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Does the Clarity of Monetary Policy Reports Reduce Volatility in Financial Markets?*

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Abstract

We study whether increased clarity of central bank reports on monetary policy can reduce volatility of returns in financial markets. We measure clarity of reports by the Czech National Bank, the European Central Bank, the Bank of England, and Sveriges Riksbank using the Flesch-Kincaid grade level. In contrast to much of the recent literature, we find only limited evidence of a negative relationship between clarity of monetary policy reports and market volatility. We conclude that reducing volatility using clearer reports is not straightforward, especially in times of crisis.

1. Introduction

This paper studies whether greater clarity of central bank reports on monetary policy leads to lower volatility of returns in financial markets. Central banks have, over the recent decades, made an increasing use of communication (Haldane, 2017). By using communication, central banks are aiming to increase the transparency of their monetary policies (Bulíř and Šmídková, 2007). A perceived benefit is that central banks can exert influence on macroeconomic developments by better guiding expectations about future policies among the public in general, and among financial market participants in particular (Blinder, Ehrmann, Fratzscher, De Haan and Jansen, 2008).

Despite the increased reliance on communication in central banks' policy practice, the evidence on benefits and costs of communication is not unanimous. One can identify two main streams of literature.

The first stream of the literature emphasizes evidence that the directional guidance given by central banks on their past and upcoming policy actions is of prime importance for financial markets participants (Ehrmann and Fratzscher, 2007, Hayo and Neuenkirch, 2010; Lamla and Lein, 2011; Rosa, 2011; Sturm and De Haan, 2011; Neuenkirch, 2013). Indeed, a recent survey among central bank governors confirms

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An online Appendix is available at: http://journal.fsv.cuni.cz/mag/article/show/id/1400

the importance of communication for monetary policy makers (Blinder, Ehrmann, De Haan, and Jansen, 2017). Moreover, recent empirical work suggests that it may not necessarily be the quantity, but rather the quality of communication that is relevant. Blinder (2008), for instance, suggests that clearer communications have higher signal-to-noise ratios and should thus provide more useful information. Fracasso, Genberg, and Wyplosz (2003) find that the perceived quality of the writing style of inflation reports negatively correlates with monetary policy surprises, while Jansen (2011) finds that greater clarity of testimonies by the Federal Reserve Chair has gone hand in hand with lower market volatility. Ehrmann and Fratzscher (2013) find that more consistent communication by members of monetary policy committees reduces uncertainty on the path of future interest rates, while Ehrmann and Talmi (2016) find that subsequent press releases by the Bank of Canada with larger differences in wording lead to higher volatility in financial markets. Smales and Apergis (2017) also find that more complex language related to Federal Open Market Committee (FOMC) decisions increases trading volume and volatility of returns.

The second stream of the literature points to trade-offs and limits to transparency. The seminal work by Morris and Shin (2002) suggests that greater transparency on public policy is not necessarily welfare-enhancing. Van der Cruijsen, Eijffinger and Hoogduin (2010) find that there is an optimal intermediate degree of transparency. In surveying the literature on uncertainty, Bloom (2014) points to trade-offs by asking whether more transparent communication of public policy would indeed reduce uncertainty or whether transparency would introduce greater volatility as financial markets jump after policy pronouncements. Finally, Shin (2017) makes the point that the signal value of market prices can become impaired when market participants focus too much on central bank communications.

This paper contributes to the literature by investigating the relationship between textual clarity of monetary policy reports and volatility in financial markets. We test whether clear communication indeed increases understanding and translates into more informed price formation on financial markets, less uncertainty, and lower volatility. There are reasons to expect clear communication to be helpful, especially in a context where investors' attention is a scare resource. For instance, several papers show how attention of market participants to individual news items may be limited (e.g. Hirshleifer, Lim and Teoh, 2009; DellaVigna and Pollet, 2009; Ehrmann and Jansen, 2017). From that perspective, it becomes relevant whether or not market participants are able to read and digest central bank communications quickly and accurately.

A distinguishing aspect of our paper is that we pay special attention to the effects of communication during the recent global financial crisis. Communicating more clearly, while perhaps beneficial, also tends to be more challenging in financially volatile times. In the wake of the crisis, many central banks have adjusted their use of communication, both in terms of content and channels. For instance, Siklos (2013) observes that during the crisis, the focus of central bank communication shifted towards financial stability and the increased uncertainty surrounding the economic outlook. Bulíř, Čihák, and Jansen (2013) find clarity of communications by several central banks decreased during the financial crisis. Neuenkirch (2013) finds that the effects of ECB communications weakened during the crisis, while, in contrast, Hayo, Kutan, and Neuenkirch (2015) find evidence that Federal Reserve communications were more market relevant during the financial crisis.

Our paper uses the Flesch-Kincaid grade level (Kincaid et al. 1975) to measure the clarity of reports on monetary policy by four central banks, namely the Czech National Bank (CNB), the European Central Bank (ECB), the Bank of England (BoE), and Sveriges Riksbank (SR). Using the Flesch-Kincaid (FK) grade level, we analyse the effects of clarity on measures of financial market volatility over a time window around the publication of central bank reports. A key benefit of the FK measure is objectivity: it does not require subjective judgements by a reader, because it is based purely on the quantitative characteristics of the underlying text. Reflecting its objective nature, the FK grade level has become a well-known measure of linguistic complexity that has been used for a wide range of texts, from consumer manuals to newspaper articles and political speeches. Also, central bankers have started using the FK grade level to measure complexity of their own communications (Haldane, 2017; Praet, 2017).

In contrast to much of the literature on central bank communication, we find no broad-based evidence that clarity of communication reduces market volatility. Using a range of regression models, we estimate the empirical effects of clarity to be small, especially in comparison to recent work on this topic (Jansen, 2011; Ehrmann and Fratzscher, 2013; Ehrmann and Talmi, 2016; Smales and Apergis, 2017). Our study therefore casts doubt on the idea that clearer central bank reports can easily reduce volatility in financial markets, especially in times of crisis. This finding does not mean that central bank communication does not have value. Presenting more accessible information may still be quite important. In particular, as emphasized for example in Blinder et al. (2008), it can be helpful for monetary policy authorities more generally in providing accountability and transparency vis-à-vis the public.

2. Methodology and Data Sources

The rationale for a negative relationship between clarity of communication and asset return volatility is as follows. When a central bank succeeds in formulating its views more clearly in its reports on monetary policy, agents more easily understand the communications. Thus, financial analysts, investors, and traders can more readily grasp the central bank's policy positions and have more precise information on which to trade. By reducing uncertainty over the central bank's policies, leading to more informed price formation, increased clarity could thus lead to less return volatility.[1]

Various elements of the central bank reports contribute to overall clarity, such as the text, the layout, and the information presented in charts and tables. Our approach is to use the variation in readability to identify potential effects on financial market volatility. If it is difficult to read a text, financial market participants are less likely to understand the content. There is also an increased likelihood that the reader does not finish reading the text. Also, we choose to focus on the executive summaries of the reports rather than the full texts. The reason is that this part of the reports will have the greatest likelihood of being read. Therefore, the clarity of the executive summary is of key importance in informing market participants.

We follow a line of research that builds on Flesch (1948) in identifying text characteristics, such as lengths of words and sentences, as good predictors of

[1] We focus on return volatility, a short-term measure of how uncertainty is related to price formation. For analyses of longer-term effects of uncertainty, see Bloom (2009) or Baker and Bloom (2013).

readability. An advantage of these readability measures is that they are based on objective elements of the underlying texts. At the same time, the FK grade level is not well suited to track the substance of the topics that are discussed or to measure the directional tone of communications. For those purposes, one should revert to content analysis, either by human coders or by computer algorithms (see also Blinder et al. (2008) or Hansen and McMahon (2016).

We use the FK grade level (Kincaid et al. 1975) to measure (lack of) clarity. The variable expresses reading difficulty as the number of years of education needed to comprehend a text. To compute the FK grade level for a text written in English, one uses the following formula:

$$FK = 0.39 * (words / sentences) + 11.8 * (syllables / words) - 15.59, \quad (1)$$

where *FK* denotes the FK grade level, and *words*, *sentences* and *syllables* denote three key textual characteristics of the individual communications. A higher average number of words per sentences (words / sentences), or longer words (syllables / words) makes it harder to understand the text. In that case, the FK grade level would increase, indicating that the reader would need more education to understand sufficiently the text, and clarity would then be lower.

We illustrate the FK grade level using three stylized examples. Suppose a central bank report only contains the following sentence: "We think inflation will be below two percent next year". The corresponding value for the FK grade level is 4.8. Now consider a variation on this sentence that replaces the word "think" with the word "expect". This substitution raises the FK to 6.0. Finally, if we add the phrase "over the next twelve months" to this new sentence, the FK increases to 6.7. These three examples illustrate how using longer words or longer sentences lead to higher values of the FK. Admittedly, these examples are simplified, and one should only apply the FK grade level to longer bodies of texts. We apply the FK grade level to written communication in English by four central banks: the CNB, the ECB, the BoE, and SR. An important selection criterion is that these central banks focus strongly on inflation outlook in their communications. At the same time, these four institutions are not all directly following an inflation targeting strategy and differences between the nature of their reports do exist. For instance, the reports by the CNB, the ECB, and SR are not primarily or exclusively published in English. However, it is likely that the English versions get wide media coverage and receive attention from financial market analysts. Table 1 gives details on the communications included in the analysis and data sources. Mainly, we use the executive summaries of the reports. For the ECB, we use the editorial of the Monthly Bulletin. A word of caution is that there is often an overlap between the content of the Monthly Bulletin and the ECB press conferences. This may limit the news value of the reports to financial markets, although measuring the variation in clarity of the Monthly Bulletins may still be interesting.

We assess the potential effects of clarity on a wide range of financial market instruments by using volatility of treasury bills, government bond yields and stock market returns. For yields on T-bills and government bonds, we use various maturities, ranging from overnight rates up to 5-year rates. For the effect on stock market returns, we compute volatility for returns of the jurisdiction's main stock market index. We use

the PX index for the Czech Republic, the Eurostoxx50 index for the euro area, the OMX30 index for Sweden and the FTSE100 index for the United Kingdom.

Table 1 Data and Sources

Country	*Data*	*Sample*	*Source*
Czech Republic	Introduction of inflation report	2000 - 2013	CNB web site
	PRIBK		Datastream
	Treasury yields, various maturities		Kladívko (2010)
	PX stock index		Datastream
Euro area	Editorial of Monthly Bulletin	1999 - 2013	ECB web site
	EONIA		Datastream
	Government bonds, various maturities	2004 - 2013	ECB SDW
	Eurostoxx 50	1999 - 2013	Datastream
Sweden	Summary of monetary policy report	1997 - 2013	SR web site
	STIBOR	1999 - 2013	
	Treasury bills, various maturities		
	Government bonds, various maturities		
	OMX 30	1997 - 2013	Datastream
United Kingdom	Summary of inflation report	1997 - 2013	BoE web site
	LIBOR	2001 - 2013	St Louis Fed
	Government bonds, various maturities	1997 - 2013	BoE web site
	FTSE 100		Datastream

Notes: Column 1 lists the country name, column 2 describes the data, column 3 lists the sample period and the final column lists the source. Abbreviations: CNB = Czech National Bank, ECB = European Central Bank, SR = Sveriges Riksbank, BoE = Bank of England, SDW = Statistical Data Warehouse. Cut-off date is 31/8/2013.

We follow the analysis in Jansen (2011) so that our results can be compared with some of the existing evidence.[2] First, we compute the standard deviation of either daily changes in yields or daily stock returns. We compute the standard deviations using ten days for the event windows. Finally, we take the natural logarithm of the standard deviations, which facilitates the interpretation of the estimations, so that the dependent variables are computed as:

$$\ln(\sigma_t^{post}) = \ln\left(\sqrt{\frac{\sum_{i=1}^{10}(r_{t+i} - \mu_r)^2}{9}},\right) \tag{2}$$

where σ_t^{post} denotes the volatility measures computed for post-event windows, r_t denotes the yield changes or returns on the day when the communication is made, and μ_r denotes the averages for r_t over the ten-day post-event window.

We estimate the effects of clarity using ten-day event windows. There can be various motives for choosing a comparatively long horizon for the event windows (Jansen 2011). The most important factor is our goal of identifying the longer-term effects, if any, of communication. From an econometric perspective, using high-frequency data would be well suited to estimate the causal effects of clarity on volatility. But, from a policy perspective, one would hope that the effects of clarity reach beyond the hourly or daily event horizon - at least to the extent that the effects of clarity are beneficial. One example in the literature is Fratzscher (2009), who finds

[2] Section 4 of the Appendix reports alternative results from GARCH models. The conclusions on the effects of clarity are unchanged.

that communication by G7 members has been able to affect exchange rates for horizons up to three months.[3]

To identify the "long-run" effects of clarity, both before and during the financial crisis, we run the following regression for each of the four central banks:

$$\ln(\sigma_t^{post}) = \alpha + \beta_{crisis} CRISIS_t + \beta_{FK} FK_t + \beta_{FKcrisis}(FK_t * CRISIS_t) + \beta_{tone} TONE_t + \beta_{pol} PRATE_t + \beta_{pre} \ln(\sigma_t^{pre}) + \boldsymbol{Y}_t' \phi + \varepsilon_t, \quad (3)$$

where t is the day of the publication of the individual monetary policy reports, σ_t^{post} denotes the volatility measures computed for the post-event windows, *FK* denotes the FK grade level of the central bank communications, and *CRISIS* is a binary dummy capturing the financial crisis. The dummy equals 1 after 14 September 2008, and zero for earlier periods.[4] We include an interaction term between clarity and the financial crisis to capture any changes in the relationship between clarity and volatility over time. In section 5, we will also present a rolling-window analysis to further study developments over time.

Equation 3 further includes a constant term, a variable capturing the tone of the communication (*TONE*), a measure for pre-event window financial market volatility (σ_t^{pre}), and the average change in the policy rate in the 30-day period prior to the release of the report (*PRATE*). The vector $\boldsymbol{Y}$ has year dummies. Including additional time dummies is not preferred given the limited number of observations. More importantly, for each of the four central banks, there is no significant variation in clarity across months or weekdays. We use the White (1980) approach in computing standard errors.

The regression models use three control variables. First, we control for the tone of the report itself. We do so by hand-coding all individual communications on a ternary scale. In doing so, we follow a standard approach that seeks to capture whether central bank communications are dovish, neutral, or hawkish in tone.[5] Secondly, we also control for recent changes in the policy stance. A tightening or easing of the policy stance could coincide with less clarity if the changes are harder to explain, but could coincide with greater clarity when the central bank succeeds in its efforts of presenting a clear argument in the monetary policy report. Lastly, we include pre-event volatility. The main idea is that drafting a clear report could be more challenging when the level of volatility is higher to begin with. Pre-event volatility is also a standard variable for earlier event studies (Clayton, Hartzell, and Rosenberg 2005, and Dubofsky 1991).

If clarity helps in reducing volatility in the years before the crisis, β_{FK} will be estimated as greater than zero. This positive parameter would indicate that lower FK grade levels (indicating higher levels of clarity) coincide with lower levels of volatility. If clarity is helpful in reducing volatility during the crisis years, the sum of β_{FK} and $\beta_{FKcrisis}$ will be positive.

[3] Section 5 will discuss results using five-day event windows. Section 1 of the on-line appendix also has results for fifteen-day event windows. In both cases, the conclusions on the absence of effects on clarity are similar to our baseline models.

[4] During the period identified by the crisis dummy, central banks also engaged in unconventional monetary policies and issued forward guidance. We leave an analysis of the clarity of these policies for future work. See Moessner, De Haan and Jansen (2016) for an analysis of the Riksbank's policies during the crisis.

[5] Details on our codings may be found in Section 2 of the on-line appendix. Papers using a similar approach include Ehrmann and Fratzscher (2007), Jansen and De Haan (2009), and Ehrmann and Talmi (2016).

The estimated coefficients for clarity are useful to put the costs or gains of clarity in perspective. For instance, β_{FK} measures the percentage change in volatility related to unit changes in the FK grade level. One could form an opinion on the desired level of clarity by comparing the costs of additional drafting of the report, which would seem small, to a potential gain in terms of reduced volatility. At the same time, an important caveat with respect to the analysis is that we are running quite a few regression models, where sometimes we have only a limited number of observations available to estimate a particular model. Any occurrence or absence of significant findings should, therefore, be interpreted with some caution.

3. Data Description

Table 2 gives summary statistics for the clarity of reports and measures of financial market volatility. The four panels describe the Czech Republic, the euro area, Sweden, and the United Kingdom. The columns show means, standard deviations, the 10th, 50th and 90th percentile, and the number of observations.

Table 2 Summary Statistics

Czech Republic	***mean***	***sd***	***p10***	***p50***	***p90***	***no. obs.***
FK level (reports)	14.1	0.9	13.1	14.0	14.9	53
O/N rate volatility	-2.9	1.6	-5.0	-2.9	-0.8	3899
3 m rate volatility	-3.1	0.6	-3.8	-3.2	-2.3	3036
1 y rate volatility	-3.5	0.6	-4.2	-3.5	-2.8	3036
2 y rate volatility	-3.6	0.6	-4.3	-3.6	-2.8	3036
5 y rate volatility	-3.4	0.6	-4.2	-3.4	-2.6	3014
Stocks volatility	0.1	0.5	-0.5	0.1	0.7	3822
Euro area	***mean***	***sd***	***p10***	***p50***	***p90***	***no. obs.***
FK level (reports)	16.0	0.8	14.9	16.0	16.9	175
O/N rate volatility	-3.2	1.3	-5.2	-3.0	-1.6	3779
3 m rate volatility	-4.1	0.9	-5.2	-4.1	-3.0	2341
1 y rate volatility	-3.6	0.7	-4.4	-3.7	-2.7	2341
2 y rate volatility	-3.3	0.5	-4.0	-3.4	-2.6	2341
5 y rate volatility	-3.3	0.4	-3.8	-3.3	-2.7	2341
Stocks volatility	0.2	0.5	-0.5	0.2	0.8	3822
Sweden	***mean***	***sd***	***p10***	***p50***	***p90***	***no. obs.***
FK level (reports)	12.4	0.9	11.2	12.4	13.6	58
O/N rate volatility	-4.0	1.4	-5.9	-4.2	-2.4	2157
3 m rate volatility	-4.0	0.7	-5.0	-3.9	-3.1	3809
1 y rate volatility	-3.7	0.7	-4.6	-3.7	-2.9	2923
2 y rate volatility	-3.3	0.5	-3.9	-3.3	-2.7	3821
5 y rate volatility	-3.2	0.4	-3.7	-3.2	-2.7	3821
Stocks volatility	0.2	0.5	-0.4	0.2	0.9	4345
United Kingdom	***mean***	***sd***	***p10***	***p50***	***p90***	***no. obs.***
FK level (reports)	12.6	0.8	11.5	12.6	13.5	67
O/N rate volatility	-3.6	2.7	-7.4	-2.4	-0.6	3164
3 m rate volatility	-4.3	0.9	-5.5	-4.3	-3.2	4130
1 y rate volatility	-3.6	0.6	-4.4	-3.6	-2.9	4337
2 y rate volatility	-3.3	0.5	-3.9	-3.3	-2.7	4337
5 y rate volatility	-3.2	0.4	-3.7	-3.1	-2.7	4337
Stocks volatility	-0.1	0.5	-0.7	-0.1	0.6	4345

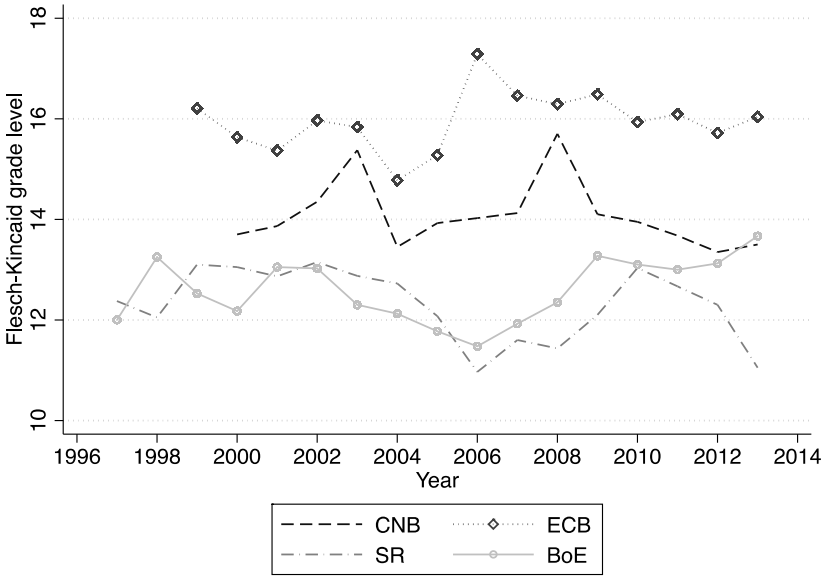
Notes: Summary statistics for clarity of central bank reports on monetary policy and measures of financial market volatility. The columns denote the mean, standard deviation, 10th percentile, median, 90th percentile, and the number of observations. See table 1 and footnote to that table for further details.

In all four cases, stock market volatility is higher than volatility of interest rates. Volatility levels in stock returns have been higher in Sweden and the euro area than in the Czech Republic and the United Kingdom. Volatility has generally been higher at

the short end of the yield curve, the exception being the Czech Republic. The FK grade level statistics in the first row indicate quite some variation across countries, which may reflect that the original versions of the reports are written in different languages. However, it is still likely that the English versions of the reports get attention from financial market analysts. The most relevant issue, also for the empirical analysis, is the changes over time rather than the cross-country differences.

Figure 1 illustrates these changes in clarity over time. The four lines denote the average yearly values of the clarity of the reports. In line with Bulíř et al. (2013), there is evidence of a decrease in clarity around the start of the global financial crisis in 2008. However, except for the UK, the decrease in clarity of reports seems temporary rather than permanent.

Figure 1 Clarity of Central Bank Reports: Annual Averages Between 1997 and 2013



Notes: The four lines indicate the average FK grade level per calendar year. The clarity measures are computed using the introductions or executive summaries of monetary policy reports. We interpret higher values of the FK grade level as indicating lower readability and less clarity. Changes over time are more relevant than the cross-country differences, as the latter may reflect that the original versions of the reports are written in different languages. Abbreviations: CNB = Czech National Bank, ECB = European Central Bank, SR = Sveriges Riksbank, BoE = Bank of England.

4. Baseline Estimation Results

Tables 3 - 6 report parameter estimates for the four key coefficients in equation 3. We report the coefficients for the FK grade level, the interaction between the FK and the crisis dummy, the pre-event volatility measure, and the changes in the policy stance. Tables 3 and 4 have results for the Czech Republic and the euro area; tables 5 and 6 have results for Sweden and the United Kingdom. In each table, the columns 1 - 8 list the various dependent variables, being the levels of volatility for interest rates of various maturities and stock returns. The tables also report F-statistics and p-values,

based on Wald tests, for the hypothesis that $\beta_{FK} + \beta_{FKcrisis} = 0$. If we can reject this null, there is statistical evidence of a relationship between clarity and volatility during the crisis years.

Table 3 Clarity and Volatility: Regression Results for The Czech Republic

	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*
	Overnight	*3 month*	*1 year*	*2 year*	*3 year*	*5 year*	*Stock returns*
Flesch-Kincaid	-0.0	0.1	0.1	0.1	0.1	0.1	-0.1
	(0.3)	(0.1)	(0.1)	(0.1)	(0.1)	(0.1)	(0.1)
FK*Crisis	0.2	-0.0	0.2	0.3	0.3	0.5	-0.1
	(0.5)	(0.5)	(0.4)	(0.4)	(0.5)	(0.4)	(0.1)
Tone	-0.1	0.1	0.3	0.3	0.2	0.1	0.1
	(0.5)	(0.2)	(0.2)	(0.3)	(0.3)	(0.2)	(0.1)
Policy rate change	6.3	-18.0	-7.8	4.5	-0.4	1.3	-11.4
	(27.2)	(13.5)	(11.3)	(14.7)	(14.1)	(11.4)	(7.5)
Pre-event volatility	0.2	0.3	0.3	0.4	0.3	0.5**	0.8***
	(0.2)	(0.2)	(0.2)	(0.3)	(0.3)	(0.2)	(0.1)
# obs	49	41	41	41	41	41	53
Adj. R^2	0.42	0.19	0.35	0.34	0.21	0.25	0.66
F-stat	0.2	0.0	0.6	1.4	1.0	2.1	2.4

Notes: Parameter estimates and standard errors (in parentheses), based on the least-squares regression described in equation 3. The dependent variables are measures for volatility of interest rates with various maturities (column 1 - 6) and stock market returns (column 7). The F-statistic is for the hypothesis that the sum of the two reported parameters on clarity equals zero. ***** denotes significance at the 10%\5%\1% level.

Table 4 Clarity and Volatility: Regression Results for Euro Area

	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*
	Overnight	*3 month*	*1 year*	*2 year*	*3 year*	*5 year*	*Stock returns*
Flesch-Kincaid	-0.1	0.0	0.2*	0.2*	0.2*	0.1*	-0.0
	(0.2)	(0.2)	(0.1)	(0.1)	(0.1)	(0.1)	(0.1)
FK*Crisis	0.1	-0.1	-0.1	-0.1	-0.2	-0.1	-0.1
	(0.3)	(0.2)	(0.2)	(0.2)	(0.1)	(0.1)	(0.1)
Tone	0.2	0.1	0.1	0.0	0.1	0.1	0.0
	(0.2)	(0.2)	(0.1)	(0.1)	(0.1)	(0.1)	(0.1)
Policy rate change	-11.2	-9.6	-11.3*	-8.2	-8.0	-6.1	2.1
	(9.1)	(6.7)	(6.0)	(6.1)	(6.0)	(5.4)	(5.1)
Pre-event volatility	-0.1	0.5***	0.3**	0.3**	0.3***	0.4***	0.5***
	(0.1)	(0.1)	(0.1)	(0.1)	(0.1)	(0.1)	(0.1)
# obs	166	106	106	106	106	106	175
Adj. R^2	0.63	0.66	0.59	0.47	0.40	0.37	0.47
F-stat	0.0	0.1	0.4	0.2	0.0	0.1	1.0

Notes: Parameter estimates and standard errors (in parentheses), based on the least-squares regression described in equation 3. The dependent variables are measures for volatility of interest rates with various maturities (column 1 - 6) and stock market returns (column 7). The F-statistic is for the hypothesis that the sum of the two reported parameters on clarity equals zero. ***** denotes significance at the 10%\5%\1% level.

Table 5 Clarity and Volatility: Regression Results for Sweden

	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
	Overnight	*3 month*	*1 year*	*2 year*	*5 year*	*Stock returns*
Flesch-Kincaid	-0.1	-0.0	0.0	-0.2	0.0	0.0
	(1.4)	(0.2)	(0.1)	(0.2)	(0.1)	(0.1)
FK*Crisis	0.4	-0.0	-0.4***	-0.0	-0.2*	-0.1
	(1.8)	(0.4)	(0.1)	(0.2)	(0.1)	(0.2)
Tone	-1.7	0.4	0.2*	0.0	0.0	-0.0
	(1.1)	(0.2)	(0.1)	(0.1)	(0.1)	(0.1)
Policy rate change	83.7	-7.0	13.6	3.8	5.3	0.2
	(191.4)	(15.6)	(11.7)	(11.3)	(8.1)	(11.1)
Pre-event volatility	0.1	0.1	-0.0	0.4**	0.3**	0.2**
	(0.5)	(0.2)	(0.2)	(0.2)	(0.1)	(0.1)
# obs	22	49	39	50	50	50
Adj. R^2	-0.24	0.36	0.42	0.11	0.42	0.64
F-stat	0.2	0.0	16.6***	2.6	8.0***	0.3

Notes: Parameter estimates and standard errors (in parentheses), based on the least-squares regression described in equation 3. The dependent variables are measures for volatility of interest rates with various maturities (column 1 - 6) and stock market returns (column 7). The F-statistic is for the hypothesis that the sum of the two reported parameters on clarity equals zero. ***** denotes significance at the 10%\5%\1% level.

Table 6 Clarity and Volatility: Regression Results for United Kingdom

	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*
	Overnight	*3 month*	*1 year*	*2 year*	*3 year*	*5 year*	*Stock returns*
Flesch-Kincaid	0.0	-0.1	-0.0	-0.1	-0.1	-0.0	-0.1
	(0.5)	(0.1)	(0.1)	(0.1)	(0.1)	(0.1)	(0.1)
FK*Crisis	-0.1	-0.6	-0.2	0.0	0.1	0.0	0.6***
	(0.7)	(0.4)	(0.2)	(0.2)	(0.2)	(0.2)	(0.2)
Tone	0.2	-0.0	0.1*	0.1	0.1	0.1	-0.1
	(0.5)	(0.1)	(0.1)	(0.1)	(0.1)	(0.1)	(0.1)
Policy rate change	-53.7	1.5	-5.4	-4.9	-5.3	-6.3	-2.5
	(34.5)	(8.9)	(6.7)	(6.6)	(6.2)	(6.1)	(5.8)
Pre-event volatility	0.3	0.2	0.3*	0.3*	0.3	0.2	0.6***
	(0.2)	(0.1)	(0.1)	(0.2)	(0.2)	(0.2)	(0.1)
# obs	47	63	66	66	66	66	66
Adj. R^2	0.88	0.60	0.55	0.29	0.16	0.03	0.47
F-stat	0.0	2.3	1.5	0.1	0.0	0.0	5.7**

Notes: Parameter estimates and standard errors (in parentheses), based on the least-squares regression described in equation 3. The dependent variables are measures for volatility of interest rates with various maturities (column 1 - 6) and stock market returns (column 7). The F-statistic is for the hypothesis that the sum of the two reported parameters on clarity equals zero. ***** denotes significance at the 10%\5%\1% level.

For the pre-crisis period, we find limited evidence that greater clarity of central bank communication coincides with lower levels of volatility in financial markets. This relationship is only statistically significant in case of the ECB (table 4). In the case of the ECB's Monthly Bulletin, and in line with Jansen (2011), clarity has the clearest connection with medium-term interest rates. Also, the size of the coefficient of 0.2, is comparable to the case of the Humphrey-Hawkins testimonies analysed in Jansen (2011).

A point estimate of 0.2 indicates that volatility declines by 20% if the FK grade level of a monetary policy report decreases by one unit. In turn, this decrease of the FK grade level implies that the average person needs one year of schooling less to sufficiently comprehend the central bank's report. This increase in clarity, and the related decline in volatility, can in principle be realised by straightforward textual edits.

During the financial crisis, evidence of a positive effect of clarity on volatility becomes scarce. The only evidence for a positive relationship is in case of communications by the Bank of England and volatility of FTSE100 returns (table 6). The estimated parameter for clarity in the crisis years is equal to 0.5 and significantly different from zero. For the case of the ECB (table 4) the coefficient $\beta_{FKcrisis}$ is smaller than zero, but not significantly so. As the low values of the F-statistic in the bottom row of table 4 indicate, we cannot reject the null hypothesis that the sum of the coefficients equals zero.

Regarding the control variables, we find that the estimated coefficients are often not significantly different from zero. Regarding the tone of the communications, there are no clear effects on volatility. For pre-event volatility, we find some evidence of a positive relationship, especially in case of the euro area (Table 4). For changes in the policy stance, there is only very limited evidence of a negative relationship, suggesting that tightening (easing) of the policy stance, occasionally, goes hand in hand with higher (lower) levels of clarity.

5. Extensions

In a first extension, we analyse results for five-day event windows. As noted, our aim was to assess the (relatively) long-run effects of clarity, which is why the baseline analysis uses ten-day event windows. However, within the context of financial markets, ten days may already be a long horizon. Therefore, we also considered event windows with a shorter length. Table 7 gives a brief overview of the results, focusing on the coefficients for the FK grade level and the interaction with the crisis dummy. Full tables with results are in Section 1 of the Appendix. As can be seen, the conclusions regarding the (absence of) effects of clarity remain the same: there is no broad-based evidence of positive coefficients for measures of clarity.

In a second extension, we use rolling-window regressions to further study the difference between non-crisis and crisis years for the case of the euro area. There are only a few cases that turn out significant results, again suggesting some caution against drawing strong positive conclusions on the effects of communication clarity. Figure 2 focuses on the two-year and three-year interest rate and shows the coefficient for the FK grade level.[6] The first vertical line denotes the last sample that only uses pre-crisis observations. The second vertical line denotes the first sample that only includes observations after September 2008.

[6] The rolling-window regressions do not include an interaction term between clarity and the crisis dummy. The window length in each regression is four years, so that the first regression covers the period 2004 to 2007. In each subsequent regression, the window shifts forward by six months. Results for other countries and time series are in the online Appendix.

Table 7 Selected Results for Five-day Event Windows

	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*
	Overnight	*3 month*	*1 year*	*2 year*	*3 year*	*5 year*	*Stock returns*
The Czech Republic							
Flesch-Kincaid	0.3	0.1	0.1	0.0	0.1	-0.0	-0.2
	(0.3)	(0.1)	(0.1)	(0.2)	(0.1)	(0.1)	(0.1)
FK*Crisis	-0.0	0.3	0.3	0.3	0.2	-0.1	-0.2
	(0.4)	(0.3)	(0.2)	(0.2)	(0.2)	(0.4)	(0.2)
Euro area							
Flesch-Kincaid	-0.1	0.2	0.1	0.1	0.1	0.2	0.1
	(0.3)	(0.2)	(0.2)	(0.2)	(0.1)	(0.1)	(0.1)
FK*Crisis	0.1	-0.4*	-0.2	0.0	-0.0	-0.0	-0.3
	(0.4)	(0.2)	(0.2)	(0.2)	(0.2)	(0.2)	(0.2)
Sweden							
Flesch-Kincaid	-0.8	-0.1	-0.0	0.0		0.1	0.1
	(2.2)	(0.2)	(0.2)	(0.2)		(0.1)	(0.1)
FK*Crisis	0.8	-0.2	0.0	-0.1		-0.1	-0.4*
	(2.5)	(0.5)	(0.2)	(0.3)		(0.3)	(0.2)
United Kingdom							
Flesch-Kincaid	0.2	-0.1	-0.1	-0.1	-0.1	-0.0	-0.2
	(0.6)	(0.1)	(0.1)	(0.1)	(0.1)	(0.1)	(0.2)
FK*Crisis	-1.1	-0.7*	-0.2	-0.1	-0.1	-0.1	0.5**
	(0.8)	(0.4)	(0.3)	(0.2)	(0.2)	(0.2)	(0.3)

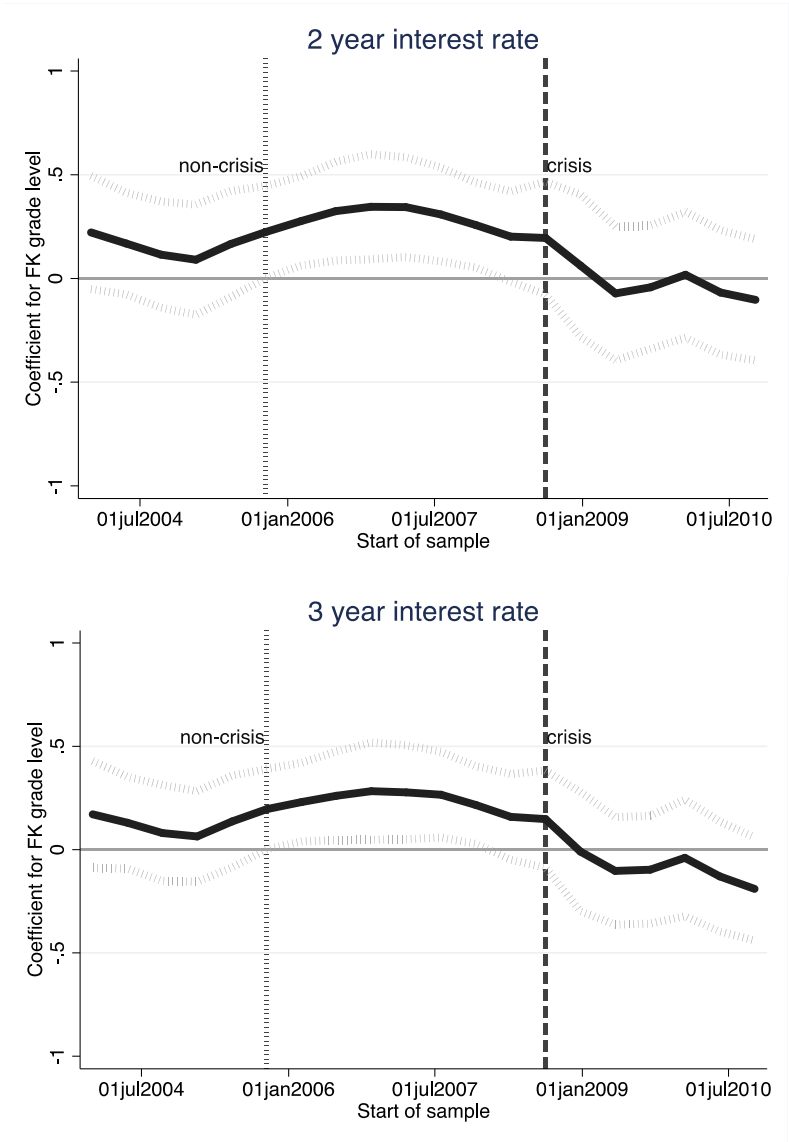
Notes: Selected parameter estimates and standard errors (in parentheses), based on the least-squares regression described in equation 3, but now using event windows with a length of five days. ***** denotes significance at the 10%\5%\1% level.

Figure 2 suggests three points. First, as long as the samples do not exclusively include observations from the crisis period, the point estimates for β_{FK} fluctuate around 0.20. This value corresponds to the estimates in table 4. Second, as soon as only observations after September 2008 are included, there is a steady decline towards zero of the estimates for β_{FK}. Third, an interesting change occurs in the middle period, as soon as the samples start to include some observations from the crisis period. There is an increase in the point estimates for β_{FK}, both for the two-year and the three-year rate. Moreover, the point estimates are significantly different from zero at the 5% level. Overall, the findings indicate that volatility of government bond yields became more responsive to clarity of Monthly Bulletins during the early stages of the crisis, implying that more (less) clarity coincided with lower (higher) return volatility.

Finally, for the crisis years, there are some indications of a positive relationship between clarity and volatility, meaning that clearer communications have gone hand in hand with higher levels of volatility. For Sweden, the sum of β_{FK} and $\beta_{FKcrisis}$ is negative for the one-year and the five-year maturity (table 5). For the euro area, the point estimates for the rolling-window analysis show a downward trend and become negative, but are not significantly different from zero, once observations from the crisis period are included (figure 2). These findings illustrate that increased transparency can, at times, create news rather than reduce noise (Blinder et al. 2008; Bloom, 2014). For future work, it would be interesting to further investigate under what conditions the relationship between clarity and volatility becomes positive.[7]

[7] We also split the control variable for the policy rate in dummies measuring rate cuts and rate hikes. This did not materially change the conclusions on clarity, though a few coefficients for the euro area case are now significant at the 5% level. See Section 7 of the Appendix.

Figure 2 Coefficients from Rolling Window Regressions: Euro Area



Notes: The thick solid lines denote the coefficient for the FK grade level of ECB Monthly Bulletins in rolling-window regressions. Dotted lines represent beta coefficients plus or minus 2 standard errors. The dependent variable is the volatility of euro area two-year interest rates (top panel) and three-year interest rates (bottom panel). Window length for each regression is four years; windows are shifted by six months in each subsequent regression. The vertical dotted line denotes the last sample that only includes pre-crisis observations. The vertical dashed line denotes the first sample that only includes crisis observations.

6. Conclusions

Can clear central bank communication on monetary policy through published reports affect volatility of returns in financial markets? In contrast to much of the literature, we find no broad-based evidence that clarity of communication in the form of reports reduces market volatility. Considering both the theoretical appeal (Blinder 2008, Blinder et al 2008, Tang and Yu 2011) and recent closely related empirical contributions (Jansen, 2011; Ehrmann and Fratzscher, 2013; Ehrmann and Talmi, 2016; Smales and Apergis, 2017), the effects of clear communication estimated in our paper are almost negligible. A positive note is that, if anything, clarity of central bank reports can sometimes have beneficial effects. We find evidence that prior to and during the early stages of the financial crisis, clarity of ECB Monthly Bulletins and asset return volatility were negatively related. However, during the financial crisis as a whole, the negative relationship between textual clarity and market volatility has largely disappeared. In all this, an important caveat is that there are still only a few significant coefficients for a relatively wide range of regression models that we analyse.

Our paper's findings suggest there is no guarantee that investing in well-drafted monetary policy reports will always coincide with reduced return volatility in financial markets. However, presenting more accessible information may of course still be important for monetary policy authorities in providing accountability and transparency to financial market participants as well as the general public (Blinder et al. 2008). It may also be the case that other communication channels, such as press conferences, speeches, or interviews, have more clearly beneficial effects on financial market volatility. We leave further exploration of this possibility for future research.

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