NBER WORKING PAPER SERIES

AN *INFLATION REPORTS* REPORT

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Working Paper 10089
http://www.nber.org/papers/w10089

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
November 2003

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NBER Working Paper No. 10089
November 2003
JEL No. E4, E5

ABSTRACT

This paper evaluates the Swedish Riksbank's "Inflation Report" and draws comparisons among the Reports issued by the Riksbank, the Bank of England, and the Reserve Bank of New Zealand. This report poses and addresses a common set of questions about each of the three central banks' "Inflation Reports". It assesses the credibility of inflation forecasts, evaluates the Reports' discussions of the current state of the economy, asks if a coherent set of models underlies the Reports, and discusses whether the Reports hold the banks sufficiently accountable for their decisions.

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An *Inflation Reports* Report

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I was asked to evaluate the Riksbank's Inflation Reports *by Anders Vredin, head of the monetary policy group at Sveriges Riksbank. The assignment included drawing comparisons among the* Reports *issued by the Riksbank, the Bank of England, and the Reserve Bank of New Zealand. This constitutes the entirety of my instructions. The content of this report, therefore, reflects my own priorities and biases in monetary policy analysis. Although several staff members at the Riksbank have provided constructive comments, they had no influence over the report's tone or criticisms.*

1. Introduction

This report addresses a common set of questions about the *Inflation Reports* produced by three central banks that target inflation—the Bank of England (**BoE**), the Reserve Bank of New Zealand (**RBNZ**), and the Sveriges Riksbank (**Riksbank**). Although *Inflation Reports* are one of many documents used to prepare Board members for monetary policy decisions, they are primarily intended as external documents designed to communicate policy objectives and decisions to the public. This report evaluates both the internal and the external roles that the *Reports* play. When assessing the *Reports'* internal roles, I occasionally sit in the policymaker's chair at the briefing table.

Before launching into the evaluation, I should share some of my priorities and biases in policy analysis. To the degree possible, monetary policy authorities would do better to be forthright in their statements of policy objectives, their understandings of the economy, and their descriptions of current and likely future policy actions. Inflation targeting countries have taken the crucial first step by laying out the policy objectives unambiguously.

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* I thank Jon Faust, Per Jansson, Stefan Palmqvist, Ellis Tallman, Steffan Viotti, and Anders Vredin for helpful comments.

Limitations in our knowledge about the structure of the economy and our inability to predict accurately future disturbances to the economy make monetary policy an inherently judgmental business. Economic science has not delivered *the* definitive model economy. Instead, it delivers a wide range of models—both theoretical and statistical—whose performance varies tremendously over time. Judgments about the relevance of those models for the policy questions at hand are necessary components of policy analysis. It therefore becomes important how economic judgments are arrived at, how they are scrutinized, and how the role that judgment plays in policy decisions gets communicated to the public. Analytical and statistical tools can help to arrive at and evaluate judgment calls. But they cannot substitute for judgment.

Four questions form the basis for the report. They are:

1. Are the inflation forecasts credible?
2. How clear is the discussion of the current state of the economy?
3. Is there a coherent model or set of models underlying the presentation of the *Report*?
4. Does the *Report* hold the Bank sufficiently accountable for its decisions?

An appendix lists the questions along with the more detailed sub-questions that I considered.

This report is based on my reading of several issues of the *Inflation Report* published by each Bank; another appendix lists this reading.

All three central banks clearly lay out their inflation targets in their *Reports*. The rationales for targeting inflation and for the chosen target inflation rate are sometimes discussed, but the rationales are not typically part of the inflation objective template that appears in *Reports*. Nevertheless it is clear the Banks pursue low inflation because they believe it stabilizes and encourages economic growth. The precise mechanism by which inflation interacts with economic growth is typically not discussed much. There's a good reason for this: the economics profession has yet to understand this important issue. Indeed, there is very little intellectual basis for preferring any particular low average inflation rate over another, although there is a strong basis for avoiding high and volatile inflations.

I have tried to be straightforward in my assessment of the *Inflation Reports*. That means I am also critical when I believe there is room for improvement. I hope the report is constructive and helpful.

I now address the four questions in turn. For a discussion of some of the recommendations that follow from this report, see Leeper (2003).

2. Are the Inflation Forecasts Credible?

Forecasts are the parts of the *Reports* that I found most difficult to accept and to judge. For each Bank it is possible to trace how the verbal supporting discussion shows up in the inflation forecast. For example, the **BoE** (May 2003) clearly links short-run developments in the economy—in this case, a higher Council Tax—to a hump in inflation over the next six months. The **Riksbank** (2003:1) faults temporarily rising oil prices for higher than forecasted current inflation, but that is followed by lower inflation over the next year as oil prices unwind. Similarly, the **RBNZ** (March 2003) attributes inflation fluctuations to changes in the exchange rate and migration inflows. So there is a definite connection between the economic facts reported and the shape of the inflation forecast path in each *Report*.

2.1 Staying Focused

Each Bank emphasizes that there is no mechanical method used to forecast inflation. I presume that does not mean that there is no "algorithm" for constructing the forecasts, for that would imply that no systematic approach is taken. Instead, I think it means that no single econometric model is used to generate the forecasts reported in the *Report*. This leaves open the question: exactly how are the forecasts generated? This question may well be addressed by a variety of supporting documents, some published in *Economic Reviews*, some published as downloadable files on the respective web pages. But a reader of the *Inflation Reports* alone cannot discern how forecasts are produced. I do not know how thoroughly the policymakers in the respective Banks understand the forecast production process. For me that understanding is essential, but for others it might not be.

To be sure, each Bank collects and reports a huge array of statistics. In this regard, the **BoE** wins the "fill the bathtub" award: report as many facts about the data as possible, regardless of their relevance or importance. In the case of the **BoE**, and to a lesser extent the **Riksbank**, it is easy to drown in the bathtub of economic statistics; little guidance is provided as to how each statistic translates into the inflation forecast. Are equity prices, hostilities in Iraq, oil prices, external demand, consumer and business confidence, house prices, capacity utilization, fiscal policy, and labor costs—only a fraction of the factors mentioned in the **BoE**'s May 2003 "Overview"—all equally important determinants of future inflation? The **Riksbank**'s "Inflation Assessment" (2003:1) is less expansive, but still leaves the reader wondering what the contribution of each listed factor is to the forecast.

The **RBNZ**'s analysis is refreshingly succinct and direct. It tends to concentrate on a small handful of key statistics, giving the reader a better focused understanding. The **RBNZ** can nonetheless be faulted for not providing quantitative links between the key statistics and the forecast path.

Much of policy analysis is an exercise in signal extraction: what does the morass of economic data signal about future paths of inflation and real GDP? At its best, policy analysis extracts this signal by linking current conditions to future conditions, and leaves irrelevant minutia behind. At their best, *Inflation Reports* would do the same.

2.2 Needed: A Model of Inflation Determination

Missing from the *Reports* is some straightforward model of inflation determination—at least in the long run. One can glean from the discussions that at business cycle frequencies, which correspond to the Banks' typical forecast horizons, the state of resource utilization is central to each Bank's view of the inflation process. And at very short horizons, fluctuations in inflation would seem to be driven primarily by relative price changes—oil, food, taxes, mortgage interest, traded to nontraded goods—which change fixed-weight price indices. But what of longer horizons? Perhaps these are not much discussed because they extend well beyond the policy horizons on which the *Reports* focus.

But the long-run determinants of inflation are important because, regardless of the policy horizons in the *Inflation Reports*, one widely touted benefit of inflation targeting is the achievement of low inflation on average over time. By emphasizing the two- or three-year horizons common in *Inflation Reports*, central banks run the risk of losing sight of the overarching objective of low long-run inflation.

To understand this point, consider the standard New Keynesian model. In that model, long-run inflation is equal to the growth rate of the money supply less exogenously given potential GDP growth (adjusted for changes in velocity, which are usually taken to be zero). A lower target inflation rate requires a lower steady state money growth rate. Of course, with a Taylor rule for monetary policy, money supply is endogenous, so long-run inflation depends on the parameters of the policy rule (along with other parameters).

Over the business cycle, though, pricing is determined by markup behavior so real marginal costs govern inflation dynamics. This points out that over short- to medium-run horizons, resource utilization (or "overheating") appears to be central to inflation, while over long horizons it is the

traditional explanation—money growth or monetary policy behavior—that is central. Of course, inflation targeting proponents argue that the inflation target itself pins down the long-run inflation rate (assuming policy is credible). But this begs the question I am raising: what determines the long-run inflation rate to be equal to the target inflation rate?

This theoretical argument is relevant for forecasting. In an econometric model of inflation, one might well find that short- to medium-run forecasts are driven by many of the factors on which *Inflation Reports* focus—relative prices, resource utilization rates, and so forth. But one would want to be certain that the model's long-run properties are also reasonable. Those forecasts can often be nailed down by cointegrating relationships that imply inflation emerges from the interaction of supply and demand for money (or, more generally, the interaction of monetary policy and private behavior). To assess the credibility of inflation forecasts more completely, it is important to know about the longer horizon forecasts. None of the Banks regularly discuss this point.

2.3 Needed: A Benchmark Statistical Model

All the Banks emphasize that their forecasts are judgmental. The view is that they can improve on model-based forecasts by bringing to bear the expertise of their analysts and a vast array of information not contained in a single forecasting model.[1] As a policymaker, I certainly want to tap into the staff's expertise and exploit all available information to arrive at accurate inflation forecasts. But I also want to have a clear sense of exactly how the staff's judgments are affecting the forecast. To gain that sense, I would find it helpful to have on hand a benchmark forecast produced by a good statistical model. The benchmark forecast would be entirely mechanical and untainted by the staff's judgment. Any number of methods could be used to produce statistical forecasts. For example, Doan, Litterman and Sims (1984) show how to produce forecasts under a variety of conditioning assumptions. The typical *Inflation Report* assumption of a constant short-term nominal interest rate, for example, can in principle be incorporated.

With the benchmark forecast to work from, the staff's job changes somewhat. First they explain what is driving the forecast in the benchmark model. This is likely to be more of a statistical

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[1] It is not obvious that judgmental forecasts uniformly dominate forecasts from Bayesian vector autoregressions, for example. Leeper and Zha (2002b; Leeper and Zha (2002a) and Robertson and Tallman (1999) show that inflation forecasts from a modest-sized identified VAR are as accurate as the Federal Reserve Board's Greenbook forecasts. This is not the place to pursue this debate.

description than an economic one. Then the staff can explain how their judgments shift the forecast away from the benchmark. Indeed, this explanation would be a central theme of the staff's briefings of the Executive Board.

It would be interesting also to produce forecasts from the benchmark model conditional on the judgmental adjustments being made. One would have to think through exactly how to do this, but the spirit is to try to learn the extent to which the judgments are consistent with historical patterns of correlation. If the judgments do not disturb the historical patterns greatly, policymakers might be more assured. And when the judgments are at odds with history, the staff has a more compelling need to justify the deviations from the benchmark model. This approach provides policymakers with more information than they would have in the absence of the benchmark forecast. And it is information that is central to arriving at and communicating policy decisions.

Another reason for producing a benchmark forecast is reproducibility. At present it is impossible to reproduce any of the inflation forecasts reported by the three Banks. Yet reproducibility is a hallmark of science. The "science of monetary policy" would seem to require reproducibility.[2] Admittedly, readers of an *Inflation Report* may still be unable to re-create the judgmental forecast even if they have access to the benchmark forecast. But the *Report* could address this issue by discussing in detail the staff's rationale for modifying the benchmark forecast. In policy analysis, as in research, reproducibility is tightly linked to credibility.

A track record of forecast accuracy is another important ingredient for making credible forecasts, as is a detailed analysis of recent forecast errors. In this regard the **Riksbank** does a much better job than either the **BoE** or the **RBNZ**. The section entitled "Material for assessing monetary policy," which appears in the first issue each year, is an excellent addition to the *Report*. I found the assessment of why inflation in 2001 exceeded the target rate (and the previously forecasted rates) to be particularly insightful (*Report* 2002:1). The parts that attempt to identify the shocks driving inflation are especially good, and I would like to see more extensive treatment along those lines. For economics writing, this is about as suspenseful as it gets: I found myself hungering for more, as each potential explanation for the forecast error was proposed and then dismissed as unimportant. This kind of analysis is critical for both policymakers and the public.

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[2] I am borrowing Clarida, Gali, and Gertler's (1999) phrase.

The **Riksbank** and the **BoE** also compare their forecasts to the forecasts of others. Although helpful, it might be possible to improve on this by giving some perspective on the historical accuracy of the alternative forecasts. How well does the Bank do on average compared to other forecasters? Are there particular states of the world when the Bank's forecasts tend to be less accurate? Are judgmental forecasts better than the statistical benchmark ones? Does any pattern of forecast errors emerge when comparing benchmark to judgmental forecasts?

A benchmark statistical model can also help with understanding the source of forecast errors. In a multivariate model one can compute how the error gets attributed to disturbances in other equations. When the model is identified, equation errors have behavioral interpretations that greatly aid in telling a story about the forecast mistakes. Even when the model is not identified, however, equation errors can point toward potential explanations. Based on footnote 37 of the 2001:1 **Riksbank** *Inflation Report*, I infer that the Bank's statistical models implied that most of the error in forecasting inflation was attributed to the "inflation equation error," which did not help identify the underlying source. This can happen in any forecasting model and the kind of analysis contained in the **Riksbank**'s *Report* can fill in the interpretation of what an "inflation equation error" means for policy.

2.4 Simple Descriptions versus Simple Behavior

The **Riksbank**'s simple rule of thumb—raise (lower) the repo rate if forecasted inflation is higher (lower) than 2% one to two years ahead—may be useful as a pedagogical device. It is simple and easily understood. Precisely because it is simple, it is also a very incomplete specification of policy behavior. It appears not to be state contingent, yet policy behavior belies this appearance. As a policymaker I am interested in the contingencies: under what conditions do I raise the repo rate if inflation exceeds its target and by how much do I raise it? Do I adjust the rate whenever the forecast of inflation differs from 2% or only when it falls outside the tolerance range of 1%-3%? That is, I am well aware that policy choices are not simple.

This underscores the tension between describing policy simply and implementing policy simply. But simple descriptions of policy need not require simple policy behavior. A policy institution that tries hard to communicate its behavior in simple terms may create an internal dynamic that biases it toward behaving in simple ways. And simple behavior is not a virtue for policymakers.

Unfortunately, the rule of thumb, which was adopted primarily as a pedagogical device because it is simple and easily understood, may lead to misunderstandings when actual policy behavior is not simple. Heikensten (1999) is a thoughtful discussion that fleshes out the simple rule by acknowledging that the rule of thumb is not followed mechanically precisely because monetary policy behavior is quite complex. [3]

2.5 Constant Interest Rate Assumption

I am troubled by the "technical assumption" that the repo rate is constant at its current level over the forecast horizon. The efficacy of the argument that a constant repo rate helps to communicate by being transparent hinges on the nature of the associated inflation forecasts. I looked at all the inflation forecasts from **Riksbank** *Inflation Reports* that are available on-line (1997:1-2003:1) and found *not one* instance when the 2-year inflation forecast fell outside the **Riksbank**'s tolerance range. Over this period the repo rate was changed 16 times, reaching a low of 2.90% and a high of 4.25%. Inflation meanwhile, varied from about -0.5% to slightly over 3% (CPI measure) and 0.5% to 3.5% (UND1X measure).[4]

These observations raise several issues. First, if the 2-year forecast of inflation was consistently within the target range, why was the repo rate changed so often? Does this imply the Board rigidly follows the rule of thumb by reacting to *any* deviation of inflation from 2%? Or do these observations imply the Board is not following the rule of thumb because it changed the repo rate even when the 2-year inflation forecasts did not indicate a need to change the rate? Second, given that actual inflation deviated from the target range—particularly on the low side—is there any systematic error in the 2-year-ahead forecasts? Third, since the technical assumption of a constant repo rate is clearly at odds with actual behavior, do there remain transparency benefits from maintaining this assumption? Fourth, how likely is it, given the current state of the economy, that the repo rate will remain fixed?[5]

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[3] See also Heikensten and Vredin (2002).

[4] It would be interesting to examine inflation forecasts back to 1994 because the range of the repo rate expands considerably, reaching a peak of nearly 9% in the middle of 1995. If the older forecasts exhibit a pattern similar to the past seven years, the larger variance in the repo rate will make the "technical assumption" still more troubling.

[5] The **Riksbank** routinely discusses the economy beyond the two-year forecast horizon and observes that the constant repo rate assumption becomes more implausible over longer horizons. Leeper and Zha (2002b) point out that a constant rate may be sufficiently at odds with historical

Of course, one reaction to these observations is that over time the **Riksbank** didn't really hold the repo rate fixed. In principle, each *Inflation Report* conditions on a different constant level of the rate. Hence, there is no inconsistency between the fixed rate assumption and the 2-year inflation forecast. But then we are in a situation where we do not see the rule of thumb in action because given the current level of the repo rate, the inflation forecast is tolerable. I would be more convinced if the *Reports* showed inflation deviating from target under a constant repo rate, but being brought back to target through a higher (or lower) rate.

This brings me to the point that none of the *Reports* I examined discussed in any detail the economic dynamics triggered by a change in monetary policy. What are the effects of a change in the repo rate on Swedish inflation and output? Counterfactual policy experiments (or alternative policy scenarios) actually serve a dual purpose. First, they inform policymakers of the likely impacts of alternative policy choices. But second, and just as important, they demonstrate the dynamic impacts of policy. Only by firmly establishing that monetary policy can in fact affect inflation over the relevant horizons can the Bank begin to claim credit for improved economic performance. Without such evidence it is impossible to distinguish between good policy and good luck as the source of healthy economic performance.

This is why I find the **Riksbank**'s exercises that project conditional on a higher repo rate to be baffling. They appear to show that even substantial changes in the repo rate have little impact on the economy. Perhaps the nature of the exercise—raising the rate 20 basis points in one year and an additional 50 basis points in two years, as in the 2003:1 *Report*—does not lend itself to demonstrating the potency of monetary policy. What would the forecast look like if the rate were raised 50 basis points immediately and kept at that higher level for two years?

Another complaint about the constant repo rate assumption is that it may be another case where the desire to communicate simply could drive the Board to behave simply. Certainly Board members do not require the simplicity of a constant repo rate to understand the forecast. And I am skeptical that the public requires it either. And to the extent that inflation forecasts actually are not conditioned on a constant interest rate, the forecasts published in the *Reports* are potentially confusing to the public, who are forced to reverse-engineer the actual interest rate paths assumed in the forecasts.

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policy behavior that it triggers the expectations formation adjustments that Lucas (1976) emphasized may undermine reduced-form forecasting models.

As a policy maker I would eventually want to see a variety of identifications of the benchmark model. After all, identification is what most of every *Inflation Report* is trying to achieve. I think we would learn more if the identification were approached systematically and in a multivariate setting.

Finally, I am interested in forecasts that extend well beyond a two-year horizon. This is partly a check on the properties of the forecasting models, but it is primarily to keep my eye on the prize of long-run price stability. The **Riksbank** does provide a section that discusses the economy beyond the forecast horizon. I found this to be rather chatty, not well connected to the forecasts, and not as helpful as merely extending the forecast would be (unless after two years inflation is always forecasted to be exactly on target).

3. How Clear is the Discussion of the Current State?

The bulk of every *Report* is devoted to describing and explaining the current state of the economy. Indeed, this is the comparative advantage of central banks the world over. Here the **Riksbank** strikes a balance between the detail of the **BoE** and the succinctness of the **RBNZ**. It is hard to say where along the continuum one should try to land. Much depends on the tastes of the particular policymakers. My tastes run toward succinctness, as focusing on a small set of facts helps me to digest the facts. But there can be circumstances when the current state cannot be adequately described by a handful of facts and more detail is needed. In general I would apply a vigorous filter to the information included in the *Inflation Report*, making certain to exclude anything that is unnecessary.

An important aspect of the description of the current state is inferences about whether recent shocks will have persistent or transitory impacts on inflation. By linking the current state to the inflation forecast, this part of the *Report* demonstrates why getting the current state right is so important. All three Banks do this well.

3.1 Needed: An Analytical Framework

What the Banks do less well is embed the detailed description of current data in an analytical framework that illuminates both why the data are important and how the current state feeds into the forecasts. The **BoE** and the **Riksbank** organize the presentation of facts into "supply" and "demand" or "determinants of inflation" categories, seeming to suggest an analytical framework is lurking in the background. But these labels do not fully substitute for a clear theoretical framework.

Aggregate supply and aggregate demand are not terribly useful constructs when a given shock hitting the economy has both supply and demand impacts. The Banks do categorize the shocks roughly according to their sector of origin: external or internal, financial market or labor market, and so forth. This categorization is helpful so long as the various sectors are linked by an analytical framework. There may be more that could be done in this direction.

The framework need not take the form of an explicitly specified theoretical model. Indeed, as our understanding of the economy evolves, so too do our theoretical constructs. Even a "model" that sketches out the important sectors and critical aspects of behavior within those sectors would help to connect the economic statistics to the forecasts and, ultimately, to the policy choices made.

Offering the readers a clearer analytical framework is also a means for educating the readers about basic economic theory. All the Banks do this to some degree—often in special boxes. And the **BoE** has had some very nice pedagogy that clarifies some issues that might otherwise worry policymakers (for example, on velocity in November 2002 and on TFP and capacity utilization in May 2003). In many ways, the Banks seems to handle these "topics courses" better than the core course, which is connecting current and future states of the economy in an analytically convenient way.

There is much that can be done to lay out an analytical framework short of specifying a complete dynamic, stochastic general equilibrium model. It would be useful to be explicit and quantitative about certain aspects of the linkages between current and future states. For example, with all the emphasis on how the degree of resource utilization affects inflation, one might imagine ways to show this empirically. What is the link between the output gap or some other utilization measure and current and future inflation? How stable is the relationship? On average, what is the impact of a 1% increase in the ouput gap on the path of inflation? How does the impact depend on the source of the gap's increase? Is there a stable relationship in the opposite direction—from inflation causing future output gaps? How do we discern whether a statistical relationship is causal? Why is this distinction important to policymakers? What does the Phillips curve for Sweden look like? Is it stable? Are the judgmental forecasts of inflation and output growth consistent with the historical Phillips curve? I throw these questions out, not because I believe we should base policy on reduced-form relationships, but because once we have before us some quantitative links between

current and future states the policy discussion becomes more productive and the policy debate becomes better focused.[6]

3.2 Needed: Alternative Scenarios

Because central banks are so adept at describing the current state, I think too much emphasis is placed on it. This shows up in the *Inflation Reports* as well. The *Report* is supposed to be a forward-looking document, and every *Report* drives home this point. But most of the discussion of policy centers on the past: what did the Bank decide at its recent meetings and how did it reach that decision? It would be helpful to talk about how policy would respond if various alternative scenarios were to occur. For example, if growth in the euro area and the United States were to remain bogged down or to turn into a recession, how would the **Riksbank** react? One can imagine a range of the more likely scenarios and discuss their implications for **Riksbank** behavior. This kind of conversation probably takes place during Board meetings, but it would be helpful to have the staff think through the scenarios beforehand and provide some quantitative analysis to back them up.

As a policymaker I would also like to look at a variety of alternative scenarios for policy choices and their likely impacts on the economy. The **Riksbank** *Report* does routinely consider "forecasting inflation with a rising repo rate," though the other Banks are less consistent in considering alternative policy choices. I was surprised at how insensitive the forecast is to even a 75 basis point increase in the repo rate (2003:1). Zha and I found much greater sensitivity in U.S. data using an identified VAR [Leeper and Zha (2002b)]. The insensitivity can give the impression that counterfactual exercises are not very informative. It can also give the impression that changes in monetary policy have little effect on the Swedish economy.

Generating alternative scenarios is another instance where a formal econometric model is handy. Returning to the benchmark model, one could construct a projection conditional on hitting the inflation target and back out the most likely path of the repo rate for achieving this. This can be thought of as reporting how policy can get inflation back on target and how costly it will be to do so—an especially useful exercise when current inflation is above target, as it was in 2001. One

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[6] Recall that my perceptions of briefings at the Banks are based on the *Inflation Reports* alone. In most Banks many supporting materials of the kind I am advocating are put before Board members.

could run a similar exercise conditional on the judgmentally forecasted path for inflation (or paths of inflation and output) and compute how likely the judgmental path is given history.[7]

4. Does A Coherent Model Underlie the Report?

If one important component of an *Inflation Report* is the link between the current state and the objective of policy, another component surely must be the link between policy decisions and current and future states—the transmission mechanism of monetary policy. It is difficult to glean from *Reports* exactly what the Banks take that mechanism to be. Although both the **BoE** and the **Riksbank** dutifully report monetary aggregates, both also claim that the relationship between money and economic activity is unreliable. Is the reader to infer that the relationship between the policy interest rate and economic activity *is* reliable? And what about other aspects of the transmission mechanism? Does the short rate affect the economy primarily through the long rate? Is the effect of monetary policy on the term structure reliable? What roles do the banking and financial sectors play in transmitting monetary policy?

4.1 More Quantitative Analysis

The **Riksbank** and the **RBNZ** push the view that monetary policy has its biggest impacts on inflation 1 to 2 years in the future. But the *Reports* I read include no empirical evidence to support this view (though they might cite supporting studies). Moreover, the identified VAR literature does not deliver an unambiguous result for how quickly policy actions show up in inflation. In U.S. data, reduced-form analysis and recursive VARs frequently report a lag of 18 months before there are noticeable impacts on inflation [Christiano, Eichenbaum and Evans (1999)]. But in VARs that model the simultaneous determination of money and the interest rate, the lags are much shorter, even after imposing a zero contemporaneous effect. Leeper and Roush (2003), for example, find that when money and the interest rate are modeled simultaneously, inflation is significantly lower within six months of a monetary policy contraction. Moreover, inflation reaches its trough after more than two years, and it continues to remain substantially lower even four years later. In contrast, when the interest rate is determined before the money stock—as in most implementations of the Taylor rule—inflation is consistently lower only after 18 months.[8] At least in the United

[7] Doan, Litterman and Sims (1984) refer to this as a "plausibility index."
[8] See also Leeper and Zha (2001).

States, the jury is still out on how long (and how variable) are the lags between monetary policy and inflation.[9]

The Banks seem to adopt an agnostic perspective on expectations formation. They turn to financial markets to extract expectations of short-term interest rates from forward rates and of inflation from the term structure. But they frequently refer to the recent past of inflation realizations as the primary determinant of expected inflation. Banks also rely to varying degrees on surveys, both of expected inflation and of business and consumer confidence. This agnosticism reflects the economics profession's uncertainty about how best to quantify expectations.

Despite the prominence of expectations-related data, it is difficult to discern whether the Banks attribute a distinct role to expectations in private agents' decisions. For example, *Reports* discuss the impacts of current fiscal policies, largely on aggregate demand, without mentioning how changes in expected taxes and government spending affect behavior. There is also remarkably little discussion of how expectations of monetary policy feed into current decisions about pricing and production. Yet stable inflation expectations are supposed to be a direct benefit of inflation targeting. It is difficult to reconcile the absence of expectations effects on private behavior with modern macroeconomic models.

All three Banks display a great reluctance to report results from quantitative analysis in their *Inflation Reports*. This is ironic given that the objective of monetary policy is described in terms of a quantitative target for inflation. To my mind quantitative analysis that explicitly connects the verbal discussion of the *Inflation Reports* to data goes a long way toward making the model (or models) underlying the *Reports* coherent and believable.

4.2 Risk Assessment

Uncertainty plays a crucial role in policy decisions. Aware of this, the *Inflation Reports* are very careful to discuss the "risks to the forecast." It appears that these risks are handled informally. Despite this informal treatment, the thoughtful analyses of the reasons that the forecast may go wrong and the likely direction of the error are indispensable to policymakers.

The **BoE** and the **Riksbank** present fan charts for their inflation forecasts.[10] (The **BoE** also does so for output forecasts.) The charts report both the central tendency—typically the mode—and the

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[9] Identification schemes based on shape and sign restrictions on impulse response functions that do not impose predeterminedness of inflation can even get substantial immediate responses of inflation to a monetary policy shock [see Canova and De Nicolo (1998), Faust (1998), and Uhlig (1997)].

dispersion of the forecast density function.[11] The risk assessment embodied in the fan charts is arrived at judgmentally, as Blix and Sellin (1999) describe.[12] To the extent that the fan charts accurately reflect the risks discussed in the text of the *Reports*, there appear to be at least two kinds of uncertainty captured: uncertainty about realizations of future shocks and uncertainty about the underlying model. It is unclear whether a third kind of uncertainty—that arising from parameter estimates—is also rolled into the fan charts.[13]

Uncertainty about future shocks and model uncertainty seem often to interact in the *Inflation Reports*. Consider an example that runs through the three Banks' *Reports*: the possibility that external demand may turn out to be weaker (or stronger) than anticipated. At times this uncertainty increases, widening the fans, and in early 2003 external demand is more likely to be weaker than to be stronger, skewing the distribution of the inflation forecast downward. I interpret the widening of the fans as stemming from a mean-preserving spread in the distribution of shocks affecting the strength of foreign economies. But if shocks continue to have mean zero, which they must if they are "shocks," then the change in bias must arise from something like changes in the parameters in private agents' decision rules. The **Riksbank** mentions the interesting possibility that 9/11 and the Iraq situation may have increased risk aversion, making private decisions more conservative than usual. One way to think about this is that nonlinearities may be important, possibly because some set of parameters describing private behavior can shift stochastically over time in response to exogenous events. Of course attitudes toward risk are not observable, so it is important to acknowledge that we are choosing to interpret observed behavior in these terms. It may be possible to formalize this as uncertainty about the underlying model: there are two models with different

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[10] The **RBNZ** reports only a central tendency measure in its forecast charts even though its *Monetary Policy Statement* discusses the risks to the forecast. It is interesting to ask why the **RBNZ** chose not to produce fan charts.

[11] Considering that the forecasts reported come from a single judgmental forecast, it is not clear why the forecast is treated as a mode.

[12] There is a peculiar asymmetry implicit in the production of the fan charts. Forecasts are explicitly judgmental, as are the staff's assessment of the degree of and bias in the uncertainty. Yet, as Blix and Sellin (1999) describe the procedure for producing fan charts, those judgmental components are inputted into a formula that produces the charts. This procedure seems to attempt to make objective the output of a process that is intrinsically subjective.

[13] Parameter uncertainty arises because model parameters are estimated rather than known with certainty. In typical applications, the model structure is taken as known with certainty, even when the parameter values are not. Model uncertainty reflects a more fundamental uncertainty stemming from the fact that we do not even know if we are estimating the "right" model.

degrees of risk aversion; the mode of the forecast averages the two models and the skewness reflects both our prior beliefs about and the fit of the two competing models.[14]

As one can see, a formal interpretation of the fan charts can be quite complex. But even if a Bank does not choose the formal approach, it is important to think carefully about the nature of the uncertainty being captured by the risk analysis. As a policymaker, I would want clarification of precisely what information the fan charts communicate. I would also want to know the extent to which the staff accounts for parameter uncertainty when reporting the risks.

4.3 Evaluate Risk Assessments

If Banks routinely report risk assessments, then those assessments should be systematically evaluated, just as the accuracy of Banks' inflation forecasts are evaluated. Here two aspects suggest themselves.[15] First, if the main scenario in the *Inflation Reports* is a mode forecast, then we ought to observe that times when risks are tilted in favor of higher (lower) inflation tend to be followed by actual inflation rates that are greater (less than) forecasted inflation rates. If such an analysis finds no systematic connection between risk assessments and forecast errors, then the value of the risk assessments is called into question.

A second type of evaluation attempts to put risk assessments into a historical context. The **Riksbank**'s annual section on "Materials for assessing monetary policy" includes a table that summarizes whether uncertainty surrounding the inflation forecast is "normal," "somewhat more than normal," "more than normal," "somewhat less than normal," or "less than normal." Over a long enough time period, these assessments, of course, should average out to "normal." But over the past few years I could find no instance when uncertainty was less than normal. This may have been a particularly volatile period or it may be a case where uncertainty tends always to be greater than normal.[16] In either case, this is the kind of internal consistency check that judgmental forecasts require, but that statistical forecasts automatically ensure.

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[14] Brock, Durlauf and West (2003) is an excellent development of model uncertainty and model averaging in the context of stylized policy evaluation. Robertson, Tallman and Whiteman (2002) offer an alternative approach to producing forecast distributions that is not explicitly tied to model uncertainty.

[15] Actually, Stefan Palmqvist suggested these, and I thank him.

[16] As in Garrison Keillor's Lake Wobegone, Minnesota on the radio show "A Prairie Home Companion," where all the children are above average.

A serious limitation of the informal—meaning not model-based—handling of uncertainty is that it precludes reporting *joint* distributions of forecasted variables. Fan charts exist, implicitly at least, for both inflation and output growth. We know these are marginal distributions obtained from some joint distribution. But without knowledge of the joint distribution, policymakers cannot be informed of the probabilistic trade-offs associated with their policy choices. Even the most hard-line inflation targeting Bank frequently trades off hitting the target in the short run when the output costs of doing so are judged to be too high. Information from the joint distribution also helps policymakers assess the plausibility of the combined inflation and output forecasts.

Leeper and Zha (2002b; Leeper and Zha (2002a) explore this issue in some detail. Using an identified Bayesian VAR we simulate the joint posterior distribution of all the variables in the model. We construct projections of macro variables conditional on alternative paths for the policy instrument. In addition to reporting forecasts with error bands—the marginal distributions—we compute a variety of joint distributions.[17] These joint distributions allow the policymakers to ask complicated questions like: "What is the probability of a recession in the next two years and inflation below the target range under the following alternative policy choices?" This is precisely the kind of question that policymakers ask and to which Bank staffs have a difficult time providing quantitative answers.

5. Does the Report Hold the Bank Sufficiently Accountable?

Given the relatively benign economic conditions of the past few years, the Banks do take ownership of their decisions and any mistakes they made. There is much in all the *Reports* that speaks to this point. The **Riksbank** appears to be the most forthcoming in this respect, however. The section on assessing monetary policy is central to the mission of accountability. There are ways that I have mentioned by which that section can be strengthened to help make the forecasts more credible. Comparisons of rule-based monetary policies to actual policies—as the **Riksbank** 2003:1 *Report* does—can also be helpful in holding the Bank accountable. But of course those exercises are only as useful as the rules to which actual behavior is being compared. I am perhaps an outlier in that I do not use the Taylor rule as a litmus test for policy behavior, though as one of several rules studied it may be instructive.

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[17] The joint posterior distribution reflects uncertainty about estimated parameters and about future shocks. The latter distribution is symmetric by assumption, but the former can be highly skewed.

Of course, in the past few years, the mistakes made by forecasts have been small. All Banks acknowledge throughout their *Reports* where their earlier views of the economy have turned out to be mistaken. The **Riksbank** devoted a great deal of careful analysis to a miss in inflation of less than one percentage point in 2001. The real question is how will the *Reports* read if the mistakes are substantially larger? If the miss is on the order of 5 (or -5) percentage points will the Banks be as forthcoming?

There are two categories of accountability worth considering. The first is institutional versus individual accountability and the second is retrospective versus real-time accountability. *Inflation Reports* are quite conscientious in addressing institutional accountability retrospectively. But there could be more individual accountability taking place in real time.

Individual accountability simply refers to the fact that policy boards consist of several members, each of whom participates in the policy debates and may even vote on the policy decisions. Because the institutional structures vary across Banks, I will focus on the **Riksbank**. The *Inflation Report* is intended to present the Board's final majority view. The annual "Material for assessing monetary policy" section of the *Report* does discuss in general terms whether certain members expressed views contrary to the consensus. That discussion is derived entirely from the minutes of the policy meetings, which are not published in the *Report*.[18] Because my evaluation is based only on information appearing in *Inflation Reports*, I could not glean a good understanding of the true nature of the policy debate. The brief synopsis in the *Inflation Report* does not present any detailed alternative scenarios that were advocated by members for how policy might behave and how that behavior would affect the economy. Hence, based on *Reports* alone, I cannot infer accurately the degree to which individual Board members are held accountable for their decisions.

Because the *Reports* report on past policy decisions and they do so with the benefit of hindsight, they also do not give the reader a real-time sense of the debate. Although there are individual decision makers involved, the *Reports* present a largely monolithic perspective on the economy and on policy choice. Is it really the case that all Board members based their decisions on the identical set of information and the identical model of the economy, as the *Report* would seem to suggest? Or do some members come to the policy meeting with different information and a

[18] But are available on-line at http://www.riksbank.se under "Top News."

different model of how the economy works and how monetary policy affects the economy? If this kind of heterogeneity exists among Board members, it ought to be communicated in the *Report*.

One way to approach this is to have Board members keep journals that record in real time their reactions to the economic facts presented in the *Report*. They could record when the facts and the *Report*'s interpretations of them accord with or differ from their own perceptions. Presumably, those differences form the basis for the policy debate and may underlie any decision to dissent from the majority opinion. Members will discover ex-post the extent to which they were right or wrong in their perceptions. Of course, this must be done in real time to ensure that members do not revise their own histories. This is essentially a micro- (individual-) level analysis of the sort already conducted in the "assessing monetary policy" sections of the *Report*. If this procedure is followed systematically, the individual members each acquire their own track record on policy decisions, which is a necessary step toward individual accountability.

A possible counter-argument to this proposal for enhanced individual accountability is that the appearance of too much disagreement among Board members may undermine the Bank's credibility and disrupt financial markets. I am certain officials in the Federal Reserve System would push this argument. To be sure, in the United States at least, there would be some journalists and pundits who would spout that anything other than harmonious consensus among Board members signals the end of sound monetary policy. But policymakers cannot be deterred by such criticism.

I think the opposite could occur. Seeing that central bank officials are subjecting their viewpoints to careful scrutiny is likely to reassure the public that monetary policy decisions are in responsible hands. Healthy debate is an integral part of the democratic process. Moreover, if members know they are expected to make cogent and public arguments for their positions, the quality and thoughtfulness of their remarks will rise.

Appendix A: Questions Addressed

The report is organized around general aspects of *Inflation Reports* from the three countries. I address the following issues:

1. Are the inflation forecasts credible?
   a) Are the determinants of inflation clearly laid out?
   b) Is the procedure for producing forecasts clearly explained?
   c) Are the forecasts reproducible?
   d) Can one distinguish between "objective" and "subjective" (or judgmental) aspects of the forecast?
   e) How reasonable is the "technical assumption" of a constant policy interest rate over the forecast horizon?
   f) Is there a track record of forecast accuracy to which the *Report* alludes and which the *Report* updates?
   g) Is there a detailed discussion of recent forecast errors, including potential sources of the errors and implications of the errors for current and future policy choices?
2. How clear is the discussion of the current state of the economy?
   a) Does the reader acquire an understanding of the economic events that produced the current state?
   b) Is it explained why knowledge of the current state is relevant for achieving the stated objectives of policy?
   c) Are data and analyses presented pertinent?
   d) Does the *Report* devote too much attention to the current state relative to likely future paths of the economy?
   e) What is the balance between discussion of current and future policy choices?
   f) Are all necessary inputs to the decision process presented and discussed?
3. Is there a coherent model or set of models underlying the presentation of the *Report*?
   a) Is there a clear connection between the Bank's view of the transmission mechanism of monetary policy and the data presented?
   b) How is uncertainty handled?
      (i) uncertainty about estimated parameters

(ii) uncertainty about realizations of future shocks

(iii)uncertainty about underlying economic model

c) What type of uncertainty do fan charts purport to capture?

4. Does the *Report* hold the Bank sufficiently accountable for its decisions?

a) Does the Bank take ownership of its decisions and any mistakes policy made?

b) Institutional versus individual accountability

c) Retrospective versus real-time accountability

Appendix B: Background Reading

My report is based on a reading of the following *Inflation Reports*:

Bank of England, *Inflation Report*, May 2002, November 2002, February 2003, May 2003.

Reserve Bank of New Zealand, *Monetary Policy Statement*, March 2002, November 2002, March 2003.

Sveriges Riksbank, *Inflation Report,* 2000:1, 2001:2, 2002:1, 2002:3, 2002:4, 2003:1, and portions of *Reports* dating back to 1997:1.

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