Monetary Policy and Uncertainty

Remarks by David Longworth
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Good evening, ladies and gentlemen. As a member of CABE and the Ottawa Economics Association, and as a frequent presenter at TABE, I am very pleased to speak to this audience of business economists, here at the Summer Outlook Policy Forum. Tonight, I want to talk about monetary policy and uncertainty.

If we could be certain that we had the true model of the world economy, complete with the right parameters and measurements, then being a macroeconomist would be extremely dull indeed. But it is impossible to have such a model, and that makes the work of macroeconomists—and central bank policy-makers—a lot more interesting.

Central bankers can be certain of one thing—we will always have uncertainty to deal with. Some of this uncertainty can be created, unwittingly, by central banks themselves. But there are two key strategies that can be followed to help mitigate this uncertainty for the public and, in turn, to reduce uncertainty for the central bank about how the public will respond to economic developments. First, a central bank should establish a clear policy objective. Second, it should operate within a transparent framework for meeting that objective.

The Bank of Canada's policy objective became clearer with the adoption of inflation targets in February 1991. Since then, the Bank has become increasingly transparent, both in its operating framework and in its communications.[1] This has reduced the private sector's uncertainty about how the Bank will respond to economic developments. Importantly, it has also tended to moderate the variability of inflation and of other economic and financial variables, notably interest rates.[2]

But there are other more general types of uncertainty that we always have to deal with when conducting monetary policy. Let me give you some examples. We cannot be sure that the data we look at give us a true and complete picture of the economy. Nor can we be sure precisely how our monetary policy actions affect the economy, or exactly how long it takes for those actions to have their impact. And we can never be sure what the state of the world economy—and thus of the Canadian economy—will be in the future, when today's monetary policy actions will have their full effect.

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Economists at central banks and elsewhere have developed strategies to deal with these more general types of uncertainty that we face. This evening, I plan to touch on two areas of uncertainty, drawing on the relevant theoretical literature and on current examples from Canada.[3] First, I will discuss data and measure-

* The speech has been slightly abridged for purposes of publication.

1. See Jenkins (2001).

2. See Longworth (2002).

3. More thorough reviews of the types of uncertainty facing policy-makers can be found in Jenkins and Longworth (2002) and Sellon (2003).

ment uncertainty, particularly as it applies to the output gap. Then, I will talk about model and parameter uncertainty; that is, uncertainty about which economic variables can best explain movements in other variables, and about the size of the effect that one variable has on another. In doing so, I will look at the effects of movements in both world oil prices and the exchange rate for the Canadian dollar on Canadian inflation and foreign trade. Finally, I will close with a brief review of the Bank's base-case outlook for the economy.

Data and Measurement Uncertainty

Let me start with data and measurement uncertainty. This refers to the possibility that economic variables are being measured in a fundamentally incorrect way, or that the data are subject to error or revision.

Theory tells us that if we had the correct model, in which monetary actions were determined by a complex, "optimal" policy rule, then data and measurement uncertainty that is random in nature would have no implications for monetary policy. But we can't be sure that mismeasurement occurs randomly. And since models used by central banks generally incorporate simple rules for setting interest rates, based on a relatively small number of variables, those rules should typically place less weight on economic concepts or variables that are more prone to data uncertainty.[4]

To illustrate this point, let's look at the output gap. This is the difference between actual output—what the economy is producing—and potential output—what it could produce without triggering inflationary pressures. The output gap is an extremely important concept for an inflation-targeting central bank. When economies start to operate above capacity, inflation pressures can build. And when economies operate below capacity, disinflationary pressures can set in.

But the output gap is not a variable that can be measured simply or directly, because potential output is not directly observable. So, to cope with this uncertainty, it is helpful to look at several different—but relevant—indicators when assessing the size of the output gap.[5] In weighing these, we should follow the principle that I just mentioned by putting less weight on indicators with higher levels of uncertainty.

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The Bank's primary measure of the output gap—the "conventional measure" that we refer to in our *Monetary Policy Reports* and *Updates*—uses a multivariate filter. To help mitigate the uncertainty associated with this key variable, we use a wide range of other indicators to come to a consensus about the likely size of the output gap. One key indicator is the performance of core inflation relative to projections. If core inflation is persistently surprising us by coming in above or below our projections—especially in the absence of identifiable special factors—this can lead us to adjust our view of the size of the output gap.

We provide an updated list of these other indicators on our Web site, under the heading "Indicators of Capacity and Inflation Pressures for Canada."[6] They include: Statistics Canada's measure of capacity utilization in the non-farm goods sector; the ratio of unfilled orders to shipments in manufacturing (excluding aerospace products and parts); labour market conditions, such as unemployment rates, participation rates, and hours worked;[7] measures of labour shortages (especially skilled labour); and the responses of firms to our *Business Outlook Survey*.[8] Our analysis has shown one question in this survey to be particularly useful in assessing capacity pressures, and that is the proportion of companies reporting that they would have difficulty meeting an unexpected surge in demand.[9]

Currently, the Bank's conventional measure says that the output gap narrowed during the first half of 2004, shrinking to less than 0.5 per cent of GDP at mid-year.

4. See Swanson (2004) and Svensson and Woodford (2003).

5. The approach of focusing on the change in the output gap rather than the level of the output gap is unlikely to be appropriate, for reasons laid out in Longworth (2003).

6. http://www.bankofcanada.ca/en/indinf.htm

7. Because it is difficult to directly measure the degree of tightness in labour markets, we look at how these variables are performing relative to our estimates of their trend level.

8. See Martin (2004).

9. See Martin and Papile (2004).

Given this low number, and the uncertainty surrounding this measure, the Bank has been particularly interested in the messages coming from other indicators of the output gap. As we said in our July *Update*, indicators in the goods market are suggesting greater pressure on capacity than the conventional measure, while labour market indicators are pointing to less pressure on capacity. So, although a fairly wide band of uncertainty continues to surround our conventional estimate of the output gap, these other indicators lead us to believe that the conventional measure is providing a more or less balanced assessment of the size of the output gap at this time.

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Let me make two more brief comments about data. First, data revisions are an important source of uncertainty. Indeed, with the exceptions of the CPI and the labour force reports, nearly all of the economic data that we look at are subject to revision. And these revisions can be substantial. For example, export and import data have undergone particularly large revisions in recent years. This makes the Bank cautious about putting too much emphasis on the most recent data point. The second comment is that even if data are not revised, they can still be volatile. The consumer price index is a case in point. Here, we temper the uncertainty that stems from volatility by focusing on core inflation, which strips out the eight most volatile elements of the index. The more volatile a series has been historically, the less weight one should put on the most recent observation when assessing future trends. There is often uncertainty about the duration of a shock, but in the case of a volatile series it is best to start with the assumption that surprise movements do not signal the beginning of a trend.

Model and Parameter Uncertainty

Let me now turn to model and parameter uncertainty. As I said at the beginning, nobody has the true model of the economy. In particular, we don't know all the significant factors that explain the behaviour of any one economic variable. And even in those cases where we are fairly sure of the relevant explanatory variables, there is uncertainty about the parameters in the relationship; that is, about the size of the effect that one variable has on the other.

Economists have developed certain theoretical techniques to deal with model and parameter uncertainty. For example, one basic strategy the Bank uses to alleviate model uncertainty is to have the staff look at a variety of models and approaches in developing policy advice.[10] However, some techniques that reduce model and parameter uncertainty are very difficult to use in practice, except in the smallest of models—and our models are typically not small. One important practical way for central bankers to deal with these kinds of uncertainty is to test how sensitive policy recommendations are to the assumptions about the particular model of the economy and the size of the parameters in that model. In doing this, it is important to have updated estimates of the parameters as well as updated analysis of the various factors at play, since both of these can vary through time with structural changes in the economy, including those resulting from changes in the monetary policy framework.

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To make these concepts more concrete, let me discuss some aspects of model and parameter uncertainty in the context of recent changes in world oil prices, movements in the Canadian dollar, and the recent behaviour of exports and imports.

As an aside, let me start by summarizing some good news in terms of the uncertainty that stems from two

10. See Coletti and Murchison (2002) and Macklem (2002).

specific sources. During the past 15 years or so, movements in oil prices and in the exchange rate have had much smaller effects on core inflation than in the past. This is partly because of the increased credibility of monetary policy brought about by the inflation-targeting framework. The implication is that these movements no longer create as much uncertainty in inflation forecasts as before.

Now, to get to the heart of the matter, what are the factors that affect inflation? While we don't know every single factor involved, it is useful to think of inflation as being a function of capacity pressures in the economy—the output gap—and of inflation expectations. Relative price shocks, such as changes in oil prices or the exchange rate, also have a short-run impact on inflation rates. The task for policy-makers is to carry out the appropriate sensitivity analysis in order to deal with parameter uncertainty and model uncertainty.

One key uncertainty relates to the modelling of inflation expectations. Actual past inflation rates, particularly past total CPI inflation, seem to be a much less important factor in determining inflation expectations these days. Rather, the process has become more forward looking and is heavily influenced by our credible inflation target. But there is still some uncertainty about the extent to which inflation expectations have become forward looking.

There is a diverse body of theoretical literature that points to the dangers of central banks assuming that inflation expectations have become more forward looking than they actually are. Researchers have found that the costs of assuming too much forward-looking behaviour and too much central bank credibility—and thus typically failing to take timely action before inflation and inflation expectations move well away from the target—are much greater than the costs of assuming too little forward-looking behaviour. So, in dealing with uncertainty surrounding the modelling of inflation expectations, we should not assume that expectations will always remain well anchored.[11]

What about relative price shocks? In theory, given a credible inflation target, relative price shocks[12] should have only a temporary effect on inflation rates. Nonetheless, movements in world oil prices clearly affect measured total CPI inflation in the short run through their impact on the prices of fuel oil and gasoline. They also often lead to increases in natural gas prices, with further ramifications for the CPI. But, in recent years, we have found little evidence of a significant impact, through the cost channel, on other elements of the CPI. In short, the trend of inflation—or core inflation—now seems little affected by oil-price swings of the order of magnitude experienced from the late 1990s through 2003.[13] In addition, there is scant evidence of second-round effects on inflation expectations and wages. In part, this is likely because increases in energy prices tend not to persist—oil prices may rise for a period of time, but then they usually reverse course. Indeed, if one looks at the patterns of both oil prices and total CPI inflation over the past five years or so, they tend to fluctuate around the core rate of inflation. Particularly large spikes in energy prices—either upwards or downwards—are more likely than not to reverse over the following 12 months. So, unless such movements persist, or are thought to be highly likely to persist over significantly long periods, it seems reasonable to assume that there will be almost no second-round effects.

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11. Soderstrom (1999) and Srour (1999) can be read in this way if their models are interpreted as setting inflation expectations to a weighted average of past inflation and the inflation target. Walsh (2003, p. 327) notes that his "results suggest that policymakers should act as if inflation were more backward-looking than they perhaps actually believe it is." Sargent (1999) gets a similar result in a simple model when robust-control techniques are used.

12. The analysis in this paragraph holds for a temporary or permanent move in relative prices. It does not apply to persistent growth in relative prices.

13. Bank of Canada (2000a, b) noted this in the context of the energy-price increases through 1999 and 2000.

The effects of movements in the exchange rate on Canadian inflation are much more difficult to detect than those of oil-price movements. This is partly because the effects are more indirect, and because we do not have all the data needed to follow the transmission channel from exchange rate changes, through import and wholesale prices, to consumer prices. But we can say that a wide variety of statistical and econometric techniques show that exchange rate pass-through effects are not large. Moreover, these effects are likely spread out over time—perhaps over two years or so.

One piece of evidence common to countries that have reduced inflation to low, or even moderate, levels is that their estimated coefficients of pass-through have declined.[14] It is not clear who sees their profit margin reduced when the domestic currency appreciates—the foreign exporter who prices to market, the domestic importer or wholesaler, or the domestic retailer. We need more data to answer this question for the Canadian economy, which might then help us to better understand the pass-through process and estimate the coefficient.

How far has the pass-through coefficient declined in Canada's case? Parameter uncertainty remains. Although the estimated coefficient has not been statistically different from zero in recent years, zero seems an extreme value to assume. In the longer run, zero seems inconsistent with optimal behaviour, because it likely implies that the prices of traded goods at the consumer level are not affected by exchange rate changes over any time horizon. We deal with this parameter uncertainty by assuming a small, positive rate of pass-through, thus balancing theoretical considerations with the results of our estimates.

There is also uncertainty about the effects of exchange rate movements on exports and imports. As we noted in our last *Update*, quite apart from the large movements in the exchange rate over the past year and a half, there are other factors that make it difficult to project Canadian trade at this time. About a year ago, the levels of imports and exports were well below what we believe economic conditions would have suggested. Since then, export levels seem to have made up a good part of the lost ground, while imports have only partially recovered. Compounding these complexities is the inherent uncertainty involved in trade data. As I mentioned earlier, there have recently been sizable revisions to Canadian trade data.

14. See, for example, Bailliu and Bouakez (2004) and Bank of Canada (2000b).

Quite apart from the large movements in the exchange rate over the past year and a half, there are other factors that make it difficult to project Canadian trade at this time.

Once we cut through all of these difficulties, we are left with two main uncertainties. The first relates to model uncertainty. What are the fundamental factors to which exports and imports are adjusting? This would be an issue regardless of exchange rate movements over the past year and a half. The second relates to parameter uncertainty. How are trade volumes adjusting to changes in the exchange rate? What is the total effect, and how long are the adjustment lags? These are extraordinarily difficult questions. In our July Update, we used our models but we also applied judgment to arrive at our projection that net exports would act as a slight drag on GDP growth in 2004 and 2005.

I hope that I've been able to give you some idea of the kinds of uncertainty that the Bank of Canada faces in the conduct of monetary policy and how we deal with them. The examples I have used reflect some of the specific risks and uncertainties that are particularly relevant to our current base-case projection.

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Conclusion

Let me conclude. It is true that uncertainty makes the work of macroeconomists and central bankers more challenging and interesting. That said, it is crucial that we at the Bank of Canada have ways to deal with this uncertainty. We have taken steps to reduce uncertainty about our monetary policy framework and actions. We mitigate data uncertainty by being cautious about our reliance on any single indicator and by looking instead at multiple indicators. And we temper model and parameter uncertainty by using a variety of different models and approaches, and by testing the sensitivity of policy recommendations to the assumptions of both the models and the parameters in the models.

But, of course, we will never eliminate uncertainty. Indeed, our current outlook is subject to factors that are particularly uncertain. I can't tell you how these factors will play out. But through our speeches, regular reports, and press releases, we will continue to address these uncertainties and keep Canadians informed about our views on the outlook for the Canadian econony.

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