Does Central Bank Transparency and Communication Affect Financial and Macroeconomic Forecasts?*

Thomas Lustenberger[a] and Enzo Rossi[b]
[a]Swiss Financial Market Supervisory Authority (FINMA)
and University of Basel
[b]Swiss National Bank and University of Zurich

In a large sample of countries across different geographic regions and over a long period of time, we find limited country- and variable-specific effects of central bank transparency on forecast accuracy and their dispersion among a large set of professional forecasts of financial and macroeconomic variables. More communication even increases forecast errors and dispersion.

JEL Codes: C23, C53, E37, E58, D8.

1. Introduction

Until not so long ago, central bankers believed that monetary policy decisions should take the markets by surprise in order to achieve maximum impact. In the last two decades, there has been a shift to

*We would like to thank the co-editor of the journal, Boragan Aruoba. We also thank Nicolas Albacete, Alex Cukierman, Beat Hintermann, Bo Honoré, Massimiliano Marcellino, Cyril Monnet, Marcel Savioz, Heinz Zimmermann, and three anonymous referees for valuable comments and suggestions. In addition, we profited from the comments of participants of the SNB Brown Bag Seminar, the Economics Lunch of the University of Basel, the BuBa-OeNB-SNB Workshop 2017, the SNB-BIS Workshop 2018, and the EABCN Conference 2018. We also thank Bettina Eberhard (BIS) and Paul Moser-Boehm (BIS) as well as Simon Dépraz for their help in collecting the central bank communication measure. A prior version of this essay was published as SNB Working Paper 2017-12 in October 2017 and WWZ Discussion Paper 2018-06 in January 2018. This research project was conducted while the first author was affiliated with the SNB and the University of Basel. The views expressed in this paper are those of the authors and do not necessarily reflect those of the SNB or FINMA. Author e-mails: thomas.lustenberger@me.com and enzo.rossi@snb.ch.

a policy of increasing transparency with respect to goals, strategies, and the basis on which decisions are made. This development is closely linked to increased central bank independence (CBI), which calls for a counterbalance in the form of transparency and accountability. Economic benefits are deemed another key reason for enhanced transparency. As summarized by Freedman and Laxton (2009), it is generally believed in the central banking community that providing more information about monetary policy may increase its effectiveness. This view is based on theoretical and empirical research that emphasizes the importance of expectations about monetary policy as a key element in determining interest rates and other asset prices.[1] By bringing market behavior in line with monetary policy objectives, the likelihood of sharply differing views on policy actions is reduced. In turn, more certainty about when the central bank will set the policy rate and its magnitude can reduce the volatility of market interest rates, increase the central bank's leverage over longer-term interest rates, and smoothen the incorporation of policy actions into asset prices. Similarly, Blinder (2007) argues that the major purpose of communicating with the markets is to condition expectations about future monetary policy.

To transmit the views of the central bank to the public and to markets, an improvement in the effectiveness of monetary policy through greater transparency requires proactive and well-planned communication. Hence, a great deal of attention has been paid to the way central banks present their key messages (for instance, Blinder et al. 2008 and Haldane 2017). It is expected that central banks will communicate more actively after than before the crisis (Blinder et al. 2017).

Parallel to the shifts in the practice of central banking toward more frequent communication and greater transparency, an expanding body of literature has emerged. In theory, both positive and negative effects are likely. Empirical work has been focused on inflation, financial markets, or private forecasts. A general finding is that transparency and communication reduce volatility in financial markets, enhance the predictability of upcoming rate decisions, and help achieve the monetary policy goals, vindicating the switch to greater openness in central banking.

[1]Survey forecasts are an approximation for expectations in an economy.

Our paper contributes specifically to the empirical relation between transparency, communication, central bank design, and private forecasts. In a broader context, we provide empirical results for the theoretical literature on the social value of information (see, for instance, Morris and Shin 2002, Hellwig and Veldkamp 2009, and Lorenzoni 2010).

We run panel regressions to examine whether increased transparency and intensified communication by central banks affect the quality and the cross-sectional distribution of forecasts. The question posed is closest to those of Middeldorp (2011), Dovern, Fritsche, and Slacalek (2012), Ehrmann, Eijffinger, and Fratzscher (2012), Neuenkirch (2013), and Naszodi et al. (2016). However, we extend the analysis along various important dimensions and provide compelling evidence that is in contrast with the literature.

First, while in previous work transparency and communication have not been defined specifically, our data set allows us to make a clear distinction between the two dimensions.[2] Transparency covers broadly the strategic, long-term orientation of the central bank toward openness which is subject to only a few changes over time, such as policy objectives, the publication of forecasts, voting records, etc. Communication, on the other hand, focuses on the tactical, flexible aspects in the provision of more detailed and fine-tuned information to the public and the markets.

[2]For instance, Faust and Svensson (2001) equate central bank transparency with the ease with which the public can deduce central bank goals and intentions from observable data. In Amato, Morris, and Shin (2002) greater transparency is achieved by expanding the modes of communication and the amount of information revealed to the public. Winkler (2002) emphasizes that transparency needs to be better defined before it can be debated. More information divulged by the central bank does not necessarily imply a greater understanding on the part of the public, part of his definition of transparency. In Chortareas, Stasavage, and Sterne (2002) transparency relates to the detail in which central banks publish economic forecasts. Blinder et al. (2008) define central bank communication more broadly as the provision of information to the public regarding the objectives of monetary policy, the monetary policy strategy, the economic outlook, and the outlook for future policy decisions. Ehrmann, Eijffinger, and Fratzscher (2012) draw a distinction between central bank transparency and communication. Transparency is measured by the announcement of a quantified inflation objective, the overall index provided by Dincer and Eichengreen (2010) as well as the subindex related to economic transparency. The last measure for transparency is the publication of internal forecasts, which they label central bank communication.

Second, we are the first to document an increase in the number of speeches held by central banks over time using the Bank for International Settlements (BIS) central bankers' speeches database. Based on it we compiled a new measure of central bank communication. It measures communication directly and comprehensively by the number of speeches. The number of speeches allows us to question the benefits of intensive central bank communication.

Third, we highlight an econometric issue in the estimation method that does not seem to have been recognized in the literature, and we offer an accurate alternative. The issue is that residuals follow a pattern when the dependent variable (either absolute cross-sectional mean forecast error or cross-sectional standard deviation) is not taken in log. There is a clear-cut lower bound to the value residuals assumed in the setting without log.

Fourth, we create an exceptionally large panel of 73 countries from all world regions and observations from 1998 to 2014 for financial and macroeconomic data. The question is whether there is a one-size-fits-all policy for central bank communication and transparency. Unlike previous studies, which have in common a limited number of advanced economies (at most around 30) and relatively short periods of observations and forecast variables, the data set we compiled allows us to widen the scope of the inquiry in terms of the number of countries, their heterogeneity, the period of investigation, and the variables to be forecasted.

Finally, our data set also allows us to account for several important economic events, such as the Great Moderation, the financial crisis, and the global recession, as well as the substantial modifications to central bank practices in their wake—in particular, forward guidance. We also analyze the effect of inflation targeting.

Overall, the evidence presented in this paper suggests a more balanced conclusion about the merits of communication and transparency in enhancing the predictability of monetary policy than has been reported in the literature.

First, the evidence for communication is uniform and quite compelling: more-frequent communication increases both forecast errors and their dispersion. The increased central bank communication seems to have resulted in cacophony and did not help investors and academics improve their macroeconomic forecasts. We link this

result with the discussion about optimal monetary policy committees' size and form.

Second, while more-frequent communication increases both forecast errors and their dispersion, we find hardly any evidence, in contrast to previous papers, that transparency, defined as the strategic component of a central bank's openness, improves the accuracy of private forecasts. At best, the impact is ambiguous. However, if it is significant, transparency tends to reduce the forecast heterogeneity especially of inflation and interest rates.

However, it is important to distinguish the pre-crisis from the post-crisis period. In fact, before the financial crisis, more intense communication lowered the errors in inflation and short-term interest rate forecasts. After the crisis, we find strong evidence that more communication increased the errors in forecasts of inflation and short-term interest rate forecasts and also increased the dispersion of real GDP and long-term interest rate forecasts. Increased transparency had a beneficial effect on the accuracy and dispersion of forecasts before the crisis, but this effect notably weakened after the crisis.

Third, additional analysis provides information about other factors that have an effect on the precision and distribution of forecasts. (i) Central bank instability is associated with less-accurate current-year forecasts of inflation and short-term interest rates 12 months ahead. (ii) Market uncertainty increases strongly forecast dispersion across all financial and macroeconomic variables. (iii) The zero-lower-bound constraint tends to reduce forecast errors of short-term interest rates, but has no effect on long-term interest rate forecasts. (iv) An inflation-targeting regime has some interesting implications for forecast precision and homogeneity. While more communication by inflation targeters improves the accuracy of short-term interest rate forecasts, greater transparency of inflation targeters not only worsens forecasts' accuracy but also tends to offset an otherwise positive effect on the heterogeneity of inflation and interest rate forecasts. (v) The next set of results is related to explicit forward guidance, as adopted by some central banks in the follow-up to the financial crisis. The results show particularly that more speeches gave rise to less-accurate long-term interest rate forecasts.

Fourth, we add to the robustness of the evidence by confirming it across a variety of additional analyses.

A caveat is in order. Whether more or less communication or whether the degree of transparency should be increased or lowered cannot be definitely answered in our framework. Our paper only studies the effect of communication and transparency on forecast accuracy and dispersion. Although the effect of communication and transparency on this dimension is important, there may be many other beneficial (or harmful) effects of giving public speeches or being transparent on, for instance, accountability, the public's understanding of monetary policy, and trust in the central bank.

The rest of the paper is structured as follows. In section 2, we review the related literature. Section 3 describes the data underlying the empirical analysis. In section 4, we explain our estimation strategy and present the results. Section 5 offers a series of robustness checks. Section 6 discusses possible policy implications. Section 7 concludes.

2. Literature

There exists a large body of literature on the effects of central bank transparency, communication, and optimal central bank design.[3] The empirical evidence suggests overall beneficial effects. One branch of literature analyzes the effect of transparency on the predictability of monetary policy in the financial markets. A number of studies suggest that increased monetary policy transparency may have contributed to an increased ability of financial markets to forecast future monetary policy actions. Most of this research has used information from the Treasury bill markets as well as the markets for federal funds and Eurodollar futures, and it focuses on a relatively short-run horizon, from one day out to six months.

Three approaches have been pursued. One approach investigates the reaction of market prices to central bank decisions. Little reaction means the decision has been priced in correctly, suggesting high predictability. Evidence has been reported on this topic (see, for instance, Ranaldo and Rossi 2010 and Wilhelmsen and Zaghini

[3]See Van Der Cruijsen, Eijffinger, and Hoogduin (2010) for an overview of the transparency literature, Blinder et al. (2008) for a survey on communication, Geraats (2006) for an overview of the practice of monetary policy transparency, and Blinder (2004) for central bank design.

2011). The second approach is based on the accuracy of expectations priced into the yield curve or futures. Here, too, findings suggest that transparency leads to improved predictability (for instance, Kuttner 2001 and Lange, Sack, and Whitesell 2003). The third approach examines forecasts and/or the determinants of disagreement among forecasters. Swanson (2006) finds that with the increased transparency of the Federal Reserve, the private-sector forecasts of interest rates have become more precise, both by improving the average quality of forecasts and by reducing their dispersion across forecasters. In line with this, Sellon (2008) finds that more-explicit guidance on interest rates led to an improvement in private-sector forecasts.

The evidence stretches beyond the United States. Middeldorp (2011) analyzes the connection between the transparency and predictability of short-term interest rates for 24 countries between 1998 and 2005. Higher transparency lowers the errors private agents make in forecasting short-term interest at the three-month horizon, and it lowers the standard deviation. Dovern, Fritsche, and Slacalek (2012) investigate determinants of disagreement in expectations of seven key economic indicators in the G-7 countries from 1989 to 2006. In line with the literature (Mankiw, Reis, and Wolfers 2003), the measure of cross-sectional dispersion is the interquartile range of forecasts in a given country and month. While disagreement about economic activity intensifies strongly during recessions, disagreement about prices is considerably lower under independence of the central bank.[4] Based also on the interquartile range of forecasts, Ehrmann, Eijffinger, and Fratzscher (2012) examine whether transparency and communication have led to more-aligned views in the forecasts of macroeconomic variables in 12 advanced economies from 1990 to 2008. While transparency and communication reduce dispersion among professional forecasts, there is some evidence of diminishing marginal effects of increases in (economic) transparency. Naszodi et al. (2016) expand the analysis of Ehrmann, Eijffinger, and Fratzscher (2012) by enlarging the panel to 26 countries and by assessing both the degree of forecasting disagreement and its accuracy. Their results suggest that transparency results in better forecasts by mitigating uncertainty.

[4]Mankiw, Reis, and Wolfers (2003) show that a sticky-information model can generate a degree of disagreement among agents.

To sum up, the empirical literature provides support for the view that transparency is beneficial in the sense that survey forecasts are more aligned with each other and forecast errors decline. The evidence corroborates the general view that enhancing transparency improves the predictability of central banks.

Theoretical papers reach more a nuanced conclusion. On the one hand, more openness may reduce uncertainty about central banks' intentions and their future actions. On the other hand, by attempting to be as open as possible, they may give the impression that they know more than they do. This is a critical issue if transparency and communication serve as a coordination device among economic agents, thereby generating the possibility that agents rely too much on the utterances of central banks. This is what Morris and Shin (2002) argue can happen. Svensson (2006) disagrees with some of their conclusions. Subsequent research could not settle the matter.[5]

Restricting transparency could be worth considering for other reasons. For instance, the seminal paper by Cukierman and Meltzer (1986) argued that ambiguity enables monetary authorities to generate surprise inflation and stimulate economic activity. King (2000) notes that a central bank should be highly transparent about its monetary policy reaction function and its target. Beyond that, it should avoid creating news itself. Too much transparency may be prone to misinterpretation and will translate into less-accurate predictions, as the amount of information that can be digested effectively is limited (Kahneman 2003).

3. Data

In this section, we describe the comprehensive database we set up for the panel regressions reported in the next section. We first describe the dependent variables and then the independent variables. The observations are for a maximum of 73 countries from 1998 to (due to a data constraint) 2014, summing up to 17 years of 204 monthly observations per country and forecast variable. The panel exhibits missing values (unbalanced panel). For a full, detailed account of

[5]In another paper (Lustenberger and Rossi 2017b), we test the model by Morris and Shin (2002) on short-term and long-term interest rate forecasts.

the variables, we refer to the working paper version of this study (Lustenberger and Rossi 2017a).

3.1 Dependent Variables

The dependent variables are the absolute cross-sectional mean errors and the cross-sectional standard deviations of forecasts made by professional forecasters in predicting two financial variables, namely, short-term and long-term interest rates, and two macroeconomic variables, namely, consumer price index (CPI) inflation and the growth rates of real gross domestic product (GDP). All data are monthly from Consensus Economics. Consensus Economics groups countries in four geographic regions: Asia-Pacific (AP), Eastern Europe (EE), Latin America (LA), and "Western countries" (WE) (North America, Western Europe, Israel, Egypt, Nigeria, Saudi Arabia, and South Africa).

Each month, the survey participants for a particular country report their forecasts of short-term interest rates for 3 and 12 months ahead. They also report their view on long-term interest rates, i.e., the yields on their country's 10-year government debt, also 3 and 12 months ahead. Forecasts for CPI inflation and the growth rate of real GDP are also reported on a monthly basis but refer to the end of the current and the following year. Forecasts are provided by nongovernmental entities (independent or research institutes affiliated with universities) and economic consulting firms. The majority are financial institutions, varying from domestic and regional commercial banks to global investment banks.

We compare forecasts with realized short-term and long-term interest rates, as well as end-of-year consumer price indexes (where CPI was not available, we chose the GDP deflator) and growth in real GDP. The data are from Reuters Eikon, Bloomberg, IMF International Financial Statistics, and the World Bank database.

3.2 Independent Variables

All independent variables are observed at a time when the forecasts are published by Consensus Economics (on that day or the day before). We call this point in time the "forecast formation date."

Speeches. We construct a new explicit measure of communication consisting of central bank speeches. To this end, we compiled a

variable made up of central bank speeches as collected by the Bank for International Settlements. For each central bank reporting their speeches to the BIS, we counted the number given in the month preceding the forecast.

Table 1 exhibits the total number of speeches per country and their monthly average divided by four geographic areas. As can be seen, most speeches are given by central banks in "Western countries" (WE), above all by the Federal Reserve (1,386) and Japan (453). Indian central bankers, grouped with the Asia-Pacific countries (AP), delivered the second-highest number of speeches (648). Figure 1 illustrates how communication activities by central banks have intensified over time. The number of speeches has steadily increased from approximately 150 in 1998 to nearly 900 in 2013 and 2014. Importantly, this reflects not only more communication activities but also a higher number of central banks reporting their speeches to the BIS since 2000 ("New Central Banks"). These are shown by the light gray columns (light blue in online version).

There is no potential endogeneity problem associated with our communication measure. Central bank speeches are announced months in advance. Therefore, the number of speeches is fixed, making our communication proxy a well-defined exogenous variable. We cannot exclude that some of the speeches were the result of unexpected events that the central bank considered important enough to justify intervention. However, for the bulk of the speeches, this is very unlikely. While the number of speeches is fixed, their content may take the economic situation into account. Hence, content analysis would raise problems of endogeneity. For this reason, we use the number of speeches as our communication variable and refrain from content analysis.

Transparency. We employ the most comprehensive measure of central bank transparency in terms of country and time coverage based on an extension of the multiple-dimensional transparency index of Eijffinger and Geraats (2006) presented by Dincer and Eichengreen (2014). The index includes five dimensions: political transparency, economic transparency, procedural transparency, policy transparency, and operational transparency. Each dimension covers three questions—for instance, Does the central bank have an explicit objective? Does the central bank disclose macroeconomic models? Does the central bank publish voting records of their board

Table 1. Central Bank Speeches by Country from 1998 to 2014

WE (24)			AP (15)			EE (24)			LA (10)		
	#	Mean		#	Mean		#	Mean		#	Mean
USA	1,386	6.79	AUS	280	1.37	CZE	35	0.17	ARG	31	0.15
JPN	453	2.22	CHN	93	0.46	HUN	11	0.05	BRA	10	0.05
DEU*	361	1.88	HKG	171	0.84	POL	20	0.10	CHL	73	0.36
FRA*	146	0.76	IND	648	3.18	RUS	3	0.01	MEX	40	0.20
GBR	373	1.83	IDN	36	0.18	TUR	83	0.41	VEN	0	0.00
ITA*	148	0.77	MYS	293	1.44	BGR	12	0.06	COL	5	0.02
CAN	344	1.69	NZL	110	0.54	HRV	4	0.02	PER	0	0.00
NLD*	88	0.46	PHL	204	1.00	EST**	19	0.09	URY	1	0.00
NOR	210	1.03	SGP	148	0.73	LVA**	8	0.04	SLV	0	0.00
ESP*	138	0.72	KOR	59	0.29	LTU**	0	0.00	GTM	1	0.00
SWE	410	2.01	TWN	0	0.00	ROU	24	0.12			
CHE	281	1.38	THA	175	0.86	SVK**	3	0.01			
AUT*	60	0.31	BGD	0	0.00	SVN**	2	0.01			
BEL*	31	0.16	PAK	108	0.53	UKR	0	0.00			
DNK	69	0.34	LKA	57	0.28	ALB	190	0.94			
FIN*	80	0.42				ARM	1	0.00			
GRC**	54	0.26				AZE	0	0.00			
IRL*	126	0.66				BLR	0	0.00			
PRT*	21	0.11				BIH	6	0.03			

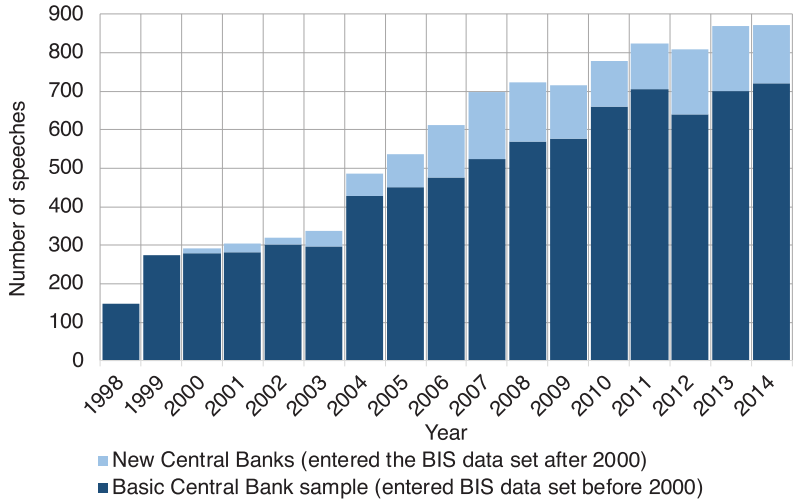
(*continued*)

Table 1. (Continued)

WE (24)			AP (15)			EE (24)			LA (10)		
	#	Mean		#	Mean		#	Mean		#	Mean
EGY	0	0.00				CYP**	3	0.01			
ISR	75	0.37				GEO	0	0.00			
NGA	29	0.14				KAZ	0	0.00			
SAU	28	0.14				MKD	39	0.19			
ZAF	233	1.14				MDA	0	0.00			
ECB*	1,386	7.22									
LUX*	37	0.19									
MLT**	19	0.23									

Notes: The table shows the total number of speeches (#) and the average number of speeches per month (mean) for a country. WE denotes "Western countries," AP Asia-Pacific countries, EE Eastern European countries, and LA Latin American countries. The number of countries in the set is given in parentheses. The euro was introduced in 1999. The ECB counts speeches given by its Executive Board members. In addition, we count all speeches given by members of the Eurosystem from 1999 onward, marked with *. Therefore, the total number of speeches used in the variable speech for AUT, BEL, FIN, FRA, DEU, IRL, ITA, NLD, PRT, and ESP is # 2,712 (mean 14.26). Countries which entered the Eurosystem after 1999 are marked with **. For these countries, all Eurosystem speeches are included following their adherence to the Eurosystem. GRC entered in 2001 (# 2,554 and mean 12.52), SVN in 2007 (# 1,961 and mean 9.66), CYP in 2008 (# 1,780 and mean 8.77), SVK in 2009 (# 1,533 and mean 7.55), EST in 2011 (# 1,086 and mean 5.35), and LVA since 2014 (# 287 and mean 1.41). LTU is not a member of the Eurosystem in our sample, for it joined in 2015. No forecasts for LUX and MLT (which entered the Eurosystem in 2008) are available. We use LUX and MLT for completeness of the total number of speeches in the Eurosystem.

Figure 1. Total Speeches per Year



Notes: Figure 1 displays the number of speeches given by representatives of central banks per year in the countries included in our sample. The basic central bank sample includes USA, JPN, DEU, FRA, GBR, ITA, CAN, NLD, NOR, ESP, SWE, CHE, AUT, BEL, GRC, ZAF, AUS, CHN, HKG, IND, IDN, MYS, NZL, SGP, KOR, TUR, LVA, BRA, and the ECB. For these central banks, there is at least one speech in 1998, in 1999, or in both.

members? The index has annual observations from 1998 to 2010 for 120 central banks.[6] A score for each central bank between 0 (minimum transparency) and 15 (maximum transparency) can be obtained. We measure transparency by the updated values of Dincer and Eichengreen, which extends the observations reported in Dincer and Eichengreen (2014) by four more years, until 2014.

Politico-Institutional Framework of Central Bank Independence. We capture the politico-institutional framework at central banks with the actual turnover of the central bank's governor in a year, as described by Dreher, Sturm, and de Haan (2010). What does the turnover rate stand for in our setup? The literature on central bank independence uses this variable as an indicator for central

[6] As documented by Dincer and Eichengreen (2014), central banks in countries with higher per capita income, deeper financial markets, more-open economies, and stronger political institutions are more likely to be more transparent than others.

bank independence, but on average over time. If a central bank has more governors in a given period, it is presumably less independent. In our application, the interpretation is different. The variable is equal to one when the central bank governor changes. Accordingly, uncertainty about future central bank behavior might easily be greater, leading to more inaccurate and dispersed forecasts. However, this is an effect of uncertainty about the person and is unrelated to the independence of the central bank. If anything, the personality of the governor should be more important in an independent central bank. This implies that in such a central bank, forecast dispersion is more likely than in a central bank where the governor changes but is known to take instructions from the government.[7]

Uncertainty Measures. We use the Chicago Board Options Exchange Volatility Index (VIX) as an uncertainty measure. The VIX is observed the day before forecasts are made. Broadly speaking, the VIX may also account for the business (interest rate) cycle, which is typically neglected in the related literature.

ZLB Dummy. We created a dummy variable for the period during which the zero lower bound (ZLB) on nominal interest rates was binding. We set the binding constraint at an interest rate level below 0.5 percent. It is only employed in the regressions of interest rate forecasts.

IT Dummy. We created a dummy that is equal to one if a central bank pursues an inflation targeting policy, and zero otherwise.

FG Dummy. We also accounted for central banks pursuing a forward guidance policy. We created a dummy that is equal to one during a period when forward guidance was pursued, and zero otherwise. We set the dummy based on Charbonneau and Rennison (2015). Accordingly, the following central banks made use of forward guidance: Japan from April 1999 to July 2000 and from October 2010 to March 2013, the United States from December 2008 to December 2014 (end of our sample period), Canada from April 2009 to April 2010, Sweden from April 2009 to July 2010 and February 2013 to December 2014, the European Central Bank from July 2013 to December 2014, and GBR from August 2013 to December 2014. All euro-area countries are equated with the European Central Bank

[7]We thank an anonymous referee for pointing this out to us.

Table 2. Summary Statistics for Forecast Errors (FE), Cross-Sectional Standard Deviation of Forecasts (Std.), Central Bank Transparency, Speeches, and Additional Variables

Variable	Mean	Std. Dev.	Min.	Max.	N
Short-Term Interest Rate (Abs. FE)	1.093	2.536	0	67.293	11,690
Long-Term Interest Rate (Abs. FE)	0.652	0.591	0	8.467	7,158
Inflation (Abs. FE, Current Year)	1.099	3.641	0	158.379	12,307
Inflation (Abs. FE, Next Year)	2.214	5.871	0	236.979	12,286
Growth (Abs. FE, Current Year)	1.3	1.394	0	12.557	11,773
Growth (Abs. FE, Next Year)	2.14	2.468	0.001	24.112	11,686
Short-Term Interest Rate (Std.)	0.52	1.281	0	41.598	11,806
Long-Term Interest Rate (Std.)	0.379	0.657	0	15.909	7,718
Inflation (Std., Current Year)	0.572	1.719	0.019	80.525	7,459
Inflation (Std., Next Year)	0.839	2.334	0	108.383	7,447
Growth (Std., Current Year)	0.453	0.391	0.026	8.653	7,459
Growth (Std., Next Year)	0.594	0.41	0.054	7.722	7,447
Central Bank Transparency					
Overall	7.7	3.29	0	15	24,593
"Western Countries" (WE)	9.4	2.97	1	15	9,456
Asia-Pacific (AP)	6.7	3.27	0	14	5,757
Eastern Europe (EE)	7.2	3.07	1	14.5	6,376
Latin America (LA)	5.9	2.14	1	9	3,004
Speech	3.51	7.374	0	50	24,593
Turnover	0.16	0.37	0	3	24,593
VIX	21.33	9.21	10.02	70.33	24,593
Inflation Targeting	0.32	0.466	0	1	24,593
Forward Guidance	0.04	0.195	0	1	24,593

Notes: The table provides summary statistics for absolute cross-sectional mean forecast errors (Abs. FE) and cross-sectional standard deviations (Std.) for the two financial variables (short-term and long-term interest rates) and the two macroeconomic variables (inflation and growth, with current-year forecasts and next-year forecasts). The table also exhibits the variation in central bank transparency in the four subsets of geographic regions ("Western," Asia-Pacific, Eastern European, and Latin American countries). Speech is the number of speeches held by central banks per month. Turnover measures replacement of central bank governors. VIX is the Chicago Board Options Exchange Volatility Index. Inflation Targeting is a dummy for inflation-targeting policy, and Forward Guidance is a dummy for forward guidance as policy instrument.

(ECB) forward-guidance dummy for the corresponding months. LVA is given a value of 1 from January 2014 after joining the currency union.

Table 2 offers summary statistics for the variables of the benchmark regressions. In the first set, we report the statistics for the

absolute forecast errors of the four dependent variables. The absolute cross-sectional mean forecast errors range from zero to a maximum of 237 percent for inflation forecasts. In the second set, we present the corresponding cross-sectional standard deviations, which range from a minimum of zero to a maximum of 108. The third set yields the details of the transparency index. It covers the whole (theoretical) range from zero to 15. In addition to the overall values, we report the values for each of the four geographic areas. The fourth set contains summaries of the other independent variables. The number of speeches (our communication variable) has a mean of 3.5 per month and a maximum of 50. For annual values of turnover of central bank governors, the minimum is zero and the maximum reaches 3. The VIX ranges from a minimum value of 10 to a maximum of 70, with an average of 21. In 11 percent of the total number of observations, the zero lower bound was effective. About 30 percent of our observations are in countries with inflation-targeting policies. Around 4 percent of observations coincide with forward-guidance periods.

4. Results

This section is divided into eight subsections. In subsection 4.1, we describe our benchmark model and compare it with previous papers. In subsection 4.2, we elaborate on our benchmark regression results, and in subsection 4.3 we highlight differences to the previous literature. Subsection 4.4 examines the impact of the level of transparency. Subsection 4.5 deals with the outcome from an inflation-targeting regime. Subsection 4.6 discusses the effects of forward guidance, subsection 4.7 analyzes regional effects, and subsection 4.8 compares the results since the financial crisis with those obtained before the crisis.

4.1 Benchmark Model

We begin with an explanation of our basic fixed-effects regression model. It is given by

$$Y_{i,h,t} = \alpha + \nu_i + \beta_{SP} \cdot \text{Speech}_{i,t} + \beta_{TI} \cdot \text{Transp.}_{i,t} + \beta_{TO} \cdot \text{Turnover}_{i,t} + \beta_{VIX} \cdot \text{VIX}_t + \beta_H \cdot H_h + \beta_T \cdot T_y + \beta_{ZLB} \cdot ZLB_{i,t} + \varepsilon_{i,h,t},$$

where i is the country, h is the forecast horizon, and t is a monthly time index.

Our left-hand-side variable $Y_{i,h,t}$ is either the logarithm of the absolute cross-sectional mean forecast error ($\log[|FE_{i,h,t}|]$) or the logarithm of the cross-sectional standard deviation of forecasts ($\log[\sigma_{i,h,t}]$) provided by Consensus Economics. Our forecast variables are short-term interest rates, long-term interest rates, the percent change per annum of the CPI, and the growth rate of real GDP.[8]

On the right-hand side, α is the intercept, and ν_i is the fixed effect for country i. $\text{Speech}_{i,t}$ captures the number of speeches held by central bank representatives of country i between $t-1$ and t. $\text{Transp.}_{i,t}$ denotes central bank transparency. $\text{Turnover}_{i,t}$ stands for the number of central bank governor turnovers, and VIX_t represents the volatility index. H_h is a horizon fixed effect for the forecast horizon, only used for CPI inflation and real GDP growth forecasts, T_y is a yearly fixed effect to capture a possible time trend, and $ZLB_{i,t}$ is a dummy for the zero lower bound (only used for short-term and long-term interest rates).

No potential endogeneity arises. All right-hand-side variables are taken at the point in time when a forecast is formed (or the day before). For instance, for the U.S. CPI inflation forecast formed on June 11, 2012 for the end-of-year CPI inflation, all right-hand-side variables are measured on June 11, 2012 (or June 10, 2012). For the number of speeches in June 2012, we counted all speeches held between May 15, 2012 (because the forecast day in the previous month was May 14, 2012) and June 11, 2012. As we described in subsection 3.2, speeches are announced months in advance, making our communication proxy a well-defined exogenous variable. The VIX is taken with its value on June 10, 2012 (the day before the forecast is formed). Hence, while higher uncertainty about stock prices on June 10, 2012 makes forecasts formed on June 11 more uncertain, a reverse effect is not possible. For this reason we do not treat survey dispersion as a measure of uncertainty as is commonly done in the literature. Turnover and transparency are also well-defined exogenous variables. It is highly unlikely that a major change in the

[8]Estimates for consumption growth and industrial production growth are available upon request.

management of the central bank, a turnover, materializes because of forecasters' performance. For transparency, it is impossible that one single, even extreme, forecast error realized in December 2012 motivates a central bank to change its transparency and communication policy in June 2012 (before the forecast error is observed).

Compared with previous research, we introduce three important new variables: the number of speeches, the turnover of the central bank's governor, and the zero-lower-bound constraint. These three variables extend the empirical literature on central bank transparency along three dimensions. They allow us to (i) make a clear distinction between transparency and communication; (ii) account for potential implications that uncertainty in a central bank's management can have on forecasts; and (iii) consider special constraints on monetary policy which arose due to the financial crisis.[9] Subsection 4.6 goes even further and extends our benchmark model with a variable for forward guidance.

We distinguish three measures of the dependent variables. The first is the absolute forecast error, the second is the cross-sectional standard deviation, and the third measure is the interquartile range. In the literature following Mankiw, Reis, and Wolfers (2003), the favorite measure of cross-sectional dispersion is the interquartile range of forecasts. Arguably, the advantage of this measure over the simple standard deviation is that it is insensitive to outliers, which might be important in the analysis of survey data.

A fundamental distinction from previous papers arises in the way we calculate the dependent variables. In order to avoid that the residuals follow a pattern, we take logs of the dependent variables.[10] Besides heteroskedasticity issues, there is a clear-cut lower bound to the value residuals assume in our setting. However, taking the log of the absolute cross-sectional mean forecast errors and the log of the cross-sectional standard deviation generates well-behaved residuals. Note that taking the log of the interquartile range does not eliminate the "truncated" pattern in the residuals. For this reason, we

[9]In addition, we employ the VIX instead of GARCH estimates as an uncertainty measure.

[10]We are grateful to Massimilano Marcellino for suggesting this data transformation.

only use the log of cross-sectional standard deviations of forecasts as a dispersion measure.

In addition, we use panel clustered standard errors, where we cluster around countries. Variance estimates using panel clustered standard errors are consistent, as shown by Stock and Watson (2008). The procedure has three advantages: it allows us to get rid of inconsistent variance estimates, to take heteroskedasticity into account,[11] and to correct for correlation in the forecast errors arising from overlapping forecast horizons.

4.2 Benchmark Regression Results

In this subsection, we discuss the results of the benchmark regressions. We pursue a conservative approach and execute two-sided tests for significance of the coefficients.[12] The results are summarized in table 3 for absolute forecast errors and for standard deviations.

The findings are sobering. Transparency does not improve the predictability of financial and macroeconomic variables. More effective is the influence of greater transparency on forecast dispersion by reducing the misalignment among forecasters of interest rates and, especially, inflation.

The main and most important novel contribution to the literature relates to communication, which, as discussed, is measured by the number of central bank speeches. Three results arise. First, communication exerts a much greater influence on private forecast performance than transparency. Second, intensive communication activities make it more difficult to forecast inflation and real GDP growth. More communication also increases the dispersion in forecasts of inflation and interest rates. Third, in terms of statistical

[11] As Santos Silva and Tenreyro (2006) pointed out, heteroskedastic residuals coming from a log-linearized model lead to biased estimates of the true model parameters. However, a visual inspection of the residuals of our benchmark model shows that at least the residuals under our log model for absolute forecast errors do not exhibit heteroskedasticity. In the log model for cross-sectional standard deviation, heteroskedasticity cannot be excluded by visual inspection, but seems to be rather a minor issue.

[12] A one-sided test would be appropriate if the estimated value departs from the reference value in only one direction. However, as summarized above, in theory, departures are possible in both directions.

Table 3. Absolute Cross-Sectional Mean Forecast Errors and Forecasts' Cross-Sectional Standard Deviations

	Absolute Cross-Sectional Mean Forecast Errors (Absolute Differences between the Cross-Sectional Mean Forecasts and Their Realizations)							
	Inflation		**Growth**		**Short-Term Interest Rate**		**Long-Term Interest Rate**	
	CY	**NY**	**CY**	**NY**	**M03**	**M12**	**M03**	**M12**
Speech	0.019^{***}	0.020^{***}	0.014^{***}	0.007	0.008^{*}	0.002	0.006	0.004
	(0.00)	(0.01)	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)
Transp.	0.022	−0.010	0.031	0.055	−0.044	−0.021	−0.051	-0.103^{*}
	(0.03)	(0.04)	(0.03)	(0.04)	(0.06)	(0.06)	(0.04)	(0.05)
Turnover	0.258^{***}	0.073	0.046	0.085	0.126	0.281^{***}	0.032	0.016
	(0.08)	(0.08)	(0.07)	(0.09)	(0.10)	(0.09)	(0.09)	(0.10)
VIX	−0.003	0.002	0.002	-0.003^{**}	0.015^{***}	0.001	0.011^{***}	-0.013^{***}
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
ZLB					-0.723^{***}	-0.736^{***}	0.068	0.233^{*}
					(0.16)	(0.12)	(0.11)	(0.12)
N	12,307	12,286	11,787	11,710	5,828	5,858	3,565	3,590
Countries	73	73	73	73	34	34	23	23
R2	0.21	0.15	0.12	0.14	0.21	0.23	0.07	0.19

(*continued*)

Table 3. (Continued)

	Cross-Sectional Standard Deviations of Forecasts (Cross-Sectional Standard Deviations of Forecasts at Each Point in Time)							
	Inflation		Growth		Short-Term Interest Rate		Long-Term Interest Rate	
	CY	NY	CY	NY	M03	M12	M03	M12
Speech	0.012***	0.008**	−0.001	0.004*	0.013***	0.002	0.007**	0.005**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Transp.	−0.109**	−0.115***	−0.017	−0.023	−0.090*	−0.082**	−0.107**	−0.091**
	(0.04)	(0.04)	(0.03)	(0.02)	(0.05)	(0.04)	(0.05)	(0.04)
Turnover	0.125	0.094	0.061	0.048	0.165**	0.087	0.104**	0.056*
	(0.09)	(0.07)	(0.04)	(0.04)	(0.08)	(0.07)	(0.04)	(0.03)
VIX	0.001	0.006***	0.005***	0.008***	0.014***	0.005***	0.010***	0.005***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
ZLB					−0.349*	−0.207	0.118	0.144*
					(0.18)	(0.13)	(0.07)	(0.07)
N	7,471	7,471	7,471	7,471	5,895	5,916	3,855	3,859
Countries	45	45	45	45	34	34	23	23
R2	0.46	0.24	0.50	0.27	0.12	0.34	0.20	0.17

Notes: Country fixed-effects panel regression with panel clustered standard errors in parentheses. *, **, and *** denote $p < 0.10$, $p < 0.05$, and $p < 0.01$, respectively. The table shows results for a fixed-effects panel regression of the log of absolute cross-sectional mean forecast errors and the log of cross-sectional standard deviations. Inflation and growth have forecasts for the current-year (CY) and the next-year (NY) value. We include a dummy for each forecast horizon since both current-year and next-year forecasts' horizons decrease over time. Short-term and long-term interest rates have two forecast horizons. M03 is the 3-month forecast horizon, while M12 stands for the 12-month forecast horizon. We also include a dummy for each year (the intercept, fixed effects, and yearly dummies are not shown in the table).

significance, the effect of speeches on inflation forecasts is highest. We provide a discussion and interpretation of these results in section 6.

The further analysis sheds light on the effects of politico-institutional aspects of central banks as measured by the turnover rate. The results suggest that instability in the management of central banks (turnover variable) makes the inflation outlook for the current year more uncertain and also reduces the predictability of future interest rate actions of the central bank in the 12 months ahead. Moreover, interest rate forecasts at the three-month horizon become more heterogenous.

The VIX plays an important role in all regressions of forecast dispersion but one. The higher market uncertainty is, the wider the dispersion becomes. In the same vein, market uncertainty makes interest rate predictions at the three-month horizon less precise. By contrast, it increases the accuracy of next year's GDP and long-term interest rate forecasts.

Another result is that when the zero lower bound is reached, short-term interest rates become easier to predict. By contrast, the zero-lower-bound constraint has no effect on forecasts of long-term interest rates. The latter finding is in line with Jain and Sutherland (2018). Neither does the ZLB affect the dispersion of interest rate forecasts.

Finally, the fit of the regressions is higher for dispersion as a dependent variable. For this type of regression, the best fit is found for growth forecasts and inflation.

4.3 Differences to the Literature

As we pointed out in section 1, we depart from previous papers along several dimensions. In terms of estimation strategy, we take the log of the independent variables instead of their level. This leaves the results unaffected. Hence, while the log generates well-behaved residuals, it does not affect the results either in quantitative or qualitative terms. Detailed results are shown in the appendix in tables A.1–A.4.

By contrast, including the yearly dummy in the benchmark regression leads qualitatively to similar results, but the number of significant coefficients in the regressions on transparency decreases.

Thus, our use of a time dummy explains largely the difference to the findings of previous work that reports significant effects of transparency such as Naszodi et al. (2016). However, our results relating to communication are not affected by the time dummy, except for the accuracy of long-term interest rates, whose coefficient becomes insignificant.

Moreover, the absolute oil price change is often used in such regressions. Large changes in oil prices are associated with larger uncertainty. Since in most cases this variable was not significant, we refrain from including it in our benchmark regression.

4.4 Impact of Transparency Level (Breakpoint 10)

Are there diminishing marginal returns from greater transparency? To answer this question, we analyze whether the worsening in the accuracy of forecasts arising from more communication shown above also holds at central banks whose transparency level is below 10, using a corresponding dummy. This threshold corresponds to the upper third of possible levels. As can be seen in table 4, except for short-term growth forecasts, more communication has similar effects on forecast errors irrespective of levels of transparency. Hence, the impaired quality of forecasts that arises from more communication observed in the whole sample cannot be attributed to distinct degrees of transparency. In this sense, we hardly find evidence of diminishing marginal returns from more transparency.

4.5 Inflation Targeting

A monetary policy strategy widely deemed to increase the transparency of policymaking is inflation targeting (IT), and some attention has been devoted to its effect on forecast performance. Cecchetti and Hakkio (2009) estimate how it affects the dispersion of private-sector forecasts of inflation. Using a panel data set that includes 15 countries over 20 years, they find no convincing evidence that IT reduces forecast dispersion. The results reported by Crowe (2010) for 11 countries suggest that IT improved the inflation forecasts for those whose initial forecast accuracy was worst, without harming the best forecasters.

We add to the evidence by assessing whether and how the introduction of IT has had any repercussion on the quality and standard

Table 4. Interaction Dummy for Transparency Below 10 and Absolute Cross-Sectional Mean Forecast Errors

	Inflation		Growth		Short-Term Interest Rate		Long-Term Interest Rate	
	CY	**NY**	**CY**	**NY**	**M03**	**M12**	**M03**	**M12**
Speech	0.019***	0.021***	0.011**	0.006	0.009**	0.001	0.006*	0.004
Speech * Lower	−0.025	−0.010	0.039**	0.006	−0.000	0.017	−0.039	−0.037
Transp.	0.021	−0.007	−0.009	0.047	−0.026	−0.049	−0.050	−0.185**
Lower	−0.003	0.034	−0.363**	−0.067	0.125	−0.213	0.064	−0.243

Notes: Country fixed-effects panel regression with panel clustered standard errors. *, **, and *** denote $p < 0.10$, $p < 0.05$, and $p < 0.01$, respectively. The table shows summary results for a fixed-effects panel regression of the log of absolute cross-sectional mean forecast errors using an interaction dummy which is one if transparency is below 10 (Lower). Inflation and growth have forecasts for the current-year (CY) and the next-year (NY) value. We include a dummy for each forecast horizon since both current-year and next-year forecasts' horizons decrease over time. Short-term and long-term interest rates have two forecast horizons. M03 is the 3-month forecast horizon, while M12 stands for the 12-month forecast horizon. We also include a dummy for each year, the VIX, and the turnover. Moreover, we include the ZLB dummy in interest rate regressions (these variables, the intercept, fixed effects, yearly dummies, and horizon dummies are not shown in the table).

deviation of forecasts of inflation, as well as of short-term and long-term interest rates. For this, we added a dummy for the presence of IT, which interacts with our communication and transparency variables, to the regressors of the benchmark analysis ($\mathrm{IT}_{i,t}$). The regression equation is now

$$\begin{aligned} Y_{i,h,t} = \alpha + \nu_i + \beta_{SP} \cdot \mathrm{Speech}_{i,t} + \beta_{SPIT} \cdot \mathrm{Speech}_{i,t} \cdot \mathrm{IT}_{i,t} \\ + \beta_{TI} \cdot \mathrm{Transp.}_{i,t} + \beta_{TIIT} \cdot \mathrm{Transp.}_{i,t} \cdot \mathrm{IT}_{i,t} + \beta_{IT} \cdot \mathrm{IT}_{i,t} \\ + \beta_{TO} \cdot \mathrm{Turnover}_{i,t} + \beta_{VIX} \cdot \mathrm{VIX}_t + \beta_H \cdot H_h + \beta_T \cdot T_y \\ + \beta_{ZLB} \cdot ZLB_{i,t} + \varepsilon_{i,h,t}. \end{aligned}$$

Some interesting results emerge from this analysis. As can be inferred from table 5, communication and transparency of inflation targeters affect the quality of short-term interest rate forecasts in opposite ways. Whereas increased communication improves their accuracy, greater transparency leads to less-accurate forecasts. Moreover, inflation targeting weakens the forecast alignment effect from more transparency. By contrast, communication of inflation targeters does not affect forecasts' heterogeneity differently from non-inflation targeters. Overall, it seems that higher levels of transparency are especially critical in countries that pursue an inflation-targeting strategy.

4.6 Forward Guidance

In this subsection, we examine whether forward guidance has improved the predictability of interest rates. For this purpose, we add a dummy capturing forward guidance ($\mathrm{FG}_{i,t}$) to the list of benchmark regressors, which interacts with both the speech and the transparency variables. The fixed-effects regression model becomes

$$\begin{aligned} Y_{i,h,t} = \alpha + \nu_i + \beta_{SP} \cdot \mathrm{Speech}_{i,t} + \beta_{SPFG} \cdot \mathrm{Speech}_{i,t} \cdot \mathrm{FG}_{i,t} \\ + \beta_{TI} \cdot \mathrm{Transp.}_{i,t} + \beta_{TIFG} \cdot \mathrm{Transp.}_{i,t} \cdot \mathrm{FG}_{i,t} + \beta_{FG} \cdot \mathrm{FG}_{i,t} \\ + \beta_{TO} \cdot \mathrm{Turnover}_{i,t} + \beta_{VIX} \cdot \mathrm{VIX}_t + \beta_h \cdot H_h + \beta_T \cdot T_y \\ + \beta_{ZLB} \cdot ZLB_{i,t} + \varepsilon_{i,h,t}. \end{aligned}$$

As outlined in table 6, the combination of increased communication with forward guidance has effects on the quality of interest

Table 5. Inflation Targeting: Absolute Cross-Sectional Mean Forecast Errors and Forecasts' Cross-Sectional Standard Deviations

	Absolute Cross-Sectional Mean Forecast Errors (Absolute Differences between the Cross-Sectional Mean Forecasts and Their Realizations)					
	Inflation		**Short-Term Interest Rate**		**Long-Term Interest Rate**	
	CY	**NY**	**M03**	**M12**	**M03**	**M12**
Speech	0.019***	0.021***	0.016***	0.007**	0.005	0.004
Speech * IT	0.002	0.021	−0.079***	−0.063***	0.002	−0.011
Transp.	0.027	−0.018	−0.141**	−0.080	−0.013	−0.092
Transp. * IT	0.051	0.096*	0.208***	0.166**	−0.053	−0.014
IT	−0.823***	−1.270***	−1.804***	−1.697***	0.508	0.153
	Cross-Sectional Standard Deviations of Forecasts (Cross-Sectional Standard Deviations of Forecasts at Each Point in Time)					
	Inflation		**Short-Term Interest Rate**		**Long-Term Interest Rate**	
	CY	**NY**	**M03**	**M12**	**M03**	**M12**
Speech	0.014***	0.009***	0.015***	0.001	0.008**	0.005**
Speech * IT	0.002	0.010	−0.000	0.014	−0.010	−0.003
Transp.	−0.132***	−0.133***	−0.107**	−0.062	−0.111**	−0.086**
Transp. * IT	0.104**	0.098**	0.104**	0.048	0.096*	0.080**
IT	−1.113***	−1.113***	−1.295***	−0.957**	−1.145**	−1.027**

Notes: Country fixed-effects panel regression with panel clustered standard errors in parentheses. *, **, and *** denote $p < 0.10$, $p < 0.05$, and $p < 0.01$, respectively. The table shows summary results for a fixed-effects panel regression of the log of forecasts' cross-sectional absolute mean errors and standard deviations including a dummy for inflation targeting. Inflation has forecasts for the current-year (CY) and the next-year (NY) value. We include a dummy for each forecast horizon since both current-year and next-year forecasts' horizons decrease over time. Short-term and long-term interest rates have two forecast horizons. M03 is the 3-month forecast horizon, while M12 stands for the 12-month forecast horizon. We also include a dummy for each year, the VIX, and the turnover. Moreover, we include the ZLB dummy in interest rate regressions (these variables, the intercept, fixed effects, yearly dummies, and horizon dummies are not shown in the table).

Table 6. Forward Guidance: Absolute Cross-Sectional Mean Forecast Errors and Forecasts' Cross-Sectional Standard Deviations

	Absolute Cross-Sectional Mean Forecast Errors (Absolute Differences between the Cross-Sectional Mean Forecasts and Their Realizations)				**Cross-Sectional Standard Deviations of Forecasts (Cross-Sectional Standard Deviations of Forecasts at Each Point in Time)**			
	Short-Term Interest Rate		**Long-Term Interest Rate**		**Short-Term Interest Rate**		**Long-Term Interest Rate**	
	M03	**M12**	**M03**	**M12**	**M03**	**M12**	**M03**	**M12**
Speech	0.009^{*}	-0.001	0.002	-0.002	0.015^{***}	0.008^{**}	0.007^{**}	0.005^{***}
Speech * FG	-0.002	0.009	0.018^{**}	0.017^{**}	0.002	-0.021^{***}	0.002	-0.000
Transp.	-0.042	-0.020	-0.048	-0.091^{*}	-0.090^{*}	-0.082^{**}	-0.107^{**}	-0.091^{**}
Transp. * FG	0.085	0.019	0.065^{**}	0.002	0.069	0.006	-0.009	0.003
FG	-0.837	-0.206	-0.957^{***}	0.146	-1.121^{**}	-0.011	0.051	-0.080

Notes: Country fixed-effects panel regression with panel clustered standard errors in parentheses. *, **, and *** denote $p < 0.10$, $p < 0.05$, and $p < 0.01$, respectively. The table shows summary results for a fixed-effects panel regression of the log of absolute cross-sectional mean forecast errors and standard deviations including a dummy for forward-guidance periods. Short-term and long-term interest rates have two forecast horizons. M03 is the 3-month forecast horizon, while M12 stands for the 12-month forecast horizon. We also include a dummy for each year, the VIX, and the turnover. Moreover, we include the ZLB dummy in interest rate regressions (these variables, the intercept, fixed effects, and yearly dummies are not shown in the table).

rate forecasts that differ from those on their homogeneity. On the one hand, more communication increases the inaccuracy of long-term interest rate forecasts. The same effect is caused by more transparency (three months ahead). On the other hand, intensified communication reduces the heterogeneity of short-term interest rate forecasts one year ahead. Summarizing, more communication and transparency under forward guidance makes forecasts of long-term interest rates less accurate.

4.7 Results Related to Geographic Regions

We also ran our benchmark regression for the four regions defined by Consensus Economics. The regions are "Western countries" (WE), Asia-Pacific (AP), Eastern Europe (EE), and Latin America (LA).

Overall, we find region-specific results. More-frequent communication worsens CPI inflation forecast accuracy in "Western countries" and in the Asia-Pacific region. On the other hand, higher transparency makes it more difficult to forecast inflation in Latin America, but it improves the forecast accuracy of both short-term rates at the 3-month forecast horizon in the Asia-Pacific area and long-term interest rates in "Western countries" at the 12-month horizon. For real GDP growth forecasts, we do not find any particular regional effect, neither for communication nor for transparency.

As far as forecasts' cross-sectional standard deviation is concerned, we do not observe any regional effect related to transparency. By contrast, for communication we find that in Latin American countries more-frequent communication decreases real GDP growth forecasts' dispersion. However, more-frequent communication increases dispersion of short-term interest rate forecasts at the 3-month horizon in "Western countries" and long-term interest rate forecasts at the 12-month forecast horizon in Eastern European countries.

4.8 Financial Crisis of 2007–08

Has the financial crisis influenced the quality and alignment of forecasts? In order to analyze this important question, we constructed a dummy for the financial crisis, starting in August 2007. The results are in table 7. According to it, the effects of transparency and

Table 7. Absolute Cross-Sectional Mean Forecast Errors, Forecasts' Cross-Sectional Standard Deviations, and the Financial Crisis of 2007–08

	Absolute Cross-Sectional Mean Forecast Errors (Absolute Differences between the Cross-Sectional Mean Forecasts and Their Realizations)							
	Inflation		**Growth**		**Short-Term Interest Rate**		**Long-Term Interest Rate**	
	CY	**NY**	**CY**	**NY**	**M03**	**M12**	**M03**	**M12**
Speech	−0.001	−0.023**	0.005	−0.004	−0.022***	−0.008	0.011*	0.003
Speech * Crisis	0.016	0.036***	0.007	0.006	0.029***	0.008	−0.004	0.003
Transp.	0.011	−0.027	0.026	0.035	−0.057	−0.049	−0.056	−0.108**
Transp. * Crisis	0.035*	0.060***	0.016	0.048*	0.047	0.064**	0.065***	0.128***
Crisis	−0.138	−0.586***	−0.147	−0.267	−0.562	−0.410	−0.763***	−0.458
	Cross-Sectional Standard Deviations of Forecasts (Cross-Sectional Standard Deviations of Forecasts at Each Point in Time)							
	Inflation		**Growth**		**Short-Term Interest Rate**		**Long-Term Interest Rate**	
	CY	**NY**	**CY**	**NY**	**M03**	**M12**	**M03**	**M12**
Speech	0.002	0.001	−0.004	−0.007*	−0.006	−0.008	−0.008**	0.003
Speech * Crisis	0.007	0.005	0.002	0.010**	0.017*	0.008	0.017***	0.003
Transp.	−0.124***	−0.128***	−0.024	−0.029	−0.108**	−0.049	−0.095**	−0.108**
Transp. * Crisis	0.042***	0.037**	0.020**	0.022***	0.050*	0.064**	0.046***	0.128***
Crisis	−0.346**	−0.209	−0.186**	−0.313***	−0.527*	−0.410	−0.682***	−0.458

Notes: Country fixed-effects panel regression with panel clustered standard errors in parentheses. *, **, and *** denote $p < 0.10$, $p < 0.05$, and $p < 0.01$, respectively. The table shows results for a fixed-effects panel regression of the log of absolute cross-sectional mean forecast errors and the log of cross-sectional standard deviations using an interaction dummy which is one after July 2007—the beginning of the financial crisis. Inflation and growth have forecasts for the current-year (CY) and the next-year (NY) value. We include a dummy for each forecast horizon since both current-year and next-year forecasts' horizons decrease over time. Short-term and long-term interest rates have two forecast horizons. M03 is the 3-month forecast horizon, while M12 stands for the 12-month forecast horizon. We also include a dummy for each year, the VIX, and the turnover. Moreover, we include the ZLB dummy in interest rate regressions (these variables, the intercept, fixed effects, yearly dummies, and horizon dummies are not shown in the table).

communication have changed since the financial crisis. Before the crisis, more-intense communication reduced the errors in forecasting inflation (for the next year) and short-term interest rates (for the next three months). Since the crisis, more communication has worsened the quality of these forecasts. Moreover, more communication has increased the dispersion of real GDP forecasts for the next year and long-term interest rate forecasts for three months ahead.

Related to transparency, the evidence is even more compelling. Since the financial crisis, greater transparency has impaired the quality of forecasts, especially those relating to inflation and short-term and long-term interest rates. In terms of forecast dispersion, while more transparency had a dispersion-decreasing effect, since the financial crisis this effect has decreased or has even been offset.

Overall, intensified communication and transparency since the financial crisis made it unambiguously more difficult for private forecasters to predict macro and financial variables compared with the pre-crisis period.

5. Robustness

We redid the estimations with a variety of alternative regressors. In sum, the benchmark results remained valid. We performed the following robustness checks.[13]

- *Transparency Subindexes:* Neuenkirch (2013) employs the overall transparency index by Eijffinger and Geraats (2006) and the five subindexes until 2009 for money market forecasts in 25 emerging market countries. The result is that all subindexes improve market expectations, with political transparency having the largest effect. We replace the overall transparency index by its five subindexes as regressors: political transparency, economic transparency, procedural transparency, policy transparency, and operational transparency.

  The results are heterogeneous. At odds with Neuenkirch (2013), we find no effect of any transparency subindex on short-term interest rates' forecast accuracy. By contrast, operational transparency has some beneficial effects in terms

[13]Estimates of all robustness checks are available upon request.

of accuracy and homogeneity of forecasts. In particular, it improves the accuracy of real GDP growth forecasts for next year and decreases heterogeneity of inflation and interest rate forecasts. Increasing political transparency produces mixed effects. On the one hand, it aligns short-term interest rate forecasts. On the other hand, it worsens the accuracy of real GDP forecasts for next year. Finally, more policy transparency worsens outcomes for long-term interest rate forecasts at the three-month horizon.

- *Excluding Euro-Area Countries:* So far, we have used all forecasts from the euro-area countries. To eliminate a potential overweight of the ECB—for instance, we have 17 euro-area countries in the calculation of absolute CPI forecast errors—we excluded all euro-area countries except for Germany[14] and redid the regression for forecast errors and cross-section standard deviations.

  Our benchmark results are confirmed. The only change compared with the benchmark is that transparency has a weaker (alignment-enhancing) effect on the standard deviations of short-term and long-term interest rate forecasts.
- *Uncertainty Measures:* We also checked whether the results remain unaltered if we replaced the VIX with the uncertainty measures from Jurado, Ludvigson, and Ng (2015) and the 30-day return volatility of country MSCI stock market indexes.

  Evidence obtained in the benchmark analysis remains unchanged for the measure by Jurado, Ludvigson, and Ng (2015). Transparency has no effect on forecast precision, but it does reduce forecast dispersion. By contrast, communication worsens the quality of forecasts and increases their dispersion. The effect of uncertainty itself on forecast errors is, contrary to the VIX utilized in the benchmark, significant for inflation forecasts. Contrary to the VIX, this uncertainty measure turns out to exert an insignificant effect on the standard deviation of inflation and GDP growth forecasts, for which the VIX yielded highly significant results. In addition, replacing the VIX with the 30-day return volatility of country MSCI

[14] For instance, Middeldorp (2011) only used observations from Germany in his analysis.

stock market indexes does not change the results related to transparency and communication either.

- *Only Basic Central Banks Sample for Speeches:*[15] As explained in subsection 3.2, the number of central banks reporting their speeches to the BIS increased over time. As a further robustness check, we repeated the benchmark analysis but limited it to the group of central banks, the majority, which has reported to the BIS on a regular basis since 1998. While the evidence of communication does not change, transparency, which in the benchmark analysis significantly reduces forecasts' misalignments, has no effect anymore. Therefore, we conclude that the dispersion-reducing effect of increased transparency that we observe in the benchmark regression is due to the newly reporting central banks.
- *Only Months with Speeches:* In the benchmark regressions we included observations in the months when actually no speech was delivered. As a robustness check, we eliminated these observations from the sample. The general message did not alter.[16]
- *Seasonality of Speeches:* We also ran our benchmark regression excluding July, August, and December since many countries have holidays during these months. Results do not change.
- *Exclusion of Outliers:* We excluded the countries with the largest outliers in terms of forecast errors and took into account the number of forecasters. The results do not change.[17]
- *Revised GDP Figures:* Finally, we found that real GDP growth forecasts react only a little to transparency and communication. However, as is well known, realized GDP figures are regularly revised. To account for this fact, we produced a proxy for GDP growth figures in real time to calculate absolute forecast errors. Our proxy is the December real GDP growth

[15]See figure 1.

[16]The coefficient of speech in the benchmark regression with absolute cross-sectional mean forecast errors as the dependent variable turned negative for interest rate forecasts but was largely insignificant.

[17]For CPI inflation forecasts, the largest absolute forecast errors (greater than 25 percentage points) are in ARG, BGR, BLR, MDA, RUS, TUR, UKR, and VEN. For interest rate forecasts, the outliers are ARG, IDN, and VEN.

forecasts for the current year (i.e., about three weeks' forecast horizon) as the nearest value to the effectively realized GDP growth figure. We reran the benchmark regression for absolute forecast errors using forecast errors calculated with this proxy. Overall, the main message concerning communication and transparency remains unchanged, but its significance decreased.

6. Policy Implications

How do we read the results found in this paper in terms of policy implications? When it comes to transparency, the policy implications are not clear-cut. If the policy objective is to get forecasters to provide more-precise forecasts, our results suggest that transparency is not an adequate tool to achieve it. If the objective is to align individual forecasts, then the general normative implication seems to be an increase in transparency. However, this result seems to be attributable to a selection of central banks that have more recently reported their speeches to the BIS.

In relation to speeches, our empirical results suggest that more-frequent communication increases the uncertainty of their recipients and/or that central banks communicate less precisely. This implies that in order to improve the quality of forecasts of variables that are central to monetary policymaking and align them among professional forecasters, central banks ought to speak less often.

The important question, then, is whether less-precise communication is an unintended effect of too much talk or whether it is a deliberate choice. The latter is not unrealistic. A case in point is particularly uncertain times, when the central bank may want to convey to the markets an increased uncertainty underlying its own forecasts or to dampen market participants' risk-taking behavior.

However, the second explanation is more realistic, for it is difficult to imagine that a central bank deliberately chooses to keep raising the uncertainty in the markets over time. The reason, as noted by Blinder (2007), is that the policy-effectiveness argument for central bank transparency boils down to teaching the markets to "think like the central bank." Doing so will enable the central bank to manage expectations of future monetary policy better and, in particular, to keep them in line with its own thinking.

According to Blinder (2004), there is no one "right way" to communicate. The most-appropriate forms of central bank communication with the public, the government, and the markets depend on the nature of the monetary policy committee. One potential disadvantage that is particularly relevant for an individualistic committee is that it may speak with too many voices, creating cacophony. Blinder (2007) argued that individualistic committees seemed to have coped with their potential cacophony problem.

Or have they? In a recent publication, Blinder (2018) seems to have a more nuanced view on this issue, predicting that the cacophony problem on monetary policy committees will not go away soon. The empirical evidence in this paper suggests that the number of speeches has created confusion rather than clarity.

To corroborate this conjecture, we regressed on a variable relating to central bank independence in lieu of (in)stability.[18] Both a higher turnover rate and a higher CBI index point qualitatively in the same direction. Both suggest a negative effect on the quality of forecasts, although they measure two distinct dimensions of the politico-institutional framework of central banks, mirrored in a correlation coefficient of –0.0026. The evidence seems reasonable for the turnover variable. More difficult is rationalizing the evidence associated with the CBI variable. After all, the central bank independence/credibility literature points to increased credibility arising from greater independence with potential favorable knock-on effects on the variance and predictability of variables. However, our CBI variable covers several dimensions of a central bank's structure. One possible dimension is consistent with the observation made by Blinder (2004) that central bank independence promotes the switch to committee decisions rather than individual decisions. This switch may have raised the risk that the central bank speaks with a cacophony of voices.

As an additional corroborating factor for this argumentation, we constructed a variable that captures the size of monetary policy

[18]Central bank independence (CBI) is proxied by the unweighted independence index constructed by Dincer and Eichengreen (2014). It runs from 0 (lowest independence) to 1 (highest independence) and ends in 2010. Benchmark model estimates replacing turnover with CBI are available upon request.

committees.[19] The correlation of committee size with the number of speeches is +0.74. This suggests that the number of speeches increases in committees' size. Moreover, the correlation of committee size with the CBI variable is +0.51. Hence, although causality may run in both directions, these correlations may suggest that the more independent central banks are, the larger the size of the monetary policy committees, and the larger the monetary policy committees are, the more speeches they deliver. This may be one explanation for the rise in the number of speeches over the years that underlie the rise of potential cacophony.

To sum up, we find that the more speeches central banks give, the greater the confusion this creates among forecasters. Whether this arises from too many voices about monetary policy issues or from too many topics not directly related to monetary policy decisions, such as climate change, education, or inequality, is an important avenue for future research. This is particularly important given our evidence that more communication and transparency have worsened the quality of forecasts and increased their misalignment especially after the financial crisis.

7. Conclusions

By increasing market participants' ability to predict future policy actions, transparency is expected to increase monetary policy effectiveness. Anticipation of the central bank's actions results in a smoother operation in the first steps of the transmission mechanism between policy actions and economic activity and inflation. The question therefore is: Does central bank communication and transparency affect macroeconomic forecasts at all and in the intended way? We answer this question based on a large sample of countries for financial and macroeconomic variables important for monetary policymaking.

The answer is only partially affirmative. Particularly, we show that a clear distinction between central bank communication and transparency should be made. Our main finding is that more speeches worsen the accuracy and precision of financial and macroeconomic forecasts. This insight had been anticipated by Simon

[19] See Lustenberger and Rossi (2017a) for details.

(1971), for whom "a wealth of information creates a poverty of attention." It also lines up with the conclusions drawn by, for instance, Morris and Shin (2002), Kahneman (2003), Sims (2003), and Blinder (2004), for whom uncoordinated communication might actually lower, rather than raise, the signal-to-noise ratio and, in turn, hamper the operation of monetary policy. Stated differently, a "central bank that speaks with a cacophony of voices may, in effect, have no voice at all" (Blinder 2004, p. 57). Thus, speaking less may be beneficial for central banks that want to raise predictability and homogeneity among financial and macroeconomic forecasts. We provide some evidence that this may be particularly true for central banks whose transparency level is already high.

Our results also show that we should not expect too much from greater transparency either. We provide compelling evidence that, in general, central bank transparency is not an effective instrument to improve the accuracy of private forecasts.

At a more detailed level, our results suggest that intensified communication and transparency since the financial crisis made it unambiguously more difficult for private forecasters to predict macro and financial variables compared with the pre-crisis period.

Overall, it seems that higher levels of transparency are especially critical in countries that pursue an inflation-targeting strategy.

A related question is whether a forward-guidance policy as pursued after the crisis has borne fruit. The evidence is mixed. Forward guidance combined with intensified communication worsened the quality of long-term interest rate forecasts but reduced the dispersion of short-term rate forecasts. Increased transparency in a forward-guidance regime produced partly less accurate long-term interest rate forecasts.

Overall, the empirical evidence supports the view expressed by Cukierman (2009), who probes the limits of transparency in general. He argues that given the high degree of opacity in the past, it is highly likely that the move of central banks over the last 20 years towards openness to the public has improved matters. However, he also reminds us that since sufficiently high transparency is now in place and is part of the orthodoxy, the time has come to take a more realistic look at the limits of its feasibility and desirability. That said, we also provide evidence that more transparency contributes to aligning single forecasts with each other. From this perspective,

transparency seems to provide the anchor by which agents' forecasting actions are coordinated. Thus, what seems to be important in the discussion about more or less central bank transparency is to make a clear distinction between its effect on forecast accuracy and its effect on forecast dispersion.

In a more general context, our results make a contribution to the theoretical literature on the social value of information. The general message arising from our empirical analysis is that more public information may make it more difficult for agents to deduce its content.

We also make a contribution in highlighting the importance of the stability and independence of central banks to the quality of private-sector forecasts. Our finding on this account is that a higher turnover of governors tends to reduce the precision of short-term interest rate and inflation forecasts. Greater central bank independence could worsen the quality of forecasts, perhaps by increasing the size of monetary policy committees that may lead to cacophony.

We have identified the communication of the central bank by the number of speeches. Future research could extent the analysis. According to Freedman and Laxton (2009), there are additional important means for the central bank's views to reach the public, such as monetary policy reports, inflation reports, press releases, and minutes. Ideally, all means of central bank communication should complement each other to get their message across most effectively. Otherwise, there is a risk of overcommunicating and transmitting different messages through the various channels. While some of these communication tools are captured by our transparency index, a more in-depth analysis may provide evidence of their effectiveness. This is the case in Jain and Sutherland (2018), who identify the communication by the central bank projections typically disseminated in monetary policy reports and inflation reports and find the projections to be important inputs to private forecasts.

Future research could also track the evolution of committee sizes and analyze the effects per speaker. Another extension could examine the content of speeches along various dimensions, such as their length, comprehensibility and keywords, and accounting for endogeneity issues. This would allow to tackle the question of whether cacophony arises from too many speeches about all sorts of issues not directly related to monetary policy or from a variety of voices on monetary policy issues.

Appendix. Differences to the Previous Literature

Table A.1. Inflation, Previous Literature, and Time Dummy

	Absolute Cross-Sectional Mean Forecast Errors (Absolute Differences between the Cross-Sectional Mean Forecasts and Their Realizations)											
	CY						NY					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Transp.	−0.229***	−0.108***	0.024	−0.272***	−0.129***	0.022	−0.397**	−0.077***	−0.005	−0.435**	−0.091***	−0.010
	(0.07)	(0.02)	(0.03)	(0.08)	(0.02)	(0.03)	(0.15)	(0.03)	(0.04)	(0.17)	(0.03)	(0.04)
VIX	0.019***	0.010***	−0.002	0.014***	0.008***	−0.003	0.013	0.005**	0.002	0.012*	0.006***	0.002
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)
|ΔOil|	−0.030***	−0.008*	−0.006*				−0.001	0.014***	0.004*			
	(0.01)	(0.00)	(0.00)				(0.02)	(0.01)	(0.00)			
Speech				0.027***	0.017***	0.019***				0.045***	0.026***	0.020***
				(0.01)	(0.00)	(0.00)				(0.01)	(0.00)	(0.01)
Turnover				0.948	0.212**	0.258***				1.054*	−0.015	0.073
				(0.63)	(0.08)	(0.08)				(0.59)	(0.09)	(0.08)
Time Dummies	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
N	12,322	12,319	12,319	12,310	12,307	12,307	12,298	12,298	12,298	12,286	12,286	12,286
Countries	73	73	73	73	73	73	73	73	73	73	73	73
R2	0.03	0.17	0.20	0.04	0.18	0.21	0.01	0.02	0.14	0.02	0.03	0.15

(*continued*)

Table A.1. (Continued)

	Cross-Sectional Standard Deviations of Forecasts (Cross-Sectional Standard Deviations of Forecasts at Each Point in Time)											
	CY						NY					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Transp.	−0.218***	−0.124***	−0.109**	−0.235***	−0.132***	−0.109**	−0.308***	−0.127***	−0.115***	−0.327***	−0.132***	−0.115***
	(0.07)	(0.03)	(0.04)	(0.07)	(0.03)	(0.04)	(0.09)	(0.03)	(0.04)	(0.10)	(0.03)	(0.04)
VIX	0.011***	0.011***	0.001	0.009***	0.011***	0.001	0.016***	0.012***	0.005***	0.015***	0.012***	0.006***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
|ΔOil|	−0.012*	0.000	0.001				−0.010	0.002	0.005***			
	(0.01)	(0.00)	(0.00)				(0.01)	(0.00)	(0.00)			
Speech				0.017***	0.012***	0.012***				0.020***	0.008**	0.008**
				(0.01)	(0.00)	(0.00)				(0.01)	(0.00)	(0.00)
Turnover				0.599	0.115	0.125				0.474	0.084	0.094
				(0.45)	(0.09)	(0.09)				(0.33)	(0.07)	(0.07)
Time Dummies	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
N	7,483	7,483	7,483	7,471	7,471	7,471	7,483	7,483	7,483	7,471	7,471	7,471
Countries	45	45	45	45	45	45	45	45	45	45	45	45
R2	0.06	0.41	0.45	0.08	0.42	0.46	0.05	0.19	0.23	0.06	0.20	0.24

Notes: Country fixed-effects panel regression with panel clustered standard errors in parentheses. *, **, and *** denote $p < 0.10$, $p < 0.05$, and $p < 0.01$, respectively. The table shows results for a fixed-effects panel regression of (the log of) absolute cross-sectional mean forecast errors and (the log of) cross-sectional standard deviations. Inflation has forecasts for the current-year (CY) and the next-year (NY) value. We include a dummy for each forecast horizon since both current-year and next-year forecasts' horizons decrease over time. If a dummy for each year is included (time dummies), it is indicated by "Yes" (the intercept, fixed effects, time dummies, and horizon dummies are not shown in the table). Regression (1) corresponds to the regression by Naszodi et al. (2016), while (2) uses the log of the left-hand-side variable. (3) adds time dummies to otherwise the same regression as (2) (the same is true for (7)–(9)). Regression (4) corresponds to our regression set up without log and time dummies, while regression (5) uses the log of the left-hand-side variable. Additionally, (6) includes time dummies (the same is true for (10)–(12)).

Table A.2. Growth, Previous Literature, and Time Dummy

	Absolute Cross-Sectional Mean Forecast Errors (Absolute Differences between the Cross-Sectional Mean Forecasts and Their Realizations)											
	CY						NY					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Transp.	−0.075**	−0.080***	0.034	−0093***	−0.089***	0.031	−0.057	−0.028	0.056	−0.016	−0.011	0.055
	(0.03)	(0.02)	(0.03)	(0.03)	(0.03)	(0.03)	(0.06)	(0.02)	(0.04)	(0.05)	(0.02)	(0.04)
VIX	0.017***	0.014***	0.002	0.016***	0.014***	0.002	0.037***	0.019***	−0.003**	0.046***	0.022***	−0.003**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)
|ΔOil|	−0.007	−0.005	−0.000				0.076***	0.027***	0.003			
	(0.00)	(0.00)	(0.00)				(0.01)	(0.00)	(0.00)			
Speech				0.013**	0.005	0.014***				0.018	0.003	0.007
				(0.01)	(0.00)	(0.00)				(0.02)	(0.01)	(0.01)
Turnover				0.009	0.005	0.046				0.018	0.021	0.085
				(0.08)	(0.07)	(0.07)				(0.20)	(0.09)	(0.09)
Time Dummies	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
N	11,800	11,799	11,799	11,788	11,787	11,787	11,722	11,722	11,722	11,710	11,710	11,710
Countries	73	73	73	73	73	73	73	73	73	73	73	73
R2	0.08	0.07	0.11	0.08	0.07	0.12	0.06	0.04	0.14	0.04	0.04	0.14

(*continued*)

Table A.2. (Continued)

	Cross-Sectional Standard Deviations of Forecasts (Cross-Sectional Standard Deviations of Forecasts at Each Point in Time)											
	CY						NY					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Transp.	−0.036**	−0.045**	−0.018	−0.041**	−0.052**	−0.017	−0.044***	−0.043**	−0.024	−0.049***	−0.051***	−0.023
	(0.02)	(0.02)	(0.03)	(0.02)	(0.02)	(0.03)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
VIX	0.008***	0.014***	0.005***	0.007***	0.013***	0.005***	0.010***	0.014***	0.008***	0.009***	0.014***	0.008***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
|ΔOil|	−0.005***	−0.009***	−0.001				−0.004***	−0.005**	−0.001			
	(0.00)	(0.00)	(0.00)				(0.00)	(0.00)	(0.00)			
Speech				0.001	−0.001	−0.001				0.002	0.005*	0.004*
				(0.00)	(0.00)	(0.00)				(0.00)	(0.00)	(0.00)
Turnover				0.041	0.026	0.061				0.070*	0.029	0.048
				(0.03)	(0.04)	(0.04)				(0.04)	(0.04)	(0.04)
Time Dummies	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
N	7,483	7,483	7,483	7,471	7,471	7,471	7,483	7,483	7,483	7,471	7,471	7,471
Countries	45	45	45	45	45	45	45	45	45	45	45	45
R2	0.20	0.37	0.49	0.19	0.36	0.50	0.14	0.15	0.26	0.14	0.16	0.27

Notes: Country fixed-effects panel regression with panel clustered standard errors in parentheses. *, **, and *** denote $p < 0.10$, $p < 0.05$, and $p < 0.01$, respectively. The table shows results for a fixed-effects panel regression of (the log of) absolute cross-sectional mean forecast errors and (the log of) cross-sectional standard deviations. Growth has forecasts for the current-year (CY) and the next-year (NY) value. We include a dummy for each forecast horizon since both current-year and next-year forecasts' horizons decrease over time. If a dummy for each year is included (time dummies), it is indicated by "Yes" (the intercept, fixed effects, time dummies, and horizon dummies are not shown in the table). Regression (1) corresponds to the regression by Naszodi et al. (2016), while (2) uses the log of the left-hand-side variable. (3) adds time dummies to otherwise the same regression as (2) (the same is true for (7)–(9)). Regression (4) corresponds to our regression set up without log and time dummies, while regression (5) uses the log of the left-hand-side variable. Additionally, (6) includes time dummies (the same is true for (10)–(12)).

Table A.3. Short-Term Interest Rates, Previous Literature, and Time Dummy

	Absolute Cross-Sectional Mean Forecast Errors (Absolute Differences between the Cross-Sectional Mean Forecasts and Their Realizations)											
	M03						M12					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Transp.	−0.369**	−0.259***	−0.037	−0.364**	−0.206***	−0.044	−0.417**	−0.184***	−0.020	0.402**	−0.130***	−0.021
	(0.15)	(0.06)	(0.07)	(0.16)	(0.05)	(0.06)	(0.17)	(0.05)	(0.06)	(0.17)	(0.05)	(0.06)
VIX	0.028***	0.029***	0.014***	0.026***	0.027***	0.015***	0.031***	0.021***	0.001	0.029***	0.019***	0.001
	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)
|ΔOil|	−0.002	0.014	0.015**				0.003	0.013*	0.002			
	(0.02)	(0.01)	(0.01)				(0.02)	(0.01)	(0.00)			
Speech				0.010	0.001	0.008*				0.012	−0.004	0.002
				(0.01)	(0.00)	(0.00)				(0.01)	(0.00)	(0.00)
Turnover				1.189	0.098	0.126				1.190	0.227**	0.281***
				(0.84)	(0.10)	(0.10)				(0.78)	(0.10)	(0.09)
ZLB				0.013	−1.085***	−0.723***				−0.225	−1.003***	−0.736***
				(0.18)	(0.18)	(0.16)				(0.20)	(0.11)	(0.12)
Time Dummies	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
N	5,875	5,840	5,840	5,863	5,828	5,828	5,875	5,870	5,870	5,863	5,858	5,858
Countries	34	34	34	34	34	34	34	34	34	34	34	34
R2	0.07	0.11	0.19	0.11	0.15	0.21	0.07	0.08	0.20	0.10	0.14	0.23

(*continued*)

Table A.3. (Continued)

	Cross-Sectional Standard Deviations of Forecasts (Cross-Sectional Standard Deviations of Forecasts at Each Point in Time)											
	M03						M12					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Transp.	−0.218**	−0.211***	−0.085*	−0.232**	−0.205***	−0.090*	−0.264**	−0.165***	−0.078*	−0.276**	−0.158***	−0.082**
	(0.09)	(0.03)	(0.05)	(0.08)	(0.04)	(0.05)	(0.11)	(0.03)	(0.04)	(0.11)	(0.03)	(0.04)
VIX	0.010***	0.025***	0.014***	0.009***	0.022***	0.014***	0.008***	0.014***	0.006***	0.008***	0.012***	0.005***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
|ΔOil|	−0.010	−0.005	0.004				−0.007	−0.006**	−0.000			
	(0.01)	(0.00)	(0.00)				(0.01)	(0.00)	(0.00)			
Speech				0.004	0.006**	0.013***				0.002	−0.003	0.002
				(0.00)	(0.00)	(0.00)				(0.00)	(0.00)	(0.00)
Turnover				0.636	0.160**	0.165**				0.562	0.085	0.087
				(0.46)	(0.08)	(0.08)				(0.41)	(0.07)	(0.07)
ZLB				0.406	−0.584***	−0.349*				0.502	−0.394***	−0.207
				(0.32)	(0.16)	(0.18)				(0.42)	(0.13)	(0.13)
Time Dummies	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
N	5,934	5,907	5,907	5,922	5,895	5,895	5,932	5,928	5,928	5,920	5,916	5,916
Countries	34	34	34	34	34	34	34	34	34	34	34	34
R2	0.09	0.08	0.11	0.15	0.10	0.12	0.11	0.23	0.33	0.15	0.27	0.34

Notes: Country fixed-effects panel regression with panel clustered standard errors in parentheses. *, **, and *** denote $p < 0.10$, $p < 0.05$, and $p < 0.01$, respectively. The table shows results for a fixed-effects panel regression of (the log of) absolute cross-sectional mean forecast errors and (the log of) cross-sectional standard deviations. Short-term interest rates have forecasts for 3 months (M03) and 12 months ahead (M12). If a dummy for each year is included (time dummies), it is indicated by "Yes" (the intercept, fixed effects, and time dummies are not shown in the table). Regression (1) corresponds to the regression by Naszodi et al. (2016), while (2) uses the log of the left-hand-side variable. (3) adds time dummies to otherwise the same regression as (2) (the same is true for (7)–(9)). Regression (4) corresponds to our regression set up without log and time dummies, while regression (5) uses the log of the left-hand-side variable. Additionally, (6) includes time dummies (the same is true for (10)–(12)).

Table A.4. Long-Term Interest Rates, Previous Literature, and Time Dummy

	Absolute Cross-Sectional Mean Forecast Errors (Absolute Differences between the Cross-Sectional Mean Forecasts and Their Realizations)											
	M03						M12					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Transp.	0.001	−0.014	−0.060	−0.001	−0.033	−0.051	0.052**	0.056*	−0.112**	0.022	0.020	−0.103*
	(0.01)	(0.03)	(0.04)	(0.01)	(0.03)	(0.04)	(0.02)	(0.03)	(0.05)	(0.00)	(0.03)	(0.05)
VIX	0.004***	0.010***	0.009***	0.005***	0.012***	0.011***	−0.003*	−0.002	−0.013***	−0.002	−0.000	−0.013***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
|ΔOil|	0.007***	0.007	0.012**				−0.004	0.002	0.001			
	(0.00)	(0.00)	(0.00)				(0.00)	(0.00)	(0.00)			
Speech				0.003*	0.009**	0.006				0.008***	0.012***	0.004
				(0.00)	(0.00)	(0.00)				(0.00)	(0.00)	(0.00)
Turnover				0.020	−0.006	0.032				−0.004	0.021	0.016
				(0.04)	(0.09)	(0.09)				(0.07)	(0.12)	(0.10)
ZLB				0.090**	0.242**	0.068				0.290***	0.434***	0.233*
				(0.04)	(0.11)	(0.11)				(0.08)	(0.12)	(0.12)
Time Dummies	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
N	3,580	3,577	3,577	3,568	3,565	3,565	3,602	3,602	3,602	3,590	3,590	3,590
Countries	23	23	23	23	23	23	23	23	23	23	23	23
R2	0.02	0.01	0.07	0.02	0.02	0.07	0.01	0.00	0.18	0.04	0.03	0.19

(*continued*)

Table A.4. (Continued)

	Cross-Sectional Standard Deviations of Forecasts (Cross-Sectional Standard Deviations of Forecasts at Each Point in Time)											
	M03						M12					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Transp.	−0.127	−0.076	−0.121**	−0.139	−0.093*	−0.107**	−0.136	−0.082**	−0.101**	−0.145	−0.092**	−0.091**
	(0.11)	(0.05)	(0.05)	(0.11)	(0.05)	(0.05)	(0.10)	(0.04)	(0.04)	(0.10)	(0.04)	(0.04)
VIX	0.004***	0.013***	0.010***	0.005***	0.013***	0.010***	0.003***	0.005***	0.005***	0.003***	0.006***	0.005***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
|ΔOil|	−0.000	−0.002	−0.001				0.001	0.001	0.002			
	(0.00)	(0.00)	(0.00)				(0.00)	(0.00)	(0.00)			
Speech				0.006*	0.010***	0.007**				0.005*	0.006***	0.005**
				(0.00)	(0.00)	(0.00)				(0.00)	(0.00)	(0.03)
Turnover				0.137	0.103**	0.104**				0.110	0.048	0.056*
				(0.11)	(0.05)	(0.04)				(0.09)	(0.03)	(0.03)
ZLB				0.124	0.155***	0.118				0.125	0.139**	0.144*
				(0.08)	(0.05)	(0.07)				(0.08)	(0.05)	(0.07)
Time Dummies	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
N	3,871	3,867	3,867	3,859	3,855	3,855	3,871	3,871	3,871	3,859	3,859	3,859
Countries	23	23	23	23	23	23	23	23	23	23	23	23
R2	0.07	0.12	0.18	0.08	0.15	0.20	0.09	0.08	0.15	0.10	0.10	0.17

Notes: Country fixed-effects panel regression with panel clustered standard errors in parentheses. *, **, and *** denote $p < 0.10$, $p < 0.05$, and $p < 0.01$, respectively. The table shows results for a fixed-effects panel regression of (the log of) absolute cross-sectional mean forecast errors and (the log of) cross-sectional standard deviations. Long-term interest rates have forecasts for 3 months (M03) and 12 months (M12) ahead. If a dummy for each year is included (time dummies), it is indicated by "Yes" (the intercept, fixed effects, and time dummies are not shown in the table). Regression (1) corresponds to the regression by Naszodi et al. (2016), while (2) uses the log of the left-hand-side variable. (3) adds time dummies to otherwise the same regression as (2) (the same is true for (7)–(9)). Regression (4) corresponds to our regression set up without log and time dummies, while regression (5) uses the log of the left-hand-side variable. Additionally, (6) includes time dummies (the same is true for (10)–(12)).

References

Amato, J. D., S. Morris, and H. S. Shin. 2002. "Communication and Monetary Policy." *Oxford Review of Economic Policy* 18 (4): 495–503.

Blinder, A. S. 2004. *The Quiet Revolution: Central Banking Goes Modern*. Yale University Press.

———. 2007. "Monetary Policy by Committee: Why and How?" *European Journal of Political Economy* 23 (1): 106–23.

———. 2018. "Through a Crystal Ball Darkly: The Future of Monetary Policy Communication." *AEA Papers and Proceedings* 108 (May): 567–71.

Blinder, A. S., M. Ehrmann, J. de Haan, and D.-J. Jansen. 2017. "Necessity as the Mother of Invention: Monetary Policy After the Crisis." *Economic Policy* 32 (92): 707–55.

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.

Cecchetti, S. G., and C. Hakkio. 2009. "Inflation Targeting and Private Sector Forecasts." NBER Working Paper No. 15424.

Charbonneau, K., and L. Rennison. 2015. "Forward Guidance at the Effective Lower Bound: International Experience." Staff Discussion Paper No. 2015-15, Bank of Canada.

Chortareas, G., D. Stasavage, and G. Sterne. 2002. "Does It Pay to Be Transparent? International Evidence from Central Bank Forecasts." *Review* (Federal Reserve Bank of St. Louis) (July/August): 99–118.

Crowe, C. 2010. "Testing the Transparency Benefits of Inflation Targeting: Evidence from Private Sector Forecasts." *Journal of Monetary Economics* 57 (2): 226–32.

Cukierman, A. 2009. "The Limits of Transparency." *Economic Notes* (Banca Monte dei Paschi di Siena SpA) 38 (1–2): 1–37.

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

Dincer, N., and B. Eichengreen. 2010. "Central Bank Transparency: Causes, Consequences and Updates." *Theoretical Inquiries in Law* 11 (75): 75–123.

Dincer, N. N., and B. Eichengreen. 2014. "Central Bank Transparency and Independence: Updates and New Measures." *International Journal of Central Banking* 10 (1, March): 189–253.

Dovern, J., U. Fritsche, and J. Slacalek. 2012. "Disagreement Among Forecasters in G7 Countries." *Review of Economics and Statistics* 94 (4): 1081–96.

Dreher, A., J.-E. Sturm, and J. de Haan. 2010. "When Is a Central Bank Governor Replaced? Evidence Based on a New Data Set." *Journal of Macroeconomics* 32 (3): 766–81.

Ehrmann, M., S. Eijffinger, and M. Fratzscher. 2012. "The Role of Central Bank Transparency for Guiding Private Sector Forecasts." *Scandinavian Journal of Economics* 114 (3): 1018–52.

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

Faust, J., and L. E. O. Svensson. 2001. "Transparency and Credibility: Monetary Policy with Unobservable Goals." *International Economic Review* 42 (2): 369–97.

Freedman, C., and D. Laxton. 2009. "Inflation Targeting Pillars: Transparency and Accountability." IMF Working Paper No. 262.

Geraats, P. M. 2006. "Transparency of Monetary Policy: Theory and Practice." *CESifo Economic Studies* 52 (1): 111–52.

Haldane, A. G. 2017. "A Little More Conversation — A Little Less Action." Speech at the Federal Reserve Bank of San Francisco Macroeconomics and Monetary Policy Conference, March 31.

Hellwig, C., and L. Veldkamp. 2009. "Knowing What Others Know: Coordination Motives in Information Acquisition." *Review of Economic Studies* 76 (1): 223–51.

Jain, M., and C. S. Sutherland. 2018. "How Do Central Bank Projections and Forward Guidance Influence Private-Sector Forecasts?" Staff Working Paper No. 18-2, Bank of Canada.

Jurado, K., S. C. Ludvigson, and S. Ng. 2015. "Measuring Uncertainty." *American Economic Review* 105 (3): 1177–1216.

Kahneman, D. 2003. "Maps of Bounded Rationality: Psychology for Behavioral Economics." *American Economic Review* 93 (5): 1449–75.

King, M. 2000. "Monetary Policy: Theory in Practice." Speech at the Meetings of the American Economic Association, Boston, Massachusetts, January 7.

Kuttner, K. N. 2001. "Monetary Policy Surprises and Interest Rates: Evidence from the Fed Funds Futures Market." *Journal of Monetary Economics* 47 (3): 523–44.

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.

Lorenzoni, G. 2010. "Optimal Monetary Policy with Uncertain Fundamentals and Dispersed Information." *Review of Economic Studies* 77 (1): 305–38.

Lustenberger, T., and E. Rossi. 2017a. "Does Central Bank Transparency and Communication Affect Financial and Macroeconomic Forecasts?" SNB Working Paper No. 2017-12.

———. 2017b. "The Social Value of Information: A Test of a Beauty and Non-Beauty Contest." SNB Working Paper No. 2017-17.

Mankiw, G. N., R. Reis, and J. Wolfers. 2003. "Disagreement about Inflation Expectations." *NBER Macroeconomics Annual 2003,* Vol. 18, ed. M. Gertler and K. Rogoff, 209–48 (chapter 4). MIT Press.

Middeldorp, M. 2011. "Central Bank Transparency, the Accuracy of Professional Forecasts, and Interest Rate Volatility." Staff Report No. 496, Federal Reserve Bank of New York.

Morris, S., and H. S. Shin. 2002. "Social Value of Public Information." *American Economic Review* 92 (5): 1521–34.

Naszodi, A., C. Csavas, S. Erhart, and D. Felcser. 2016. "Which Aspects of Central Bank Transparency Matter? A Comprehensive Analysis of the Effect of Transparency on Survey Forecasts." *International Journal of Central Banking* 12 (4, December): 147–92.

Neuenkirch, M. 2013. "Central Bank Transparency and Financial Market Expectations: The Case of Emerging Markets." *Economic Systems* 37 (4): 598–609.

Ranaldo, A., and E. Rossi. 2010. "The Reaction of Asset Markets to Swiss National Bank Communication." *Journal of International Money and Finance* 29 (3): 486–503.

Santos Silva, J. M. C., and S. Tenreyro. 2006. "The Log of Gravity." *Review of Economics and Statistics* 88 (4): 641–58.

Sellon, G. H. 2008. "Monetary Policy Transparency and Private Sector Forecasts: Evidence from Survey Data." *Economic Review* (Federal Reserve Bank of Kansas City) (Third Quarter): 7–34.

Simon, H. A. 1971. "Designing Organizations for an Information-Rich World." In *Computers, Communications, and the Public Interest*, ed. M. Greenberger, 37–52 (chapter 2). The Johns Hopkins University Press.

Sims, C. A. 2003. "Implications of Rational Inattention." *Journal of Monetary Economics* 50 (3): 665–90.

Stock, J. H., and M. W. Watson. 2008. "Heteroskedasticity-Robust Standard Errors for Fixed Effects Panel Data Regression." *Econometrica* 76 (1): 155–74.

Svensson, L. E. O. 2006. "Social Value of Public Information: Comment: Morris and Shin (2002) Is Actually Pro-Transparency, Not Con." *American Economic Review* 96 (1): 448–52.

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

Van Der Cruijsen, C. A. B., S. C. W. Eijffinger, and L. H. Hoogduin. 2010. "Optimal Central Bank Transparency." *Journal of International Money and Finance* 29 (8): 1482–1507.

Wilhelmsen, B.-R., and A. Zaghini. 2011. "Monetary Policy Predictability in the Euro Area: An International Comparison." *Applied Economics* 43 (20): 2533–44.

Winkler, B. 2002. "Which Kind of Transparency? On the Need for Effective Communication in Monetary Policy Making." *Ifo Studies* 48 (3): 401–27.