Central Banks' Predictability: An Assessment by Financial Market Participants*

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Our analysis of central banks' predictability is based on a unique data set of almost 500 market participants worldwide who were asked questions with respect to the performance of the Bank of England, the Bank of Japan, the European Central Bank, and the Federal Reserve. Our results indicate a positive and economically notable relationship between central banks' ability to convey their objectives and their overall communication skills on the one hand, and market participants' perception of the banks' predictability on the other hand. The perceived importance of disseminating more specific information does not contribute to better central bank predictability.

JEL Codes: E52, E58, F39.

1. Introduction

About twenty years ago, there was near agreement among central bankers that markets should not be able to anticipate the actions of the central bank. Indeed, monetary policy was intentionally opaque. For example, in the United States prior to February 1994, market participants had to infer from observed changes in open market operations whether or not the Federal Reserve had changed its target rate (Poole 2005). The main reason for opaqueness is that it

*We thank participants of the Annual Money, Macro and Finance Group conference in Bath, the European Public Choice Society Conference in Budapest, and research seminars at the Reserve Bank of New Zealand, University of Auckland, and University of Christchurch for helpful comments and suggestions on earlier versions of the paper. Any errors remain our own responsibility. Corresponding author (Hayo): Philipps-University Marburg, School of Business and Economics, D-35032 Marburg, Germany; Tel.: +49(0)6421–2823091; Fax: +49(0)6421–2823088; E-mail: hayo@wiwi.uni-marburg.de.

makes it easier to surprise markets and allow for "creative ambiguity" (Cukierman and Meltzer 1986). Surprising markets was deemed desirable; unanticipated monetary policy actions were thought to be more effective than anticipated actions, because, among other things, they cause greater movement in market prices such as interest rates.

Nowadays, central bank opaqueness has been nearly completely replaced with transparency. Many central banks appear to be avoiding the creation of any monetary policy surprises at all. Underlying this change in monetary practice is the emergence of an academic literature emphasizing the advantages of central bank transparency, which is thought to improve predictability and the anchoring of expectations (Geraats 2002, 2009; Siklos 2002). For instance, Woodford (2001) argues that a more predictable central bank will lead to a larger number of counterparties available to trade with the bank at a given and expected price. The consequence is that a smaller change in the market price will be required to absorb a given change in the supply of a particular instrument. Moreover, managing private-sector agents' expectations is thought to be especially important (Woodford 2003).

From this perspective, the smaller number of monetary policy surprises or, put differently, the higher degree of predictability, can be interpreted as a consequence of central banks' efforts to increase their transparency since the mid-1990s (Dincer and Eichengreen 2014). For instance, objectives and goals are specified and quantified, macroeconomic forecasts are published, interest rate decisions are announced and immediately explained, and some central banks provide indications of the likely course of monetary policy in the near future. Eijffinger and Geraats (2006) provide a comprehensive transparency index based on fifteen dimensions. In this paper, we categorize the items comprising their index as "formalized aspects of transparency." In addition to these more formalized measures, central banks are also increasingly concerned with improving their informal communication with financial markets, including speeches made and interviews given by members of the respective decision-making body. In contrast to post-meeting statements (and minutes), which many central banks make available after each interest rate decision (albeit often with a time lag), speeches and interviews are not regularly scheduled events. Therefore, we categorize these means of addressing the public as "informal communications" (for

an overview of the literature on central bank communication, see Blinder et al. 2008).

Both a higher degree of transparency and frequent informal communications are believed to facilitate the conduct of monetary policy by anchoring inflation expectations and reducing private-sector uncertainty over monetary policy. Indeed, several papers show that more formalized aspects of transparency (see, among many others, Demiralp 2001; Lange, Sack, and Whitesell 2003; Swanson 2006; Andersson and Hoffmann 2009; Dincer and Eichengreen 2014; Hayo and Mazhar 2014) as well as informal communications (see, among many others, Heinemann and Ullrich 2007; Jansen and de Haan 2009; Hayo and Neuenkirch 2010; Sturm and de Haan 2011) increase central bank predictability. The clarity of information provided by central banks would appear to be relevant as well. Jansen (2011), for instance, finds that volatility in financial markets is lower when the Federal Reserve Chairman provides a more informative semi-annual Humphrey-Hawkins testimony. Bulir, Cihak, and Jansen (2013) show significant and persistent differences in the clarity of inflation reports over time and across countries and conclude that a single model for clarity of central bank communication is not appropriate.

Empirically, however, it is often difficult to discern exactly through which channels predictability is being improved, that is, the literature is not clear about which particular formal or informal aspect of transparency or communication is primarily responsible for improved predictability. Put differently, the extant literature suffers from problems of identification arising from the fact that studies looking at formal aspects of transparency do not control for informal communication and vice versa. Thus, in spite of the evidence presented to date, it is arguably unclear which of the various measures proposed for enhancing central bank predictability are actually effective.

In this paper, we address this gap in the literature by examining the relationship between predictability, communication, and transparency from a different angle. We asked financial market participants for their perceptions of the performance of four major central banks—the Bank of England (BoE), the Bank of Japan (BoJ), the European Central Bank (ECB), and the Federal Reserve (Fed)—and for their preferences about specific, transparency-enhancing

measures (Geraats 2009; Dincer and Eichengreen 2014). Specifically, we assess how market participants view information dissemination by central banks in the form of conditional interest rate projections, individual voting records, minutes of policy meetings, and transcripts of policy meetings.

Our analysis is based on a unique data set of 478 market participants from financial institutions located across the globe that was collected by Barclays in 2013 using an extensive questionnaire jointly developed with us.[1] Methodologically, we approach the question of the effectiveness of specific instruments designed to improve monetary policy transparency by studying how these instruments are viewed by financial market participants. The main advantage of our approach compared to the extant literature is that we can assess the effectiveness of specific transparency-enhancing measures while controlling for the influences of other measures. The main drawback is that we base our conclusions on market participants' expressed opinions rather than their actions. We believe that the survey evidence in this paper can improve our understanding of how and to what extent transparency and informal communication influence private actors' expectations and, therefore, the predictability of central bank actions. Based on these findings, we provide some policy guidance for assessing how central banks can or cannot improve their perceived predictability.

Several previous studies utilize survey data to study various aspects of central banking from the viewpoint of professional observers. For instance, Fry et al. (2000) collect responses from central bankers on issues of transparency and credibility. Blinder (2000) focuses on the heads of central banks and asks them about important determinants of credibility. De Haan, Eijffinger, and Waller (2005) employ a slightly modified version of Blinder's (2000) questionnaire with the aim of comparing credibility across various central banks. Including these questions in the Ifo Institute for Economic Research's Economic Survey International, they obtain more than 200 answers from professional economists. They find, among other

[1]Other parts of the questionnaire are used as input for studies on (i) the special role of central bank communication during the financial crisis and (ii) how financial market participants process central bank news (see Hayo and Neuenkirch 2015a, 2015b).

things, that in 2000—that is, right after the creation of the European Monetary Union—the Fed was ranked highest in terms of credibility, closely followed by the Bundesbank. The BoE and ECB are in third and fourth place; the other central bank in our study, the BoJ, is ranked even lower.

However, none of these studies focuses on the predictability of monetary policy, which is at the heart of the present paper, nor are they concerned with measuring the views of financial market participants, who are the specific group making up our sample.

The rest of the paper is organized as follows. Section 2 describes the survey instrument that we employ for our analysis as well as important descriptive statistics. Section 3 discusses our econometric approach. Section 4 contains the empirical estimation results. Section 5 concludes.

2. The Survey

The survey of financial market participants was conducted by Barclays Europe between April 17, 2013 and May 1, 2013. All subscribers to Barclays's fixed-income newsletter were invited via e-mail to participate in an online survey. Our sample consists of 478 completed questionnaires.[2] Respondents are from all over the world and work in a variety of positions—for instance, as analysts, traders, or portfolio managers (see table 6 in the appendix for more details). A general analysis of the survey data, targeted to Barclays's clients, can be found in Barclays (2013).

In the following, we introduce the subset of survey questions relevant for this paper and discuss some descriptive results.[3]

[2]Note that throughout the survey, participants were allowed to answer "don't know" or to skip questions. In fact, 580 respondents did not complete the entire questionnaire, possibly due to time constraints. In light of this loss in the number of observations, we investigated the possibility of sample-selection bias. However, based on the questions answered by both groups, we found no evidence of notable differences between those who completed the survey and those who did not.

[3]A careful completion of the full questionnaire, which contained more than the questions utilized in the present paper (see also footnote 1), took about fifteen minutes. In light of how pressed for time financial market participants are, we considered it essential to limit the number of items per question so as to avoid too many non-responses (see also footnote 2). Consequently, in the case of Q4,

Q1: How well do you think the BoE/BoJ/ECB/Fed performs on predictability?
Q2: How well do you think the BoE/BoJ/ECB/Fed performs on conveying their objectives?
Q3: Please rank your overall sense of how well the BoE/BoJ/ECB/Fed communicates with the financial markets.
Q4: In your opinion, how important is it for central banks to publish the following information?
  a. Conditional interest rate projections.
  b. Individual voting records.
  c. Minutes of policy meeting.
  d. Transcript of policy meeting.

Table 1 provides some descriptive statistics. We derive a central bank's rank (Q1–Q3) and the relative importance of different types of information (Q4) based on statistical mean-comparison t-tests with unequal variances. Table 1 shows that the Fed performs better than "well" and achieves the best ranking across all three dimensions, that is, in terms of predictability, conveying its objectives, and communication skills. The other three banks follow by more than half a standard deviation and are perceived to perform only between "well" and "fairly well." Within this group, the BoE ranks best, followed by the BoJ, and then the ECB.

There is not much evidence that respondents evaluate the central bank in their home area to be significantly better than do respondents from other regions (columns "Home" and "Non-H."). Only in the case of "conveying objectives" do we find that respondents from Europe (excluding the United Kingdom) have a significantly more favorable picture of the ECB's performance ($t = 2.33$, p-value: 0.02). Put differently, these results imply that the Fed ranks first in all three dimensions when omitting North American respondents.

Regarding the importance of special types of information, we find that market participants believe all of them to be useful. In terms of their relative relevance, however, respondents consider publication of policy meeting minutes to be the most important source of

we focus only on those items that were not used by all four central banks at the time of the survey.

Table 1. Descriptive Statistics

	Mean	Std. Dev.	Rank	Home	Non-H.
Q1: Predictability					
Bank of England	2.61	0.80	2	2.61	2.61
Bank of Japan	2.34	0.91	3	2.21	2.36
European Central Bank	2.43	0.91	3	2.57	2.39
Federal Reserve	3.08	0.76	1	3.12	3.07
Q2: Conveying Objectives					
Bank of England	2.66	0.82	2	2.64	2.66
Bank of Japan	2.68	0.94	2	2.86	2.65
European Central Bank	2.48	0.95	4	2.66	2.43
Federal Reserve	3.19	0.76	1	3.22	3.19
Q3: Communication in General					
Bank of England	6.77	1.59	2	6.81	6.75
Bank of Japan	6.35	1.85	3	6.38	6.34
European Central Bank	6.44	1.81	3	6.48	6.43
Federal Reserve	7.68	1.49	1	7.70	7.68
Q4: Special Types of Information					
Interest Rate Projections	3.84	0.98	2	—	—
Voting Records	3.69	1.00	4	—	—
Minutes	4.49	0.74	1	—	—
Transcripts	3.89	1.04	2	—	—

Notes: Coding of Q1 and Q2: 4 = extremely well, 3 = well, 2 = fairly well, 1 = not well. Coding of Q3: 10 = extremely well . . . 1 = extremely poor. Coding of Q4: 5 = essential, 4 = important, 3 = useful, 2 = not important, 1 = distracting. Full text of survey questions can be found in section 2. Rank is determind by mean-comparison t-tests with unequal variances at a 5 percent level of significance. The "Home" column shows means computed for respondents located in the home region of the respective central bank compared to those from the rest of the world ("Non-H.").

information. Much less important—almost a full standard deviation behind—are the other three measures. Thus, interest rate projections[4] and publication of transcripts of policy meetings rank second and the release of voting records ranks last. A quote from the

[4]Moessner, Jansen, and de Haan (2017) provide an overview of different types of communication about future interest rates. Along the lines of Campbell et al. (2012), their major distinction is between mere forecasts of macroeconomic performance and likely monetary policy actions on the one hand and an explicit commitment to monetary policy action under specific macroeconomic conditions on the other hand. Therefore, survey respondents could have had different types of interest rate projections in mind when answering this question. Given the phrasing of Q4, however, we cannot control for these potentially different interpretations.

open-comments part of the survey referring to the ECB underlines this finding: "It would be extremely useful to have minutes before the next interest rate decision, like the BoE and the Fed. Disappointing that the ECB does not publish the minutes."

More generally, and reassuringly in terms of the internal consistency of the survey respondents' answers, the central bank considered best in terms of predictability (the Fed) has adopted all four of these transparency measures. In contrast, the ECB had adopted none of these measures at the time the survey was conducted (April 2013). It is worth noting that the ECB changed its communication policy in 2015 and now provides an "account" of monetary policy meetings with a four- to six-week delay. In addition, the ECB employed qualitative forward guidance in its introductory statements to press conferences on July 4, 2013 and June 5, 2014.[5] The BoE and BoJ both publish minutes and voting records, and provide some indication of the policy path via forward guidance.

In light of the academic literature, it is surprising that market participants do not perceive individual voting records to be more important. Various studies show that (attributed) voting records are informative with respect to future interest rate policy (see, among many others, Gerlach-Kristen 2004, 2009; Horvath, Smidkova, and Zapal 2012; Horvath and Jonasova 2015). Thus, either financial market participants are not aware of the results of these academic studies, which seems unlikely, or they can obtain similar or even superior information via other channels of communication. That minutes are preferred over all three of the other measures suggests that our respondents are more interested in the general gist of the discussion rather than in the in-depth information provided by, for instance, transcripts. Put differently, there appears to be decreasing marginal utility in central bank transparency.

Finally, we want to learn more about the relationship between the overall communication skills of the four central banks and the importance of the four specific transparency-enhancing items as perceived by financial market participants. Table 2 sets out bivariate correlation coefficients. Generally, we find a weak positive relationship

[5]See http://www.ecb.europa.eu/press/pressconf/2013/html/is130704.en.html, http://www.ecb.europa.eu/press/pressconf/2014/html/is140605.en.html, and Moessner, Jansen, and de Haan (2017).

Table 2. Bivariate Correlation Coefficients between Perceived Importance of Formal Transparency Instruments and General Communication Ability

	Q3: Communication in General			
	BoE	**BoJ**	**ECB**	**Fed**
Q4: Special Types of Information				
Interest Rate Projections	0.05	0.07	−0.01	0.00
Voting Records	0.03	0.02	−0.01	0.09
Minutes	0.07	−0.01	0.01	0.09*
Transcripts	0.08	0.07	−0.01	0.06

Notes: Coding of Q3: 10 = extremely well . . . 1 = extremely poor. Coding of Q4: 5 = essential, 4 = important, 3 = useful, 2 = not important, 1 = distracting. Full text of survey questions can be found in section 2. ** and * indicate significance at the 1 percent and 5 percent level, respectively.

between the respondents' assessment of the central banks' communications skills and the degree of importance they attribute to the various formal transparency measures. However, only one of these sixteen correlation coefficients (ρ) is statistically significant at the 5 percent level, namely, dissemination of minutes by the Fed ($\rho = 0.09$).[6] This indicates that the general communication skills measure an influence that goes beyond the specific transparency-enhancing measures—for instance, the frequent delivery of speeches and interviews in which central bankers provide "informal" updates about the economic outlook and the likely future course of monetary policy.

3. Empirical Methodology

In our multivariate econometric analysis, we use ordered probit models to explain the relationship between financial market participants'

[6]In contrast, the magnitude of the correlation coefficients computed for the various pairs of the four transparency-enhancing items is at least $\rho = 0.19$ and always statistically significant at a 5 percent level. The same holds for the association between the perceived communication skills of the four central banks, which ranges from $\rho = 0.42$ to $\rho = 0.61$.

evaluation of central bank predictability (Q1, *pred*) as the left-hand-side variable, and central banks' perceived ability to convey their objectives (Q2, *obj*), financial market participants' overall perception of central bank communication (Q3, *comm*), and the relative importance of different types of information provided by central banks (Q4, *transp*) as right-hand-side variables. Since Q1–Q3 were asked separately for the four central banks in our sample, we employ a seemingly unrelated regression (SUR) framework to account for potential correlation among the error terms for respondent i across central banks. Hence, our general specification is as follows:

$$\begin{aligned}
pred(BoE)_i^* &= \alpha_1 obj(BoE)_i + \beta_1 comm(BoE)_i \\
&\quad + \gamma_1' transp_i + \delta_1' pos_i + \zeta_1' loc_i + \varepsilon_{1,i} \\
pred(BoJ)_i^* &= \alpha_2 obj(BoJ)_i + \beta_2 comm(BoJ)_i \\
&\quad + \gamma_2' transp_i + \delta_2' pos_i + \zeta_2' loc_i + \varepsilon_{2,i} \\
pred(ECB)_i^* &= \alpha_3 obj(ECB)_i + \beta_3 comm(ECB)_i \\
&\quad + \gamma_3' transp_i + \delta_3' pos_i + \zeta_3' loc_i + \varepsilon_{3,i} \\
pred(Fed)_i^* &= \alpha_4 obj(Fed)_i + \beta_4 comm(Fed)_i \\
&\quad + \gamma_4' transp_i + \delta_4' pos_i + \zeta_4' loc_i + \varepsilon_{4,i}. \qquad (1)
\end{aligned}$$

$pred(.)_i^*$ are the latent continuous variables representing the ordinal choice for the perception of BoE/BoJ/ECB/Fed predictability by survey participant i. $\alpha_1, \ldots, \alpha_4$ and $\beta_1, \ldots, \beta_4$ are the coefficients for the explanatory variables $obj(.)_i$ and $pred(.)_i$. $\gamma_1', \ldots, \gamma_4'$, $\delta_1', \ldots, \delta_4'$, and $\zeta_1', \ldots, \zeta_4'$ are vectors of coefficients for the explanatory variables $transp_i$ and for dummy variables representing the respondent's position pos_i and geographical location loc_i. The residuals $\varepsilon_{1,i}, \ldots, \varepsilon_{4,i}$ are assumed to follow a standard normal distribution and allow for a non-zero contemporaneous correlation across the four equations. The ordered probit models are estimated by maximum likelihood.

Employing a SUR approach has two major advantages over estimating separate models for each central bank. First, SUR estimation takes into account our expectation that individuals' views about central bank predictability are not independently distributed across the four central banks. Second, a SUR setup allows for directly

comparing coefficients and implementing efficient statistical tests in the context of one nested model.

To show the robustness of our findings, we estimate an alternative specification based on constructing a cross-sectional panel, which combines the information on the four central banks in one data set (see Hayo and Neuenkirch 2015a, 2015b). In this framework, we control for central-bank-specific fixed effects implying that we capture central-bank-specific differences in the average perception of predictability.[7] This means that the influence of the various degrees of actually adopted transparency measures is already accounted for. Thus, the influence of the remaining three explanatory variables—that is, specifying objectives, general communication ability, and transparency instruments—is estimated after controlling for the special types of information already provided.

To avoid misinterpretation of our empirical analysis, we emphasize that we cannot exclude the possibility of a simultaneous relationship between the left-hand-side variables and some of the right-hand-side variables. Inasmuch as the regressors are endogenous, the estimated coefficients reflect conditional correlations rather than causal effects.

4. Explaining Central Bank Predictability

First, we evaluate the appropriateness of the SUR framework for estimating equation (1). Table 3 shows the matrix of correlation coefficients of cross-equation residuals. All six correlation coefficients are significant at the 5 percent level, indicating that individuals' views about central bank predictability are not independently distributed across the four central banks. This finding underlines the importance of allowing for cross-equation correlations in the error terms when studying individuals' perceptions of central bank predictability.

Table 4 sets out the estimation results for equation (1). Only two variables are significant at a 5 percent level for all four central banks in the sample. First, we find a positive relationship between

[7]Note that the inclusion of individual fixed effects is not feasible, as these would be perfectly collinear with the respondents' perception of the four specific transparency measures.

Table 3. Explaining Predictability: Correlation of Residuals

	BoE	BoJ	ECB	Fed
BoE	1	0.24**	0.36**	0.39**
		(0.07)	(0.07)	(0.06)
BoJ		1	0.17**	0.43**
			(0.06)	(0.06)
ECB			1	0.35**
				(0.06)
Fed				1

Notes: The table shows correlation coefficients of the residuals across equations and their standard errors (in parentheses) obtained after estimation of equation (1) using ordered probit in a SUR framework. Number of observations: 478. Huber (1967)/White (1980) robust standard errors are used. ** and * indicate significance at the 1 percent and 5 percent level, respectively.

the assessment of central banks' ability to convey their objectives and their predictability. Second, the positive evaluation of central banks' communication skills also contributes to a positive appraisal of their predictability. The quantitative effects of communication are homogenous across all four central banks.[8] In the case of conveying objectives, however, there is some heterogeneity across central banks. First, the positive impact on predictability is significantly larger for the Fed than it is for the BoJ and the ECB. Second, statistical testing reveals that financial market participants consider the BoE to be significantly better in terms of predictability than the BoJ.[9]

We find no systematic relationship between the perception of the importance of more specialized types of information (interest rate projections, voting records, minutes, and transcripts) and the

[8]Equality restriction for communication across all central banks: $\text{Chi}^2(3) = 1.1$, p-value: 0.78.

[9]Equality restrictions for conveying objectives across all central banks: $\text{Chi}^2(3) = 9.2$, p-value: 0.03; BoE vs. BoJ: $\text{Chi}^2(1) = 4.0$, p-value: 0.05; BoE vs. ECB: $\text{Chi}^2(1) = 0.8$, p-value: 0.39; BoE vs. Fed: $\text{Chi}^2(1) = 1.0$, p-value: 0.32; BoJ vs. ECB: $\text{Chi}^2(1) = 1.5$, p-value: 0.22; BoJ vs. Fed: $\text{Chi}^2(1) = 8.4$; p-value: 0.00; ECB vs. Fed: $\text{Chi}^2(1) = 3.8$, p-value: 0.05.

Table 4. Explaining Central Bank Predictability (Q1)

	BoE	BoJ	ECB	Fed
Conveying Objectives (Q2)	0.791**	0.560**	0.691**	0.913**
	(0.100)	(0.086)	(0.076)	(0.095)
Communication (Q3)	0.206**	0.256**	0.212**	0.212**
	(0.047)	(0.039)	(0.036)	(0.046)
Interest Rate Projections (Q4a)	−0.031	0.024	−0.082	−0.127*
	(0.068)	(0.076)	(0.060)	(0.062)
Voting Records (Q4b)	0.036	0.004	0.027	0.045
	(0.063)	(0.073)	(0.061)	(0.058)
Minutes (Q4c)	−0.038	−0.135	0.133	−0.009
	(0.081)	(0.092)	(0.081)	(0.082)
Transcripts (Q4d)	0.003	0.079	−0.076	−0.011
	(0.056)	(0.060)	(0.056)	(0.062)
Position:				
Analyst/Economist	−0.241	−0.177	0.057	−0.582**
	(0.167)	(0.177)	(0.155)	(0.167)
Execution/Trading (Reference)				
Portfolio/Liability Manager	−0.419*	−0.405*	0.161	−0.596**
	(0.185)	(0.188)	(0.170)	(0.187)
Other	−0.187	−0.075	0.071	−0.410*
	(0.155)	(0.168)	(0.151)	(0.165)
Location:				
Asia excl. Japan	−0.250	−0.256	0.149	−0.563**
	(0.215)	(0.200)	(0.227)	(0.214)
Europe excl. United Kingdom (Reference)				
Japan	−0.673**	−0.644**	−0.536**	−0.985**
	(0.208)	(0.204)	(0.177)	(0.210)
North America	−0.426*	−0.481**	−0.175	−0.351*
	(0.177)	(0.184)	(0.159)	(0.179)
United Kingdom	−0.331	−0.315	−0.053	−0.493**
	(0.171)	(0.181)	(0.164)	(0.171)
Other	−0.012	−0.160	0.057	−0.216
	(0.266)	(0.274)	(0.251)	(0.229)
First Cut Point	0.955*	1.365**	1.867**	0.566
	(0.449)	(0.505)	(0.431)	(0.491)
Second Cut Point	2.583**	2.738**	3.258**	2.205**
	(0.468)	(0.522)	(0.449)	(0.503)
Third Cut Point	4.408**	4.084**	4.727**	4.010**
	(0.514)	(0.555)	(0.472)	(0.514)

Notes: The table shows coefficients and their standard errors (in parentheses) for an ordered probit estimation of equation (1) allowing for correlaton in the error terms across equations. Number of observations: 478. Full text of survey questions and coding of Q1–Q4 can be found in section 2. Huber (1967)/White (1980) robust standard errors are used. ** and * indicate significance at the 1 percent and 5 percent level, respectively.

predictability of central banks.[10] Given, first, that the Fed regularly engages in all four special forms of transparency and the ECB did not at the time of the survey and, second, the very favorable picture of the Fed and the unfavorable assessment of the ECB, one could have expected a positive relationship between some of these variables and the perceived level of predictability. However, it appears to be the general assessment of communication skills that explains perceived predictability of central banks rather than the dissemination of specific information. This raises serious concerns about the effectiveness of individual central bank transparency measures. Put differently, studies showing positive effects of such transparency measures may suffer from omitted variables biases, as they do not control for the influence of informal communication channels.

How participants perceive central bank predictability is significantly influenced by the positions they hold. Portfolio and liability managers have a less favorable rating of BoE, BoJ, and Fed predictability compared to the reference group of those working in execution and trading. In the case of the Fed, analysts and economists as well as "other" participants also assess the bank's predictability as worse compared to the reference group. In addition, there are differences between participants based on geographical region. Japanese respondents consider the predictability of all four central banks to be worse compared to the ratings of the reference group, that is, respondents living in Europe (excluding the United Kingdom). A similar picture emerges for respondents from North America, who express a less favorable assessment of the BoE, BoJ, and Fed; respondents from Asia (excluding Japan) and the United Kingdom come to a similar conclusion for the Fed.

The estimated coefficients of ordered probit models are difficult to interpret, as they measure the influence of the explanatory variables on the latent variable $pred(.)_i^*$. Marginal effects, in contrast, measure changes in the probability of perceiving the central bank's predictability as "not well"/"fairly well"/"well"/"extremely well" due to changes in the explanatory variable of interest, keeping all

[10]Exclusion restriction for interest rate projections across all central banks: $\text{Chi}^2(4) = 6.8$, p-value: 0.15; exclusion restriction for voting records: $\text{Chi}^2(4) = 0.8$, p-value: 0.94; exclusion restriction for minutes: $\text{Chi}^2(4) = 5.3$, p-value: 0.25; exclusion restriction for transcripts: $\text{Chi}^2(4) = 4.1$, p-value: 0.40.

other explanatory variables at fixed values. Table 5 sets out average marginal effects for selected variables, which are computed as the average of all marginal effects evaluated at each observation. That is, we keep all other explanatory variables at their fixed values for each observation while changing the variable of interest by one standard deviation (SD) (see table 1).

To economize on space, we focus our interpretation on the change in probability of the extreme category 4 (extremely well). A one-SD increase in perceived success in conveying objectives is associated with an increase in the likelihood of assessing the central bank's predictability as "extremely well" by about 10 percentage points (pp) (BoE), 8 pp (BoJ), 10 pp (ECB), and 19 pp (Fed). We consider these magnitudes to indicate a notable positive economic effect of central banks' ability to convey their objectives on perceived predictability. Put differently, clearly specifying the central bank's objective makes it easier for financial markets to anticipate monetary policy actions. This linkage appears to be especially strong in the case of the Fed.

Moreover, a one-SD increase in perceived communication skills also contributes to an increase in the probability of the central bank receiving the highest rating for predictability. In the case of the BoE (5 pp), the ECB (6 pp), and the Fed (9 pp), the figures are roughly half as large compared to the ones for conveying objectives. In the case of the BoJ, the marginal effect (7 pp) for communication skills is almost the same size as the one for conveying objectives. Thus, the magnitude of the estimated effects is still economically relevant and suggests that general communication skills are associated with higher predictability. Again, this relationship is particularly pronounced in the case of the Fed, which is in line with evidence presented by Hayo and Neuenkirch (2010) on the power of informal central bank communication for predicting interest rate changes.

The robustness of our analysis is shown by estimating a cross-sectional panel, which combines the information on the four central banks in one data set. As can be seen from table 7 in the appendix, the results are qualitatively unchanged compared to the baseline results presented in table 4. Thus, even after controlling for central bank fixed effects, we do not discover any significant explanatory power of the perceived importance of providing special types of information for central banks' predictability.

Table 5. Explaining Predictability (Q1): Marginal Effects for Selected Variables

	Pr(Pred. = 1)	**Pr(Pred. = 2)**	**Pr(Pred. = 3)**	**Pr(Pred. = 4)**
Bank of England				
Conveying Objectives (Q2)	−0.069**	−0.120**	0.090**	0.099**
	(0.011)	(0.013)	(0.012)	(0.013)
Communication (Q3)	−0.035**	−0.061**	0.046**	0.050**
	(0.008)	(0.014)	(0.011)	(0.011)
Bank of Japan				
Conveying Objectives (Q2)	−0.110**	−0.043**	0.076**	0.077**
	(0.016)	(0.008)	(0.011)	(0.012)
Communication (Q3)	−0.098**	−0.038**	0.068**	0.069**
	(0.014)	(0.009)	(0.011)	(0.012)
European Central Bank				
Conveying Objectives (Q2)	−0.119**	−0.077**	0.094**	0.102**
	(0.012)	(0.009)	(0.011)	(0.012)
Communication (Q3)	−0.069**	−0.045**	0.055**	0.059**
	(0.012)	(0.008)	(0.010)	(0.011)
Federal Reserve				
Conveying Objectives (Q2)	−0.026**	−0.110**	−0.051**	0.187**
	(0.005)	(0.011)	(0.011)	(0.017)
Communication (Q3)	−0.012**	−0.050**	−0.023**	0.085**
	(0.003)	(0.012)	(0.006)	(0.018)

Notes: The table shows selected average marginal effects and their standard errors (in parentheses) for ordered probit estimation of equation (1) allowing for correlation in the error terms across equations. Number of observations: 478. Coding of dependent variable: 1 = not well, 2 = fairly well, 3 = well, 4 = extremely well. Full text of survey questions and coding of Q2–Q3 can be found in section 2. Huber (1967)/White (1980) robust standard errors are used. ** and * indicate significance at the 1 percent and 5 percent level, respectively.

Finally, to gain further insight into one of our key explanatory variables—overall communication skills—we also estimate a cross-sectional panel containing our survey information about all four central banks. The general setup follows the aforementioned robustness test, and the results can be found in table 8 in the appendix. Similar to our results from the bivariate correlations presented in table 2, we find that the overall communication skills cannot be explained by the specific transparency-enhancing measures. Only two variables are significant at the 5 percent level. First, analysts/economists perceive the ECB's communications skills to be better than the reference group, that is, those working in execution or trading. Second, respondents from Japan perceive the Fed's communication skills to be better than the reference group, that is, respondents from Europe (excluding the United Kingdom). We interpret these findings as implying that the respondents' assessment of the central banks' overall communication skills reflects a different but important influence that goes beyond the other covariates employed in our study (see also the end of section 2).

5. Conclusions

In this paper, we examine the relationship between market participants' perception of central bank predictability on the one side, and their assessment of central bank communication skills and success in conveying objectives as well as the importance of transparency-enhancing measures—such as voting records, transcripts or minutes of policy meetings, and conditional interest rate projections—on the other side. Our analysis is based on a unique data set of 478 market participants worldwide who were asked questions about the performance of the Bank of England, the Bank of Japan, the European Central Bank, and the Federal Reserve.

For all four central banks in the sample, our results indicate a positive association between the assessment of central banks' ability to convey their objectives and their overall communication skills on the one hand and the perception of predictability on the other hand. We find not only significant statistical associations but also effects of notable economic magnitude. In contrast, the perceived importance of disseminating specific types of information does not seem to contribute to better central bank predictability when controlling

for informal communication. These estimation results, obtained in a seemingly unrelated regression system of all four central banks, also hold up in a panel-type framework, where we control for central bank fixed effects.

This suggests that the additional predictive power of these special transparency instruments in a world where informal communication channels are well developed is relatively small. Moreover, the descriptive analysis of our data suggests that of all four transparency instruments, minutes are perceived as most important by financial market actors. Given that minutes contain much less information than other transparency measures—for instance, transcripts—this suggests that central bank transparency may be characterized by substantial decreasing marginal utility. Thus, our findings raise doubts that the adoption of more and more instruments potentially fostering transparency is helpful for improving the financial market's ability to predict central bank actions. Thus, in contrast to much of the extant literature, our recommendation to central banks is that—from the perspective of financial market participants—a clearly defined monetary policy objective and a sound general communication strategy are more important than the dissemination of very specific and detailed information.

Appendix

Table 6. Distribution of Respondents

Location		**Position**	
Asia excl. Japan	42	Analyst/Economist	140
Europe excl. United Kingdom	98	Execution/Trading	86
Japan	69	Portfolio/Liability Manager	103
North America	111	Other	149
United Kingdom	119		
Other	39		
Sum	478	Sum	478

Table 7. Explaining Predictability (Q1): Panel Estimations

	BoE	BoJ	ECB	Fed
Conveying Objectives (Q2)	0.793**	0.673**	0.811**	0.915**
	(0.085)	(0.091)	(0.073)	(0.089)
Communication (Q3)	0.174**	0.256**	0.194**	0.145**
	(0.047)	(0.043)	(0.037)	(0.045)
Interest Rate Projections (Q4a)	−0.038	0.033	−0.077	−0.109
	(0.063)	(0.085)	(0.063)	(0.057)
Voting Records (Q4b)	0.034	0.005	0.008	0.053
	(0.059)	(0.081)	(0.064)	(0.055)
Minutes (Q4c)	−0.040	−0.133	0.146	−0.005
	(0.075)	(0.101)	(0.086)	(0.076)
Transcripts (Q4d)	0.010	0.092	−0.077	−0.021
	(0.052)	(0.066)	(0.059)	(0.060)
Position:				
Analyst/Economist	−0.238	−0.265	0.073	−0.569**
	(0.151)	(0.195)	(0.165)	(0.174)
Execution/Trading	Ref.	Ref.	Ref.	Ref.
Portfolio/Liability Manager	−0.374*	−0.526*	0.172	−0.569**
	(0.165)	(0.208)	(0.182)	(0.174)
Other	−0.170	−0.130	0.109	−0.415**
	(0.143)	(0.188)	(0.160)	(0.155)
Location:				
Asia excl. Japan	−0.278	−0.319	0.131	−0.511**
	(0.195)	(0.218)	(0.237)	(0.193)
Europe excl. United Kingdom	Ref.	Ref.	Ref.	Ref.
Japan	−0.677**	−0.698**	−0.533**	−0.894**
	(0.191)	(0.227)	(0.183)	(0.192)
North America	−0.435**	−0.519**	−0.090	−0.306
	(0.164)	(0.206)	(0.166)	(0.167)
United Kingdom	−0.349*	−0.387	−0.066	−0.446**
	(0.158)	(0.202)	(0.172)	(0.159)
Other	−0.019	−0.153	0.131	−0.159
	(0.245)	(0.306)	(0.266)	(0.211)
Central Bank Fixed Effects	1.048	0.440	Ref.	1.531*
	(0.623)	(0.712)		(0.650)
First Cut Point	1.962**			
	(0.456)			
Second Cut Point	3.429**			
	(0.463)			
Third Cut Point	5.059**			
	(0.471)			

Notes: The table shows coefficients and their standard errors (in parentheses) for a panel ordered probit model with perceived predictability as dependent variable. Number of observations: 1,739. Full text of survey questions and coding of Q1–Q4 can be found in section 2. Huber (1967)/White (1980) robust standard errors are used. ** and * indicate significance at the 1 percent and 5 percent level, respectively.

Table 8. Explaining Communication (Q3): Panel Estimations

	BoE	BoJ	ECB	Fed
Interest Rate Projections (Q4a)	0.073	0.133	0.007	−0.027
	(0.093)	(0.110)	(0.094)	(0.073)
Voting Records (Q4b)	−0.015	−0.001	−0.039	0.113
	(0.103)	(0.094)	(0.095)	(0.071)
Minutes (Q4c)	0.066	−0.171	0.086	0.112
	(0.132)	(0.162)	(0.133)	(0.111)
Transcripts (Q4d)	0.091	0.123	−0.028	0.015
	(0.073)	(0.095)	(0.083)	(0.065)
Position:				
Analyst/Economist	0.110	0.072	0.539*	0.246
	(0.239)	(0.271)	(0.264)	(0.225)
Execution/Trading	Ref.	Ref.	Ref.	Ref.
Portfolio/Liability Manager	0.159	0.007	0.213	0.196
	(0.255)	(0.312)	(0.300)	(0.233)
Other	0.047	−0.120	0.404	−0.003
	(0.248)	(0.272)	(0.263)	(0.227)
Location:				
Asia excl. Japan	−0.053	0.478	−0.222	0.013
	(0.281)	(0.336)	(0.329)	(0.249)
Europe excl. United Kingdom	Ref.	Ref.	Ref.	Ref.
Japan	0.297	0.404	0.121	0.450*
	(0.279)	(0.300)	(0.270)	(0.221)
North America	0.145	0.157	−0.283	0.088
	(0.271)	(0.292)	(0.294)	(0.234)
United Kingdom	0.142	0.229	−0.056	−0.165
	(0.238)	(0.282)	(0.249)	(0.213)
Other	0.018	0.002	0.147	0.109
	(0.393)	(0.425)	(0.414)	(0.322)
Central Bank Fixed Effects	−0.294	−0.059	Ref.	0.635
	(1.023)	(1.094)		(0.908)
Constant Term			6.011**	
			(0.691)	

Notes: The table shows coefficients and their standard errors (in parentheses) for a panel least squares estimation with perceived communication as dependent variable. Number of observations: 1,739. Full text of survey questions and coding of Q3–Q4 can be found in section 2. Huber (1967)/White (1980) robust standard errors are used. ** and * indicate significance at the 1 percent and 5 percent level, respectively.

References

Andersson, M., and Hoffmann, A. 2009. "Gauging the Effectiveness of Quantitative Forward Guidance: Evidence from Three Inflation Targeters." ECB Working Paper No. 1098.

Barclays. 2013. "A Quantum Shift in Central Bank Communication." Unpublished Report, Barclays Economic Research.

Blinder, A. S. 2000. "Central-Bank Credibility: Why Do We Care? How Do We Build It?" *American Economic Review* 90 (5): 1421–31.

Blinder, A. S., M. Ehrmann, M. Fratzscher, J. de Haan, and D.-J. Jansen. 2008. "Central Bank Communication and Monetary Policy: A Survey of Theory and Evidence." *Journal of Economic Literature* 46 (4): 910–45.

Bulir, A., M. Cihak, and D.-J. Jansen. 2013. "What Drives Clarity of Central Bank Communication about Inflation?" *Open Economies Review* 24 (1): 125–45.

Campbell, J., C. Evans, J. Fisher, and A. Justiniano. 2012. "Macroeconomic Effects of FOMC Forward Guidance." *Brookings Papers on Economic Activity* (Spring): 1–54.

Cukierman, A., and A. Meltzer. 1986. "A Theory of Ambiguity, Credibility, and Inflation under Discretion and Asymmetric Information." *Econometrica* 54 (5): 1099–1128.

de Haan, J., S. Eijffinger, and S. Waller. 2005. *The European Central Bank: Credibility, Transparency, and Centralization.* Cambridge, MA: MIT Press.

Demiralp, S. 2001. "Monetary Policy in a Changing World: Rising Role of Expectations and the Anticipation Effect." Finance and Economics Discussion Series No. 2001–55, Federal Reserve System.

Dincer, N. N., and B. Eichengreen. 2014. "Central Bank Transparency and Independence: Updates and New Measures." *International Journal of Central Banking* 10 (1): 189–259.

Eijffinger, S., and P. Geraats. 2006. "How Transparent are Central Banks?" *European Journal of Political Economy* 22 (1): 1–21.

Fry, M., D. Julius, L. Mahadeva, S. Roger, and G. Sterne. 2000. "Key Issues in the Choice of a Monetary Policy Framework." In *Monetary Policy Frameworks in a Global Context*, ed. L. Mahadeva and G. Sterne. London: Routledge.

Geraats, P. M. 2002. "Central Bank Transparency." *Economic Journal* 112 (483): F532–F565.

———. 2009. "Trends in Monetary Policy Transparency." *International Finance* 12 (2): 235–68.

Gerlach-Kristen, P. 2004. "Is the MPC's Voting Record Informative about Future UK Monetary Policy?" *Scandinavian Journal of Economics* 106 (2): 299–313.

———. 2009. "Outsiders at the Bank of England's MPC." *Journal of Money, Credit and Banking* 41 (6): 1099–1115.

Hayo, B., and U. Mazhar. 2014. "Monetary Policy Committee Transparency: Measurement, Determinants, and Economic Effects." *Open Economies Review* 25 (4): 739–70.

Hayo, B., and M. Neuenkirch. 2010. "Do Federal Reserve Communications Help Predict Federal Funds Target Rate Decisions?" *Journal of Macroeconomics* 32 (4): 1014–24.

———. 2015a. "Central Bank Communication in the Financial Crisis: Evidence from a Survey of Financial Market Participants." *Journal of International Money and Finance* 59 (December): 166–81.

———. 2015b. "Self-Monitoring or Reliance on Media Reporting: How Do Financial Market Participants Process Central Bank News?" *Journal of Banking and Finance* 59 (October): 27–37.

Heinemann, F., and K. Ullrich. 2007. "Does It Pay to Watch Central Bankers' Lips? The Information Content of ECB Wording." *Swiss Journal of Economics and Statistics* 143 (II): 155–85.

Horvath, R., and J. Jonasova. 2015. "Central Banks' Voting Records, the Financial Crisis and Future Monetary Policy." *European Journal of Political Economy* 38 (June): 229–43.

Horvath, R., K. Smidkova, and J. Zapal. 2012. "Central Banks' Voting Records and Future Policy." *International Journal of Central Banking* 8 (4): 1–19.

Huber, P. 1967. "The Behavior of Maximum Likelihood Estimates under Non-Standard Conditions." In *Proceedings of the Fifth Berkeley Symposium on Mathematical Statistics and Probability*, Vol. 1, ed. L. M. Le Cam and J. Neyman, 221–33. Berkeley, CA: University of California Press.

Jansen, D.-J. 2011. "Does the Clarity of Central Bank Communication Affect Volatility in Financial Markets? Evidence from

Humphrey-Hawkins Testimonies." *Contemporary Economic Policy* 29 (4): 494–509.

Jansen, D.-J., and J. de Haan. 2009. "Has ECB Communication Been Helpful in Predicting Interest Rate Decisions? An Evaluation of the Early Years of the Economic and Monetary Union." *Applied Economics* 41 (16): 1995–2003.

Lange, J., B. Sack, and W. Whitesell. 2003. "Anticipations of Monetary Policy in Financial Markets." *Journal of Money, Credit and Banking* 35 (6): 889–909.

Moessner, R., D.-J. Jansen, and J. de Haan. 2017. "Communication about Future Policy Rates in Theory and Practice: A Survey." *Journal of Economic Surveys* 31 (3): 678–711.

Poole, W. 2005. "How Predictable is Fed Policy?" *Review* (Federal Reserve Bank of St. Louis) 87 (6): 659–68.

Siklos, P. 2002. *The Changing Face of Central Banking.* Cambridge: Cambridge University Press.

Sturm, J.-E., and J. de Haan. 2011. "Does Central Bank Communication Really Lead to Better Forecasts of Policy Decisions? New Evidence Based on a Taylor Rule Model for the ECB." *Review of World Economics* 147 (1): 41–58.

Swanson, E. 2006. "Have Increases in Federal Reserve Transparency Improved Private Sector Interest Rate Forecasts?" *Journal of Money, Credit and Banking* 38 (3): 791–819.

White, H. 1980. "A Heteroskedasticity-Consistent Covariance Matrix Estimator and a Direct Test for Heteroskedasticity." *Econometrica* 48 (4): 817–38.

Woodford, M. 2001. "Monetary Policy in the Information Economy." In *Economic Policy for the Information Economy.* Proceedings of the 2001 Economic Policy Symposium sponsored by the Federal Reserve Bank of Kansas City, held in Jackson Hole, Wyoming, August 30–September 1.

———. 2003. *Interest and Prices: Foundations of a Theory of Monetary Policy.* Princeton, NJ: Princeton University Press.