0.27	(2.5)
-2	0.20	(1.6)	0.18	(1.6)	0.18	(1.6)
-3	- 0.09	(0.8)	- 0.13	(1.1)	- 0.13	(1.1)
-4	0.10	(1.0)	0.08	(0.9)	0.08	(0.9)
-5	- 0.06	(0.6)	- 0.09	(1.1)	- 0.09	(1.1)
Long-run elasticities:						
GDP gap	0.17		0.15		0.15	
(sacrifice ratio)	(1.51)		(1.68)		(1.68)	
Real exchange rate	0.04				0.20	
Real oil prices	0.008		0.008		0.008	
Indirect taxes	0.60		0.36		0.36	
$\overline{R}^2$	0.74		0.74		0.45	
SEE	0.34		0.34		0.34	
DW	1.98		1.99		1.99	

* Sum of coefficients constrained to zero.

inappropriate structural restrictions which slow the model response inadvertently. A common difficulty of these models is that the mechanism adopted to represent the gradual adjustment of prices to costs is generally not neutral to the rate of inflation.[20] As a result, a reduction in inflation would lower real wages, and (for the reasons discussed above) raise the sacrifice ratio.

Estimates of the effect of a level change in indirect taxes or in the real exchange rate can also readily be calculated as $c(1)/(1-a'(1))$ and $b(1)/(1-a'(1))$, respectively. These calculations are presented at the bottom of Table 2, where it can be observed that while indirect tax increases are stagflationary, a real depreciation (i.e., an *increase* in *s*) is not. It is estimated that owing to its secondary effects on wages or expectations, a one percentage point increase in indirect taxes would raise the rate of inflation by 0.4 per cent, unless offset by an increase in the cumulative gap between supply and demand of 0.7 percentage-point year.[21] A real depreciation would produce a transitory, not a permanent, rise in the rate of inflation; it would not require an offsetting rise in the gap.

Since $b(1)$ is not significantly different from zero, it can be constrained to that value and the price equation can be rewritten:

$$\Delta^2 p = a'(L)\Delta^2 p_{-1} + b'(L)\Delta^2 s'_{-1}$$
$$+ c(L)\Delta t + d(L)\Delta P_{oil-1}$$
$$+ e(y\text{-}y^*)_{-1} - f\Delta(y\text{-}y^*)_{-1} + \eta$$

where $b'_i = -\sum\limits_{j\,=\,i+1} b_j,$

in order to identify readily as $b'(1)/(1-a'(1))$ the price level effect of a depreciation (a rise in *s'*).

The result, $b'(1)/(1-a'(1)) = 0.20$, is in line with the import share of the Canadian CPI basket, which is comforting. However, as for the aggregate demand equation reviewed earlier, considerable smoothing of the (nominal) exchange rate was required to produce even this minimal result.

The equation is reasonably successful in explaining variations in Canadian inflation over the last twenty years (see Charts 7 and 8). It captures the sharp decline in inflation which followed the 1981-82 recession particularly well. Indeed, given its severity, the 1981-82 recession clearly dominates the sample period, and it provides most of the evidence upon which the sacrifice ratio is estimated. Estimates of the sacrifice ratio are not as robust over time as one would wish.

Dynamic simulation of a decline in the rate of inflation

Our finding of a sacrifice ratio of 1.7 suggests that reducing inflation by 1 percentage point would require a cumulative gap between supply and demand of 1.7 percentage-point year, i.e., 1.7 percentage points for one year or 0.85 percentage points for two years, or any other equivalent combination.

Our estimates of the effect of interest rates and exchange rates on aggregate demand can help us translate this requirement into interest rate space. These estimates indicate that a one

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19. *A similarly low sacrifice ratio was obtained by Cozier and Wilkinson (1990) for the GDP deflator. The value of the sacrifice ratio is not independent of the measure of potential output. Flexible measures based on a Hodrick-Prescott filter such as the one used here tend to produce a lower sacrifice ratio than measures based on smoother trends.*

20. *For example, the typical partial adjustment model for prices* $p = \alpha + \beta\ ulc + (1-\beta)\,p_{-1}$, *where p is the logarithm of prices and ulc is the logarithm of unit labour costs, driven, say, by a wage Phillips curve, would yield* $p = ulc + (\alpha - (1-\beta)\,\pi)/\beta$ *in an inflationary steady state, where* π *is the rate of inflation.*

21. *The confidence intervals surrounding these numbers are fairly wide, however.*

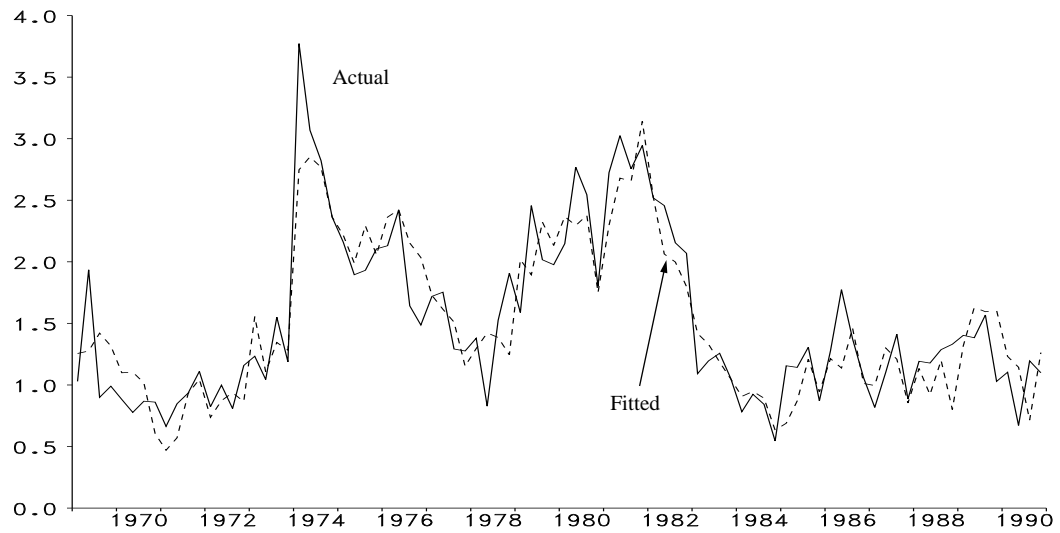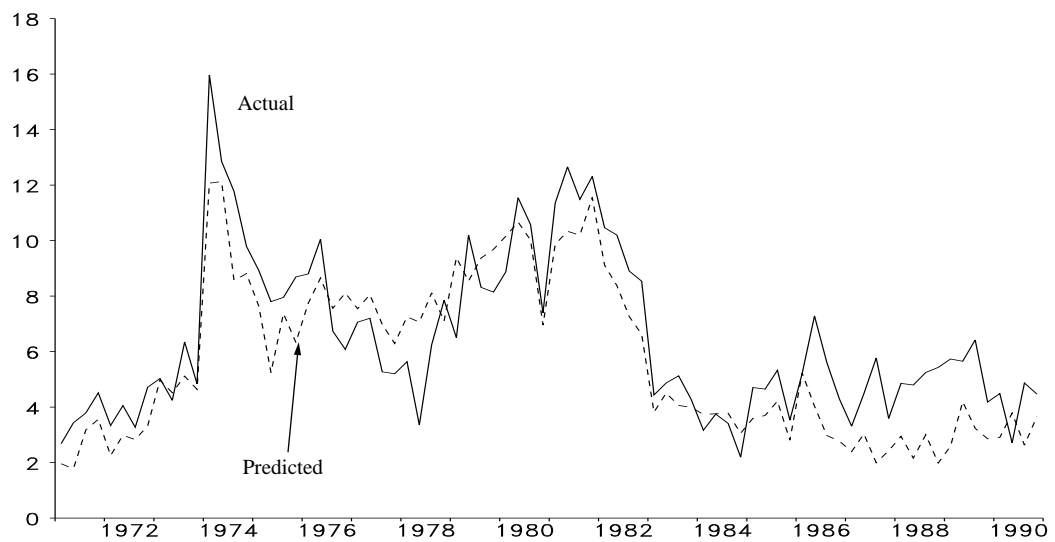Chart 7   Actual and fitted inflation rate

Chart 8   Actual and predicted inflation rate

Single equation dynamic simulation
Quarterly growth rate at annual rate

percentage point increase in real short-term interest rates would reduce spending by about 0.6 per cent (some estimates go as high as 0.77 per cent) in the absence of exchange rate movement. However, the currency should appreciate in response to the rise in interest rates if foreign rates remain constant. If markets adequately perceive what monetary policy is attempting and, maybe more importantly, what it can accomplish, the real appreciation of the currency should be equal to the cumulative forward increase in real interest rates that the central bank is contemplating.

Starting from that premise, it is interesting to note that a smaller rise in interest rates spread over a longer period will cause the same initial exchange rate reaction as a larger rise maintained over a shorter period, but the exchange rate will be maintained at a higher level longer in that first case. This implies that a smaller rise in interest rates spread over a longer period would have a larger total effect on spending (through the exchange rate) than a larger rise spread over a shorter period. It will also produce a larger but slower deceleration in inflation.
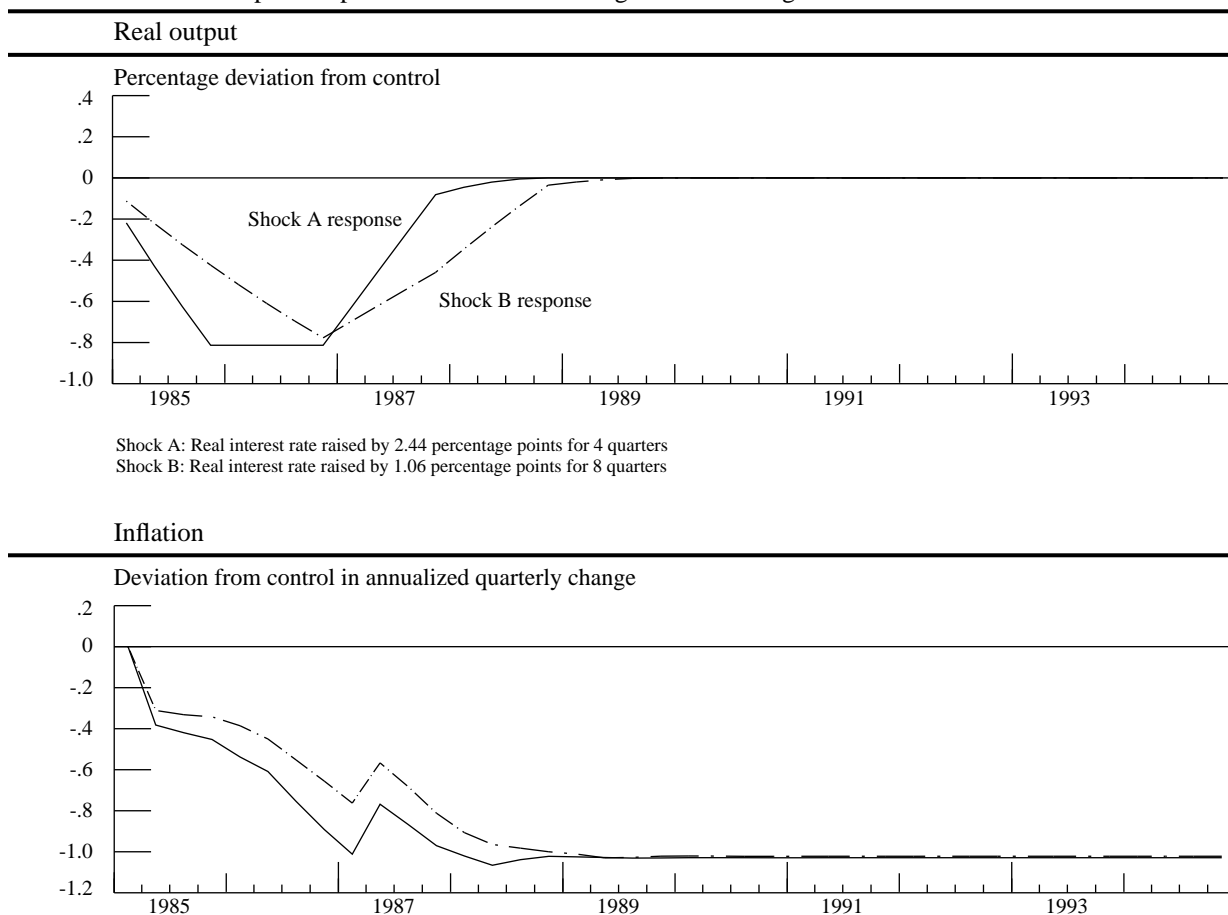
As an example, a one percentage point rise in real short-term interest rates maintained for one year would produce a 0.6 percentage point increase in the cumulative excess supply gap (spread over three years) through the interest rate effect and a 0.1 percentage point increase (spread over four) through the exchange rate effect, for a total reduction of 0.41 percentage points in inflation. (The exchange rate effect is obtained by multiplying the cumulative deviation of the real exchange rate from control (0.5 per cent) by the estimated elasticity of spending to real exchange rate (0.2).) By contrast, a fifty basis point increase maintained over two years would produce the same 0.6 percentage point increase in cumulative gap through the interest rate effect (albeit spread over a longer period), but a 0.2 percentage point increase through the exchange

rate effect, leading to a total reduction in inflation of 0.47 percentage points.

From these calculations, it can be seen that a one percentage point reduction in inflation would require a 244 basis point increase in real interest rates maintained for one year or a 106 basis point increase maintained for two. Chart 9 shows the time profile of output and inflation to these two choices.

Of course, markets may have a different perspective of what the central bank can achieve. Thus, the reaction of the exchange rate to short-term monetary actions may differ from what could be anticipated. In this case, the change in interest rates required to achieve the desired reduction in inflation would have to be adjusted in light of the exchange rate reaction. One guide in making such an adjustment is the index of monetary conditions that can be constructed by weighting interest rates and the exchange rate by their relative influence on total spending. The estimates derived from the aggregate demand equations presented earlier suggest that a one **percentage** point increase in short-term interest rates has the same effect on spending over time as a 3 **per cent** appreciation of the currency.

Chart 9   Profile of output and prices to alternative strategies for reducing inflation

Real output

Percentage deviation from control

Shock A response

Shock B response

1985 1987 1989 1991 1993

Shock A: Real interest rate raised by 2.44 percentage points for 4 quarters
Shock B: Real interest rate raised by 1.06 percentage points for 8 quarters

Inflation

Deviation from control in annualized quarterly change

1985 1987 1989 1991 1993

CONCLUSION

In this paper, I suggested that central bank actions have a more direct impact on short-term interest rates and on the exchange rate than on monetary aggregates. I presented a description of the monetary policy transmission mechanism in which monetary policy operates through changes in short-term interest rates and the exchange rate and influences monetary aggregates, total spending and prices with significant lags. I also suggested that a small aggregative model was better suited than a large scale econometric model to

quantify these linkages and presented estimates of the effect of interest rates and the exchange rates on real activity and prices.

Although monetary aggregates do not feature prominently in this paper, I indicated that they provide important information about the stance of monetary policy. That information is particularly valuable to the central bank as a way to monitor the consequences of its actions and contain the risks inherent in the conduct of a forward-looking policy in a stochastic or uncertain environment. These issues are discussed more fully in Duguay and Poloz (1994).

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The role of economic projections in Canadian monetary policy formulation

by Pierre Duguay and Stephen Poloz

INTRODUCTION

The purpose of this paper is to describe economic aspects of the framework within which monetary policy is formulated in Canada. Given the lags between changes in the instruments of policy and their ultimate effects, and the general uncertainty associated with economic behaviour, the framework is explicitly forward-looking and probabilistic in nature. Thus, in this description of the practical aspects of the policy process, we focus primarily on the role played by economic projections and near-term monitoring of economic developments. In doing so, we hope also to give the reader an appreciation for the relevance of uncertainty to the policy process, and to illustrate how policy reacts to unexpected developments.

The plan of the paper is as follows. The first section lays some groundwork for later material by discussing the conceptual or theoretical aspects of policy, outlining policy objectives and the reasoning behind them, and setting up the conceptual framework within which policy is planned, new information is considered, and decisions are taken. Emphasis is placed on policy indicators and guides and the rationale for their choices. The input of the Bank staff into the monetary policy formulation process is the subject of the following section. There we discuss the role of staff economic projections in planning, monitoring and updating, and review the principles of how policy reacts when plans are not realized. The final section offers some concluding remarks.

MONETARY POLICY OBJECTIVES AND FRAMEWORK[1]

In macroeconomic terms the central bank has only one policy instrument – the provision of the means of ultimate settlement – which implies that there can be only one independent, nominal goal variable. Recognizing this practical limita-

1. *The foundations of the conceptual framework to the conduct of Canadian monetary policy were laid out in Bouey (1982) and Crow (1988) and reviewed in Freedman (1990b).*

tion, and acknowledging as well a number of important interdependencies between the various objectives set out in the Bank of Canada Act, the Bank of Canada has focussed on a gradual approach to price stability as the central objective of monetary policy. The Bank's reasons for this choice are by now well-known and we will not debate them here: Preserving the value of money is clearly within the scope of monetary action; and it is believed to be the surest way from a monetary perspective to mitigate fluctuations in production and employment and the best contribution that monetary policy can make to the economic and financial welfare of the country.[2] It is widely believed that inflation distorts information and erodes confidence not only in the value of money but also in the appropriateness of market solutions.[3] A commitment to a steady rate of inflation is regarded by the Bank as not credible, for with a built-in tolerance of inflation, doubts will persist about the resolve of the monetary authorities to reverse the effects of an adverse shock that would raise inflation from its targeted level.

In the context of most mainstream macreconomic models, one can describe in general terms the monetary policy requirements of achieving price stability from an initial situation with inflation as follows: the policy must produce a deceleration in the rate of growth of monetary aggregates and nominal spending; this requires an initial tightening of monetary conditions (likely resulting in both a rise in interest rates and an appreciation of the currency); the resulting slowing in demand will cause inflation to decelerate over time and eventually allow monetary conditions to ease. One can attempt to quantify

this scenario using economic models in order to set a realistic time frame for achieving price stability. However, as the effects of monetary policy on the economy are spread over time and cannot be predicted at all precisely, and as the relevant features of the economy and economic policy other than monetary policy may change, a successful practical strategy must also provide some assurance that cumulative one-way errors will be avoided and that the longer-term objectives of monetary policy are properly borne in mind in day-to-day decisions.

A useful way to describe the framework within which monetary policy is conducted is to identify the intermediate elements between the instruments that are under direct control of the central bank (primarily the supply of settlement balances to financial institutions) and the ultimate goal that the central bank sets out to achieve (improved economic performance through the pursuit of price stability). These elements range from proximate targets, variables upon which the instruments operate directly, such as short-term interest rates; through intermediate variables which may be used as a nominal anchor to provide protection against cumulative one-way errors, such as monetary aggregates, the exchange rate, or nominal spending; to ultimate targets or goals, such as price stability and economic growth.

Debate about the appropriate objectives for monetary policy over the past two decades has focussed mainly on intermediate targets. From 1975 to 1982, the monetary aggregate M1 (the sum of currency and demand deposits at banks) was used by the Bank of Canada as a formal intermediate target, and short-term interest rates served as a proximate target (see White 1979). The purpose in setting policy in terms of a target for M1 was to bring about a gradual decline in inflation. Because the demand for transactions balances appeared to be reliably linked to total

2. *Crow (1989b), Selody (1990), and Howitt (1990). See also the studies sponsored by the C.D. Howe Institute devoted to an assessment of the goal of price stability: Lipsey (1990) and York (1990).*
3. *See, for example, Leijonhufvud (1981), Chapter 9; also see the 1990* Annual Report of the Governor.

spending and to short-term interest rates, M1 targeting offered a convenient rule for setting interest rates which permitted a direct feedback to total spending. Unfortunately, the high interest elasticity of the demand for M1 meant that the changes in interest rates required to keep M1 on target were insufficient to prevent large deviations of total spending and inflation from their desired paths. This problem could in principle be overcome by conducting a countercyclical M1-rule, albeit at the cost of increased complexity in explaining policy. However, shifts in the demand for transactions balances due to financial innovation led the Bank to abandon M1 targeting in 1982.[4]

The search for an alternative monetary aggregate did not uncover any that could perform the role that was assigned to M1. The introduction of chequable daily interest savings accounts blurred the distinction between transactions and savings balances and thus shifted attention to the broader monetary aggregates. The latter internalize many shifts in money demand due to financial innovation and, by virtue of being relatively less sensitive to changes in the general level of interest rates, tend to track total spending, particularly the price component of total spending, rather better than does M1. However, as a corollary, these broader aggregates fall no more directly under the influence of central bank actions than does total nominal spending itself. In addition, the relationship between the broader monetary aggregates and nominal spending can be disturbed by changing intermediation patterns of credit demand or by shifts between holdings of Canada Savings Bonds and savings deposits, and the demand functions for broader aggregates have been found to exhibit random drift, which reduces considerably their usefulness as a formal nominal anchor (see Caramazza, Hostland and

Poloz 1990; Caramazza, Hostland and McPhail 1992; Hostland 1990).

Another variable frequently put forward as a potential intermediate target of monetary policy is the nominal exchange rate (see, e.g., Artis and Currie 1981). While the Bank recognizes that the exchange rate is an important price for the Canadian economy, one over which it has some (although far from exclusive) influence, it does not regard this variable as a suitable intermediate target for monetary policy. This is because an exchange rate target involves giving considerable weight to the monetary policy and economic conditions of another country. The Bank regards the exchange rate as an integral part of the monetary policy transmission mechanism, a variable that along with interest rates plays a pivotal role in the equilibration of aggregate supply and demand (Crow 1992). Given the unpredictability of the magnitude of the effect of monetary actions on the exchange rate, the Bank monitors a construct which combines changes in the three-month interest rate and in the effective exchange rate, weighted by an estimate of their relative influence on aggregate demand, as a broader gauge of monetary conditions (Crow 1989b; Murray and Khemani 1990; Poloz 1990).[5] This measure provides a regular reminder of the role that the exchange rate plays along with short-term interest rates in the transmission of monetary policy. However, it is also the case that exchange rate movements have a role to play in response to supply and demand shocks, particularly to swings in the terms of trade brought

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4. *For an evaluation of Canada's experience with M1 targeting, see Courchene (1981), Bouey (1982) and Thiessen (1983).*

5. *This construct is a rough rule of thumb based on empirical estimates of the relative effects of changes in real interest rates and the real exchange rate on aggregate demand. Although the data are consistent with a range of values, present estimates suggest that the effects on real spending of an appreciation of 1% would be approximately offset by a reduction in short-term interest rates of 25-35 basis points. The measure therefore adds the change in short-term interest rates to about one-third the percentage appreciation of the exchange rate from a given base period.*

about by changes in world commodity prices. Exchange rate movements buffer these swings, spread their effect across the economy, and lessen the disruption to domestic costs and prices.

The appropriateness of nominal spending as a nominal anchor has been examined in Masson (1983), Bean (1983), Longworth and Poloz (1986), and McCallum (1988, 1990), among others. While the ability of central banks to influence nominal spending directly is generally perceived to be quite limited, it nevertheless is no less controllable than are most broadly-defined monetary aggregates. Moreover, nominal spending can be useful to policy-makers in a conceptual sense, since it lies approximately midway between those nominal financial variables such as short-term interest rates which the central bank can hope to influence relatively directly and goal variables such as the rate of inflation. If, over the long run, the real side of the economy is fundamentally self-equilibrating, the authorities may be reasonably confident that generating a rate of monetary expansion consistent with nominal spending growth equal to the rate of growth of natural or potential output will be consistent with price stability in the long term; and that gradually reducing the rate of monetary expansion to that growth rate will, over time, bring about the desired reduction in inflation. Thus, nominal spending can be regarded as an accounting device which allows one to reconcile movements in the measures of money and credit with the desired evolution of the longer-term objectives of policy. However, as noted by Freedman (1990a), the attractiveness of nominal spending as a policy target is diminished by such practical concerns as the quality and timeliness of nominal spending data, and the relative roles of central banks and governments in taking responsibility for nominal spending.

From the unsettled debate over alternative intermediate targets has emerged an increased emphasis by central banks on the ultimate goal of policy (Crow 1993). The commitment to price stability as a means to better economic performance in Canada was reiterated on the occasion of the federal budget on 26 February 1991 and formalized in a joint announcement by the Governor and the Minister of Finance of specific targets for reducing inflation. The targets, which are expressed in terms of the year-over-year rate of increase in the consumer price index, decline over time as follows: 3 per cent by the end of 1992, 2.5 per cent by mid-1994, and 2 per cent by the end of 1995, in each case ± 1 per cent.[6] It is important to note that this announcement did not indicate a change in monetary policy objectives. As noted earlier, price stability had already been the declared goal of monetary policy. However, it did represent the first specific public statement of the horizon over which price stability would be sought, and it has yielded an explicit set of guideposts for the conduct of monetary policy.

Despite the decision to pursue specific inflation reduction targets, the numerous intermediate variables that lie between the instruments of policy and the rate of inflation continue to play a vital role in the policy formulation process. This is because the lag between policy actions and their ultimate effects on measured inflation is both long and variable. Thus, a policy directed at specific inflation targets must be forward-looking, paying considerable attention to economic projections and monitoring economic developments through intermediate variables. The linkages between these variables are made explicit

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6. *After this paper was completed, the government and the Bank announced that the 1 to 3 per cent target range would be maintained from 1995 to 1998 and that, on the basis of the experience with low inflation over the period, a decision would be made by 1998 on the range that would be consistent with price stability.*

Table 1   Summary of the projection and monitoring process

	Function	Annual frequency	Timing	Comments
1.	Medium-term projection	2	After release of National Accounts for Q2 and Q4	- Review all assumptions and conventions - approximately 7-year horizon - full analysis of starting point
2.	Quarterly update	2	After release of National Accounts for Q1 and Q3	- Review most assumptions - approximately 2-year horizon - full analysis of starting point
3.	Mid-quarterly reassessment	4	About 6 weeks after completion of previous projection	- a three-quarter horizon - assess shocks to preceding projection, and probable implications for policy
4.	Monitoring	52	Each Friday	- two-quarter horizon - assess all new information and its cumulative effect on preceding projection

within the context of projections of the economy constructed by the Bank staff. While these projections are not taken literally by senior management, they do provide a useful basis for discussion of policy, and a benchmark by which to judge new economic developments and to gauge whether policy settings require any reconsideration in response to those developments. This process is the subject of the next section.

ECONOMIC PROJECTIONS AS AN AID TO DECISION-MAKING

The Bank staff prepares economic projections of varying levels of detail through an annual cycle. The cycle consists of: semiannual medium-term projections, which focus on a 6-7 year horizon; two quarterly short-term updates between medium-term exercises, with a horizon of 7-9 quarters; mid-quarter reassessments between each of the four formal projection exercises, with a near-term focus of 2-3 quarters; and weekly updates based on newly-released data. Table 1 summarizes the discussion to come.

Medium-term projections

The Bank staff translates the inflation reduction targets into medium-term projections for the Canadian economy. These projections lay out reference paths for key macro variables, including those that fall under the Bank's range of influence, consistent with the policy objective, the starting point and projections of certain exogenous variables. As such, they represent an

essential input of the Bank staff into the policy deliberations of senior management.

Until recently, the Bank's quarterly econometric model RDXF (see Robertson and McDougall 1980) has been used as an organizing framework for incorporating sectoral specialists' judgment into the projections. The model consists of some 400 equations. However, a new model which will replace RDXF as the main projection tool, called QPM (for Quarterly Projection Model) has been under development for sometime. QPM is much more highly aggregated than RDXF, entertains a mixture of forward and backward-looking expectations, and has full stock-flow accounting; see Laxton and Tetlow (1992) for a description of the prototype. The new model is expected to formalize a good deal of the judgment that previously was applied to RDXF. However, the nature of the projection process, which is discussed below, is unlikely to be affected substantially.

Each behavioural equation of the staff's model includes an error term, the projected evolution of which is determined by sectoral specialists based on judgment or projections from satellite models. These assumptions are the subject of wide-ranging discussions among the staff at an early stage in the projection process. In the final analysis, the staff projections are essentially probabilistic in nature, as the consensus view and the notional confidence interval around it are the product of a wide range of economic models and competing views.

A medium-term projection exercise, with a 6-7 year horizon, is undertaken twice yearly, in the fall and in the spring. The process begins with projections for major overseas economies and for the United States. Canadian sectoral specialists then update their projections of other exogenous variables and develop adjustment or error-term profiles for the model equations that fall under their purview. Given the reference path

for inflation and the assumed error term profiles for the model equations, the projection team computes paths for such variables as interest rates, the exchange rate and the monetary aggregates M1 and M2, which will be consistent with the objectives of policy, conditional upon the judgment of the staff. Some iterations generally occur at this stage, as specialists adjust their assumptions in light of feedbacks from other sectors on their own so that the final product will accord well with their judgment. The staff may then prepare some alternative scenarios as a means of illustrating the degree of uncertainty surrounding the projections, and the importance of particular risks that they have identified. These could include varying such critical assumptions as the world price of oil and the rate of growth of potential output, or varying certain key model coefficients. The exercise thereby produces a range of paths for each of the key macro variables which, it is hoped, take reasonable account of the degree of uncertainty associated with economic models and with informed judgment. Upon presentation of the exercise to senior management, the latter may ask for additional scenarios based on modified policy assumptions or highlighting alternative risks that they consider particularly relevant.

Short-term projection updates

The above process is repeated in winter and summer, but in less detail and for a shorter horizon of 7 to 9 quarters. Combining the semiannual medium-term and the two short-term projection exercises produces a quarterly projection cycle, the timing of which is determined by the publication of Canada's National Income and Expenditure Accounts. The short-term projection exercise essentially generates paths for interest rates (and monetary conditions) that, in the judgment of the staff, would produce a profile for

inflation consistent with the inflation-reduction targets.[7] During the quarter since the previous projection exercise, data updates would have been received for all of the variables in the model and sectoral specialists would have reconsidered their error-term profiles. Given a new starting point and revised judgment, the staff develop new scenarios for all variables, which they believe will be consistent with a suitable path for inflation, and present the results of this exercise to senior management. Identifiable risks to the projection are illustrated through the preparation of alternative scenarios.

In addition to the quarterly presentations of the medium-term and short-term projections to senior management, a formal meeting to reassess the near-term projection (2-3 quarters) is held approximately mid-way through each quarter. In effect, therefore, the projection exercise is formally updated, at varying levels of detail, eight times per year.

While forecast accuracy is helpful in this context, what is more important from the point of view of policy is that the Bank react to forecast errors or unforeseen shocks in a manner that restores the economy to a path that will ensure continued progress towards price stability, while taking due account of the degree of uncertainty associated with the predicted implications of those shocks. The projection exercise only provides suggested profiles for monetary conditions based on a particular policy assumption, and a convenient accounting framework against which new data may be reconciled and economic shocks identified.

Monitoring and the role of monetary and credit aggregates

Although data on the consumer price index and its components are published only two or three weeks after the month to which the data pertain, there is a substantial lag between policy actions and their effects on inflation, and for this reason it is not enough simply to know the extent of the most recent deviation of measured inflation from its targeted path. Rather, making informed judgments about the appropriate setting of monetary conditions demands a level of understanding of the current economic situation that enables one to anticipate the kinds of forces that will influence the economy over the coming 6-8 quarters.

Out of the staff projection exercise emerge hypothetical paths for, among other variables, nominal spending, interest rates, the exchange rate and monetary aggregates consistent with the inflation-reduction targets and with the projected paths for certain exogenous variables. Through the course of the quarter, the Bank monitors an extensive range of higher-frequency economic data, such as employment, retail sales, housing starts, wages, productivity and various price indices, all of which can be taken to indicate something about the underlying state of the economy, once they are reconciled in the context of an economic model. Sectoral specialists analyze these data as they arrive, making extensive use of sectoral models, and comment on the implied error in their previous projections. For purposes of monitoring GDP, a new "add-up" is completed every week and presented to senior management. This exercise extends to the projections of the overseas economies and the United States as well.

Additional monitoring information is obtained from the monetary and credit aggregates. Given the level of noise typical in monthly data, there is generally a presumption that devia-

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7. *In the background note on inflation-reduction targets, the Bank has noted that if a large shock were to occur within a short time prior to the upcoming reference point in the announced target path, it could prove impossible to meet the target in time; in such an instance, the Bank would put in place the response necessary to bring the inflation rate back to the target range before the subsequent checkpoint.*

tions of these variables from their projected values are due primarily to disturbances in their relationship to total spending, perhaps as a result of some institutional development. However, if a deviation from projection persists over time and it becomes clear that it cannot be explained by changed institutional factors, it becomes increasingly likely that the data are signalling that either output or prices (or both) are also deviating from their projected paths.

The information contained in money and credit is also exploited in a second, complementary way. Research on these aggregates has shown that their movements contain information about movements in total spending and prices. In particular, the rate of growth of real M1 has been found to be a strong leading indicator of the rate of growth of real spending, while the rate of growth of M2 has emerged as a leading indicator of the rate of inflation, with M2 and M2+ among the best contemporaneous indicators of nominal spending.[8] One of the products of this research has been a series of astructural reduced-form models which predict real output, inflation or nominal spending over the next one or two quarters. As the data on monetary and credit aggregates become available, these indicator models are used to calculate alternative short-term projections which play a role in influencing the judgment of specialists in the next projection exercise. In effect, these astructural models can give an early indication of the likely direction of the error in the staff's projections.[9]

Reaction to shocks

Conceptually it is possible to distinguish two types of shock which will call for a change in policy stance. The first type is one in which fundamental economic conditions in the economy change, or turn out differently from what was anticipated, in which case existing monetary conditions may be inconsistent with the medium-term policy goal given the changed perceptions of the state of the economy. Detecting a shock to the underlying economy, or at least discussing whether or not the economy is unfolding as expected, is of course the central purpose of the monitoring exercise described above. Once a shock has been identified, the staff would assess its impact on the projection and reexamine the consistency of the projected path of monetary conditions with the goals of policy in light of that change. Once again, it should be noted that staff projections are only one input into the policy discussions of senior management. Other inputs would include independent private-sector forecasts, views obtained directly from outside contacts, and conditions in financial and foreign exchange markets. Should an adjustment to monetary conditions be decided upon, the short-term money market operations of the Bank would be directed towards bringing about the desired change.

The second type of shock is one where monetary conditions change without there being any perceived change in the underlying economic fundamentals. For example, there may be an autonomous shift in exchange market sentiment, bringing the currency under downward pressure.

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8.   *See Cockerline and Murray (1981), Hostland, Poloz and Storer (1987), Milton (1988), Muller (1992). M2 is the sum of M1 and all notice deposits and personal fixed-term deposits at banks. M2+ comprises M2, deposits at near-banks, life insurance annuities and money market mutual funds.*

9.   *New work in this area is focussing on developing models with longer forecasting horizons. In particular, while it has been found in previous work that the strongest indicator of future inflation is M2, the highest correlation occurs at a 2-quarter lead. Given the adoption of specific inflation-reduction targets it would be more useful to extract from current economic and financial data the leading information pertaining to inflation 6-8 quarters ahead.*

In such circumstances the Bank would want to react immediately, both to restore monetary conditions to those felt to be consistent with the economic situation and the inflation reduction target, and to avoid the possibility of any cumulative decline in confidence in the currency. In the first instance, foreign exchange market intervention would be used to counter the shock. If the shock persisted, however, it would become evident that foreign exchange market intervention could not restore monetary conditions to their appropriate level. In this case, the Bank would act to adjust the level of liquidity in the system through adjustments to settlement balances of direct clearing financial institutions, thereby producing an appropriate rise in interest rates. Indeed, it is often the case that some upward pressure on market interest rates will accompany the decline in the currency in the first instance. In any case, in such circumstances the Bank would attempt over time to achieve an interest rate level that would approximately offset the effects on aggregate demand of the movement in the exchange rate, thereby leaving monetary conditions roughly unchanged, provided that no speculative momentum had developed in the exchange market.

Alternatively, exchange rate pressure might develop as a consequence of a change in U.S. real rates of interest. One could distinguish three possible situations, although the feasible set of conditions would in fact constitute a continuum along which these would be polar cases. In the first case, a rise in U.S. interest rates might reflect an expansionary shock in U.S. aggregate demand. If the U.S. interest rate response were such as to limit spillovers onto aggregate demand in Canada, Canadian interest rates might be allowed to rise just sufficiently to offset the estimated expansionary effect of the depreciation of the Canadian dollar. A second possibility would be a rise in U.S. interest rates that resulted from a change in U.S. monetary policy – for example, a

decision to attempt to reduce ongoing inflation – rather than from a reaction to a change in aggregate demand. Such an action could spill over onto aggregate demand in Canada and require an easing in Canadian monetary conditions. Depending on the reaction of the Canadian dollar that resulted from the change in interest rate differentials, the required easing could be consistent with either a rise or a fall in Canadian interest rates. Finally, one could imagine an exogenous shock that affected both the U.S. and Canadian economies similarly; in this case, to the extent that the typical responses of the two economies to interest rate movements were similar, one could expect interest rates in the two countries to behave in like fashion.

Sometimes the exchange rate may come under pressure, and monetary conditions will be disturbed, for reasons that are clearly related to shifts in economic fundamentals. In particular, because Canada is a producer and exporter of commodities, a rise in world commodity prices would be expected to put upward pressure on the Canadian dollar. Since a real appreciation would have to occur in this case regardless of the response of monetary policy, any attempt to offset the nominal appreciation via a downward adjustment to interest rates would produce upward pressure on domestic prices. In such an instance it is possible that a full analysis will suggest that little or no adjustment to interest rates was needed to maintain progress towards the Bank's medium-term goals.

CONCLUDING REMARKS

This paper has presented an overview of the framework within which monetary policy is currently conducted in Canada. The goal of monetary policy is the gradual elimination of inflation.

The conceptual framework is based on a mainstream approach to the policy transmission mechanism under floating exchange rates, in which monetary policy operates through changes in interest rates and the exchange rate, and influences monetary aggregates, total spending and prices with significant lags. The strategy that has been adopted reconciles the need for policy to be forward-looking with the risks inherent in relying on projections based on economic models and judgment. It uses economic projections to translate the Bank's objectives into suggested paths for the instruments of policy, and uses various economic and financial indicators, notably monetary aggregates, to monitor progress and help the Bank to act in a timely fashion when necessary. The projection and monitoring exercises provide a formal procedure for conveying to senior management the views of the staff on the economic outlook, and facilitates discussion of policy options when unexpected developments threaten the Bank's ultimate objectives. In the end, the policy framework is a pragmatic one. There are no simple rules, but rather a process of successive approximation anchored by a firm long-term commitment to price stability.

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Bank of Canada operations in financial markets

by Tim Noël

INTRODUCTION

I would like to thank the Toronto Association for Business and Economics and the Treasury Management Association of Toronto for this opportunity to speak to you today. In the past year and a half, the Bank of Canada has made some important changes in the way it implements monetary policy and intervenes in financial markets. Given this audience's involvement and interest in financial markets, it is appropriate and timely that I discuss these developments with you.

Before talking about monetary policy operations, however, I would like to set the stage by highlighting an increasingly important aspect of the Bank's overall framework of monetary policy – transparency. The Bank has been accelerating its moves to become more transparent because of the growing recognition that transparency and policy credibility and effectiveness go hand in hand. Our commitment to increased transparency has been reflected, among other things, in specific inflation-control targets, the dissemination

of the concept of monetary conditions and the way we measure them, and the publication of the new semi-annual *Monetary Policy Report*. A more open approach has also been reflected in our dealings with financial markets, and it is this area that will be the focus of my remarks today.

Our objective in all these initiatives has been to reduce the amount of uncertainty regarding our objectives, our views on economic and financial developments and our actions. This in turn will help everyone in the economy – investors, traders, consumers, labour and business – understand how we view the situation. This should increase the likelihood that the market's expectations and our own are consistent.

INITIATIVES IN OUR MARKET OPERATIONS: WHAT AND WHY

So, what has changed in the way the Bank manages its financial market operations? When I was appointed Deputy Governor at the Bank of Canada in 1994, I was given the responsibility for financial markets and debt management. For the

first time, the Bank's domestic and international financial market operations reported to one Deputy Governor, and both operations are, since August, part of the new Financial Markets Department. The domestic and international trading rooms of the department in Ottawa will be merged into a single facility. The decision to bring these activities together is not the result of a sudden awareness of the linkages between markets. We have long recognized the relationship, and we hope through this change to improve internal communications and to explore opportunities for cost reductions.

In addition to the reorganization of our operations, in the past year or so we have also introduced significant changes to our methods of market intervention, both on the domestic and the international sides of our business. These developments reflect both the desire for greater transparency in our operations and the recognition of the important linkages between these two market areas. Let me first turn to our foreign exchange market activity.

Last year, the Bank undertook a review of the foreign exchange activities it carries out on behalf of the government. With the agreement of the Department of Finance, we announced some changes to improve the efficiency and effectiveness of official foreign exchange intervention. The basic objective of intervention remains the same – maintaining orderly market conditions in the context of a floating exchange rate. In the past, this desire to maintain orderly markets tended to lead us to intervene frequently in order to "lean against the wind." This often led to intervention even when movements in the exchange rate reflected underlying fundamentals and were still relatively modest. With the market for the Canadian dollar having grown substantially in recent years and with commensurate increases in its depth and liquidity, we felt that a change in our intervention tactics was called for.

The general approach is now to intervene less regularly, but when engaged, to do so more vigourously. The idea is to address sharp short-run movements in the dollar that have the potential to become disorderly, as opposed to gradual trend movements based on fundamentals.

Foreign exchange intervention may on occasion also be more closely co-ordinated with our activities in the domestic money market if there are risks that currency weakness could become a self-reinforcing trend. It is important to underline, however, that intervention in the foreign exchange market is *not* linked to domestic money market operations in *more normal circumstances*. As I said earlier, it is focussed on ensuring orderly markets.

This brings me to the Bank of Canada's operations in domestic money markets. Our ability to affect overnight interest rates directly has always been the key instrument used in those operations. The major innovation, introduced in June 1994, is our operating or target range for overnight rates. This represents an important shift in focus away from the 3-month treasury bill rate towards the overnight rate as the Bank's short-term, operational objective. Under our previous approach, our control of the banking system's reserves and open market operations in the overnight market were used to influence 1-day rates. In conjunction with outright purchases or sales of treasury bills, this allowed us to target fairly precisely the level of the 3-month treasury bill rate. From there our actions, through their impact on expectations, affected the whole yield curve and the exchange rate and hence overall monetary conditions.

The primary reason for this change in focus is the fact that it is the overnight rate that the Bank can most directly influence. Therefore, our actions to keep it within a target range, or to change the range, should be easier for market participants to understand and judge. At the same

time, it is the strong linkage between the overnight rate and short-term market rates in general that makes this change of emphasis possible. I should mention, however, that a by-product of the move to the use of operating bands for the overnight rate is reduced volatility in overnight rates and somewhat greater movement in the 3-month rate.

Before describing our activity in domestic financial markets, I want to note that, although the primary focus of our operations in the domestic money market has changed, the tools we employ remain the same: I am referring here to our management of the settlement balances held by financial institutions at the Bank of Canada, our primary instrument of policy, along with buyback operations – Special Purchase and Resale Agreements (SPRAs) and Sale and Repurchase Agreements (SRAs) – and occasional outright treasury bill transactions.

SPECIFICS OF MARKET OPERATIONS

Let me now describe how we operate with this greater focus on the overnight rate. Each day, the Bank of Canada targets a level for the overnight rate within the 50-basis-point band. The daily drawdown/redeposit mechanism is used to generate a trading range for the overnight rate consistent with the daily target. Typically, this daily target is not at the extremities of the band, in order to avoid unnecessarily frequent buyback operations by the Bank to keep the rate inside the range. However, there may, on occasion, be circumstances that would lead us to keep the rate very close to the upper or lower limit of the range for a period of days, as a first step towards a possible increase or reduction in the band.

This "testing of the waters" allows the Bank to gauge the reaction of the market in terms of the implications for other interest rates and the exchange rate to a possible change in our operating range. Let me add more generally that we value the feedback we get from market participants. Indeed, we look to the market for an independent view, through direct dialogue as well as price quotes. In this regard, our new operating procedure hopefully gives market participants a clearer framework within which they can provide us with feedback about our operations.

The Bank intervenes in the market as required to keep most overnight market trading within the band. When the overnight rate begins to move above the ceiling of our band in a persistent manner, the Bank intervenes to add temporary liquidity to the system through SPRAs. Conversely, when the overnight rate looks as if it will fall below the floor of the Bank's target band, we engage in SRAs, which temporarily absorb liquidity from the overnight market.

It is important to note that some trades in the overnight market may occur outside of the trading band without prompting our intervention. The goal is to achieve a daily average level of overnight trading within the band. Isolated trading outside of the band is therefore not likely to trigger Bank of Canada activity. Many other factors, such as the size and concentration of financing needs, the length of time since our previous intervention on that day and prospects for rates returning to the band, are all considered when determining whether or not to intervene.

Changes in the overnight range are very important events for the Bank and for the market. They may indicate that the Bank sees a change in the desired path of monetary conditions as needed to be consistent with the achievement of the Bank's inflation-control targets. Or, alternatively, following a movement in the Canadian dollar to a new trading level, the Bank may be

seeking a rebalancing of monetary conditions between interest rates and the exchange rate to return the overall level of monetary conditions to its previous level. A third possible reason for a change in the range is to help calm markets in response to unanticipated events.

Shifts in the overnight band are communicated to the market as quickly and clearly as possible. They are signalled through the offer of either SPRAs or SRAs at the relevant new level. In its effort to communicate effectively, the Bank offers to intervene at the new level immediately upon making its decision, regardless of where the overnight rate is trading. The dissemination of the new band information from money market jobbers and major banks to the rest of the market is almost instantaneous.

The time of day when a change in the overnight band occurs depends on the motivation for the shift. Changes in the band to reflect economic fundamentals or to rebalance monetary conditions are generally made around nine o'clock. However, changes in the overnight range to help calm markets can occur at any point during the day.

While the focus of our operating procedures has shifted more to the overnight rate, we still occasionally use the secondary tool of outright treasury bill purchase or sales, generally to pace the movements in overall short-term rates. Intervention in the treasury bill market has generally been less frequent than it was under the previous system.

Since the Bank Rate is still linked to the 3-month treasury bill rate, the Bank of Canada remains sensitive to rapid movements in that market. But more importantly, the rate of interest used in the monetary conditions index is a 3-month rate. Thus, the Bank may still have a view about the pace of the movement in money market rates even if it does not feel it necessary or even appropriate to move its overnight range.

Accordingly, you may see the Bank selling treasury bills, while at the same time offering SPRAs to ensure that the 1-day rate remains within the range. This is not a contradiction, but a reflection of a desire to make two different points – of which the stability of the range is the more important. It is in this context that the Bank of Canada indicated in a recent press release that the Bank will no longer constrain itself to intervening at one specific interest rate between treasury bill auctions. It will instead transact at prevailing market levels. This further reflects the Bank's willingness to allow the 3-month rate to move in response to market forces.

It is worth noting that our new operating procedures have evolved over time – not all of the features were decided at the time we moved to the operating-band concept. For instance, initially a change in the band was signalled via SPRAs or SRAs only when overnight rates threatened to trade outside the boundaries of the new band. The present procedure is more consistent with our goal of transparency.

Before I conclude, I would like to say something about two events that will lead to further changes in the way we operate. The first is the movement over the next few months of treasury bills onto the Debt Clearing Service (DCS) of the Canadian Depository for Securities. The expected resulting growth of the repo market for bills may lead us to include the overnight repo rate for General Collateral in our calculation of the published overnight rate.

The second and more significant development is the introduction of the Large Value Transfer System (LVTS) in Canada, which will establish finality of payment on a real-time basis. This development, most likely to occur in 1997, will have important implications for the methods we will use to influence overnight rates. We intend to discuss possible changes to our techniques for the implementation of monetary pol-

icy under an LVTS with market participants –
possibly before year-end. One outcome of such
changes may be a decision by the Bank to move
the Bank Rate from its present link to the
3-month treasury bill rate to something more
directly tied to our monetary policy operations.
This could involve, for example, a shift of the
Bank Rate to the upper end of the operating
range. Once we have a clearer understanding of
the nature of the new techniques required to
operate in the new environment, we may con-
sider introducing some changes even before the
LVTS is put in place.

CONCLUSION

I would like to conclude by reiterating that the
Bank is committed to a more open, more trans-
parent monetary policy. This has involved both
an increasing emphasis on effective communica-
tions and changes in the way we implement mon-
etary policy through financial markets. And no
doubt, further changes will be made over time to
our operations. I can assure you that we will con-
tinue to consult with the market on ways to make
them as effective, as clear and as understandable
as possible. The Bank's goal in becoming more
transparent in the implementation of monetary
policy is to ensure that our actions are well
understood by markets. In this manner, our oper-
ations in the financial markets can be more read-
ily judged in terms of their consistency with the
Bank's achievement of its inflation-control tar-
gets, on the way to price stability.