Does Clear Central Bank Communication on Inflation Affect Volatility in Financial Markets?[a]

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Abstract

We study whether clarity of central bank communication on inflation affects return volatility in financial markets. We measure clarity of inflation reports by the Czech National Bank, the European Central Bank, the Bank of England and Sveriges Riksbank using the Flesch-Kincaid grade level, a standard readability measure. We find evidence of a negative relationship between clarity and market volatility prior to and during the early stage of the global financial crisis. However, as the crisis unfolded, there is no longer robust evidence of a negative connection. We conclude that reducing noise using clear communication is possible, but not without challenges in times of crisis.

JEL classifications: E44, E52, E58

Keywords: central bank communication, clarity, financial markets, inflation reports, volatility

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1 Introduction

This paper studies whether greater clarity of central bank publications leads to lower return volatility in financial markets and, if so, whether the global financial crisis affected the relationship between clarity and volatility. Central banks have, over the recent decades, increasingly made use of communication. First, in using various types of communication channels, central banks are able to increase the transparency of their monetary policies. Second, in using communication actively, central banks are guiding expectations on inflation, the growth outlook, and future monetary policy decisions (Blinder, Ehrmann, Fratzscher, De Haan and Jansen 2008). By now, there is abundant evidence that communications by various central banks – such as the Federal Reserve, the Bank of England, and the European Central Bank – are relevant for financial markets (Kohn and Sack 2004, Ehrmann and Fratzscher 2007, Rosa and Verga 2007, Hayo and Neuenkirch 2010, Lamla and Lein 2011, Sturm and De Haan 2011).

Recent work has suggested that not necessarily only the quantity but also the quality of central bank communication is relevant. A number of papers focus on the benefits of clear communications. Blinder (2008), for instance, suggests that clearer communications have higher signal-to-noise ratios and should thus provide more useful information. In evaluating inflation reports by twenty central banks, Fracasso, Genberg, and Wyplosz (2003) find that the perceived quality of the writing style negatively correlates with monetary policy surprises – suggesting that clarity reduces uncertainty. For the Humphrey-Hawkins testimonies by the Federal Reserve Chairman, Jansen (2011) finds that greater clarity has gone hand in hand with lower volatility in markets

for various financial instruments. Using a New-Keynesian framework, Tang and Yu (2011) show that clear central bank communication could lead to less volatile inflation and interest rate dynamics, which presumably implies lower volatility of prices in financial markets. Ehrmann and Fratzscher (2013) find that more consistent communication by members of monetary policy committees reduces uncertainty on the path of future interest rates.

However, the debate on the effects of clear communication is ongoing. Various papers have pointed to trade-offs and potential 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. Finally, 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.

To further our understanding regarding the effects of clear communication, this paper uses inflation reports by four central banks to investigate the relationship between textual clarity and financial market volatility. We test whether clear communication indeed increases understanding and translates into more informed price formation on financial markets, less uncertainty, and lower levels of volatility.

Disentangling cause and effect is far from straightforward, because communicating more clearly, while perhaps beneficial, also tends to be more challenging in financially volatile times. Individual communications can differ by

readability as well as by the content of fundamental news. However, these two characteristics do not necessarily show a strong correlation (Bulíř, Čihák, and Jansen 2013). We therefore pay special attention to the effects of communication during the recent global financial crisis. Three recent papers have considered central bank communication during the crisis from a range of perspectives. Siklos (2013) uses DICTION, a software program for text analysis, to study the tone of communications by five central banks. He finds a greater focus on financial stability and also more attention for uncertainty concerning the economic outlook. Using various readability measures, Bulíř, Čihák and Jansen (2013) find that clarity of communications by a number of monetary authorities decreased during the financial crisis. Hayo, Kutan, and Neuenkirch (2014) analyse market reactions to Federal Reserve communication and find evidence that communications were more market relevant during the financial crisis.

Our paper adds to the growing, empirical literature on effects of communication clarity (Jansen 2011, Ehrmann and Fratzscher 2013). It contributes to the literature by disentangling the relationships between communication clarity and financial volatility. To do that, we perform an event-window analysis of central bank communication. Specifically, we measure clarity of inflation reports by four central banks (the Czech National Bank, the European Central Bank, the Bank of England, and Sveriges Riksbank) before and during the recent financial crisis. We use the Flesch-Kincaid grade level (FK), a well-established readability statistic, as a measure of textual clarity (Kincaid et al. 1975). The benefit of this measure is objectivity: the FK grade level is completely based on the characteristics of the underlying texts. Readability statis-

tics have been used in various settings, including the analysis of readability of informed-consent forms in medicine (Paasche-Orlow, Taylor and Brancati 2003) and the quality of annual reports in accounting (Clatworthy and Jones 2001).

We then analyse measures of financial market volatility over a time window around the publication of inflation reports. We study the effects of clarity on the volatility of interest rates and stock market returns. This paper does not presuppose that any degree of market volatility is to be avoided. Indeed, in certain situations, clear communication is bound to be newsworthy and create volatility in line with its fundamental content – irrespective of the clarity of the document. Blinder et al. (2008, p. 912) discuss how communication can contribute to the effectiveness of monetary policy precisely by creating news. At the same time, they also describe how a second aim of effective communication is 'reducing noise (e.g. by lowering market uncertainty)'. Our paper primarily studies whether clear communication through inflation reports can indeed reduce noise.

In comparison to recent contributions (Jansen 2011, Ehrmann and Fratzscher 2013), the empirical effects of clarity found in our study are estimated to be small. We do find that when clarity of the reports is relevant, the effects are mostly beneficial. First, we find some evidence that prior to and during the early stages of the financial crisis, volatility of financial market returns was responsive to clarity of communication, that is more (less) clarity went hand in hand with lower (higher) levels of return volatility in financial markets. Secondly, during the financial crisis, there is no broad indication that greater clarity of reports was associated with lower volatility of returns. Thirdly, we

find that only in a few instances greater clarity went hand in hand with higher levels of volatility during the global financial crisis. Overall, we conclude that reducing noise in financial markets using clear inflation reports is possible, but not without challenges in times of crisis.

2 Methodology and data sources

The intuition for a negative relationship between clarity of communication and asset return volatility is as follows. If the central bank succeeds in formulating its views more clearly, agents would more easily understand the communications. Thus, financial analysts, investors, or traders could 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]

There are various elements of the inflation reports which 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 volatility. If it is difficult to read a text, the content is less likely to be understood. 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,

[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).

the clarity of the executive summary is of key importance in informing market participants.

We follow a well-developed line of research (Flesch 1948, Kibby 1975) that has identified text characteristics, such as lengths of words and sentences, as good predictors of readability. The most important benefit of these readability measures is that they are based on objective elements of the underlying texts. Taking other elements of communication into account through content analysis would introduce a degree of subjectivity into the analysis (for further discussion, see Blinder et al. 2008).

We use the Flesch-Kincaid grade level (Kincaid et al. 1975) to measure (lack of) clarity. This 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:

$$FK = 0.39 * \frac{words}{sentences} + 11.8 * \frac{syllables}{words} - 15.59 \quad (1)$$

where FK denotes the Flesch-Kincaid 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 an inflation 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 ideally 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 Czech National Bank, the European Central Bank, the Bank of England, and Sveriges Riksbank. The main selection criterion is that these central banks focus strongly on the outlook for inflation in their communications. Table 1 gives details on the communications included in the analysis and data sources. Mainly, we use the executive summaries of the inflation reports. For the European Central Bank, we use the editorial of the Monthly Bulletin. We assess the effects of clarity on 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. We also study the effect on stock market returns. To this end, 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.

(insert table 1 about here)

We follow the analysis in Jansen (2011) so that our results can be compared with the existing evidence.[2] First, we compute the standard deviation of

[2]Future research could consider other approaches, such as GARCH estimations or realised

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:

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

where $ln(\sigma_t^{post})$ denotes the volatility measures computed for the 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.

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

$$ln(\sigma_t^{post}) = \alpha + \beta_{crisis} * CRISIS_t + \beta_{FK} * FK_t + \beta_{FKcrisis} * (FK_t * CRISIS_t)$$

$$+ \beta_{pre} * ln(\sigma_t^{pre}) + \beta_{pol} * (\Sigma_{k=0}^{30}\Delta i_{t-k}^{p}) + \mathbf{Y}_t'\boldsymbol{\gamma} + \epsilon_t \tag{3}$$

where t is the day of the publication of the individual inflation reports, $ln(\sigma^{post})$ denotes the volatility measures computed for the post-event windows, FK denotes the Flesch-Kincaid grade level of the central bank communications, and $CRISIS$ is a binary dummy capturing the financial crisis. This dummy equals 1 after 14 September 2008, and zero for earlier periods.[3] 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

volatility measures.

[3]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, for instance, Moessner, De Haan and Jansen (2013) for an analysis of the Riksbank's policies during the crisis.

4, which discusses the estimation results, we will also present a rolling-window analysis to further study developments over time. Equation 3 further includes a constant term (α), measures for pre-event window financial market volatility ($ln(\sigma_t^{pre})$), the average change in the policy rate in the 30-day period prior to the release of the report ($\Sigma_{k=0}^{30}\Delta i_{t-k}^{p}$). The vector $\mathbf{Y}$ 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. Finally, ϵ_t is the error term, where we use the White (1980) approach in computing standard errors.

The estimations use only two control variables. The reason is that Bulíř, Čihák, and Jansen (2013) have only limited success in explaining variation in textual clarity of inflation reports across countries or over time using fundamental content.[4] Still, rather than treating variation in clarity in the current paper as exogenous, we include two variables that, in principle, could be important for the clarity of reports. First, we include pre-event volatility. The idea is that drafting a clear report is 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, Dubofsky 1991). Second, we control for the policy context in which the report was released. We do so by using the recent changes in the policy stance. The idea is that clarity will not be affected, if at all, while the policy stance does not change. Only when rates are changing could, perhaps, clarity change. A tightening or easing of the policy stance could coincide with less clarity if the changes are harder to

[4]For instance, neither expected inflation, expected deviations from inflation targets, nor voting records, can robustly explain variations in clarity.

explain, but could coincide with greater clarity when the central bank succeeds in its efforts of presenting a clear argument in the inflation report.

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 Flesch-Kincaid 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.

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 level of the Flesch-Kincaid grade level. One could form an opinion on the desired level of clarity by comparing the costs of additional drafting of the inflation report to a potential gain in terms of reduced volatility.

3 Data description

Table 2 gives summary statistics for the clarity of inflation 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.

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. The most relevant issue, also for the empirical analysis, are the changes over time rather than the cross-country differences. Figure 1 illustrates these changes over time. The four lines denote the average yearly values of the clarity of the inflation reports. Generally, in line with the results of Bulíř, Čihák, and Jansen (2013), there is evidence of a decrease in clarity around the start of the global financial crisis in 2008.

(insert table 2 and figure 1 about here)

4 Estimation results

Tables 3 and 4 report parameter estimates for the coefficients β_{FK} and $\beta_{FKcrisis}$ in equation 3. Table 3 has results for the Czech Republic and the euro area; table 4 has 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.

(insert tables 3 and 4 about here)

For the pre-crisis period, we find some evidence that greater clarity of central bank communication coincides with lower levels of volatility in financial markets. This relationship is, however, only statistically significant in case of

the ECB (table 3, panel B). 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, roughly 0.20, is comparable to the case of the Humphrey-Hawkins testimonies analysed in Jansen (2011).

A point estimate of 0.20 indicates that volatility declines by 20% if the FK grade level of an inflation 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 inflation 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 4, panel B). The estimated parameter for clarity in the crisis years is equal to 0.44 (p=0.02). For the case of the ECB (table 3, panel B) the coefficient $\beta_{FKcrisis}$ is smaller than zero, but not significantly so. As the bottom row of table 3 indicates, we cannot reject the null hypothesis that the sum of the coefficients equals zero.

We use rolling-window regressions to further study the difference between non-crisis and crisis years for the case of the euro area. Figure 2 focuses on the two-year and three-year interest rate and shows the coefficient for the FK grade level.[5] The first vertical line denotes the last sample that only uses pre-

[5]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 regressions, the window shifts forward by six months.

crisis observations. The second vertical line denotes the first sample that only includes observations after September 2008.

Figure 2 suggests three points. Initially, 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 3. 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.

(insert figure 2 about here)

A final point is that 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 4, panel A). 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 an increasing number of 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.

5 Conclusions

Can clear central bank communication on inflation through published reports affect volatility of financial market returns? Considering both the theoretical appeal (Blinder 2008, Tang and Yu 2011) and recent empirical contributions (Jansen 2011, Ehrmann and Fratzscher 2013), the effects of clear communication estimated in this paper are small. If anything, however, the indications are that clarity has beneficial effects. We find evidence that prior to and during the early stages of the financial crisis, clarity of reports and asset return volatility were negatively related. However, during the financial crisis as a whole, the negative relationship between clarity and volatility has largely disappeared and may have, but only to a limited extent, turned into a positive one.

Overall, the findings in this paper suggest two things. First, there is no guarantee that greater clarity of inflation reports will always coincide with reduced return volatility in financial markets. But we do find evidence that clear central bank communication is at times able to reduce noise in financial markets. Second, reducing noise by publishing clear inflation reports is not without challenges in times of crisis. It may be the case that other communication channels, such as press conferences, speeches, or interviews, have had different effects on financial markets. We leave further exploration of this issue for future research.

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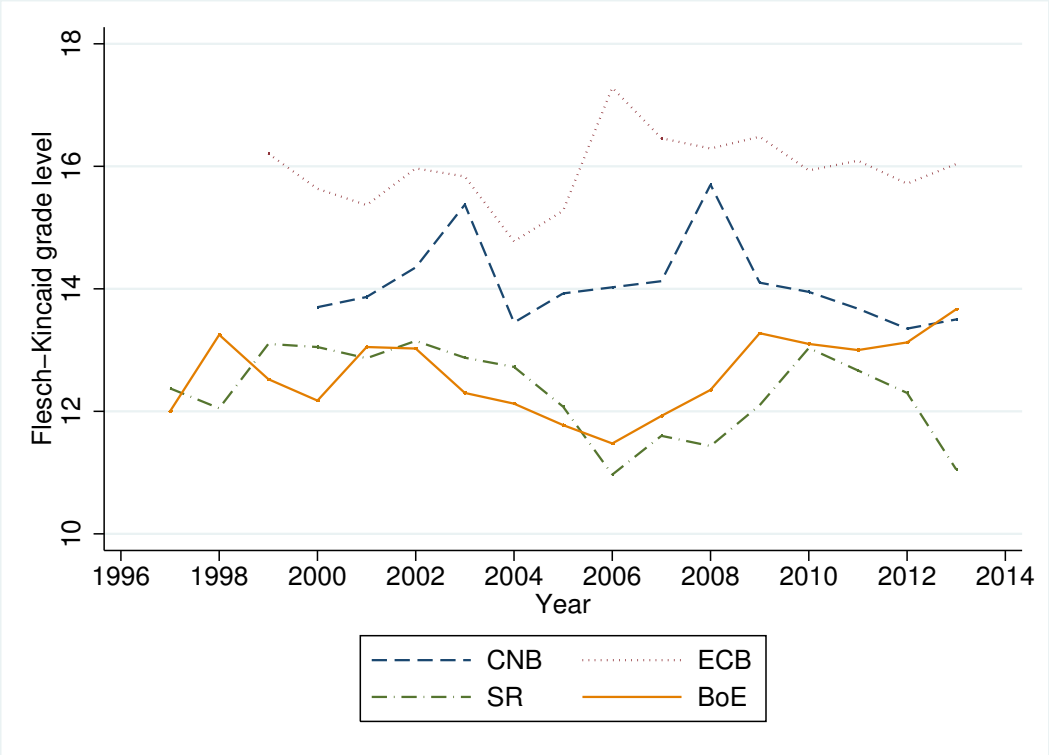
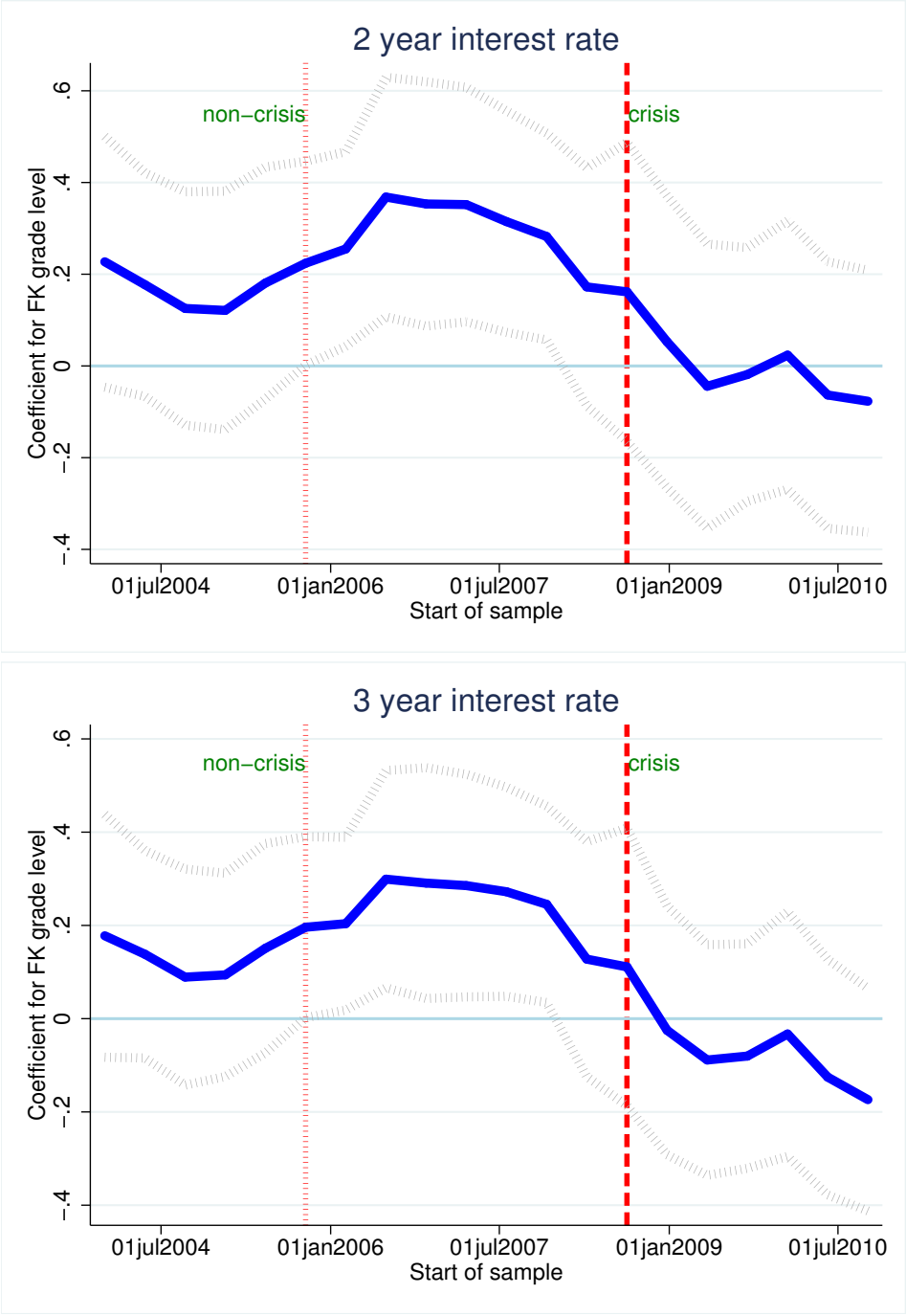
Figure 1: Clarity of inflation reports: annual averages between 1997 and 2013



Notes: The four lines indicate the average Flesch-Kincaid grade level per calendar year. The clarity measures are computed using the introductions or executive summaries of the reports. We interpret higher values of the Flesch-Kincaid 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.

Figure 2: Coefficients from rolling window regressions: euro area



Notes: The thick solid lines denote the coefficient for the Flesch-Kincaid 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.

Table 1: Data and sources

Country	**Data**	**Sample**	**Source**
Czech Republic	Introduction of inflation report	2000-2013	CNB web site
	Overnight interest rate (PRIBK)	2000-2013	Datastream
	Treasury yields, various maturities	2000-2010	Kladívko (2010)
	PX stock index	2000-2013	Datastream
Euro area	Executive summary of Monthly Bulletin	1999-2013	ECB web site
	Overnight interest rate (EONIA)	1999-2013	Datastream
	Government bonds, various maturities	2004-2013	ECB SDW
	Eurostoxx 50 stock index	1999-2013	Datastream
Sweden	Summary of monetary policy report	1997-2013	SR web site
	Overnight rate (STIBOR)	1999-2013	SR web site
	Treasury bills, various maturities	1999-2013	SR web site
	Government bonds, various maturities	1999-2013	SR website
	OMX30 stock index	1997-2013	Datastream
United Kingdom	Summary of inflation report	1997-2013	BoE web site
	Overnight interest rates (LIBOR)	2001-2013	St. Louis Fed
	Government bonds, various maturities	1997-2013	BoE website
	FTSE100 stock index	1997-2013	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.

Table 2: Summary statistics

Czech Republic	mean	sd	p10	p50	p90	count
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 months 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	count
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 months 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	count
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 months 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	count
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 months 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 inflation reports 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.

Table 3: Clarity and volatility: regression results (1)

Panel A: Czech Republic	(1) Overnight	(2) 3 month	(3) 1 year	(4) 2 year	(5) 3 year	(6) 5 year	(7) Stock returns
FK level (reports)	-0.01	0.10	0.07	0.10	0.09	0.09	-0.06
	(0.26)	(0.11)	(0.12)	(0.13)	(0.10)	(0.09)	(0.10)
FK*Crisis	0.17	-0.01	0.25	0.46	0.44	0.52	-0.08
	(0.50)	(0.45)	(0.31)	(0.35)	(0.43)	(0.38)	(0.14)
Observations	49	41	41	41	41	41	53
Adjusted R^2	0.43	0.22	0.32	0.30	0.21	0.26	0.65
F-statistic	0.15	0.04	1.17	2.62	1.55	2.81	1.57
p-value	0.70	0.84	0.29	0.12	0.23	0.11	0.22
Panel B: euro area	(1) Overnight	(2) 3 month	(3) 1 year	(4) 2 year	(5) 3 year	(6) 5 year	(7) Stock returns
FK level (reports)	-0.09	0.04	0.22*	0.20**	0.17*	0.15*	-0.00
	(0.15)	(0.17)	(0.11)	(0.10)	(0.09)	(0.09)	(0.06)
FK*Crisis	0.05	-0.09	-0.17	-0.15	-0.18	-0.14	-0.13
	(0.31)	(0.23)	(0.16)	(0.16)	(0.14)	(0.14)	(0.14)
Observations	166	106	106	106	106	106	175
Adjusted R^2	0.63	0.66	0.60	0.48	0.40	0.37	0.47
F-statistic	0.02	0.12	0.21	0.17	0.01	0.01	1.07
p-value	0.88	0.73	0.64	0.68	0.91	0.93	0.30

Notes: Parameter estimates and standard errors (in parentheses), based on the least-squares regression described in equation 3, for the Flesch-Kincaid grade level and the interaction between the FK grade level and a binary crisis dummy that equals 1 after 14 September 2008. 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 and p-value are for the hypothesis that the sum of the reported parameters equals zero. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 4: Clarity and volatility: regression results (2)

Panel A: Sweden	(1) Overnight	(2) 3 month	(3) 1 year	(4) 2 year	(5) 5 year	(6) Stock returns	
FK level (reports)	0.23	-0.11	-0.07	-0.19	-0.00	0.02	
	(1.58)	(0.11)	(0.14)	(0.15)	(0.08)	(0.10)	
FK*Crisis	-0.10	0.19	-0.26	0.03	-0.21*	-0.10	
	(1.97)	(0.39)	(0.15)	(0.18)	(0.11)	(0.16)	
Observations	22	49	39	50	50	50	
Adjusted R^2	-0.31	0.31	0.38	0.14	0.43	0.65	
F-statistic	0.02	0.04	10.34	2.63	7.95	0.39	
p-value	0.88	0.84	0.00	0.12	0.01	0.54	
Panel B: United Kingdom	(1) Overnight	(2) 3 month	(3) 1 year	(4) 2 year	(5) 3 year	(6) 5 year	(7) Stock returns
FK level (reports)	0.05	-0.05	-0.06	-0.09	-0.08	-0.03	-0.14
	(0.50)	(0.14)	(0.09)	(0.10)	(0.11)	(0.10)	(0.12)
FK*Crisis	0.04	-0.59	-0.13	0.10	0.12	0.09	0.58***
	(0.64)	(0.42)	(0.25)	(0.22)	(0.18)	(0.17)	(0.21)
Observations	47	63	66	66	66	66	66
Adjusted R^2	0.88	0.61	0.54	0.29	0.15	0.03	0.48
F-statistic	0.04	2.65	0.72	0.00	0.06	0.18	5.98
p-value	0.84	0.11	0.40	0.97	0.81	0.67	0.02

Notes: Parameter estimates and standard errors (in parentheses), based on the least-squares regression described in equation 3, for the Flesch-Kincaid grade level and the interaction between the FK grade level and a binary crisis dummy that equals 1 after 14 September 2008. 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 and p-value are for the hypothesis that the sum of the reported parameters equals zero. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.