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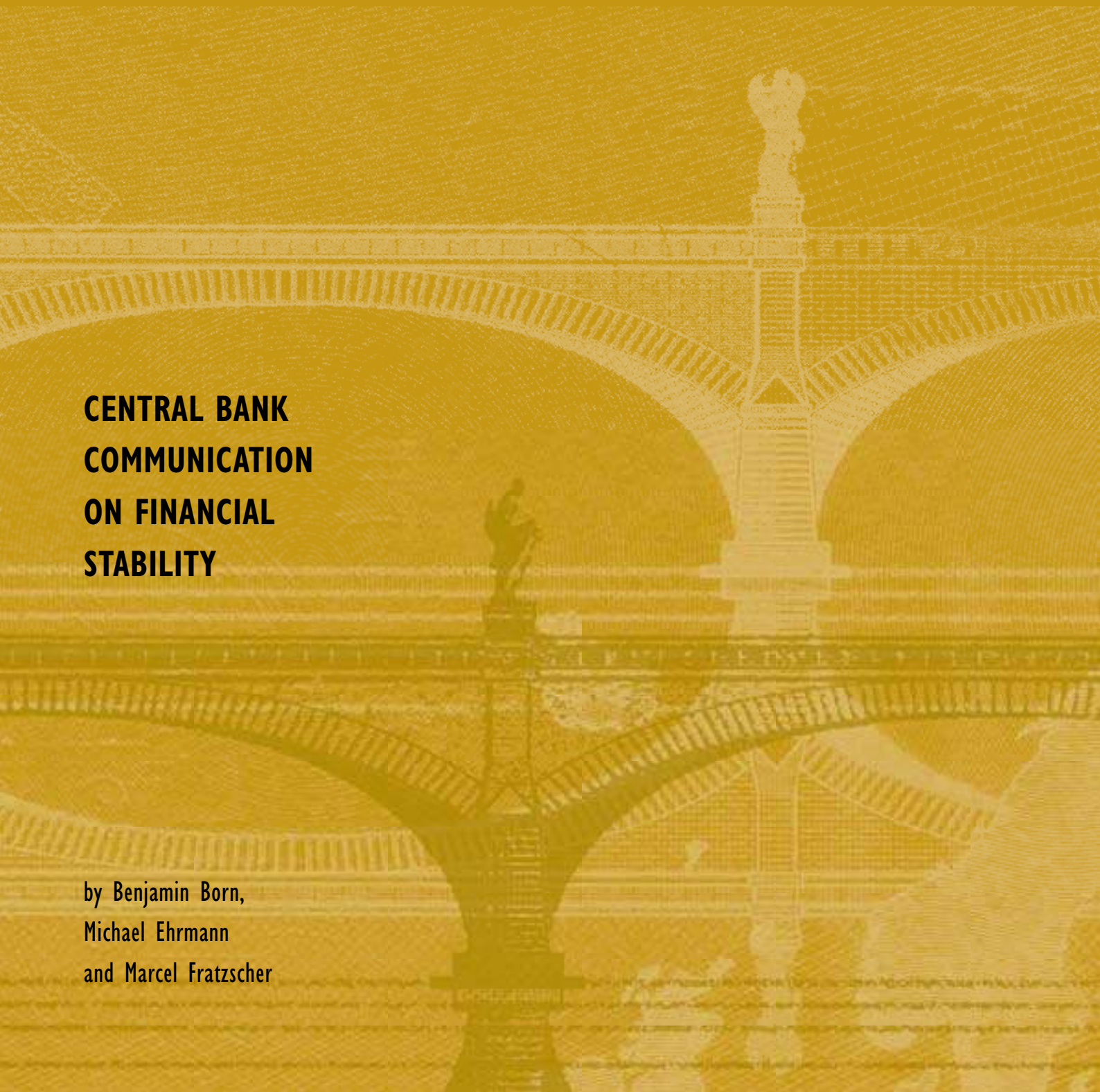

CENTRAL BANK COMMUNICATION ON FINANCIAL STABILITY

by Benjamin Born,
Michael Ehrmann
and Marcel Fratzscher

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CENTRAL BANK COMMUNICATION ON FINANCIAL STABILITY[1]

by Benjamin Born[2], Michael Ehrmann[3] and Marcel Fratzscher[3]

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CONTENTS

Abstract 4

Non-technical summary 5

1 Introduction 6

2 Motivation and literature 8

3 Measuring communication and the effects on financial markets 9

3.1 Choice of data frequency, data sample and the relevant financial markets 9

3.2 Choice and identification of communication events 10

3.3 Measuring the content of communications 13

3.4 The event study methodology 14

4 The effects of financial stability-related communication 16

4.1 Stylized facts about timing and content of communication 17

4.2 Effects of FSRs and speeches/interviews 17

4.3 Sample splits and robustness 19

5 Conclusions 21

References 23

Appendices 25

Figures and Tables 27

Abstract

Central banks regularly communicate about financial stability issues, by publishing Financial Stability Reports (FSRs) and through speeches and interviews. The paper asks how such communications affect financial markets. Building a unique dataset, it provides an empirical assessment of the reactions of stock markets to more than 1000 releases of FSRs and speeches by 37 central banks over the past 14 years. The findings suggest that FSRs have a significant and potentially long-lasting effect on stock market returns, and also tend to reduce market volatility. Speeches and interviews, in contrast, have little effect on market returns and do not generate a volatility reduction during tranquil times, but have had a substantial effect during the 2007-10 financial crisis. The findings suggest that financial stability communication by central banks are perceived by markets to contain relevant information, and they underline the importance of differentiating between communication tools, their content and the environment in which they are employed.

JEL classification: E44, E58, G12.
Keywords: central bank, financial stability, communication, event study.

Non-technical summary

The global financial crisis has triggered heated discussions on how best to achieve financial stability in the future. An important role in that regard has been assigned to central banks, many of which have explicit financial stability mandates. In the light of this, a large number of central banks have communicated extensively on financial stability-related matters, e.g. through the publication of Financial Stability Reports (FSRs) and financial stability-related speeches and interviews.

The aim of the current paper is to shed light on the potential effects of central bank communication about financial stability. It takes a financial market perspective and studies how financial sector stock indices react to the release of such communication, given that the financial sector is one of its main addressees. For that purpose, the paper constructs a unique and novel database on communication comprising more than 1000 releases of FSRs and speeches/interviews by central bank governors from 37 central banks over a time period from 1996 to 2009, i.e. spanning nearly one and a half decades. The degree of optimism that is expressed in these communications is determined using a computerized textual-analysis software.

A first striking finding from this classification is that the tone of FSRs had continuously become more optimistic after 2000, reaching a peak already in early and becoming more pessimistic thereafter. This stylized fact, together with formal tests conducted in the paper, suggests that FSRs comment on the current market environment, but also contain forward-looking assessments of risks and vulnerabilities.

The paper's findings suggest that communication about financial stability has important repercussions for financial sector stock prices. Moreover, there are clear differences between FSRs, on the one hand, and speeches and interviews, on the other. FSRs clearly create news in the sense that the views expressed in FSRs move stock markets in the expected direction. This effect is quite sizeable as, on average, FSR releases move equity markets by more than 1% during the subsequent month. Another important finding is that FSRs also reduce noise, as market volatility tends to decline in response to FSRs. These effects are particularly strong if the FSR contains an optimistic assessment of the risks to financial stability, when FSRs are found to move equity markets upwards in up to two thirds of the cases. Speeches and interviews, in contrast, have only modest effects on stock market returns, and cannot reduce market volatility.

However, the effects of FSRs and speeches crucially depend on market conditions and other factors. Importantly, during the financial crisis, FSRs were moving financial markets less than before the crisis, while speeches by governors did move financial markets. Finally, the results indicate that financial stability communication of central banks influences financial markets primarily via a coordination channel, i.e. it provides relevant information which exerts a significant and persistent effect on markets.

The findings of the paper suggest that financial stability communication by central banks are indeed perceived by markets to contain relevant information. They underline that communication by monetary authorities on financial stability issues can indeed influence financial market developments. Yet the findings also show that such communication entails risks as they may unsettle markets. Hence central bank communication on financial stability issues needs to be employed with utmost care, stressing the difficulty of designing a successful communication strategy on these matters.

1. Introduction

The global financial crisis has triggered heated discussions on how best to achieve financial stability in the future. An important role in that regard has been assigned to central banks, many of which have explicit financial stability mandates. In the light of this, a large number of central banks have communicated extensively on financial stability-related matters, e.g. through the publication of Financial Stability Reports (FSRs) and financial stability-related speeches and interviews.

The aim of the current paper is to shed light on the potential effects of central bank communication about financial stability. It takes a financial market perspective and studies how financial sector stock indices react to the release of such communication, given that the financial sector is one of its main addressees. Doing so, it covers a large number of countries over nearly one and a half decades, and studies the effects of FSRs as well as of speeches and interviews by central bank governors.

An assessment of the effects of financial stability-related communication requires a view on its aims. In line with the aims put forward by Blinder et al. (2008), we focus on the potential of such communication to "create news" and to "reduce noise". A number of central banks have specified the purpose of their FSRs. The ECB's reports, for instance, aim "*to promote awareness in the financial industry and among the public at large of issues that are relevant for safeguarding the stability of the euro area financial system. By providing an overview of sources of risk and vulnerability for financial stability, the Review also seeks to play a role in preventing financial crises*" (European Central Bank, 2011, p. 7).[1] In light of these statements, it is interesting to study to what extent the views that a central bank expresses in its communications get reflected in the markets. For instance, if the central bank expresses a rather pessimistic view about the prospects for financial stability, and this view gets heard in financial markets, we would expect that stock prices for the financial sector decline. In that sense, these communications "create news". The other motive, to "reduce noise", should then be reflected in market volatility, in the sense that a communication by the central bank should contribute to reducing uncertainty in financial markets, thereby reducing volatility.

But why, and through what channels should central bank communications have an effect on financial markets at all? A number of factors could come into play here. First, the central bank is obviously an important player in financial markets. For instance, if it is ready to change its policy rates, it can directly affect asset prices. Its communication can therefore exert effects through what has been labelled the "signalling channel" in the literature on foreign exchange interventions (e.g., Kaminsky and Lewis 1996). Second, the analyses that feed into the communications are potentially of high quality, and there are few other institutions communicating about financial stability, such that a central bank publication might indeed contain news. Thus, a co-ordination channel might be at play, whereby communication by the central bank works as a co-ordination device, thereby reducing heterogeneity in expectations and information, and thus inducing asset prices to more closely reflect the underlying fundamentals, a channel that has also been found to be important to explain the effect of foreign exchange interventions (Sarno and Taylor 2001, Fratzscher 2008). This channel might imply that communications have longer-lasting effects, as they might change the dynamics in financial markets.

To conduct the empirical analysis, the paper constructs a unique and novel database on communication comprising more than 1000 releases of FSRs and speeches/interviews by central bank governors from 37 central banks and over the past 14 years. We not only identify

[1] In a similar vein, the Bank of England' FSRs aim "*to identify the major downside risks to the UK financial system and thereby help financial firms, authorities and the wider public in managing and preparing for these risks*." See http://www.bankofengland.co.uk/publications/fsr/index.htm.

the precise timing of these communications, but we also determine their content. We employ a computerized textual-analysis software (called DICTION 5.0), which allows us to grade each of the central bank financial stability statements, based on different semantic features, according to the degree of optimism that is expressed.

A first striking finding from this classification is that the tone of FSRs had continuously become more optimistic after 2000, reaching a peak already in early 2006 and becoming more pessimistic thereafter. This stylized fact, together with formal tests conducted in the paper, suggests that FSRs comment on the current market environment, but also contain forward-looking assessments of risks and vulnerabilities.

The paper's findings suggest that communication about financial stability has important repercussions for financial sector stock prices. Moreover, there are clear differences between FSRs, on the one hand, and speeches and interviews, on the other. FSRs clearly create news in the sense that the views expressed in FSRs move stock markets in the expected direction. This effect is quite sizeable as, on average, FSR releases move equity markets by more than 1% during the subsequent month. Another important finding is that FSRs also reduce noise, as market volatility tends to decline in response to FSRs. These effects are particularly strong if the FSR contains an optimistic assessment of the risks to financial stability, when FSRs are found to move equity markets upwards in up to two thirds of the cases. Speeches and interviews, in contrast, have only modest effects on stock market returns, and cannot reduce market volatility.

However, the effects of FSRs and speeches crucially depend on market conditions and other factors. Importantly, during the financial crisis, FSRs were moving financial markets less than before the crisis, while speeches by governors did move financial markets. Finally, the results indicate that financial stability communication of central banks influences financial markets primarily via a coordination channel, i.e. it provides relevant information which exerts a significant and persistent effect on markets.

The paper shows that while the release schedule of FSRs is pre-scheduled, speeches and interviews are a much more flexible communication tool. For instance, their number is clearly positively correlated with financial market volatility. Given their flexibility, speeches and interviews by definition carry some surprise element. Since it is mostly at the discretion of the central bank governors whether or not to make statements about financial stability, the fact that a governor feels compelled to raise financial stability issues in a speech or an interview can therefore be an important additional news component. In contrast, due to the fixed release schedule for Financial Stability Reports, financial markets expect statements about financial stability issues on the release days. There might be surprising elements in their content, but the mere fact that the FSR is released does not come as a surprise. This difference might be at the heart of the different effects of the two instruments on market volatility.

The empirical findings of the paper raise a number of policy issues. Communication on financial stability issues by a central bank has been and will likely be watched even more closely in the future, and thus can potentially have an important influence on financial markets. Does this imply that central banks should limit transparency and their communication on certain financial stability issues, as argued by Cukierman (2009), or does this make the case for enhanced transparency and accountability, as argued by others? The findings of the paper underline that communication by monetary authorities on financial stability issues can indeed influence financial market developments. Yet the findings also show that such communication entails risks as they may unsettle markets. Hence central bank communication on financial stability issues needs to be employed with utmost care, stressing the difficulty of designing a successful communication strategy on these matters.

The paper proceeds in section 2 by outlining a more general motivation and relating the current paper to the existing literature. Section 3 explains the dataset underlying the empirical analysis. In particular, it reports how the measures for central bank communication have been extracted and quantified. It also shows how the incidence and the content of the communications relate to the external environment, and presents the event study methodology that we employ. Section 4 discusses the empirical results and implications, and presents robustness tests. Section 5 concludes.

2. Motivation and literature

Given the important role of monetary authorities for financial stability, corresponding central bank communication has always played an important role as a policy instrument, for mainly three reasons. First, financial markets are inherently characterized by asymmetric information and co-ordination problems, characteristics which lie at the heart of the potential risks to financial stability. To address these problems, transparency and communication are crucial. In particular, the central bank can be much more effective in promoting financial stability if it has established a reputation that its analysis and communication are of high quality. Accordingly, communication also serves the role of making the central bank credible. Finally, any body that is entrusted with financial stability tasks will need to be accountable, which calls for a clear mandate, and a transparent conduct of the assigned task. Although Oosterloo and de Haan (2004) found that there is often a lack of accountability requirements for central banks' financial stability objectives, this is very likely to change in the future, once financial stability has become a more important and explicit objective of central banks.

These aspects of communication for financial stability do therefore closely resemble the role of monetary policy-related communication, as established in the recent literature on central bank communication (see, e.g., Blinder et al. 2008, Gosselin et al. 2007, Ehrmann and Fratzscher 2007a). Also in the monetary policy sphere, communication serves i) to make central banks credible (mirroring the importance of financial stability communication for reputational purposes), ii) to enhance the effectiveness of monetary policy (just like good financial stability communication can contribute to financial stability), and iii) to make central banks accountable.

While being very similar along these three dimensions, there are also differences between monetary policy-related and financial stability-related communication. Central banks have become much more transparent about their conduct of monetary policy over the last decades, along with an increasing importance given to communication. There is a debate on possible limits to central bank transparency (e.g., Mishkin 2004, Morris and Shin 2002, Svensson 2006), but the arguments are much more contentious than in the case of financial stability-related communication. As demonstrated by Cukierman (2009), a clear case for limiting transparency can be made when the central bank has private information about problems within segments of the financial system. Release of such information may potentially be harmful, e.g. by triggering a run on the financial system. This suggests that policy makers need to be even more careful when designing their communication strategy with regard to their financial stability objectives.

While the literature on central bank communication for monetary policy purposes has been growing rapidly over the recent decade, the communication on financial stability has received considerably less attention. Svensson (2003) argues that through the publication of indicators of financial stability in FSRs, central banks can issue early warnings to economic agents, thereby ideally preventing financial instability from materializing, and thereby ensuring that financial stability concerns do not impose a constraint on monetary policy. Cihak (2006, 2007) provides a systematic overview of FSRs as the main communication channel that

central banks use for this purpose. He documents, on the one hand, that the reports have become considerably more sophisticated over time, with substantial improvements in the underlying analytical tools, and on the other hand, that there has been a large increase in the number of central banks that publish FSRs. The frontrunners are the Bank of England, the Swedish Riksbank, and Norges Bank (Norway's central bank), all of which started publication in 1996/1997. It is probably not a coincidence that these three central banks are typically also listed in the group of the most transparent central banks with regard to monetary policy issues (Eijffinger and Geraats 2006, Dincer and Eichengreen 2009). In the meantime, around 50 central banks are now releasing FSRs.

A first empirical analysis of FSRs has been conducted by Oosterloo et al. (2007), with the aim to understand who publishes FSRs, for what motives, and with what content. Their results indicate that there are mainly three motives for publication, namely to increase transparency, to contribute to financial stability, and to strengthen co-operation between different authorities with financial stability tasks. They also find that the occurrence of a systemic banking crisis in the past is positively related to the likelihood that an FSR is published.

Even less work has been done with regard to the effects of financial stability-related communication. To our knowledge, the only exception is Allen et al. (2004), who conducted an external evaluation of the Riksbank's work on financial stability issues, and came up with a number of recommendations, such as making the objective of the Riksbank's FSRs explicit, providing the underlying data, or expanding the scope of the FSR to, e.g., the insurance sector. The present paper aims to fill this gap and analyzes how central bank communications about financial stability are received in financial markets.

3. Measuring communication and the effects on financial markets

This section introduces the dataset that we develop to study the effects of financial stability-related communication. We start by explaining the choice of data frequency, the sample of countries and time that we use, and the choice of the financial sector stock market indices as our measure for financial markets. Subsequently, we describe the process for identifying the relevant communications, how their content is coded, and the econometric methodology.

3.1 Choice of data frequency, data sample and the relevant financial markets

We are interested in the effects of financial stability-related communication on financial markets. A first choice that is required relates to the frequency of the analysis. Given the speed of reactions in financial markets, it is necessary to identify the timing of the events as precisely as possible. Identification of a precise time stamp will allow for an analysis in a very tight time window around the event, thereby ensuring that the market reaction is not distorted by other news. We opted for a daily frequency for two practical reasons. First, given the aim to provide a cross-country study over a relatively long horizon, financial market data are not consistently available at higher frequencies. Second, the identification of the precise days of the release of central bank communications has already not been trivial in many cases, whereas the identification of the exact time of the release within a day is largely impossible. While a higher frequency might have been desirable, it is important to note that the daily frequency is commonly employed in the announcements effect literature – for instance, two classic references with regard to the effect of *monetary policy* on stock markets, Rigobon and Sack (2004) as well as Bernanke and Kuttner (2005) both use daily data.

The sample of countries and the time period of the study have been determined on the basis of the release of FSRs. We tried to identify the release dates of the FSRs or relevant speeches or interviews by central bank governors for all those central banks listed in Cihak (2006, 2007), i.e. for all central banks which release FSRs. We succeeded to identify such release dates for

35 countries, 24 of which are advanced economies according to the IMF's country classification. Additionally, we included the euro area, as well as the United States as the only country that does not release an FSR, restricting ourselves to studying the effect of speeches and interviews in this case. In total, our sample therefore covers 37 central banks (see Table 1). Our sample starts in 1996, i.e. the year when the first FSR was released by the Bank of England. The data were extracted in October 2009, such that the sample ends on September 30, 2009.

As to the selection of a financial market that shall be subject of this study, we opted for stock market indices relating to the financial sector, as we expect that empirical effects of financial stability communication should be most easily detectable for this sector. Such data are available from Datastream back to 1996, i.e. to the start of our sample period, for all the countries in our sample. This choice is partially owed to the large cross-country dimension and the need to get historical data for nearly one and a half decades, which limited the availability of less traditional market measures, such as implied volatilities or expected default frequencies (EDFs). While the link of these measures to financial stability would have been relatively direct, we hope that the *financial sector* stock indices (using MSCI indices) provide a measure that is reasonably closely related to financial stability issues, too. All stock indices are expressed in local currency, given that we are interested in the response of national financial markets to national communication. We will furthermore show that our results are robust to using the overall stock market indices, rather than focusing on the financial sector stocks alone.

3.2 Choice and identification of communication events

At the core of this paper is a measure of communication events that quantifies the content of communication. We focus on the two most important channels of communication about financial stability issues, namely FSRs and speeches and interviews. FSRs are typically relatively comprehensive documents that discuss various aspects of financial stability. They normally begin with an overall assessment of financial stability in the respective country, often including an international perspective. They usually contain an evaluation of current macroeconomic and financial market developments and the assessment of risks to banks and systemically relevant non-banking financial institutions. Cihak (2006) calls these sections the "core" part of an FSR and differentiates them from the "non-core" part that includes research articles on special issues, often written by outside experts. The weights attributed to these two parts vary considerably across central banks. The spectrum ranges from FSRs that only cover the core part (e.g. Norway) to FSRs which only consist of articles covering a special topic (e.g. France). Most central banks lie somewhere in between this range and are usually closer to the first type. Typically, FSRs are published twice a year, i.e. are relatively infrequent communications.

A second important channel for central banks to communicate about financial stability issues is to give speeches and interviews. By their very nature, these are much more flexible than FSRs. Their timing can be chosen flexibly (Ehrmann and Fratzscher (2007b, 2009) have shown this for monetary policy-related speeches), and their content can be much more focused. Of course, this is also due to the fact that they are much shorter than FSRs.

As we are interested in testing the response of financial markets to central bank communication, we need to identify the release dates as a first step (recall that we will conduct the analysis at a daily frequency, hence there is no need to identify the timing within a given day – as long as the release takes place before markets close). As to FSRs, we carefully ensured a proper identification of their release dates, mainly based on information provided on central banks' websites and by central bank press offices, and complemented with information from news reports about the release of FSRs as recorded in Factiva, a database that contains newspaper articles and newswire reports from 14,000 sources. As shown in Table 1, the dataset contains information on 367 FSRs. The increasing tendency of

central banks to publish FSRs is reflected in this database. Starting from less than 10 FSRs per annum in the 1990s, we could identify around 50 FSRs each year in the mid 2000s (note that the drop in numbers in 2009 is entirely due to the fact that the sample ends in September, i.e. covers only three quarters of the year). As to the country coverage, the early publishers are obviously represented more frequently, with 20 and more reports, whereas "late movers" have far fewer observations, down to 1 for the case of the Bank of Greece, which published its first FSR in June 2009 (for Indonesia and the Philippines, we could not identify the release dates; note that dropping these two countries from the sample does not affect our results in any substantive way).

Table 1

To identify speeches and interviews is more difficult. Our objective is to extract all relevant public statements that relate to financial stability. For tractability reasons, we restricted our search to speeches by the central bank governor – even in cases where a central bank has a member of its governing body that has an explicit assignment regarding financial stability. We used Factiva and extracted all database entries containing the name of the policy maker together with some keywords that appear with certain regularity in the editorials of the FSRs.[2] From all hits obtained, we extracted those containing statements by the relevant policy maker with a reference to financial stability issues. Since newswire reports typically record the precise time stamp, we were in a position to allocate the speeches and interviews to the appropriate trading days. Communications during weekends were allocated to the subsequent Monday, communications in the evening – such as dinner speeches – to the subsequent trading day. Furthermore, we very carefully chose only the first report about a given statement, which typically originated from a newswire service. This choice has the advantage that the reporting is very timely, usually comes within minutes of each statement, and that it is mostly descriptive without providing much analysis or interpretation. To avoid double counting, we discarded all subsequent reports or analysis of the same statement.

A number of issues are worth noting about this data extraction exercise. First, the search was conducted only in English language. We might therefore not have discovered all statements, if these were made and reported upon exclusively in other languages. However, due to the fact that Factiva contains also newswire reports and due to the extensive coverage of this topic by newswires, this issue should not be very problematic.

Second, one can easily think of other keywords to use in the database search. We have experimented with larger sets, e.g. including also the terms "volatile", "volatility", "risk", "adverse" or "pressures". However, the additional hits typically related to monetary policy communications (such as central bank governors talking about inflationary "pressures", "risks" to price stability, etc.), such that the resulting dataset on financial stability communications was basically unaltered.

Third, the news sources might be selective in their reporting, thus possibly not covering all relevant statements. However, given the sensitivity of the topic and the importance that it has for financial markets, we are confident that the coverage is close to complete. Furthermore, as we are interested in testing the market response to communication, it makes sense to focus only on those statements that actually reach market participants, and this is best achieved by looking at prominent newswire services.

[2] To be precise, we used the following search terms: "financial stability or systemic or systemically or crisis or instability or instabilities or unstable or fragile or fragility or fragilities or banking system or disruptive or imbalances or vulnerable or strains".

Fourth, our news sources may wrongly report or misinterpret a statement by policy makers. Again, our objective is to assess communication from the perspective of financial markets and therefore we analyze the information market participants actually receive.

The resulting dataset contains 768 communication. The breakdown by year in Table 1 reveals large time variations, with a massive increase in the number of speeches in 1998, i.e. during the Asian and the Russian crisis, as well as during the financial crisis of 2007-2010. This suggests that the occurrence of speeches and interviews is responsive to the prevailing circumstances, which is in stark contrast to FSRs, which are typically released at pre-specified dates. Speeches and interviews do therefore provide the central bank with a very flexible instrument to communicate financial stability concerns, as their timing can be chosen flexibly.

Figure 1 provides a first graphical check of the relation between financial markets and the frequency of financial-stability related speeches and interviews, by plotting their total number in all countries in a given quarter on the right-hand axis, and the standard deviation of daily returns of the global financial stock index in each quarter on the left-hand axis. The evolution of the two lines is extremely close, clearly suggesting that communication intensifies in times of financial market turbulence.

Figure 1 and Table 2

The results of a more formal test are provided in Table 2. The table calculates the cumulated stock market returns and the standard deviation of daily stock market returns preceding the communication events, and compares them to equivalent figures for non-event days (with tests for statistically significant differences given in the columns denoted by "Diff"). The left part of the table contains the results for FSRs, the right part for speeches and interviews. The different rows of the table relate to different time windows prior to the event, with the first row measuring returns on the day prior to the event, the second row on the 2 days prior to the event, and so on. Standard deviations are calculated for time windows exceeding 3 days. The non-event comparison figures are calculated for a sample where no communication event has occurred in the preceding 60 business days, and no communication event follows in the subsequent 60 business days. The sample is furthermore restricted to non-overlapping observations.

The picture that resulted from Figure 1, i.e. that the occurrence of speeches and interviews is closely related to stock market volatility, is confirmed in the very last set of columns in Table 2: on days before an event ("event days"), volatility is substantially higher than on non-event days, with the difference being statistically significant at the 1% level throughout all time windows considered. This is in contrast to the results for the FSRs, the publication schedules of which, as we know, are pre-determined. Even though there are some time windows where the volatility is statistically significantly different, the results are far less consistent. Furthermore, if anything, market volatility tends to be lower on event days than on non-event days, a pattern which is most likely driven by the fact that most central banks started to release their FSRs in the early 2000s, when market volatility was comparatively low.

A similar comparison for the stock market returns also reveals that communication by central banks intensifies during periods of stock market declines. Whereas the average stock return prior to non-event days is typically positive, it is on average negative prior to speeches and interviews, and differences are statistically significant at the 1% level, regardless of the time window. No such pattern is visible for FSRs. The main conclusion from this analysis therefore is that while the release schedule of FSRs is pre-defined, speeches and interviews are a much more flexible communication tool, and react to the current market environment.

In the light of these findings, one might ask whether speeches and their content are predictable, such that financial markets might have priced in the effects already prior to the

communication event. In such a case, the subsequent event study methodology would not be appropriate. However, it is important to note that while speeches and interviews occur more frequently in times of high market volatility and declining stock markets, this does not imply any predictability of speeches or their content. Probit models including measures of stock market misalignment, the market trend and its volatility (either directly or their absolute values), do a poor job in predicting the events: the 99th percentile of the predicted probabilities of the events is smaller than 0.025.

3.3 Measuring the content of communications

Once we have identified the communication events, it is necessary to measure their content in order to make the data amenable to econometric analysis. In other words, we want to capture those dimensions and elements of FSRs and speeches/interviews which are relevant for financial market participants and thus will be reflected in asset prices.

A discussion of the various possibilities of achieving this is provided in Blinder et al. (2008). The simplest option consists of assigning a dummy variable that is equal to one on event days, and to zero otherwise. While easily done, this approach limits the analysis severely, namely to a study whether communication affects volatility or absolute returns. If we are interested in the effect of the content of communication, a method for quantification of such content is required. The approach adopted in some part of the literature on monetary policy-related communication, namely to read the communications and code them on various scales, was not feasible for our purposes, given the amount of text that needed to be quantified. We have therefore opted for an automated approach for the current paper.[3]

We employed the computerized textual-analysis software DICTION 5.0,[4] which searches text for different semantic features by using a corpus of several thousand words, and scores the text along an optimism dimension. This dimension may be important as it provides agents with information about the current state and the prospects of the financial system and underlying risks. The respective scores are computed by adding the standardized word frequencies of various subcategories labelled as optimistic, and by subtracting the corresponding frequencies of pessimistic subcategories. In broad terms, optimism refers to "language endorsing some person, group, concept or event, or highlighting their positive entailments."

This software has been used extensively in communication sciences and in political sciences, e.g. to analyze speeches of politicians (Hart 2000, Hart and Jarvis 1997), but has also been applied in the context of central banks (Bligh and Hess 2007, Armesto et al. 2009). Furthermore, Davis et al. (2006) have used it to measure the reaction of financial markets to earnings announcements, and find a significant incremental market response to optimistic and pessimistic language usage in earnings press releases.

There are a number of advantages of this approach over human coding of the text. First, the software creates a coding that is more mechanical and thus objective, compared to human coding which tends to be more judgmental. While some subjectivity could arise due to the choice of the content of the dictionaries against which a text is assessed, it is important to note that the corpus has been defined based on linguistic theory and without an active participation by the authors of this paper. Another advantage is the replicability of the coding, which is in stark contrast to human coding, and also allows more text to be added without distorting the scoring process. Third, the automated approach allows a consistent coding of long passages of text, and across a large number of communications. Human coding of long texts with various

[3] An alternative approach is used by Lucca and Trebbi (2009), where FOMC statements are cut down into small segments of text, the semantic orientation of which is then calculated by checking how often these text segments appear in conjunction with the words dovish or hawkish in a large body of text.
[4] See http://www.dictionsoftware.com.

points is rather difficult, as no part should in principle be given a larger weight in the assessment. Given the breadth of FSRs, this issue is particularly severe in the current application. At the same time, a drawback of the automated approach is that it does not consider the context of the text, and thus cannot generate a "tailor-made" coding for financial stability-related communication.

Based on this computerized textual-analysis software, we computed a score for each individual speech or interview (note that, effectively, we are coding the content of the related news reports, rather than the original source text), and for the overview part of each FSR.[5] Subsequently, we transformed the resulting scores into a discrete variable, which takes the value of -1 for the lowest third of the distribution, a value of 0 for the middle part of the distribution, and the value of +1 for the upper third of the distribution. That is, a value of +1 denotes a relatively optimistic text, while a value of -1 corresponds to a relatively pessimistic statement. The discretization of scores is required for the subsequent analysis, where we are interested in the market effects of optimistic vs. pessimistic communication, rather than the effect of an incremental change in tone. This transformation was applied for the speeches as well as for the FSRs. Note that we will test for robustness using a very different measurement approach, which also attempts to capture the surprise component contained in the respective communications, as well as (for the parts of the subsequent analysis where a discretization is not required) using the raw optimism scores given by the software.

It is important to note that this implies a *relative* coding, i.e. a given communication is scored in a comparative fashion against the other texts in the sample. However, due to the large sample, both across countries and along the time dimension, our communications cover periods of relative stability and tranquillity, as well as periods of financial market crises or turbulence. Accordingly, the overall sample of text should be relatively balanced, such that text which is coded with plus or minus one should indeed represent a corresponding opinion. We denote the resulting indicators by $I_{it}^{optimism,FSR}$ and $I_{it}^{optimism,speech}$, respectively, where i denotes a given country, and t stands for time. In the appendix, we provide a number of examples of speeches and interviews, and how they were coded.

3.4 The event study methodology

What are the effects of FSRs and speeches/interviews on financial markets? The natural econometric approach to test our hypotheses of interest is the event study methodology. We use this methodology because we are interested not only in the contemporaneous effect of financial stability statements, but we also want to know how persistent the effect is over time. We can define the release of an FSR, or the delivery of a speech or an interview as an event. The question we want to address is whether the event affects stock markets in a causal fashion. For that purpose, it is essential that we can compare the stock market evolution following the event to the counterfactual, i.e. a predicted value that we believe would have occurred had the event not happened. A crucial issue in any event study is therefore to find a benchmark model to calculate *expected* returns, which in turn allows calculation of *excess* returns.[6] Most event studies look at the effect of events, such as earnings announcements or stock splits, on individual stocks, and use some variant of a factor model, such as the Fama–French (1993) three-factor model, or the Carhart (1997) four-factor model, which extends the previous model by a momentum factor.

Given that we are interested in the evolution of national stock market indices rather than of individual stocks, the book-to-market ratio and the size factor of the Fama–French model are

[5] While this overview carries different names across central banks, e.g. editorial, introductory chapter, executive summary, etc., it is rather similar in nature for all FSRs.
[6] For overviews of the event study literature see, e.g., MacKinlay (1997) or Kothari and Warner (2007).

not applicable. Following Edmans et al. (2007) and Pojarliev and Levich (2007), we start by defining normal returns as:

$$R_{it} = \gamma_{0i} + \gamma_{1i}R_{it-1} + \gamma_{2i}R_{mt-1} + \gamma_{3i}R_{mt} + \gamma_{4i}R_{mt+1} + \gamma_{5i}D_t + \gamma_{6i}T_{it-1} + \gamma_{7i}S_{it-1} + \gamma_{8i}M_{it-1} + \varepsilon_{it}, \quad (1)$$

where R_{it} is the daily local currency return on the financial sector stock market index for country i on day t, R_{mt} is the daily US dollar return on Datastream's global financial sector stock market index, and D_t denotes dummy variables for Monday through Thursday. T_{it-1} stands for the trend in stock markets over the 20 days prior to the event, S_{it-1} for the standard deviation of daily stock market returns over the 20 days prior to the event, and M_{it-1} for the "misalignment" of stock indices on the day preceding the event, measured as the percentage deviation of the stock indices from their national average over the entire sample period.

The first 5 factors follow Edmans et al. (2007). The lagged index return controls for possible first-order serial correlation. The global stock market index is meant to capture the effects of international stock market integration, and since some indices might be lagging or leading the world index, Edmans et al. (2007) not only include the contemporaneous global returns, but furthermore a lead and a lag. The last three terms are owed to earlier event studies on exchange rates such as Pojarliev and Levich (2007) or Fratzscher (2009). The trend factor attempts to allow for persistence in stock market movements, and is therefore closely related to the momentum factor in the Carhart four-factor model. The inclusion of the standard deviation is an attempt to capture the effect of market volatility. Finally, the misalignment factor is based on the idea that there might be booms or busts in stock markets, and that over a sufficiently long sample, there could be some mean reversion (albeit possibly allowing for a drift). We test for robustness to the exclusion of these last three terms, given that they are derived from the exchange rate literature rather than the stock market event studies, and find our results to be qualitatively unaltered.

Model (1) is estimated country by country, only including days that were neither preceding nor preceded by communication events for 60 days (in each direction). Based on the estimated parameters (denoted by hats), it is then possible to calculate excess returns on event days as

$$\hat{\varepsilon}_{it} = R_{it} - (\hat{\gamma}_{0i} + \hat{\gamma}_{1i}R_{it-1} + \hat{\gamma}_{2i}R_{mt-1} + \hat{\gamma}_{3i}R_{mt} + \hat{\gamma}_{4i}R_{mt+1} + \hat{\gamma}_{5i}D_t + \hat{\gamma}_{6i}T_{it-1} + \hat{\gamma}_{7i}S_{it-1} + \hat{\gamma}_{8i}M_{it-1}). \quad (2)$$

The hypothesis to be tested is whether communication leads to excess returns in the expected direction, i.e. whether

$$\hat{\varepsilon}_{it} > 0 \;\; if \;\; I_{it}^{optimism,c} = 1 \text{ or } \hat{\varepsilon}_{it} < 0 \;\; if \;\; I_{it}^{optimism,c} = -1, \quad (3)$$

where the superscript c stands for the two communication types, FSR and speeches or interviews. A more complex approach is required if we want to calculate the *longer-term* effects of communication beyond the event day. While we assume that world markets are exogenous to a communication in an individual country also over extended time windows, this is obviously not the case for the own lag, the recent trend, standard deviation and misalignment: as of the second day, it is necessary to calculate predicted returns for the preceding day, and to plug these into equation (2), thus yielding

(4)
$$\hat{\varepsilon}_{it+k} = R_{it+k} - (\hat{\gamma}_{0i} + \hat{\gamma}_{1i}\hat{R}_{it+k-1} + \hat{\gamma}_{2i}R_{mt+k-1} + \hat{\gamma}_{3i}R_{mt+k} + \hat{\gamma}_{4i}R_{mt+k+1} + \hat{\gamma}_{5i}D_{t+k} + \hat{\gamma}_{6i}\hat{T}_{it+k-1} + \hat{\gamma}_{7i}\hat{S}_{it+k-1} + \hat{\gamma}_{8i}\hat{M}_{it+k-1})$$

Note that compared to equation (2), R_{it-1}, T_{it-1}, S_{it-1} and M_{it-1} have all been replaced by their predicted value in the absence of a communication event. For k=0, the two coincide, whereas for all days k>0, it is important to calculate the appropriate predicted values. Tests for the effects of communication over longer time horizons with a time window of K days then amount to asking whether

(5)
$$\sum_{k=0}^{K}\hat{\varepsilon}_{it+k} > 0 \;\; if \;\; I_{it}^{optimism,c} = 1 \text{ or } \sum_{k=0}^{K}\hat{\varepsilon}_{it+k} < 0 \;\; if \;\; I_{it}^{optimism,c} = -1.$$

Following common practice in the event study literature, we employ two types of tests for the effects of communications (both described in detail in MacKinlay, 1997). First, we apply a non-parametric sign test to study whether the above conditions hold in more than 50% of all cases. The underlying idea is that by construction – if the factor model is correct – excess returns and cumulated excess returns are on average zero, and that it is equally probable that they are positive or negative. If the events systematically move stock markets in the expected direction, we should find that the excess returns are non-zero, and of the expected sign, in significantly more than 50% of cases. The second (parametric) test checks the average size of the (cumulated) excess returns, and tests these against the null hypothesis that they are zero.

In a similar vein, to test whether communications reduce noise, i.e. lower stock market volatility, we furthermore test whether

(6)
$$\sigma_{\hat{\varepsilon}_{i,t/t+k}} < \sigma_{\hat{\varepsilon}_{i,t-1/t-1-k}} \;\; if \;\; D_{it}^{c} = 1$$

with $\sigma_{\hat{\varepsilon}_{i,t/t+k}}$ the standard deviation of daily excess returns in country i from time t to $t+k$, $\sigma_{\hat{\varepsilon}_{i,t-1/t-1-k}}$ their standard deviation over the k days prior to the event, and D_{it}^{c} a dummy variable that is equal to one on the days when a communication of type c is released in country i.[7] Also here, we apply the non-parametric sign test whether the above conditions hold in more than 50% of all cases and the test whether the difference of the two standard deviations is equal to zero.

4. The effects of financial stability-related communication

This section starts by providing some stylized facts of how the content of FSRs and speeches evolved over time – and to what extent it managed to be forward-looking and identify risks and vulnerabilities rather than reflect market developments (section 4.1). It then proceeds by identifying and testing for the effects of communication on financial markets (section 4.2) and presents a number of sample splits and robustness tests that also sheds further light on the channels trough which communication affects markets (section 4.3).

[7] Excluding the daily excess returns on day t from calculating the post-event standard deviations does not alter our results. This implies that the results are not driven by the initial market reaction on the day of the announcement.

4.1 Stylized facts about timing and content of communication

How did the content of FSRs and speeches evolve over time and across countries? And to what extent was such communication forward-looking rather than reflecting market developments? Figure 2 provides an overview of how the optimism expressed in FSRs (upper panel) as well as speeches and interviews (lower panel) has evolved over time. It plots, for each year, the average and median optimism for the respective communication events, as well as the 25th and the 75th percentiles. Note that the figure for FSRs starts only in 1999, given that in the years before, there were too few FSRs being published to provide a meaningful picture.

Figure 2 and Table 3

A number of interesting issues emerge from this figure. Most importantly, it is striking that the tone of FSRs had continuously become more optimistic after 2000, reaching a peak in early 2006. This suggests that FSRs contain commentaries on the current market environment, but that they are also forward-looking, with some anticipation of the 2007-2010 crisis. However, there is a relatively large heterogeneity across countries, as shown by the breadth of the scores encompassed by the 25th and the 75th percentiles. This is especially the case for speeches and interviews, which do not seem to follow any obvious pattern over time.[8]

Table 3 looks further into the question to what extent the content of communications reflects previous financial market developments, and reports corresponding test results. Separately for FSRs and speeches and interviews, it reports the average return and standard deviation of financial sector stock indices over the usual time windows (from one day to 60 days prior to the event), separately for communications coded as -1, 0 and +1 on the optimism scale in columns (1), (2) and (3), respectively. The statistical significance of a test for equality is provided for each pair, i.e. (1) vs. (2), (1) vs. (3), and (2) vs. (3).

The results show that the content of FSRs reflects to some extent prior financial market developments. There is a monotonic relation between the tone of FSRs and the preceding stock market returns: the more optimistic the FSR, the larger have been the preceding returns. However, these differences are typically not statistically significant. At the same time, pessimistic FSRs (i.e. those coded with -1) have, on average, been preceded by considerably larger stock market volatility than neutral or positive FSRs, regardless of the length of the time window, with the differences being highly statistically significant.

Interestingly, no such relations are identifiable for speeches and interviews: there is not a single case where stock market volatility or returns would be related to the content of speeches in a statistically significant manner. If anything, it seems to be the case that there is quite some "leaning against the wind": the returns preceding optimistic speeches are consistently *lower* than the returns preceding pessimistic ones, suggesting that a positive picture is given especially in cases of bad stock market performance.

4.2 Effects of FSRs and speeches/interviews

We now turn to the question to what extent central bank communication was affecting financial markets. A first test is provided in Figure 3, which compares the actual evolution of stock markets following communication events to the predicted evolution on the basis of the benchmark model (1). The upper panel reports the results for the FSRs, the lower panel those for speeches and interviews. The solid line plots the average actual cumulated returns over 60

[8] Note that the raw scores cannot be read as direct indications of optimism, as it is not the case that scores below 50 would represent pessimistic text. The interpretation of the scores should be made relative to a large number of texts within the same category.

days following the communication events. The dashed line, in contrast, shows the expected cumulated returns that would result from the benchmark model in the absence of a communication event. To combine pessimistic as well as optimistic communications in one chart, the cumulated returns are multiplied by -1 for pessimistic communications, whereas they are left unchanged for optimistic communications. Accordingly, we would expect the actual returns to lie above the predicted returns after statements if the markets follow the point of view expressed by the central bank (i.e. we observe negative excess returns in response to pessimistic statements, and positive ones in the case of optimistic communications).

Figure 3

The figure provides a compelling picture about the effects of central bank communication. The upper panel for FSRs shows that markets move in the direction of the central bank view, since the actual returns are substantially larger than the predicted returns. Moreover, the effect is quite sizeable economically: for several time windows, FSR releases move equity markets on average by more than 1% in the direction indicated by the FSRs.

Interestingly, expected cumulated returns in this case are relatively close to zero, suggesting the predictions of the benchmark model are close to those of a random walk model. In other words, due to the fact that the release pattern of FSRs is not systematically related to the previous stock market performance, the benchmark model has a hard time in predicting the subsequent returns.

Looking at the lower panel of Figure 3, the findings are remarkably different for speeches and interviews. As we have seen above, speeches and interviews typically follow stock market declines, and the model clearly predicts further declines subsequently (the dashed line in the figure). As a matter of fact, actual returns do on average decline after a speech or an interview; however, comparing the expected with the actual evolution, it is also apparent that the stock markets decline by less than expected in the presence of central bank communications. The difference between predicted and actual cumulated returns is substantially smaller than for FSRs, however.

The figure also suggests that central bank communications are potentially affecting financial markets even at very long horizons, given that the gap between predicted and actual cumulated returns is present for the entire horizon of time windows we look at, and begins to narrow only towards the end of the horizon.

Tables 4 and 5

The formal test results for the effects of central bank communication are provided in Tables 4 and 5, covering FSRs and speeches and interviews, respectively. The first set of results relates to equation (5), i.e. tests whether optimistic statements yield positive excess returns, and pessimistic ones lead to negative excess returns. The first column shows the share of cases in which the condition was met, as well as the results of the non-parametric sign test. Shares above 0.5 would suggest that stock markets move in the direction of the content of communications. The statistical significance is assessed by stars (*** for 1%, ** for 5%, and * for 10% significance) – whereas numbers that are significantly *smaller* than 0.5 would be characterized by apostrophes (''' for 1%, '' for 5%, and ' for 10% significance).

There is clear evidence that the views represented in FSRs get reflected in financial markets, in significantly more than 50% of all cases. In terms of magnitudes, which are reported in the second column, FSRs generate excess returns on the day of the release of 0.27% on average, and cumulated excess returns up to 1.6% in the longer run, with the largest effects found after 25 to 50 trading days, i.e. after 5 to 10 weeks. Such an effect is indeed sizeable and

economically meaningful, in particular when considering that FSRs are generally released twice a year per country.

How are these effects generated? Table 4 also provides a breakdown according to the type of the FSR, and reveals that in particular optimistic FSRs affect financial markets. They typically generate positive excess returns, which are furthermore large in magnitude, thus leading to statistically significant estimates. The cumulated excess returns are largest after 55 days, amounting to more than 3%. This suggests that an optimistic assessment provided in FSRs leads to an improvement in stock market sentiment over a fairly long horizon, in a way that is not matched by pessimistic FSRs leading to a deterioration in sentiment.

Table 4 also provides the results for tests whether the release of FSRs lowers stock market volatility, i.e. tests whether condition (6) holds, again using both the non-parametric sign test and the parametric test. There is compelling evidence that FSRs do indeed lead to a significant reduction in market volatility.

Moving on to the effect of speeches as reported in Table 5, a rather different picture emerges. The effect on returns is less systematic than for FSRs. With some delay, optimistic speeches generate positive excess returns. The effect for pessimistic speeches on returns is, on average, non-existent, however. Of course, this is not to say that no speech would ever exert reactions on financial markets – rather, *on average*, there seems to be very little effect. At the same time, speeches do not lower stock market volatility – if anything, there is some tendency, especially of optimistic speeches, to somewhat increase it. This suggests that financial stability-related speeches are less able to reduce noise.

To summarize, these findings suggest, first, that communication about financial stability has the potential to affect financial markets. FSRs exert very different effects than speeches and interviews: The views expressed in FSRs get reflected in stock market returns, and in a long-lasting fashion, in particular if the FSR contains an optimistic assessment of the risks to financial stability. FSRs also manage to reduce market volatility somewhat. Speeches and interviews, in contrast, only modestly affect market directions, and do leave market volatility mainly unaffected. An assessment of the effects of these tools therefore needs to clearly distinguish between the two.

4.3 Sample splits and robustness

We have subjected our benchmark results to a number of sample splits and robustness tests, which we will describe now. There are basically four dimensions to these tests. The first analyzes whether the breadth of the underlying panel dataset masks important heterogeneity, and we test for robustness by introducing various sample splits. The second is concerned with speeches and interviews in particular, and tests whether their effects are different if they are clustered. Third, we test whether our focus on financial stocks is important, or whether the results are robust to using the entire stock market indices. Fourth, we ask whether the split into optimistic and pessimistic content determines our results by providing an alternative way of identifying the content of communication, and by using the raw scores as generated by Diction. All results are provided in Tables 6 and 7, with FSRs being covered in Table 6, and speeches and interviews in Table 7. Given the large number of tests, we only show results for a time window of 25 business days.

Tables 6 and 7

The first set of results relates to various sample splits. Given the large number of countries and the long time sample, it might be the case that there is substantial heterogeneity across countries or over time that we do not capture in the full sample. The first such split addresses possible cross-country heterogeneity, by re-running the estimation separately for all advanced and all emerging economies (following the IMF's country classification). Results are overall

robust. The interesting insight, though, is that there is a reduction in volatility following FSRs by central banks in advanced countries, whereas the main effects on returns originate in emerging countries.

Also the second split along the time dimension reveals interesting patterns. Separate tests for the period prior to the financial crisis 2007-2010 (defining the starting date in September 2007, i.e. with Northern Rock; defining the start of the crisis with Lehman does not affect our results) and the time of the crisis shows that FSRs have exerted no systematic effect on stock markets during the crisis, whereas the effects of speeches and interviews are precisely driven by the period of the crisis, underlining that speeches and interviews may be much more influential during periods of financial stress.

The third sample split intends to identify whether the role of the central bank in financial supervision matters, by testing once for the effects of communication by central banks that do have a formal role in financial supervision, and once for those central banks without such a task. The classification is based on the CBFA index developed in Masciandaro and Quintyn (2009).[9] This differentiation does not seem to play an important role, given that the results are robust, and no major differences overall between the two groups emerge.

Table 7 shows furthermore whether there are differences if speeches and interviews are clustered, i.e. the central bank governor might give a sequence of speeches or interviews in a relatively short time window. Such a sequence might be inherently different from one isolated event. We define a communication event to be part of a cluster if other speeches or interviews occur within 60 days after the event, or have occurred within 60 days before the event. As a matter of fact, these types exert very different effects. Speeches that are part of a cluster are not influencing the market view, and tend to increase market volatility. This is in sharp contrast to the stand-alone speeches, which create news, i.e. move markets along with the views expressed, and tend to do so largely without changing volatility.

The rows of section C in Tables 6 and 7 present additional robustness tests. First, replacing the financial sector stock indices with the broad national stock market index, we can test whether our results apply more broadly, or are confined to the financial sector. The results are remarkably robust. Furthermore, results are also not sensitive to the precise way we had split the communications into optimistic and pessimistic content. To test for this, we take two routes: First, by defining an alternative approach to discretizing the codes that attempts to control for the expected component contained in the communication, and to construct a surprise measure instead. We do so by means of the following auxiliary regression:

$$C_{it}^{optimism,c} = \alpha_{0i} + \alpha_{1q} + \alpha_2 T_{it-1} + \alpha_3 S_{it-1} + \alpha_4 M_{it-1} + \mu_{it}\,, \tag{7}$$

where $C_{it}^{optimism,c}$ denotes the raw Diction coding of a given communication of type c along the optimism dimension, and α_{0i} and α_{1q} are country fixed effects and time fixed effects for each quarter of the sample, respectively. The country fixed effects allow for the possibility that there is a different style in the reporting, thus leading to a different mean coding for each country. Such differences should be well known to observers, and therefore not be a surprise. The time fixed effects control for a common evolution across countries, given that often developments in financial markets are internationally determined. Such common time patterns

[9] This index takes the value 1 if the central bank is not assigned the main responsibility for banking supervision; 2 if the central bank has the main (or sole) responsibility for banking supervision; 3 if the central bank has furthermore responsibility for either insurances or the securities markets; 4 if the central bank has responsibility in all three sectors. We allocate central banks to the group with supervisory functions if their index value is larger than one.

should also not come as a surprise to financial markets. The last three explanatory factors are as described in benchmark model (1), i.e. they control for the trend, for stock market volatility, and for a possible stock market misalignment. We retrieve the residuals $\hat{\mu}_{it}$ from these regressions, and define a communication to be optimistic if $\hat{\mu}_{it}$ is above the 66th percentile in the distribution, as pessimistic if it is below the 33rd percentile, and as neutral otherwise. Even though this classification is very different from the original, unconditional, one, it turns out that the results are remarkably robust. Our second test for the role of our discretization method reverts to the original, raw, scores generated by Diction. Higher scores denote more optimistic communications, such that we would expect stock returns to increase correspondingly. This is indeed what we find, consistently with our earlier results: both FSRs and speeches exert some effects, with those of FSRs being substantially larger than those of speeches. With this measure, we are of course not able to separate out optimistic and pessimistic communications, such that we are neither able to conduct the non-parametric test, nor to fill the tables where we break down the results by the content of the communication.

The final point we address here is the question through which channel communication affects financial markets. Is it that communication affects markets because it contains relevant information, and thus coordinates markets and functions as a focal point – akin to what is known as a coordination channel (e.g. Sarno and Taylor 2001, Fratzscher 2008)? Or is it that market participants believe that financial stability communication has a bearing on monetary policy decisions by central banks – or what is referred to as a signalling channel? The evidence discussed so far, in particular the persistence of the effects of communication, strongly points towards the coordination channel being at work (see Sarno and Taylor 2001). Yet a more direct test of these two channels is to ask whether financial market participants perceive that financial stability communication by central banks could be followed by monetary policy decisions, which should imply that market interest rates are reactive to such communications. As can be seen in the bottom panels of Tables 6 and 7, it is clear that there is no systematic reaction of short (3-month) or long (5 to 10 year) interest rates. Thus, this is further evidence suggesting that there is very little role for a signalling channel, but that it is rather the coordination channel that is at work.

To summarize, the findings suggest that the effects of communication are not universal. Market conditions seem to matter, with different effects during the financial crisis. The origin of the communication also is important, with central banks in advanced economies exerting different effects from those in emerging economies. A sequence of speeches and interviews seems to be affecting stock markets less than an isolated communication by the central bank governor. But importantly, speeches and interviews were moving stock returns during the crisis, while they were not in the pre-crisis period. Finally, the evidence here further supports the conclusion that it is mainly a coordination channel that is at work – i.e. that communication provides relevant information about financial stability itself, rather than giving a signal about monetary policy, thereby affecting financial markets.

5. Conclusions

This paper has provided an empirical assessment of the effects of central bank communication about financial stability, a topic that has remained almost entirely unexplored in the literature to date. The paper has studied the impact of central bank statements on financial markets, arguably one of the most important target groups of this type of communication. In more detail, it has constructed a unique dataset covering over 1000 communication events (a third of which being FSRs, and two thirds being speeches and interviews by central bank governors) by 37 central banks over a time period from 1996 to 2009, i.e. spanning nearly one and a half decades, and analyzed the reaction of financial sector stocks to these events. The

emphasis of the paper has been to identify whether financial stability-related communication "creates news" and/or "reduces noise".

The paper's findings suggest that communication about financial stability has important repercussions on financial sector stock prices. However, there are clear differences between FSRs on the one hand and speeches and interviews on the other. FSRs clearly create news in the sense that the views expressed in FSRs get reflected in stock market returns. These effects are furthermore long-lasting. They also reduce noise, as market volatility tends to decline in response to FSRs. These effects are particularly strong if FSRs contain optimistic assessments of the risks to financial stability. Speeches and interviews, in contrast, do on average move financial markets far less. In particular, while having only modest effects on stock market returns, they do not reduce market volatility. However, speeches and interviews were affecting market returns significantly more during the 2007-10 global financial crisis, indicating the potential importance of this communication tool during periods of financial stress.

The mechanism by which the central bank affects financial markets seems to be related to the notion of a co-ordination channel, whereby communication by the central bank works as a co-ordination device, thereby reducing heterogeneity in expectations and information, and thus inducing asset prices to more closely reflect the underlying fundamentals (Sarno and Taylor 2001). This conclusion is based on the finding that statements have longer-lasting effects, which seems to imply that they have the potential to change the dynamics in financial markets, and based on the result that central bank communication about financial stability does not affect market interest rates in a systematic fashion.

The paper has also demonstrated how flexibly speeches and interviews can be used as a communication tool, with a higher frequency in times of heightened financial market volatility. In contrast to FSRs with their pre-defined release schedules, the mere occurrence of a speech or an interview can constitute news to financial markets in itself, a fundamental difference that might explain why the two communication channels have so different effects on market volatility. The findings of the paper therefore underline that communication by monetary authorities on financial stability issues can influence financial market developments, but that it needs to be employed with utmost care, stressing the difficulty of designing a successful communication strategy on financial stability.

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Appendix: Examples of speeches and interviews and their coding

05 March 1996: "Brazil Central Bk President Denies Bank Sector Instability"

"Central bank President Gustavo Loyola Tuesday denied rumors of instability in Brazil's banking sector and said increasing bank investigations and encouragement for bank mergers have quelched any possibility of a crisis […]" Source: Dow Jones International News

Coded: Optimism =1

27 October 1997: "China c.banker sees more small bank bankruptcies.."

"Some smaller Chinese banks and credit cooperatives could sink into bankruptcy due to bad loans, although a banking crisis was unlikely, central bank governor Dai Xianglong has said." Source: Reuters News

Coded: Optimism =-1

28 January 1998: "U.K. BOE's George Confident Asia Contagion Can Be Avoided"

"Governor of the Bank of England Eddie George said Wednesday he was 'reasonably confident' wider financial contagion from the Asia crisis could be avoided." Source: Dow Jones International News

Coded: Optimism =1

09 November 2000: "Korea markets unstable as worries linger-c.bank."

"South Korea's financial markets continue to show signs of instability as the second phase of financial restructuring progresses, the governor of the central Bank of Korea said on Thursday." Source: Reuters News

Coded: Optimism =-1

19 September 2002: "Mboweni Confident of Financial Stability."

"SA's financial regulators are highly optimistic about the stability of the country's financial system, Tito Mboweni, the SA Reserve Bank governor, said yesterday […]" Source: All Africa

Coded: Optimism =1

10 April 2003: "Fukui says should consider preemptive move on banks."

"Bank of Japan Governor Toshihiko Fukui said on Thursday that Japan should consider ways to provide ailing banks with capital as a preemptive measure before any financial crisis occurred." Source: Reuters News

Coded: Optimism =0

24 September 2003: "Argentina's Central Bank Downplays Big Bank Restructuring"

"Plans to restructure the Argentine financial sector in the wake of last year's financial crisis do not entail a widespread shakeup of the country's banks, top Argentine Central Bank officials said Tuesday." Source: Dow Jones International News

Coded: Optimism =0

17 March 2004: "Greenspan says U.S. banking system healthy."

"Federal Reserve Chairman Alan Greenspan said on Wednesday the U.S. banking system weathered the 2001 recession well, and was in good shape to help finance the economic recovery." Source: Reuters News

Coded: Optimism =1

11 September 2007: "CREDIT WRAPUP 5-Trichet sure major banks sound, Bernanke silent"

"Europe's banks are sound despite the confidence blow from a U.S. subprime crisis, said the head of the European Central Bank on Tuesday, while the [...]" Source: Dow Jones International News

Coded: Optimism =1

05 February 2008: "ECB's Noyer: Global Fincl System In Crisis For More Than A Year"

"The global financial system has been in a crisis situation for over a year, and the crisis isn't over, Bank of France Governor Christian Noyer said Tuesday." Source: Dow Jones International News

Coded: Optimism =-1

24 September 2008: "Swedish c.bank head repeats financial system stable"

"Swedish Riksbank Governor Stefan Ingves said on Wednesday Sweden was now feeling the effects of the recent market turmoil more strongly, but repeated reassurances that the financial system was stable." Source: Reuters News

Coded: Optimism =1

03 October 2008: "Bernanke: Fed to do all it can to combat crisis"

"Federal Reserve Chairman Ben Bernanke said on Friday the U.S. central bank will do whatever it can to combat the credit crisis and help the economy." Source: Reuters News

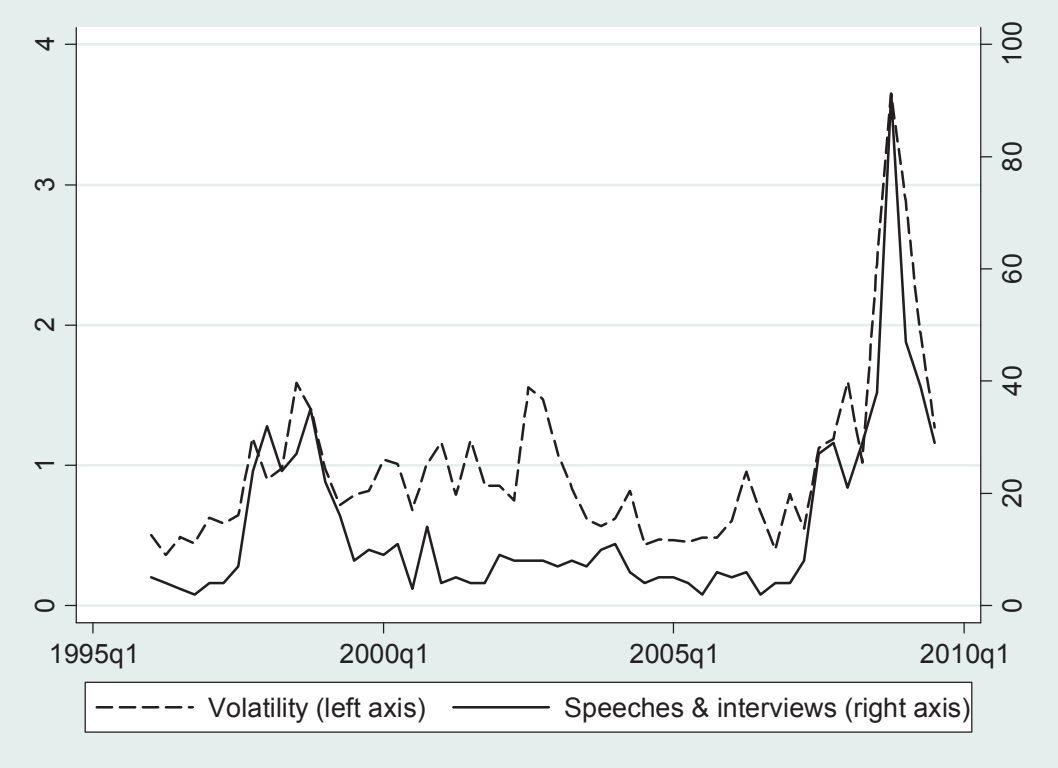
Coded: Optimism =0

06 October 2008: "Turkish banks face narrower credit channels-c.bank"

"Central Bank Governor Durmus Yilmaz said on Monday Turkish banks were facing narrower credit channels due to the global credit crisis, but said they faced no difficulty in renewing external loans." Source: Reuters News

Coded: Optimism =0

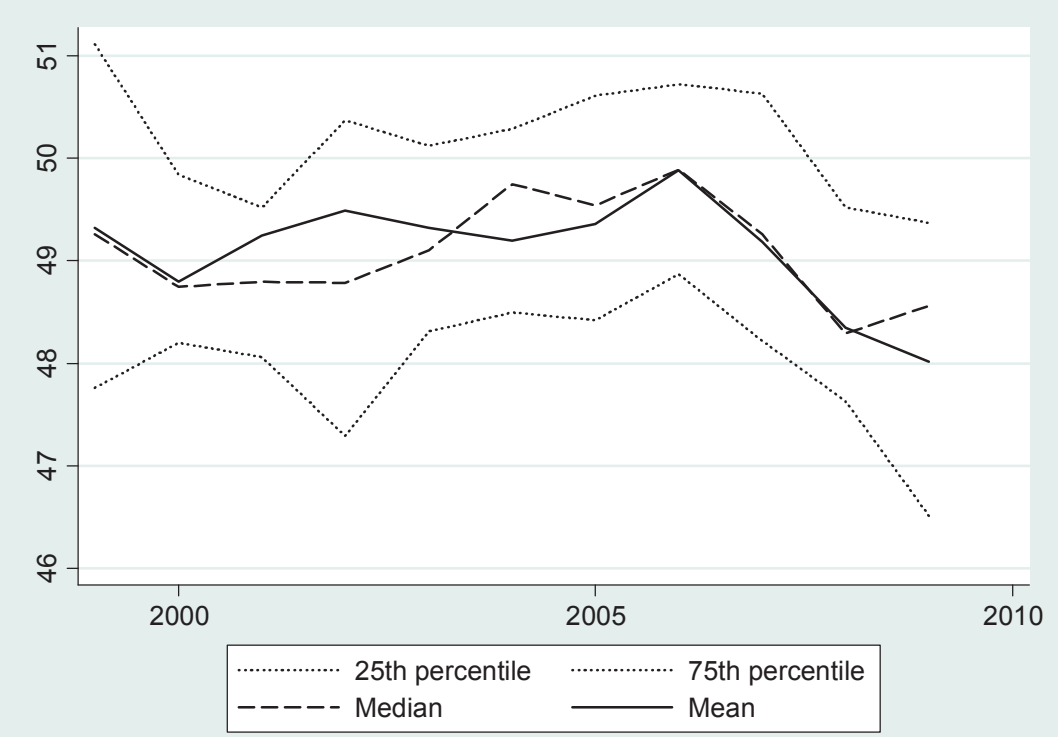
Figure 1: Stock market volatility and the occurrence of speeches and interviews



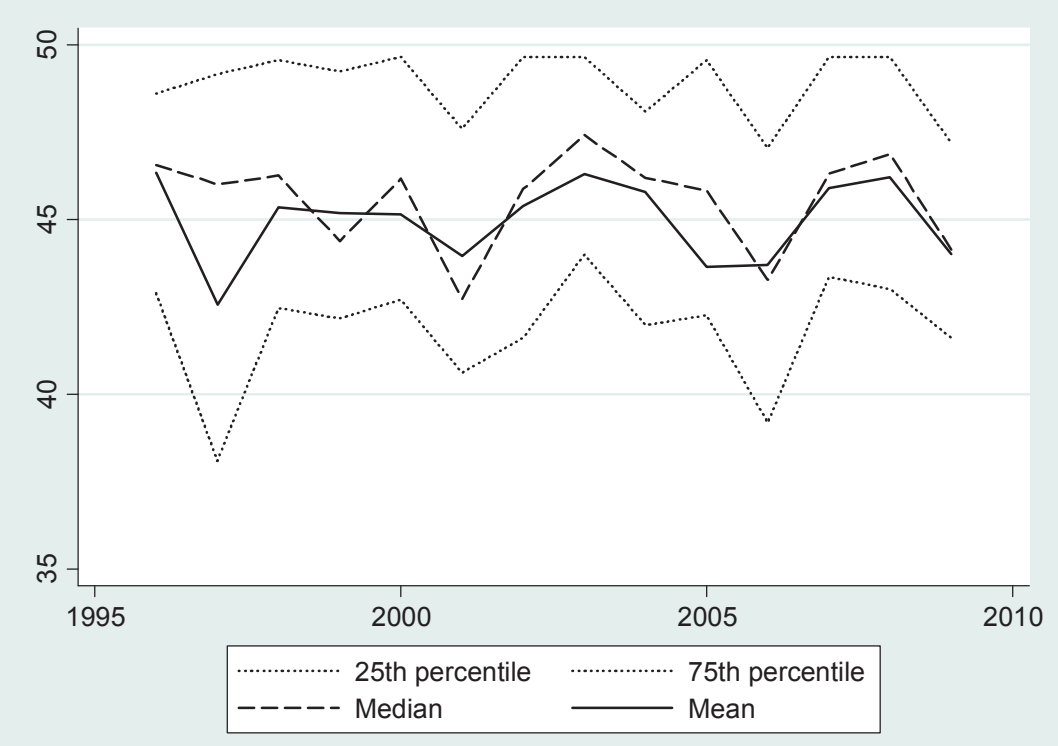
Notes: The figure shows the total number of speeches and interviews in all countries in a given quarter on the right-hand axis (solid line), and the standard deviation of daily returns of the global financial stock index in each quarter on the left-hand axis (dashed line).

Figure 2: The evolution of optimism over time

Panel A: FSRs

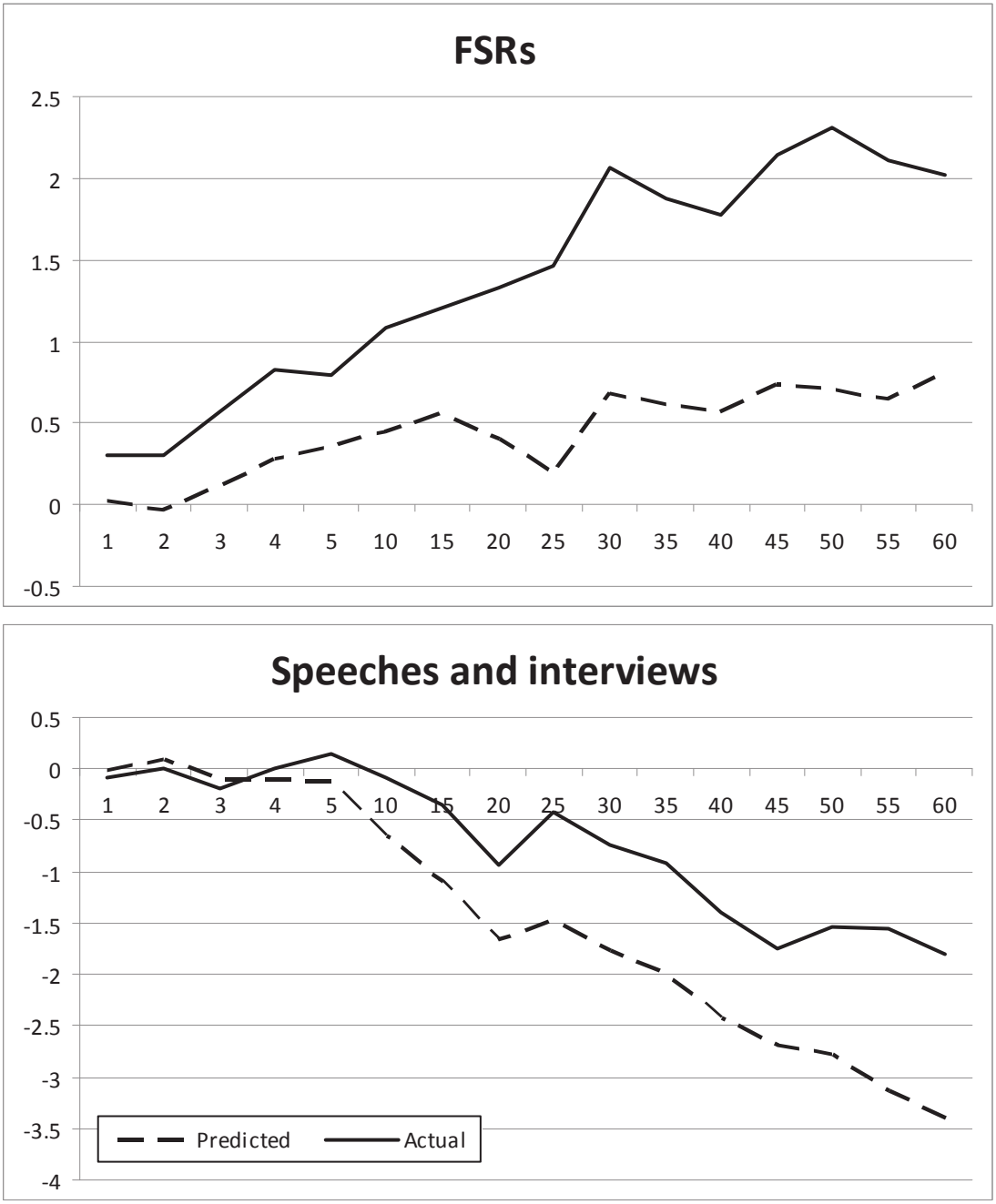


Panel B: Speeches and interviews



Notes: The figure plots the average, median, 25th and 75th percentiles of the optimism scores for FSRs (Panel A) and speeches and interviews (Panel B) in any given year.

Figure 3: Predicted versus actual evolution of stock markets after communication events



Notes: The figure compares the actual evolution of cumulated stock market returns (in %) following communication events to the predicted evolution on the basis of the benchmark model (1). The upper panel reports the results for the FSRs, the lower panel those for speeches and interviews. The solid line plots the average actual cumulated returns starting from day 1 after the communication event and up to day 60. The dashed line shows the expected cumulated returns that would result from the benchmark model in the absence of a communication event. The cumulated returns are multiplied by -1 for pessimistic communications, whereas they are left unchanged for optimistic communications.

Table 1: Summary statistics for FSRs and speeches

		FSRs	Speeches & Interviews
By country	Argentina	12	13
	Australia	11	25
	Austria	17	11
	Belgium	7	3
	Brazil	14	9
	Canada	14	22
	Chile	11	15
	China	5	28
	Czech Republic	5	11
	Denmark	11	2
	Euro Area	10	48
	Finland	23	12
	France	13	31
	Germany	5	58
	Greece	1	26
	Hong Kong	12	44
	Hungary	17	17
	Indonesia		6
	Ireland	4	2
	Israel	6	7
	Japan	8	32
	Netherlands	8	17
	New Zealand	10	18
	Norway	20	3
	Philippines		50
	Poland	10	13
	Portugal	5	8
	Singapore	7	1
	South Africa	11	20
	South Korea	9	14
	Spain	14	10
	Sri Lanka	3	2
	Sweden	24	18
	Switzerland	7	16
	Turkey	8	22
	United Kingdom	25	23
	United States		111
By year	1996	1	14
	1997	3	39
	1998	5	118
	1999	7	56
	2000	10	37
	2001	14	17
	2002	18	33
	2003	25	32
	2004	40	26
	2005	53	17
	2006	51	17
	2007	54	68
	2008	51	179
	2009	35	115
Overall		367	768

Note: The table shows the number of FSRs and speeches that are contained in the database, by country and by year.

Table 2: Stock market conditions and the occurrence of communications

	Financial Stability Reports						Speeches & Interviews					
	Returns			Standard deviation			Returns			Standard deviation		
# days	Bench-mark	Event days	Diff	Bench-mark	Event days	Diff	Bench-mark	Event days	Diff	Bench-mark	Event days	Diff
1	0.046	-0.113		--	--	--	0.046	-0.135 **		--	--	--
2	0.110	-0.069		--	--	--	0.110	-0.272 ***		--	--	--
3	0.173	-0.087		--	--	--	0.173	-0.522 ***		--	--	--
4	0.191	-0.028		4.823	4.211 **		0.191	-0.628 ***		4.823	7.820 ***	
5	0.161	-0.008		4.905	4.361 **		0.161	-0.797 ***		4.905	7.848 ***	
10	0.354	-0.260 *		5.125	4.676 *		0.354	-1.400 ***		5.125	7.783 ***	
15	0.800	-0.148 **		5.308	4.867 **		0.800	-1.476 ***		5.308	7.780 ***	
20	0.949	0.187		5.309	4.981		0.949	-2.235 ***		5.309	7.766 ***	
25	1.313	0.538		5.369	5.023 *		1.313	-2.458 ***		5.369	7.808 ***	
30	1.394	1.272		5.484	5.111 *		1.394	-2.957 ***		5.484	7.811 ***	
35	1.742	1.821		5.503	5.217		1.742	-2.967 ***		5.503	7.826 ***	
40	2.071	2.231		5.474	5.291		2.071	-2.972 ***		5.474	7.803 ***	
45	2.510	2.329		5.682	5.359		2.510	-3.224 ***		5.682	7.759 ***	
50	2.761	2.732		5.547	5.383		2.761	-3.482 ***		5.547	7.757 ***	
55	2.426	2.854		5.682	5.394		2.426	-3.801 ***		5.682	7.733 ***	
60	3.073	3.409		5.600	5.408		3.073	-3.704 ***		5.600	7.744 ***	

Notes: The table shows cumulated stock market returns and the standard deviation of daily stock market returns preceding the communication events (in columns "Event days") and for non-event days (in columns "Benchmark"). Results of mean comparison tests are given in the columns denoted by "Diff". The different rows of the table relate to different time windows prior to the event, starting from a time window of 1 business day to a time window of 60 business days. Standard deviations are only calculated for time windows exceeding 3 business days. The non-event comparison figures are calculated for a sample where no communication event has occurred in the preceding 60 business days, and no communication event follows in the subsequent 60 business days. The sample is furthermore restricted to non-overlapping observations. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 3: Stock market conditions and the content of communications

	Financial Stability Reports												Speeches & Interviews											
	Returns						Standard deviation						Returns						Standard deviation					
# days	(1) '-1'	(2) '0'	(3) '1'	(1) vs (2)	(1) vs (3)	(2) vs (3)	(1) '-1'	(2) '0'	(3) '1'	(1) vs (2)	(1) vs (3)	(2) vs (3)	(1) '-1'	(2) '0'	(3) '1'	(1) vs (2)	(1) vs (3)	(2) vs (3)	(1) '-1'	(2) '0'	(3) '1'	(1) vs (2)	(1) vs (3)	(2) vs (3)
1	-0.343	-0.208	0.186		**	**	--	--	--	--	--	--	-0.112	-0.078	-0.212				--	--	--	--	--	--
2	-0.225	-0.222	0.215				--	--	--	--	--	--	-0.248	-0.134	-0.428				--	--	--	--	--	--
3	-0.186	-0.301	0.203				--	--	--	--	--	--	-0.443	-0.287	-0.821				--	--	--	--	--	--
4	-0.157	-0.095	0.151				4.975	3.902	3.806	**	**		-0.612	-0.473	-0.794				8.305	7.714	7.475			
5	-0.022	-0.143	0.132				5.145	4.005	3.985	**	**		-0.703	-0.541	-1.130				8.268	7.783	7.524			
10	-0.948	-0.038	0.156				5.493	4.232	4.352	**	**		-1.448	-0.988	-1.751				7.753	7.956	7.643			
15	-0.765	-0.408	0.655				5.809	4.284	4.559	***	**		-1.245	-1.059	-2.091				7.774	8.035	7.539			
20	-0.744	0.007	1.199		*		5.916	4.413	4.666	***	**		-2.240	-1.645	-2.799				7.773	8.092	7.445			
25	-0.449	0.377	1.584				6.014	4.393	4.714	***	**		-1.759	-2.428	-3.131				7.783	8.123	7.529			
30	0.246	1.264	2.210				6.157	4.479	4.755	***	***		-2.613	-2.451	-3.760				7.755	8.145	7.540			
35	1.349	1.808	2.261				6.356	4.554	4.805	***	***		-2.364	-2.837	-3.648				7.755	8.171	7.559			
40	1.235	2.099	3.258				6.478	4.603	4.861	***	***		-2.136	-2.504	-4.194				7.720	8.161	7.534			
45	1.239	2.142	3.493				6.572	4.665	4.910	***	***		-2.425	-2.791	-4.376				7.700	8.106	7.478			
50	0.928	2.914	4.195				6.602	4.723	4.896	***	***		-2.797	-3.081	-4.502				7.736	8.072	7.471			
55	1.248	2.933	4.237				6.643	4.721	4.892	***	***		-3.197	-3.427	-4.723				7.682	8.064	7.461			
60	2.137	2.897	5.043				6.654	4.751	4.896	***	***		-2.755	-3.438	-4.842				7.701	8.062	7.476			

Notes: The table shows cumulated stock market returns and the standard deviation of daily stock market returns preceding pessimistic (columns (1)), neutral (columns (2)) and optimistic communications (columns (3)). Results of tests for statistically significant differences are given in the columns (1) vs (2), (1) vs (3) and (2) vs (3). The different rows of the table relate to different time windows prior to the event, starting from a time window of 1 business day to a time window of 60 business days. Standard deviations are only calculated for time windows exceeding 3 business days. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 4: Effects of FSRs

	Joint model				Pessimistic FSRs				Neutral FSRs				Optimistic FSRs			
	Returns		Standard deviation		Returns		Standard deviation		Returns		Standard deviation		Returns		Standard deviation	
# days	non-parametric	parametric	non-parametric	parametric	non-parametric	parametric	non-parametric	parametric	non-parametric	parametric	non-parametric	parametric	non-parametric	parametric	non-parametric	parametric
1	0.54	0.27 ***	-- --	-- --	0.44 '	-0.33	-- --	-- --	0.49	-0.09	-- --	-- --	0.53	0.20 *	-- --	-- --
2	0.54	0.33 **	-- --	-- --	0.46	-0.54	-- --	-- --	0.52	0.10	-- --	-- --	0.55	0.14	-- --	-- --
3	0.58 **	0.46 ***	-- --	-- --	0.40 "	-0.75	-- --	-- --	0.53	0.18	-- --	-- --	0.55	0.20	-- --	-- --
4	0.57 **	0.54 ***	0.51	-0.08 *	0.39 "'	-0.73	0.50	-0.10	0.51	0.12	0.52	-0.13 **	0.54	0.37 **	0.51	-0.02
5	0.53	0.44 **	0.53	-0.07 *	0.47	-0.49	0.51	-0.05	0.55	0.21	0.55	-0.11 *	0.54	0.39 *	0.53	-0.05
10	0.53	0.63 **	0.55 **	-0.08 **	0.50	-0.40	0.48	-0.04	0.48	-0.38	0.55	-0.08	0.56 *	0.84 ***	0.61 ***	-0.11 **
15	0.57 **	0.64 **	0.52	-0.06 *	0.44 '	-0.29	0.51	-0.08	0.51	0.02	0.50	-0.02	0.58 **	0.95 ***	0.55 *	-0.08 **
20	0.56 **	0.92 **	0.55 **	-0.05 *	0.50	-0.01	0.56 *	-0.07	0.61 **	0.51	0.55	-0.02	0.61 ***	1.75 ***	0.55	-0.06 **
25	0.57 **	1.27 ***	0.56 ***	-0.07 **	0.48	-0.28	0.60 **	-0.13 **	0.59 **	0.69	0.55	-0.04	0.62 ***	2.18 ***	0.54	-0.05
30	0.58 ***	1.39 ***	0.56 ***	-0.05 *	0.49	-0.36	0.57 **	-0.11 *	0.59 **	0.90 *	0.57 *	-0.02	0.65 ***	2.33 ***	0.55	-0.03
35	0.57 **	1.27 ***	0.56 ***	-0.05 *	0.51	0.11	0.56 *	-0.10 *	0.62 ***	1.50 **	0.55	-0.04	0.64 ***	2.53 ***	0.58 **	-0.01
40	0.53	1.21 **	0.55 **	-0.04	0.54	0.33	0.52	-0.07	0.61 **	1.47 **	0.57 *	-0.03	0.59 **	2.63 ***	0.56 *	-0.01
45	0.56 **	1.41 ***	0.55 **	-0.05 *	0.52	0.17	0.56 *	-0.12 **	0.57 *	1.45 **	0.58 **	-0.04	0.63 ***	2.86 ***	0.52	-0.01
50	0.56 **	1.60 ***	0.56 ***	-0.06 **	0.51	-0.11	0.56 *	-0.12 **	0.59 **	1.46 *	0.58 **	-0.05	0.63 ***	2.97 ***	0.55	-0.01
55	0.56 **	1.47 **	0.56 **	-0.05 *	0.55	0.31	0.58 **	-0.11 **	0.61 **	2.12 **	0.57 *	-0.04	0.66 ***	3.09 ***	0.52	0.00
60	0.55 *	1.21 **	0.55 **	-0.05 *	0.54	0.62	0.58 **	-0.11 **	0.61 **	2.66 ***	0.55	-0.05	0.63 ***	2.87 ***	0.52	0.00

Notes: The table shows results of the test for communication effects. The first set of results (Returns, non-parametric) tests the share of cases in which $\sum_{t=0}^{k} \hat{\varepsilon}_{it+k} > 0 \;\; if \;\; I_{it}^{optimism,FSR} = 1$ or $\sum_{t=0}^{k} \hat{\varepsilon}_{it+k} < 0 \;\; if \;\; I_{it}^{optimism,FSR} = -1$, for different time windows *k* in the rows of the table. The second column (Returns, parametric) shows the average size of the cumulated excess returns $\frac{1}{N}\sum_{n=1}^{N}\sum_{t=0}^{k} I_{nt}^{optimism,FSR}\hat{\varepsilon}_{nt+k}$ and tests whether these are different from zero. The columns for "standard deviation" show the share of cases in which the standard deviation of excess returns over *k* days after the release of an FSR is smaller than the standard deviation during the k days prior to the release, i.e. $\sigma_{\hat{\varepsilon}_{i,t/t+k}} < \sigma_{\hat{\varepsilon}_{i,t-1/t-1-k}} \;\; if \;\; D_{it}^{c} = 1$ (non-parametric), and their average difference (parametric), and tests these against 0.5 and 0, respectively. The second to fourth panel of the table repeats the exercise for FSRs that have been coded as $I_{it}^{optimism,FSR} = -1$, $I_{it}^{optimism,FSR} = 0$ and $I_{it}^{optimism,FSR} = 1$, respectively. Standard deviations are only calculated for time windows exceeding 3 business days. ***, **, and * indicate statistical significance against the null hypothesis at the 1%, 5%, and 10% levels, respectively. ''', '', and ' indicate statistical significance against the alternative hypothesis at the 1%, 5%, and 10% levels, respectively

Table 5: Effects of speeches and interviews

	Joint model				Pessimistic speeches and interviews				Neutral speeches and interviews				Optimistic speeches and interviews			
	Returns		Standard deviation		Returns		Standard deviation		Returns		Standard deviation		Returns		Standard deviation	
# days	non-parametric	parametric	non-parametric	parametric	non-parametric	parametric	non-parametric	parametric	non-parametric	parametric	non-parametric	parametric	non-parametric	parametric	non-parametric	parametric
1	0.45 "	-0.09	-- --	-- --	0.54	0.12	-- --	-- --	0.48	-0.06	-- --	-- --	0.45 "	-0.05	-- --	-- --
2	0.48	-0.10	-- --	-- --	0.57 **	0.38 **	-- --	-- --	0.44 "	-0.27	-- --	-- --	0.52	0.17	-- --	-- --
3	0.49	-0.10	-- --	-- --	0.52	0.28	-- --	-- --	0.46	-0.59	-- --	-- --	0.50	0.07	-- --	-- --
4	0.51	0.11	0.47 '	0.02	0.51	0.07	0.50	-0.18 *	0.45 '	-0.49	0.46	0.08	0.53	0.28	0.46	0.15 '
5	0.53 *	0.26	0.48	0.01	0.49	-0.02	0.53	-0.19 **	0.45 "	-0.47	0.45 '	0.10	0.55 *	0.48 *	0.46	0.11
10	0.55 ***	0.55 **	0.49	0.00	0.46	0.05	0.51	-0.04	0.48	-0.29	0.49	0.04	0.57 **	1.11 ***	0.46	0.01
15	0.54 *	0.74 **	0.48	0.04	0.47	0.06	0.49	0.05	0.49	-0.49	0.50	0.04	0.54	1.47 ***	0.45 '	0.03
20	0.52	0.73 **	0.49	0.06 '	0.50	0.17	0.46	0.06	0.45 '	-0.70	0.53	0.05	0.54	1.54 ***	0.47	0.07
25	0.55 **	1.04 **	0.50	0.06 "	0.47	0.04	0.48	0.04	0.45 '	-0.42	0.56 **	0.02	0.56 **	2.02 ***	0.48	0.12 "
30	0.54 **	1.04 **	0.51	0.06 "	0.50	0.63	0.50	0.04	0.46	-0.39	0.53	0.02	0.57 ***	2.55 ***	0.49	0.12 "
35	0.56 ***	1.06 **	0.50	0.06 '	0.48	0.70	0.51	0.04	0.49	-0.29	0.52	0.01	0.60 ***	2.67 ***	0.49	0.12 "
40	0.54 *	1.01 *	0.50	0.05 '	0.51	0.93	0.52	0.03	0.49	0.07	0.51	0.01	0.57 ***	2.78 ***	0.47	0.11 "
45	0.52	0.95 *	0.50	0.05 '	0.52	1.13	0.53	0.01	0.50	0.05	0.51	0.01	0.56 **	2.83 ***	0.47	0.12 "
50	0.55 ***	1.24 **	0.51	0.04 '	0.49	1.06	0.54 *	0.00	0.50	0.20	0.51	0.02	0.59 ***	3.33 ***	0.48	0.11 "
55	0.55 **	1.58 **	0.52	0.04 '	0.50	0.58	0.53	0.01	0.50	0.06	0.53	0.01	0.59 ***	3.55 ***	0.50	0.10 "
60	0.55 **	1.63 **	0.50	0.03	0.50	0.38	0.51	0.00	0.49	0.25	0.52	0.00	0.60 ***	3.45 ***	0.48	0.09 '

Notes: See notes to Table 4, but all results relate to speeches and interviews rather than FSRs.

Table 6: Effects of FSRs – sample splits and robustness

	Joint model				Pessimistic FSRs				Neutral FSRs				Optimistic FSRs			
	Returns		Standard deviation		Returns		Standard deviation		Returns		Standard deviation		Returns		Standard deviation	
	non-parametric	parametric	non-parametric	parametric	non-parametric	parametric	non-parametric	parametric	non-parametric	parametric	non-parametric	parametric	non-parametric	parametric	non-parametric	parametric
A - Benchmark	0.57 **	1.27 ***	0.56 ***	-0.07 **	0.48	-0.28	0.60 **	-0.13 **	0.59 **	0.69	0.55	-0.04	0.62 ***	2.18 ***	0.54	-0.05
B - Sample splits																
1. Country Group																
Advanced economies	0.56 *	0.91 **	0.59 ***	-0.11 ***	0.46	-0.31	0.62 ***	-0.20 ***	0.57 *	1.10 **	0.59 **	-0.09 **	0.58 *	1.62 ***	0.55	-0.03
Emerging economies	0.62 **	2.27 **	0.48	0.05	0.55	-0.14	0.50	0.20	0.64	-0.83	0.40	0.17	0.69 ***	3.21 ***	0.51	-0.07
2. Crisis versus pre-crisis																
Pre-crisis	0.63 ***	2.10 ***	0.55 *	-0.05 **	0.39 "	-1.06	0.61 **	-0.08 *	0.61 **	0.77 *	0.55	-0.01	0.64 ***	2.73 ***	0.51	-0.05 *
Financial crisis 2007-2010	0.45	-0.55	0.60 **	-0.13 *	0.58	0.65	0.58 *	-0.20	0.52	0.47	0.58	-0.11	0.52	-0.32	0.65 **	-0.01
3. Supervisory role																
CB is supervisor	0.56	1.47 **	0.55 *	-0.09 *	0.61	0.96	0.39	-0.15	0.63 *	0.50	0.56	-0.05	0.64 **	2.63 ***	0.63 **	-0.10 *
CB is not supervisor	0.58 **	1.17 **	0.57 **	-0.06 *	0.44	-0.67	0.66 ***	-0.13 *	0.57	0.79	0.55	-0.04	0.59 *	1.80 ***	0.46	0.00
C - Robustness																
All stocks	0.58 ***	1.16 ***	0.55 **	-0.02	0.50	-0.31	0.58 **	-0.05	0.54	0.00	0.48	0.04	0.66 ***	1.96 ***	0.60 ***	-0.06 **
Alternative coding	0.53	0.72 *	0.56 ***	-0.07 **	0.52	0.43	0.52	0.01	0.57 *	0.40	0.63 ***	-0.12 **	0.59 **	1.86 ***	0.54	-0.10 **
Raw Diction scores	--	0.50 ***	0.56 ***	-0.07 **	--	--	--	--	--	--	--	--	--	--	--	--
D - Testing for the signalling channel																
Short-term interest rates	0.54 *	0.05	0.55 **	0.01	0.50	-0.06	0.59 **	0.00	0.58 *	0.12 *	0.51	0.01 '''	0.58 **	0.04	0.55	0.00
Long-term interest rates	0.53	0.02	0.52	0.00	0.45	-0.03	0.51	0.00	0.57 *	0.03	0.50	0.00	0.52	0.00	0.56 *	0.00

Notes: See notes to Table 4. All results relate to the effect of FSRs at a time window of 25 days. Row 1 reports the benchmark results, each subsequent row reports results of a specific sample split or robustness test. Sample splits for advanced/emerging economies, pre-crisis/financial crisis, CB as supervisor or not. Robustness tests relate to using overall stock indices rather than financial sector stocks indices, as well as to using an alternative coding of the content of the communications, or using the raw Diction optimism scores directly, rather than their discretized versions. The last panel shows the effects on short- and long-term interest rates.

Table 7: Effects of speeches and interviews – sample splits and robustness

	Joint model				Pessimistic speeches and interviews				Neutral speeches and interviews				Optimistic speeches and interviews			
	Returns		Standard deviation		Returns		Standard deviation		Returns		Standard deviation		Returns		Standard deviation	
	non-parametric	parametric	non-parametric	parametric	non-parametric	parametric	non-parametric	parametric	non-parametric	parametric	non-parametric	parametric	non-parametric	parametric	non-parametric	parametric
A - Benchmark	0.55 **	1.04 **	0.50	0.06 "	0.47	0.04	0.48	0.04	0.45 '	-0.42	0.56 **	0.02	0.56 **	2.02 ***	0.48	0.12 "
B - Sample splits																
1. Country Group																
Advanced economies	0.54 *	1.02 **	0.48	0.07 "	0.50	0.56	0.47	0.04	0.45 '	-0.34	0.52	0.02	0.58 **	2.53 ***	0.46	0.15 "
Emerging economies	0.57 *	1.10	0.56 **	0.04	0.36 "	-1.74	0.50	0.03	0.47	-0.63	0.65 ***	0.03	0.52	0.60	0.52	0.06
2. Crisis versus pre-crisis																
Pre-crisis	0.52	0.48	0.51	0.02	0.48	-0.10	0.47	0.06	0.48	-0.88	0.55 *	0.01	0.52	0.84	0.52	0.01
Financial crisis 2007-2010	0.59 ***	1.87 **	0.49	0.11 "	0.45	0.29	0.48	0.02	0.43 "	0.10	0.56 *	0.03	0.62 ***	3.58 ***	0.43 '	0.27 "
3. Supervisory role																
CB is supervisor	0.54	0.75	0.50	0.06	0.50	0.61	0.49	-0.03	0.48	0.11	0.50	0.08	0.56 *	1.81 **	0.50	0.12
CB is not supervisor	0.56 **	1.37 **	0.51	0.06	0.44 '	-0.49	0.47	0.10 '	0.43 '	-0.97	0.62 ***	-0.04	0.57 *	2.30 ***	0.45	0.12
4. Clustering																
Speeches as part of cluster	0.51	-0.04	0.35 "'	0.43 "'	0.47	-0.20	0.24 "'	0.50 "'	0.56	1.84	0.37 '	0.36 "'	0.50	-0.22	0.41	0.45 "
Speeches outside cluster	0.56 **	1.25 ***	0.53 **	-0.01	0.47	0.08	0.52	-0.03	0.43 "	-0.86	0.59 ***	-0.05	0.58 **	2.50 ***	0.49	0.05
C - Robustness																
All stocks	0.51	0.87 ***	0.48	0.06 "	0.51	-0.22	0.48	0.05	0.48	-0.28	0.53	0.01	0.52	1.46 ***	0.44 ''	0.13 "'
Alternative coding	0.53	0.75 *	0.50	0.06 "	0.48	0.37	0.47	0.09 '	0.48	-0.51	0.53	0.01	0.53	1.84 ***	0.51	0.08
Raw Diction scores	--	0.13 **	0.50	0.06 "	--	--	--	--	--	--	--	--	--	--	--	--
D - Testing for the signalling channel																
Short-term interest rates	0.49	-0.07	0.53 *	-0.03 *	0.44 "	-0.01	0.53	-0.02	0.41 "'	-0.17	0.54 *	-0.02	0.42 "'	-0.15	0.52	-0.04 *
Long-term interest rates	0.49	-0.06	0.50	0.00	0.48	-0.02	0.50	-0.01 **	0.42 "'	-0.04	0.53	0.00	0.47	-0.12	0.48	0.01

Notes: See notes to Table 8, but all results relate to speeches and interviews rather than FSRs. The table also contains test results for speeches and interviews that are part of a cluster or not.