What Operating Procedures Should Be Adopted to Maintain Price Stability?—Practical Issues

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In this paper I provide a broad-brush examination from a practitioner's point of view, of some of the issues relating to the maintenance of price stability. I focus mainly on a framework in which the centerpiece of policy is an explicit target range for inflation control, of the sort that has been used in recent years in New Zealand, Canada, the United Kingdom, Sweden, Finland and a number of other countries.[1] However, I also make reference to systems that rely upon a monetary aggregate as an intermediate target, such as those used by Germany and Switzerland. While the experience over the past few years has largely been directed to bringing down the rate of inflation toward price stability, some of the lessons from that experience are equally relevant to the task of maintaining price stability, once it has been achieved.

One of the themes that recurs throughout this paper is the importance of the credibility of the monetary authorities in determining the response of financial markets and of the public to various shocks, and consequently, the appropriate reaction by the authorities themselves to such shocks. This raises the possibility that, over time, as price stability is maintained and central bank credibility gradually increases, there may be changes in the way the monetary authorities respond to economic shocks.

The paper begins with a discussion of the definition of price stability, focusing on the use of the consumer price index (CPI) in

setting the target for policy, and possible biases in that measure. The second section deals with the central role of the forecast of inflation in the conduct of policy under an explicit target for inflation control and the appropriate policy response to a variety of shocks in circumstances with different levels of credibility. While this section deals with the response to shocks in a qualitative way, the subsequent section discusses how the central bank decides upon the size of the adjustment to very short-term interest rates in response to a shock to the system that results in a change to the forecast of inflation. It also examines the speed with which inflation should be brought back to the target if it should move away from it (in either direction), and possible tactical problems in achieving a desired path for monetary conditions. In the fourth section, I discuss a number of issues related to achieving and maintaining price stability, including the effect on the behavior of inflation of different specifications of inflation expectations formation, how monetary conditions can be eased when interest rates are already very low, and some of the differences between targeting monetary aggregates and explicitly targeting measures of inflation. The fifth section emphasizes the importance of transparency of policy and the way in which policy goals and policy actions are communicated to the financial markets and the public.

The analysis is directed to countries operating under a flexible exchange rate regime. It is thus relevant both for small open economies, such as Canada and New Zealand, and for very large countries, such as the United States, Germany, and Japan. The analysis does not apply to a small economy which has fixed the value of its currency to that of a larger country since the maintenance of price stability in such a country is based on the maintenance of price stability in the larger country to which it is tied and on reasonable stability in the real exchange rate vis-à-vis that country.

It is important to distinguish between two concepts of price stability. The first focuses on an ex ante achievement of a given rate of inflation (for example, the bias in the measure of inflation used) but does not require correction of the price level ex post for an inflation outcome that differs from the target. Thus, base drift is permitted for the level of prices, but not for the target rate of change

of prices. The second focuses on stability in the price level (for example, a constant price level or a price level rising at a rate equal to the bias in the measure of the price index used). A period of positive inflation that resulted in the price level rising above the target would have to be followed by a corresponding period of either negative inflation or inflation less than the bias in the measure, in order to bring the price level back to its target.[2]

Except where noted otherwise, in this paper I treat the price stability target in terms of the first concept and not the second, that is, as the achievement of a target rate of inflation rather than a target price level. This is in line with current views of those central banks that have been using explicit targets for the rate of increase in the CPI to bring down inflation and to maintain price stability.

The definition of price stability for operational purposes

Price stability has been described by Chairman Greenspan in qualitative terms as a rate of inflation so low that it has virtually no influence on economic behavior. For a country aiming at the achievement of price stability by setting an explicit target for prices (whether stated in terms of a level or a rate of increase) it is necessary to have a quantitative measure for price stability. This in turn leads to three questions: first, what measure of inflation should be used as the basis for policy; second, what is the bias in that price measure; third, are there arguments other than statistical bias for targeting a positive rate of inflation?

Measure of prices

There are a variety of consumer and producer price indexes that could be used as the basis for setting policy. While there is no obviously ideal price index, most countries that have chosen to target explicitly on a measure of prices or inflation have used the CPI or a variant of the CPI. Typically, the focus of policy has been on a measure of "core" inflation that excludes very volatile components. In large part, the emphasis on the CPI has been a practical decision, based on arguments relating to the fact that the CPI is the best known

by the public of the various price measures, that it is released on a frequent basis, that it is rarely revised, and that it is used in indexing formulas. It has also been argued that as the measure closest to the cost of living for households, the CPI is an appropriate measure for the target for monetary policy, which has as its ultimate aim contributing to a rising standard of living for households.

One argument that has been made against the use of the CPI as the measure of inflation for policy purposes is that it is too narrow, since it focuses only on the prices of currently produced goods and services and does not take into account the prices of future goods and services.[3] According to this line of reasoning, monetary policy should focus on measures of prices that accord some weight to asset prices, not because the latter may be one of many useful leading indicators of aggregate demand pressures, but because such asset prices reflect expectations of future prices of goods and services, which deserve to be included along with prices of currently produced goods and services in the measure of prices being targeted. This approach has not gained favor, however, in part because of difficulties in measuring asset prices (most notably, the price of human capital), in part because there are factors other than the future prices of goods and services that affect current asset prices (such as changes in the real rate of interest and expected shifts in the distribution of income between labor and capital and the resulting effect on profits). There is also the possibility of "bubbles" in asset prices that are unrelated to future developments.[4]

The argument that the price index chosen should reflect the cost of living of households should not be pushed too far. One of the key arguments for a policy of achieving and maintaining price stability is that it facilitates better decisionmaking among investors and savers by reducing or eliminating distortions and uncertainty surrounding price signals. And better investment decisions result in a higher level or rate of growth of productivity and hence higher standards of living. But this suggests that the goal of stable prices should be directed to a broader measure of the prices than the CPI, either a variant of the GDP deflator or a measure of the prices of all transactions in the economy.

Table 1
Correlation Coefficients of Movements in Various Price Measures

A. Quarterly Changes (1971Q2–1996Q1)

	CPI	CPIXFET	PGDP	FWPGDP
CPI	1.00	.82	.85	.87
CPIXFET		1.00	.77	.74
PGDP			1.00	.93
FWPGDP				1.00

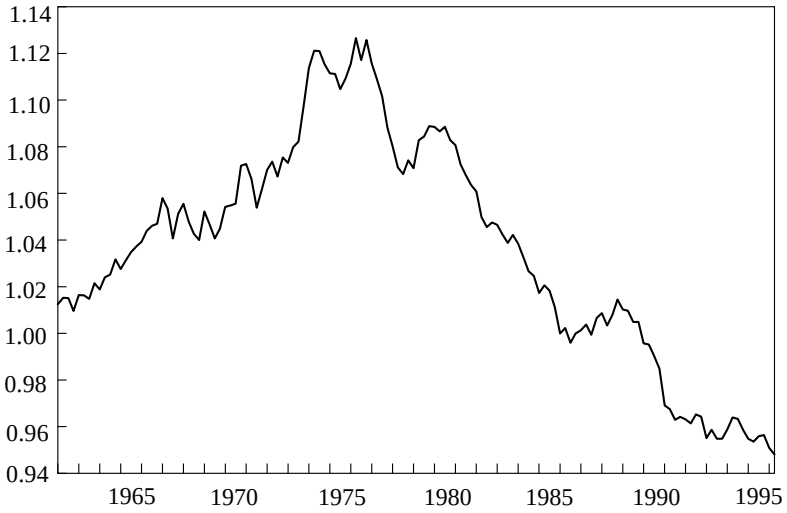
B. Four-quarter Changes (1972Q1–1996Q1)

	CPI	CPIXFET	PGDP	FWPGDP
CPI	1.00	.97	.95	.95
CPIXFET		1.00	.95	.96
PGDP			1.00	.99
FWPGDP				1.00

CPI = consumer price index.
CPIXFET = consumer price index excluding food, energy and the effect of indirect taxes.
PGDP = GDP deflator.
FWPGDP = Fixed-weight GDP deflator.

If the different measures of prices moved in very similar way the issue of which measure to use would be less important. However, there can be quite significant differences in inflation movements in the short run, and the levels of different measures of prices can differ importantly even in the long run. The top panel of Table 1 shows the correlations in Canada among quarterly changes in the overall CPI, the core CPI excluding food and energy and the effect of indirect taxes, the GDP deflator, and the fixed-weight GDP deflator over the last twenty-five years, while the bottom panel shows the correlations among the four-quarter growth rates of these same measures. As is clear from the data, the four-quarter growth rates are much more

Chart 1
Gross Domestic Product Deflator
Divided by the Consumer Price Index

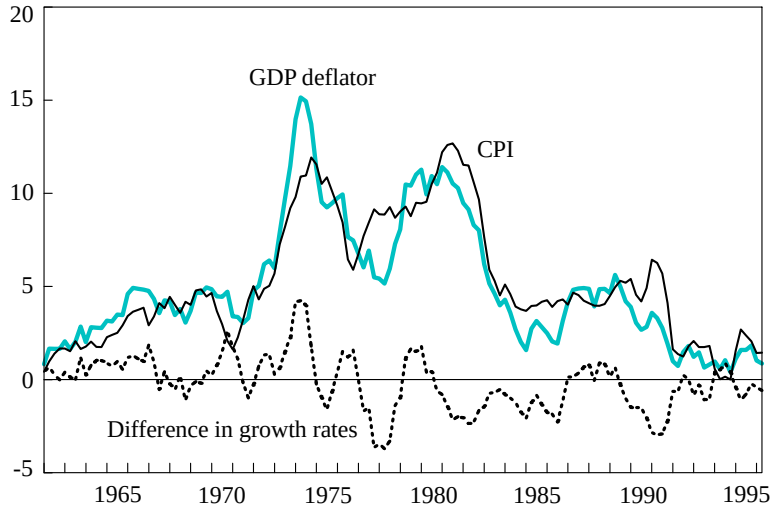


closely correlated than the quarterly movements. The greater similarity of the four-quarter rates of increase of prices suggests that broader inflationary pressures dominate over the longer time periods while special factors affect the various measures over the shorter time periods.

Even over much longer time periods, however, there can be differences in the trend movements of the different price measures. Chart 1 shows the ratio of the GDP deflator to the CPI in Canada over a 35-year period and Chart 2 shows the four-quarter growth rates of the two measures over the same period. Part of the difference in the behavior of the two measures relates to terms of trade developments, with the relative prices of commodities rising in the 1960s and 1970s, and declining on balance subsequently. Since, in Canada, commodities play a more important role in production than in consumption, the GDP deflator initially grew faster than the CPI and

Chart 2
Gross Domestic Product Deflator and the Consumer Price Index

Year-over-year percent change



more slowly thereafter. Another factor that has played an important role in the less rapid growth of the GDP deflator than of the CPI over the last two decades has been the downward tendency in machinery and equipment prices, especially computer prices.

In the end, some variant of the CPI measure will probably continue to be the object of policy, largely because of its convenience and its usefulness for communicating with the public.[5] Moreover, as will be discussed in detail in the next section, choosing a particular core inflation measure for operational purposes (such as the CPI excluding certain volatile components) and emphasizing caveats indicating the types of shocks where the first round effects on prices can be accommodated (for example, indirect tax changes) can be important in helping to achieve the objectives of policy. In any case, even though the CPI is used as the centerpiece of the policy framework, close attention should be paid to movements in the broader measures,

and different movements in the various measures should be examined for clues as to whether the CPI movements are reflecting underlying trends or special factors.

Biases in the CPI

As is well known, there are five principal sources of bias in the CPI—base weighting, imperfect adjustment for quality changes, new goods, outlet substitution, and formula bias.[6] In most countries, the best estimate of CPI bias is that it is well under one percentage point, although some observers in the United States have suggested that it could be as much as two percentage points.[7]

An obvious way of reducing the bias in the CPI would be to update the consumer basket more frequently. In Canada, for example, such updates are done every four years, on average, while in the United States they are done about every ten years. Evidence from U.S. and Canadian studies indicates that revising the basket less frequently adds between 0.1 and 0.2 percentage points to the annual bias in the U.S. CPI.

A more difficult area to assess is that of quality adjustments. Of course, this is an area that can cut both ways, with overadjustment and underadjustment of prices for quality changes both possible. And while the effect of some quality changes can be quantified fairly directly (for example, using hedonic measures), others may be much harder to capture. Examples would include improvements in the quality of medical care and the increased convenience in accessing financial services through ATMs or home computers.

In the context of targeting on the CPI, considerable efforts should be devoted to reducing the bias in that measure where possible, for example by updating the basket more frequently in those countries where updates are currently infrequent. Since the bias cannot be totally eliminated because of the difficulty in making quality adjustments, measures of residual bias should be estimated and used in the process of targeting on price stability.

What are the arguments other than statistical bias for aiming at a positive rate of inflation?

What measure of inflation is consistent with price stability? If one were certain about the size of the bias in the CPI (say it were equal to *b*), one could argue that the CPI corrected for bias would be the appropriate measure. Thus, the center of the inflation band would be *b*, if the authorities targeted the rate of inflation, or the slope of the price level target would be *b*, if the level of prices were the target.

It has, however, been argued that even though a measured inflation rate of *b* was consistent with "true" price stability, it would be appropriate to target a band for inflation higher than one centered on *b*. The arguments in favor of a higher target for the CPI are associated with two possibilities: first, that the costs of a decline in prices are greater than the costs of the equivalent rise in prices and, hence, one should try to minimize those occasions in which the price level is falling; or, second, that rigidities in prices and/or wages make it harder for the system to respond to negative demand shocks near price stability.[8]

Suppose that price stability is defined as the achievement of a rate of inflation equal to *b*, where *b* is the measure of bias in the CPI. This will imply a rate of inflation below *b* about 50 percent of the time, and, if *b* is relatively small, negative measured inflation from time to time. What are the implications for the economy of such periods of very low or negative inflation?

The first point to note is that use of the term deflation to describe a small decrease in prices lasting a short period, rather than a period of sustained price declines, can be very misleading, particularly for the "person on the street." The term deflation is associated in the public mind with the depression of the 1930s, when prices fell more than 20 percent over a four-year period. Short periods in which the average level of prices fall 0.5 percent or 1 percent are not in any way similar to a situation with an ongoing decline of prices of a substantial amount over a number of years. The kinds of concerns expressed about the latter situation, for example that households will

decide to defer consumption expenditures in the expectation that prices will be significantly lower in the future than at present, or that the economy will enter into a debt-deflation spiral, are simply much less important or nonexistent in cases of very small price declines over short periods.[9] The fact that the authorities would be acting to bring the rate of inflation back to its target rate would reduce even further the likelihood that deflationary expectations would take hold in such circumstances.[10]

The second issue that is relevant in this context is whether there are floors to prices and wages such that they are unlikely to decline even if there is slack in the system and the implications of such a situation for the working of the system and for monetary policy. In other words, would aiming at price stability result in outcomes that are costly for the economy?

As far as downward rigidity to prices is concerned, the evidence suggests that many prices, especially those in high productivity industries, can fall. And empirical analysis by Crawford and Dupasquier (1994) and Yates (1995) concludes that the weight of the evidence is against there being significant downward nominal rigidity in prices. Nonetheless, this does not rule out the possibility that there is downward rigidity in some prices, and that relative prices will be significantly affected by a large negative demand shock.[11]

In the case of wages, there are two types of concerns. Would downward rigidity in aggregate wages prevent a needed downward adjustment from taking place in the case of an aggregate demand or supply shock? Would relative wage adjustments be harder to achieve in the case of a shock that reduced the equilibrium relative wages of certain types of labor?

The evidence thus far, although still fragmentary, suggests that wages can and do decline. Thus, Lebow, Roberts, and Stockton (1992) and Crawford and Dupasquier (1994) have assessed macro-level wage data in the United States and Canada, respectively, and have arrived at the conclusion that there is little wage rigidity. On the other hand, Card and Hyslop (1996) have found evidence of wage

rigidities in micro-level data. Nonetheless, they concluded that "the overall impact of nominal wage rigidities is probably modest."[12]

In terms of aggregate wage movements, it is worth noting that with positive productivity growth the average wage will normally rise over time. In such circumstances, unchanged nominal wages will enable a decline in the real wage up to the rate of productivity growth to occur, if one is needed. And rigidities to the downward adjustment of wages might well lessen as the public becomes accustomed to price stability.[13] It is the case, however, that the existence of even partial wage rigidities would imply a longer period of disequilibrium in response to shocks that require changes in relative wages than if wages were able to adjust more quickly. The area of price and wage rigidities is one in which the need for further research is very evident.

The forecast of future inflation and its response to shocks

The lags between actions by the central bank in adjusting its policy instrument (the overnight rate or very short-term rate of interest)[14] and the rate of inflation is on the order of one to two years in most countries. Because of these lags, the central bank must take a forward-looking approach in its decisionmaking and focus on the forecast or projected rate of inflation. Indeed, it has been argued with some justification that the forecast rate of inflation (and its relationship to the target band) should be thought of as an intermediate target by countries that have set explicit inflation or price level targets as their ultimate goal.[15]

How does the central bank decide on the instrument settings needed to achieve its price stability goal? The typical decision process in countries with an explicit inflation or price level target has three parts: a forecast or projection of the rate of inflation one to two years out, which is modified in response to shocks to the economy; views on the linkages or transmission mechanism between the adjustment in the policy instrument and the rate of inflation, which determine the size of policy action needed in response to a change in the forecast rate of inflation;[16] and a

mechanism for communicating the views of the authorities regarding the reasons for the policy actions. These three elements are the subject of this section and subsequent sections.

Broadly speaking, because of the lags between the policy instrument and the rate of inflation, the response of the monetary authorities to shocks to the economic system depends on the assessment of the effects of such shocks on the projected rate of inflation one to two years out. This requires a judgment as to whether the shock is a demand shock or a supply shock and whether it is persistent or temporary.[17] Moreover, the appropriate response to the shock may depend in part on the degree of credibility of the monetary authorities. This is particularly the case when there is some uncertainty about the nature or duration of the shock, since the room for maneuver for the authorities in such a case (that is, their ability to react less strongly than would otherwise be appropriate until more information becomes available on the nature of the shock) will depend on their credibility. The pre-announced response to contingencies may also be an important factor in determining the action required in response to certain kinds of shocks.

Temporary demand shock

If a demand shock (whether positive or negative) is expected by the authorities to be temporary, its effect on forecast inflation will depend on how the expected rate of inflation changes as the current rate of inflation changes. In circumstances in which monetary policy is lacking in credibility, expected inflation will likely respond strongly to movements in actual inflation and, consequently, even a temporary change in the pressure of aggregate demand would lead to a change in forecast inflation. To bring the forecast rate of inflation back to the target in such a case would therefore require an adjustment in the policy instrument, with interest rates rising in the face of a positive demand shock and declining in the face of a negative demand shock.

If a past history of achieving its target rate of inflation or maintaining price stability had resulted in full credibility for the monetary

authorities, expected inflation would be closely linked to the target rate of inflation and would not be much affected by a temporary rise in the actual rate of inflation. Thus, a credible central bank could respond less strongly to a demand shock than one with less credibility, as long as the shock was clearly temporary. The credibility of the authorities thus gives them "room for maneuver," in the sense that they do not have to react as strongly to what appear to be temporary demand shocks.

Persistent demand shock

If a demand shock is viewed as persistent, it will lead to a change in forecast inflation and require a change in the setting of the policy instrument. While a central bank with credibility could take less strong action for a period, relying upon the fact that expected inflation would not immediately follow actual inflation, this would be a very risky strategy. Although the change in demand pressures would initially result in only a moderate change in actual inflation for a limited period following the shock, as the new level of inflation persisted it would begin to affect expected inflation, and the credibility of the authorities would decline in the face of a period of higher or lower inflation than had been targeted.

More formally, one can think of a situation in which monetary policy has very different levels of credibility as reflected in the following type of Phillips-curve relationship (expressed in terms of prices rather than wages).

$$\pi = \pi^e + b\,(y - y^*)$$

$$\pi^e = \pi^T, \text{ full credibility}$$

$$\pi^e = A(L)\pi, \text{ no credibility}$$

Here π, π^e and π^T are actual, expected and target inflation, y and y^* are the logarithms of output and capacity output, and $A(L)$ is a polynomial lag function indicating that expected inflation is tied to

current and past rates of inflation.[18] While the equations specify the relationships with full credibility and no credibility, there are also intermediate outcomes with partial credibility, in which expected inflation is linked to a combination of target inflation and past rates of inflation.[19]

With full credibility, the price-output relationship resembles the 1960s-style Phillips curve, with expectations anchored by the target. However, any attempt to exploit the relationship by persistently running output above capacity would lead to a weakening of the linkage between expected inflation and target inflation and to re-establishment of the link between expected inflation and actual inflation that prevailed through the inflationary period of the 1970s and 1980s. In short, while credibility gives the central bank room for maneuver in response to temporary demand shifts, it would crumble if it were used to avoid taking the necessary action to offset a persistent demand shock. In the latter case, action should be taken as quickly as possible in order to avoid inflation moving away from the target for a significant time period and hence leading to entrenched expectations of a rate of inflation inconsistent with the target of price stability.

In this context, I would note that the view that focusing on inflation and price stability makes central banks insensitive to changes in economic activity and unemployment is simply incorrect. In fact, having a target range for price stability with both upper and lower bands results in a monetary policy with stabilizing properties with respect to output in response to unexpected persistent movements of aggregate demand.

Consider a situation in which the measured rate of inflation is within the target band[20] and aggregate demand increases to a level greater than the capacity of the economy to produce goods and services. The rate of inflation will begin to rise toward the upper end of the band. To offset these pressures, the monetary authorities will tighten monetary conditions and hence will provide offsetting restraint to the demand pressures. Conversely, if the measured rate of inflation is initially within the band and demand weakens, there

will be downward pressure on the trend rate of inflation and it will move toward the bottom of the band. The monetary authorities will act to ease monetary conditions, thereby providing stimulus to the economy. Thus, by responding to the implications for trend inflation of aggregate demand shocks, monetary policy acts in a countercyclical manner and provides an offsetting influence to these shocks.

The Taylor rule,[21] which links the short-term real interest rate to the rate of inflation relative to its target and the level of output relative to capacity, is often interpreted as one in which the monetary authority has two objectives—inflation at its target rate and output at capacity. However, it can equally well be interpreted as reflecting a situation in which the authorities have as their objective a target rate of inflation, with the forecast rate of inflation as an intermediate target and the current level of aggregate demand relative to capacity as the key indicator of movements in forecast inflation. Of course, a more sophisticated forecast of future inflation would be based on many factors in addition to current inflation and the current level of aggregate demand relative to capacity. Most notably, it would include past movements of monetary conditions which have not yet had their full effect on aggregate demand because of lags in response,[22] known or expected exogenous shocks to demand, such as changes in external demand from developments in the economies of the country's trading partners, anticipated fiscal policy measures, and so forth. Nonetheless, one can treat the implicit forecast in the Taylor rule as a simple way of responding to future inflation pressures.

Supply shocks and other price level shocks

Depending on how the policy framework is structured, there can be a variety of responses to supply shocks. At one end of the spectrum, if the target is based on the overall CPI and is aimed at achieving a price level rather than a rate of increase of prices, a supply shock feeding into prices would have to be completely reversed over time. At the other end of the spectrum, if the policy framework focuses on the rate of increase in prices and does not seek to reverse the once-and-for-all price level adjustments to supply

shocks, the emphasis of policy would be on avoiding a feed-through from the price level shock to the ongoing rate of inflation. Such an approach would permit drift in the price level but not in the rate of inflation. It could be facilitated by focusing on an operational definition of inflation that removed the effects of certain types of supply shocks, by explicit assertions by the authorities regarding their responses to certain contingencies, or by some combination of the two. I focus on the latter since it is the approach used in Canada and elements of the strategy appear in the framework used by most of the central banks with an explicit target for inflation control.

Consider a change in a sales tax or value added tax (VAT). The focus in Canada for operational purposes on a target that excludes indirect tax changes (more precisely, the CPI excluding food, energy, and the effect of indirect taxes) gives a clear indication that monetary policy will not aim at reversing the first round or price level effects of a sales tax change.[23] However, both implicitly, by focusing on this measure for operational purposes, and explicitly, in statements about the policy response to such a tax change, the Bank of Canada has made it clear that it will react to any effect of the tax change on the ongoing rate of inflation.

The implication of this approach on the need to adjust the monetary policy instrument will depend on the reaction of the public to the tax change. Consider an increase in taxes. At one extreme, the public is able to distinguish between changes in the level of prices and changes in the ongoing rate of inflation,[24] and there would be no need for tightening actions by the central bank. At the other extreme, if the price effect of the sales tax increase fed directly into the expected rate of inflation (that is, the public was unable to distinguish between once-and-for-all level changes and ongoing inflation pressures, or the public expected the central bank to accommodate whatever inflation pressures result from the tax changes, as was done in some past episodes of tax changes), considerable tightening of monetary conditions might be needed to bring about sufficient slack in the economy to offset the inflation pressures from the tax increase. The greater the credibility of the authorities and the more closely expected inflation is linked to the target rather than to

past rates of inflation, the more likely that the reaction to the sales tax change will approach the first case rather than the second. While credibility is being built up, however, the most likely outcome is an intermediate one, in which the tax increase results in some rise in expectations of future inflation but less than would be typical for the same year-over-year advance in prices resulting from an aggregate demand shock. Thus, some tightening would be needed but less than in the second case.

Because it follows an explicit announcement, a tax change is the kind of shock that can be interpreted most easily as a change in price level rather than a change in ongoing inflation. However, a similar approach can be taken to certain supply shocks. For example, food and energy price movements tend to be more volatile than the price movements of the rest of the consumer basket of goods and services. Removing them from the measure of inflation that is treated as the focus of policy for operational purposes (the CPI excluding food, energy, and the effect of indirect taxes) lessens the likelihood that sharp and volatile movements in these components would influence inflation expectations. At the same time, since the target rate of increase of the operational definition of inflation would be adjusted to take into account any longer-term trend difference between food and energy prices and the rest of the CPI, the integrity of the approach is maintained and the importance of the overall CPI as the key variable in the system is reinforced.[25] In fact, over the last fifteen years, this has not been a problem in Canada since the trend of food and energy prices has been similar to that of the rest of the basket.

Another important type of shock that could have significant effects on inflation is a currency depreciation. The cause of a depreciation, in particular whether it is a real depreciation associated with economic weakness or a nominal depreciation associated with inflationary pressures, is a crucial element in determining whether a change in currency value will lead to an increase in the price level or is part of pressures on the ongoing rate of inflation. Hence, the cause of the depreciation will determine the nature of the monetary actions needed in response to it.

Examples might be helpful in illustrating this distinction. In a number of countries (including Canada) there was a sharp downward movement in the real value of the currency in the early 1990s, at a time of considerable slack in the economy. Indeed, in many of these countries, a major element in the decline in the value of the currency was the economic slack,[26] with the financial markets leading a successful speculative attack on currency parities in the expectation that they could not be held in the economic circumstances. In the event, the combined effect of the depreciation and the slack in the economy was a temporary rise in the rate of inflation, but one which was appreciably less than anticipated by most observers based on past episodes of currency depreciation. Furthermore, the increase in the price level directly resulting from the real depreciation did not feed into a rise into expected inflation, in large part because of the offsetting effect of the slack in the economy.[27]

In contrast, persistent domestic inflation pressures, which involve continuing upward movements in domestic prices and wages, will cause similar upward movements in the prices of tradable goods and services through downward pressure on the nominal external value of the currency. In these circumstances, the real value of the currency remains more or less unchanged. Such currency movements are a normal consequence of the inflation process, and not simply a once-and-for-all movement in the price level.

A final type of price level shock in some countries involves changes in the mortgage cost component of housing when the latter is closely linked to current interest rates (for example, if interest rates on mortgages float off the current short-term rate). A common adjustment in such countries is to remove this component from the operational definition of the target. If it were not excluded, interest rate movements aimed at bringing the rate of inflation back to the target could have a perverse effect on inflation expectations. Focusing on a measure that excludes this component should have little or no long-run effect on the CPI since the effect disappears over the interest rate cycle.[28]

The use of "caveats" and wider bands to help deal with supply shocks

Thus far, I have focused on the use of an operational definition for inflation that excludes the effects of certain kinds of supply shocks as a way of minimizing the effects of such shocks on expectations of future inflation and, hence, from directly affecting the ongoing rate of inflation. A similar result can be achieved by establishing in advance that the authorities will not react to certain kinds of shocks, provided that they affect only the price level and not the momentum of inflation. These "caveats" can serve as an alternative to having an operational definition for inflation that excludes such shocks, but they may not be quite as transparent to the public. They can also complement the use of an operational definition that excludes such shocks.

Another approach to achieving the same end would be to widen the target band for inflation, especially after price stability is achieved. The typical band used by central banks in bringing down the rate of inflation has been ± 1 percentage point. In Canada, this band is well below what would be needed to include, say, 95 per cent of inflation outcomes (that is, plus or minus two standard deviations) based on empirical work with historical inflation. The reason for choosing such a narrow band was the importance for communications purposes of focusing on a path that clearly showed a downward trend during the disinflation period, even at a risk of being outside the band at times. A wider band might have left the impression, especially initially, that the authorities were not serious about reducing inflation and would simply aim at maintaining current levels of inflation.

Once price stability has been achieved, the focus changes from achieving a downward trend for inflation to maintaining price stability. While the achievement of price stability and the associated acquisition of credibility are likely to reduce the variability of inflation, the narrow band is still unlikely to include a very high proportion, say 95 percent, of outcomes.[29]

A wider band for target inflation would ensure that more of the price movements resulting from supply shocks remained within the bands. To the extent that movements outside the band have an appreciable effect on expectations, the wider band might lessen the likelihood of supply shocks significantly affecting the expected rate of inflation. Two reservations are in order, however. Such a widening of the band would probably be successful only after the central bank has established a considerable degree of credibility by bringing inflation down to very low levels and would have to be carefully explained. Otherwise, it could be interpreted as a retreat from the commitment to maintain price stability. Second, it should not be used as a way of deferring the taking of action to bring inflation back to the center of the band in response to a persistent demand shock.

How are inflation projections done in practice?

While the above, lengthy discussion of shocks is important in conceptually distinguishing among various elements feeding into the inflation process, in practice there is less clarity about the sources of inflation pressure. Thus, in projecting future rates of inflation it is important to use all relevant available information.

There are a number of approaches to forecasting inflation one to two years out—structural models, reduced-form or vector-autoregression models, surveys of expectations, judgmental forecasts, as well as any of these adjusted to take account of data coming from information variables (especially monetary aggregates and other financial data). Many countries combine a number of approaches in developing their inflation forecast. While the degree of formality of the various approaches may differ from country to country, what is interesting is the central role the forecast has come to play in those central banks with inflation targets.[30] Of course, no one takes the point estimate of such forecasts as more than a best estimate (and one that almost certainly will be revised as new information comes in).[31] Nonetheless, the forecast is the crucial starting point for the analysis of what needs to be done to keep inflation within its band over the policy horizon of one to two years. It also can be used as the basis for simulations that examine the effect on forecast inflation

as well as on other variables of alternative assumptions about the movement of exogenous variables or about the momentum of the economy. Such risk analyses can be very useful in assessing the sensitivity of the baseline forecasts to different scenarios.

In assessing the prospects for inflation, it should be clear from our earlier discussion that it is crucial to make a distinction between two types of factors that affect price developments—those that if not offset will lead to a permanent change in the rate of inflation and those that lead to transitory changes in inflation, which are expected to dissipate over time.[32] In the augmented Phillips-curve model of inflation, the fundamental factors affecting the underlying rate of inflation are the path of output relative to capacity and the expected rate of inflation.

It is because of the fundamental role of the path of output relative to capacity in determining the rate of inflation that so much attention is paid (both by the authorities and the financial markets) to information about aggregate demand, especially when an economy is operating near capacity.[33] It should be emphasized that it is not the rate of growth of demand that is crucial, but the *level* of excess demand or supply.[34] However, this emphasis on demand does not mean that the authorities have a target growth rate or target level for output. The estimate of capacity is always very uncertain and neither the level nor the rate of growth of capacity can be determined with precision. This is why there has to be continued re-assessment of the relationship of the path of excess demand or slack in the economy and the rate of inflation. And estimates of capacity (and hence slack) have to be re-calibrated from time to time in response to surprises in inflationary outcomes in either direction.

This way of interpreting inflation developments is of relevance in dealing with the assertion frequently heard in the United States that the Federal Reserve is underestimating the rate of growth of capacity output and preventing the economy from growing at its full potential by maintaining a policy stance that is too tight. If this were indeed the case, the outcome would be ever-increasing slack and a rate of inflation that was both declining over time and always coming in

lower than the projection of the authorities.[35] In such circumstances, the estimate of capacity would be adjusted and the policy stance altered in response to the incoming information.

It is also sometimes argued that the emphasis in the policy process on the forecast of inflation and the incorporation of a wide variety of real as well as nominal information in developing the forecast is risky in that it could lead to cumulative one-way errors, as in the 1960s and 1970s, with continuously accelerating or decelerating inflation. However, a crucial difference between the way policy was conducted in earlier years and the way policy is currently conducted is the more central role that the target for inflation plays in the process. Indications that the measure of excess demand or supply is incorrect, or that policy actions are not sufficient to offset the pressures of demand on inflation, lead quickly to an adjustment of the policy instrument.

There is, however, a perceptual problem in this process, in that actions to affect the path of aggregate demand may have to be taken in advance of any direct signs of inflation ("getting ahead of the curve") and policy is sometimes criticized as reacting to nonexisting problems. It is, nonetheless, precisely this early taking of action that is crucial to achieving the desired outcome.

The role of financial variables in forecasting the inflation rate

In addition to focusing on the usual variables that enter into the inflationary process, central banks use information variables or indicators as a cross-check against their structural analysis. Sometimes this is formalized through the use of vector-autoregression models and other types of analysis of information content. Thus, for example, in the case of Canada, the narrow aggregate real M1 is a good leading indicator of real output growth, while M2+, a broad aggregate, serves as an indicator of inflation over the next quarter or two. Moreover, recent work using vector error-correction models suggests that nominal M1 also has useful properties as a leading indicator of inflation over a longer time horizon.[36]

More recently there has been considerable attention paid to the possible use of nominal interest rates, especially in conjunction with the yields on indexed bonds, as a measure of market expectations of inflation.[37] These can serve as a cross-check on the central bank's own medium-term forecasts, as an indicator of the credibility of the policy framework, or as a signal of the interpretation by the market of central bank actions.

The Bank of England has taken the lead among the central banks in the development and use of such measures, in part because of the availability in the United Kingdom of indexed or real return bonds across the maturity spectrum.[38] The difference between the rate on these bonds and on conventional bonds of the same maturity gives the central bank an indication of the average rate of inflation expected over that time horizon. Transformation of the data from a yield-to-maturity basis to a series of forward real and nominal rates of interest and the use of the latter to estimate the expected rate of inflation over these future time periods give a more transparent set of data for interpretation purposes.

Even in those countries that issue indexed bonds, the interpretation of the difference between the real rate and the rate on conventional instruments as a measure of inflation expectations is far from straightforward. Differences in tax treatment and the liquidity properties of the two types of debt can affect the level of the differential, although these factors probably change only slowly. Thus, the tendency is to focus more on changes in the differential as an indicator of changes in the expected rate of inflation, and less on the level of the differential as a measure of the level of expected inflation.

There is another important factor that affects the conventional interest rate but not the rate on indexed debt and that is a risk premium for inflation uncertainty.[39] Thus, for example, an aggregate demand shock that leads to a rise in both the expected rate of inflation and increased uncertainty about the future path of inflation will lead to a rise in the differential that exceeds the change in the expected rate of inflation. And unlike the other two factors affecting

the differential, this one can change fairly quickly, making it difficult at times to interpret even the change in the differential.

For those countries without an indexed instrument, there is less scope for use of the term structure of interest rates to derive inflation expectation measures, since some assumption about the real rate (either constancy or relatively small movements) will be needed.[40] However, the empirical tendency for expected real interest rates and inflation expectations to move in opposite directions tends to balance the "noise" that movements in expected real interest rates add to inflation expectations and hence improves the ability of forward interest rates to indicate inflation expectations.[41] Moreover, the forward interest rates can be useful indicators of market expectations of future movements in the policy stance of the central bank as well as of future exchange rate movements. They can also be used to interpret the market's response to central bank actions or to "news" on the economy and inflation.[42]

The appropriate response of policy instruments to changes in forecast inflation

In the framework for inflation control that has been described above, the central bank must adjust its instrument in response to forecasts of inflation because of the lags between policy actions and inflation outcomes. The next issue to be addressed is how much the instruments should be adjusted in response to a given differential between forecast inflation and the target.

Estimating the relationship between interest rate movements and the rate of inflation

Assume that the outcome of the process of forecasting inflation and the related interpretation of leading indicators (and/or market assessments) is that the underlying trend of inflation is very likely to move away from the target and to remain there unless action is taken (for example, as a result of an aggregate demand shock). The response by the authorities would, of course, be to raise or lower the very short-term benchmark interest rate on which the central bank has most influence.

There are a number of factors that have to be taken into account in deciding on the size and timing of the movement of the interest rate instrument. While the magnitude of the links between the instrument and inflation is not known with any precision, the central bank can derive estimates of the relationships underlying this link from both structural and reduced-form models. Unfortunately, in any specific episode there is considerable uncertainty about the responses of the economic participants in virtually every link in the transmission process between the central bank action and the subsequent change in the rate of inflation.[43] That said, the monetary authorities have to take action when pressures on the rate of inflation are likely to push it away from the target in more than a transitory fashion, and that action has to be taken on the basis of the best estimates of the linkages.[44]

A path is therefore laid out for the instrument that would prevent the trend of inflation from moving away from the target or would bring it back to target if it had moved away. However, because of the degree of uncertainty surrounding the estimates of these linkages, there must be a continuous assessment of the effect of the change in the instrument on the various elements in the transmission process and on other variables that can yield useful information about the unfolding process. Thus, close attention is paid to the outcome (relative to the projected outcome) of a wide variety of variables in response to the change in the path of the instrument. Outcomes that differ from projection may be indicating that additional shocks have taken place, or that the initial shock was misinterpreted, or that the strength or timing of the linkages from the instrument to the other variables is different from what was expected. Depending on the interpretation, there may or may not be need for further changes in the path of the instrument variable. This process of continuously responding to the interpretation and re-interpretation of economic and financial developments by adjusting the instrument has been termed a process of "successive approximation."

In assessing the effect of the change in the benchmark interest rate on aggregate demand and inflation, it is important to take into

account movements in both market interest rates and the exchange rate. When taking policy actions, central banks do not know the extent to which the effects of their actions will fall on interest rates and the extent to which they will fall on the exchange rate. It is the combined effect of central bank actions on the two variables (termed monetary conditions and encapsulated in a monetary conditions index at the Bank of Canada and in some other central banks)[45] that is crucial for the effect of the policy actions on aggregate demand and inflation.

Thus, for example, while a decline in aggregate demand may clearly necessitate an easing in monetary conditions because of its implications for the future path of inflation, that easing can occur through a decline in interest rates, a depreciation of the currency, or some combination of the two.[46] And it is the markets, rather than the monetary authorities, that determine the "split" of a given change in monetary conditions between the interest rate component and the exchange rate component in the short run. Of course, the relative importance of exchange rate movements and interest rate movements in affecting aggregate demand will differ across countries. In Canada, for example, empirical work suggests that a 3 percent real depreciation has about the same long-run effect on aggregate demand as a one-percentage-point decline in real short-term interest rates. For less open economies, the exchange rate change that corresponds to a one-percentage-point change in interest rates would be considerably larger. Nonetheless, given the potentially large movements in exchange rates that have taken place in recent years, attention to the aggregate demand effects of exchange rate changes is appropriate even for large, less open economies.

The discussion thus far has focused on a change in the desired path of monetary conditions in response to an economic shock.[47] In other circumstances desired monetary conditions may remain unchanged, but actual monetary conditions may change and hence require action by the authorities. Consider, for example, a situation in which the exchange rate appreciates for reasons unrelated to economic developments (for example, confidence in the currency rises in response to a political development). This results in a tightening in monetary

conditions, and the appropriate policy response is to reduce the very short-term interest rate so as to bring about a decline in money-market rates. This adjustment is termed a "rebalancing" of monetary conditions.

In sum, central bank actions have to be taken on the basis of projections of inflation, which are based on the interpretation of current and expected movements of aggregate demand and other factors, as well as estimates of the links from policy actions to aggregate demand and from aggregate demand to inflation. While the projections and estimates will at times be incorrect, response to the evolving outcomes and to new information ensures that, at a minimum, the process will not result in cumulative or persistent one-way errors.

How quickly should inflation be brought back to the target if it moves away?

An important operational question is the speed with which the inflation rate should be brought back to the target if it moved away from it following a shock that the authorities were not able completely to offset. The answer to this question may involve a tradeoff between the volatility engendered by a very rapid return to the target, and the damage to credibility if inflation remains away from the target for a period of time, particularly if it remains outside the target band.

Consider, for example, a situation in which an incorrect interpretation of the economic situation (say, an overestimate or underestimate of the level of capacity in the economy or a demand shock that is more persistent than expected) resulted in inflation moving away from its target. Should the authorities try to bring inflation back to the center of the band as quickly as possible or should they aim for a gradual adjustment?

An attempt to engineer a very rapid return minimizes the potential effect on credibility of being away from the target. But it can lead to variability in output and volatility in financial markets, as interest

rates and exchange rates swing around sharply to achieve the rapid return to the target.[48] A more gradual response smooths the path of output and may reduce the amplitude of fluctuations in interest rates and exchange rates. But it does risk some loss of credibility and the possibility that a higher or lower rate of inflation than the target rate might get entrenched.

The choice made in the Bank of Canada, based on empirical work regarding the implications of different speeds of return to the target, has been to aim at bringing inflation back to the center of the band over a six- to eight-quarter horizon. To try to minimize possible effects on credibility of pursuing such a policy, the Bank of Canada (1991) made this general approach explicit in the discussion of contingencies in its background statement introducing the targets. It was thus relying upon transparency and a clear understanding by the market of how it proposed to respond to certain shocks to minimize any credibility effects of the gradualist approach.

Tactical problems in achieving the desired path for monetary conditions

Another operational problem experienced at times in Canada has been the difficulty in achieving easier monetary conditions, even when economic developments and the inflation situation clearly call for such an easing. The problem arises from the interactions between markets before credibility is fully established.[49] Consider a situation in which more weakness in the economy than had been forecast indicates to the authorities that inflation is on a downward trend toward the lower end of the band, thus signaling the need for easier monetary conditions. If the markets remain concerned about the commitment of the authorities to price stability, they may interpret the easing as evidence of insufficient resolve on the part of the authorities. In these circumstances, the actions by the central bank to reduce the benchmark short-term interest rate could lead to a sharply declining currency, and, as extrapolative expectations develop in the exchange market, to rises in interest rates further out the maturity spectrum. Thus, the action by the central bank could be counterproductive in these circumstances, and hence, caution and a

measured pace of easing, as well as a full explanation by the central bank of the basis of its views, might be required.

This type of concern is especially relevant in circumstances where there are other factors that call credibility into question. In Canada, for example, concerns about the fiscal situation and the political situation interacted with a two-decade history of significant inflation to leave the monetary authorities with limited credibility in spite of a more recent record of very low inflation. This, in turn, resulted in a situation in which the attempted easing by the authorities at times led to the counterproductive outcomes just described. However, more recently, when the fiscal situation improved markedly and the political problems receded, the markets were better able to accept easing monetary actions without the same concern for negative reactions that had been exhibited earlier.

Some issues related to the achievement and maintenance of price stability

The implication of different specifications of expected inflation

As was discussed earlier, with increased credibility, expected inflation may become more closely tied to the target rate of inflation than to past inflation. It is possible, in addition, that this link is stronger when inflation is at or below its target level than when it is above the target level. A simple characterization of this set of relationships is as follows:

$$\pi = \pi^e + b(y - y^*)$$

$$\pi^e = A(L)\pi, \quad \pi > \pi^T$$

$$\pi^e = \pi^T, \qquad \pi \leq \pi^T.$$

An alternative representation might link expected inflation to current and past rates of inflation when excess demand is positive and there is upward pressure on inflation, while expected inflation

is related to the target rate of inflation when excess demand is negative and there is downward pressure on inflation. Whatever the exact specification of the model, it raises the possibility that the augmented Phillips curve holds at certain times while the older Phillips curve, without augmentation, holds at others, at least temporarily.[50]

What might cause this type of behavior, with rates of inflation below the price stability target less likely to lead to downward revisions of long-run inflation expectations than rates of inflation above the price stability target are to lead to upward revisions of expectations? Partly, it is a reflection of the history of the postwar period with its long experience of price increases but virtually none of price declines. Partly, it is based on an interpretation of the incentives facing the central bank. As formulated explicitly in the time-inconsistency models of the Barro-Gordon type, central banks may have an incentive to raise inflation above expected inflation to try to achieve extra output over the short run. There are no such incentives on the downside since a rate of inflation below expectations is associated with economic slack. Hence, there is no reason to interpret a rate of inflation below the announced target as indicative of a desire by the authorities to push inflation below the target.

What is the role in the policy framework of movements of the current rate of inflation?

As was evident in the earlier discussion, it is the effect of shocks to the forecast of inflation relative to the target for inflation that is the crucial determinant of the need for central bank action. Movements of the current rate of inflation play two roles within this policy framework.

First, movements of current inflation relative to the bands can provide a useful communications opportunity to explain central bank actions. Central to this role is the interpretation and explanation of the source of shocks, particularly whether they are likely to be transitory or more long-lasting, and their implications for the future path of inflation. If, for example, a rise in the measured rate of

inflation is associated with a shock that is likely to have only temporary effects on inflation and is so perceived by the public, only a relatively modest central bank action would be needed in response. However, if the shock leads to an increase in the momentum of inflation that is expected to persist and to affect future rates of inflation, firm action should be taken even if inflation is still within the band.

The other key role of the actual outcome of inflation is as a check both on the model being used explicitly or implicitly to forecast inflation, and on the interpretation of shocks. A sequence of over- or under-predictions of inflation would indicate either that one or more of the key relationships on which policy is based, say that between the pattern of demand and inflation, is incorrectly specified, perhaps because capacity has been incorrectly estimated, or that the forecasters had interpreted the shocks incorrectly (for example, underestimating the persistence of a demand shock) and had therefore arrived at an incorrect assessment of the effect of the shock on inflation and/or inflation expectations.[51]

How can monetary policy be eased when interest rates are close to zero?

One of the criticisms of the policy goal of achieving price stability is that it rules out using negative real interest rates to provide stimulus to the economy at a time of weakness.[52] The implication of this line of argument is that targeting a positive rate of inflation is superior to price stability because of the added flexibility the possibility of having negative real rates gives the policymaker.

An important point worth noting in the context of this argument is that the achievement of price stability is likely to lead to a lessening in the amplitude of the business cycle fluctuations, since in the postwar period deep recessions (of the sort that might call for negative real rates) have typically been preceded by periods of strong inflation pressure that resulted in significant distortions in spending behavior, which, in turn, affected the subsequent downturn. In the absence of such inflationary distortions, the downturns are likely to be much milder. Hence, there is less likelihood of the

need for a period of negative real interest rates. And the empirical work examining how the economy would have functioned if there had been no possibility of negative real interest rates indicates that there would have been only a small deterioration in overall economic performance.[53]

Moreover, while there is a floor of zero to nominal short-term rates, a near-zero nominal rate may still imply a real interest rate appreciably below its equilibrium value,[54] and hence, the interest rate channel can still be used to provide some stimulus to the economy.[55] In addition, for those who believe in more direct links between money and/or credit and spending,[56] central bank actions can be expansionary even when interest rate declines are limited because rates are close to zero. Also, in a flexible exchange rate world monetary conditions can be eased through both interest rate and exchange rate movements. Even if there is only limited easing possible via the interest rate, there can still be a depreciation of the currency at a time of economic weakness and downward pressure on the rate of inflation.[57]

Differences between targeting on monetary aggregates and targeting on inflation

While the nature of the policy process described above appears on the surface to be significantly different from that in countries using monetary aggregates as an intermediate target, I would argue that the differences are smaller than would appear on the surface. What is the role of an intermediate target? It is a variable that is closely linked with the final target of monetary policy and is affected by changes in the central bank's instrument (that is, the short-term interest rate). In the case of Germany and Switzerland today and in the case of many other countries that targeted monetary aggregates in earlier years, the final target was clearly the rate of inflation,[58] and the centrality of the monetary aggregates derived from their ability to serve as a leading indicator of inflation.[59] When this link broke down in many countries, monetary aggregates fell into disfavor as an intermediate target, although in some of these countries they were retained as information variables.

Since the value of the monetary aggregate as an intermediate target is the result of its link to inflation, it is not surprising that central banks respond to the movement in such an aggregate only when they believe that it is signaling future movements in inflation. And in circumstances where other information suggests that movements of the aggregate are not precursors of future inflation developments, even central banks targeting on the aggregates appear unwilling to adjust interest rates in response to movements in the monetary aggregate target.[60] Implicitly (or perhaps explicitly) they are making a forecast of inflation and responding to it. Put another way, even central banks targeting monetary aggregates do not adjust interest rates in an automatic or mechanical way when these aggregates grow too rapidly or too slowly. They clearly interpret the effect these movements have on future inflation in light of other information regarding financial and real side developments, such as indications of financial innovations, and so forth.

This is not to say that there are no differences between targeting inflation directly, and targeting monetary aggregates directly and inflation indirectly. The weight given to the aggregates as an indicator of inflation is clearly greater in the latter than in the former, the growth of the aggregates may have a direct effect on inflation expectations in those countries targeting on the aggregates, and there may be a different response to supply shocks.

It might also appear that decisions regarding the magnitude of policy actions are much simpler for countries that rely on monetary aggregates than for those that focus directly or indirectly on inflation. Movements of monetary aggregates above or below their targets lead to changes in short-term rates (based on the estimated relationships between changes in interest rates and changes in the monetary aggregates) designed to bring them back to their target. The approach thus seems to rely simply on the effect of interest rate changes on the monetary aggregates, and not on the entire transmission mechanism. But the perceived simplicity of this process is more apparent than real. First, as just discussed, there is typically no automaticity of reaction to movements in monetary aggregates; rather, there is an interpretation of whether the movements are

driven by demand and price movements or by financial shocks (such as innovations). Second, a continuing assessment of the usefulness of the aggregates as a leading indicator of inflation is needed. Third, especially in the case of broader aggregates, the relationship between interest rate movements and the growth of aggregates occurs in large part through the effect of the interest rate changes on output and prices, so that knowledge of the transmission process may still be needed. Fourth, judgment is needed on the speed with which the monetary aggregate is brought back to its target. Fifth, in the case of a narrow aggregate target with high interest rate elasticity the interest rate movements needed to bring the aggregates back to target may not be sufficient to rein in inflationary or disinflationary pressures.[61] It is thus not evident that any less judgment is needed or used in adjusting interest rates in countries whose policy is based on monetary aggregate targets than in those focusing on inflation or price targets.

In sum, there is less difference between targeting on monetary aggregates and inflation-control targeting than appears on the surface.

Transparency and communications

Throughout this paper, there have been a large number of references to credibility, and to the implications of a greater or lesser degree of credibility on the actions that a central bank would have to take to achieve its target for inflation or price stability. In particular, the relevance of credibility was noted in the ability of the central bank to respond to demand shocks somewhat less quickly in circumstances when it is not sure whether they are temporary or persistent (the room for maneuver argument), the ability not to respond to supply shocks that have an effect only on the price level, the ability to bring inflation back to its target gradually when it has strayed from its target, and the ability to take easing action without creating doubts about the commitment of the authorities to the price stability target.

Given the significant benefits of credibility, how can the central bank improve its credibility and what can it do to lessen the negative effects of a lack of complete credibility? The only certain way of

achieving credibility is a long period of success in maintaining a very low rate of inflation. And, as has often been noted, credibility is fragile and can be weakened by an apparent reversal of the commitment to the policy goal of low inflation or price stability. That said, there are certain things that can be done to enhance credibility, some by the central bank, others by authorities outside the central bank.

Fiscal problems can result in a concern by markets about the potential for monetization of the debt, lessening the credibility of the monetary authorities and resulting in a higher expected rate of inflation and a higher inflation uncertainty premium. Indeed, with serious fiscal problems there is the potential for a vicious circle, in which increases in international interest rates are expected to lead to increases in domestic rates, which, in turn, would cause a deterioration of the fiscal situation.[62] With the resulting rise in risk premiums, domestic interest rates could well rise more than international rates, even through domestic economic and inflation conditions do not warrant tighter monetary conditions.[63] Thus, in countries with serious fiscal problems, the credibility of the monetary authorities can be enhanced by an improvement by the government of its deficit and/or debt position. Similarly, political or constitutional difficulties (for example, weak governments unable to take needed fiscal action, or concerns about the future breakup of a country) can result in higher risk premia and a greater concern that inflation will be used to try to extricate a country from its debt burden, and they can therefore exacerbate a situation in which the monetary authorities are lacking in credibility. Any lessening of these difficulties might therefore lead to an improvement in the credibility of the monetary authorities.

Changes in institutional arrangements that clarify the mandate of the central bank and/or increase its independence can be of considerable assistance in building up credibility (and reducing risk premia). New Zealand has been a leader in this respect, with the central bank receiving both a clear mandate to achieve price stability (the definition of which is determined in an agreement between the Governor and the Minister of Finance) and the instrument inde-

pendence to achieve that goal. In formal terms, these institutional changes can be seen as one way in which central banks can pre-commit to the achievement of price stability and can be sheltered from any political pressure on their day-to-day operating tactics to achieve that goal.

One important way in which the central bank can itself take the initiative to increase credibility or at least to mitigate the potentially negative effects of an absence of credibility is by increasing transparency of its objectives and actions.[64] By being clearer and more explicit about its goals, methods of operations, and interpretation of economic developments, the central bank can increase the understanding by the market and the public of its objectives and its tactical actions, and reduce the likelihood of an unfavorable response to its actions. Transparency can thus be thought of as a bridge to credibility, where the latter is not yet built up, or as a support to credibility where it already exists.

There are a number of aspects of transparency that need to be addressed. Consider, first, transparency about the objective of price stability. This can help longer-term savers and investors plan their behavior on the basis of the commitment by the central bank to stable prices in the long run.[65] Clear explanations by the central bank of the benefits of price stability will also help build public support for the objective. In addition, it is essential to have a clear statement of objectives if one expects markets to understand the policy actions being taken.

While a publicly-announced longer-term objective of price stability (or very low inflation) is the centerpiece of the policy strategy, it can be very useful to make the policy objective more concrete. This is the role of the targets for inflation or for the growth rate of monetary aggregates, particularly on the way to price stability. The central bank can then build up credibility by achieving its announced targets. It is also helpful to maintain a band for price changes even when price stability is achieved, both to maintain the accountability of the central bank, and to give some indication of the types of inflation outcomes that are most likely to lead the central bank to

take action. In this context, it is worth repeating that a discussion in advance of how the central bank will react to various contingencies will have the benefit of helping the public and markets to understand the thinking of the central bank, and will reduce the likelihood of a misinterpretation of the actions of the central bank (or lack of action) when one of the contingencies occurs. For example, as discussed earlier, an assertion in advance that the central bank would accommodate the first round or price level effects of a rise in a sales taxes or VAT but not the second round effects, or wage-price spiral, would forewarn the market and public that there would be one year in which growth in the overall CPI would rise above the target (although other measures such as the CPI less food, energy and indirect taxes would be largely unaffected by the tax change), while policy action would be taken if the initial price effect fed into a wage-price spiral.

Transparency with respect to the views of the monetary authorities regarding the transmission mechanism and the economic situation is likely to result in the market having a better understanding of the tactics which the central bank is using and why it is taking action to change the benchmark rate of interest. Indeed, in cases where markets are in full agreement with the central bank's interpretation of economic and inflation developments and in which they understand the tactics being employed, money market rates are likely to move in advance of the adjustment of the benchmark rate on which the central bank operates, as the markets correctly anticipate action by the authorities. For example, the release of surprisingly weak inflation or output data indicates that future inflation would likely be lower than previously anticipated, that an easing of monetary conditions would be appropriate, and that a decline in the benchmark rate is likely to be forthcoming. In these circumstances, one would expect to see in response to the newly released data, a decline in money market interest rates and possibly in interest rates further out the maturity spectrum, as well perhaps as some depreciation of the currency, as markets act in anticipation of a decline in the benchmark rate. This type of response facilitates policy actions by signaling that the market agrees with the central bank interpretation of economic developments and the need for some easing to achieve the targets (without loss of credibility).

Recently, many central banks have issued periodic reports on inflation or on monetary policy to explain their actions in the recent past and to indicate some of the factors likely to play a role in their future actions. Speeches by senior officials and testimony in Congress or Parliament can also play an important role in this regard, although a situation in which different officials provide differing interpretations of economic developments may be confusing to the markets.

In Canada, in addition to the above measures, there have recently been a number of changes in operating tactics aimed at helping markets to understand central bank tactics and actions. These include: the use of a narrow band for the benchmark 1-day rate to signal the range desired by the central bank for this rate;[66] the linking of bank rate to the top of the band for the 1-day rate rather than to the 91-day treasury bill rate in order to lessen the confusion arising from two sometimes conflicting signals of the policy stance of the bank; and the issue of a press release when the band and bank rate are changed, explaining the reasons for the change. The outcome, in my view, has been a much better understanding by the markets of the central bank actions, a more favorable backdrop against which to take action, and less likelihood of an unfavorable reaction by the market to a change since it is less likely to be a surprise to them.

In sum, transparency and more open communications can be very helpful in building up credibility and in obtaining the desired outcome from policy actions. In the end, however, it is the achievement of price stability or the pre-announced desired path for inflation that will be the key to the development of credibility.

Author's Note: I am indebted to a number of my colleagues at the Bank of Canada for comments and criticisms of earlier drafts of this paper. Any remaining errors are, of course, my own responsibility.

Endnotes

[1]See Leiderman and Svensson (1995) or Haldane (1995a) for discussions of inflation targeting and the experience of a number of countries that have adopted inflation targets as the goal of policy. For a discussion of the Canadian experience, see Freedman (1995a).

[2]For a comparison of the implications of the two concepts, see Fillion and Tetlow (1994) and Haldane and Salmon (1995).

[3]Alchian and Klein (1973), Goodhart (1995).

[4]Asset prices should, however, be treated as an important information variable, because of their reflection of market expectations of future economic developments and their direct effect on future aggregate demand (for example, the possible effect of a stock market boom on housing and durables purchases).

[5]Whether the authorities choose to use the ordinary CPI or some other measure such as the trimmed mean will depend both on the properties of the latter and the ability to explain its movements to the public.

[6]See, for example, Gordon (1993), Crawford (1993), and Yates (1995).

[7]The Bureau of Labor Statistics estimate of bias for the U.S. CPI is 0.6 percentage points. For a different view, see the report by the Boskin committee (1995). The bias in the CPI in the United States may be higher than that in many other countries because of the formula bias in the U.S. measure.

[8]Note that these two arguments are mutually inconsistent, with the former focusing on the effects on the economy of declining prices and wages, and the latter focusing on the possibility that the economy will be unable to generate declines in prices and wages.

[9]The recent Japanese experience with mildly declining prices was associated with considerable weakness in the economy but not a serious depression.

[10]If the target were based on a price level rather than a rate of inflation, this argument would be even stronger since a period of declining prices would be expected to be followed by a period of rising prices.

[11]See also Yates (1995).

[12]See also McLaughlin (1994). For contrary views, see Akerlof, Dickens, and Perry (1996) and Fortin (1996).

[13]In Canada, there is fragmentary evidence of some increase in the relative importance of variable pay schemes (bonuses, and so forth) as opposed to increases in base wage rates. If sustained, this development would be a practical example of institutional changes toward greater wage flexibility.

[14]For ease of exposition, throughout this paper I refer to the very short-term rate of interest as either the instrument of monetary policy (rather than as the operational target of policy, a more accurate term in many countries) or as the benchmark rate of interest. In fact, the actual

instrument in many countries is the change in the central bank balance sheet that results in the change in the very short-term rate of interest.

[15]Svensson (1996).

[16]If the inflation outcome differs from that which had been projected, there might have to be modifications in the model of the economy underlying the forecast or in the linkages presumed to hold between interest rates and the rate of inflation.

[17]I use the term persistent (or long-lasting) rather than permanent because very few shocks are truly permanent, and the effects for policy purposes are similar whether the shock lasts, say, three years or a much longer time.

[18]In this simplified model, the only source of lags comes from expectations. More complex models would allow for other sources of lags and dynamics, for example, contracts lasting more than one time period.

[19]In rational or partly rational expectations models, expected inflation will be linked entirely or in part to the model forecast of future inflation.

[20]The band may be centered on a zero rate of inflation or on a non-zero rate of inflation.

[21]See Taylor (1993).

[22]These can be thought of as past easing or tightening still "in the pipeline."

[23]In the explanation of how monetary policy would operate on the path to price stability, it was indicated that a series of tax changes would be treated differently from an occasional change, with the former necessitating an offsetting change in the trend rate of growth of core inflation (CPI excluding food, energy, and the effect of indirect taxes) so that the trend in the overall CPI would not be affected by the continuing series of tax changes. A similar distinction is made between transitory and trend differences between core inflation and food and energy price inflation. Whether these provisos should carry over to a world in which price stability has been achieved would depend on the credibility of the price stability target and whether inflation expectations would adjust to higher measured inflation caused by a series of tax or food and energy price changes.

[24]Their ability to make this distinction may be assisted by the treatment of taxes in the definition of inflation for operational purposes and by a communications exercise that indicates that the central bank will accommodate the first-round effects on the price level of the sales tax change but not any second-round effects leading to a wage-price spiral.

[25]Thus, for example, if the overall CPI target growth were 1 percent, food and energy prices had a trend growth of 3 percent, and food and energy comprised 20 percent of the CPI basket, the operational target of CPI excluding food and energy would have to be set at 0.5 percent.

[26]Another factor in many cases was an overvaluation of the currency.

[27]Indeed, many importers were not able to pass through all of the direct effect of the depreciation to their customers.

[28]A change in real interest rates can have a lasting effect on the mortgage cost component of

housing, but this would be a once-and-for-all change in the price level, not an ongoing effect on the rate of inflation.

[29]See Crawford and Kasumovich (1996) on inflation variability in Canada.

[30]Haldane (1995b), Duguay and Poloz (1994), Longworth and Freedman (1995).

[31]And the Bank of England even publishes confidence bands around its inflation forecast.

[32]The distinction between the fundamental factors and the transitory factors affecting inflation is an organizing principle in the semi-annual *Monetary Policy Report* issued by the Bank of Canada.

[33]Recent developments in the United States attest to this observation.

[34]In some models both factors play a role, although the level of excess demand is more important than its rate of growth. The term "speed limit effect" is sometimes applied to the effect of the rate of growth of output on inflation.

[35]This argument would not carry over to an environment in which price inflation was rigid in the downward direction and the inflation rate was near zero.

[36]See Armour and others (1996). All these relationships can be thought of either as causal or as simple empirical regularities without a theoretic explanation.

[37]Breedon (1995), Svensson (1993, 1994), Côté, Jacob, Nelmes, and Whittingham (1996).

[38]In other countries indexed debt is issued only at a small number of maturities. Only in the United Kingdom is there sufficient breadth of issues to permit estimates of expected inflation over various future time periods.

[39]It is thus not surprising that in Canada survey results of expected inflation are consistently lower than estimates from the differences between interest rates on conventional debt and on indexed debt. Similarly, in the United Kingdom, this measure of inflation expectations consistently overpredicts inflation outcomes.

[40]See, for example, Ireland (1996).

[41]Söderlind (1995).

[42]Svensson (1993).

[43]Thiessen (1995).

[44]See Brainard (1967) on the effect of uncertainty on the size of the action that the authorities should take.

[45]As noted in Freedman (1994), the monetary conditions index concept is most useful in the period between formal projection exercises. Moreover, while the real monetary conditions index (based on the real interest rate and the real value of the currency) is the theoretically appropriate construct, much more use is made of the nominal index because of the practical difficulties of constructing the real index in the short run.

[46]Of course, whether the easing occurs through an interest rate decline or through a currency depreciation will have implications for the component of aggregate demand that will be affected, as well as the time path for the rate of inflation.

[47]Certain kinds of shocks affect both desired monetary conditions and actual monetary conditions. Thus, for example, a terms of trade improvement would require a tightening in desired monetary conditions because it is expansionary, but also typically results in tighter actual monetary conditions since it leads to an appreciation of the exchange rate. For more details, see Freedman (1995b).

[48]There is even the possibility of instrument instability in certain cases. See, for example, Holbrook (1972).

[49]Zelmer (1996).

[50]If inflation persistently remains below the target, eventually expectations would begin to adjust to actual inflation and the rigid link between expected inflation and target inflation would break down.

[51]See Longworth and Freedman (1995).

[52]Summers (1991).

[53]Fuhrer and Madigan (1994).

[54]It is worth noting that the equilibrium real interest rate has probably increased in response to the elimination of restrictions in financial markets.

[55]Of course, in a period of deflation, the floor to real interest rates would not be zero but would equal the rate of deflation. This reinforces the importance of avoiding periods of ongoing deflation.

[56]See, for example, Gertler and Gilchrist (1993) for a discussion of the role of the credit channel in the transmission mechanism.

[57]Of course, in circumstances where governments are not overly constrained by their debt position, an easing in fiscal policy can also help provide stimulus to the economy.

[58]Of course, the really ultimate target is improvement in the standard of living in the country, and price stability is the means whereby monetary policy contributes to that ultimate goal.

[59]This property may derive from a causal relationship or simply reflect an empirical regularity.

[60]This is analogous to the Poole (1970) analysis of financial shocks versus real shocks.

[61]Thiessen (1983).

[62]This effect is strongest when the debt outstanding is concentrated in shorter-term issues.

[63]Conversely, at times of falling international interest rates, the potential improvement in the fiscal situation could lead to a greater decline in domestic rates than in international rates.

[64]Thiessen (1995), Blinder (1996).

[65]Support by the government for the announced goal can also be helpful in convincing the public that the objective is more likely to be met.

[66]In the future (after the introduction of a large-value payment system) the central bank will also signal its preferred position within the band for the 1-day rate.

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