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How forward looking are central banks?
Some evidence from their forecasts

Michał Brzoza-Brzezina, Jacek Kotłowski, Agata Miśkowiec

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Michał Brzoza-Brzezina – National Bank of Poland and Warsaw School of Economics;
Email: michal.brzoza-brzezina@nbp.pl

Jacek Kottowski – National Bank of Poland and Warsaw School of Economics; Email: jacek.kotlowski@nbp.pl

Agata Miśkowiec – Warsaw School of Economics; Email: agata.miskowiec@gmail.com

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Abstract

We estimate forward-looking Taylor rules on data from macroeconomic forecasts of three central banks (Bank of England, National Bank of Poland and Swiss National Bank) in order to determine the extent to which these banks are forward looking in their monetary policy decisions. We find that all three banks are to some extent forward-looking, however to a varying degree. With respect to inflation, the NBP and the SNB look far into the future, while the BoE seems to concentrate on current inflation. As to output, the BoE and the SNB take into account its future or current value while for the NBP this variable is insignificant. We also find that central banks prefer to concentrate on one particular horizon rather than take into account the whole forecast.

JEL: C25, E52, E58

Keywords: Taylor rule, forward-looking monetary policy, feedback horizon

1 Introduction

According to most central bankers and many academics, efficient monetary policy should be forward-looking. Such monetary policy is able to better stabilize output and inflation fluctuations (Rudebusch and Svensson (1998), Bernanke, Labauch, and Mishkin (1999)). This observation has even led to suggestions that central banks should explicitly adjust interest rates to deviations of forecasted output and inflation from targets (Svensson (1997)).¹

Central banks have claimed for many years that they conduct monetary policy in a forward-looking way. In order to convince the public that this is the case they publish inflation reports, minutes of decision-makers' meetings and, in particular, macroeconomic forecasts (including inflation, GDP and sometimes the interest rate path). Especially publishing inflation forecasts - which often are *de facto* intermediate targets for monetary policy - has become a common practice. Mishkin and Schmidt-Hebbel (2001) and Fracasso, Genberg, and Wyplosz (2003) listed central banks that failed to fulfil that unwritten rule. Today, each bank from their lists publishes a macroeconomic forecast.

Things become less clear when it comes to decide how forward-looking central banks should be and how far they look indeed into the future. As to the first question, the literature is vast. Several theoretical studies have been conducted, analysing the performance of monetary policy rules with various horizons. Batini and Haldane (1999) estimated the optimal forecast horizon (according to their definition - one that is securing as good inflation as any other, while at the same time delivering significantly lower output variability) to be between three and six quarters ahead. They also noticed that the greater the degree of forward-lookingness of the private sector, the smaller the compensating need for forward-looking behaviour on the part of the central bank. Consistently, Batini and Nelson (2000) found that for the Bank of England the optimal feedback horizon ranges from 2 quarters if agents other than the central bank are assumed to be forward-looking, up to 15 quarters in models with no forward-looking behaviour in the economy. In case of the Czech Republic, Strasky (2005) found that the Czech National Bank's optimal targeting horizon was three quarters.

At the same time however, Batini and Pearlman (2002) used a New Keynesian closed economy model to show that long inflation feedback horizons can lead to

¹Still, it should be mentioned that a part of the theoretical literature questions the benefits of forward-looking behaviour (Clarida, Gali, and Gertler, 2001; Woodford, 2000). Leitemo (2008) shows in a new Keynesian model that if agents are forward looking the central bank should be backward looking and vice versa.

indeterminacy. The same was proved for open economy models (Batini, Levine, and Pearlman (2004)). However, in spite of the numerous studies on the subject, no consensus over the question how forward-looking central banks should be has been reached. Commenting on the literature on optimal policy horizons Goodhart (2001) suggested that the selection of monetary policy horizons is so model specific that little advance can be made unless such studies apply the context of monetary policy as found in practice.

As to the second question, i.e. how far in practice central banks look into the future while setting interest rates, there is substantially less evidence. Central banks themselves usually avoid pointing at particular horizons at which they target inflation or output. They prefer to provide this information indirectly, e.g. stating that they intend to bring inflation to target in the medium term. The medium-term orientation of the European Central Bank's monetary policy was emphasized at the start of Stage Three of European Monetary Union (see e.g. ECB (2011)). As explained by Trichet (2003), the medium-term orientation clarifies that there is no fixed time horizon over which price stability has to be re-established. It gives the ECB the flexibility to vary the appropriate monetary policy horizon and adapt it to the nature of the shock the bank responds to.

Only few central banks committed (in an explicit or implicit way) to specific targeting horizons. For example, the Reserve Bank of New Zealand (after problems with hitting the inflation target in 1998 and 1999) has modified its inflation targeting regime to lengthen the horizon over which it tries to achieve its inflation target to 6-8 quarters (Drew and Orr (1999)). The Bank of England used to have a policy horizon of two years (King (1997)). Even less is said about the horizon at which monetary authorities care about output fluctuations. In empirical papers gauging optimal policy horizons, focus tends to be on inflation forecasts horizons, while output values are limited to current ones (like in the framework presented by Rudebusch and Svensson (1998)). In particular, to our best knowledge, no paper has tried to exploit the evidence implicit in central banks' own macroeconomic forecasts. This study tries to fill this gap.

We collect data on macroeconomic projections of three central banks - the Bank of England (BoE), the National Bank of Poland (NBP) and the Swiss National Bank (SNB) and use them to recover the horizon at which these banks look at future inflation and output. The choice of central banks is determined by the availability of a sufficient number of projections based on the assumption of constant interest rates during the projection horizon.

Our findings are the following. First, the NBP and SNB are clearly forward looking with respect to inflation - both look at the last quarter of their forecasts. Surprisingly, we do not find such evidence for the BoE, where our models point at current inflation being most important.

Less evidence is available with respect to the relevant forecast horizons for output. According to our findings, the BoE targets output one quarter ahead and the NBP does not take it into account at all. The SNB seems to look at current output, but due to data limitations this result should be interpreted with caution.

Finally, to our surprise we find little evidence that monetary authorities take into account (even with varying weights) their whole forecasts. In contrary, the evidence speaks clearly for concentrating strongly on one particular horizon.

The rest of the paper is organised as follows. In section two we describe the data and the econometric approach. In section three we present the results, in section four the conclusions.

2 Data and model

2.1 Data

We use data from macroeconomic forecasts of three central banks - Bank of England, National Bank of Poland and Swiss National Bank. The choice of banks was based on twofold criteria. First, we selected central banks that applied inflation targeting or a similar strategy (the SNB has a two pillar strategy²). Subsequently, the number of short-listed banks had to be restricted due to the availability of a sufficient number of projections based on the assumption of constant interest rates during the projection horizon.

As already mentioned, our attention concentrates on forecasts based on the assumption of constant interest rates (so called conditional forecasts). These seem best suited to conduct our study, since they show explicitly the consequences of not changing the interest rate. If following such a forecast the central bank changes the interest rate it is relatively easy (from the econometric point of view) to figure out which forecast horizon triggered this decision. On the other hand, forecasts based on interest rates expected by financial markets or the endogenous interest rate could be misleading. To see this, consider the central bank's own interest rate forecast (endogenous interest rate). If the central bank aims at bringing inflation back to target in n quarters, one can expect the forecasted interest rate to bring inflation (forecast) back to target at this horizon. Hence, at this particular horizon the inflation gap would be closed and unable to explain why the central bank changed interest rates.

Estimation is based on quarterly data. The sample ends in 3Q 2011. For the BoE there were 59 observations available (1Q 1997 - 3Q 2011), for the SNB - 42 (4Q1999 - 3Q 2011) and for the NBP 26 (3Q 2004 - 3Q 2011). Since in case of the SNB and NBP for a certain period of time projections have been published twice (SNB) or three times a year (NBP) some observations were missing. Projection horizons are presented in Table 1.

Dealing with the data, we had to solve two important problems. The first one was related to the time varying horizon of the NBP forecast. The projection always covers the current calendar year and two subsequent years. Such a rule raised the question whether the Monetary Policy Council (assuming it looks far into the future) looks at a fixed quarter (e.g. 8th) or the last quarter of

²See Baltensperger, Hildebrand, and Jordan (2007). In the last quarter of our sample the SNB decided to peg its currency and, hence abandoned its independent monetary policy regime.

projection, which is time varying. To solve this problem and to ensure a fixed forecast horizon, necessary for estimation purposes, we decided to aggregate the forecasts beyond the 7th quarter as a simple average of forecasts from the 8th to the last quarter.

The second problem was that the SNB does not publish GDP forecasts. In order to keep the study coherent we decided to generate a GDP forecast for Switzerland and use it in our estimations. The forecast was obtained from a VAR estimated in real time. Of course using the VAR forecast limits the information content of GDP projections in the Swiss case, and we interpret the related part of our findings with much caution.

Before moving to the estimation procedure, the data was transformed. First, inflation was corrected for the central bank target. This is especially important in case of the BoE, where the target has been changed in 2004 (see Table 2). Second, we demeaned the GDP forecast, thus obtaining a proxy for the output gap.

The dependent variable in our model was based on the change of the central bank instrument. For the analysed central banks the standard instrument was the short-term interest rate, and this is our main variable of interest. However, investigating monetary policy conducted by the BoE and the SNB, in the last period of the sample we encountered the zero lower bound problem. Despite of forecasts showing a strongly negative output gap and/or inflation below target, both central banks were unable to lower the nominal interest rate below zero to ensure an adequate level of real interest rates.

For that reason the BoE and SNB decided to apply alternative monetary policy instruments. The SNB conducted massive interventions on the foreign exchange market to limit the pressure on the appreciation of the Swiss franc and finally decided to peg the Swiss franc to the euro in September 2011. The BoE launched the Asset Purchase Facility Programme (also called quantitative easing - QE) consisting of purchasing government and corporate bonds. According

Table 1: Time horizon of central banks' inflation and GDP projections (in quarters)

Central bank	inflation	GDP
BoE	8	8
SNB	12	12
NBP	8-11	8-11

to BoE reports the programme has some impact on the level of the yield curve leading to lowering medium- and long-term interest rates and increasing inflation expectations. For that reason we decided to include the QE programme in our research. The most substantial movements of the yield curve were observed at the date of announcing the QE programme and at the times, when the extensions of the programme were decided upon. The programme has been launched in March 2009 with a limit of £75 billion of assets over three months funded by central bank reserves. It has been expanded on three occasions - in May, August and November 2009 to £125, £175 and £200 billion respectively (Joyce, Lasasosa, Stevens, and Tong (2010)). We denoted the MPC meetings, when the introduction and the expansions of the APF were announced as monetary policy easing analogously to interest rate decreases. For the SNB such a straightforward procedure was not possible because the bank has not announced officially neither ex-ante nor ex-post the scale and timing of interventions. For that reason we didn't include the interventions in our analysis. We interpreted, however the pegging of the Swiss franc as monetary policy easing and we included this event in our research.

Monetary policy decisions are most commonly made on monthly basis³, while inflation reports containing macroeconomic forecasts are issued at lower frequency. We assumed that the current forecasts influence not only the decision made during the meeting next to the forecast release but also the decision made during the meeting in the subsequent month. It might have been possible that strong uncertainty about the current situation in the financial sector or on the F/X market didn't allow the central bank to react immediately to the forecast. Moreover the starting point of the projection (current quarter) is often estimated on the basis of monthly data and the release of the true quarterly data or even broader monthly data set may increase the credibility of the projection.

Therefore we set the dependent variable as follows. If the central bank raised (lowered) the rate during the meeting next to the forecast release or/and during the next meeting we assume the bank tightened (loosened) policy in reaction to the forecast. If the bank didn't change rate during both meetings we coded it as no policy change. This rule applies to both the BoE and NBP. The SNB usually makes the decisions on quarterly basis following the publication of the forecast⁴, so there was no need to modify the general rule.

³With the exception of SNB where the decisions are made usually once a quarter.

⁴The only exception in our sample was October 2008 when the SNB cut the rates reacting to the collapse of Lehman Brothers.

Table 2: Model variables description

Central bank	Instrument	Inflation target ($\bar{\pi}$)
BoE	Repo Rate until 4Q2005	2.5% RPIX (until 2Q2004)
	Official Bank Rate (since 1Q2006)	2% CPI (since 3Q2004)
	Quantitative easing (since 1Q2009)	
SNB	3M Swiss franc LIBOR	2% CPI
NBP	Reference rate	2.5% CPI

2.2 Model

For estimation we use an ordered probit model. This approach is frequently used to estimate monetary policy rules⁵ because movements of the central bank interest rates are taken in discrete steps. In our framework the dependent variable - the change of the monetary policy stance (change of the central bank rate or of the QE program) - can take values $(-1, 0, 1)$. When the central bank lowers the reference rate, expands the QE program the dependent variable amounts to -1. In the opposite case it amounts to 1, and in remaining cases to 0. Pegging of the Swiss franc to the euro was denoted as -1. We assume that the central bank's desired monetary policy stance is given by a targeting rule:

$$\Delta I_t = f\left(\tilde{\pi}_t^f(k), \tilde{x}_t^f(l)\right), \quad (1)$$

where

$$\tilde{\pi}_t^f(k) = \sum_{h=0}^k f_G(h)(\pi_{t+h}^f - \bar{\pi}_t) \quad \tilde{x}_t^f(l) = \sum_{h=0}^l f_G(h)x_{t+h}^f \quad (2)$$

and k and l are maximum forecast horizons for inflation and the output gap respectively. Moreover, ΔI_t stands for the change of central bank monetary policy stance; π_{t+k}^f - inflation forecast published at time t for period $t+k$; $\bar{\pi}_t$ - inflation target at time t ; x_{t+l}^f the output gap forecast for period $t+l$. $f_G(h)$ - is an aggregating Gaussian function, which takes the form

$$f_G(x) = \frac{1}{\sqrt{2\pi}\sigma^2} e^{\frac{-(x-m)^2}{2\sigma^2}}, \quad (3)$$

where m - mean and σ - standard deviation.

⁵E.g. Eichengreen, Watson, and Grossman (1985), Davutyan and Parke (1995), Gascoigne and Turner (2004), Carstensen (2006), Kotłowski (2006).

The aggregating function (3) helps us to include inflation and output gap forecasts into the model. Central bank forecasts extend over several quarters, which means that we have to deal with a large amount of explanatory variables: two for each forecast horizon (one for inflation and one for output). Given the limited data set and the potentially high correlation of forecasts at different horizons, the approach of treating inflation and output at each horizon as a separate variable seemed unrealistic. Therefore, we decided to assume a specific functional form that would deliver weights for aggregating forecasts at all horizons into one value for inflation and one for output and find the parameters of this function.

The choice of the normal distribution resulted from the following expected features:

- The distribution should have a single optimum to fulfill the assumption that central bankers pay highest attention to a single horizon,
- The distribution should be two-tailed to fulfill the assumption that policy makers consider not only one forecast horizon but also look at shorter- and longer-term forecasts,
- The set of weights should be allowed to encompass the whole forecast path, including zero (current quarter) and 8 or 12 (the end of the forecast horizon),
- The mean and the standard deviation of the distribution should not be related to each other, which allows to independently test two features: which forecast horizon is the most important (mean) and what is its relative significance to other horizons (standard deviation).

The normal distribution fulfills these criteria and seems well suited to describe realistic ways of aggregating forecasts at various horizons. Figures 1 and 2 present examples of Gaussian functions with various parameters m and σ . It becomes evident that this function is able to handle both very tight (where the central bank takes into consideration only one particular horizon) and diffuse aggregation (where the central bank is essentially indifferent with respect to various horizons). By varying the mean parameter we can control the forecast horizon with the highest weight in the central bank's rule. By varying the standard deviation

we can control the weight of the peak horizon relative to the other horizons. Additionally, this function leaves only two parameters to estimate, which, given our limited set of data, is a big advantage.

Now, let us consider an unobservable monetary policy stance I_t^* desired by the central bank conditional on future inflation and output gap. This variable changes according to:

$$\Delta I_t^* = \mathbf{X}_t' \beta + \varepsilon_t, \varepsilon_t \sim N(0, \sigma_x^2), \quad (4)$$

where $\mathbf{X}_t = (\tilde{\pi}_t^f(k), \tilde{x}_t^f(l))'$ stands for the set of explanatory variables from (1) and β is a 2×1 parameters vector. We do not observe the changes of I_t^* , but only discrete changes of the reference rate or of the QE program. We assume that when the desired policy stance falls by more than α_1 the bank adjusts the observable policy stance downwards. Alternatively when the desired policy stance increases by more than α_2 the bank tightens policy:

$$\begin{cases} \Delta I_t = -1 & \text{when } \Delta I_t^* < \alpha_1, \\ \Delta I_t = 0 & \text{when } \alpha_1 \leq \Delta I_t^* \leq \alpha_2, \\ \Delta I_t = 1 & \text{when } \Delta I_t^* > \alpha_2 \end{cases} \quad (5)$$

where α_1 and α_2 are estimated values.

3 Results

3.1 Model estimation

The main aim of this paper is to determine whether central banks adopt a forward-looking approach in their conduct of monetary policy, and if so - what length of horizon they take into account. In order to investigate the given problem, a three-step procedure was employed.

First, as presented above, a Gaussian function with a given mean m and standard deviation σ was used to assign weights to aggregate the forecasts. We ranged the mean from 0 (current period) to 8 quarters for the BoE and NBP and from 0 to 12 for the SNB with a step of 0.1. The standard deviation of the Gaussian distribution function for the weights ranged from 0.2 to 2 with a step of 0.2. This way we constructed a broad set of single cumulative values for inflation and output gap forecasts which differed by weights attributed to subsequent forecast horizons.

Second, ordered probit models as described in (1) were estimated. The approach we chose was to estimate models containing all possible combinations of aggregated forecasts (inflation and output gap) obtained in the first step (with various means and standard deviations for inflation and output gap aggregated forecasts).

Finally, having considered all possible combinations of explanatory variables, the models with the best fit were selected for each central bank.

As the probit model is not linear and the dependent variable is not continuous, traditional measures of fit cannot be used to evaluate the model. Therefore, *log-likelihood* served as the best model specification selection criterion. *Pseudo- R^2* coefficient is another commonly used indicator of the discrete variables models fit, yet in the given exercise its indications were parallel to results shown by the *log-likelihood*. The estimation results for the best models are summarized in Table 3.

For two of three of the investigated central banks the coefficients on inflation turn out to be statistically significant at the level of 10%. For the BoE inflation is significant at the level of 15%. The output gap proves to be significant for the BoE and SNB, in line with the strategy of flexible inflation targeting conducted by the banks (implicitly in case of the SNB). For the NBP the output gap was insignificant, suggesting that its strategy can be described as strict rather than flexible inflation targeting (Svensson (1997)).

Table 3: Estimation results for the BoE, SNB and NBP

Bank of England				
<i>Pseudo-R</i> ² = 0.27				
Variable	(<i>m</i> ; σ)	Coefficient	Std. error	p-value
<i>inflation</i>	(0;0.2)	0.804	0.518	0.1203
<i>output gap</i>	(1;1.2)	1.153	0.278	0.0000
Swiss National Bank				
<i>Pseudo-R</i> ² = 0.60				
Variable	(<i>m</i> ; σ)	Coefficient	Std. error	p-value
<i>inflation</i>	(12;0.2)	5.934	1.742	0.0007
<i>output gap</i>	(0;0.2)	3.037	0.795	0.0001
National Bank of Poland				
<i>Pseudo-R</i> ² = 0.46				
Variable	(<i>m</i> ; σ)	Coefficient	Std. error	p-value
<i>inflation</i>	(8;1)	5.591	1.681	0.0009
<i>output gap</i>	(3;0.2)	-0.462	0.666	0.4882

Note: $m = 0$ indicates use of current data instead of forecasts.

As to targeting horizons, the SNB and the NBP target inflation at the end of their forecasts while the BoE takes into account mostly current data. As to output, the BoE looks one quarter ahead while for the SNB the mean for output gap weight distribution is 0. This, however may be the result of using a VAR model for generating output gap forecast instead of using official SNB forecasts. Accordingly, we treat this finding with appropriate caution.

We find surprisingly little evidence that monetary authorities take into account (even if with varying weights) their whole forecasts. In contrary, the evidence speaks mostly for concentrating strongly on one particular horizon. In most of the estimations, σ parameters are small, which strongly indicates that banks focus on one particular point of their forecast (irrespectively of the scope of their forward-lookingness). Standard deviation bigger than 1 can be observed only for the output gap in the BoE model.

As far as the goodness of fit is concerned we can say that the models are better fitted for the SNB and the NBP than for the BoE. The *pseudo-R*² for the Bank of England model equals to only 0.27 despite our attempt to incorporate QE into the definition of the dependent variable. Such a low level of fit and the higher p-value for inflation may result from the fact that in the last period covered by the sample the Bank of England met both, a strongly negative output gap and

inflation above the target simultaneously. The elevated inflation resulted mostly from indirect tax increases and depreciation of the GBP in 2008-2010. In spite of forecasts showing inflation above or close to the target in the forecast horizon the BoE decided to lower interest rates and expand the QE programme reacting to a strongly negative output gap and disturbances in the financial sector.

3.2 Robustness check

The applied simulation method has one drawback, which has to be addressed. When we search for the best model, varying the mean and standard deviation for the weights distribution functions we do not have any guarantee whether a unique maximum exists. To check the robustness of our results we employ the following procedure.

We fixed the mean m_{INF} for the weights distribution for inflation at 0 and estimated the parameters of the probit model for all possible combination of standard deviation for inflation σ_{INF} and mean and standard deviation for output gap (m_{GAP} and σ_{GAP}). Then we increased the mean m_{INF} to 1 and again estimated the model for all possible combination of three remaining parameters σ_{INF} , m_{GAP} and σ_{GAP} . We repeated this procedure until m_{INF} was equal to 8 for BoE and NBP or 12 for SNB. The same exercise has been done for σ_{INF} , m_{GAP} and σ_{GAP} (fixing one parameters and varying the others).

The results for all four parameters have been exhibited separately on Figures 3, 4 and 5 for the BoE the SNB and the NBP respectively.

Basing on the charts we can check how flat the likelihood function is and whether a single maximum exists. To illustrate the behaviour of the likelihood function we additionally show on Figures 6 - 8 the value of *log-likelihood* as functions of the mean m_{INF} and m_{GAP} assuming standard deviations constant at 1.

The distribution of the *log-likelihood* are broadly in line with the results gathered in Table 3. For the Bank of England (Figures 3 and 6) the *log-likelihood* function for the output gap shows a clear peak for the mean equal to 1, while the distribution of *log-likelihood* with respect to inflation proves to be almost flat with a small peak at mean equal to 0. The distributions of *log-likelihood* with respect to varying standard deviations of the output gap and inflation are not informative - the function is flat without a well defined maximum (in particular for the output gap).

The results obtained for the SNB (Figures 4 and 7) show that for the mean of the weights distribution for inflation the *log-likelihood* function peaks at 12

quarters. However, the function is bimodal - there is another smaller peak for $m_{INF} = 0$. This suggests that the SNB takes into account mostly the inflation forecast at the 12 quarters horizon but does not disregard current data. In case of output gap the function is rather flat for horizons ranging from 0 to 6 quarters with a small peak at 0 (current data). The two remaining charts may lead to conclusion that the *log-likelihood* is a decreasing function of standard deviations for both inflation and the output gap.

The *log-likelihood* distribution with respect to inflation for the NBP (Figures 5 and 8) shows a clear peak for mean equal to 7-8 quarters and for standard deviation equal to 1. For the output gap we cannot recognize a maximum neither for the mean nor for the standard deviation - the *log-likelihood* function is flat.

3.3 Final remarks

Some potential weaknesses and drawbacks of the method employed are outlined below.

First, short time series (especially for Poland) could have affected the quality of estimation. This is, however, a restriction of an objective nature, resulting primarily from the fact that inflation targeting is a relatively new way of ensuring price stability. Publishing forecasts by central banks has only recently become a common practice, which shortens available time series and narrows the sample of countries that could be tested.

Further, the qualitative form of the dependent variable in estimated models may raise some concerns. The dependent variable was artificially restricted to one of three categories, corresponding to tightening, easing or keeping the monetary policy stance unchanged. This move was forced by data constraints: due to a relatively small number of available observations, introduction of additional options would result in diminishing the number of degrees of freedom.

Finally, problems arising due to the choice of forecasting method for the Swiss GDP (VAR) should be addressed. It was the only case where the estimation of the model showed that a central bank is relying on current data on output gap, instead of including projections into its methodological framework. However, one cannot exclude that this result is biased by using a different data set than in case of the two other banks. VARs are considered to be effective tools for forecasting. In addition, it is known that the SNB actually used this class of models for forecasting (see Baltensperger, Hildebrand, and Jordan (2007)). However, specification of the model used by the bank is unknown, and thus - output forecasted by the SNB may differ from the one used in this study, which may affect

to some degree the results.

4 Conclusions

We use central bank macroeconomic forecasts to determine the horizon of monetary policymakers' forward-lookingness. To this end we analyse inflation and output forecasts based on the assumption of constant interest rates from three central banks: the Bank of England, the National Bank of Poland and the Swiss National Bank. Next we estimate forward-looking Taylor rules in a way that allows to determine the forecast horizon to which decision-makers attach highest attention.

Our main findings are as follows. First, all banks are to some extent forward-looking. In particular, with respect to the inflation forecast the Swiss National Bank and the National Bank of Poland concentrates on the final part of their forecasts. Surprisingly, the Bank of England seems to pay attention mainly to current inflation.

With respect to output the Bank of England and the Swiss National Bank look at current data or one quarter ahead while the National Bank of Poland seems not to pay attention to its GDP forecast. However, the results obtained for the Swiss National Bank should be interpreted with caution, since this bank does not publish a GDP forecast.

Second, our technique allows to figure out, how concentrated horizons chosen by policymakers are. In other words, we check, whether central bankers take into account forecasts at various horizons or rather concentrate on one particular point of the forecast. To our surprise we find consistently that the latter is the case.

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Figures

Figure 1: Examples of Gaussian functions with $\sigma = 1$

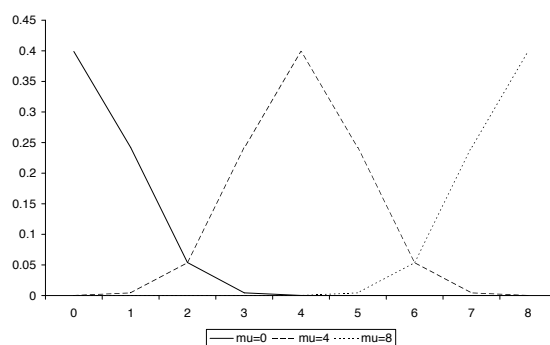


Figure 2: Examples of Gaussian functions with $m = 4$

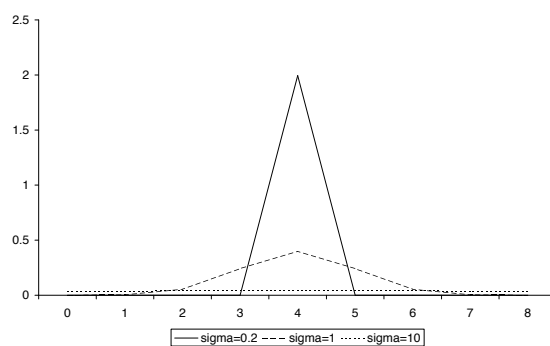


Figure 3: Log-likelihood function with respect to inflation and output gap distribution parameters - Bank of England.

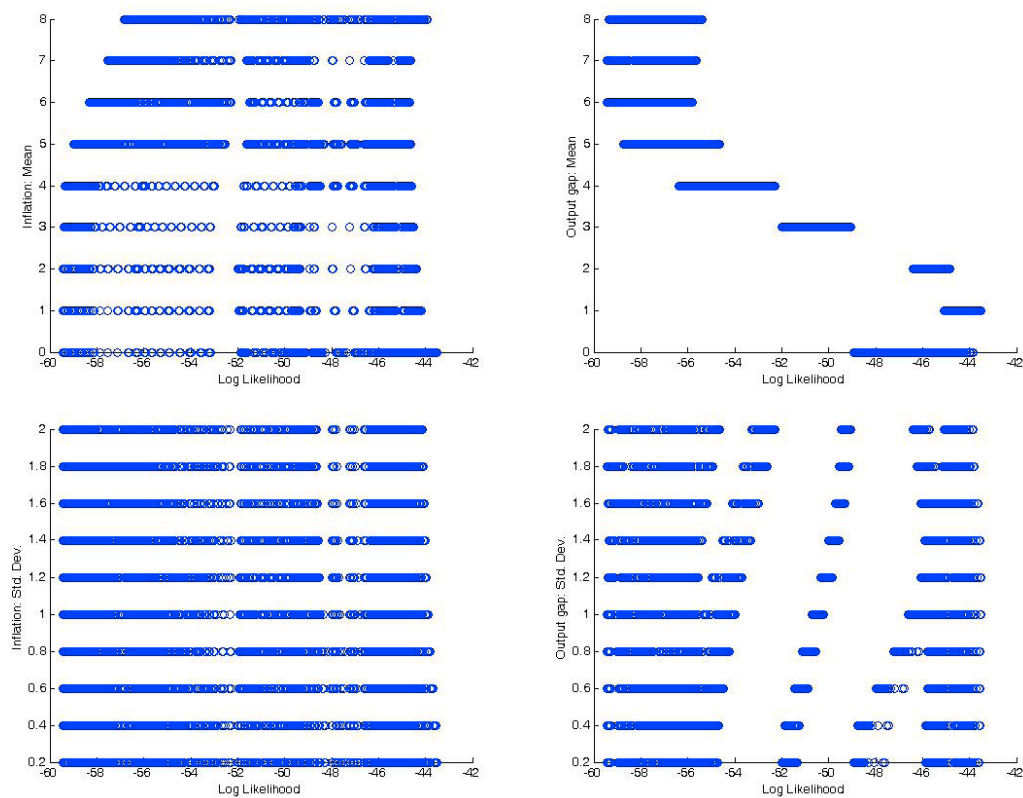


Figure 4: Log-likelihood function with respect to inflation and output gap distribution parameters - Swiss National Bank.

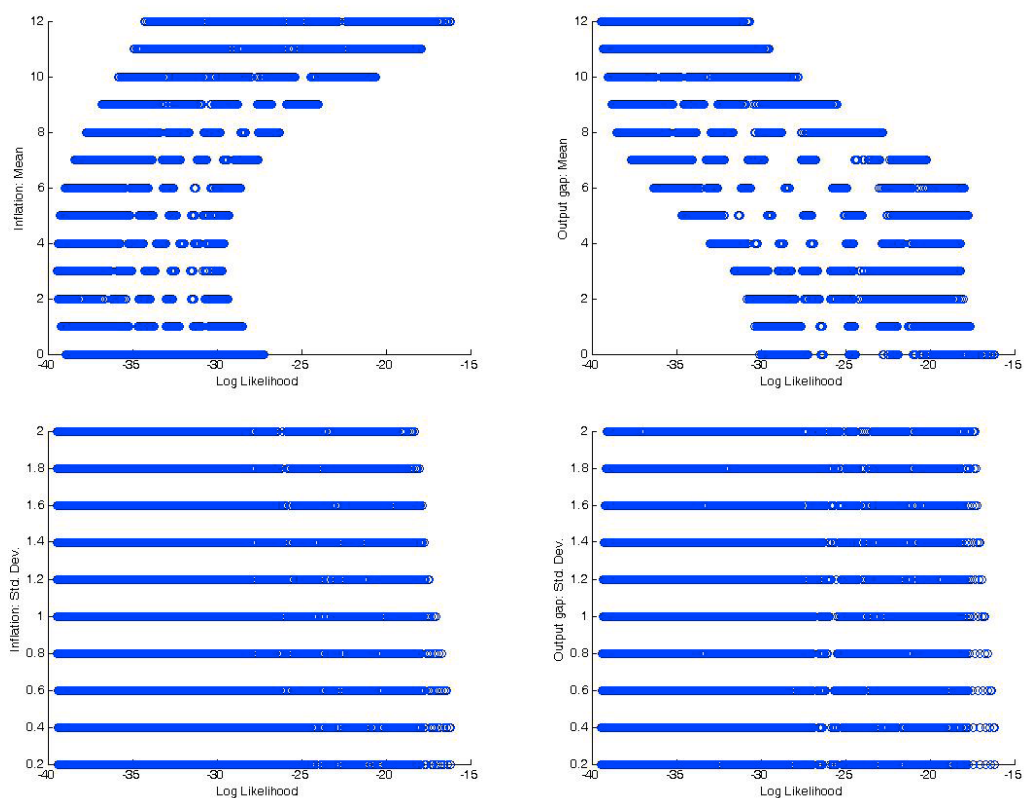


Figure 5: Log-likelihood function with respect to inflation and output gap distribution parameters - National Bank of Poland.

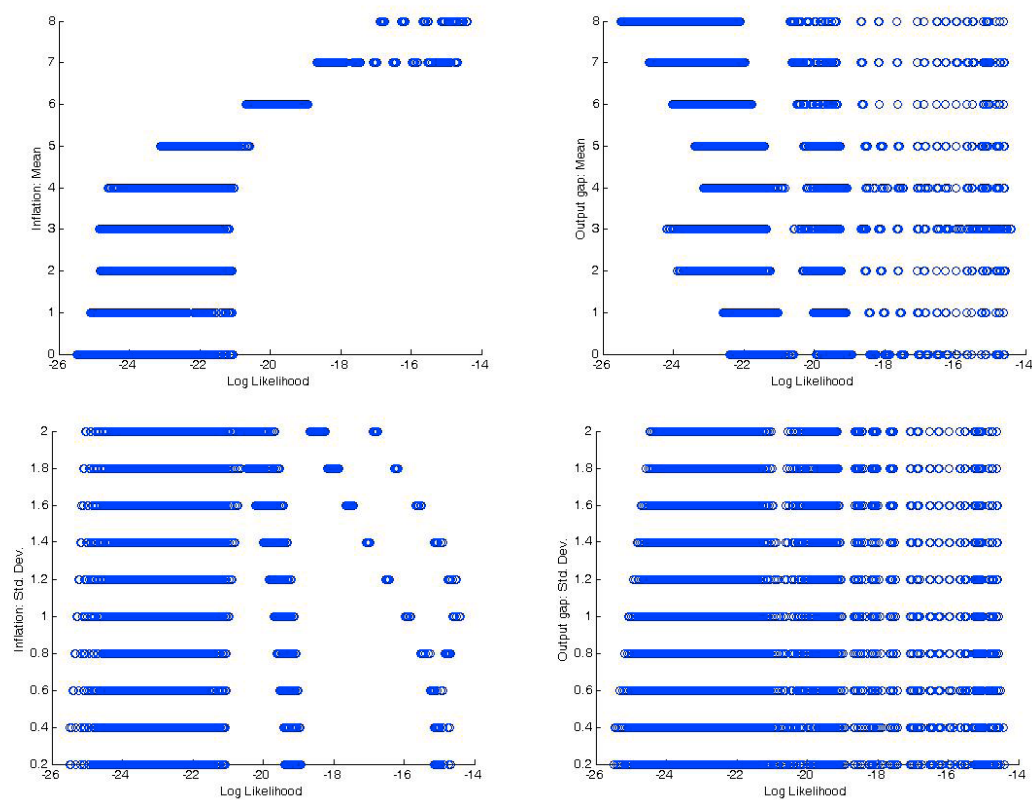


Figure 6: Surface of log-likelihood function with respect to inflation and output gap distribution mean - Bank of England.

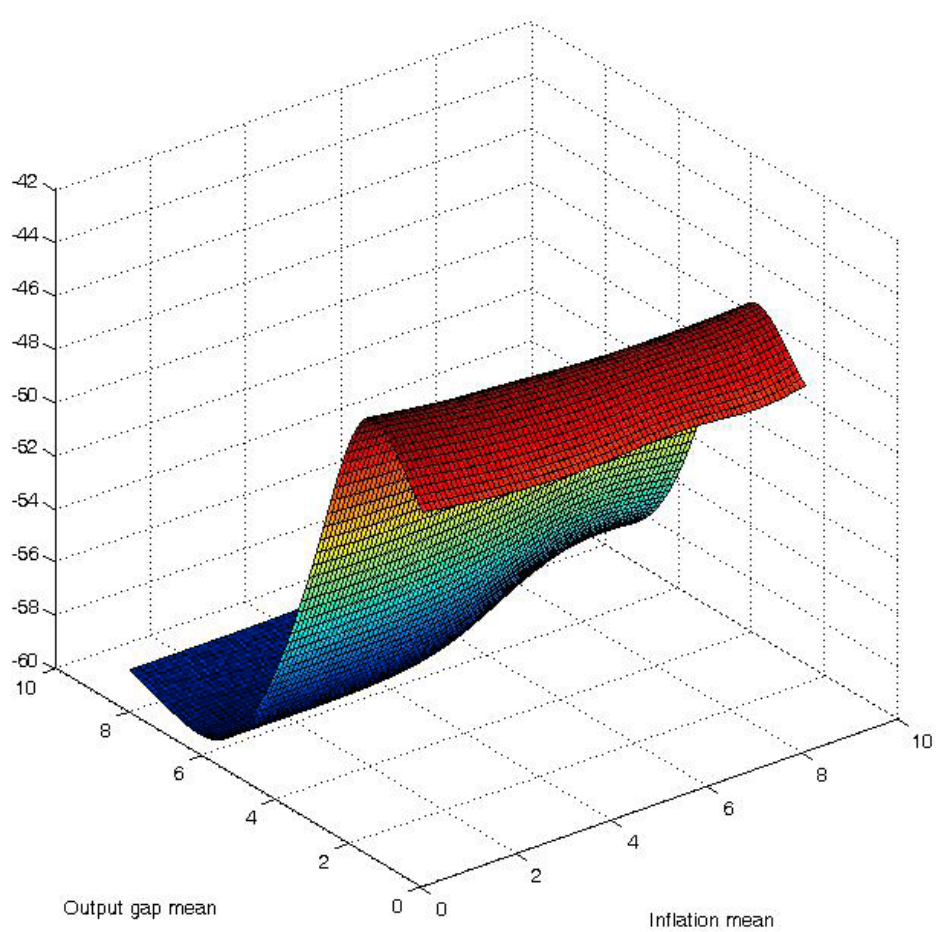


Figure 7: Surface of log-likelihood function with respect to inflation and output gap distribution mean - SNB.

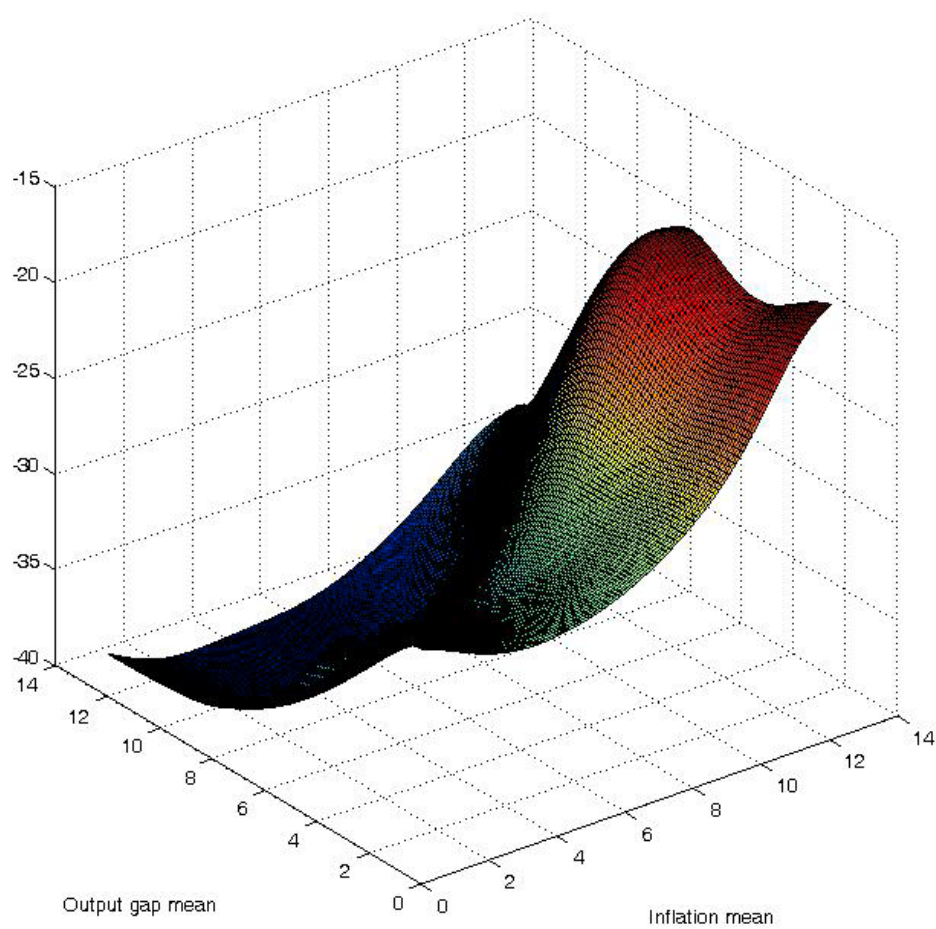


Figure 8: Surface of log-likelihood function with respect to inflation and output gap distribution mean - NBP.

