The Empirical (Ir)Relevance of the Interest Rate Assumption for Central Bank Forecasts

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The interest rate assumptions for macroeconomic forecasts differ considerably among central banks. Common approaches are given by the assumption of constant interest rates, interest rates expected by market participants, or the central bank’s own interest rate expectations. From a theoretical point of view, the latter should yield the highest forecast accuracy, while the lowest accuracy is expected from forecasts conditioned on constant interest rates. However, when investigating the predictive accuracy of the Bank of England’s mean and density forecasts for inflation and output growth made conditional on a constant interest rate path versus those made conditional on a market interest rate path, we find no significant differences. We conclude that the choice of the interest rate assumption, while being a major concern from a theoretical point of view, appears to be at best of minor relevance empirically.

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A. Central Bank Statements on Forecast Conditioning Assumptions 20
1. Introduction

It is well known that, due to lags in the monetary transmission mechanism, central banks have to rely on forecasts for the variables they intend to control, often given by inflation and output. In these forecasts, the policy variable, i.e. the short-term interest rate set by the central bank, plays a special role. According to Galí (2011), in practice one can basically distinguish three approaches. Firstly, forecasts can be conditioned on a constant interest-rate (henceforth CIR) assumption where the interest rate is assumed to remain at the level it had attained at the time the forecast was made. The CIR approach was pursued, for example, by the ECB until 2006 and the Sveriges Riksbank until the end of 2005. Secondly, the expectations of market participants can serve as a conditioning assumption about the interest rate path, which is current practice at, for example, the Bank of Japan and the ECB. Market expectations (ME) are usually derived from the term structure of interest rates. Finally, a central bank can issue unconditional forecasts for its target variables by using its own expectations about the interest rate path. The central bank expectation (CBE) approach has been adopted, for instance, by the Norges Bank, the Riksbank and the Federal Reserve System. The Fed’s December 2011 FOMC statement, announcing that “participants agreed that adding their projections of the target federal funds rate to the economic projections already provided in the SEP [Summary of Economic Projections] would help the public better understand the Committee’s monetary policy decisions”, contributed to drawing the attention of economists to the topic of interest rate assumptions.

Among academics, there seems to be a clear ranking of the three approaches, CIR, ME and CBE, in terms of their suitability for central bank forecasts. Galí (2011), Svensson (2006) and Woodford (2005) advocate the CBE approach, i.e. unconditional forecasts. Galí (2011) shows that it is possible to construct different forecasts conditional on one given nominal interest rate path, thus calling into question any conditioning assumptions about interest rates. A similar point is raised by Woodford (2005). Svensson
(2006) adds that unconditional forecasts allow monetary policy to operate in “its most effective way” (Svensson 2006, p. 10). When comparing the ME approach to the CIR approach, he claims that “ME projections are much better than CIR projections” (Svensson 2006, p. 5).

Practitioners do not necessarily share these views, as reflected by the fact that a large share of central banks does not base its forecasts on its own interest rate expectations. This could be due to several reasons. For example, Goodhart (2009) finds that using the central bank’s expectations of the interest rate could be misunderstood as a commitment. Therefore, an interest rate path derived from market expectations is “a brilliant compromise” (Goodhart 2009, p. 94) between the potential lack of credibility of a constant rate assumption and the problems associated with publishing a path of future interest rates expected by the central bank. However, there are also central banks that use the constant interest rate assumption, for instance the Swiss National Bank.

Arguments in favor of this approach can be found in Goodhart (2001).

Summing up, the discussion about the interest rate assumption is mainly motivated by concerns about “shaky theoretical grounds” (Galí 2011, p. 549) of the conditioning of forecasts on interest rates, about monetary policy effectiveness and about communication issues. Yet, the choice of the interest rate assumption also has implications for forecast accuracy. Svensson (2006) notes that the unconditional forecast is the best forecast in the sense of minimizing squared forecast errors. This also implies that forecasts based on ME should be more precise in terms of squared forecast errors than forecasts based on CIR, because, empirically, ME and CBE should be highly correlated unless the central bank acts in a rather intransparent manner. Of course, improving forecast accuracy itself is not an aim of a central bank, but it is most likely related to the ability of achieving desired values of the target variables. Moreover, an improvement in forecast precision helps private agents to make better decisions, thereby affecting welfare, as mentioned by Svensson (2006). Thus, the choice of the interest rate assumption
has important consequences also due to its impact on forecast accuracy.

It is still an open question how large the gains or losses are that come with the choice of a specific interest rate assumption. While corresponding figures might in principle be calculable in small stylized models, an empirical investigation is challenging. Yet, it would be important to assess, at least qualitatively, the empirical effects of a change in the interest rate assumption. For example, one could ask whether the benefits of the US when the Fed adopted the CBE approach or of the Euro Area when the ECB switched from CIR to ME have been noticeable in some respect. According to the reasoning above, such an investigation could, in principle, be based on a comparison between the central banks’ forecast performance before and after the switch. Noticeable benefits of the switch should manifest themselves in terms of significant improvements in forecast accuracy. However, such a comparison would be likely to suffer from the instability of the predictive content of forecasting models over time often encountered in the case of macroeconomic forecasts.¹

In this work, we therefore exploit the forecasts of the Bank of England (BoE) in order to assess the impact of the interest rate assumption on forecast accuracy. The feature which makes these forecasts excellent candidates for our investigation is given by the fact that, since 1998, the BoE has published forecasts conditional on two different interest rate assumptions: CIR and ME. Thus, conclusions reached with these data should be rather robust with respect to instabilities over time. While these forecasts, in principle, only contain information about the potential benefits of the ME approach over the CIR approach, they might be regarded as a first indication concerning the benefits of the CBE approach. Actually, when comparing several central banks which either use the ME approach or the CBE approach, Andersson and Hofmann (2009) conclude that if a central bank is transparent and committed to maintaining price stability, the behavior of key variables like inflation expectations and long-term bond yields does not

¹See, for instance, Rossi (forthcoming).
seem to be affected by the type of interest-rate assumption. Therefore, the forecast accuracy observed for the ME approach of the BoE might be a good proxy for the forecast accuracy with the CBE approach.

The remainder of this paper is organized as follows. Section 2 describes the data set of this study, and Section 3 presents test results for equal predictive accuracy of the BoE point and density forecasts for inflation and real output growth. Section 4 revisits the predictive content of the interest rate paths, and Section 5 concludes.

2. Data

There have been many changes in the interest rate assumptions for central banks’ forecasts. In Table 5 we show the history for selected central banks that have varied their assumptions in recent years. In general, central banks have tended to move away from the CIR approach towards the ME or the CBE approach. In some cases, the ME approach has turned out to be an intermediate step only on the way towards the CBE approach.

With respect to data availability, the BoE is a special case among the central banks considered. Since 1998, its quarterly Inflation Reports comprise two different forecasts for inflation and output growth, respectively, made by the Monetary Policy Committee (MPC) for up to eight quarters ahead. The difference between the forecasts is given by the underlying interest rate assumption. For one of the forecasts, nominal interest rates are assumed to be constant over the forecast horizon (CIR approach), whereas the other forecast is conditioned on an interest rate path that is based on market expectations about the future level of the official bank rate (ME approach). The forecast data are publicly available on the BoE website. The BoE has no clearly laid-out preference for one over the other interest rate assumption. With the Inflation Report of August 2004,

\[\text{\footnotesize \cite{ref}}\]
Table 1: Average of absolute differences between mean forecasts.

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<tr>
<td>mean of $</td>
<td>\pi^{CIR}_{t+h</td>
<td>t} - \pi^{ME}_{t+h</td>
<td>t}</td>
<td>$</td>
<td>0.000</td>
<td>0.003</td>
<td>0.008</td>
<td>0.017</td>
<td>0.031</td>
</tr>
<tr>
<td>mean of $</td>
<td>\gamma^{CIR}_{t+h</td>
<td>t} - \gamma^{ME}_{t+h</td>
<td>t}</td>
<td>$</td>
<td>0.007</td>
<td>0.025</td>
<td>0.044</td>
<td>0.070</td>
<td>0.102</td>
</tr>
<tr>
<td>mean of $</td>
<td>CIR_{t+h</td>
<td>t} - ME_{t+h</td>
<td>t}</td>
<td>$</td>
<td>0.083</td>
<td>0.147</td>
<td>0.228</td>
<td>0.325</td>
<td>0.396</td>
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however, the emphasis was slightly shifted towards the market-rate assumption.

A special feature of the Inflation Report forecasts, or, rather, MPC forecasts is that they are actually issued as density forecasts, using the two-piece normal distribution. The BoE reports the three location parameters mean, mode, and median along with measures of skew and uncertainty, from which the parameters of the forecast densities can be inferred, see Wallis (2004). The inflation forecasts will be evaluated based on the price indices targeted and forecast by the BoE. Before 2004, the relevant price index was the retail price index excluding mortgage interest payments, called RPIX in short. Since 2004, the forecast objective is the inflation rate of the all items consumer price index, abbreviated CPI. Real output growth realizations are those calculated for the seasonally adjusted GDP chained volume measure ABMI, taken from the BoE realtime database. We use the second vintage thereof, yielding observations up to 2010Q4 for the construction of forecast errors and determining the end of our data set. The forecast horizons under study range from 0 (the nowcast) to 8 quarters ahead.

The constant interest rate path used by the BoE corresponds to the level of the

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4 The UK’s Office for National Statistics (ONS) provides inflation figures for RPIX and CPI with one decimal place. To be closer to the two-decimal-place precision of the BoE inflation forecasts, we recalculate the annual changes of these indices.

5 The realtime database is available under [http://www.bankofengland.co.uk/statistics/gdpdatabase/](http://www.bankofengland.co.uk/statistics/gdpdatabase/).

6 In anticipation of the statistical inference conducted later in this study, we can state at this point that all test results are robust with respect to varying the real GDP vintage. For the price indices, there are no real-time data available. However, the RPIX figures are never revised, see for instance the discussion in Groen, Kapetanios and Price (2009). The CPI comprises only minimal revisions, as described by the ONS (2003).

7 The BoE has been publishing CPI inflation forecasts and real output growth forecasts made conditional on market rates for up to 12 quarters ahead since August 2004.
official bank rate (formerly the repo rate) in the mid-quarter months February, May, August and November, constantly written forth over the two-year horizon. The available market rates data begin in 2000Q1 and thus determine the start date of our data set. This date corresponds to the introduction of a new calculation method for market expectations of the BoE’s official bank rate, as stated in the August 2000 Inflation Report.\textsuperscript{8} Forecast errors of the interest rate paths are calculated by subtracting a quarterly average of the monthly interest rates from the respective interest rate forecast to account for potential interest changes within a quarter.

Figure 1 shows scatter plots of the interest rate data from 2000Q1 to 2010Q4 using all forecast horizons. The top panel plots the constant rate path against the quarterly average of the official bank rate. The constant rate path tends to overestimate the decisions about the official bank rate, which is basically a result from the financial crisis were interest rates were lowered dramatically. Constant rates are available in 25 basis-point steps only. Obviously, they are the same over all nine forecast quarters, thus the plot appears cleared up. The panel in the middle plots the market rate path against the quarterly average of the official bank rate decisions. They are much more dispersed than in the constant-rates plot, and the overestimation of the official bank rate appears more pronounced, as values under the 45-degree line imply. The bottom panel shows the constant path plotted against the market path. Overall, they are relatively close together, but deviate at low levels of the constant rate due to the market’s expectations of higher future interest rates in these instances.

Table 1 shows that, in general, the average absolute deviations between the constant-rate forecasts for inflation, $\pi_{CIR}^{t+h|t}$, and the market-rate mean forecasts for in-

\textsuperscript{8}The passage cites as follows: “Since the November 1999 Report, market expectations have been derived from interest rates on gilt-edged securities used as collateral in short-term sale and repurchase agreements and from the gilt-edged yield curve. These rates provide a more direct guide to market expectations of the future path of official interest rates.” The data are available at www.bankofengland.co.uk/publications/inflationreport/interest_rates.xls. Moreover, the calculation of the market rates path is changing from time to time to adjust to market conditions, as stated under http://www.bankofengland.co.uk/publications/inflationreport/conditioning_path.htm.
Table 2: Tests for equal predictive ability of Bank of England inflation and real output growth forecasts.

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<tr>
<td></td>
<td>n</td>
<td>44</td>
<td>43</td>
<td>42</td>
<td>41</td>
<td>40</td>
<td>39</td>
<td>38</td>
<td>37</td>
</tr>
<tr>
<td></td>
<td>d(\pi_{t+h</td>
<td>t})</td>
<td>0.000</td>
<td>0.002</td>
<td>0.009</td>
<td>0.014</td>
<td>-0.005</td>
<td>-0.042</td>
<td>-0.054</td>
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<td></td>
<td>(0.306)</td>
<td>(0.146)</td>
<td>(0.128)</td>
<td>(0.217)</td>
<td>(0.758)</td>
<td>(0.187)</td>
<td>(0.129)</td>
<td>(0.802)</td>
<td>(0.410)</td>
</tr>
<tr>
<td></td>
<td>d(f(\pi)_{t+h</td>
<td>t})</td>
<td>-0.000</td>
<td>-0.006</td>
<td>-0.012</td>
<td>-0.018</td>
<td>0.000</td>
<td>0.033</td>
<td>0.042</td>
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<tr>
<td></td>
<td>(0.306)</td>
<td>(0.093)</td>
<td>(0.163)</td>
<td>(0.205)</td>
<td>(0.990)</td>
<td>(0.393)</td>
<td>(0.330)</td>
<td>(0.781)</td>
<td>(0.634)</td>
</tr>
<tr>
<td></td>
<td>d(y_{t+h</td>
<td>t})</td>
<td>0.008</td>
<td>0.009</td>
<td>-0.032</td>
<td>-0.083</td>
<td>-0.148</td>
<td>-0.117</td>
<td>-0.088</td>
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<tr>
<td></td>
<td>(0.334)</td>
<td>(0.613)</td>
<td>(0.367)</td>
<td>(0.466)</td>
<td>(0.440)</td>
<td>(0.483)</td>
<td>(0.509)</td>
<td>(0.425)</td>
<td>(0.226)</td>
</tr>
<tr>
<td></td>
<td>d(f(y)_{t+h</td>
<td>t})</td>
<td>-0.008</td>
<td>-0.005</td>
<td>0.021</td>
<td>0.040</td>
<td>0.056</td>
<td>0.027</td>
<td>0.013</td>
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<tr>
<td></td>
<td>(0.277)</td>
<td>(0.766)</td>
<td>(0.503)</td>
<td>(0.588)</td>
<td>(0.597)</td>
<td>(0.712)</td>
<td>(0.782)</td>
<td>(0.501)</td>
<td>(0.248)</td>
</tr>
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Note: Figures in parentheses are p-values for t test statistics using Newey-West (1987) standard errors. The truncation lag is chosen based on the procedure proposed by Andrews (1991). The number of observations is denoted by n.

Inflation, \( \pi_{t+h|t}^{ME} \), are not very large. \( \pi_{t+h|t}^{CIR} \) and \( \pi_{t+h|t}^{ME} \) denote the mean inflation forecast made in period t for period \( t+h \) based on the CIR approach and on the ME approach, respectively. The average absolute deviations steadily increase over the forecast horizon, consistent with the view that interest changes affect inflation with a considerable delay only. For the inflation forecasts, the average absolute deviation attains up to 18 percentage points at the policy horizon of 8 quarters. For the two series of output growth forecasts, \( y_{t+h|t}^{CIR} \) and \( y_{t+h|t}^{ME} \), the average absolute deviations are higher for \( h = 0, \ldots, 7 \) than those for inflation, but slightly smaller for \( h = 8 \). The average absolute deviations of the two interest rate paths CIR and ME also increase along the forecast horizons, reaching around 73 basis points for \( h = 8 \).

### 3. Testing For Equal Predictive Accuracy

In this section, we try to compare the predictive accuracy of the forecasts based on the ME and the CIR approach. These forecasts can probably be thought of as coming from nested models, where the forecasts with the ME approach employ the larger model. The CIR approach would then correspond to the ME approach with those parameters set to zero which are related to forward rates. However, the forecast model itself is not
available to us, so that its population-level predictive accuracy cannot be evaluated. However, the test for finite-sample predictive accuracy by Giacomini and White (2006) can be employed, assuming that the BoE forecasting models are subject to non-vanishing parameter estimation uncertainty. Put differently, this test is valid if the BoE does not expand the size of the estimation window over time.

Concerning the point forecasts, in the following analysis we concentrate on the means of the forecast series. Moreover, as also noted by Mitchell and Wallis (2011), the framework of Giacomini and White (2006) is general enough to encompass density forecasts. Therefore, we also evaluate the competing density forecasts for inflation and for real output growth based on their logarithmic scores.

Let \( d(x_{t+h|t}) \equiv (x_{t+h|t}^{CIR} - x_{t+h})^2 - (x_{t+h|t}^{ME} - x_{t+h})^2 \) denote the difference in the squared forecast errors of the two competing mean forecasts for the variable \( x \), made at time \( t \) for period \( t+h \). Superscript \( CIR \) again indicates that the original forecast series is based on the constant-rate assumption, while \( ME \) implies the market-rate assumption, and \( x_{t+h} \) denotes the realization. Furthermore, let \( d(f(x)_{t+h|t}) \equiv \log(f_{t+h|t}^{CIR}(x_{t+h})) - \log(f_{t+h|t}^{ME}(x_{t+h})) \) be the difference in the logarithmic scores of the two competing density forecasts. The score is the value of the forecast density made in \( t \) for \( t+h \) at the value of the realization \( x_{t+h} \). We calculate the differences \( d(x_{t+h|t}) \) and \( d(f(x)_{t+h|t}) \) for both inflation and real output growth. To conduct a Giacomini and White (2006) test, we simply regress the respective differences on a constant. An estimate of the constant being significantly different from zero implies the rejection of the null of equal predictive accuracy of the two competing forecasts. If forecasts based on market interest rates are more precise, \( d(x_{t+h|t}) \) is expected to be positive and \( d(f(x)_{t+h|t}) \) to be negative.

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9 See Clark and McCracken (2010) for a survey on forecast evaluation methods.  
10 Probably, none of the estimation schemes typically considered in the literature (recursive, rolling, fixed) exactly corresponds to the approach of practitioners. Rather, practitioners might switch between the schemes, with their choice depending on structural breaks and data availability. For example, the estimation window might expand for some time and then be reduced again, because data prior to a structural break is discarded. Therefore, asymptotically, the assumption of non-vanishing estimation uncertainty required for the testing framework of Giacomini and White (2006) is probably justified here, even if neither the rolling nor the fixed scheme are used.
Before turning to the test results, it is instructive to take a look at the differences between the mean forecasts which are caused by the different interest rate assumptions. Figure 2 plots constant-rate and market-rate mean forecasts for inflation, real output growth and their underlying interest rate paths. The three panels of the left side show forecasts for one year ahead, i.e. for \( h = 4 \). A difference in the forecasts itself is hardly detectable for the inflation forecast, as the congruent graphs and the area plot around zero show. For real output growth, though, the deviations are slightly larger, with the dashed line of the market-rate forecast running below the solid line of the constant-rate forecast most of the time. Yet, the differences between the constant-rate path and the market-rate path for \( h = 4 \) are rather pronounced, as the findings of Table 1 already showed. In the plots for the policy horizon, i.e. for \( h = 8 \), the differences are apparently larger, both for the inflation and the real output growth forecasts, being in line with the view that monetary policy affects these variables with strong lags only. The market-rate forecast falls short of the constant-rate forecast for most of the time, in particular at the end of the sample. This results from the fact that the market path is on average above the constant path for \( h = 8 \). At the end of the sample, the official bank rate was not operational as policy instrument. Thus, the constant-rate path derived from the official bank rate remains at its suspended level, while the market expectations already incorporate a picking-up in interest rates.

The results for the inflation mean forecasts, based on quadratic loss, are shown in the top panel of Table 2. Although, according to Figure 2, differences between the mean forecasts based on different interest assumptions are noticeable at least for larger forecast horizons, the regression exercise fails to detect any statistical differences in the performance of these forecasts at the conventional 5% level. The magnitude of the \( p \)-values shows no specific pattern of increment. The same holds for the inflation density forecasts, based on log scores. When considering the results for the real output growth mean point forecasts, no significant difference in the performance of these forecasts is
Table 3: Correlation coefficients and root mean squared forecast errors for the interest rate data.

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<tbody>
<tr>
<td></td>
<td>CIR(_{t+h</td>
<td>t}, i_{t+h})</td>
<td>1.00</td>
<td>0.97</td>
<td>0.88</td>
<td>0.76</td>
<td>0.62</td>
<td>0.44</td>
<td>0.24</td>
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<tr>
<td></td>
<td>MR(_{t+h</td>
<td>t}, i_{t+h})</td>
<td>1.00</td>
<td>0.96</td>
<td>0.89</td>
<td>0.81</td>
<td>0.70</td>
<td>0.54</td>
<td>0.34</td>
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<tr>
<td></td>
<td>CIR(_{t+h</td>
<td>t}, ME_{t+h</td>
<td>t})</td>
<td>0.99</td>
<td>0.99</td>
<td>0.98</td>
<td>0.97</td>
<td>0.95</td>
<td>0.92</td>
</tr>
<tr>
<td></td>
<td>root mean squared forecast errors</td>
<td>CIR(_{t+h</td>
<td>t})</td>
<td>0.06</td>
<td>0.47</td>
<td>0.87</td>
<td>1.20</td>
<td>1.50</td>
<td>1.77</td>
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<tr>
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<td>ME(_{t+h</td>
<td>t})</td>
<td>0.14</td>
<td>0.50</td>
<td>0.84</td>
<td>1.13</td>
<td>1.44</td>
<td>1.74</td>
<td>2.00</td>
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<td>relative RMSFE</td>
<td>0.41</td>
<td>0.93</td>
<td>1.04</td>
<td>1.06</td>
<td>1.04</td>
<td>1.02</td>
<td>1.01</td>
<td>1.00</td>
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detectable, either. The p-value attained for two years ahead is the smallest, but with a magnitude of 0.226 beyond any reasonable significance level. The results for the density forecasts of real output growth are similar, with no rejections of the null of equal predictive accuracy, regardless of the horizon considered. Thus, surprisingly, the interest rate assumption does not seem to affect forecast accuracy.

4. Predictive Accuracy Revisited: The Interest Rate Paths

The results of Section 3 are in stark contrast to what one would expect, because conditioning on the market-rate path is supposed to deliver a more accurate description of future economic dynamics. The most obvious reason for these results would thus be a lack of forecast accuracy of the market rate path itself. Goodhart and Lim (2011) actually find that UK interest rate forecasts for more than two quarters ahead have essentially no predictive power.

Table 3 reports correlation coefficients for the interest rate series. For the current quarter and up to three quarters ahead, both the CIR path and the ME path are highly correlated with the bank rate. The correlation of the CIR path and the official bank rate steadily declines and is basically zero for seven quarters out. For \( h = 8 \), the correlation becomes negative with a value of \(-0.31\). Similarly, the correlations of the ME path with the official bank rate decline over the forecast horizons. The figures, however, are
always higher than those of the CIR path/bank rate correlations, as one would expect. Nonetheless, the ME path/bank rate correlation at the policy horizon is negative, too. Both interest rate paths imply similar root mean squared forecast errors.

To check whether these findings translate into the inference on forecast accuracy, we conduct tests of equal predictive accuracy of the constant- and the market-rate path. For this purpose, we define the difference in the squared forecast errors of the interest rate paths by 

\[ d(i_{t+h|t}) \equiv (CIR_{t+h|t} - i_{t+h})^2 - (ME_{t+h|t} - i_{t+h})^2, \]

where \( i_{t+h} \) denotes the quarterly average of the official bank rate. Test results are shown in Table 4. It turns out that, indeed, one cannot detect a significant difference between these paths for any forecast horizon, with \( p \)-values for \( h = 0, 1, 2 \) of around 0.3 being the smallest, but for other forecast horizons being much larger, culminating in 0.97 for seven quarters out. Thus, while the market rate path is more strongly correlated with the observed interest rates according to Table 3 and mostly has lower root mean squared forecast errors, this does not manifest itself in the form of statistically superior forecast accuracy.

Since the forecast accuracy observed for the market-rate path of the BoE is likely to be a good proxy for the forecast accuracy with the CBE approach, it is doubtful whether this result would change even if one compared forecasts conditional on the constant rate path to the unconditional forecasts using the interest rates expected by the central bank itself. This supposition is reinforced by the fact that Goodhart and Lim (2011) find limits to forecast accuracy for the interest rate forecasts of the Reserve Bank of New Zealand (i.e. the interest rate under the CBE approach) which are very

| Table 4: Tests for equal predictive ability of Bank of England interest rate paths. |
|-----------------------------------|---|---|---|---|---|---|---|---|---|
| \( h \) | 0  | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  |
| \( n \) | 44 | 43 | 42 | 41 | 40 | 39 | 38 | 37 | 36 |
| \( d(i_{t+h|t}) \) | -0.017 | -0.032 | 0.053 | 0.166 | 0.188 | 0.120 | 0.047 | 0.025 | 0.082 |
| (0.309) | (0.288) | (0.267) | (0.460) | (0.689) | (0.853) | (0.943) | (0.965) | (0.878) |

Note: Figures in parentheses are \( p \)-values for \( t \) test statistics using Newey-West (1987) standard errors. The truncation lag is chosen based on the procedure proposed by Andrews (1991). The number of observations is denoted by \( n \).
similar to those of the market rates for the BoE.

One might argue that the sample under study is simply too small in order to find significant differences between the forecasts conditioned on constant or on market rates. Yet, if ten years of data are not enough to detect such differences, it seems that the relevance of the conditioning assumption is very limited, at least empirically.

5. Conclusion

The choice of the interest rate path underlying the forecasts of central banks has been intensively discussed in the economic literature. From a theoretical point of view, the CBE approach appears to be the preferred option. The ME approach is considered second-best, and the CIR approach ranks last.

Empirical studies concerning the choice of the interest rate assumption have hardly been conducted. In this work, we attempt to rank the ME approach and the CIR approach with respect to their effects on forecast accuracy. From a theoretical point of view, the ME approach should clearly lead to higher accuracy. The inflation and output forecasts by the BoE turn out to be ideal candidates for this comparison, because the BoE publishes forecasts for both approaches. The forecast accuracy under the ME approach could be considered as a proxy for forecast accuracy under the CBE approach according to the results of Andersson and Hofmann (2009).

In stark contrast to our expectations, we find no evidence that the performance of forecasts made conditional on a constant rate assumption differs significantly from those of forecasts made conditional on a market rate assumption. These results hold for the mean forecasts as well as for the density forecasts. The reason for these results might be given by the fact that the predictive accuracy of constant and market interest rates does not differ significantly, either.

We conclude that, while the choice of the interest path for central bank forecasts might be an important concern from a theoretical point of view, its empirical relevance appears to be very limited.
References


URL: http://ideas.repec.org/p/fip/fedlwp/2010-031.html


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Note: The above categorization is based on references and quotations shown in Appendix A.  
* Based on Reifschneider and Tulip (2007) and Goodhart (2009).  
*** Including scenario analyses using market rates.
Figure 1: Scatter plots with 45-degree line of constant interest rate paths, market interest rate paths and quarterly averages of the official bank rate.


X-axis: Constant interest rate path. Y-axis: Market interest rate path.
Figure 2: Plots of inflation mean forecasts, real output growth mean forecasts and the corresponding interest rate paths.

Inflation forecast for $h = 4$: constant-rate forecast (solid), market-rate forecast (dashed), difference between both (area)

Inflation forecast for $h = 8$: constant-rate forecast (solid), market-rate forecast (dashed), difference between both (area)

Real output growth forecast for $h = 4$: constant-rate forecast (solid), market-rate forecast (dashed), difference between both (area)

Real output growth forecast for $h = 8$: constant-rate forecast (solid), market-rate forecast (dashed), difference between both (area)

Interest rate path for $h = 4$: constant rates (solid), market rates (dotted), difference between both (area)

Interest rate path for $h = 8$: constant rates (solid), market rates (dotted), difference between both (area)
A. Central Bank Statements on Forecast Conditioning

Assumptions

Banco Central Do Brasil

- First report available is from September 1999 ("Inflation Report") and states on p.79 that “Normally, the Inflation Reports will issue two fan charts. The first and most important is constructed on the assumption of a constant nominal interest rate over the course of the projection period, while the second is accessory by nature and is based on the assumption that the nominal interest rate will be that built-into market expectations.”

Banco Central de Chile

- Reports available since May 2000 ("Monetary Policy Report")
- CIR for reports of May 2000 to May 2004. For instance, the report of September 2000, p.8, states that “Confidence intervals [...] summarize the Central Bank’s risk assessment for future economic growth, on the assumption that the monetary policy rate will remain at UF + 5.0% over the next two years.”
- ME assumption since report of September 2004, p.63: “This section presents the Board’s recent evaluation of Chile’s economic prospects for the next two years, including the analysis and the decisions made during the last monetary policy meeting of 7 September 2004. It provides projections for the most likely course of inflation and economic growth, and examines the main risks. These projections are based on the methodological assumption that the monetary policy rate will reflect a gradual decline in the monetary impulse in coming years, consistent with achieving the inflation target focused on 3% and which is comparable to trends deduced from financial asset prices. Projections are also conditional on a series of developments that make up the baseline, or most likely, scenario. New information will modify this scenario and associated projections. Forecasts are presented in the form of confidence intervals, to reflect the future risks to monetary policy.”
- Also variations are reported, e.g. in the report of May 2009, p.23: “The projections used in this Report are based on the working assumption that, in the short term, the MPR path will be similar to what can be inferred from financial asset prices on 8 May 2009. However, toward the end of the projection horizon, the MPR path will be lower than the trend being signaled by these prices.”

Bank of England

- Reports are available since 1997 ("Inflation Report")
• CIR inflation forecasts since 1993 are available in a spreadsheet format under www.bankofengland.co.uk/publications/inflationreport/irprobab.htm

• The report of February 1998 states on p. 42 that
  “The projection for inflation is based on the assumption that official interest rates will remain unchanged at 7.25% during the next two years. The projection was agreed by the Monetary Policy Committee (MPC) on 5 February. In addition, for the first time, a new projection is presented under the assumption that official interest rates follow market expectations over the next two years.”

Bank of Japan

• Reports available since October 2000 (“Outlook and Risk Assessment of the Economy and Prices”, since April 2004 “Outlook for Economic Activity and Prices”)

• CIR assumption in early days, for instance in October 2000 (only available online under http://www.boj.or.jp/en/mopo/outlook/gor0010.htm/:
  “The forecasts of Policy Board members are based on the assumption that there will be no change in monetary policy. Forecasts of the majority of Policy Board members are shown as a range with the highest and lowest figures excluded. If there are multiple highest and/or lowest figures, only one from either end is excluded.”

• Switch from CIR to ME assumption made with report of April 2006, p.8:
  “Individual Policy Board members make the above forecasts with reference to market participants’ view regarding the future course of the policy interest rate that is incorporated in market interest rates. Their forecasts made in October 2005 were based on the assumption that there would be no change in monetary policy.”

• Example of ME assumption in report of October 2011, p.17:
  “Individual Policy Board members make their forecasts with reference to the view of market participants regarding the future course of the policy interest rate - a view that is incorporated in market interest rates.”

Board of Governors of the Federal Reserve System

• The conditioning assumptions of the Fed are not entirely clear.

• Reifschneider and Tulip (2007), pp.12-13, state that Greenbook based on interest rate assumptions, while FOMC projections are made rather on a CBE assumption:
  “A final issue of comparability concerns the conditionality of forecasts. Currently, each FOMC participant conditions his or her individual projection on “appropriate monetary policy”, defined as the future policy most likely to foster trajectories for output and inflation consistent with the participant’s interpretation of the dual mandate. Although the definition of “appropriate monetary policy” was less explicit in the past, Committee participants presumably had a similar idea in mind when making their forecasts historically. Whether or not the other forecasters in our
sample generated their projections on a similar basis is unknown, but we think it reasonable to assume that most sought to maximize the accuracy of their predictions and so conditioned their forecasts on their assessment of the most likely outcome for monetary policy. However, this assumption is not valid for the Greenbook projections. Through most of the 1990s, the Federal Reserve staff conditioned its forecasts on a roughly flat path for the federal funds rate. This practice meant that real activity and inflation might evolve over the projection period in a way that was potentially inconsistent with the FOMC’s policy objectives and, therefore, unlikely to occur. That is, the staff took the approach over much of our sample period of designing its forecasts not to maximize forecasting accuracy but instead to inform the FOMC about the potential consequences of unchanged policy. Thus, the Greenbook’s historical forecast errors may tend to overstate the uncertainty of the outlook to some degree.”

- The “Semianual Monetary Policy Report to the Congress” of February 2007 names for the first time the term “appropriate monetary policy” which is likely to correspond to a CBE assumption (available online under http://www.federalreserve.gov/newsevents/testimony/bernanke20070214a.htm: “The central tendency of those forecasts - which are based on the information available at that time and on the assumption of appropriate monetary policy–is for real GDP to increase about 2-1/2 to 3 percent in 2007 and about 2-3/4 to 3 percent in 2008.”

- Goodhart (2009), p.87, finds that “For simplicity, most MPCs initially chose constant future policy interest rates, from the latest available level, as their main framing assumption. Occasionally, such an assumption would have been grossly at odds with perceived reality, as in the case of the United States from 2004 until early 2006, when the explicit position of the Federal Open Market Committee (FOMC) was for there to be a “measured increase” in policy rates over time. In that case, the Greenbook conditioning assumption, which has also been usually for constant rates,3 is widely believed to have been changed, but the degree of secrecy, and length of lag before publication (five years), means that we will not have confirmation of this for some time.”

European Central Bank

- The ECB in “A Guide to Eurosystem Staff Macroeconomic Projection Exercises” of June 2001 states on p.7 the CIR assumption: “The projections are based on the technical assumption that three-month interest rates in the euro area remain constant over the horizon of the projection.”

- Publication of June 2006 staff projections, p.1, available online under http://www.ecb.int/pub/pub/mopo/html/index.en.html?skey=staff+macroeconomic+projections, has the ME assumption underlying: “For the first time, the Eurosystem projections are based on the technical assumption that short-term market interest rates move in line with market expectations
rather than, as previously assumed, remain constant over the projection horizon. This change is of a purely technical nature. It was introduced in order to further improve the quality and the internal consistency of the macroeconomic projections and does not imply any change in the ECB’s monetary policy strategy or in the role of projections within that strategy.”

Magyar Nemzeti Bank

- Reports available since June 2000 ("Report on Inflation")
- MNB has moved from CIR assumption to CBE assumption, as stated in the report of March 2011 on p. 15:
  “Starting in March 2011, the staff of the national Bank of Hungary moved on to the preparation of a forecast with endogenous policy rate path from former forecasts with unchanged policy rate. The change is in line with the practice of inflation targeting central banks, the majority of which also having shifted to forecasts with endogenous policy rate path.”

Reserve Bank of Australia

- Switch from CIR to ME assumption with “Statement on Monetary Policy” of August 2009:
  “The forecasts presented below are based on the assumption that the exchange rate remains around its current level and that oil prices move broadly in line with near-term futures pricing. In previous Statements the forecasts were prepared using the additional technical assumption that the cash rate remained constant throughout the forecast period. In the current environment, however, it is not particularly realistic to assume that the cash rate remains at the historically low level of 3 per cent out to the end of 2011. Given this, the current forecasts have been prepared on the technical assumption of a return towards a more normal setting of monetary policy over the forecast horizon. This use of a more realistic technical assumption by the Bank staff in no way constitutes a commitment by the Board to a particular future path of the cash rate.”

Reserve Bank of New Zealand

- In the Reserve Bank of New Zealand Bulletin 65 No. 2 of June 2002, the article by Hampton (2002) states on p.6:
  “In order to understand our preference for using an endogenous interest rate path, it is intuitive to refer to the period prior to our use of the endogenous policy reaction
function. Up until 1997, the projections used in policy evaluation and in the Bank’s publications were conventional constant interest rate projections. Interest rates and the exchange rate were generally held constant throughout the projection horizon at the values prevailing at the time the forecasts were prepared.”

Sveriges Riksbank

  “The assessment of inflation in the coming years is presented in this chapter, together with some conceivable alternative paths. […] A technical assumption for the assessment is that economic policy remains unchanged.”

- Example from report of December 2002, p. 46 hints at scenario analysis with ME assumption:
  “In the Riksbank’s main scenario […], inflation is forecast as usual on the technical assumption that the repo rate will be unchanged at the present level of 4.0 per cent; this serves to bring out the consequences for the formation of monetary policy. An illustrative calculation is therefore presented here that incorporates a path for the repo rate that is in line with market expectations as reported in the survey that Prospera undertook on behalf of the Riksbank in November 2002."

- Switch to ME assumption with report 2005:3, p.5, of October 2005:
  “The analyses in the Report’s main scenario to date have been based on the assumption that the repo rate remained constant for the coming two years. In this Report the forecasts in the main scenario are based instead on the assumption that the repo rate evolves in line with financial market expectations, as reflected in implied forward interest rates. These forecasts extend three years ahead. One advantage of such an assumption is that it normally provides a more realistic picture of future monetary policy. Another benefit is that it makes it easier to compare the Riksbank’s forecasts with those of other forecasters. Moreover, it facilitates evaluations of the forecasts. One advantage of extending the forecast horizon is that it gives a clearer idea of how inflation is being influenced by various temporary shocks.”

- Explanations on the entire strategy are provided in the Monetary Policy Report 2007/1 of February 2007 in a box starting on p. 19:
  “Up to the autumn of 2005, the Riksbank based its forecasts in the main scenario on the assumption that the repo rate remained constant during the forecast period. This made it easy for the Riksbank to communicate, which was particularly important when establishing the new monetary policy regime and building up credibility for the inflation target. At the same time, it was mostly an unrealistic assumption that made it difficult to make good forecasts. Moreover, it gave no clear guidance as to how the Riksbank viewed future interest rate developments. This was a disadvantage since the general public’s and the markets’ expectations of the future
interest rate path are just as important for the way monetary policy influences the economy as the expectations regarding the decision on the current level of the interest rate. These problems diminished when the Riksbank began making forecasts based on market expectations, as reflected in implied forward rates (Footnote: Between 1999 and 2003, the Riksbank published alternative inflation forecasts based on repo rate expectations in market surveys. The Riksbank’s decision to publish its own forecasts for the repo rate is a further step towards greater clarity. Market expectations do not necessarily reflect the considerations that form the basis for monetary policy decisions. By making its own forecasts for the repo rate, the Riksbank can explain more clearly to the general public and the financial markets how it envisages future interest rate developments and how it reasons when making monetary policy decisions. It is also natural in forecasting work to treat the repo rate as one forecast variable among others."

Swiss National Bank

- SNB has introduced the CIR assumption in 1999 and has since not changed it


- The Quarterly Bulletin of December 2011 reports on p.7 that “These forecasts are based on the assumption of a constant three-month Libor of 0% over the entire twelve-month forecast horizon and implies a depreciating Swiss franc.”