

## Probabilistic Forecast Paths in Economics and Finance

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### Abstract

Communicating interest rate strategies constitutes a primary task of monetary policy-makers. The US Federal Reserve and other central banks frequently give guidance to financial markets about the likely path of the short interest rate over time. In this paper, we review briefly the existing approaches adopted by policymakers and contrast them with the probabilistic methods adopted by the Australian shadow board at the Centre for Applied Macroeconomic Analysis.

Keywords: interest rates; probability forecasting; monetary policy communication

## 1 Introduction

According to traditional practice, central banks said little about their future plans for interest rates. Over the last twenty years, accompanied by a general recognition that transparency about monetary policy strategy can be helpful to financial markets, some central banks have provided signals about the future path of short-term interest rates. Rudebusch (2008) identifies three broad communication channels: indirect signals, direct qualitative signals, and direct quantitative signals. Intriguingly, several central banks have introduced probabilistic interest rate paths as direct quantitative channels.

In this paper, we survey briefly the various approaches adopted by monetary policymakers and discuss the advantages of the probabilistic communication over methods that eschew the quantification of uncertainty about the interest rate path. We consider a new approach, adopted by a “Shadow Board” of (virtual) policymakers in Australia, which provides probabilistic information about the path of future interest rates at the individual policymaker level. We discuss extending the approach to deal with a zero lower bound on nominal interest rates.

The remainder of this paper is set out as follows. In the subsequent section, we describe briefly the motivation for providing signals about the future path of short-term interest rates. Then, in Section 3, we categorise and describe the approaches used currently by central banks in practice, with a particular emphasis on quantitative methods for policy communication. In Section 4, we consider the approach used by the Australian “Shadow Board”. In the final Section, we draw some conclusions and discuss the difficulties of policy communication in the presence of a lower bound on interest rates.

## 2 The case for and against signalling the path of interest rates

Following Rudebusch (2008), we draw a distinction across three communication channels for the path of (short) interest rates, with a special emphasis on direct quantitative signals, which incorporate probabilistic paths.

With indirect signals, the central bank concerned releases verbal information about policy intentions, but does not describe the path of interest rates itself. For example, inflation targeting central banks routinely issue forecasts for macroeconomic aggregates, and in some cases, these forecasts are conditional on an unchanged interest rate beyond the current period. If this forecast implies high inflation—or a strong probability of high inflation—with the rate unchanged, financial markets will infer that the rate is expected to rise. Rudebusch (2008) notes that in the US, the Federal Open Markets Committee (FOMC) has, at times, also described the risks to the macroeconomic outlook. These could be interpreted as indirect probabilistic signals. Clearly, a drawback of the indirect approach is that the guidance regarding the timing and magnitude of future policy remains inexact. Nevertheless, indirect signals are the most prevalent method of communicating the path of short-term interest rates.

Signals that are direct and qualitative are occasionally utilised by monetary policymakers. For example, in the late 1990s, the FOMC gave verbal predictions about the direction on interest rates. In the financial press, this is sometimes referred to as policy “bias”. Rudebusch (2008) gives an example from October 5, 1999, in which the FOMC “... adopted a directive that was biased toward a possible firming of policy going forward”. Often central banks rely on key phrases in speeches by policymakers, and regular monetary policy statements, to predict the sign of future interest rate changes. Phrases such as “policy accommodation”, or “policy firming”, tell market participants that in the future interest rates should be expected to fall, or rise, respectively. But the forecast horizon for the anticipated policy change remains vague by this approach, as does the threshold probability of the event that would cause the central bank to activate this channel of communication.

In contrast, direct and quantitative signals involve numerical projections of short interest rates over specified horizons. In theory, these could be complete forecast densities, the probabilities of particular interest rate events (such as a sign changes), or “point” forecasts (sometimes referred to as “the central track” for interest rates). In practice, for reasons that are not clear, only the first and third of these avenues are currently explored by central banks; see the discussion in the subsequent section.

Rudebusch (2008) describes the “ongoing debate” about the value of communicating policy intentions, providing a list of advantages and disadvantages. The main advantages include enhanced accountability and transparency about future policy actions, and the influence on market expectations of future policy. Greater transparency about the uncertainty around the future policy path, and about the probabilities of interest—such as the probability of “an interest rate increase”—offer a more complete description of future policy.

Bernanke (2004) notes that “FOMC communication can help inform the public’s expectations of the future course of short-term interest rates, providing the Committee with increased influence over longer-term rates and hence a greater ability to achieve its macroeconomic objectives”. A theoretical model by Rudebusch and Williams (2006) examines the impacts of revealing the central bank’s view of the future path of interest rates, in which private agents have imperfect information about policy. In that model, typically, publishing the central bank’s expectation of future interest rates influences public expectations, and helps the policymaker minimise the welfare loss from macroeconomic fluctuations.

In common with other new policy communication channels, a potential drawback is scope

for the public to misunderstand the policy signals (at least, initially). Arguably, the public find “point” forecasts easier to understand than probabilistic information. On the other hand, “point” forecasts in the absence of measures of imprecision can be misinterpreted as policy promises.

A related difficulty posed by interest rate paths for the monetary policymaker involves the difficulty of predicting future interest rates. In addition to the usual difficulties of macroeconomic forecasting (such as data revisions, short samples), interest rate decisions are often made by committee. Some monetary policy committees reach decisions by “consensus”, rather than formal voting. Inevitably, the identities of the committee members change over time. Occasionally the policy strategy shifts too. For example, an inflation targeting central bank might be instructed (by the Government) to target inflation over a “more flexible horizon”. That said, all of these uncertainties affect the paths of inflation and output, so if a central bank publishes probabilistic paths for other macroeconomic aggregates, interest rates should be treated similarly.

Thinking of policy communication from a positive perspective, it is striking that monetary policymakers have adopted a wide variety of different strategies, both across central banks and through time. With the tendency for monetary policymakers to become both more transparent and accountable over the last couple of decades (Blinder, Ehrmann, Fratzscher, De Haan and Jansen (2008) provide a discussion), there are no cases of central banks shifting away from probabilistic policy projections, once they have been introduced. In contrast, a few central banks have introduced indirect or direct qualitative signals and subsequently removed them. If central banks are only drifting slowly towards a more probabilistic approach, perhaps the marginal advantages of introducing policy paths, over existing policy channels, appear modest to many policymakers?

### 3 Current monetary policy communication in practice

In this section, we review briefly the current practices for signalling future monetary policy actions at a selection of central banks.

As discussed by Archer (2005), the Reserve Bank of New Zealand (RBNZ) was a pioneer in the introduction of direct quantitative signals, publishing “projections [for macroeconomic aggregates] based on time-varying, endogenously-determined interest rates, and to show the resulting interest rate path”. Regular press releases provide verbal projections for the short interest rate (Overnight Cash Rate, OCR). For example, the Press Release on 14 March 2013 stated “[t]here are both upside and downside risks to this outlook. At this point we expect to keep the OCR unchanged through the end of the year”.<sup>1</sup> Monetary Policy Statements, issued quarterly, and contain charts of the Governor’s point projections (36 months ahead) under different scenarios.<sup>2</sup>

Norges Bank and Sveriges Riksbank publish probabilistic paths for the interest rate. In a Press Release on 14 March 2013, Norges Bank noted that “[t]he analyses suggest that the key policy rate be kept low longer than previously anticipated. The first increase in the key policy rate is now projected to take place in spring 2014”.<sup>3</sup> The Monetary Policy Report with financial stability assessment, published four times a year (in March, June, September

<sup>1</sup><http://www.rbnz.govt.nz/news/2013/5184068.html>

<sup>2</sup>The Governor of the Reserve Bank of New Zealand is a single decision maker. However, an “advisory group” directly advises the Governor on policy decisions.

<sup>3</sup><http://www.norges-bank.no/en/about/published/press-releases/2013/key-rate/>

and December) contains charts with the assessment of the outlook for the key policy rate. Specifically, Norges Bank publishes projections for the key policy rate (up to 36 months ahead) with associated probabilities (30%, 50%, 70% and 90% uncertainty bands). At the latest meeting of the Executive Board of Sveriges Riksbank, on 13 February 2013, the Press Release noted that the “Board . . . decided to hold the [short interest rate] unchanged at 1.0 per cent . . . [and the rate] is expected to remain at this low level for around a year”.<sup>4</sup> Riksbank charts the forecast paths (with 50%, 75% and 90% uncertainty bands) along with probability forecasts for inflation and GDP.<sup>5</sup>

Breaking with its traditional reliance on indirect and direct qualitative signals, the Federal Reserve recently switched to revealing conditional central projections for the interest rate path: “the Committee decided to keep the target range for the federal funds rate at 0 to 1/4 percent and currently anticipates that this exceptionally low range . . . will be appropriate at least as long as the unemployment rate remains above 6-1/2 percent, inflation between one and two years ahead is projected to be no more than a half percentage point above the Committee’s 2 percent longer-run goal and longer-term inflation expectations continue to be well-anchored”.<sup>6</sup> Furthermore, starting with the January meeting (2012) of the FOMC, “participants also submitted their assessments of the path for the target federal funds rate that they viewed as appropriate and compatible with their individual economic projections”.<sup>7</sup> The Summary of Economic Projections (for example, March 19-20, 2013) includes the number of policymakers forecasting an increase in the short interest rate (by the end of each calendar year, up to 2015)—in effect, a direct qualitative signal at the individual policymaker level (rather than an aggregate committee view). There is also a verbal acknowledgement that the outlook for the future path is “subject to considerable uncertainty”.<sup>8</sup>

The direct approach is also currently preferred by the Bank of Canada, although with a more qualitative flavour. A press release accompanying the announcement of the overnight rate decision has recently provided the likely path of interest rates. For example, on 6 March 2013, the press release noted that “the considerable monetary policy stimulus currently in place will likely remain appropriate for a period of time, after which some modest withdrawal will likely be required, consistent with achieving the 2 per cent inflation target”.<sup>9</sup> For the Bank of Canada, the forecast horizon for the policy change is not revealed, neither at the individual policymaker level, nor at the aggregate committee (Governing Council) level.

Given the Bank of England’s preference for probabilistic projections for other macroeconomic aggregates, known as “fan charts”, it is surprising that the communication channel for interest rates remains indirect. The Bank’s Monetary Policy Committee (MPC) determines the path of interest rates but does not directly communicate the projections. For example, the MPC minutes for the meeting on 6/7 March 2013 reveal that “[t]he Committee set monetary policy in order to meet the 2% inflation target in the medium term and to do so in a way that avoided undesirable volatility in output in the short term”.<sup>10</sup>

<sup>4</sup><http://www.riksbank.se/en/Press-and-published/Press/Press-Releases/2013/Repo-rate-unchanged-at-10-percent/>

<sup>5</sup>See, for example, <http://www.riksbank.se/en/Monetary-policy/Forecasts-and-interest-rate-decisions/Current-forecast-for-the-repo-rate-inflation-and-GDP/>.

<sup>6</sup><http://www.federalreserve.gov/newsevents/press/monetary/20130320a.htm>

<sup>7</sup><http://www.federalreserve.gov/monetarypolicy/fomcminutes20120125ep.htm>

<sup>8</sup><http://www.federalreserve.gov/monetarypolicy/fomcminutes20130320ep.htm>

<sup>9</sup><http://www.bankofcanada.ca/2013/03/press-releases/fad-press-release-2013-03-06/>

<sup>10</sup><http://www.bankofengland.co.uk/publications/minutes/Documents/mpc/pdf/2013/mpc1303.pdf>

## 4 Communication by the Australian “shadow board”

While some central banks opt for conveying probabilistic information about the path of interest rates, most do not. Indeed, direct signals (whether qualitative or quantitative) are the exception, rather than the norm. While the elicitation of a probabilistic path from a single policymaker is relatively straightforward, it is not clear how the Scandinavian central banks resolve the problems for a committee. (Blinder, Ehrmann, Fratzscher, De Haan and Jansen (2008) describe the heterogeneity in committee types across central banks.) An unique dataset at the Centre for Applied Macroeconomic Analysis (CAMA), shows that individual (shadow) policymakers have (at times) strong asymmetries (and sometimes bi-modality) in their probabilistic paths for interest rates, complicating the aggregation problem.

To circumvent elicitation issues, the shadow board members make probabilistic assessments in terms of 25 basis point intervals, or bins. Henckel, Vahey and Wakerly (2011) describe the PRO-POL study and methods to aggregate the interest rate assessments of individual policymakers into a committee (or board) view using opinion pools. (See also <http://cama.crawford.anu.edu.au/pro-pol/>.) In this probabilistic control framework, each member of the shadow board records the uncertainty by giving probabilistic assessments of the appropriate (target) interest rate path.

The shadow board operates in the following way. Each month, a round of voting occurs the Monday before the Tuesday interest rate decision by the Reserve Bank of Australia (RBA) Board. Each member votes for an interest rate setting (electronically) using probabilities for each interest rate (in 25 basis point intervals). There is no requirement for voting to be independent and, unlike the RBA, shadow board members are not provided with common background macroeconomic information. Each member submits a probabilistic interest rate path by sending a single email (by 9am on Monday) responding to the request email. The data submitted by the shadow board are compiled, and charts showing the individual probabilistic distributions are published on the CAMA website by 12 noon on Monday, a day ahead of the RBA's actual decision.

The shadow board has been running as a trial since August 2011, and a distinguished team of macroeconomists has been assembled to participate in the study as shadow board members. The shadow board is comprised entirely of economic experts. Each member has agreed that her (his) probabilistic assessments of the appropriate interest rate for Australia will be communicated directly to the public at an individual level via the CAMA website. Hence, disagreements between board members are communicated directly to the public, providing a range of views to the debate about contemporary economic policy in Australia.

## 5 Conclusion

The communication of interest rate strategies takes many forms in practice. Several prominent central banks have adopted probabilistic paths for interest rates. In this paper, we have reviewed briefly the various methods adopted by policymakers in practice. And we have highlighted the novel probabilistic approach adopted by the the Australian shadow board at the Centre for Applied Macroeconomic Analysis.

In one way, the Australian shadow board faces a more straightforward decision than many actual policymakers in the Northern Hemisphere. The Australian macroeconomy has been very resilient to the Great Recession observed since 2007 in many rich economies. The central banks of the United States and the United Kingdom, for example, have moved interest

rates to very low levels and have opted to use additional monetary policy tools. In theory, the probabilistic approach to communicating interest rate paths can be extended to multiple instruments. But to date, no central banks have investigated this avenue.

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