Forward Guidance and the private forecast disagreement – case of Poland

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Abstract

During the period of policy easing in 2013 and prospective tightening in 2017-2019 the National Bank of Poland (NBP) applied the forward guidance to manage expectations of market participants. The goal of such a policy was to lower the uncertainty related to the future decisions of the Monetary Policy Council. We attempt to verify whether the central bank's communication indeed reduced disagreement, based on the results of the professional forecasters' survey. We found that the forward guidance policy introduced in 2013 lowered the perceived interest rate risk in both one-year and two-year horizons. On the other hand, abandoning the policy in 2014 increased the disagreement in the disproportionately large manner. The more pronounced forward guidance reintroduced in 2017 again allowed to reduce short-term uncertainty. However, it took over a year to strengthen the impact reducing the disagreement especially in case of two-year forecasts. The forward guidance most likely prevented increase of disagreement during the so called NBP image crisis in the late 2018 and in the first quarter of 2019. Overall our research highlights that it is relatively easy to lose confidence with ill-considered communication, but building credibility requires systematic long work.

Keywords: forward guidance, density forecasts, survey of professional forecasters

JEL classification codes: E52, E58

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1. Introduction

During the period of policy easing in 2013 the National Bank of Poland (NBP) introduced forward guidance as a policy tool. This decision followed similar moves made by major central banks including the US Federal Reserve, the European Central Bank (ECB) and the Bank of England. The new policy assumed communication of expectations about future interest rate decisions to market participants. According to the NBP Inflation report the aim of the Forward Guidance was to manage medium and long-term interest rate expectations, as well as to reduce the uncertainty over policy developments in the medium term (NBP 2013).

Monetary Policy Council (MPC) continued providing interest rate predictions in the sixth-month horizon for approximately one year and suspended it in 2014. The Forward guidance was reintroduced in 2017 by the new NBP governor and MPC members. This policy aimed to trim expectations for rate increase.

The aim of this study is to verify if application of the forward guidance indeed reduced interest rates uncertainty based on the density forecasts of the NBP professional forecasters survey for periods from 1Q 2012 to 1Q 2019 (full available information at the moment of writing). We found that the six-month forward guidance introduced in 2013 lowered perceived interest rate risk in the one-year and two-years horizon. On the other hand, abandoning the policy in 2014 increased short-term disagreement in the disproportionately large spectrum. The more pronounced forward guidance reintroduced in 2017 again allowed to reduce uncertainty. However its initial impact was rather moderate. It took over a year to significantly impact long term forecast. Overall our research highlights that it is relatively easy to lose confidence with ill-considered communication, but building credibility requires systematic long work.

This paper is structured as follows. The next section presents the subject literature highlighting influence of central bank communication policies on professional forecasters expectations. Section 3 discusses the content of the NBP professional forecasters survey, Section 4 describes the development of Forward Guidance policies in Poland. Section 5 provides methodology of our research. Section 6 presents estimation output. Finally, Section 7 concludes the paper.

2. Literature review

The aim of this section is to summarize studies on forward guidance in a broader context of communication polices used by the central banks. We present how central banks communication evolved during the last two decades and highlight why in this context

publishing expectations regarding future interest rate decisions may have a limited relevance for market participants.

The studies on communication policies have become inevitable since introduction of inflation targeting strategy by the Reserve Bank of New Zealand in 1990. Under such regime a central bank usually pays more attention to their public policy announcements in order to maintain credibility of its targets. Simultaneously the amount of information released into the public increases. (Roger and Stone 2005).

There is strong consensus that introduction of numerical inflation target by majority of central banks in the 90's per se anchored long term expectations and allowed to reduce inflation forecast disagreement in the long-run horizon (e.g. exceeding 1 year, see Mankiw *et al* 2003, Levin *et al* 2004, Crowe 2010), while the impact on short term uncertainty was negligible (Cecchetti and Hakkio 2009). Experiences of Poland have not deviated strongly from general conclusions. Łyziak (2013) provided evidence that expectations of financial professionals and corporate sectors showed strong convergence to the center of the NBP target.

Simultaneously to introduction of numerical targets, central banks started navigating market participants' expectations trough more detailed discussions of policymakers' stance (e.g. publishing statement from the meeting and minutes, introducing press conferences with Q&A sessions). Swanson (2006) showed that increased transparency of Federal Reserve allowed to improve rates predictability amongst financial professionals, even there were no improvement in forecasting macroeconomic conditions (e.g. GDP, PCE/CPI inflation). Author concluded that explicit policy announcements introduced after 1994 also increased response from market participants on policy signals from FOMC.

Eijffinger and Geraats (2006) reported lower volatility of output gap and reduction of interest rates in the Eurozone, the United States, and the United Kingdom, after central banks increased their transparency. On the other hand, authors do not provide statistically significant results for smaller economies (e.g., Swedish Riksbank, Reserve Bank of New Zealand). Furthermore, researchers were frequently failing to produce universal rules on the communication strategy, e.g., how to manage expectations based on collective and individual communication (Ehrmann and Fratzscher 2007, Blinder et al 2008). Similarly, the communication strategies used in Poland and in other CEE states have not always resulted in uncertainty reduction (see Rozkrut et al 2007).

Another influential milestone in the central banks' communication was regular publication of macroeconomic forecasts inside inflation reports. Numerous researchers provided evidence that central banks forecasts affect private forecasters consensus, especially in the longer horizons (Romer and Romer 2000, Hubert 2015). NBP introduced its macroeconomic projection in 2005 – publishing macroeconomic forecasts resulted in lower uncertainty regarding GDP growth (Kotłowski 2015).

The financial crisis of 2009 and exhaustion of traditional monetary policy tools forced major central banks to create new policies. One of the solutions was to communicate expectations regarding future interest rate development to market participants (known as forward guidance). Given historical context the introduction of such a tool tended to be a continuation of strategies pursued in the previous decades.

The subject literature describes two characteristic of central bankers' forward guidance (Cambpell et al., 2012; Yates, 2013; Evans, 2017). First of all commitments are conditional – declarations do not create legal requirement to fulfil the obligations, but central banks need to weigh potential costs related to the loss of their credibility. Secondly, communication can have either quantitative or qualitative character.

Quantitative declarations are published in the form of a policy rate forecast seen as if the macroeconomic scenario provided by the central bank should materialize. Probably the most popular example of such a projection is the Fed *dot-plot*, similar forecasts are also published by e.g. Swedish Riksbank and Norwegian Norges (both banks presented their expectations even prior the Global financial Crisis).

Qualitative declarations consist of comments in the policy statement or verbal comments in the Question & Answers session at the press conference. A few examples of these statements from US Federal Reserve (Fed), Bank of Japan (BoJ) and European Central Bank (ECB) are presented in Table 1.

Subject literature distinguishes between the so-called *Delphic* and *Odyssean* forward guidance. The former one has general character and provides information on what market participants should expect in case of no significant shocks. A good example of such a declaration is Fed statement from August 2011. The policymakers communicated that rates should remain flat till the mid-2013. Odyssean declarations are far more complex. Decision makers communicate what economic conditions are necessary to change interest rates. Such declarations were introduced by the Fed in its statement from the December 2012 meeting. The Federal Open

Market Committee (FOMC) highlighted that the policy rate should remain stable as long as unemployment rate exceeds 6.5% and the personal consumption expenditure (PCE) inflation forecasted by the Fed staff does not exceed long-term target of 2% by more than 0.5pp.

Table 1: Examples of qualitative forward guidance

ECB– July 2013 (Delphic guidance)	The Governing Council expects the key ECB interest rates to remain at present or lower levels for an extended period of time
Fed – August 2011 (Delphic guidance).	The Committee currently anticipates that economic conditions--including low rates of resource utilization and a subdued outlook for inflation over the medium run--are likely to warrant exceptionally low levels for the federal funds rate at least through mid-2013.
Fed – December 2012 r. (Odyssean guidance)	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 for the federal funds rate 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. The Committee views these thresholds as consistent with its earlier date-based guidance.
BoJ– July 2018 (Delphic guidance)	The Bank intends to maintain the current extremely low levels of short- and long-term interest rates for an extended period of time, taking into account uncertainties regarding economic activity and prices including the effects of the consumption tax hike scheduled to take place in October 2019.

Source BoJ, ECB and Fed policy statements

Unfortunately, there is growing evidence that forward guidance failed to improve the predictability of interest rates. Kool and Thornton (2015) reported similar forecast error in Sweden and Norway before and after introducing interest rate projection, which is perceived as a mature form of forward guidance. The performance of central banks predictions was similar to random walk process. Furthermore, economies where central banks do not communicate their future policies achieved similar forecast errors for short-term interest rates. More recent studies by Jain and Sutherland (2018) confirmed no reduction in disagreement between forecasters on their projections of the future interest rate path.

Experiences from developed economies lead to a conclusion that marginal benefit of communicating future policy moves is small, as benefits of increased of transparency were consumed earlier e.g. with projections of macroeconomics forecasts or policy announcements. The aim of this paper is to measure if introduction of forward guidance policy indeed resulted in lower disagreement of financial professionals in Poland. According to the author's knowledge there were no similar analysis published for the Central and Eastern Europe region so far.

3. NBP survey of professional forecasters.

This section discusses content of the NBP survey of professional forecasters (further SFP). The mentioned publication is the single poll, which aggregates information regarding subjective perceptions of interest rate and macroeconomic uncertainty (regarding e.g. GDP growth, CPI Inflation). Survey describes overall distribution by the three variables: median of expectations, width of 50% and 90% confidence interval. Therefore, it provides much deeper information regarding the potential surprises and uncertainty comparing to more popular surveys provided by Bloomberg or Reuters, where only median of forecasts is published.

The SFP report was introduced in the late 2011, but presently the NBP archives full- reports from 2012 onwards only. The panel of professionals participating in the survey consist mainly of the commercial banking analysts (approximately 80% of respondents), supported by the experts from the academic research groups (15% of participants) and the employers' organizations (5%).

Forecasters are requested to provide their predictions of NBP reference rate, Consumer Price Index (CPI) and Gross Domestic Product (GDP) with the confidence intervals. Secondly NBP collects analysts' assumptions of the foreign exchange rate (EUR/PLN), oil prices (Brent), unemployment rate, wage in the national economy, as well as GDP in the Eurozone (yet without providing subjective information about forecast uncertainty). NBP aggregates individual projections into a joint distribution (see methodology paper – Kowalczyk et al 2013 – for further details).

For the purpose of this paper we are interested in predictions of the annual average of interest rate for the next year (T+1) and two years ahead (T+2). The SFP also contains the long-run forecasts (indicating the average rate for the next five years) and the quarterly forecast for the corresponding quarter year and two years ahead. We do not investigate the long-term forecast disagreement as Forward Guidance is usually affecting rather short-term expectations (e.g. Swanson 2017).

The NBP professional survey provides also the forecasts for 4 and 8 quarters ahead horizon. We found these predictions as less relevant in the context of policy makers' decisions comparing to the forecast of annual averages dynamics (as central banks typically do not react to temporary changes). Dispersion of such macroeconomic forecasts may be affected by temporary shocks e.g. GDP forecasts are likely to have greater disagreement for the periods following parliamentary elections, introduction of new economic policies.

The major shortcoming of the survey is relatively short sample - at the moment of writing there are 29 observations available. Therefore, previous research often tended to be inconclusive (e.g., Kowalczyk and Stanisławska, 2016).

4. NBP and the Forward Guidance policy

The aim of this chapter is to describe experiences of NBP with the forward guidance policy, as well as to present significant events, which affected interest rate forecast distribution. There are six major events in our investigated sample, which need to be discussed in order to understand changes in interest rates forecast uncertainty over time. Each of mentioned events will have its representation in the final equation.

First of all, the Polish economy was close to fall into a recession from the late 2012 to the early 2013. During that time economists presented different views on how strong impulse the Monetary Policy Council (MPC) should provide in order to stimulate economy, as well as how fast the monetary policy should be normalized. Economic downturn affected particularly the one-year ahead interest rate expectations of professional forecasters at the beginning of 2013.

Secondly, the MPC introduced short-term forward guidance in July 2013. Decision makers communicated that interest rates should remain flat approximately in the six- month horizon. Those declarations were consistently continued till March 2014. At this meeting MPC declared that the rates should remain flat till October. From that time the committee was reiterating this commitment, yet without prolonging time horizon of forward guidance. The aim of the study is to verify if the MPC rhetoric actually lowered dispersion of the rates forecasts on that time.

The abandoning of forward guidance resulted in greater forecast disagreement. The rise of uncertainty was additionally fueled by fears of the personal conflict between MPC members and the NBP governor, after publication of a tape with a private conversation between the NBP governor Marek Belka and Minister of Internal Affairs Bartłomiej Sienkiewicz. The Central Bank head led an ambiguous discussion on the use of unconventional monetary policy instruments and seriously offended one of the Council Members (Wprost 2014). Bloomberg press agency columnist Mark Gilbert (2014) stated that this was an example of the worst behavior of central bankers in Europe, what strongly reverberated in the financial markets.

Another episode resulting in greater volatility was related to the change of the NBP governor and MPC members in 2016. Prior to the appointment of the central bank governor politicians

of the governing PiS party communicated preference for dovish executives, supporting unconventional easing (Polish Press Agency 2015)

The forward guidance policy was reintroduced in 2017 to trim expectations of interest rate hikes. The NBP president initially announced that the main policy parameters should remain stable in the period exceeding one year. Such commitment soon became a usual habit during MPC press conferences (see archival videos at NBP YouTube channel).[2] From the second half of 2018 onwards, NBP president has begun to point that stable rates are plausible towards the end of his term (2022), in order to solidify the forward guidance.

Finally, in the Q4 of 2018 and Q1 of 2019 there were another two significant crisis related to the image of the NBP. In November the president of supervisory board of one commercial banking group published a tape with a corruption offer from the president of the Financial Supervision Authority (KNF). There were an allegations that NBP president participated in the process. In 2019 several media outlets commented on extraordinary salaries of NBP communication direction and president cabinet director. Parliament implemented a bill forcing central bank to reveal payments to departments directors. According to the governmental Public opinion research center (CBOS) share of negative opinions about NBP increased from 7% to approximately 30%, while number of supporters diminished by 10pp (from 55% to 45%). The shifts in the opinion polls was bigger comparing to 2013 year with governor Belka tape – the speculation about replacement of government were present in the multiple media articles.

5. Methodology

This chapter presents methodology of our research. We attempt to decompose interest rate disagreement extracting impact of economic uncertainty perceived by forecasters and direct effects of NBP communication policies.

Our aim is to build regressions describing variance of interest rate forecasts made by professional forecasters. The uncertainty of interest rate forecasts is assumed to be related to inflation and GDP growth uncertainty reported in the poll of forecasters. We also attempt to verify, if dummy variables describing events discussed in section 4 have statistically significant effects.

[2] MPC press conferences are available at: https://www.youtube.com/playlist?list=PLE37C73CEC1E1E930 (in Polish only)

Firstly, we discuss the variables that affect interest rate forecast uncertainty independently from forward guidance policy events. Following findings of Romer and Romer (2000), and Gavin and Mandal (2000), the entry point of our analysis is the assumption that private forecasts respond proportionally to changes in the output gap and deviations from the inflation target (in line with the so-called Taylor rule). The generalized policy rule is given by the following formula:

$$i_t = i_t^* + \beta_1 * (\pi_t - \overline{\pi_t}) + \beta_2 * (y_t - \bar{y}_t) + e_t \quad (1)$$

where i_t is the central bank policy rate, i_t^* is the long-run equilibrium rate natural rate perceived by monetary authorities, $\pi_t - \overline{\pi_t}$ denotes difference between the current CPI annual dynamics and the central bank inflation target, $y_t - \bar{y}_t$ is the difference between the log of the current GDP level and its potential and unobservable level, finallyβ_1 and β_2 are estimated parameters.

We assume that professional forecasters surveyed by the NBP are capable to estimate the policy rule parameters, but disagree between themselves on the forecast values of y_t and π_t.

With such assumptions we are able to decompose ex-ante forecast variance of interest rate. To achieve analytical solution to the problem we need to use two simplifying assumptions. Firstly, we need to proxy the output gap uncertainty by the disagreement related to GDP growth as only such a variable is reported in the survey. Such hypothesis does not take into consideration the overall risk, e.g., this related to the problem of output gap estimation.

Secondly, we expect that individual density forecasts for both GDP growth and CPI inflation are described with normal distribution. The real distribution is likely to vary over time, with possible asymmetrical skews.

Given stable inflation target and no change in perception of natural rate and potential output interest rate forecast variance should be described by the following formula:

$$\sigma^2{}_{i_t} = {\beta_1}^2 * \sigma_{y_t}^2 + {\beta_2}^2 * \sigma_{\pi_t}^2 + 2 * \beta_1 * \beta_2 * \rho(\pi_t, y_t) * \sigma_{y_t} * \sigma_{\pi_t} + e_t \quad (2)$$

where $\rho(\pi_t, y_t)$ is a Pearson correlation coefficient between forecasts of annual GDP growth dynamics and similarly defined CPI inflation increase, σ_x is a standard deviation of variable x.

We calculated standard deviations of policy rate forecasts, inflation forecasts and GDP forecasts based on the NBP professional forecasters survey, which describes forward looking expectations. For each single forecast of specific economic variable the survey contains

information about the width of the 50% confidence interval and the mean of the empirical distribution generated from analysts' predictions[3].

To derive the cross-sectional standard deviation of forecasts from the mentioned dataset we assumed that the forecasts in each case were randomly generated from the normal distribution. This assumption allows for a numerical derivation of the standard deviation statistic, yet it is a significant simplification. The actual distribution could be for example asymmetrical. Since the mean of the normal distribution is equal to its median then the 50% forecast confidence interval should match the interval between the 25^{th} and 75^{th} percentile of the forecast distribution under the assumption of normality. For a normally distributed variable the distance between the 25^{th} and the 50^{th} percentile is equal 0.675 times the standard deviation of that variable. Therefore, we computed cross-sectional standard deviation of each forecast from the range comprising 50% of all observations by dividing the reported width of the confidence interval by two and then by 0.675.

Such estimated standard deviations are used as observations in case of explained variable - interest forecast uncertainty and explanatory variables i.e. GDP growth uncertainty, CPI inflation uncertainty. The detailed description of data is presented in the Appendix 1.

Subject literature also reports that interest rate forecast uncertainty tends to be described by an autoregressive progress (e.g., Kotłowski 2015). We introduce the three-year historical time-series standard deviation of the central bank interest rate (based on realized data) as an additional explanatory variable to account for such dependency. Historical realizations provide more information on monetary policy surprises, which should influence the present decisions.

We also introduced trend as an explanatory variable to verify if downward slope reported by Swanson (2006) is still visible in a more recent period. Some reduction of disagreement of forecasts was possible not only due to greater transparency of central banks, but also due to technological improvements, e.g., development of modern and more accurate econometric models. The negative parameter would suggest that such hypothesis is still valid.

We aim to verify if introduction of forward guidance has an additional additive effect on forecast uncertainty. Five separate dummy variables were introduced. The first one takes value of one in the period when MPC used announcements about expected changes in interest rates

[3] Please see the report at: https://www.nbp.pl/home.aspx?f=/statystyka/amakro/amakro.htm (Polish version only).

(2013 Q2 – 2014 Q1), the second dummy identifies the period when long-term forward guidance was introduced (between Q1 2017 and the end of the sample at Q1 2019).

We also introduce another dummy variable related to lagged effects of the forward guidance introduction. The positive value covers the period from 2Q of 2018 to the end of the sample. The selected period is not random – in the mentioned quarters for the first time median of professional stopped to price interest rate hikes in the two years horizon (in line with the MPC guidance). Such tendency was consolidated in the next quarters.

Finally, some unfavorable events were taken into account with another set of dummy variables, namely the depression period from Q4 2012 to Q1 2013, abandoning of forward guidance and the clash between the NBP governor Marek Belka and the MPC after the leak of tapes (Q2-Q3 2014). During the Q2-Q3 2014 standard deviation was 10pp (30%) higher comparing to the previous and next events, therefore level shift is clearly visible. Eventual shortening the horizon should result in additive outliers in residuals. For further details see figure 1 in Appendix 1.

Another dummy is related to fears around elections of the new NBP governor and the new MPC in Poland (Q4 2015 -Q2 2016). In each of mentioned periods there were an expectations of a politically driven rate cuts (despite higher inflation) visible in the central forecasts. appointment Adam Glapiński as a NBP governor (first policy meeting in July of Q3 2016) cut the speculation about imminent monetary policy changes.

Finally the last dummy is related to NBP image crisis of 4Q18 and 1Q19. Detailed event, which occurred in both quarters are described in the previous section. The complete econometric model is given by the following formula:

$$\sigma^2{}_{i_t} = \beta_0 + \beta_1{}^2\sigma^2_{y_t} + \beta_2{}^2\sigma^2_{\pi_t} + 2|\beta_1||\beta_2|\beta_4\sigma_{y_t}\sigma_{\pi_t} + |\beta_3|\,\sigma^2{}_{i_{hist,t}} + \beta_Z Z_t + \varepsilon_t, \qquad (3)$$

where $\sigma^2{}_{i_{hist,t}}$ is a three-year historical deviation of interest rates measured at time *t* and Z_t is a vector of dummy variables. β_4 is identical to $\rho(\pi_t, y_t)$, operator $|*|$ denotes absolute value.

The series of $\sigma^2_{y_t}$, σ_{π_t}, and $\sigma^2{}_{i_t}$ were transformed with the TRAMO-SEATS procedure in order to remove seasonal and irregular factors (Gomez & Maravall 1996). Calculations resulted in extraction of the smoothed trend estimates of respective variables. The smoothed variables were used in our further analysis. The presence of seasonal factors is related to different forecast horizons presented in quarterly surveys. For example, a prediction of an average CPI inflation in the next year, released in the first quarter of the current year, requires estimation of

the state of the economy in the next seven quarters. In case of the survey published in the fourth quarter of the year, the forecast horizon shortens to four quarters. Possible irregularities are the result of changes in the participation of respondents (the number of forecasters responding to the poll varies between iterations). The historical standard deviation of interest rates was not transformed (${\sigma^2}_{i_{hist,t}}$).

Finally, all of the explanatory variables (except dummies) were standardized by subtracting the mean and dividing by the standard deviation of the respective variable in order to provide a simple economic explanation to the constant parameter. The estimate of β_0 should present the typical subjective standard deviation of (unobservable) interest rates probability distribution during an average economic condition.

The equations were estimated using the ordinary least squares (OLS) method. The Newey-West method was used to obtain heteroscedasticity and autocorrelation robust standard errors of parameter estimates. We also attempted to restrict parameters in such a manner that any increase of uncertainty regarding macroeconomic developments and adverse events ($Z_{negative}$) would always lead to higher rates uncertainty. Similarly, forward guidance ($Z_{positive}$) should only have positive impact and lower disagreement. To successfully enforce such restrictions in the final equation we replaced parameters β_i with an absolute function of these parameters,. Instead of linear estimation of β_4 we use rescaled function $\frac{e^{\beta_4}}{1+e^{\beta_4}}$, limiting results to range from -1 to 1. The final equation has following form:

$$\begin{aligned}{\sigma^2}_{i_t} = \beta_0 + {\beta_1}^2\sigma_{y_t}^2 + {\beta_2}^2\sigma_{\pi_t}^2 + 2|\beta_1||\beta_2|(2\frac{e^{\beta_4}}{1+e^{\beta_4}} - 1)\sigma_{y_t}\sigma_{\pi_t} + |\beta_3|{\sigma^2}_{i_{hist,t}} + \\ \beta_5 * trend + |\beta_{Z\_positive}|\, Z_{positive} - |\beta_{Z_{negative}}|\, Z_{negative} + \varepsilon_t,\end{aligned} \quad (4)$$

6. Estimation Results

This section discusses the impact of National Bank on Poland communication policies on interest rate forecast uncertainty. We begin with an analysis of the impact on the divergence of one-year ahead interest rate forecasts. All the estimates of parameters in section are rounded to 2 digit figures. Number describing interval range are presented as integers.

According to our model the standard deviation of the interest rate forecast equals 0.37 basis points (bp) in the sample. The value was derived using a square root of the estimated parameter

β_0 which can be interpreted as the sample variance of ${\sigma^2}_{i_t}$ in the absence of any events considered in our investigation.

Assuming the normal distribution of forecasts, the confidence intervals covering 99.99% observations should span over 8 standard deviations. At such level of confidence this range covers area of 298bp. Concluding, even under such a conservative level of confidence professional forecasters should not believe that any increase or decrease of policy rates could be greater than 150bp (150bp is approximately equal to four standard deviations of the dependent variable, given the symmetry of a normal distribution).

Amongst macroeconomic variables, we found historical volatility and uncertainty regarding GDP growth as factors increasing subjective divergence of policy rate forecasts. The parameter corresponding to inflation forecast uncertainty turned out to be insignificant. Similar conclusion was valid in the case of the interaction between the GDP growth and CPI inflation forecasts. We were unable to reject the hypothesis that linear effect related to β_4 parameter is equal to zero. There was also no statistically significant linear trend in the data.

Detailed results of the estimated model (4) are available in Table 2. The third column contains estimated parameters of non-linear equation. To simplify interpretation, we calculated values corresponding to the linear form in the second column. These values represent a linear marginal effect of the dependent variable (as a change in interest rate forecast variance) due to unit changes in the values of explanatory variables. Based on this information we are capable to present binding conclusions about change in ex-ante standard deviation of interest rate forecast, as well as its confidence intervals.

The forward guidance introduced by NBP in 2013 had a small but statistically significant impact on reduction of forecast disagreement. The standard deviation of interest rate forecasts was lower on average by 3bp under the forward guidance policy than without this regime. This should imply that 99.99% confidence interval was narrowed by 25bp.

On the other hand, abandoning the declarations about future rate decisions and worries about the conflict of the NBP governor with the MPC members (after the tape leak) led to a rapid increase of uncertainty. The ex-ante standard deviation of interest rate forecast increased by approximately 15bp, implying that 99.99% confidence interval was covering the area wider by nearly 120bp in this period in comparison to other periods. Increased forecast disagreement sustained for 2 quarters. The rise of standard deviation was even greater when comparing to the late 2012, when it was obvious that Poland will soon face an activity slowdown.

The policy noise prior the appointment of Adam Glapiński as a head of the NBP and new MPC members in the early 2016 increased the standard deviation by approximately 2bp. It is clear that limitations of the NBP professional forecasters survey could lead to the underestimation of the total impact, because there were no questions regarding expectations about unconventional policies in the NBP professional survey. Furthermore, the assumption of a symmetric distribution of interest rate forecasts is likely to overly simplify our observation of the response to the governor appointment event. In this case forecasters were more eager to highlight greater downward risks to the forecasts, i.e., the lower bound of the 90% range reported by the analysts was lower comparing to the previous quarters, while higher boundary strongly shrank.

Finally, the longer forward guidance (with one-year horizon ahead) reintroduced in 2017 has also a positive impact on lowering the forecast uncertainty, similarly to the effects of the FG policies experienced in 2013. Our model suggests that standard deviation diminished totally by approximately 15bp in these periods in comparison to other periods (without forward guidance). However the impact were gradual – nearly half of disagreement reduction occurred initially after policy introduction, the impact increased after a year with consistent communication of flat rates. Please keep in mind that, the filtered technique used in the model is sensitive to the end of the sample instability, therefore strict magnitude of reduction may be altered with new data points. However the general conclusions are unlikely to change, given the scale of uncertainty reduction.

The forward guidance also prevented rise of uncertainty during the image crisis related to KNF gate. Despite strong accusations and rumors about the potential resignation of the NBP president, the reported uncertainty regarding monetary policy did not increased (contrary to 2014 case).

Table 2 – One year ahead interest rate forecast uncertainty.

Model parameters					
	Coefficient – linear form	Coefficient – estimation	Std. Error	t-statistic	Prob.
Constant	0.14	0.14	0.01	27.63	0.00
GDP uncertainty*	0.13	0.13	0.01	9.72	0.00
Historical rates volatility**	0.02	0.02	0.01	3.08	0.01
Forward guidance – 6M**	-0.03	0.03	0.01	2.78	0.01
Forward guidance – 1Y**	-0.05	-0.05	0.01	-3.64	0.00
Forward guidance – 1Y (from 2Q of 2018)**	-0.04	-0.04	0.01	-5.29	0.00

Abandoned FG & Belka's clash with MPC**	0.13	-0.13	0.01	-11.00	0.00
Glapinski's appointment**	0.02	0.02	0.01	2.94	0.01
2012 depression. **	0.07	0.07	0.02	4.01	0.00
Model diagnostics					
R-squared	0.91	Mean dependent var		0.13	
Adjusted R-squared	0.89	S.D. dependent var		0.07	
S.E. of regression	0.02	Akaike info criterion		-4.39	
Sum squared resid	0.01	Schwarz criterion		-4.01	
Log likelihood	71.62	Hannan-Quinn criter.		-4.27	
F-statistic	31.93	Durbin-Watson stat		2.15	
Prob(F-statistic)	0.00				
Sample (adjusted): 2012Q1 2019Q1					
Included observations: 29 after adjustments					

Coefficient of variables denoted with '*' were estimated with a power function (β^2). variables denoted with '**' with an absolute value function ($|\beta|$) in line with equation (4). In the third column we present originally estimated parameters of mentioned functions. In the second column, values of linear form were presented to simplify interpretation of marginal effects.
Source: Authors calculations

The estimation of two years forecast seems less robust e.g. Durbin-Watson statistics suggest some autocorrelation, the residuals for the years 2017-2018 are more volatile, comparing to the previous year.

Standard deviation of the two-year ahead interest rate forecasts at stands at 0.66 percentage points and the 99.99% confidence interval of forecasts spans over the 530bp range in the sample. This means that forecasters should assume that the total interest rate increase or decrease would not exceed 285bp in nearly any case. Please note that the assumption of normal distribution does not take into a consideration problem of effective lower bound – the distribution can freely span over the negative levels (e.g. -5%), while professional analysts are unlikely to present such views.

Parameter estimates of macroeconomic variables reveal a significant impact of both GDP growth forecast uncertainty and the historical interest rates volatility on the ex-ante subjective variance of interest rate forecasts (Table 3). The parameter corresponding to CPI forecast uncertainty and interactions between CPI forecasts and GDP forecasts was statistically insignificant. Contrary to Swanson (2006) we found no strong evidence of interest rate uncertainty reduction trend. The parameter slope was statistically insignificant – it does not deviate strongly from zero. This result suggests that more transparent communications policies other than forward guidance has small effect in Poland – In the mentioned period NBP did not introduce major amendments to other policy tools e.g. minutes, inflation projection.

The impact of the introduction of forward guidance in 2013 has similar effect comparing to 1-year horizon (reduction of standard deviations was not greater than 3bp, 99.99% confidence intervals narrowed by approximately 20bp).

Returning to this policy in 2017 initially have some positive impact. However again it took over a year for the MPC to convince professional forecasters that rates will remain flat. The strong reduction of disagreement is visible from the second quarter of 2018, over a year after the introduction of forward guidance. According to the model, the area covering 99.99% confidence intervals narrowed by approximately 165bp. Please keep in mind the mentioned quantity has only indicative character. First of all we do not know if the policy exhausted all of its potential yet, secondly used filtered techniques (TRAMO-SEATS algorithm) are sensitive when it comes to the end of the sample.

Table 3 – Two years ahead interest rate forecast uncertainty.

Model parameters					
	Coefficient – linear form	Coefficient - estimation	Std. Error	t-statistic	Prob.
Constant	0.44	0.44	0.01	35.37	0.00
GDP uncertainty*	0.07	0.26	0.01	18.01	0.00
Historical rates volatility**	0.05	0.05	0.00	12.41	0.00
Forward guidance – 6M**	-0.03	-0.03	0.01	-3.21	0.00
Forward guidance – 1Y**	-0.06	-0.06	0.02	-3.15	0.00
Forward guidance – 1Y (from 2Q of 2018)**	-0.17	-0.17	0.03	-5.79	0.00
@TREND	0.00	0.00	0.00	0.80	0.43
Model diagnostics					
R-squared	0.97	Mean dependent var		0.42	
Adjusted R-squared	0.96	S.D. dependent var		0.11	
S.E. of regression	0.02	Akaike info criterion		-4.63	
Sum squared resid	0.01	Schwarz criterion		-4.30	
Log likelihood	74.15	Hannan-Quinn criter.		-4.53	
F-statistic	110.46	Durbin-Watson stat		1.54	
Prob(F-statistic)	0.00				
Sample (adjusted): 2012Q1 2018Q3					
Included observations: 27 after adjustments					

Source: Authors calculations

7. Conclusions

Contrary to the experiences of developed economies (Kool and Thornton 2015, Jain and Sutherland 2018), our research confirmed that application of forward guidance lowered the disagreement regarding the next year interest rate amongst private forecasters in Poland both

in 2013 and 2017. The possible explanation of this phenomenon may be related to imperfections of individualistic comments provided by the MPC members. Rozkrut et al. (2007) argued that interviews describing views of individual members did not reduce uncertainty regarding interest rate forecasts in Poland due to the noise created by pivotal voters. Our results indicate that a structured, collective communication allowed to consume benefits of greater transparency.

Secondly, we found a heterogenous impact of forward guidance. In a one-year forecast horizon significantly less binding declarations made by Marek Belka's MPC in 2013 had lower effects in reducing the disagreement than stronger commitments of Adam Glapinski from 2017, but initially the difference was rather small. It is possible that central banks communication tends to be more effective in a more uncertain environment - during the term of Marek Belka interest rate volatility was much greater than presently. Declarations from central bank in such environment may have greater value to the analysts comparing to the period where policy is expected to be stable. Adam Glapinski's communication policy resulted in the stronger reduction of disagreement in 2018, after nearly a year of consistent messaging that rates should remain flat in the one or even two year horizon to market participant.

Similar phenomenon was visible in case of long-term forecast - communication policy strongly lowered disagreement, but again it took over a year for the Monetary Policy Council to convince professional forecasters towards credibility of its declaration.

The estimated models showed asymmetry of reaction between consistent positivistic declarations of keeping the interest rate stable and negative events e.g. communication incidents or political noise. Events showing the indecision of the Monetary Policy Council (e.g., the case of suspending the forward guidance policy in 2014) or shattering public perception of the relationship between NBP governor and other members led to non-proportional increase in forecast disagreement. However the image crisis in 4Q of 2018 suggest that credible forward guidance may prevent increase of disagreement during such periods.

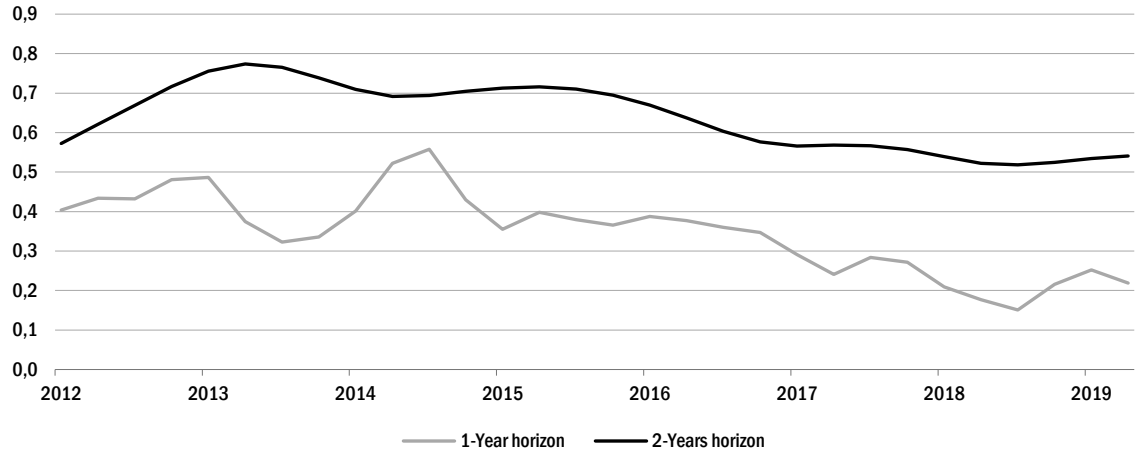
Overall our research highlights that it is relatively easy to lose confidence with ill-considered communication, but building credibility requires systematic long work.

Appendix 1 – Variables used within the model

The aim of this appendix is to present both the explained and explanatory variable. Each of series presented in the figures 1-3 were implied based on width of 50% confidence interval, published in the NBP survey of professional forecasters. Such data was transformed with the TRAMO-SEATS algorithm to extract seasonal and irregular factors.

The interest rate uncertainty is presented at the figure 1. In the one year horizon, the biggest uncertainty was reported firstly during the period of slowdown in early 2013 and after abandoning the forward guidance in 2014. The historically lowest uncertainty was recorded in 2018, under a regime of forward guidance and relatively low inflation.

Figure 1 – Interest rate uncertainty – implied ex-ante standard deviation of forecasts.

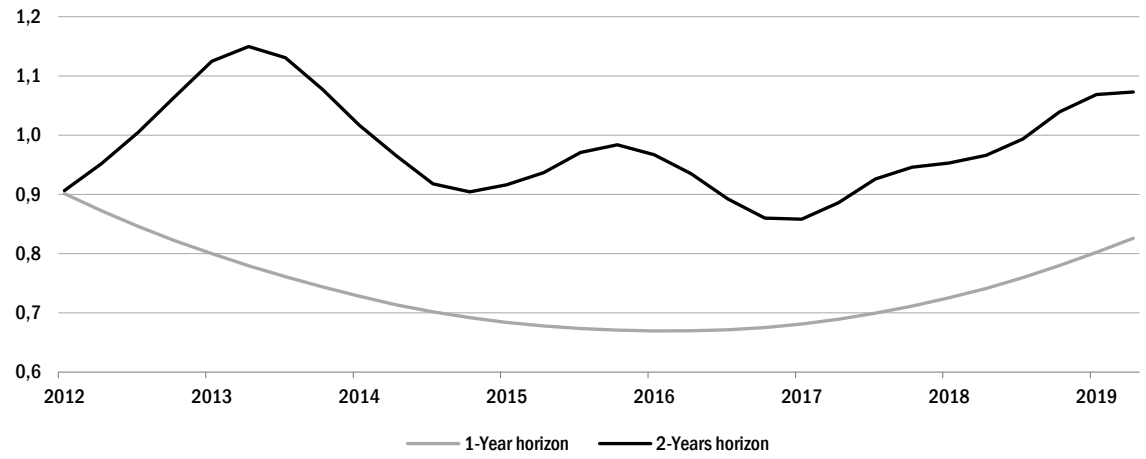


Source: Authors calculations based on NBP survey of professional forecasters

The figure 2 present GDP growth uncertainty. The short term indicator corresponds to the global activity – the highest readings were recorded prior the Eurozone sovereign debt crisis and protracted slowdown in the Eurozone (there were a technical recession in Italy, German GDP growth for two consecutive quarters was close to zero).

Similar tendencies are lagged in case of two years uncertainty - greater uncertainty is visible right after the bottom of the slowdown. Domestically, there is also an idiosyncratic shock visible in late 2015 related to change of government. The transition of power in the central bank was described in Section 4.

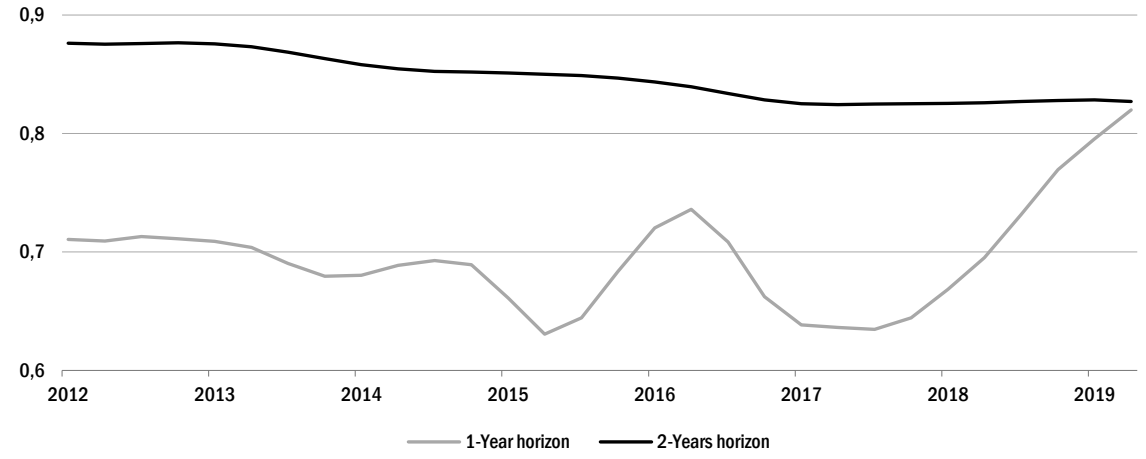
Figure 2 – GDP uncertainty – implied ex-ante standard deviation of forecasts.



Source: Authors calculations based on NBP survey of professional forecasters

Finally the last charts present inflation uncertainty. The two years uncertainty is rather persistent – we see a benign downward trend visible as inflation globally tends to be less volatile. In case of one year uncertainty the dynamics is greater – there are two periods of inflation target undershooting in 2015 and 2017. At the moment of writing (2019), the uncertainty is elevated due to unclear cost of electrical energy, after a strong increase of CO2 emission rights.

Figure 3 – CPI uncertainty – implied ex-ante standard deviation of forecasts.



Source: Authors calculations based on NBP survey of professional forecasters

In the paper we also refer to interactions between both forecast. There is a positive correlation between GDP and CPI forecast uncertainty visible both in one and two-years horizon. The Pearson correlation coefficient stays at respectively 0.53 and 0.43 (rounded to a two digit figure), what allow to reject the hypothesis that there is no coincidence between variables.

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