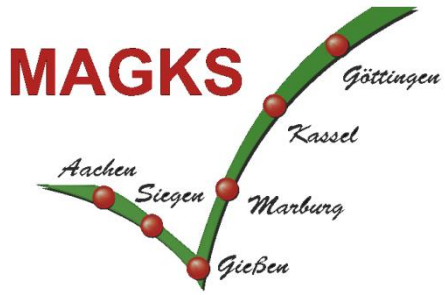

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Financial Markets and ECB Monetary Policy Communication – A Second QE Surprise

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Financial markets and ECB monetary policy communication - A second QE surprise*

Martin Baumgärtner†

Draft: January 25, 2022

This paper shows that a different communication style of the European Central Bank (ECB) affects stock prices differently. A break in the ECB's communication from 2016 onwards makes it necessary to adjust the identification of monetary policy surprises in the euro area. By modifying the high-frequency identification of monetary policy shocks in the euro area, I can show that two quantitative easing shocks occur per decision: One during the release and one during the press conference. Although the impact on policy rates is identical, the release window shock seems to have a more pronounced effect on stock prices.

JEL: E44, E52, E58

Keywords: Unconventional Monetary Policy, High-Frequency Data, ECB, Communication

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I. Introduction

Monetary policy surprises are typically measured during central bank decisions. Even though the measures taken by central banks are similar, the form in which they are announced differs. Therefore, a rich literature develops various methodologies to construct suitable surprises for different central banks. In this paper, I show, using the ECB as an example, that not only the differences between central banks are relevant for the identification of shocks, but that the identification must also be adjusted when the form of communication within a central bank changes.

Unlike other central banks, the ECB's monetary decisions are published in two steps. First, every six[1] weeks on Thursdays at 13:45, the decision is published in written form on the ECB's website and via news agencies. Until 2016, this *release* included only a brief statement on changes in the ECB's primary interest rates. In a second step, the *Press Conference* at 14:30, the measures taken will be explained by the president and journalists will be allowed to ask questions. In this window, the most unconventional measures were also announced. While the focus in the release window was on short-term interest rates, the second window mainly was about measures that had the longer end of the yield curve in view. However, since 2016 information on purchase programs or other supportive activities have also been integrated into the first written report so that there is no longer a clear separation of the two windows. So far, this change in detail has not yet been reflected in the literature.

In order to do so, I show in this paper that the change in overnight interest swap (OIS) in the release window is driven by more than one significant latent factor. I replicate previous studies and show that financial market reactions change with new data. By adjusting the methodology, I demonstrate how this effect can be integrated, and the shocks can be correctly identified. It turns out that the structure of the additional shock is similar to the previously known quantitative easing surprise. However, the effects depend on the window the shock occurs. In the release window, the reaction of stock prices is much more pronounced.

This paper builds on the literature based on Gürkaynak et al. (2005) to estimate monetary policy surprises using high-frequency data and factor models. The authors use a narrow time frame around Federal Open Market Committee releases to estimate two latent factors via factor decomposition. These *target* and *path* factors explain a large part of the variation in OIS. While the former puts the highest weight on the short term, the *path* factor impacts longer-term rates. The *path* factor was mostly associated with forward guidance, in which, later also partly large scale asset purchases (LSAP) fell. To separate the two effects, Swanson (2021) varies the rotation. He shows that for 1991 to 2019, not two factors

[1] Until 2015, the frequency of the meetings was every four weeks.

have influence, but three. The author introduces the identification assumption that the influence of this factor should be minimal in the pre-QE period and creates a third (LSAP) factor, which is orthogonal to the previous two.

Due to the unique structure of the publication of ECB decisions, an adapted strategy is needed in the euro area. Brand et al. (2010) are the first to use the ECB structure to separate the shocks in detail. They find a target and path factor and a timing factor, interpreted as a kind of short-term forward guidance. The methodologies of Gürkaynak et al. (2005), Brand et al. (2010), and Swanson (2021) are combined into one framework by Altavilla et al. (2019). The authors construct a total of four shocks: a target shock from the release window and timing, forward guidance and quantitative easing (QE) shock for the press conference window. In addition, the authors provide the Euro Area Monetary Policy Event-Study Database (EA-MPD), which captures the changes in various financial market variables during the two windows.

The remainder of this paper is structured as follows. In Section II I show that the current identification in the literature omits meaningful central bank surprises in the release window and modify the identification. Then I evaluate the new resulting surprise in comparison to the literature in Section III. The final section concludes this paper.

II. Methodology

For the years from 1999 to 2015, the press release following an ECB governing council meeting consisted of two sentences: One on future interest rates and a notice that the president would further explain these measures in the press conference. This changes as of December 2015, as the central bank, also comments on its LSAP. This announcement is limited to the raw facts. Neither program details are elaborated nor why the central bank considers the measures necessary.

The main question is, of course, how this effect can be measured and how financial market participants interpret this information. To investigate this, I use the EA-MPD published by Altavilla et al. (2019). The dataset contains the change in various financial market variables 30 minutes around both time windows for data for each ECB decision. The idea is that markets should have inserted all known information into the market price by then. Any new news, expansionary and restrictive, should therefore be measurable in this time window. Since OIS rates[2] have a strong link to central bank policy, I use them to measure surprises in financial markets concerning monetary policy. Per factor decomposition, the observed responses are attributed to several latent factors. Similar to previous

[2]OIS allow for securing an interest rate linked to the Eonia in the future. Thus, the product has a direct link to central bank policy.

Table 1: Example of the changes in the release note

Meeting date	**22 October 2015**	**02 June 2016**
Interest rate	*At today's meeting, which was held in Malta, the Governing Council of the ECB decided that the interest rate on the main refinancing operations and the interest rates on the marginal lending facility and the deposit facility will remain unchanged at 0.05%, 0.30% and -0.20% respectively.*	*At today's meeting, which was held in Vienna, the Governing Council of the ECB decided that the interest rate on the main refinancing operations and the interest rates on the marginal lending facility and the deposit facility will remain unchanged at 0.00%, 0.25% and -0.40% respectively.*
QE		*Regarding non-standard monetary policy measures, on 8 June the Eurosystem will start making purchases under its corporate sector purchase programme (CSPP). Moreover, starting on 22 June, it will conduct the first operation in its new series of targeted longer-term refinancing operations. Further information on implementation aspects of the CSPP will be released after the press conference on the ECB's website.*
Press conference	*The President of the ECB will comment on the considerations underlying these decisions at a press conference starting at 14:30 CET today.*	*The President of the ECB will comment on the considerations underlying these decisions at a press conference starting at 14:30 CET today.*

studies, I consider the change of OIS rates with maturities of 1, 3, 6 months, 1, 2, 5, and 10 years. The data spans from January 2002 to March 2021, with 205 observations.

A. Number of relevant surprises

The first question is to examine how many factors are relevant and whether the change in central bank communication has altered this number. A common way to determine the number of factors (k) is to test the rank of the matrix using the method developed by Cragg and Donald (1997). The null hypothesis is that the matrix has the rank k.
For the release window, I use three different periods: first the window before the communication switchover (January 2002 to November 2015), second the window after the switchover (December 2015 to March 2021), thus dividing the data set into a pre-change and post-change sample, and third the whole sample. Table (2) shows the results for all windows.

Table 2: Ranktest

	Release Window		
	Pre	Post	Full
	2002-2015	2016-2021	2002-2021
$H_0 : k = 0$	46.26	46.51	53.90
	(0.00)	(0.00)	(0.00)
$H_0 : k = 1$	18.94	25.85	25.77
	(0.17)	(0.03)	(0.03)
$H_0 : k = 2$		14.95	13.54
		(0.06)	(0.09)

Note: The table shows the Wald statistic of the Cragg and Donald (1997) rank test for the release window. The hypotheses $H_0 = k$ is evaluated against $H_0 < k$. The resulting p-values are in parentheses.

There is a clear difference between the samples. In the period up to 2015, the null hypothesis for one factor cannot be rejected. It follows, in agreement with Brand et al. (2010) and Altavilla et al. (2019), that one factor is relevant. However, the later period shows a structural break: the hypothesis $k = 1$ is rejected, assuming that two factors are relevant here. This is also evident in the full sample, which is influenced by two factors. Integrating the unconventional measures into the press release added information. Therefore, two factors are relevant.[3]

[3]For the conference window, I can replicate the results of Altavilla et al. (2019). Two and three factors are relevant here.

B. Factor Model

To adequately present the central bank's policy, it is necessary to adapt the identification of monetary policy surprises to this change in communication. In doing so, I adapt the dominant approach in the literature so that the modification can be easily interpreted and compared. Let us assume a factor model:

$$X = F\Lambda + \epsilon \tag{1}$$

where X contains the change in OIS rates, F is a corresponding matrix with the factors, and Λ is the loading matrix. After decomposition, the factors cannot be interpreted structurally since they usually influence each component X. To distinguish the factors from each other and to be able to interpret them, the factors must be rotated accordingly. Therefore, one rotates the model by introducing a matrix U, where $UU' = I$ and I corresponds to the identity matrix. This results in:

$$X = \bar{F}\bar{\Lambda} + \epsilon \tag{2}$$

with $\bar{F} = FU$ and $\bar{\Lambda} = U'\Lambda$. Introducing restrictions in U makes it possible to identify orthogonal factors. Furthermore, the monetary policy surprises can be identified by using the following restrictions for the release window:

1) The second factor does not load on the one-month OIS rates.

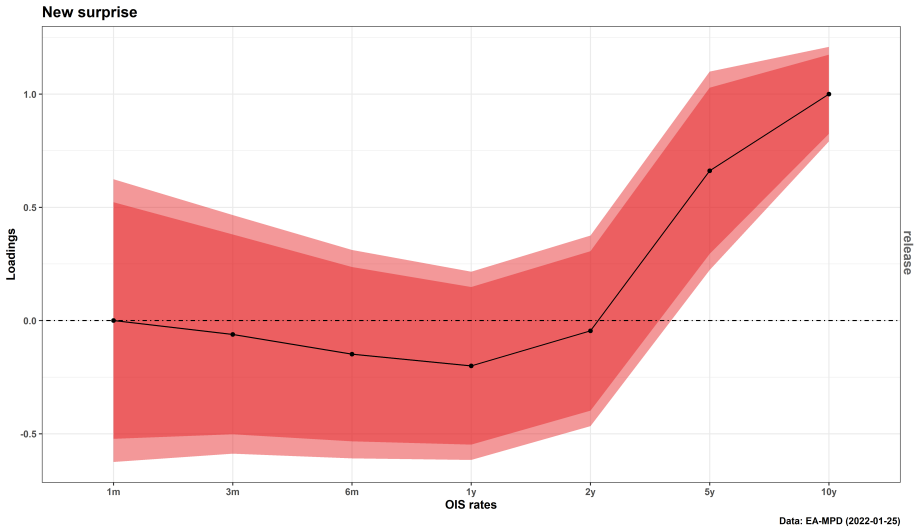
2) The second factor has a minimum variance before December 2015.

The first restriction is based on Gürkaynak et al. (2005) and separates the additional factors from the short-term oriented measures. The second restriction is inspired by the approach used by Swanson (2021) that if a factor does not exist, it should have a minimal variance.[4] Accordingly, before the change in press releases, the factor should have no impact.
Figure (1) shows the loading of the new second factor on the OIS rates.[5] The identified factor loads exclusively on the long term, five and ten-year swaps. Therefore, the new factor is reminiscent of a QE factor. This is also consistent with the expected outcome, as the new information in the releases concentrates on LSAP. Also, the comparison with the conference window shows strong similarities between the second factor in the release window and the third surprise in the conference window found by Altavilla et al. (2019) (See Figure (2)).

[4]Swanson (2021) thus identifies QE surprises. Since no QE shocks are expected before the financial crisis, the variance for this period should be minimal.

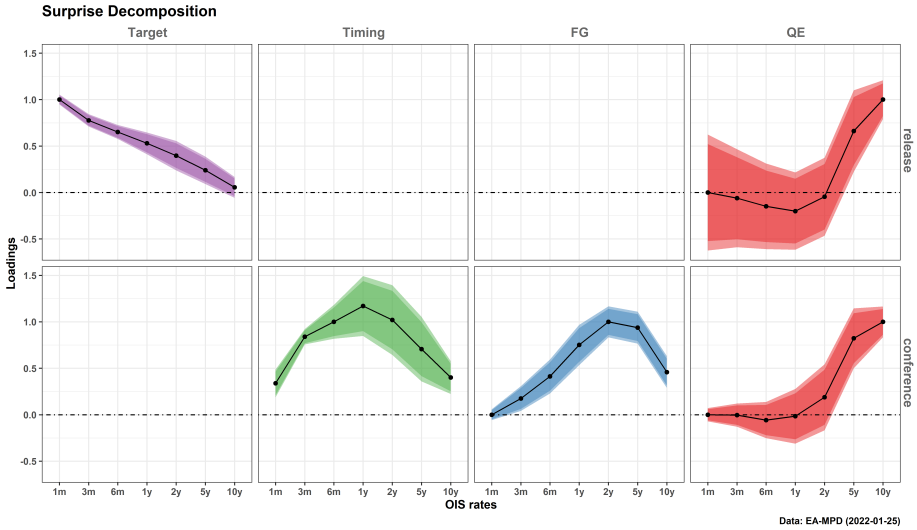
[5]It should be noted that, except for the one-month swap rate, the influences are not forced by restrictions but are estimated and thus can be interpreted.

Figure 1 : Loading structure



Notes: This graph depicts the loadings of the new factor in the release window for different OIS horizons based on the rotation. The factor is scaled that it has an unit effect on the ten-year OIS rates.

Figure 2 : Loading structure (All surprises)



Notes: This graph depicts the loadings of all factors for different OIS horizons based on the rotation based on the EA-MPD. The first row shows the factors identified in the release window and the second row in the conference window. The target factor is scaled to have a unit effect on the one-month OIS rate, the timing factor on the six-month OIS rate, forward guidance on two years, and the QE surprises are normalized to ten-year OIS rates.

So, starting in December 2015, there are two QE surprises per central bank meeting, one at the time of the ECB press release and one at the press conference. These are not different from each other in terms of the loading structure. Still, they are different in terms of the information they convey: While relatively little and condensed information is published in the release window, these measures are explained more during the press conference. In addition, it is possible for the public to ask questions and thus better understand the measures and the intention behind them.
The next step is to ask how the two factors differ in their effect. It would be possible to conclude which communication style is better suited to produce the desired result.

III. Results

In the process of an ECB announcement, based on the preceding analysis, two QE shocks occur, one in the conference window (starting in October 2014) and one in the release window (starting in December 2015). The differences between the two surprises in other high-frequency variables will be examined below. To ensure that the different starting times do not distort the results, I only consider the period starting December 2015. Both surprises are normalized to have a unit effect on the 10-year OIS rates[6] in the respective window. To study the impact of different windows and thus different communication of QE, I estimate the following equation:

$$\Delta x_{w,t} = QE_{w,t} + D_{release} + QE_{w,t} \times D_{release} + C_{w,t} + \epsilon_{w,t} \tag{3}$$

where Δx_t denotes the change of different financial variables during the monetary announcement t in window w. As variables for $\Delta x_{w,t}$ I use changes in OIS rates, the STOXX50 and the EURO STOXX Banks (SX7E) index[7] available in the EA-MPD. $QE_{w,t}$ stands for the QE surprise at time t in window w and $D_{release}$ is a dummy which indicates whether it is the conference window (0) or the release window (1). $C_{w,t}$ includes several control variables: First, all other monetary surprises known from Altavilla et al. (2019), the weekly seasonally adjusted U.S. jobless claims published during the ECB press conference, and a dummy controlling for the ECB president. The estimation in one equation allows separating the effect of the release window on the intercept and the interaction of the dummy with the QE Surprise. If the two windows produce similar effects in the variables, then the *window* coefficient and the interaction term should be insignificant. A significant dummy by itself suggests a general difference between the two windows. On the other hand, a significant interaction term would show that QE

[6] 10-year rates are most affected by a QE shock. (See Figure (2))
[7] The EURO STOXX Bank index focuses on banks and financial services providers from the STOXX 600.

has different effects depending on the relevant period. Otherwise, these elements would indicate how exactly the effect differs. The results can be found in Table (3) and (4).

Table 3: Regression results: OIS rates

	OIS_{6m}		OIS_{2y}		OIS_{10y}	
	(1)	(2)	(3)	(4)	(5)	(6)
QE	−0.08**	−0.10***	0.18**	0.17**	1.00***	0.99***
	(0.04)	(0.04)	(0.07)	(0.07)	(0.05)	(0.05)
$D_{release}$	0.35***	0.33***	0.14	0.16	−0.04	0.01
	(0.10)	(0.11)	(0.18)	(0.21)	(0.13)	(0.15)
$QE \times D_{release}$	0.04	0.05	−0.13	−0.13	0.00	0.01
	(0.06)	(0.06)	(0.11)	(0.11)	(0.08)	(0.08)
Target	0.78***	0.76***	0.61***	0.58***	0.26***	0.23***
	(0.03)	(0.03)	(0.06)	(0.06)	(0.04)	(0.05)
Timing	0.95***	0.89***	1.12***	0.98***	0.51***	0.38***
	(0.10)	(0.10)	(0.19)	(0.19)	(0.14)	(0.14)
FG	0.52***	0.50***	1.02***	0.95***	0.56***	0.49***
	(0.05)	(0.05)	(0.10)	(0.10)	(0.07)	(0.07)
jobless claims		−0.00		0.00		0.00
		(0.00)		(0.00)		(0.00)
$D_{Lagarde}$		0.31		0.27		0.16
		(0.31)		(0.59)		(0.43)
Constant	−0.22***	0.80**	−0.20	1.47**	−0.13	1.32***
	(0.07)	(0.34)	(0.13)	(0.65)	(0.10)	(0.47)
D_{years}	No	Yes	No	Yes	No	Yes
Adj. R^2	0.91	0.91	0.79	0.80	0.93	0.94
Num. obs.	86	86	86	86	86	86
F statistic	139.74	64.56	53.06	24.62	191.76	89.42

Regression of OIS intraday changes on monetary surprises per window. The odd model numbers show the basic model and the even ones extend it with various control variables: U.S. unemployment claims, and two dummies for the ECB president and years. Standard errors are displayed in parentheses. ***, **, * indicate significance at the 1, 5, and 10 per cent level, respectively.

For the variables most closely related to the central bank, OIS rates, there seems to be no deviating influence of the QE factor in the release window. Still, there are indications of a generally different effect between the windows. Looking at the coefficient of the six-month OIS rates for the release window, $D_{release}$, we find a significant positive effect. The reactions are stronger in the release window than during the press conference. Simultaneously, there is no evidence of a divergent effect between the QE shocks in the different windows. In general, positive (restrictive) surprises increase OIS rates. However, the effect varies according to the construction of the factors. Target surprises have the most substantial impact in the short term, and QE factors have the most decisive influence in the long term.

This changes when looking at stock prices, STOXX 50 and SX7E. Target, timing and forward guidance show the expected signs in each specification but vary in significance. Especially the effects on the SX7E are less clear. Altavilla et al. (2019) find similar results in their evaluation. They attribute this to a possible existence of information shocks. That is, the central bank's interest rate decision also reveals information about the economy, which has the opposite effect on stock prices (Campbell et al., 2012; Miranda-Agrippino and Ricco, 2018). Other studies find similar effects, but point to other possible explanations, such as delayed information processing by financial market participants and uncertainty in the announcement (Bauer and Swanson, 2020; Baumgaertner, 2020). A complicated picture emerges for QE and $D_{release}$, the variables of interest. For the STOXX50, I find no effect different from zero but a significant negative interaction coefficient with the release window. Thus, in the release window, the effect of a QE shock is significantly stronger than in the press conference window. For SX7E, however, the QE coefficient is positive and thus contradicts economic intuition. The interaction term has the appropriate negative sign and is significant at the 10% level, but even then, the sum of both coefficients would be zero, so there would be no clear relationship between QE and SX7E.

Figure (3) illustrates the observed effects by plotting the magnitude of the overall coefficient depending on the QE shock and the policy window. For the ten-year OIS rates[8], the interaction term does not play a role, so the two straight lines are almost synchronous. For the STOXX50, however, the difference becomes apparent. While a QE shock in the press conference window shows no significant correlation, the effect in the release window is pronounced. A restrictive (expansionary) QE shock lowers (raises) stock prices. The graph for SX7E shows that the direction of the effect in the press conference window is more similar to the OIS rates than the STOXX50. In the release window, the slope of the straight line becomes flatter, but still shows no negative correlation. The SX7E's reaction can presumably be explained by the fact that the index focuses on banks for which QE has a potentially negative side effect. An expansion of QE keeps the yield outlook in the interest rate environment lower for longer and, therefore, lowers the banks' stock prices.
Possible explanations for the difference between the two policy windows in the STOXX50 could be related to the content of the release and follow the findings of Smales and Apergis (2017a), Smales and Apergis (2017b), and Hayo et al. (2020). The authors show that press conferences have become more linguistically complex with the introduction of unconventional monetary policy, which leads to a change in trading activity during the press conference. This could explain the results: First, the two surprises differ in their content: While the release window is very focused on the actual central bank policy, the press conference explains

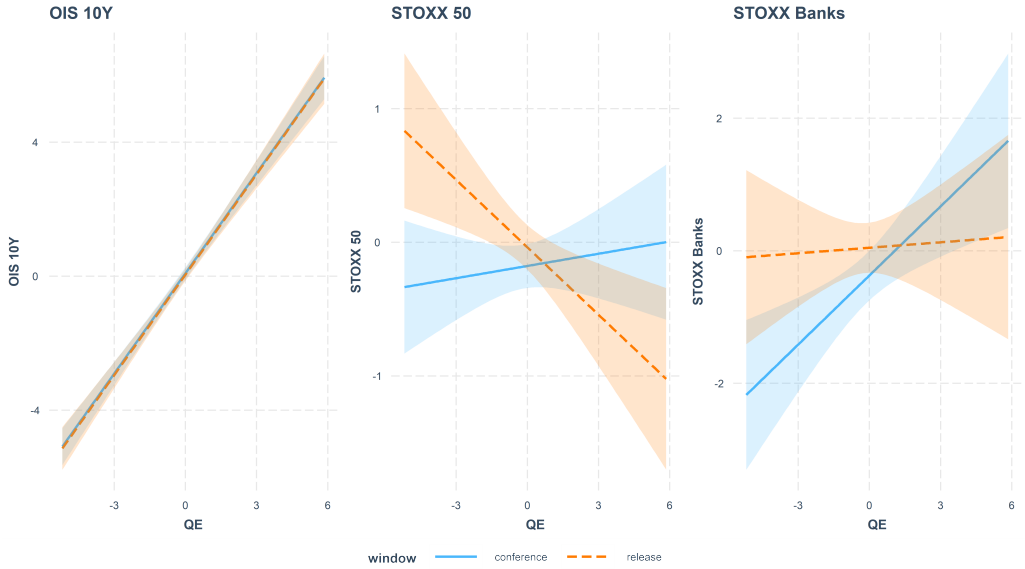
[8]Other OIS rates show a very similar pattern, but have been omitted here for the sake of clarity.

Table 4: Regression results: Stock prices

	STOXX50		SX7E	
	(1)	(2)	(3)	(4)
QE	0.03	0.05	0.35***	0.37***
	(0.05)	(0.05)	(0.11)	(0.11)
$D_{release}$	0.14	0.16	0.42	0.53
	(0.12)	(0.14)	(0.27)	(0.32)
$QE \times D_{release}$	−0.20***	−0.20***	−0.32*	−0.34*
	(0.07)	(0.08)	(0.16)	(0.17)
Target	−0.15***	−0.11**	−0.09	−0.02
	(0.04)	(0.04)	(0.09)	(0.10)
Timing	−0.23*	−0.14	−0.45	−0.37
	(0.13)	(0.13)	(0.28)	(0.30)
FG	−0.27***	−0.23***	−0.42***	−0.39**
	(0.06)	(0.07)	(0.14)	(0.15)
jobless claims		0.00		0.00
		(0.00)		(0.00)
$D_{Lagarde}$		0.17		0.74
		(0.40)		(0.92)
Constant	−0.07	−1.22***	−0.24	−1.36
	(0.09)	(0.44)	(0.20)	(1.00)
D_{years}	No	Yes	No	Yes
Adj. R^2	0.30	0.31	0.14	0.14
Num. obs.	86	86	86	86
F statistic	7.09	3.68	3.29	1.97

Regression of stock prices on monetary surprises per window. The odd model numbers show the basic model and the even ones extend it with various control variables: U.S. unemployment claims, and two dummies for the ECB president and years. Standard errors are displayed in parentheses. ***, **, * indicate significance at the 1, 5, and 10 per cent level, respectively.

Figure 3 : Interaction effects



Notes: This graph illustrates the level of the coefficient for OIS_{10Y}, STOXX50 and STOXX Banks from Table (4) for the release window (orange) and the press conference window (blue). Overlapping lines indicate no interaction effect whereas crossed lines indicate a relevant interaction term.

the background and motivation of the central bank in much more detail. The possibility of follow-up questions requires the president to communicate quickly and consistently. If this does not succeed, it is conceivable that the central bank's signal will be more restrained compared to the release.
Second, the form of the release is initially different. The release window is always in text form, whether through the central bank's website or news outlets. On the other hand, the press conference is initially only audio-visual, i.e., a video stream. This can mean that it becomes more challenging to process the incoming information, as the amount of information that can be evaluated increases[9], and at the same time, it becomes technically more demanding to evaluate the content, as automation solutions are usually based on plain text.

IV. Conclusion

This paper sharpens the identification of central bank shocks in the euro area. The analysis of high-frequency data during the ECB release shows that a new relevant factor appears in the data with the integration of QE in the ECB press release. This demonstrates that when central bank communication changes, the

[9]Thus, in addition to the language of the central bank, there are attempts to include the appearance of central bankers during the pronouncement in the analysis. (Gorodnichenko et al., 2021)

identification of monetary policy surprises also needs to be examined.

My analysis shows that this additional factor is indeed a QE shock. The effects on the different OIS maturities are almost identical, so comparing the two shocks in their impact is possible. There is a significantly different effect between the release and the press conference window for stock prices. One explanation for this reaction would be that compressed information from the central bank is more easily captured by financial markets, thus generating less uncertainty.

Although future research should focus on the specific link between complexity and stock prices, an important policy conclusion can be drawn. In addition to choosing the right policy instrument, central banks should pay more attention to how they announce them. Short and clear texts have a more substantial effect than more complex press conferences.

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