RESEARCH ARTICLE

Central Bank Communication and Financial Market Comovements in the Euro Area

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Abstract

We examine whether unscheduled communication of members of the European Central Bank's (ECB) Governing Council affects financial market comovements. To assess comovements, we employ well-defined measures of stock market and government bond yield coexceedances, i.e., the measures of whether markets jointly decrease or increase and by how much. We use the daily data from 2008 to 2014 for the four largest euro area countries, Germany, France, Italy and Spain, in a quantile regression framework and control for persistence in coexceedances and a comprehensive set of relevant factors capturing returns and volatility in various segments of financial markets. We find that central bank communication often contributes to greater coexceedances but only when there are extreme events in the financial markets. The results also suggest that markets perceive the ECB's communication as a euro area-wide shock, but propagation of this shock depends on the financial (in)stability of individual euro area countries.

Keywords Central bank communication · Financial market comovements · Quantile regression

JEL Classification E52 · E58

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1 Introduction

There is extensive literature examining international financial market comovements. This body of literature has largely focused on examining how economic or financial fundamentals drive financial market comovements and whether these comovements go beyond what can be explained by fundamentals (Bekaert et al. 2014; Forbes and Rigobon 2002; Longin and Solnik 2001). In contrast, we know much less about how policy news (including central bank news and its communication) drives comovements and especially whether and how policy actions and communication of these policies matter.

Central bank communication practices have changed dramatically over the last two decades. Central banks started explaining their policies to the public in a greater detail during this period, both in the area of monetary policy (Dincer and Eichengreen 2014) as well as financial stability (Horváth and Vaško 2016). ECB representatives started communicating their views even more intensively during the crisis period to provide clearer and more transparent descriptions of policy outlooks. Importantly, ECB representatives also broadened their communication, and in addition to conventional monetary policy, they also started communicating the strategy and implementation of unconventional monetary policy measures.

As a result, a large body of literature emerged examining the effects of central bank communication (see Blinder et al. 2008, and Blinder et al. 2017, for surveys). This body of literature extensively examines the effect of domestic central bank communication on domestic financial markets such as stock market or bond returns and includes a handful of studies on international spillovers of central bank communication (Hayo et al. (2010), Hayo and Neuenkirch 2012).

So far, we are aware of only one study that focuses on the effect of central bank communication on financial market comovements (Beck et al. 2013). Beck et al. (2013) examine US and Canadian bond and stock markets and investigate whether policy actions and communications of central banks in the US and Canada influence the correlations between these two markets. Beck et al. (2013) find that central bank communication and policy actions increase the correlations between the two financial markets. Additionally, in a closely related research area, Albuquerque and Vega (2009) provide evidence showing how US and Portugal macroeconomic and earnings news matter for the stock market comovements between these two countries. They find that Portuguese macroeconomic news reduces comovements and other news is irrelevant.

In this paper, we use an extensive dataset of the unscheduled communication of the European Central Bank (ECB)'s Governing Council members and examine how the ECB's central bank communication affects financial market comovements in the euro area.[1] The euro area is characterized by the common monetary policy determined by the ECB with the intent to affect economic conditions in the euro area as a whole. The evidence for the effect of central bank news on financial market comovements is very scarce, and to our knowledge, it is not available for the euro area.

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[1] We understand unscheduled communication to be any verbal or written statement by a member of a policy-making body (the Governing Council in the case of the ECB, i.e., the executive board of the ECB and national central bank governors) that occurs outside of any scheduled release of a central bank.

According to the Treaty on European Union, the primary objective of the ECB is to maintain euro area-wide price stability, and therefore, its communication should primarily focus on euro area-wide issues. Under these conditions, the ECB's communication is likely to increase financial market comovements if the communication is clear and concerns the euro area as a whole. The main hypothesis is also underpinned by Pastor and Veronesi (2012), who find an increase in stock market comovements can be explained by political uncertainty. Their model predicts that economic policy news should increase correlations among stock markets around the world, because political uncertainty drives increases in the volatility of individual stocks. Interestingly, this suggests that transparent central bank communication can reduce diversification possibilities by inducing greater comovements among financial assets.

However, central bank communication may have heterogeneous effects on comovements among individual euro area countries. Although unconventional monetary policy is pursued with the euro area considerations, specific programs selectively aimed at dysfunctional segments are often determined geographically. For instance, purchases of the sovereign debt of specific countries within the Securities Markets Programme (SMP) aimed to normalize yields in distressed countries; at the same time freed cash could easily flow to core countries' sovereigns and compress prices and lift yields. The announcements regarding this program may then propagate heterogeneously into the euro area financial markets, decreasing comovements. Leombroni et al. (2018) examine the effect of ECB communication on bond yields and find the homogeneous reaction of yields in the euro area before the period of sovereign debt crisis. After that, the reaction became heterogeneous and ECB communication affected the difference between yields in core and peripheral euro area countries.

Previous literature often employed models, which treat comovements as a linear phenomenon, while financial market comovements may have a nonlinear structure (Bae et al. 2003; Baur and Schulze 2005). To account for nonlinearity, we apply the coexceedances measure developed by Baur and Schulze (2005), which builds on an original measure of comovements by Bae et al., (2003). Baur and Schulze (2005) define coexceedances as the joint occurrence of extreme returns in two or more markets. In addition, we also employ the quantile regression framework by Baur and Schulze (2005) to examine whether the effects of central bank communication on financial market comovements matter depending on the conditional quantile of the dependent variable. Markets may process central bank communication selectively, paying more attention in more turbulent times (see Matejka et al. 2017 on the theory of rational inattention or Gertler and Horvath 2018, which shows that European financial markets respond to ECB news selectively).

Examining the stock market and sovereign bonds daily series between 2008 and 2014 (i.e the period prior the zero lower bound) for the largest EU countries (Germany, France, Italy and Spain) and the ECB's unscheduled communication, we find that central bank communication contributes to greater financial market comovements but only when financial markets exhibit extreme values. This result holds even if we control for the persistence of comovements and many economic and financial fundamentals. As a result, this finding shows that financial markets perceive the ECB's unscheduled communication as a euro area-wide shock. This finding also provides little support for the notion that central bank communication can limit concurrent extreme events in financial markets.

The remainder of the paper is structured as follows. We provide a literature survey in section 2. We present our model in section 3. Section 4 provides our empirical results. Concluding remarks are presented in section 5. An appendix, including a description of the data, additional figures and regression results follows.

2 Related Literature

We briefly survey the literature on central bank communication in this section and focus specifically on studies addressing the effect of communication on financial markets. We refer to Bekaert et al. (2014), Forbes and Rigobon (2002) and Longin and Solnik (2001) and references therein for the literature on financial market comovements.

Central banks play an important role in the overall functioning of financial markets and frequently communicate their views on the economy through a number of channels, using both scheduled and unscheduled announcements such as regular central bank publications, reports, speeches, interviews, press conferences, committees voting records or minutes (Blinder et al. 2008).

Central banks' communications on financial stability have become more transparent in last two decades. Horváth and Vaško (2016) construct an index of central bank transparency regarding the communication of financial stability issues for a global sample of countries and find that the overall transparency increased over time; in addition to economic and financial characteristics, this increase was driven by previous experience on monetary policy transparency. Horváth and Vaško (2016) show that there is an optimal level of transparency that promotes financial stability.

There is an extensive body of literature examining the effect of domestic central bank communication on domestic financial markets. This literature uses both daily and intraday data and often focuses on the US Federal Reserve, the ECB, and a few other major central banks. The literature reports that financial markets typically react to central bank communication and that all different forms of communication matter (both scheduled and unscheduled announcements); see Blinder et al. (2008) for a survey. Coenen et al. (Coenen et al. 2017; Coenen et al. 2018) provide an in-depth analysis of central bank communication during the crisis, focusing on the experience of the ECB with unconventional policy measures and its consequences for market uncertainty. Belke (2018) discusses the ECB central bank communication practices with respect to the interaction with political sphere.

Born et al. (2014) find that communication regarding financial stability by central banks contains relevant information for markets. More specifically, Born et al. (2014) provide evidence that Financial Stability Reports (FSR) reduce market volatility and affect stock market returns. Additionally, the intensity of communication regarding financial stability has increased in the period since the recent global financial crisis (Born et al. 2014). Hansen and McMahon (2018) discuss how central bank generate surprises to the markets and note that central bank communication has both high-frequency and low-frequency component; announcements related to monetary policy framework such as inflation target change represent the low-frequency communication. The low-frequency communication may have important effects to anchoring inflation expectations.

Using intraday data, Ranaldo and Rossi (2010) examine the reaction of Swiss financial markets (bond, equity and foreign currency markets) to monetary policy

announcements, interviews and speeches by the board members of the Swiss National Bank. They find that financial markets significantly react to scheduled written communication (e.g., monetary policy announcements) as well as to unscheduled verbal communication (e.g., interviews and speeches).

Using minute-by-minute data, Gertler and Horvath (2018) examine how the verbal communication of the ECB's Executive Board and national central bank governors affects financial markets (interest rates, exchange rates and stock markets) controlling for the lagged central bank communication, financial market uncertainty, excess liquidity and lagged values of financial markets. They confirm the relevance of verbal communication primarily for interest rates with the reaction of the stock market and exchange rates remains more muted. Cieslak and Schrimpf (2019) examine the communication of several central banks and make a distinction between monetary policy related news and non-monetary news. They find that financial markets responded more strongly to non-monetary news during the crisis times, while monetary news become dominant after 2013.

Ehrmann and Fratzscher (2007a) compare individualistic communication practices by the US Federal Reserve and the collegial approach used by the ECB and show that regardless different communication strategies, both central banks significantly affect interest rates. On the other hand, Briere (2006) investigates the effect of central bank communication on interest rate options and finds that speeches given by US Fed Chairman Greenspan are more influential than those made by the ECB's President Duisenberg. In addition, Ehrmann and Fratzscher (2007b) find that timing in central bank communication matters, with communication events closer to monetary policy meetings exerting a stronger effect on financial markets.

Using the speeches of US Fed representatives from 1998 to 2009, Hayo et al. (2015) make a distinction between the effect of hawkish and dovish speeches. The bond yields react to both hawkish and dovish speeches, but the reaction to the dovish speeches is stronger. In addition, the markets react more strongly to the Chairman and during financial crisis.

The literature examining the effect of domestic central bank communication on foreign financial markets is scarcer. Hayo et al. (2010) investigate the effect of US Fed monetary announcement and speeches on financial markets in Europe and the Pacific region. While both European and Pacific region markets respond to US Fed events, the European reaction tends to be more pronounced. Hayo and Neuenkirch (2012) examine the effects of the US Fed monetary policy communication on Canadian financial markets and find important international spillovers of US Fed monetary policy communication.

Similarly, Beck et al. (2013) employ a multivariate GARCH model and examine US and Canadian stock and bond markets and how their conditional correlation is affected by the policy actions and communications of central banks in the US and Canada. The results suggest that the conditional correlation increases following central bank actions.

3 Data

We use two main sources of data. First, we use the data on unscheduled communication of ECB Governing Council members. Second, we use stock market and government bond yields data for the four largest euro area countries: Germany, France, Italy and Spain.

3.1 ECB Communication Data

The source of our ECB communication data is Gertler and Horvath (2018). The dataset contains unscheduled communication of the ECB Governing Council members between July 2008 and January 2014, which originally appeared in Reuters News for Thomson Reuters Eikon. Therefore, the central bank communication data covers mainly the period of global financial crisis and ends before the monetary policy reaches the zero lower bound. Following Ehrmann and Fratzscher (2007a), the dataset contains only unscheduled communication - forward-looking statements made by Governing Council members between monetary policy decision meetings.

Gertler and Horvath (2018) classify the statements as to whether the communication event contains a hawkish tone, i.e., dwelling on upward risks to price stability, positive economic outlook or future policy tightening and/or unwinding unconventional monetary policies. In such a case, the communication event is attributed a value of 1. The value −1 is conversely assigned to a dovish tone of communication. Communication events with a neutral outlook are assigned with 0.

We use daily data in our regressions. In cases where multiple communication events fall on the same date, we use the average value of communication events.

Figure 1 presents the moving average of our communication events code. We observe negative values of the code in late 2008 and the first half of 2009 coinciding with the period of sharp ECB interest rate cuts. Recovery in 2011 and consequent upward inflation risks are also well reflected by the very hawkish tone visible in the figure.
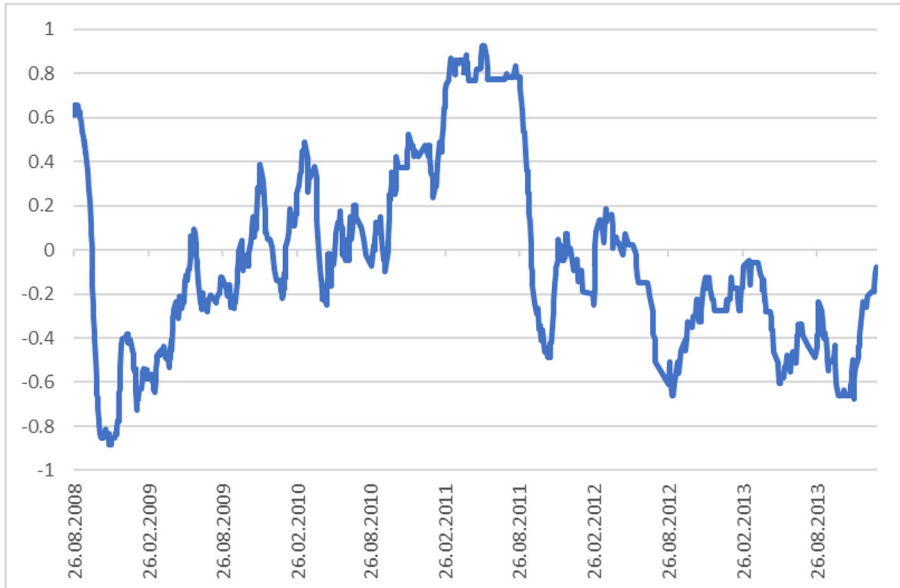

Fig. 1 Trends in ECB Communication. Note: The figure presents the moving average of the communication events code. The moving average of 20 days is used to see the communication trend more easily. The communication event code is equal to 1 if the event contains a hawkish tone of communication, i.e., noting upward risks to price stability, positive economic outlook or future policy tightening, including unwinding unconventional policies. A value of −1 is assigned to a dovish tone of communication. The communication events with a neutral message are attributed a value of 0

In terms of frequency of central bank communication events, we observe 1384 forward-looking communication events between 1st July 2008-31st January 2014. If we exclude the weekends and (German) public holidays, there are 1420 days between 1st July 2008-31st January 2014 indicating that there is approximately one communication event per day. The ECB representatives issued 39% negative comments, 30% neutral comments and 31% positive comments during our sample period.

3.2 Financial Market Data

We use national stock market indexes and sovereign bond yields in four euro area countries (Germany, France, Spain and Italy). Government bond yields with 1-year and 5-years maturity are taken from Bloomberg, and the German Deutscher Aktienindex (GDAXI), the French Cotation Assistée en Continu (CAC PAX), the index of the Spanish Continuous Market (IBEX) and the Dow Jones index for Italy (DWIT) are obtained from Thomson Reuters Eikon for Wealth Management. Following Baur and Schulze (2005), all stock market indexes and sovereign bond yields are standardized to zero mean and unitary variance.

We present the evolution of the (normalized) stock market indexes and sovereign bond yields over time in Figs. A.1-A.13 in the Appendix. Stock market volatilities increase following the fall of Lehman Brothers and again during the peak of the European debt crisis in the second half of 2011. Sovereign bond yield volatility increases after 2010 and especially after 2011 with the outbreak of the sovereign debt crisis. While government bond yield volatility seems to be lower on average compared to stock market volatility, some notable extreme events in the yields are present, too.

3.3 Control Variables

To assess the effect of central bank communication on financial market comovements, we control for a number of variables. To put some structure into our empirical model, our control variables largely follow the literature on stock market coexceedances (Baur and Schulze 2005; Horváth et al. 2018; Horváth and Lyocsa 2018), as this literature shows that the control variables are often relevant for financial market comovements. These control variables capture foreign or global factors for different economically important asset classes. The scatter plots of all control variables are available in Figs. A.14-A.23 in the Appendix.

Exchange Rate We use the nominal exchange rate USD/EUR from the ECB Statistical Data Warehouse. The exchange rate behavior has been characterized both by appreciation and depreciation episodes. The exchange rate volatility is time-varying, but there is no clear persistent upward or downward trend.

Gold Prices Spot prices of gold are obtained from the website of the World Gold Council. The price of gold was rising almost steadily until the beginning of 2013 and witnessed substantial decline afterward. Gold prices exhibited the highest volatility following the fall of Lehman Brothers.

US Treasury Securities Yields U.S. Treasury securities yields at 20-years constant maturity in percent are obtained from the US Fed (Board of Governors Federal Reserve). While the yields fluctuate around some long-term value, they decreased in 2012 and exhibited higher volatility around this year, too.

Oil Prices The source of Europe Brent Oil spot price (USD/barrel) data is the website of the US Energy Information Administration. Oil prices decreased rapidly in 2008–2009, which was also the period characterized by the highest volatility.

European Stock Market We take Eurostoxx 50 from Reuters Wealth Management. Eurostoxx 50 volatility peaks after the fall of Lehman Brothers and then also increases somewhat during the European sovereign crisis in 2011.

4 Empirical Model

Following Baur and Schulze (2005), the measure of financial market comovements is constructed using coexceedances as:

$$
Coex_t = \begin{cases} \min(R_1, R_2) & if & R_1 > 0, R_2 > 0 \\ \max(R_1, R_2) & if & R_1 < 0, R_2 < 0 \\ 0 & & otherwise \end{cases} \tag{1}
$$

where R_i is the standardized return for market i at time t so that the standard variable has a zero mean and unitary variance. Standardization is performed on the market returns R_t defined as:

$$
R_t = ln\left(\frac{P_t}{P_{t-1}}\right) \tag{2}
$$

P_t represents index or price at time t for market i. Standardized yields are used in case of bond markets replacing standardized stock return in eq. (1). Because of standardization, the coexceedances have a straightforward interpretation. If the coexceedance has a value of x, then both returns are at least x standard deviation from the mean (Baur and Schulze 2005).

This measure provides the value of bivariate joint occurrence of market return declines or increases. We present the coexceedances among the four euro area countries in Figs. 2 and 3. In general, coexceedances reflect spillovers in the same direction across markets. Stock market coexceedances increased, especially after the fall of Lehman Brothers in late 2008 and then again during the European sovereign crisis in 2011.

Evidence from the coexceedance measure signals the presence of an integrated stock market but relatively diverse government securities markets in the largest euro area countries. While stock market pairs rarely do equal zero, i.e., diverse daily returns are rarely observed, this is a rather usual and persistent issue in the securities market (persistent zero level of coexceedance around events of heightened uncertainty). Moreover, such coexceedance equaling zero can only be found in pairs of countries, one being more of a safe haven type (Germany, France) and the other a stressed type (Spain, Italy).

The two turbulent periods around the global financial crisis and European debt crisis fully expose polar characteristics of these securities important for investment decisions.

Standardization of both market returns to zero mean and unitary variance before coexceedance calculation provides a direct interpretation of coexceedance measure.

To examine the effect of central bank communication on financial market comovements, we use the quantile regression (and compare the results to the ordinary least squares regressions). Application of quantile regression requires no distributional assumptions, unlike the logistic regression or application of extreme value theory. The quantile regression model can be written as:

$$Coex = X\boldsymbol{\beta}(\tau) + \varepsilon(\tau) \ \ where \ \ Q_{\varepsilon(\tau)}(\tau|X) = 0 \tag{3}$$

where $\varepsilon(\tau)$ is error term, $\boldsymbol{\beta}(\tau)$ is ($m \times 1$) vector of parameters, X stands for ($n \times m$) matrix of m explanatory variables and $Coex$ represents ($n \times 1$) coexceedance vector.

The conditional τ-th quantile can be expressed as follows:

$$Q_{Coex}(\tau|X) = X\boldsymbol{\beta}(\tau) \tag{4}$$

More specifically, we estimate the following equation:

$$\begin{aligned} Q_{Coex,t}(\tau|X) = {}& \beta_1 Coex_{t-1} + \beta_2 r\_fx_{t-1} + \beta_3 Vol\_fx_{t-1} + \beta_4 r\_oil_{t-1} + \beta_5 Vol\_oil_{t-1} \\ & + \beta_6 r\_bond_{t-1} + \beta_7 Vol\_bond_{t-1} + \beta_8 r\_gold_{t-1} + \beta_9 Vol\_gold_{t-1} \\ & + \beta_{10} r\_stx_{t-1} + \beta_{11} Vol\_stx_{t-1} + \beta_{12} Communication_{t-1} + u_t \end{aligned} \tag{5}$$

Along with the value of the central bank communication code ($Communication_{t-1}$), we include the following explanatory variables: lagged coexceedances ($Coex_{t-1}$), exchange rate returns (r_fx_{t-1}) and its volatility (Vol_fx_{t-1}), oil returns (r_oil_{t-1}) and its volatility (Vol_oil_{t-1}), US Treasury bond returns (r_bond_{t-1}) and its volatility (Vol_bond_{t-1}), return on gold (r_gold_{t-1}) and its volatility (Vol_gold_{t-1}), and European stock market returns (r_stx_{t-1}) and its volatility (Vol_stx_{t-1}).
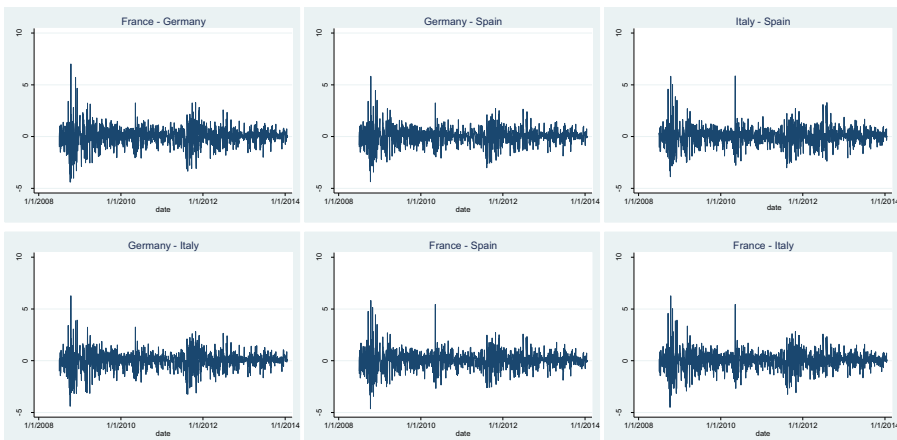

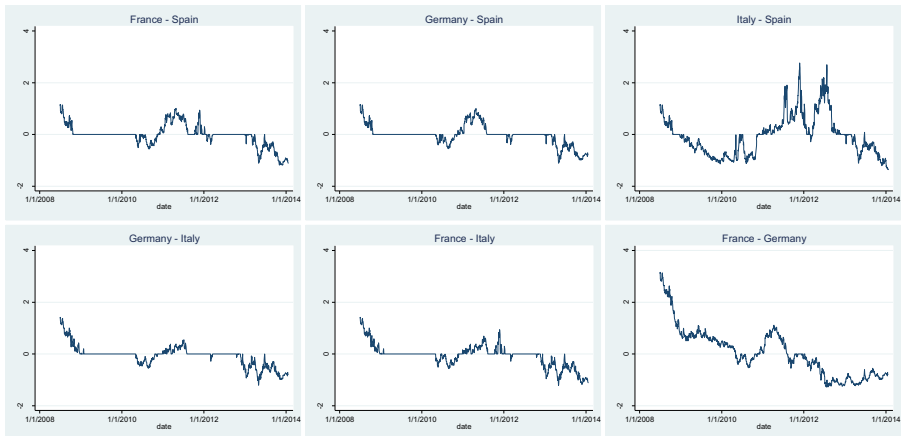Fig. 2 Stock Market Coexceedances in 4 Euro Area Countries

Fig. 3 Government Bond Yields (5y) Coexceedances in 4 Euro Area Countries

All explanatory variables are lagged by 1 day to rule out simultaneity concerns. The control variables are in log returns to achieve stationarity (the original series have been tested for the unit root using the augmented Dickey-Fuller test and for stationarity using the KPSS test). Volatilities are computed based on GARCH(1,1) for the corresponding asset class.

The expected effect of central bank communication ($Communication_{t-1}$) on coexceedances is a priori unclear. Obviously, the sign of the expected effect is likely to depend on the conditional τ-th quantile. For τ equal to median, if ECB communication is perceived by the markets as a euro area wide shock, it is likely that the coefficient for $Communication_{t-1}$ will be positive. It may also be the case central bank communication will induce comovements in financial markets only in case of extreme events when the market incorporates news more strongly because more is at stake. In some sense, this could potentially suggest some rational inattention on the side of financial markets (Matejka et al. 2017) and/or selective attention to news (Gertler and Horvath 2018).

Following Baur and Schulze (2005), Horváth et al. (2018) and Horváth and Lyocsa (2018), among others, we control for the persistence in coexceedances ($Coex_{t-1}$) to capture possible clustering of extreme events.

The use of control variables is rationalized by adjusting for European and global factors. For τ equal to the median, we expect that higher returns and volatility of control variables are likely to increase the coexceedances. We control for different asset classes because the spillovers among these classes are typically notable (Baruník et al. 2016; Guo et al. 2011) with nonnegligible liquidity spirals (Brunnermeier and Pedersen 2009) and flight to quality effects (Caballero and Krishnamurthy 2008).

5 Results

Table 1 presents the quantile regression results of the central bank communication effect on stock market coexceedances. We present the results for all pairs of stock markets for various quantiles. We present only the coefficient of communication effects on coexceedances; the estimated coefficients for control variables are available in the online Appendix.

Table 1 The effect of central bank communication on stock market coexceedances

Quantile	1	10	25	50	75	90	99	OLS
DE-FR	0.35***	−0.02	−0.01	0.01	0.61 (0.67)	0.11	0.14***	0.08
	(0.01)	(0.10)	(0.09)	(0.04)		(0.09)	(0.03)	(0.06)
DE-IT	0.05***	−0.07	−0.02	0.01	0.08 (0.06)	0.15*	−0.18***	0.07
	(0.02)	(0.12)	(0.08)	(0.04)		(0.08)	(0.01)	(0.05)
IT-ES	−0.04***	0.05	0.02	0.01	0.11*	0.07	−0.22 (0.17)	0.07
	(0.01)	(0.12)	(0.08)	(0.03)	(0.60)	(0.11)		(0.05)
DE-ES	−0.05 (0.05)	−0.06	−0.01	0.01	0.11*	0.07	−0.22***	0.06
		(0.10)	(0.08)	(0.03)	(0.60)	(0.12)	(0.01)	(0.05)
FR-ES	0.13***	−0.04	−0.05	0.01	0.12**	0.09	0.15 (0.11)	0.07
	(0.03)	(0.12)	(0.08)	(0.03)	(0.60)	(0.13)		(0.05)
FR-IT	0.03**	−0.06	0.01	0.01	0.10*	0.10	−0.03 (0.08)	0.06
	(0.01)	(0.10)	(0.08)	(0.03)	(0.05)	(0.13)		(0.05)

*, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively. Standard errors are reported in parentheses. The control variables are as follows: returns on currency, currency volatility, returns on oil, volatility of oil, returns on US securities, securities volatility, returns on gold, gold volatility, volatility of national stock market and returns on national stock market. The coefficients and standard errors on control variables are not reported (but are available in the online Appendix)

Our results suggest that central bank communication matters for the coexceedances only in the case of extreme events. The coefficient for communication at the 1% quantile is typically positive, suggesting that central bank communication is associated with stock market comovements at the time when stock markets are plummeting, controlling for a number of relevant economic and financial variables. The coefficient in the OLS regression is also positive, but the standard errors are large. The increase in stock market comovements following policy news is in line with the theoretical prediction from the Pastor and Veronesi (2012) model. This finding also complies with empirical evidence by Beck et al. (2013), who find that stock market correlations between the US and Canada increase once central bank communication news is released.

However, the association between coexceedances and central bank communication is not uniform across the pairs of countries even in the tails of the distribution of the coexceedance measure. Both positive strongly significant and negative strongly significant coefficients are present in the 1% and 99% quantile over different pairs of countries. Why do we observe such a heterogeneity?

A strongly significant and positive coefficient for Germany-France of 0.35 suggests that while stock markets in both countries were quickly contracting, strongly dovish communication was prevailing. We observe a less powerful, but still significant, result for most other pairs of countries. The exception is the coefficient estimate for the Italy-Spain pair. This seemingly counterintuitive coefficient for this country pair is likely to be driven by the economic developments of late 2010 and 2011. While the core countries of the euro area were going through recovery, policymakers were sending hawkish messages since early 2010 (see Fig. 1). which also later materialized in monetary policy tightening in 2011. However, the markets almost immediately understood that monetary policy tightening could be harmful to the insufficiently capitalized banking sector of more sensitive countries and respective market indexes of these countries were falling. Consequently, these negative expectations materialized in

drained liquidity in some financial market segments. In response, the ECB introduced the Securities Market Program in 2010 and 2011 to rebalance liquidity positions of the mainly Italian and Spanish banking sector and provided 1 billion EUR in 3-years LTROs in late 2011.

The opposite story can be revealed from the coefficients on the other tail of coexceedance distribution. In general, the negative significant coefficients (around −0.2) show that dovish central bank communication precedes positive stock market returns across countries. However, for the core countries (Germany-France), policy loosening is more related to foreseen turbulences on the periphery, while hawkish messages signal a recovery that foremost affects the core countries; therefore, these markets adjust upwards together.

We present the regression results on the effects of central bank communication on the sovereign market coexceedances in Table 2. Regarding the 1st quantile, the strongest and most significant relationship is on the upper tail of distribution in the pair of periphery countries Italy-Spain and France-Spain. On the other tail (99th), the higher coefficients that exhibit significance are linked to the growing risk premium on sovereign bonds after prevailingly hawkish comments in the course of the build-up phase of the debt crisis. For both the risk premium build-up and downward adjustment due to SMP purchases, the most affected are short maturity sovereign bonds, which aligns well observable history of periphery countries during the debt crisis.

Using the OLS, we find that the effect of central bank communication on government bond yields comovements is often positive and significant. This result shows that central bank communication is perceived by the markets as a euro area-wide shock contributing to greater comovements in this financial market segment.

The control variables are typically statistically significant and exert the expected sign (available in online Appendix), especially for very high and very low quantiles. Therefore, this result paints a similar picture as does the effect of central bank communication, namely, that extreme events respond disproportionately more strongly to small changes in fundamentals (i.e., a sort of amplification mechanism).

As a robustness check, we exclude the days when macroeconomic news was released from our regressions. We consider the following macroeconomic news: Eurostat's new release of the euro area consumer price index (HICP) and gross domestic product (GDP) releases, including the releases of their flash estimates. The results are available in Tables A.3 and A.4 in the Appendix and largely support our baseline findings. As a consequence, this result suggests that releases of macroeconomic news do not affect the impact of central bank communication on financial market comovements.

Overall, our results suggest that unscheduled central bank communication matters for the financial market comovements, and typically the comovements become stronger following the communication. In this regard, we confirm the findings of Beck et al. (2013), who examined the case of US and Canada. However, our results are different in the sense that we analyze the international financial markets comovements in a monetary union, which, to our knowledge, has not been examined before. We also observe an amplification mechanism, i.e., the fundamentals matter more strongly when there is a joint occurrence of extreme events on financial markets. Finally, our results also point to some heterogeneity among the euro area countries, where financial market comovements differ somewhat for countries undergoing economic or financial difficulties.

Table 2 The effect of central bank communication on government bond yields coexceedances

Quantile	1		10		25		50		75		90		99		OLS	
	a	b	a	b	a	b	a	b	A	b	a	b	a	b	a	b
DE-FR	0.01*** (0.00)	−0.01 (0.01)	0.01** (0.00)	0.00 (0.01)	0.01 (0.01)	0.07* (0.03)	0.01 (0.01)	0.03 (0.02)	0.01 (0.01)	0.04 (0.03)	0.01** (0.00)	0.00 (0.01)	0.01*** (0.00)	0.01 (0.02)	0.01** (0.00)	0.00 (0.00)
DE-IT	−0.03 (0.02)	0.01 (0.02)	0.00 (0.01)	0.01 (0.01)	0.03 (0.02)	0.01 (0.01)	0.01 (0.01)	0.01 (0.01)	0.01 (0.02)	0.01 (0.02)	0.00 (0.01)	0.01 (0.01)	0.04 (0.03)	0.03 (0.05)	0.00 (0.00)	0.01** (0.00)
IT-ES	0.07*** (0.01)	−0.00 (0.00)	0.01 (0.01)	0.01** (0.01)	0.03 (0.03)	0.02 (0.05)	0.01 (0.01)	0.02 (0.03)	−0.01 (0.01)	0.06 (0.06)	0.01 (0.01)	0.01* (0.01)	0.02*** (0.00)	−0.01 (0.01)	0.02*** (0.01)	0.01** (0.00)
DE-ES	0.06*** (0.02)	0.00 (0.01)	0.01 (0.01)	0.02*** (0.01)	0.01 (0.01)	0.02 (0.02)	0.01 (0.01)	0.01 (0.01)	−0.01 (0.01)	−0.01 (0.02)	0.01 (0.01)	0.02*** (0.01)	0.03*** (0.01)	0.01** (0.00)	0.01*** (0.00)	0.01*** (0.00)
FR-ES	0.07*** (0.04)	0.01 (0.02)	0.01* (0.01)	0.03*** (0.01)	0.01 (0.01)	0.09** (0.04)	0.01 (0.01)	0.03* (0.02)	0.01 (0.01)	0.04 (0.03)	0.01* (0.01)	0.03*** (0.01)	0.03*** (0.00)	0.05*** (0.00)	0.01*** (0.00)	0.01*** (0.00)
FR-IT	−0.02 (0.02)	0.01 (0.01)	0.01 (0.01)	0.02*** (0.01)	0.04*** (0.01)	0.10** (0.05)	0.01 (0.01)	0.02 (0.02)	0.01 (0.01)	0.03 (0.03)	0.01 (0.01)	0.02*** (0.01)	0.02 (0.03)	0.09*** (0.02)	0.00 (0.00)	0.01*** (0.00)

*, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively. Standard errors are reported in parentheses. The columns denoted by a) provide the results for 1-year government bonds, while b) stands for 5-years government bonds. The control variables are as follows: returns on currency, currency volatility, returns on oil, volatility of oil, returns on US securities, securities volatility, returns on gold, gold volatility, volatility of national stock market and returns on national stock market. The coefficients and standard errors on control variables are not reported (but are available in the online Appendix)

6 Concluding Remarks

We examine the effect of unscheduled central bank communication on financial market comovements. We use a comprehensive daily database of speeches, conference discussions and interviews of the ECB's Governing Council members from 2008 to 2014. We measure financial market comovements using the coexceedances measure by Baur and Schulze (2005), i.e., the joint occurrence of large/extreme market returns in two separate financial markets. We calculate the coexceedance measure for the four largest euro area countries, France, Germany, Italy, and Spain, both for stock markets and government bond yields. While there is a sizable body of literature examining the effect of central bank communication on financial markets, to our knowledge, the effect of central bank communication on financial market coexceedances has not yet been examined.

The ECB's objective is to promote price stability in the euro area and therefore, its communication typically has a euro area-wide perspective. If markets are well integrated, signals from ECB communication should propagate to these markets and intensify financial markets comovements. We indeed find evidence of higher comovements as a response to central bank communication; however, this is often only the case for extreme joint returns in the markets. According to this result, central bank communication during times of crisis (or extreme events) exhibits disproportionately stronger effects on the markets.

We also find evidence of specific patterns of financial market comovements in cases of specific pairs of countries. Our results suggest persistent heterogeneity in the assessment of sovereign debt and its intensification during turbulent times, unless these heterogeneities are tackled by appropriately designed policy. In the absence of euro area fiscal authority, nonlinear properties of confidence make the sovereign debt of euro area countries an alternative investment (conservative vs. return-bearing), with unconventional monetary policy measures trying to patch this heterogeneity. Bond markets commove as a response to central bank communication much more if they share common characteristics. If not, only a strong signal paired with policies that release tensions from sensitive markets[2] helps markets to move in single direction.

In terms of future research, we believe we need more evidence on how central bank communication (and other central bank measures) affects international financial spillovers and comovements, especially in the upcoming monetary policy normalization in the euro area. The research may also focus specifically on communication regarding macroprudential measures and how the effects of macroprudential-oriented communication depend on the level of the country's financial stability. In addition, it would be interesting to examine the effect of ECB communication on financial comovements among small euro area countries, among core-peripheral euro area countries or among the euro area countries substantially hit by the financial crisis (such as Greece).

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[2] In our sample, a secondary market purchase program is actively helping to restore confidence in the segment of Italian and Spanish bond market and 3-year long-term refinancing operations are more broadly helping to improve liquidity conditions in the stressed markets of the euro area.

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