

APPENDIX TO

“MEASURING EURO AREA MONETARY POLICY”*

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—August 4, 2019—

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The views expressed in this appendix are those of the authors and do not necessarily reflect those of the European Central Bank or the Eurosystem.

A Appendix: ECB Monetary Policy Events

Table A.1 shows summary statistics of ECB policy decisions and Table A.2 presents all the monetary policy events considered in our study. It shows the evolving pattern of the ECB meeting policy and the associated changes in policy communication. In this section, we point out these changes, and we also highlight some particular events and practices concerning the ECB meetings.

Table A.1: Frequency of policy decisions and press conferences in the euro area

Year	# of Policy Events		#Rate Change
	<i>policy decision released at 13:45</i>	<i>press conference start at 14:30</i>	
1999	23	9	2
2000	24	13	6
2001	24	11	4
2002	12	11	1
2003	12	11	2
2004	12	11	0
2005	12	11	1
2006	12	12	5
2007	12	11	2
2008	13	12	4
2009	12	12	4
2010	12	12	0
2011	12	12	4
2012	12	12	1
2013	12	12	2
2014	12	12	2
2015	8	8	0
2016	8	8	1
2017	8	8	0
2018	6	6	0
Total	258	214	41

Note: The table reports for each year the number of policy decisions, the number of press conferences and the number of rate changes from January 1999 to September 2018.

Table A.2: Press-release and conference dates

Date	Press Release	Press Conference	Δ Rate	MRO	Date	Press Release	Press Conference	Δ Rate	MRO
07/01/99	01:45 PM	02:00 PM	0	3.00%	02/11/06	01:45 PM	02:30 PM	0	3.25%
21/01/99	01:45 PM	No Conf.	0	3.00%	07/12/06	01:45 PM	02:30 PM	1	3.50%
18/02/99	01:45 PM	No Conf.	0	3.00%	11/01/07	01:45 PM	02:30 PM	0	3.50%
04/03/99	01:45 PM	02:00 PM	0	3.00%	08/02/07	01:45 PM	02:30 PM	0	3.50%
18/03/99	01:45 PM	No Conf.	0	3.00%	08/03/07	01:45 PM	02:30 PM	1	3.75%
08/04/99	01:45 PM	02:00 PM	1	2.50%	12/04/07	01:45 PM	02:30 PM	0	3.75%
22/04/99	01:45 PM	No Conf.	0	2.50%	10/05/07	01:45 PM	02:30 PM	0	3.75%
06/05/99	01:45 PM	02:00 PM	0	2.50%	06/06/07	01:45 PM	02:30 PM	1	4.00%
20/05/99	01:45 PM	No Conf.	0	2.50%	05/07/07	01:45 PM	02:30 PM	0	4.00%
02/06/99	01:45 PM	02:00 PM	0	2.50%	02/08/07	01:45 PM	No Conf.	0	4.00%
17/06/99	01:45 PM	No Conf.	0	2.50%	06/09/07	01:45 PM	02:30 PM	0	4.00%
01/07/99	01:45 PM	No Conf.	0	2.50%	04/10/07	01:45 PM	02:30 PM	0	4.00%
15/07/99	01:45 PM	02:00 PM	0	2.50%	08/11/07	01:45 PM	02:30 PM	0	4.00%
29/07/99	01:45 PM	No Conf.	0	2.50%	06/12/07	01:45 PM	02:30 PM	0	4.00%
26/08/99	01:45 PM	No Conf.	0	2.50%	10/01/08	01:45 PM	02:30 PM	0	4.00%
09/09/99	01:44 PM	02:00 PM	0	2.5%	07/02/08	01:45 PM	02:30 PM	0	4.00%
23/09/99	01:45 PM	No Conf.	0	2.5%	06/03/08	01:45 PM	02:30 PM	0	4.00%
07/10/99	01:45 PM	02:30 PM	0	2.5%	10/04/08	01:45 PM	02:30 PM	0	4.00%
21/10/99	01:45 PM	No Conf.	0	2.5%	08/05/08	01:45 PM	02:30 PM	0	4.00%
04/11/99	01:45 PM	02:30 PM	1	3.00%	05/06/08	01:45 PM	02:30 PM	0	4.00%
18/11/99	01:45 PM	No Conf.	0	3.00%	03/07/08	01:45 PM	02:30 PM	1	4.25%
02/12/99	01:45 PM	02:30 PM	0	3.00%	07/08/08	01:45 PM	02:30 PM	0	4.25%
15/12/99	01:45 PM	No Conf.	0	3.00%	04/09/08	01:45 PM	02:30 PM	0	4.25%
05/01/00	01:45 PM	02:30 PM	0	3.00%	02/10/08	01:45 PM	02:30 PM	0	4.25%
20/01/00	01:45 PM	No Conf.	0	3.00%	08/10/08	01:00 PM	No Conf.	1	3.75%
03/02/00	01:45 PM	02:30 PM	1	3.25%	06/11/08	01:45 PM	02:30 PM	1	3.25%
17/02/00	01:45 PM	No Conf.	0	3.25%	04/12/08	01:45 PM	02:30 PM	1	2.50%
02/03/00	01:45 PM	02:30 PM	0	3.25%	15/01/09	01:45 PM	02:30 PM	1	2.00%
16/03/00	01:44 PM	No Conf.	1	3.50%	05/02/09	01:45 PM	02:30 PM	0	2.00%
30/03/00	01:45 PM	02:30 PM	0	3.50%	05/03/09	01:45 PM	02:30 PM	1	1.50%
13/04/00	01:45 PM	02:30 PM	0	3.50%	02/04/09	01:45 PM	02:30 PM	1	1.25%
27/04/00	01:45 PM	No Conf.	1	3.75%	07/05/09	01:45 PM	02:30 PM	1	1.00%
11/05/00	01:45 PM	02:30 PM	0	3.75%	04/06/09	01:45 PM	02:30 PM	0	1.00%
25/05/00	01:45 PM	No Conf.	0	3.75%	02/07/09	01:45 PM	02:30 PM	0	1.00%
08/06/00	01:45 PM	02:30 PM	1	4.25%	06/08/09	01:45 PM	02:30 PM	0	1.00%
21/06/00	01:45 PM	No Conf.	0	4.25%	03/09/09	01:45 PM	02:30 PM	0	1.00%
06/07/00	01:45 PM	02:30 PM	0	4.25%	08/10/09	01:45 PM	02:30 PM	0	1.00%
20/07/00	01:45 PM	No Conf.	0	4.25%	05/11/09	01:45 PM	02:30 PM	0	1.00%
03/08/00	01:45 PM	No Conf.	0	4.25%	03/12/09	01:45 PM	02:30 PM	0	1.00%
31/08/00	01:45 PM	No Conf.	1	4.50%	14/01/10	01:45 PM	02:30 PM	0	1.00%
14/09/00	01:45 PM	02:30 PM	0	4.50%	04/02/10	01:45 PM	02:30 PM	0	1.00%
05/10/00	01:45 PM	02:30 PM	1	4.75%	04/03/10	01:45 PM	02:30 PM	0	1.00%
19/10/00	01:45 PM	02:30 PM	0	4.75%	08/04/10	01:45 PM	02:30 PM	0	1.00%
02/11/00	01:45 PM	02:30 PM	0	4.75%	06/05/10	01:45 PM	02:30 PM	0	1.00%
16/11/00	01:45 PM	No Conf.	0	4.75%	10/06/10	01:45 PM	02:30 PM	0	1.00%
30/11/00	01:45 PM	No Conf.	0	4.75%	08/07/10	01:45 PM	02:30 PM	0	1.00%
14/12/00	01:45 PM	02:30 PM	0	4.75%	05/08/10	01:45 PM	02:30 PM	0	1.00%
04/01/01	01:45 PM	No Conf.	0	4.75%	02/09/10	01:45 PM	02:30 PM	0	1.00%
18/01/01	01:45 PM	No Conf.	0	4.75%	07/10/10	01:45 PM	02:30 PM	0	1.00%
01/02/01	01:45 PM	02:30 PM	0	4.75%	04/11/10	01:45 PM	02:30 PM	0	1.00%
15/02/01	01:45 PM	No Conf.	0	4.75%	02/12/10	01:45 PM	02:30 PM	0	1.00%
01/03/01	01:44 PM	02:30 PM	0	4.75%	13/01/11	01:45 PM	02:30 PM	0	1.00%
15/03/01	01:44 PM	No Conf.	0	4.75%	03/02/11	01:45 PM	02:30 PM	0	1.00%
29/03/01	01:44 PM	No Conf.	0	4.75%	03/03/11	01:45 PM	02:30 PM	0	1.00%
11/04/01	01:46 PM	02:30 PM	0	4.75%	07/04/11	01:45 PM	02:30 PM	1	1.25%
26/04/01	01:45 PM	No Conf.	0	4.75%	05/05/11	01:45 PM	02:30 PM	0	1.25%
10/05/01	01:45 PM	02:30 PM	1	4.50%	09/06/11	01:45 PM	02:30 PM	0	1.25%
23/05/01	01:45 PM	No Conf.	0	4.50%	07/07/11	01:45 PM	02:30 PM	1	1.50%
07/06/01	01:45 PM	02:30 PM	0	4.50%	04/08/11	01:45 PM	02:30 PM	0	1.50%
21/06/01	01:45 PM	02:30 PM	0	4.50%	08/09/11	01:45 PM	02:30 PM	0	1.50%
05/07/01	01:45 PM	02:30 PM	0	4.50%	06/10/11	01:45 PM	02:30 PM	0	1.50%
19/07/01	01:45 PM	No Conf.	0	4.50%	03/11/11	01:45 PM	02:30 PM	1	1.25%
02/08/01	01:46 PM	No Conf.	0	4.50%	08/12/11	01:45 PM	02:30 PM	1	1.00%
30/08/01	01:45 PM	02:30 PM	1	4.25%	12/01/12	01:45 PM	02:30 PM	0	1.00%
13/09/01	01:45 PM	No Conf.	0	4.25%	09/02/12	01:45 PM	02:30 PM	0	1.00%
17/09/01	05:30 PM	No Conf.	1	3.75%	08/03/12	01:45 PM	02:30 PM	0	1.00%

27/09/01	01:45 PM	No Conf.	0	3.75%	04/04/12	01:45 PM	02:30 PM	0	1.00%
11/10/01	01:45 PM	02:30 PM	0	3.75%	03/05/12	01:45 PM	02:30 PM	0	1.00%
25/10/01	01:46 PM	No Conf.	0	3.75%	06/06/12	01:45 PM	02:30 PM	0	1.00%
08/11/01	01:45 PM	02:30 PM	1	3.25%	05/07/12	01:45 PM	02:30 PM	1	0.75%
06/12/01	01:45 PM	02:30 PM	0	3.25%	02/08/12	01:45 PM	02:30 PM	0	0.75%
03/01/02	01:45 PM	03:00 PM	0	3.25%	06/09/12	01:45 PM	02:30 PM	0	0.75%
07/02/02	01:46 PM	02:30 PM	0	3.25%	04/10/12	01:45 PM	02:30 PM	0	0.75%
07/03/02	01:45 PM	02:30 PM	0	3.25%	08/11/12	01:45 PM	02:30 PM	0	0.75%
04/04/02	01:46 PM	02:30 PM	0	3.25%	06/12/12	01:45 PM	02:30 PM	0	0.75%
02/05/02	01:45 PM	02:30 PM	0	3.25%	10/01/13	01:45 PM	02:30 PM	0	0.75%
06/06/02	01:45 PM	02:30 PM	0	3.25%	07/02/13	01:45 PM	02:30 PM	0	0.75%
04/07/02	01:45 PM	02:30 PM	0	3.25%	07/03/13	01:45 PM	02:30 PM	0	0.75%
01/08/02	01:45 PM	No Conf.	0	3.25%	04/04/13	01:45 PM	02:30 PM	0	0.75%
12/09/02	01:45 PM	02:30 PM	0	3.25%	02/05/13	01:45 PM	02:30 PM	1	0.50%
10/10/02	01:45 PM	02:30 PM	0	3.25%	06/06/13	01:45 PM	02:30 PM	0	0.50%
07/11/02	01:45 PM	02:30 PM	0	3.25%	04/07/13	01:45 PM	02:30 PM	0	0.50%
05/12/02	01:45 PM	02:30 PM	1	2.75%	01/08/13	01:45 PM	02:30 PM	0	0.50%
09/01/03	01:45 PM	02:30 PM	0	2.75%	05/09/13	01:45 PM	02:30 PM	0	0.50%
06/02/03	01:45 PM	02:30 PM	0	2.75%	02/10/13	01:45 PM	02:30 PM	0	0.50%
06/03/03	01:45 PM	02:30 PM	1	2.50%	07/11/13	01:45 PM	02:30 PM	1	0.25%
03/04/03	01:45 PM	02:30 PM	0	2.50%	05/12/13	01:45 PM	02:30 PM	0	0.25%
08/05/03	01:45 PM	02:30 PM	0	2.50%	09/01/14	01:45 PM	02:30 PM	0	0.25%
05/06/03	01:45 PM	02:30 PM	1	2.00%	06/02/14	01:45 PM	02:30 PM	0	0.25%
10/07/03	01:45 PM	02:30 PM	0	2.00%	06/03/14	01:45 PM	02:30 PM	0	0.25%
31/07/03	01:45 PM	No Conf.	0	2.00%	03/04/14	01:45 PM	02:30 PM	0	0.25%
04/09/03	01:45 PM	02:30 PM	0	2.00%	08/05/14	01:45 PM	02:30 PM	0	0.25%
02/10/03	01:45 PM	02:30 PM	0	2.00%	05/06/14	01:45 PM	02:30 PM	1	0.15%
06/11/03	01:45 PM	02:30 PM	0	2.00%	03/07/14	01:45 PM	02:30 PM	0	0.15%
04/12/03	01:45 PM	02:30 PM	0	2.00%	07/08/14	01:45 PM	02:30 PM	0	0.15%
08/01/04	01:45 PM	02:30 PM	0	2.00%	04/09/14	01:45 PM	02:30 PM	1	0.05%
05/02/04	01:45 PM	02:30 PM	0	2.00%	02/10/14	01:45 PM	02:30 PM	0	0.05%
04/03/04	01:45 PM	02:30 PM	0	2.00%	06/11/14	01:45 PM	02:30 PM	0	0.05%
01/04/04	01:45 PM	02:30 PM	0	2.00%	04/12/14	01:45 PM	02:30 PM	0	0.05%
06/05/04	01:45 PM	02:30 PM	0	2.00%	22/01/15	01:45 PM	02:30 PM	0	0.05%
03/06/04	01:45 PM	02:30 PM	0	2.00%	05/03/15	01:45 PM	02:30 PM	0	0.05%
01/07/04	01:45 PM	02:30 PM	0	2.00%	15/04/15	01:45 PM	02:30 PM	0	0.05%
05/08/04	01:45 PM	No Conf.	0	2.00%	03/06/15	01:45 PM	02:30 PM	0	0.05%
02/09/04	01:45 PM	02:30 PM	0	2.00%	16/07/15	01:45 PM	02:30 PM	0	0.05%
07/10/04	01:45 PM	02:30 PM	0	2.00%	03/09/15	01:45 PM	02:30 PM	0	0.05%
04/11/04	01:45 PM	02:30 PM	0	2.00%	22/10/15	01:45 PM	02:30 PM	0	0.05%
02/12/04	01:45 PM	02:30 PM	0	2.00%	03/12/15	01:45 PM	02:30 PM	0	0.05%
13/01/05	01:45 PM	02:30 PM	0	2.00%	21/01/16	01:45 PM	02:30 PM	0	0.05%
03/02/05	01:45 PM	02:30 PM	0	2.00%	10/03/16	01:45 PM	02:30 PM	1	0.00%
03/03/05	01:45 PM	02:30 PM	0	2.00%	21/04/16	01:45 PM	02:30 PM	0	0.00%
07/04/05	01:45 PM	02:30 PM	0	2.00%	02/06/16	01:45 PM	02:30 PM	0	0.00%
04/05/05	01:45 PM	02:30 PM	0	2.00%	21/07/16	01:45 PM	02:30 PM	0	0.00%
02/06/05	01:45 PM	02:30 PM	0	2.00%	08/09/16	01:45 PM	02:30 PM	0	0.00%
07/07/05	01:45 PM	02:30 PM	0	2.00%	20/10/16	01:45 PM	02:30 PM	0	0.00%
04/08/05	01:45 PM	No Conf.	0	2.00%	08/12/16	01:45 PM	02:30 PM	0	0.00%
01/09/05	01:45 PM	02:30 PM	0	2.00%	19/01/17	01:45 PM	02:30 PM	0	0.00%
06/10/05	01:45 PM	02:30 PM	0	2.00%	09/03/17	01:45 PM	02:30 PM	0	0.00%
03/11/05	01:45 PM	02:30 PM	0	2.00%	27/04/17	01:45 PM	02:30 PM	0	0.00%
01/12/05	01:45 PM	02:30 PM	1	2.25%	08/06/17	01:45 PM	02:30 PM	0	0.00%
12/01/06	01:45 PM	02:30 PM	0	2.25%	20/07/17	01:45 PM	02:30 PM	0	0.00%
02/02/06	01:45 PM	02:30 PM	0	2.25%	07/09/17	01:45 PM	02:30 PM	0	0.00%
02/03/06	01:45 PM	02:30 PM	1	2.50%	26/10/17	01:45 PM	02:30 PM	0	0.00%
06/04/06	01:45 PM	02:30 PM	0	2.50%	14/12/17	01:45 PM	02:30 PM	0	0.00%
04/05/06	01:45 PM	02:30 PM	0	2.50%	25/01/18	01:45 PM	02:30 PM	0	0.00%
08/06/06	01:45 PM	02:30 PM	1	2.75%	08/03/18	01:45 PM	02:30 PM	0	0.00%
06/07/06	01:45 PM	02:30 PM	0	2.75%	26/04/18	01:45 PM	02:30 PM	0	0.00%
03/08/06	01:45 PM	02:30 PM	1	3.00%	14/06/18	01:45 PM	02:30 PM	0	0.00%
31/08/06	01:45 PM	02:30 PM	0	3.00%	26/07/18	01:45 PM	02:30 PM	0	0.00%
05/10/06	01:45 PM	02:30 PM	1	3.25%	13/09/18	01:45 PM	02:30 PM	0	0.00%

Note: the table shows all the Governing Council dates used to create the asset changes in the EA-MPD. Also, the table presents the time at which the press release is published and the conference starts (CET). The “No Conf.” figures in the “Press Conference” columns highlights events in which there was no conference following the press release. “ Δ Rate” is a dummy variable which equals zero when there are no changes in the MRO rate and one otherwise. Finally, the “MRO” columns highlight the MRO rate level.

First, between **January 1999 and October 2001** the Governing Council set the interest rates twice per month. However, during this period, in some months, there were three meetings (July 1999, April and November 2000 and April 2001), in others one (February, August and December 1999, December 2000 and July, November and December 2001) and in September 2000 there were no meetings. Also, the press conference given by the ECB president was not regularly following the publication of the press release. In this early phase, the meeting of the **19th September 2001** was unscheduled. In this month, the Governing Council exceptionally met to lower the rates in concert with the FED’s rate cut decision following the 9/11 terrorist attacks in the US.

In a second phase, from **November 2001 until December 2014**, the Governing Council decisions were regularly taken on the first Thursday of each month, with some minor exceptions. In particular, in **July 2003** the Governing Council met on the 10th and the 31st. On the 31st the press release was not followed by the ECB president’s press conference. The reason was that from 2002 to 2008, except in 2006, in all the **August** meetings the Governing Council met through the teleconference and no conferences were following. The 31st July meeting anticipated the August 2003 meeting, which did not take place. In **October 2008** the Governing Council met on the 2nd and the 8th. In the second meeting, the Governing Council exceptionally met through teleconference, and a press release was made available at 13:00 CET including both the interest rate change and a short note similar to a standard introductory statement. The press release was not followed by a conference.

Beginning in **January 2015**, the Governing Council has started meeting every six weeks. In this period, a change in the ECB policy was introduced at the **March 2016** meeting, when the decisions concerning non-standard monetary policy measures were included in the press release. For example, the increase in the amount of purchase under the Asset Purchasing Programme (APP) from 60bn/month to 80bn/month was announced in the press release published after this meeting.

B Appendix: High-Frequency Dataset

The underlying dataset from which all the asset price/yield changes are constructed is the Thomson Reuters Tick History (TRTH) database.¹ The data availability depends on the instruments under consideration. Table B.1 summarizes our dataset, showing the Reuters Identification Code (RIC) and data availability.

In the data on financial market reactions to monetary policy we make available, we report OIS, sovereign yields, stock prices, and exchange rates. The **OIS** contracts are over-the-counter interest rate swaps where the underlying is the euro area inter-bank rate, EONIA. At the end of the contract duration, one side (floating leg) pays the average of the realized interest rate while the other (fixed leg) pays a fixed interest rate that was agreed upon at the initiation of the contract. The OIS quote we observe for a given maturity in any trade is then the risk-neutral interest rate expectation for the period covered by the contract agreed by the two parties. This information is similar to the information provided by the yield of a bond of the same maturity, however, OIS do not require an upfront payment—i.e., there is no loan and therefore credit risk, and liquidity implications of OIS are milder than those of fixed-rate bonds. Further, OIS are euro area-wide interest rate measures, not affected by country risk either as credit risk or as safe haven premia. Unlike US Federal Funds Futures, which have fixed calendar month coverage, each OIS contract is fixed maturity. We also consider **sovereign bonds**, where we report the changes in bond yields of the four largest euro area members, Germany, France, Italy, and Spain. **Stock indexes**, we cover are the STOXX50, which is an index made up of the fifty largest and liquid stocks in the euro area, and the SX7E index, which comprises twenty-six among the largest banks in the euro area. Finally, we also include **exchange rates**. These are foreign currency per one Euro. Hence, negative changes reported in the database denote Euro depreciations.

¹In the paper and the appendix we use “asset price/yield change” when we refer to variations of asset prices around the press release and the press conference. Instead, we refer to “market surprise” when we are talking about the interpretable series we extracted via a principal component approach— meaning the Target, Timing, Path and QE factors. Finally, we refer to “shock” when we refer to structural shocks identified with the aid of a structural model, such as a VAR.

Table B.1: Assets available in the dataset

Asset	RIC	Start Date
Overnight Index Swap		
OIS1W	EUREONSW=	1999-01-28
OIS1M	EUREON1M=	1999-01-02
OIS3M	EUREON3M=	1999-01-02
OIS6M	EUREON6M=	1999-01-02
OIS1Y	EUREON1Y=	1999-01-02
OIS2Y	EUREON2Y=	1999-11-19
OIS3Y	EUREON3Y=	2002-09-12
OIS4Y	EUREON4Y=	2011-06-26
OIS5Y	EUREON5Y=	2013-02-01
OIS6Y	EUREON6Y=	2011-06-24
OIS7Y	EUREON7Y=	2011-06-24
OIS8Y	EUREON8Y=	2011-06-24
OIS9Y	EUREON9Y=	2011-06-24
OIS10Y	EUREON10Y=	2011-06-24
OIS15Y	EUREON15Y=	2013-08-07
OIS20Y	EUREON20Y=	2013-08-07
Government Bond		
DE3M	DE3MT=RR	2005-10-19
DE6M	DE6MT=RR	2005-10-19
DE1Y	DE1YT=RR	2003-28-05
DE2Y	DE2YT=RR	1998-01-01
DE3Y	DE3YT=RR	1998-01-01
DE4Y	DE4YT=RR	1998-01-01
DE5Y	DE5YT=RR	1998-01-01
DE6Y	DE6YT=RR	1998-01-01
DE7Y	DE7YT=RR	1998-01-01
DE8Y	DE8YT=RR	1998-01-01
DE9Y	DE9YT=RR	1998-01-01
DE10Y	DE10YT=RR	1998-01-01
DE15Y	DE15YT=RR	2010-11-09
DE20Y	DE20YT=RR	1998-01-01
DE30Y	DE30YT=RR	1998-01-01
IT2Y	IT2YT=RR	1998-01-01
IT5Y	IT5YT=RR	1998-01-01
IT10Y	IT10YT=RR	1998-01-01
ES2Y	ES2YT=RR	1998-01-01
ES5Y	ES5YT=RR	1998-01-01
ES10Y	ES10YT=RR	1998-01-01
FR2Y	FR2YT=RR	1998-01-01
FR5Y	FR5YT=RR	1998-01-01
FR10Y	FR10YT=RR	1998-01-01
Currency		
USD	EUR=RR	1998-01-01
GBP	EURGBP=R	1998-01-15
JPY	EURJPY=R	1998-01-01
Stock Index		
STOXX50E	.STOXX50E	1998-02-20
SX7E	.SX7E	1998-02-20

Note: The table shows the assets available in the EA-MPD. The first column highlights the asset name, the second the Reuters Identification Code (RIC) and the final column the first policy date for which data on that particular RIC is available.

C Appendix: Filtering Procedure

A crucial first step of constructing the EA-MPD is cleaning the high-frequency data to eliminate observations that do not reflect actual market activity. Removal of spurious quotes is key as they might otherwise enter into the calculation of the asset changes compromising the reliability of surprises.² In our application, we face the delicate trade-off between being too aggressive and thus risking of removing valid quotes and be too lax and letting invalid observations affect the calculation of the surprises. After some experimentation, we have implemented the following procedure:³

1. Delete entries with a timestamp outside the interval when markets are open.
2. Delete entries with missing bid or ask price.
3. Delete entries with either the bid or the ask price larger in absolute value than 2500 basis points.
4. Delete entries for which the bid-ask spread is negative.
5. Delete entries with either the bid or ask price exactly equal to zero.
6. Delete entries for which the bid-ask spread is more than 50 times the median spread on that day.
7. Delete entries for which the mid-quote deviated by more than 10 mean absolute deviations from a rolling centered median of 50 observations (25 observations before and 25 after, excluding the observation under consideration).
8. When multiple quotes have the same timestamp, replace these with a single entry with the median bid and median ask price.

Almost all of the misquotes that are dropped are before 2005, and a great majority of these are before 2001. After cleaning, tick data are discretized to a minutely frequency. We do the discretization using the last tick in a minute, and we carry forward the last observation in case of no transactions within a minute. In each window, the quote we use is the median of this cleaned, discretized data.

²Brownlees and Gallo (2006) discuss several techniques that can be used to clean high-frequency data.

³The only outliers we detected in the Governing Council dates after our cleaning procedure were in 17 February 2000 for some OIS maturities. Unfortunately, Reuters does not have the logs for events so far in the past. However, we checked the intraday data, and noticed that there are jumps in these maturities that were larger than 200 basis points. We also cross checked with assets with similar maturities and found almost no change in their yields. We manually dropped these misquotes.

D Appendix: Euro Area Monetary Policy Event-Study Database

To build the asset price/yield changes database, we take the price/yield difference in short windows on Governing Council dates (Table A.2 shows all the event dates). Our methodology accommodates the difference between the FED, on which most of the literature focuses (Kuttner, 2001; Gürkaynak et al., 2005), and the ECB ways of communicating the decisions. FED decisions about interest rates are released with a statement which explains the reasons behind the decisions, describes the economic situation and provides information about the future behavior of the FED (*Forward Guidance*). In contrast, there are two steps in the ECB communication procedure; first at 13:45 *Central European Time* (CET) the ECB releases a very short note where it states the decisions about the three main interest rates (the *main refinancing operation rate*, MRO, the *marginal lending facility rate*, MLF, and the *deposit facility rate*, DF). Then, after forty-five minutes, at 14:30 CET the president of the ECB reads the *introductory statement* (IS) which is a document containing the reasons underlying the choice of the interest rates, describing ECB's view about the economic situation and providing information on its future behavior. This part lasts around fifteen minutes and is followed by a forty-five-minute session of *questions and answers* (Q&A).

Given this information release structure, we calculate the changes reported in the database as follows:

Press Release 13:45 CET

1. Compute lower median 13:25-13:35 (10min)
2. Compute upper median 14:00-14:10 (10min)
3. $Change_t^R = upper_t^{med} - lower_t^{med}$

Press Conference 14:30 to 15:30 CET

1. Compute lower median 14:15-14:25 (10min)
2. Compute upper median 15:40-15:50 (10min)
3. $Change_t^C = upper_t^{med} - lower_t^{med}$

Monetary Event 13:45 to 15:30 CET

1. Compute lower median 13:25-13:35 (10min)

2. Compute upper median 15:40-15:50 (10min)

$$3. \text{Change}_t^M = \text{upper}_t^{\text{med}} - \text{lower}_t^{\text{med}}$$

We collect all the changes for all the instruments around the three windows, and we present the **Euro Area Monetary Policy Event-Study Database (EA-MPD)** as a single workbook consisting of four sheets. The first worksheet contains information on the securities and event windows used in the three sheets presenting data. The second sheet has the intraday event windows for the press release, third has the intraday windows used for the press conference, and fourth has the intraday windows covering their union, the monetary event. Figure D.1 shows the asset price/yield changes for the one-year OIS as a time series for the three windows.

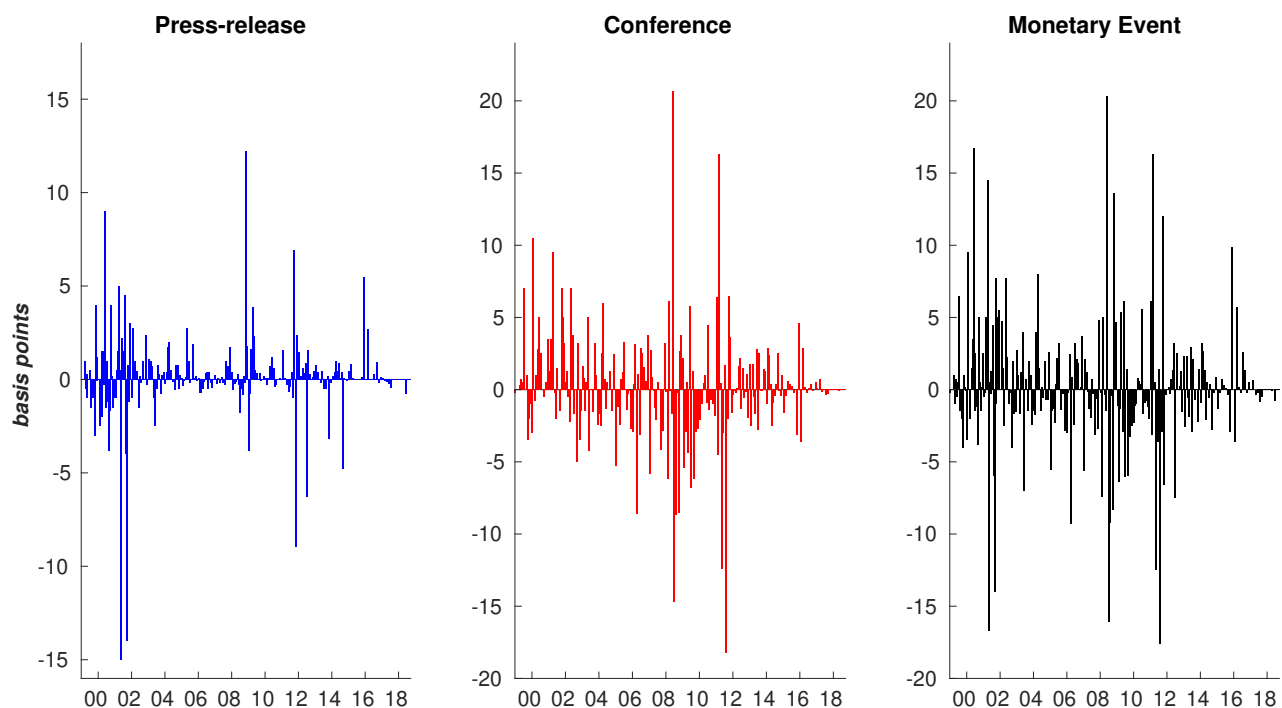


Figure D.1: One-year OIS changes. The figure shows the one-year OIS changes as a time series. From left to right the three panels show the changes around the press release, conference, and monetary event windows.

Table D.1 shows a selection of dates from the tree worksheets in three panels to give a sense of the database coverage. Each sheet contains, in the first column the Governing council dates on which the asset price/yield changes have been constructed. The other columns present the assets and report the change for the particular date highlighted in the first column. The complete EA-MPD is available as an online appendix to our paper and will be regularly updated and made available by the authors. Tables D.2 to D.4 present descriptive statistics for the asset price/yield change series in the EA-MPD.

Table D.1: Selected dates and assets from the EA-MPD

Press Release					
Date	OIS SW	OIS 1M	OIS 3M	OIS 6M	OIS 1Y
11/3/2011	-10	-14	-9	-8	-9
7/5/2012	-8	-10	-9	-8	-6
12/3/2015	4	5	5	6	5
1/21/2016	0	1	1	0	0

Press Conference					
Date	OIS SW	OIS 1M	OIS 3M	OIS 6M	OIS 1Y
11/3/2011	0	0	0	2	4
7/5/2012	1	1	0	-1	-1
12/3/2015	0	0	1	3	5
1/21/2016	0	0	-2	-3	-4

Monetary Surprise					
Date	OIS SW	OIS 1M	OIS 3M	OIS 6M	OIS 1Y
11/3/2011	-10	-14	-11	-8	-7
7/5/2012	-8	-10	-9	-8	-8
12/3/2015	4	5	7	8	1
1/21/2016	0	1	-1	-3	-4

Note: The table shows the structure of the EA-MPD using excerpts from the database.

Table D.2: Descriptive statistics: OIS

Release						
Asset	Min	Datemin	Max	Datemax	Mean	Std
OISSW	-45	17-Sep-2001	17	11-Apr-2001	0	5
OIS1M	-35	17-Sep-2001	15	06-Nov-2008	0	4
OIS3M	-30	17-Sep-2001	14	06-Nov-2008	0	3
OIS6M	-22	17-Sep-2001	14	06-Nov-2008	0	3
OIS1Y	-15	10-May-2001	12	06-Nov-2008	0	2
OIS2Y	-13	10-May-2001	8	06-Nov-2008	0	2
OIS3Y	-8	03-Nov-2011	7	06-Nov-2008	0	2
OIS4Y	-10	07-Nov-2013	5	03-Dec-2015	0	2
OIS5Y	-10	07-Nov-2013	5	03-Dec-2015	0	2
OIS6Y	-9	07-Nov-2013	5	03-Dec-2015	0	2
OIS7Y	-8	07-Nov-2013	4	03-Dec-2015	0	2
OIS8Y	-7	07-Nov-2013	3	03-Dec-2015	0	2
OIS9Y	-7	07-Nov-2013	4	08-Dec-2016	0	2
OIS10Y	-6	07-Nov-2013	5	08-Dec-2016	0	1
OIS15Y	-5	07-Nov-2013	6	08-Dec-2016	0	2
OIS20Y	-2	20-Jul-2017	6	08-Dec-2016	0	1
Conference						
Asset	Min	Datemin	Max	Datemax	Mean	Std
OISSW	-20	07-Jun-2001	14	08-Nov-2001	0	2
OIS1M	-15	11-Apr-2001	7	21-Jun-2001	0	2
OIS3M	-11	04-Aug-2011	11	05-Jun-2008	0	2
OIS6M	-14	04-Aug-2011	16	05-Jun-2008	0	3
OIS1Y	-18	04-Aug-2011	21	05-Jun-2008	0	4
OIS2Y	-23	03-Jul-2008	19	05-Jun-2008	0	4
OIS3Y	-22	03-Jul-2008	13	03-Mar-2011	0	4
OIS4Y	-14	04-Aug-2011	8	03-Dec-2015	0	3
OIS5Y	-13	04-Aug-2011	8	03-Dec-2015	0	3
OIS6Y	-10	04-Aug-2011	8	03-Dec-2015	0	3
OIS7Y	-8	04-Aug-2011	8	03-Dec-2015	0	3
OIS8Y	-7	22-Jan-2015	9	03-Dec-2015	0	3
OIS9Y	-9	22-Jan-2015	9	03-Dec-2015	0	3
OIS10Y	-9	22-Jan-2015	9	03-Dec-2015	0	3
OIS15Y	-12	22-Jan-2015	9	03-Dec-2015	0	3
OIS20Y	-12	22-Jan-2015	8	03-Dec-2015	0	3
Monetary						
Asset	Min	Datemin	Max	Datemax	Mean	Std
OISSW	-45	17-Sep-2001	30	11-Apr-2001	0	5
OIS1M	-35	17-Sep-2001	17	11-Apr-2001	0	4
OIS3M	-30	17-Sep-2001	16	06-Nov-2008	0	4
OIS6M	-22	17-Sep-2001	17	06-Nov-2008	0	4
OIS1Y	-18	04-Aug-2011	20	05-Jun-2008	0	4
OIS2Y	-23	03-Jul-2008	19	05-Jun-2008	0	5
OIS3Y	-23	03-Jul-2008	14	03-Mar-2011	0	5
OIS4Y	-14	04-Aug-2011	13	03-Dec-2015	0	4
OIS5Y	-12	04-Aug-2011	13	03-Dec-2015	0	4
OIS6Y	-10	04-Aug-2011	13	03-Dec-2015	0	4
OIS7Y	-8	04-Aug-2011	13	03-Dec-2015	0	4
OIS8Y	-8	22-Jan-2015	13	03-Dec-2015	0	3
OIS9Y	-9	22-Jan-2015	13	03-Dec-2015	0	3
OIS10Y	-9	22-Jan-2015	12	03-Dec-2015	0	3
OIS15Y	-11	22-Jan-2015	11	03-Dec-2015	0	4
OIS20Y	-12	22-Jan-2015	10	03-Dec-2015	0	4

Note: Descriptive statistics of OIS rate changes, in basis points.

Table D.3: Descriptive statistics: German bonds

Release						
Asset	Min	Datemin	Max	Datemax	Mean	Std
DE3M	-11	08-Oct-2008	12	06-Nov-2008	0	3
DE6M	-8	03-Nov-2011	9	06-Oct-2011	0	2
DE1Y	-9	03-Nov-2011	13	06-Nov-2008	0	2
DE2Y	-15	10-May-2001	9	02-Apr-2009	0	2
DE3Y	-12	10-May-2001	9	02-Apr-2009	0	2
DE4Y	-8	10-May-2001	8	02-Apr-2009	0	2
DE5Y	-9	07-Nov-2013	7	02-Apr-2009	0	2
DE6Y	-7	07-Nov-2013	7	02-Apr-2009	0	1
DE7Y	-7	07-Nov-2013	7	02-Apr-2009	0	1
DE8Y	-6	07-Nov-2013	6	02-Apr-2009	0	1
DE9Y	-5	14-Jun-2018	5	08-Dec-2016	0	1
DE10Y	-5	07-Nov-2013	6	08-Oct-2008	0	1
DE15Y	-4	14-Jun-2018	6	08-Dec-2016	0	1
DE20Y	-5	03-Feb-2000	12	04-Dec-2008	0	2
DE30Y	-5	03-Feb-2000	13	08-Oct-2008	0	2
Conference						
Asset	Min	Datemin	Max	Datemax	Mean	Std
DE3M	-9	04-Aug-2011	37	02-Oct-2008	0	5
DE6M	-13	04-Aug-2011	16	05-Jun-2008	0	3
DE1Y	-14	03-Jul-2008	19	05-Jun-2008	0	4
DE2Y	-25	03-Jul-2008	23	05-Jun-2008	0	5
DE3Y	-23	03-Jul-2008	21	05-Jun-2008	0	4
DE4Y	-21	03-Jul-2008	18	05-Jun-2008	0	4
DE5Y	-20	03-Jul-2008	16	08-Feb-2007	0	4
DE6Y	-16	03-Jul-2008	13	05-Jun-2008	0	4
DE7Y	-12	03-Jul-2008	12	03-Dec-2015	0	3
DE8Y	-11	22-Jan-2015	12	03-Dec-2015	0	3
DE9Y	-12	22-Jan-2015	13	03-Dec-2015	0	3
DE10Y	-13	22-Jan-2015	12	03-Dec-2015	0	3
DE15Y	-15	22-Jan-2015	12	03-Dec-2015	0	4
DE20Y	-8	02-Aug-2012	13	03-Dec-2015	0	3
DE30Y	-18	22-Jan-2015	12	03-Dec-2015	0	3
Monetary						
Asset	Min	Datemin	Max	Datemax	Mean	Std
DE3M	-13	03-Nov-2011	39	02-Oct-2008	1	6
DE6M	-13	04-Aug-2011	16	05-Jun-2008	0	3
DE1Y	-15	03-Jul-2008	19	05-Jun-2008	0	4
DE2Y	-27	03-Jul-2008	23	05-Jun-2008	0	5
DE3Y	-24	03-Jul-2008	21	05-Jun-2008	0	5
DE4Y	-21	03-Jul-2008	18	05-Jun-2008	0	4
DE5Y	-20	03-Jul-2008	15	05-Jun-2008	0	4
DE6Y	-16	03-Jul-2008	16	03-Dec-2015	0	4
DE7Y	-13	03-Jul-2008	16	03-Dec-2015	0	3
DE8Y	-11	22-Jan-2015	16	03-Dec-2015	0	3
DE9Y	-12	22-Jan-2015	16	03-Dec-2015	0	3
DE10Y	-13	22-Jan-2015	16	03-Dec-2015	0	3
DE15Y	-14	22-Jan-2015	14	03-Dec-2015	0	4
DE20Y	-11	03-Feb-2000	12	03-Dec-2015	0	3
DE30Y	-17	22-Jan-2015	13	08-Oct-2008	0	3

Note: Descriptive statistics of German bond yield changes, in basis points.

Table D.4: Descriptive statistics: Other bonds, stock and exchange rates

Release						
Asset	Min	Datemin	Max	Datemax	Mean	Std
IT2Y	-17	14-Jun-2018	9	06-Nov-2008	0	3
FR2Y	-14	10-May-2001	9	06-Nov-2008	0	2
ES2Y	-14	10-May-2001	10	08-Jun-2000	0	2
IT5Y	-14	14-Jun-2018	8	02-Apr-2009	0	2
ES5Y	-21	20-May-1999	7	04-Aug-2011	0	2
FR5Y	-9	07-Nov-2013	8	02-Apr-2009	0	2
ES10Y	-10	10-Mar-2016	7	08-Oct-2008	0	2
FR10Y	-7	10-Mar-2016	10	07-Jan-1999	0	2
IT10Y	-11	07-Nov-2013	6	03-Dec-2015	0	2
STOXX50E	-2	06-Nov-2008	2	10-Mar-2016	0	0
SX7E	-2	06-Nov-2008	5	10-Mar-2016	0	1
USD	-1	10-Mar-2016	1	03-Dec-2015	0	0
GBP	-1	07-Nov-2013	1	03-Dec-2015	0	0
JPY	-2	06-Nov-2008	1	03-Dec-2015	0	0
Conference						
Asset	Min	Datemin	Max	Datemax	Mean	Std
IT2Y	-24	03-Jul-2008	22	02-Aug-2012	0	6
FR2Y	-24	03-Jul-2008	21	05-Jun-2008	0	4
ES2Y	-24	03-Jul-2008	17	05-Jun-2008	0	5
IT5Y	-21	04-Jul-2013	32	02-Aug-2012	0	6
ES5Y	-19	03-Jul-2008	23	02-Aug-2012	0	5
FR5Y	-20	03-Jul-2008	16	05-Jun-2008	0	4
ES10Y	-12	04-Jul-2013	31	02-Aug-2012	0	4
FR10Y	-14	22-Jan-2015	14	03-Dec-2015	0	3
IT10Y	-13	04-Jul-2013	38	02-Aug-2012	0	5
STOXX50E	-3	02-Aug-2012	2	22-Oct-2015	0	1
SX7E	-7	02-Aug-2012	3	04-Jul-2013	0	1
USD	-1	22-Oct-2015	2	10-Mar-2016	0	0
GBP	-1	22-Oct-2015	1	10-Mar-2016	0	0
JPY	-1	22-Jan-2015	1	10-Mar-2016	0	0
Monetary						
Asset	Min	Datemin	Max	Datemax	Mean	Std
IT2Y	-25	03-Jul-2008	21	05-Jun-2008	0	6
FR2Y	-26	03-Jul-2008	21	05-Jun-2008	0	5
ES2Y	-25	03-Jul-2008	21	05-Jun-2008	0	5
IT5Y	-22	04-Jul-2013	29	02-Aug-2012	0	6
ES5Y	-21	06-Sep-2012	20	02-Aug-2012	0	5
FR5Y	-20	03-Jul-2008	16	03-Dec-2015	0	4
ES10Y	-16	06-Sep-2012	29	02-Aug-2012	0	4
FR10Y	-15	22-Jan-2015	19	03-Dec-2015	0	3
IT10Y	-16	04-Jul-2013	36	02-Aug-2012	0	5
STOXX50E	-4	03-Dec-2015	2	22-Oct-2015	0	1
SX7E	-7	02-Aug-2012	3	04-Jul-2013	0	1
USD	-1	08-Dec-2016	2	03-Dec-2015	0	0
GBP	-1	11-May-2000	2	03-Dec-2015	0	0
JPY	-1	04-Aug-2011	2	03-Dec-2015	0	0

Note: Descriptive statistics of French, Italian, and Spanish bond yield changes in basis points, and stock returns, and exchange rate returns in percentage points.

E Appendix: Consistency Checks

To check the plausibility of the asset price/yield changes that will be used to measure monetary policy surprises, we implement consistency checks utilizing three tests. First, we check whether the changes in the press release and press conference windows constructed for the same instrument are uncorrelated. This is indeed the case. Within the same window, changes in yields of the same instrument at close maturities are positively correlated, as expected. Second, we plot and visually inspect maturity structures of yield changes to verify that these do not display jumps at a single maturity. They do not. Lastly, we assess the effects of US *Initial Jobless Claims* (IJC), a macroeconomic news release that almost always lies within our press conference window. We find that even when the IJC surprise statistically significantly affects some asset prices/yields reported in our dataset, the total variance explained by the release is small and never exceeds 10% of the total.

E.1 Asset Price/Yield Change Correlations

We verified that the following are true for all relevant assets and maturities. There are:

- High correlations of changes across close maturities within each window (Figure E.1, both panels)
- Essentially zero correlation of changes for the same asset/maturity across windows (Figure E.2, both panels)
- High correlations of changes of OIS and sovereign yields of the same maturities within each window (Figure E.3).

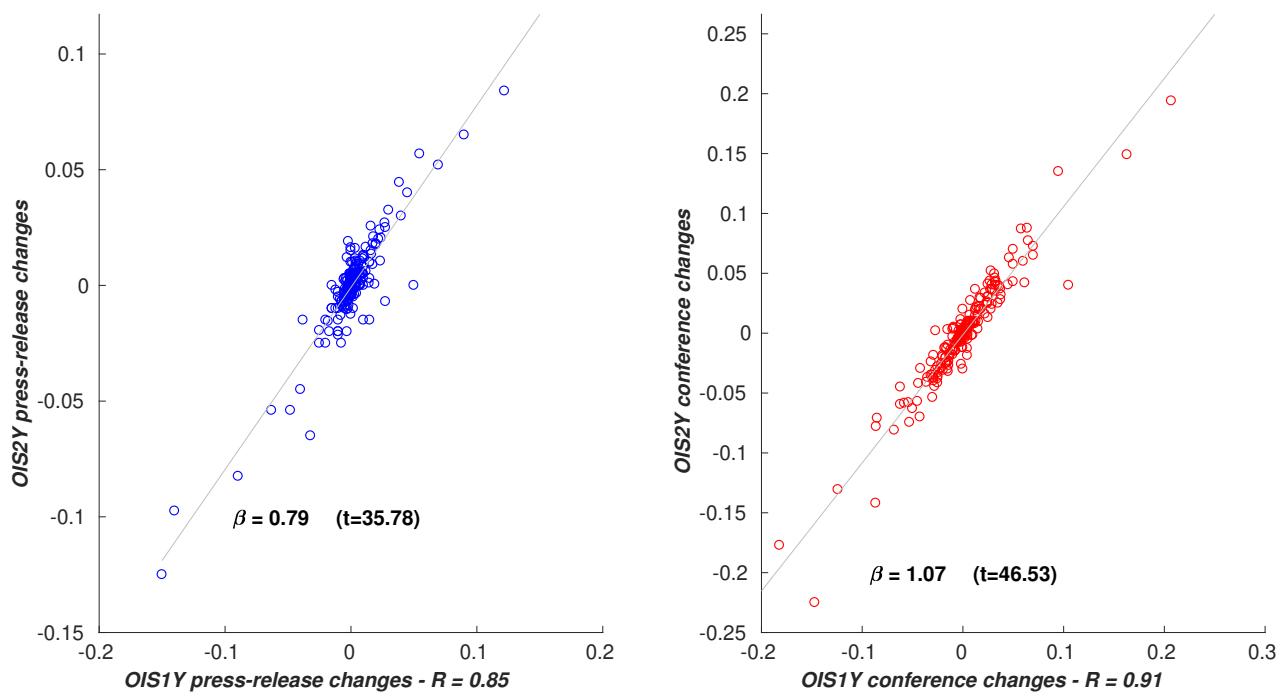


Figure E.1: One- and two-year OIS changes—within window comparison

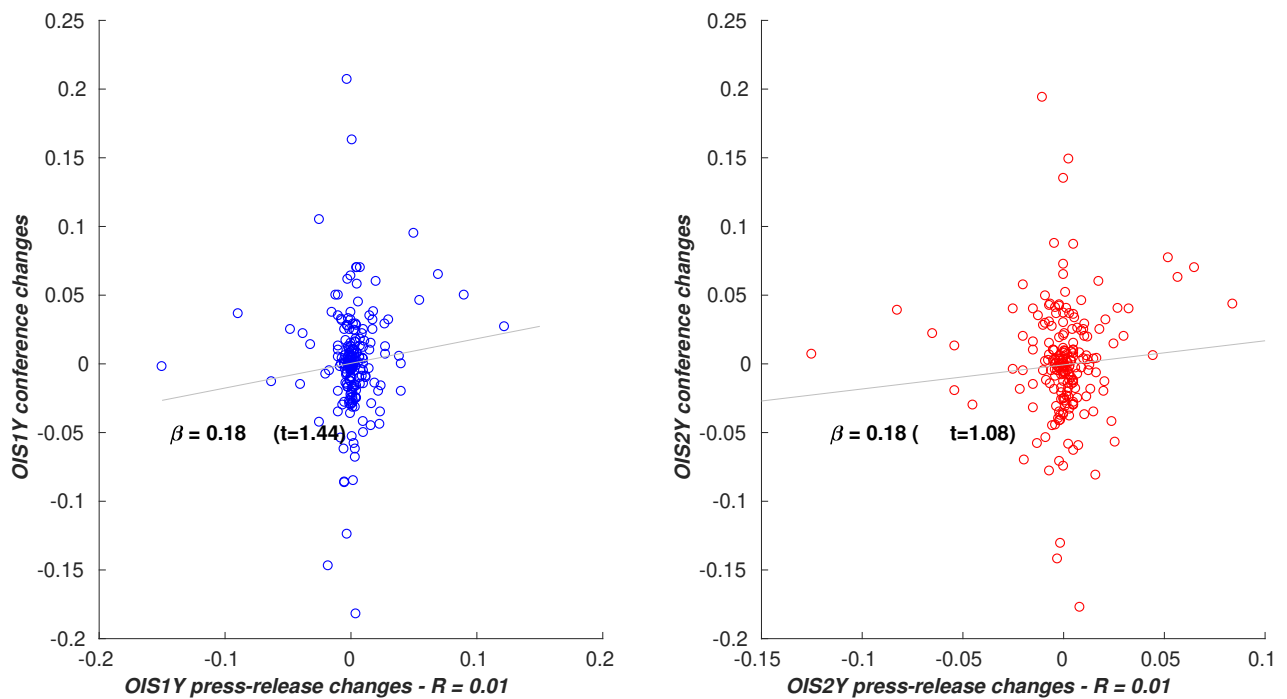


Figure E.2: One and two-year OIS changes—across windows comparison

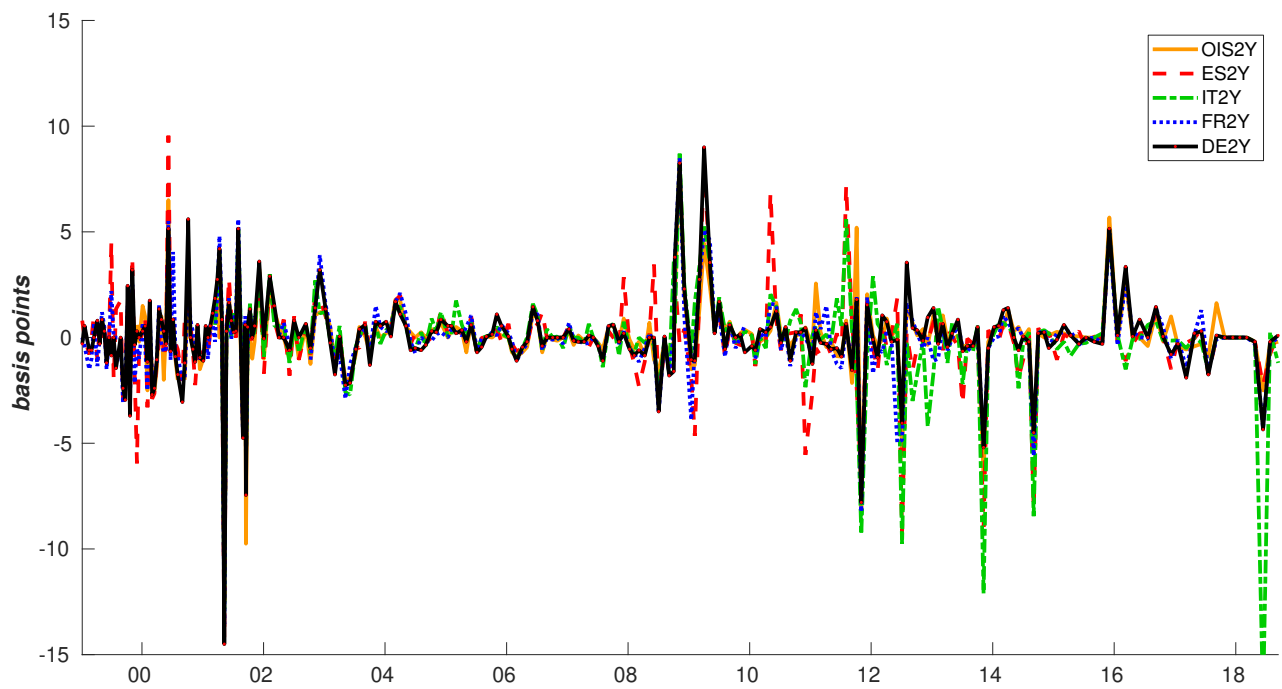


Figure E.3: Comovements in two-year OIS and sovereign yield changes—all events

E.2 Maturity Structure of Changes

To visually verify that the data cleaning procedure described above has worked, we produced maturity structures of changes in yields of every fixed income security we have data for and studied these. We find that these term structures of yield changes are fairly smooth except for 17 February 2000, mentioned above. Note that our cleaning procedure flags large jumps in prices of securities within the event windows but does not impose smoothness across maturities. Hence, not having overly jagged maturity structures of changes provides independent verification that the cleaning procedure has worked properly.

We further compare the asset change maturity structures built with high-frequency data with the same curve built using daily data. In the latter case, the asset changes are constructed by taking the difference between the closing price of the Governing Council date and the closing price of the day before. For each Governing Council date, we plot both curves, and we assess the dates in which the two differs remarkably. For these dates, we check the underlying movements in the high-frequency series to understand the reasons of the differences. In the majority of these cases we see trends before the press release, or jumps in the prices/yields outside our measurement windows that are unrelated to policy communication. Hence, as expected, daily data not only does not allow separating the two components of ECB policy communication, it also tends to be a noisier measure of their union, the monetary event.

E.3 US Initial Claims

The weekly release of the *US initial jobless claims* (IJC) coincides in many instances with the beginning of press conference, as also noted by [Brand et al. \(2010\)](#). The IJC is released every Thursday at 8:30 *Eastern Standard Time* (EST), and with the exception of some dates in which this coincides with 13:30 or 15:30 CET for daylight saving time, this is released at 14:30 CET when the ECB press conference begins. However, [Brand et al. \(2010\)](#) control for the IJC release creating a dummy variable to account for coincident releases. We employ a continuous measure of the IJC surprise, S_t , that is now standard in the literature:

$$(E.1) \quad S_t = \frac{A_t - E(A_t)}{\sqrt{VAR(A_t - E(A_t))}}$$

where A_t is the actual value of the release and $E(A_t)$ is the market expectation of the actual value of the release. We measure the expectation as the median value of the economists' survey done by Bloomberg. This difference is standardized by its standard deviation.

We studied the reactions of OIS and German Bund yields to IJC surprises measured this way, in the conference window. Table E.1 shows that even in the cases where the yield reaction is significant, the R^2 coefficients are always tiny—never in double digits. Thus, the possible confounding effects of the simultaneous release of US IJC is small. Even though we control for the IJC surprises in the applied work in our paper, researchers not doing this would not be contaminating their estimates much.

Table E.1: IJC surprises and OIS and Bund reactions

	Policy Meeting Dates			Non Policy Meeting Dates		
	Beta	p-value	R^2	Beta	p-value	R^2
OISSW	0.00	0.20	0.01	0.00	0.04*	0.01
OIS1M	0.00	0.24	0.01	0.00	0.11	0.00
OIS3M	0.00	0.10	0.01	0.00	0.06	0.01
OIS6M	-0.01	0.00***	0.04	0.00	0.00***	0.02
OIS1Y	-0.01	0.00***	0.05	0.00	0.00***	0.04
OIS2Y	-0.01	0.00***	0.07	0.00	0.00***	0.04
OIS3Y	-0.01	0.00***	0.08	0.00	0.00***	0.03
OIS4Y	-0.01	0.18	0.03	0.00	0.14	0.01
OIS5Y	-0.01	0.17	0.03	0.00	0.06	0.01
OIS6Y	-0.01	0.12	0.04	0.00	0.06	0.01
OIS7Y	-0.01	0.12	0.04	0.00	0.05*	0.02
OIS8Y	-0.01	0.14	0.04	0.00	0.02*	0.02
OIS9Y	-0.01	0.12	0.04	0.00	0.06	0.01
OIS10Y	-0.01	0.11	0.05	0.00	0.05*	0.02
OIS15Y	-0.01	0.14	0.07	0.00	0.92	0.00
OIS20Y	-0.01	0.18	0.06	0.00	0.88	0.00
<hr/>						
	Policy Meeting Dates			Non Policy Meeting Dates		
	Beta	p-value	R^2	Beta	p-value	R^2
DE3M	0.00	0.45	0.01	0.00	0.44	0.00
DE6M	-0.01	0.01**	0.05	0.00	0.02*	0.01
DE1Y	-0.01	0.01**	0.05	0.00	0.00***	0.02
DE2Y	-0.01	0.00***	0.07	0.00	0.00***	0.04
DE3Y	-0.01	0.00***	0.08	0.00	0.00***	0.05
DE4Y	-0.01	0.00***	0.08	0.00	0.00***	0.06
DE5Y	-0.01	0.00***	0.07	0.00	0.00***	0.05
DE6Y	-0.01	0.00***	0.08	0.00	0.00***	0.06
DE7Y	-0.01	0.00***	0.07	0.00	0.00***	0.05
DE8Y	-0.01	0.00***	0.07	0.00	0.00***	0.05
DE9Y	-0.01	0.00***	0.06	0.00	0.00***	0.05
DE10Y	-0.01	0.00***	0.06	0.00	0.00***	0.05
DE15Y	-0.01	0.05*	0.06	0.00	0.01**	0.03
DE20Y	-0.01	0.00***	0.04	0.00	0.00***	0.04
DE30Y	-0.01	0.01**	0.03	0.00	0.00***	0.04

Note: the table shows the results of a linear regression with the asset changes in the first column, as a dependent variable, and the IJC surprise as an explanatory variable $\Delta Asset_t = \beta IJC_t + \epsilon_t$. The results under the line “Policy Meeting Dates” highlights results for the dates in which we have the release of the IJC published during the ECB president conference. Instead, the results under the line “Non Policy Meeting Dates” highlights results for dates in which the IJC is released, but there are no Governing Council meetings.

F Appendix: The Factor Rotation

We now describe in more detail the identification strategy and rotation of the factors described in Section 3.1 of the paper. Identification of press release factors is as in [Gürkaynak et al. \(2005\)](#) and those of the press conference factors are as in [Gürkaynak2005b](#) and [Swanson \(2017\)](#). In what follows, if A is a matrix, we denote its j -th column as $A_{.j}$ and its i -th row as $A_{i.}$.

As described in the main text, the factor structure for the press conference is given by

$$X = F\Lambda + \epsilon,$$

where F is the matrix whose rows contain the unobserved factors for each policy event, and Λ is the matrix of loadings. The latent factors cannot be interpreted as monetary policy surprises: factors are unique up to a orthonormal transformation, i.e., for every (3×3) matrix U satisfying $UU' = I$, we can equivalently express X as

$$X = \tilde{F}\tilde{\Lambda} + \epsilon^j, \quad \text{where } \tilde{F} = FU, \text{ and } \tilde{\Lambda} = U'\Lambda.$$

We impose economic restrictions to identify a unique matrix U^* such that the rotated factors, $F^* = FU^*$, can be interpreted as orthogonal surprises, each describing a particular dimension of monetary policy.⁴ Orthonormality gives six restrictions on the elements of U . Three restrictions comes from the columns of U having unit length:

$$(F.2) \quad U'_{.1}U_{.1} = 1, U'_{.2}U_{.2} = 1, \text{ and } U'_{.3}U_{.3} = 1,$$

and three from the columns of U being orthogonal:

$$(F.3) \quad U'_{.1}U_{.2} = 0, U'_{.1}U_{.3} = 0, U'_{.2}U_{.3} = 0.$$

To identify the monetary policy factors, we need thus to impose three additional restrictions on the elements of U . Requiring that the second and third factors do not load on the one-month OIS gives two restrictions

$$(F.4) \quad U'_{.2}\Lambda_{.1} = 0, \text{ and } U'_{.3}\Lambda_{.1} = 0.$$

⁴Note that the first two rotated factors are rotations of the first two factors from the principal components analysis and continue to be the two factors that capture the maximal share of the variance in X .

The third and final additional restriction comes from requiring that the rotated third factor has minimum variance in the pre-crisis period (2 January 2002 - 7 Aug 2008). In other words, among all the orthonormal matrices satisfying (F.2)-(F.4), we want to pick the one giving a rotated third factor with the lowest variance in the pre-crisis period. This is the idea behind the Swanson (2017) identification of what turns out to be the QE factor. Let F^{pre} denote the factor matrix for all the pre-crises monetary policy events. The third factor is $F^{\text{pre}}U_{3\cdot}$, and its variance is $\sum_{t=1}^T (F_{t\cdot}^{\text{pre}}U_{3\cdot})^2 / T$, where T is the number of pre-crises policy events. The rotation matrix $\{u_{ij}\}$ can thus be obtained by solving the following optimization problem

$$U^* = \arg \min_{\{u_{ij}\}} \frac{1}{T} \sum_{t=1}^T (F_{t\cdot}^{\text{pre}}U_{3\cdot})^2$$

subject to

$$U'_{\cdot 2}\Lambda_{\cdot 1} = 0, \quad U'_{\cdot 3}\Lambda_{\cdot 1} = 0$$

$$U'_{\cdot 1}U_{\cdot 1} = 1, \quad U'_{\cdot 2}U_{\cdot 2} = 1, \quad U'_{\cdot 3}U_{\cdot 3} = 1$$

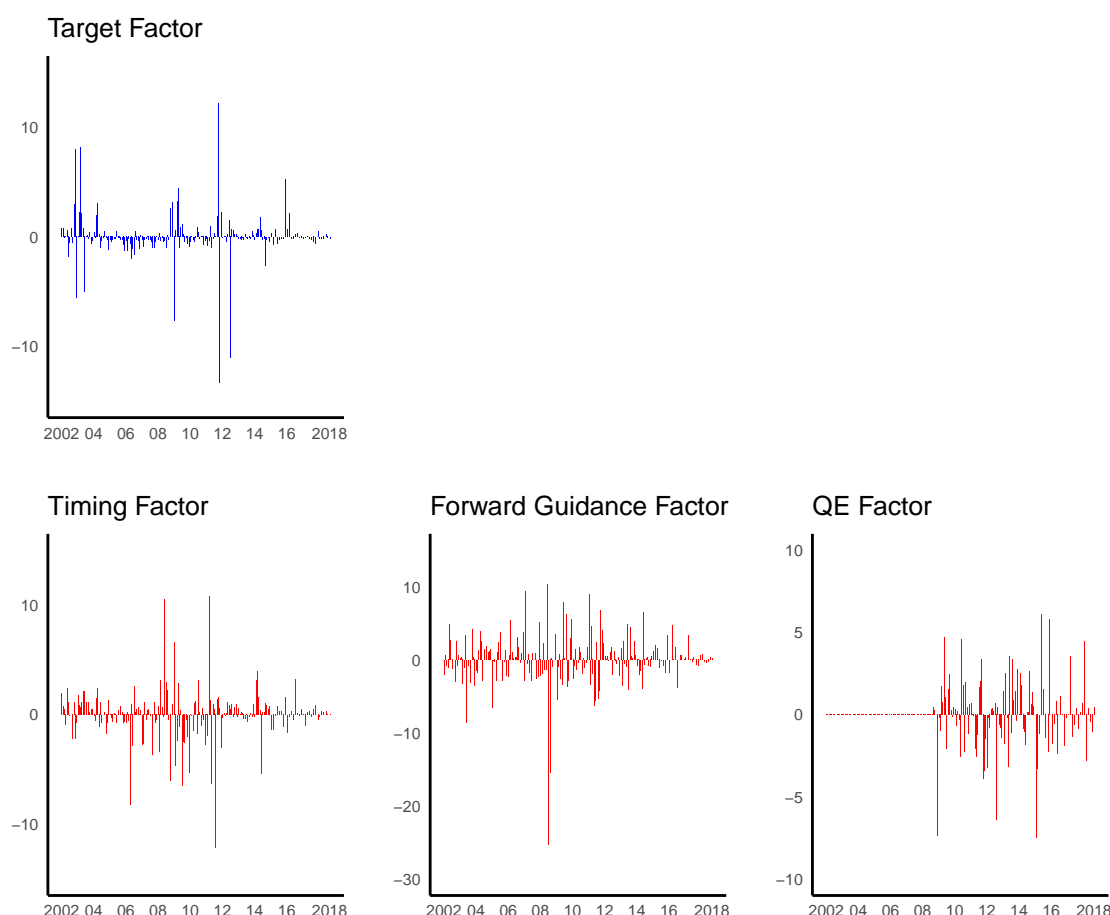
$$U'_{\cdot 1}U_{\cdot 2} = 0, \quad U'_{\cdot 1}U_{\cdot 3} = 0, \quad U'_{\cdot 2}U_{\cdot 3} = 0.$$

It is easy to check that the first order conditions of the optimization problem gives the final restriction. The matrix U^* is unique up to a sign normalization. We scale the columns of $F^* = FU^*$ so that the resulting three factors, Timing, FG, and QE, are positively correlated with the six-month, two-year, and ten-year OIS rates, respectively. As such, we can interpret positive factors as expressing restrictive monetary surprises.

G Appendix: Market Surprises and ECB's Actions

In this section, we describe and discuss the Target, Timing, Path (Forward Guidance) and QE factors over the press release and the conference windows as time series. We compare these identified surprises with ECB's relevant policy actions and check that we have an accurate mapping. We focus in particular on larger surprises, and compare these with market commentaries to see whether the two coincide. The time series of the surprises are shown in figure G.1. As can be seen in the top left panel, the largest realization for the Target factor

Figure G.1: Estimated factors in the press release window (upper panel) and the press conference window (lower panels), 2002-2018



Note: The figure shows the estimated factors over time reported in basis points. As the factors are identified up to scale, we scale them such that target has unit effect on one-month OIS, timing has unit effect on six-month OIS, forward guidance has unit effect on the two-year and QE has unit effect on the ten-year yields.

occurred on 3 November 2011 when the ECB cut its policy rates by 25 basis points, which came unexpectedly in part because it was the first meeting of Mario Draghi as ECB President. After the rate on the deposit facility was brought down to zero on 5 July 2012, which shows up as a large and negative realization for the Target surprise, realizations for the Target factor

have become smaller, with the exception of two episodes: a sizeable negative realization on 4 September 2014 when the ECB cut the deposit facility rate to more negative values, which was unexpected as also suggested by surveys among analysts ahead of the policy meeting;⁵ and a positive realization on 3 December 2015 when the ECB cut the deposit facility rate by a further 10 basis points.⁶

Similarly, the volatility of the Timing factor in the conference window has declined after the rate on the deposit facility was brought down to zero in July 2012. The largest realizations of the Timing factor match well with market commentary around ECB announcements, such as the episodes of 4 August 2011, 3 March 2011, and 5 June 2008, building support for our identification. In these three episodes the policy rates were left unchanged, as expected—and we indeed find that there are no Target surprises in the press release window; but there were important announcements during the press conference. In the second and third episodes the Introductory Statement during the press conference contained expressions (“strong vigilance” in one episode, and “state of heightened alertness” and readiness to act “in a firm and timely manner” in the other episode) meant to signal high likelihood of policy actions in the subsequent policy meetings. We find large and positive realizations for the Timing factor, and indeed in both episodes the policy rates were hiked in the following policy meeting. In the 4 August 2011 episode the ECB President announced in the press conference several non-standard measures to support liquidity in the banking system, such as the extension of fixed-rate full-allotment for weekly liquidity provision operations at least until the end of the year. On that day, in the conference window we find a very large negative realization of the Timing factor and a relatively large and negative realization of the Forward Guidance factor.

The largest realization of the Forward Guidance factor in the conference window occurred on 3 July 2008, and was a negative surprise. This is interesting because on that date policy rates were increased by 25 basis points, and this was fully expected—our Target factor indeed hardly moved, and this is supported also by survey evidence gathered ahead of the policy meeting; but the press conference was taken as signaling that no more hikes were planned, leading markets to price out further increases. Another noteworthy episode is on 4 July 2013 when the ECB, first time ever and unexpectedly according to market commentaries, announced Forward Guidance on policy rates; this announcement was made in the press conference, and

⁵Bloomberg News on 4 September 2014 at 01:01am: reported that “Of 57 economists surveyed by Bloomberg News, 51 said [today] the ECB will keep its key interest rate unchanged.”

⁶On 3 December 2015 at 13:50 Bloomberg News reported on the 10 basis point cut and on the prediction made by Nick Kounis, head of macro research at ABN Amro NV in Amsterdam, before the publication of the decision: “10 basis points [cut] could be overall a disappointment”. Associated Press at 13:59 reported: “The size of the cut, however, appeared to be a disappointment for investors.”

our methodology correctly identifies a large and negative realization of the Forward Guidance factor in the conference window.

The largest realization of the QE factor in the conference window is on 22 January 2015; it is negative and corresponds to the announcement of the ECB’s asset purchase programme, which was made in the press conference. Other sizeable realizations of the QE factor coincide with ECB’s communication on its asset purchase programme, such as on 3 December 2015 when the ECB announced in the press conference the extension of the asset purchases. On that date we read a positive realization of the QE factor, suggesting that markets were expecting a more forceful action, as also evidenced by surveys and market commentaries.⁷ The large positive realization on 3 June 2015 is also interesting: against the background of increasing long-term rates in the weeks preceding the policy meeting, President Draghi said during the press conference that “we should get used to periods of higher volatility” and that “the Governing Council was unanimous in its assessment that we should look through these developments and maintain a steady monetary policy stance”. These remarks led to market participants’ assigning lower probability to future non-standard policy easings.

⁷On 3 December 2015 Reuters News at 14:43 reported in real time President Draghi’s announcement of QE extension: “We decided to extend the asset-purchase programme. The monthly purchases of 60 billion euros under the asset-purchase programme are now intended to run until the end of March 2017 or beyond if necessary [...]”. Reuters news added that: “Analysts polled by Reuters last week had expected the ECB to increase the monthly purchases to 75 billion euros as well as extending the purchases”. Reuters News at 15:48 reported: “Disappointment that he [President Draghi] didn’t do even more [...] Euro zone bond yields rose and stock markets fell”. The Wall Street Journal on the following day (4 December 2016) reported: “Markets were expecting so much more. Royal Bank of Scotland economists, for instance, had forecast a 0.2-point rate reduction, a 25 billion euros-a-month (\$26.5 billion) increase in the pace of bond purchases and a six-month extension. The market reaction was violent: European stocks fell by more than 3%, the euro jumped more than three cents against the dollar and eurozone bond yields shot higher”.

H Appendix: Regression Tables of Sovereign Yield and Exchange Rate Responses

Table H.1: Estimated effects of monetary policy surprises on Italian sovereign yields

Panel (A): Press release window									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
VARIABLES	IT 2Y	Jan-02/Dec-07 IT 5Y	IT 10Y	IT 2Y	Jan-08/Dec-13 IT 5Y	IT 10Y	IT 2Y	Jan-14/Sep-18 IT 5Y	IT 10Y
Target	0.10 (0.11)	-0.03 (0.12)	-0.06 (0.09)	0.45** (0.20)	0.39** (0.19)	0.16 (0.12)	0.99*** (0.34)	0.85** (0.42)	0.80 (0.62)
Observations	72	72	72	71	71	71	42	42	42
R-squared	0.04	0.00	0.03	0.22	0.16	0.05	0.12	0.10	0.08

Panel (B): Conference window									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
VARIABLES	IT 2Y	Jan-02/Dec-07 IT 5Y	IT 10Y	IT 2Y	Jan-08/Dec-13 IT 5Y	IT 10Y	IT 2Y	Jan-14/Sep-18 IT 5Y	IT 10Y
Timing	1.05*** (0.06)	0.77*** (0.07)	0.42*** (0.06)	0.62*** (0.18)	0.25 (0.19)	0.14 (0.11)	0.89*** (0.32)	1.19** (0.48)	0.77* (0.46)
FG	1.01*** (0.06)	0.92*** (0.07)	0.61*** (0.06)	0.97*** (0.10)	0.76*** (0.10)	0.29*** (0.08)	0.76*** (0.16)	1.08*** (0.27)	1.12*** (0.31)
QE							0.57*** (0.11)	0.96*** (0.24)	1.76*** (0.17)
IJC	-0.09 (0.06)	-0.15 (0.09)	-0.20** (0.09)	0.05 (0.49)	-0.57 (0.59)	-0.57 (0.41)	-0.08 (0.27)	0.17 (0.42)	0.06 (0.41)
Observations	67	67	67	71	71	71	42	42	42
R-squared	0.96	0.91	0.78	0.43	0.26	0.08	0.71	0.69	0.80

*Note: The table reports the reaction of Italian sovereign yields at different maturities to surprises in monetary policy using intraday data. Coefficients are expressed in percentage per annum per standard deviation change in the factors. Robust standard errors in parentheses; ***, **, and * denote statistical significance at the 1%, 5% and 10% levels, respectively.*

Table H.2: Estimated effects of monetary policy surprises on Spanish sovereign yields

Panel (A): Press release window

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Jan-02/Dec-07			Jan-08/Dec-13			Jan-14/Sep-18		
VARIABLES	ES 2Y	ES 5Y	ES 10Y	ES 2Y	ES 5Y	ES 10Y	ES 2Y	ES 5Y	ES 10Y
Target	0.06 (0.10)	-0.04 (0.12)	-0.07 (0.09)	0.39** (0.18)	0.26* (0.14)	0.25 (0.15)	1.00*** (0.33)	0.87** (0.41)	0.81 (0.67)
Observations	72	72	72	71	71	71	42	42	42
R-squared	0.02	0.01	0.03	0.16	0.11	0.12	0.43	0.22	0.10

Panel (B): Conference window

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Jan-02/Dec-07			Jan-08/Dec-13			Jan-14/Sep-18		
VARIABLES	ES 2Y	ES 5Y	ES 10Y	ES 2Y	ES 5Y	ES 10Y	ES 2Y	ES 5Y	ES 10Y
Timing	0.61*** (0.12)	0.41*** (0.14)	0.21* (0.11)	0.53*** (0.12)	0.31** (0.13)	0.11 (0.10)	0.93*** (0.30)	1.18** (0.44)	0.68 (0.41)
FG	0.86*** (0.09)	0.69*** (0.08)	0.34*** (0.08)	0.90*** (0.09)	0.71*** (0.08)	0.32*** (0.08)	0.72*** (0.15)	0.99*** (0.26)	0.95*** (0.26)
QE							0.54*** (0.10)	0.68*** (0.13)	1.45*** (0.17)
IJC	-0.02 (0.33)	-0.52 (0.38)	-0.69* (0.36)	0.07 (0.41)	-0.50 (0.46)	-0.70* (0.40)	0.19 (0.23)	0.02 (0.40)	0.03 (0.37)
Observations	113	113	113	71	71	71	42	42	42
R-squared	0.52	0.33	0.11	0.54	0.35	0.12	0.74	0.67	0.80

Note: The table reports the reaction of Spanish sovereign yields at different maturities to surprises in monetary policy using intraday data. Coefficients are expressed in percentage per annum per standard deviation change in the factors. Robust standard errors in parentheses; ***, **, and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Table H.3: Estimated effects of monetary policy surprises on the exchange rate

Panel (A): Press release window				
VARIABLES	(1) EUR	(2) EUR	(3) EUR	(4) EUR
Target	0.03* (0.01)	-0.01 (0.01)	0.02* (0.01)	0.23** (0.09)
Observations	185	72	71	42
R-squared	0.01	0.01	0.10	0.08

Panel (B): Conference window				
VARIABLES	(1) EUR	(2) EUR	(3) EUR	(4) EUR
Timing	0.06*** (0.01)	0.07*** (0.02)	0.05*** (0.01)	0.23** (0.09)
FG	0.05*** (0.01)	0.02 (0.01)	0.05*** (0.01)	0.24*** (0.07)
QE	0.07*** (0.02)			0.08** (0.04)
IJC	0.05 (0.03)	0.08** (0.03)	0.00 (0.05)	-0.08 (0.16)
Observations	180	67	71	42
R-squared	0.19	0.25	0.41	0.26

*Note: The table reports the reaction of the euro-dollar exchange rate over different samples to surprises in monetary policy using intraday data. Coefficients are expressed in percentage points per standard deviation change in the factors. Robust standard errors in parentheses; ***, **, and * denote statistical significance at the 1%, 5% and 10% levels, respectively*

I Appendix: Persistence of Effects

An important and open question has to do with the longevity of financial market effects of surprises identified in high-frequency event studies. This has especially been important for the debate over unconventional monetary policy, where immediate market reactions were visible in real time in most occasions, but doubts lingered as to whether on balance these policies had lasting effects. In particular, the effects of QE have been very difficult to trace over time as QE surprises were not quantified and only the announcement times were known, leading to the use of dummy variables to capture QE effects that were not very precisely estimated. An important paper in this vein is [Wright \(2012\)](#) who traces the effects of Fed QE surprises in a VAR identified via heteroskedasticity. He finds a half life of about three months, which is economically significant but not very long.

Our continuous measure of QE surprises allows estimating the persistence of QE effects using much richer information than before. To gain insight about the persistence of the effects of the ECB monetary policy measures, we use a small daily vector autoregression with financial variables as in section 5 of the paper, but we replace the 2-year OIS with the 10-year yield as we want to focus on longer maturities, which our analysis in section 4 has shown to be affected the most by QE. The measure of the 10-year yield we include in the model is the German, French, Italian and Spanish 10-year sovereign yield, added one at the time. We keep in the vector Y_t the other variables we have used in the VAR in section 5: log of the EUR-USD exchange rate, the log of the stock market index (Euro Stoxx 50), and the 2-year inflation linked swap (ILS2Y). To these measures, in the robustness check, we add the spread of the *AAA* and *BBB* corporate yields, the EA implied stock volatility index — i.e., the VIX for the EA, and the 2-year OIS and the 5-year EA GDP-weighted yields.⁸

Our data set is daily and covers the period 2005-03-31 to 2018-09-13, which is the longest available for the selected variables. Consistent with the previous analysis, we use the Target, Timing, and Forward Guidance factors as external instruments for the VAR estimated on the full sample (2005-03-31 to 2018-09-13). In the Quantitative Easing cases, the instrument is used on the period 2014-01-01 to 2018-09-13 only.

Figure [I.1](#) shows the results for Target (first column), Timing (second column), Forward Guidance (third column) and Quantitative Easing (forth column) surprises on German, Italian, French and Spanish 10-year government yields. The responses of all countries' yields are

⁸The GDP weighted 5-year EA yield is used instead of the 5-year OIS, as the latter is only available for a short sample.

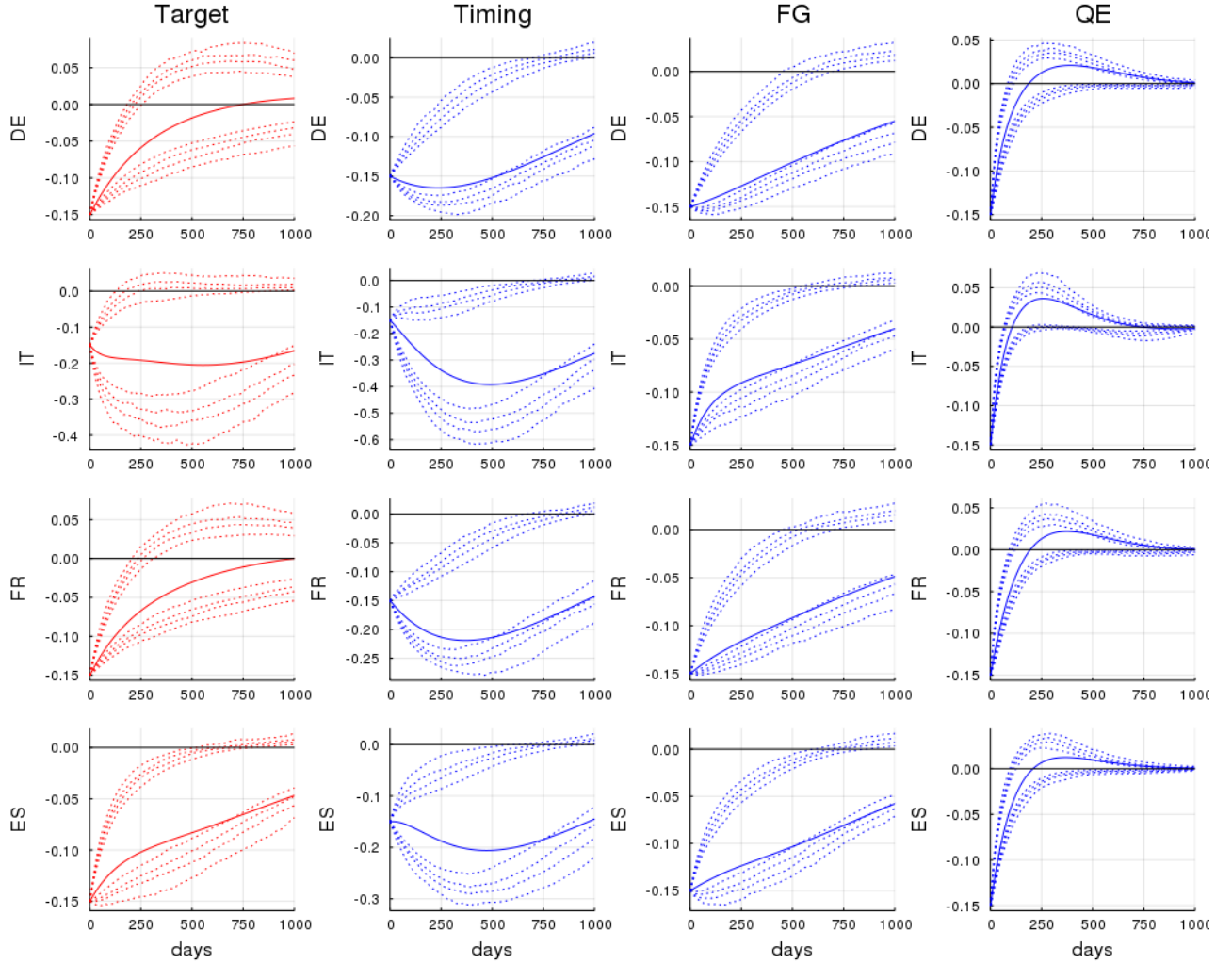
strongly persistent. The results further show that for Target, the IRFs are not statistically different from zero after a few periods. This is not surprising in light of the results we have shown in section 5 of the paper documenting that Target does not have a material effect on 10-year yields on impact. Timing and Forward Guidance are more heterogeneous, even if in almost all the cases (except for Italy for Timing) the response seems quite persistent. Finally, the QE shock is persistent and well identified as judged by the narrow confidence bands. Our finding of a half-life of about one year for the QE effects is much longer than that of [Wright \(2012\)](#) for the US—at about three months—which was obtained using QE announcement dates in a heteroskedasticity-based estimation setting. It is also much longer than [Swanson \(2017\)](#), who estimates a persistence in the US similar to Wright, using local projections. [Andrade et al. \(2016\)](#), using a shorter sample, also find persistent effects of QE in the euro area.

To further investigate these results, we check whether these findings are robust to different VAR specifications. Figure [I.2](#) shows the IRFs from a “Combinatoric” VAR (CVAR). The CVAR works as follows: we add to the four variables we used in the previous specification (10-year sovereign yield, the log of the EUR-USD exchange rate, the log of the stock market index, Euro Stoxx 50, and the 2-year inflation linked swap, ILS2Y), four more variables (the BBB-AAA corporate bond spread, the EA stock market implied volatility index (VSTOXX), the 2-year OIS and the 5-year EA GDP-weighted yields, and we specify a different VAR for each possible combination of two to eight variables. The 10-year yield is always included, as the instrumented variable. Additionally, we ran each of these using eight different specifications of the 10-year yield,⁹ for a total of $8(2^7 - 1) \approx 1000$ specifications. For each model, we always use the longest sample available. The figure highlights that IRF coefficients, estimated from different models, display a clear and persistent pattern. Especially the QE and Forward Guidance surprises affected the 10-year yields for a long period of time.

It is interesting to find the persistence of unconventional policy in the euro area on long-term interest rates to be much higher than what is found for the US. In interpreting this result it is important to keep in mind the difference in methodologies. We employ a VAR with a continuous measure for Forward Guidance and QE surprises as instruments for the euro area, in contrast to heteroskedasticity-identified VARs and local projections for the US. We note the high and robust persistence of unconventional policy effects we find with the VAR but caution that these results are not directly comparable to those in the literature for the US.

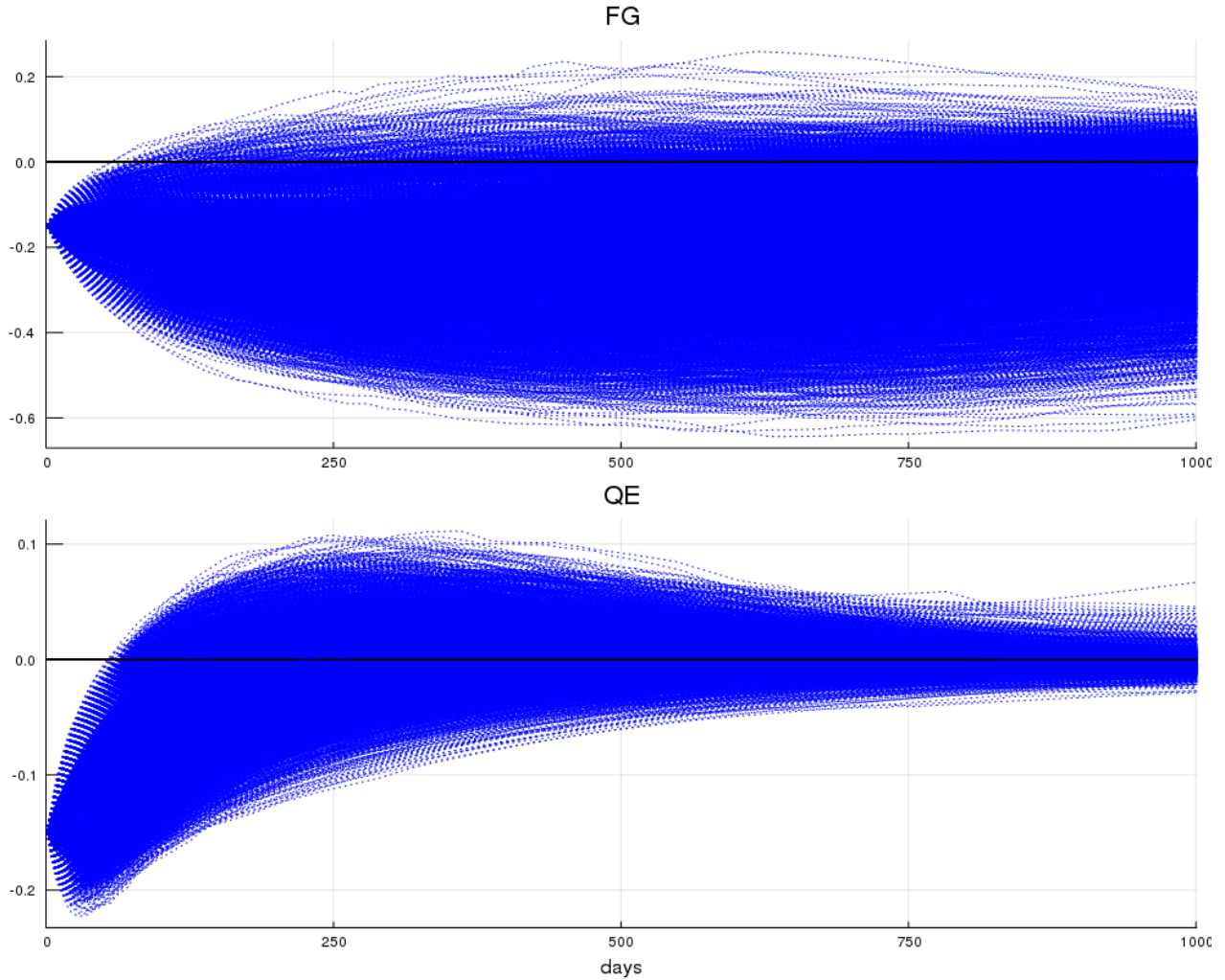
⁹As 10-year yields we include the German, Italian, Spanish and French yields, the OIS yields, the EA GDP-weighted yield, and the EA yields derived by the ECB using the [Svensson \(1994\)](#) methodology, utilizing AAA-rated euro area central government bonds and all euro area central government bonds (including AAA-rated).

Figure I.1: Persistence, sovereign bonds



Note: Daily VAR including 10-year yield (German, Italy, France, and Spain added one at the time), log STOX50E, log EUR/USD exchange rate, 2-year Inflation linked swap. The 10-year yield is instrumented by the Target, Timing, Forward Guidance and QE factors, and the respective responses are reported.

Figure I.2: Persistence, robustness



Note: Daily VAR including all the combinations from two to eight variables among 10-year yields, log STOXX50E, log EUR/USD exchange rate, 2-year Inflation linked swap, BBB-AAA corporate bonds spread, 2-year OIS, 5-year EA GDP-weighted yield, and EA implied stock volatility (VSTOXX). The 10-year yield is always included and is instrumented by the Forward Guidance and QE factors. The respective responses are reported. As 10-year yields we include the German, Italian, Spanish and French yields, the OIS yields, the EA GDP-weighted yield, and the EA yields derived by the ECB using the [Svensson \(1994\)](#) methodology, and reflecting AAA-rated euro area central government bonds and all euro area central government bonds (including AAA-rated).

J Appendix: Non-linearity

Starting with the seminal work of [McCallum \(1991\)](#), the monetary policy literature has paid attention to possible asymmetric effects of monetary policy on real variables. In particular it has studied the different effects during expansions and recessions, good and bad credit market conditions, and high or low inflation regimes, with a general consensus that there is indeed heterogeneity.¹⁰ The more recent literature, using [Romer and Romer \(2004\)](#) identification and [Jordà \(2005\)](#) local projections, finds that monetary policy tightening has stronger effects than loosening ([Tenreyro and Thwaites, 2016](#); [Barnichon and Matthes, 2017](#)).

In this section we ask a related but distinct question and study whether market participants perceive monetary policy effects differently when the surprise is positive versus negative. The financial market reaction to monetary policy surprises captures the updates to beliefs of market participants, which may not be the same as the actual future impact of monetary policy if there are information asymmetries. Independently of whether market participants form “correct” beliefs of monetary policy asymmetry, changes in asset prices are the first step of monetary policy transmission and understanding whether there are asymmetries in the financial market response to monetary policy is important in its own right. For brevity we do not repeat all of our analysis allowing for asymmetries but present the salient cases that show the presence or lack of asymmetric responses. We do this for risk free rates and sovereign yields by including an indicator variable for negative surprises and allowing interactions.

Tables [J.1](#) to [J.3](#) report the results. These results are striking in their lack of asymmetry. Across the three tables for the effects of policy surprises on euro area risk free rates and Italian and Spanish sovereign yields, only very few interaction terms are statistically significant.¹¹ Importantly, even in the few cases where the interaction term is significant, we find positive interaction effects for negative surprises, indicating stronger effects of easing surprises on the yield curve. Hence, we find no evidence that the yield curve responses in the euro area may lead to, or are consistent with, weaker effects of monetary policy when policy is expansionary.

We leave studying the possible asymmetry in real effects of monetary policy in the euro area for future work but note the apparent difference between the results in the literature for

¹⁰The small literature on non-linear effects of monetary policy focuses on the possible asymmetric responses of macroeconomic, rather than financial, variables. [Thoma \(1994\)](#) shows that monetary policy is more effective in expansions than recessions. [Weise \(1999\)](#) finds using a Smooth-Transition VAR (ST-VAR) model that monetary policy does not have any power in recessions. [Peersman and Smets \(2002\)](#), [Garcia and Schaller \(2002\)](#) and [Lo and Piger \(2005\)](#), using a two-state Markov-Switching Model (MSM) find that monetary policy is more powerful in recessions than in expansions.

¹¹Although not of direct interest, the statistical significance of the dummy itself is in most cases due to a few outlier observations.

the US real effect asymmetry and the symmetry we find in financial market effects in the euro area.

Table J.1: Estimated nonlinear effects of monetary policy surprises on OIS yields

Panel (A): Press release window							
VARIABLES	(1) OIS 1M	(2) OIS 3M	(3) OIS 6M	(4) OIS 1Y	(5) OIS 2Y	(6) OIS 5Y	(7) OIS 10Y
Target	1.01*** (0.02)	0.71*** (0.04)	0.64*** (0.08)	0.47*** (0.10)	0.35*** (0.13)	0.20 (0.14)	0.04 (0.11)
Targetx(Target<0)	-0.01 (0.05)	0.07 (0.06)	0.02 (0.09)	0.12 (0.11)	0.12 (0.16)	0.13 (0.16)	0.10 (0.13)
Target<0	0.02 (0.05)	0.07 (0.08)	0.17* (0.10)	0.32** (0.15)	0.40** (0.20)	0.33 (0.26)	0.20 (0.20)
Observations	185	185	185	185	185	185	185
R-squared	0.98	0.92	0.83	0.62	0.35	0.14	0.03
Panel (B): Conference window							
VARIABLES	(1) OIS 1M	(2) OIS 3M	(3) OIS 6M	(4) OIS 1Y	(5) OIS 2Y	(6) OIS 5Y	(7) OIS 10Y
Timing	0.25*** (0.09)	0.87*** (0.03)	1.01*** (0.03)	1.17*** (0.04)	1.01*** (0.04)	0.66*** (0.05)	0.37*** (0.04)
FG	-0.07 (0.05)	0.19*** (0.03)	0.45*** (0.02)	0.76*** (0.03)	0.95*** (0.05)	0.99*** (0.10)	0.43*** (0.08)
QE	0.05 (0.04)	0.00 (0.03)	-0.01 (0.02)	0.01 (0.03)	0.18*** (0.04)	0.88*** (0.08)	0.98*** (0.06)
Timingx(Timing<0)	0.18 (0.14)	-0.03 (0.04)	-0.02 (0.04)	-0.04 (0.04)	-0.01 (0.04)	0.08 (0.05)	-0.07 (0.04)
FGx(FG<0)	0.13** (0.06)	-0.00 (0.03)	-0.06*** (0.02)	-0.03 (0.03)	0.08 (0.05)	-0.04 (0.10)	0.01 (0.08)
QEx(QE<0)	-0.08 (0.06)	0.01 (0.06)	-0.02 (0.03)	0.05 (0.04)	0.01 (0.05)	-0.07 (0.10)	0.05 (0.08)
Timing<0	0.08 (0.15)	0.12 (0.07)	0.00 (0.06)	-0.14** (0.06)	-0.06 (0.06)	0.25*** (0.08)	-0.21*** (0.07)
FG<0	0.02 (0.13)	0.21** (0.08)	0.00 (0.06)	-0.20*** (0.07)	-0.07 (0.10)	0.33* (0.17)	-0.27** (0.13)
QE<0	-0.05 (0.13)	-0.12 (0.10)	0.03 (0.07)	0.19** (0.07)	-0.12* (0.07)	-0.04 (0.12)	0.06 (0.09)
IJC	0.05 (0.05)	-0.04 (0.03)	0.02 (0.03)	0.00 (0.03)	-0.00 (0.02)	-0.00 (0.03)	0.00 (0.03)
Observations	180	180	180	180	180	180	180
R-squared	0.62	0.96	0.99	0.99	0.99	0.98	0.97

*Note: The table reports the reaction of OIS and German sovereign yields at different maturities to surprises in monetary policy using intraday data. Coefficients are expressed in percentage per annum per standard deviation change in the factors. Robust standard errors in parentheses; ***, **, and * denote statistical significance at the 1%, 5% and 10% levels, respectively.*

Table J.2: Estimated nonlinear effects of monetary policy surprises on Italian sovereign yields

Panel (A): Press release window

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Jan-02/Dec-07			Jan-08/Dec-13			Jan-14/Sep-18		
VARIABLES	IT 2Y	IT 5Y	IT 10Y	IT 2Y	IT 5Y	IT 10Y	IT 2Y	IT 5Y	IT 10Y
Target	0.11 (0.15)	-0.07 (0.12)	-0.08* (0.04)	0.18 (0.30)	0.17 (0.33)	0.07 (0.21)	1.31** (0.53)	1.18** (0.55)	0.93 (0.78)
Targetx(Target<0)	0.03 (0.29)	0.11 (0.39)	0.14 (0.32)	0.52 (0.32)	0.48 (0.33)	0.23 (0.23)	1.86*** (0.62)	1.70*** (0.61)	2.29** (0.84)
Target<0	0.12 (0.31)	0.01 (0.31)	0.20 (0.25)	0.84 (0.67)	1.17* (0.69)	0.83 (0.57)	2.74 (1.65)	2.64* (1.41)	2.40** (1.14)
Observations	72	72	72	71	71	71	42	42	42
R-squared	0.04	0.01	0.05	0.31	0.25	0.11	0.27	0.26	0.24

Panel (B): Conference window

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Jan-02/Dec-07			Jan-08/Dec-13			Jan-14/Sep-18		
VARIABLES	IT 2Y	IT 5Y	IT 10Y	IT 2Y	IT 5Y	IT 10Y	IT 2Y	IT 5Y	IT 10Y
Timing	1.13*** (0.09)	0.71*** (0.19)	0.23 (0.26)	0.76** (0.34)	0.69* (0.36)	0.36 (0.22)	0.45 (0.34)	0.54 (0.35)	0.14 (0.36)
FG	0.93*** (0.15)	0.81*** (0.14)	0.51*** (0.12)	0.75** (0.33)	0.34 (0.36)	-0.03 (0.36)	0.71** (0.29)	0.83* (0.43)	1.10** (0.53)
QE							0.63*** (0.15)	1.26*** (0.22)	1.95*** (0.33)
Timingx(Timing<0)	-0.09 (0.12)	0.15 (0.20)	0.24 (0.27)	-0.51 (0.48)	-0.83* (0.45)	-0.46 (0.30)	0.99* (0.50)	1.27** (0.57)	1.15* (0.68)
FGx(FG<0)	0.18 (0.17)	0.22 (0.16)	0.13 (0.15)	0.20 (0.37)	0.42 (0.40)	0.26 (0.40)	-0.23 (0.37)	-0.24 (0.44)	-0.82 (0.60)
QEx(QE<0)							-0.38** (0.19)	-1.03*** (0.29)	-0.21 (0.39)
Timing<0	0.10 (0.19)	0.15 (0.29)	-0.11 (0.38)	-1.54 (1.97)	-0.43 (2.08)	-0.51 (1.95)	0.25 (0.60)	0.01 (1.00)	-1.09 (1.18)
FG<0	0.08 (0.28)	-0.09 (0.32)	-0.34 (0.35)	-1.62 (2.18)	-2.25 (2.42)	-2.46 (2.34)	-0.80 (0.64)	-1.70* (0.89)	-2.36** (1.07)
QE<0							-0.95 (0.70)	-1.43 (0.92)	0.65 (1.11)
IJC	-0.07 (0.05)	-0.11* (0.07)	-0.15* (0.08)	0.10 (0.53)	-0.44 (0.58)	-0.44 (0.41)	0.04 (0.26)	0.29 (0.42)	0.17 (0.47)
Observations	67	67	67	71	71	71	42	42	42
R-squared	0.97	0.92	0.79	0.45	0.28	0.11	0.79	0.80	0.84

*Note: The table reports the reaction of Italian sovereign yields at different maturities and for different subsamples to surprises in monetary policy using intraday data. Coefficients are expressed in percentage per annum per standard deviation change in the factors. Robust standard errors in parentheses; ***, **, and * denote statistical significance at the 1%, 5% and 10% levels, respectively.*

Table J.3: Estimated nonlinear effects of monetary policy surprises on Spanish sovereign yields

Panel (A): Press release window

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
VARIABLES	Jan-02/Dec-07			Jan-08/Dec-13			Jan-14/Sep-18		
	ES 2Y	ES 5Y	ES 10Y	ES 2Y	ES 5Y	ES 10Y	ES 2Y	ES 5Y	ES 10Y
Target	0.05 (0.14)	-0.08 (0.13)	-0.08 (0.06)	0.15 (0.32)	0.16 (0.22)	0.12 (0.26)	0.89*** (0.24)	0.90** (0.44)	0.78 (0.82)
Targetx(Target<0)	-0.00 (0.29)	0.11 (0.41)	0.10 (0.34)	0.46 (0.34)	0.26 (0.28)	0.27 (0.30)	1.98*** (0.49)	2.10*** (0.55)	2.83*** (0.89)
Target<0	-0.09 (0.34)	0.01 (0.32)	0.20 (0.25)	0.76 (0.63)	0.73 (0.60)	0.53 (0.53)	1.22*** (0.38)	1.84** (0.68)	2.22** (0.86)
Observations	72	72	72	71	71	71	42	42	42
R-squared	0.02	0.01	0.05	0.23	0.15	0.16	0.68	0.47	0.30

Panel (B): Conference window

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
VARIABLES	Jan-02/Dec-07			Jan-08/Dec-13			Jan-14/Sep-18		
	ES 2Y	ES 5Y	ES 10Y	ES 2Y	ES 5Y	ES 10Y	ES 2Y	ES 5Y	ES 10Y
Timing	0.96*** (0.17)	0.71*** (0.22)	0.30* (0.16)	0.93*** (0.19)	0.64** (0.24)	0.26 (0.18)	0.43** (0.21)	0.70** (0.33)	0.04 (0.37)
FG	0.61*** (0.21)	0.44* (0.22)	0.23 (0.22)	0.69*** (0.26)	0.49* (0.29)	0.14 (0.32)	0.89*** (0.25)	0.92* (0.47)	1.07** (0.46)
QE							0.39** (0.18)	0.58* (0.29)	1.47*** (0.36)
Timingx(Timing<0)	-0.47* (0.27)	-0.51 (0.32)	-0.28 (0.26)	-0.45 (0.29)	-0.44 (0.34)	-0.19 (0.28)	1.26*** (0.34)	1.04* (0.56)	1.09* (0.56)
FGx(FG<0)	0.32 (0.23)	0.30 (0.25)	0.01 (0.24)	0.24 (0.29)	0.26 (0.33)	0.09 (0.35)	-0.55* (0.29)	-0.13 (0.49)	-0.49 (0.59)
QEx(QE<0)							-0.01 (0.23)	0.01 (0.37)	-0.05 (0.41)
Timing<0	0.63 (0.87)	0.05 (1.08)	-0.61 (1.18)	1.35 (1.38)	0.68 (1.68)	0.50 (1.76)	0.41 (0.56)	0.12 (1.02)	-1.13 (1.11)
FG<0	-0.44 (0.96)	-0.87 (1.15)	-1.64 (1.28)	-0.43 (1.61)	-0.64 (1.90)	-1.91 (2.05)	-0.66 (0.42)	-1.00 (0.86)	-0.99 (0.94)
QE<0							-1.18** (0.47)	-0.87 (0.92)	0.14 (0.98)
IJC	0.03 (0.32)	-0.46 (0.38)	-0.63* (0.37)	0.13 (0.39)	-0.44 (0.45)	-0.59 (0.41)	0.43** (0.20)	0.19 (0.41)	0.07 (0.42)
Observations	113	113	113	71	71	71	42	42	42
R-squared	0.53	0.34	0.13	0.55	0.36	0.14	0.84	0.73	0.83

Note: The table reports the reaction of Spanish sovereign yields at different maturities for different subsamples to surprises in monetary policy using intraday data. Coefficients are expressed in percentage per annum per standard deviation change in the factors. Robust standard errors in parentheses; ***, **, and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

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