Supplementary Internet Appendix

Monetary policy's rising FX impact in the era of ultra-low rates

A. Data filtering

Our intraday data (at a 1-minute frequency) are sourced from Thomson Reuters TickHistory, covering the FX spot exchange rate, 2-year and 10-year bond yields and 1-month and 6-month OIS interest rates. We first check for possible outliers and data reporting errors. At first, we implement a standard filter for outliers. We are very cautious in defining outliers, restricting our choice to observations more than 5 standard deviations away from the sample mean. This filtering choice allows us to exclude implausible quotes that are the results of extreme events.[24]

Furthermore, there could be days with very infrequent updating of quotes in relatively illiquid markets. In our analysis, however, it is crucial to understand if a monetary policy decision has an impact or not on a specific instrument. No change in the quote, for example, means the decision was fully expected by the market and already priced in. For illiquid markets, however, there is the possibility that quotes remain constant because not enough trades and hence updating of quotes is taking place. In that case, a monetary shock would possibly be considered as fully anticipated, potentially leading to a bias in the results. For the same reason, however, we do not want to exclude possibly fully anticipated shocks. It is thus crucial to distinguish these two cases. In the first case, we would simply exclude the observation from the sample as a data error, while in the second we need to keep it. To take this decision, we do some extensive cross-checking of our high-frequency against Bloomberg daily quotes. We then compute daily changes based on our database using opening and closing quotes for each market at each event day. If the shock measure for any given event is zero, we check the daily change on that trading day as results from Thomson Reuters data. If that is zero as well we compare it with the daily change from Bloomberg. If this change is not zero, then we consider the observation as a data reporting error and exclude it from the sample.

B. Time-varying parameter model: Methodology

To test if the impact of monetary policy news on the exchange rate has changed over time, we estimate a time-varying parameter model based on non-parametric regression techniques along the lines of Ang & Kristensen (2012). This method allows us to use all the information contained in

[24]For example we apply this filter to the decision of the 15^{th} of January 2015 of the SNB to abandon its fixed exchange rate of the Swiss franc against the Euro. The change in the exchange rate was more than 7 standard deviations away from the sample mean on that day.

the regressors, yet assigning more weight to observations close to a specific time observation.

Assume that there is a sequence of events at time $0 < t_1 < t_2 < t_3 < .... \leq T$ and we are interested in estimating α_τ, $\beta_{target,\tau}$ and $\beta_{slope,\tau}$ for a specific time $\tau \in (0, T)$. For each given point in time τ it is possible to estimate the parameters of interest $\left(\hat{\alpha}_\tau, \hat{\beta'}_\tau\right)'$ by minimizing the following objective function

$$arg \min_{(\alpha,\beta)} \sum_{i=1}^{N} K_h\left(t_i - \tau\right)\left[\Delta s_{t_i} - \alpha - \beta_{target} \cdot MPS_{t_i}^{OIS} - \beta_{path} \cdot MPS_{t_i}^{Bond-OIS}\right]^2$$

with $K_h\left(\bullet\right)$ a kernel function.

The optimization defined above leads to:

$$\left(\hat{\alpha}_\tau, \hat{\beta'}_\tau\right)' = \left[\sum_{i=1}^{N} K_{h_c}\left(t_i - \tau\right) X_{t_i} X'_{t_i}\right]^{-1} \left[\sum_{i=1}^{N} K_h\left(t_i - \tau\right) X_{t_i} \Delta s'_{t_i}\right]^{-1} \tag{10}$$

where X_{t_i} is a vector of regressors containing the monetary policy shocks and a constant term while Δs_{t_i} is the exchange rate change described previously.

This estimator can be thought of as a weighted least squared estimator with weights that are proportional to the distance of each observation from time τ. In this way we can construct a sequence $\left\{\hat{\beta'}_\tau\right\}_{\tau=1}^{T}$ of estimated coefficients using for each event all the information contained in the regressors matrix, effectively discounting proportionally more more distant events. Defining $\psi = \left(\hat{\alpha}_\tau, \hat{\beta'}_\tau\right)'$ it can be shown that the variance of the estimator is given by:

$$\left(\hat{\psi} - \psi\right) \to N\left(0, \frac{k}{Th_c}\Lambda_\tau^{-1} \otimes \Omega_\tau\right) \tag{11}$$

with $\Lambda_\tau = \frac{1}{T}\sum_{i=1}^{N} K_h\left(t_i - \tau\right) X_{t_i} X'_{t_i}$, $\Omega_\tau = \sum_{i=1}^{N} K_{h_c}\left(t_i - \tau\right) \hat{\varepsilon}_{t_i} \hat{\varepsilon}'_{t_i}$ and $\hat{\varepsilon}_{t_i}$ the estimated residuals.

To implement this procedure, we need to choose a specific kernel function and an optimal bandwidth. The combination of these two elements determines how much weight is given to observations distant from τ. We choose a standard Gaussian density as kernel:

$$K\left(z\right) = \frac{1}{\sqrt{2\pi}} \exp\left(-\frac{z^2}{2}\right) \tag{12}$$

with $z_i = \frac{t_i - \tau}{h_c T}$; we divide by T to take into account the sample size. Finally we compute the optimal bandwidth h for each country individually. As outlined in Ang & Kristensen (2012) the optimal bandwidth can be computed with a two stage procedure. First assume that Λ_τ and Ω_τ are constant and that ψ_τ can be described as a polynomial:

$$\psi_\tau = \alpha_0 + \alpha_1 \tau + ... + \alpha_n \tau \tag{13}$$

we can estimate this equation and get

$$\hat{v}_1 = k\hat{\Lambda}_\tau^{-1} \otimes \sigma_\psi \quad \hat{v}_2 = \mu \frac{1}{T} \sum_{i=1}^{N} \hat{\psi}_{t_i}{}'' \tag{14}$$

Notice that in the case of a normal kernel $k = \int K(z) = 0.2821$ and $\mu = c2(RMSE)/h$ with $c = 0.7737$. The optimal bandwidth in this case is given by:

$$h_c^\star = \left[\frac{\| \hat{v}_1 \|}{\| \hat{v}_2 \|^2} \right]^{\frac{1}{5}} T^{-\frac{1}{5}} \tag{15}$$

C. Further tests and robustness

We conduct a battery of robustness checks. We assess whether our main results would be altered when considering 10-year rates instead of the 2-year rates when measuring path shocks. To shed more light on the growing impact of monetary policy surprises on exchange rates, we also assess whether simple rolling regressions point in a similar direction as our non-parametric kernel regression method. We assess if the length of the event window matters and if the release of minutes of policy meetings has a different impact than scheduled monetary policy announcements do. Some main takeaways are discussed in the following.

A. Measuring path shocks based on long-term rates

We show that our results are qualitatively robust to using the 10-year bond yield rather than 2-year bond yield to measure the path shock (these results are shown in the Online Appendix in Table A.V). Both the estimated coefficients, β_{target} and β_{path}, however, tend to be somewhat larger than when 2-year yields are employed for measuring path shocks. This stems from the fact that the 10-year bond yield tends to move less than the 2-year bond yield in response to a given monetary policy announcement. Note that, for the G3 economies, the explanatory power of the regression is greater when using 10-year bond yields.

B. *Lengthening the event window*

Some UMP announcements may have taken the market some time to interpret and to fully incorporate into prices. It is therefore possible that our narrow window does not capture the complete information in the monetary policy announcement. This will not necessarily bias our estimates of exchange rate *responsiveness* so long as the exchange rate responds at least as quickly to the news as OIS and bond markets. However, our robustness exercises show that the results are little changed with the use of longer windows of up to one and half hours after the event (see Table A.IX in the Online Appendix).

C. *The role of minutes releases*

To assess whether the release of minutes of the policy meeting has a different impact on the exchange rate than the announcement of interest rate decisions we repeat the analysis in Section III, but – instead of UMP events – our dummy variable takes a value of one to identify the release of minutes of the monetary policy meetings. We estimate this equation for the United States, United Kingdom and Australia, three countries with a sufficient history of releasing meeting minutes. To conserve space, these results are reported in Table A.VIII of the Online Appendix.

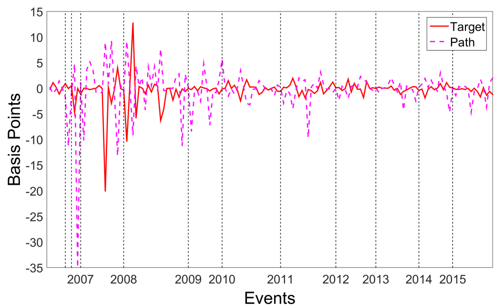
For both the United States and Australia, the release of minutes tends to have a smaller impact on the exchange rate, conditional on its impact on interest rates. The coefficients on the interaction terms, $\beta^{minutes}_{target}$ and $\beta^{minutes}_{path}$ are negative (and in Australia's case statistically significant). In contrast for the United Kingdom, the release of minutes is estimated to have a larger impact on the exchange rate, with $\beta^{minutes}_{target}$ significantly greater than zero. All of these results are robust to using the 10-year bond yield in place of the 2-year yield in the computation of the path shock.

D. *Rolling window regressions*

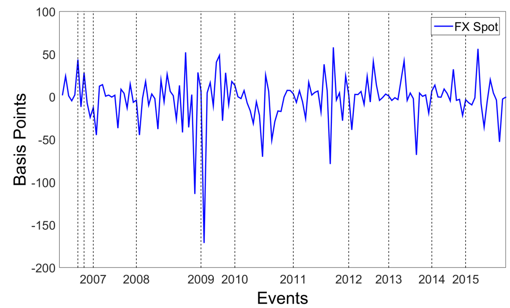
The increased sensitivity of the exchange rate to monetary policy is also generally robust to using simple rolling window regressions rather than the non-parametric estimation technique used in the analysis above. Due to the relatively small number of observations, we look at univariate regressions here, with monetary policy shocks identified via the response in 2-year bond yields. Of course, with short samples the estimated coefficients are unsurprisingly more volatile and hence the non-parametric kernel regression is our overall preferred methodology. That said, results reported in the Figure A.II in the Online Appendix show that qualitatively similar results are obtained when using more simple techniques.

Tables and Figures

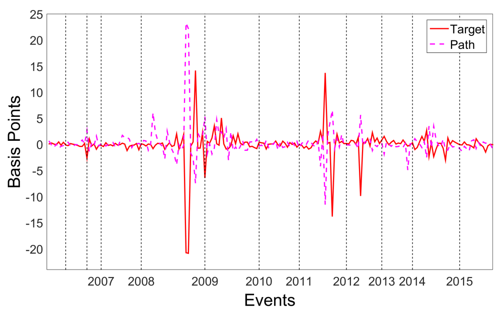
Figure A.I: Evolution of monetary policy shocks and FX movements



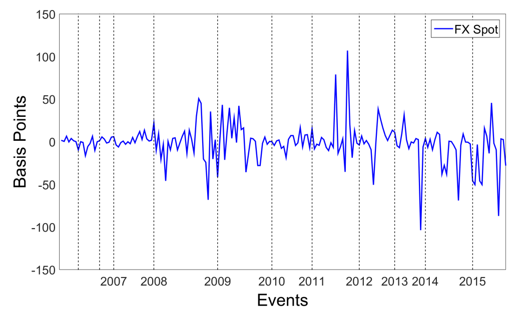
(a) United States



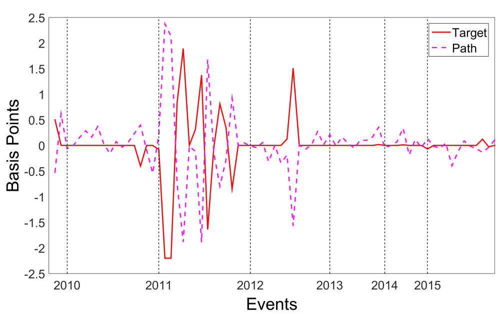
(b) United States



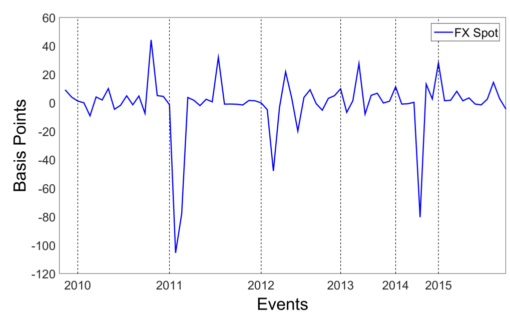
(c) Euro Area



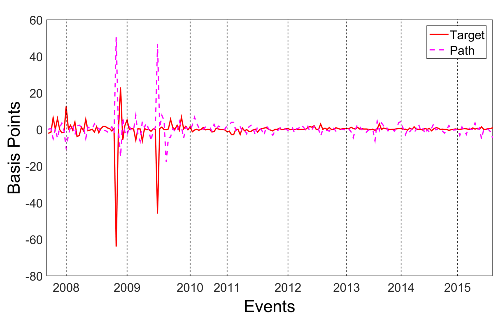
(d) Euro Area



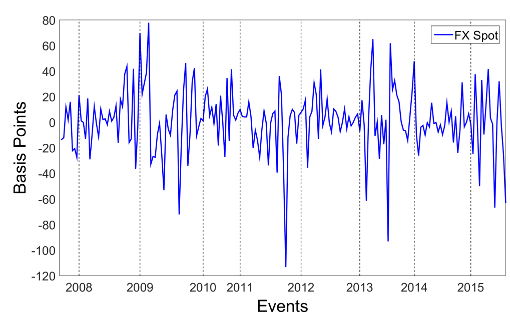
(e) Japan



(f) Japan

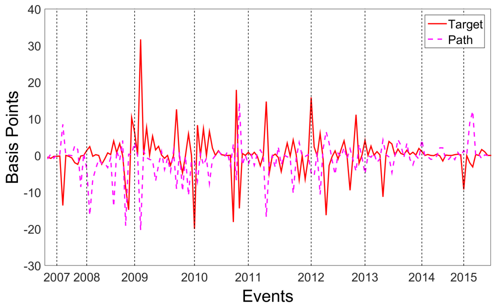


(g) United Kingdom

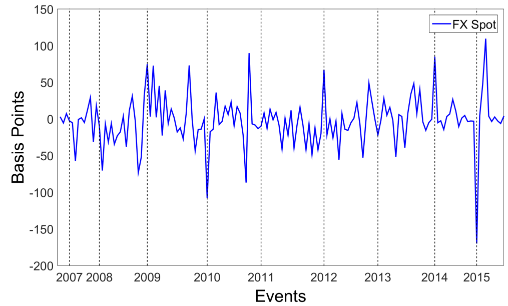


(h) United Kingdom

Figure A.I cont. Evolution of monetary policy shocks and FX movements

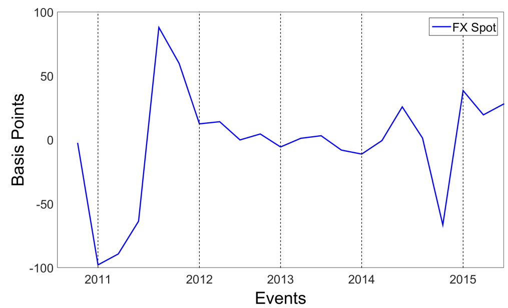


(i) Australia

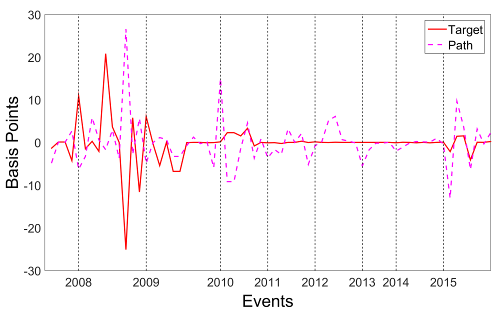


(j) Australia

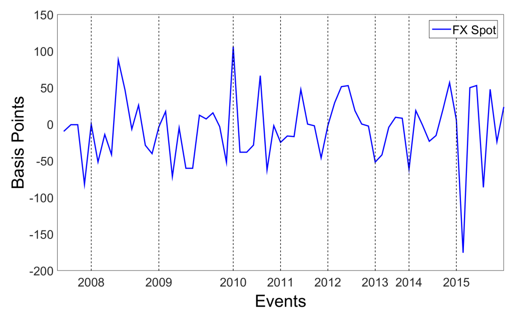
(k) Switzerland



(l) Switzerland

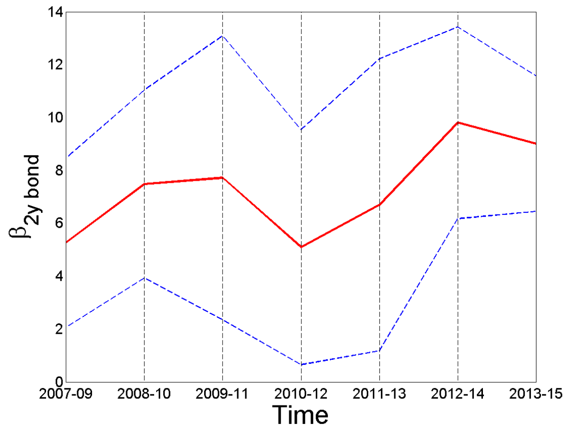


(m) Canada

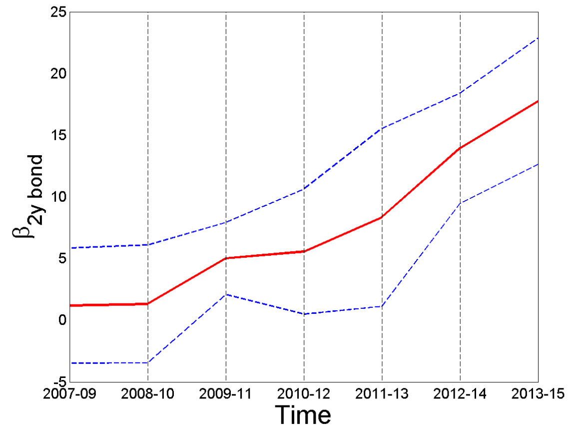


(n) Canada

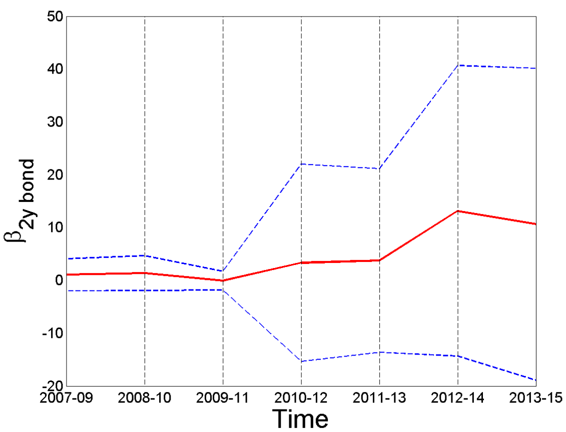
Figure A.II: Rolling window impact of monetary policy shocks on the exchange rate



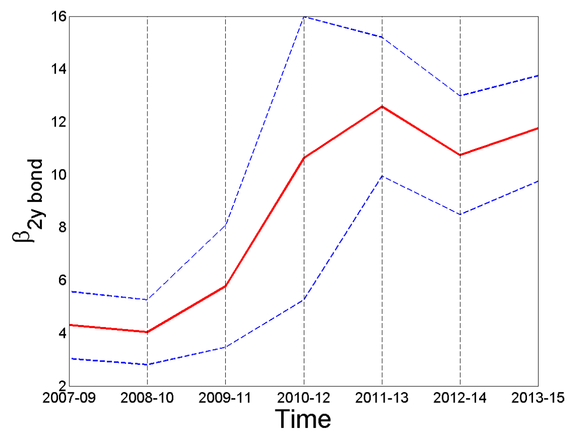
(a) USD response to 2 year bond shock ($\beta_{2y\ bond}$)



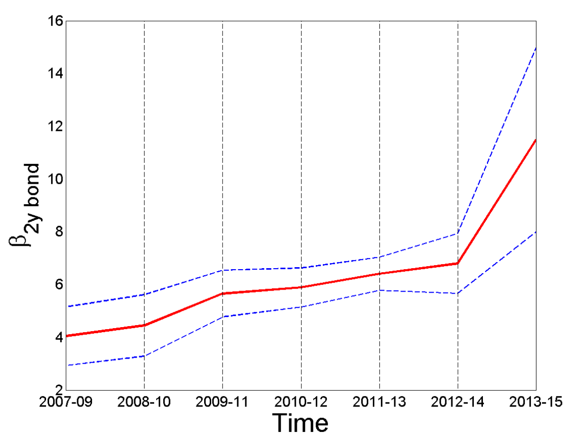
(b) EUR response to 2 year bond shock ($\beta_{2y\ bond}$)



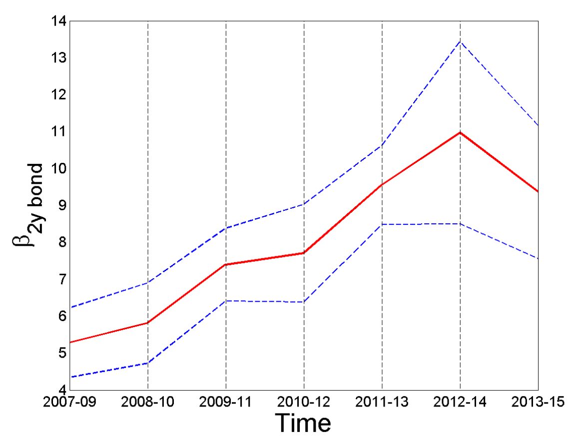
(c) JPY response to 2 year bond shock ($\beta_{2y\ bond}$)



(d) GBP response to 2 year bond shock ($\beta_{2y\ bond}$)



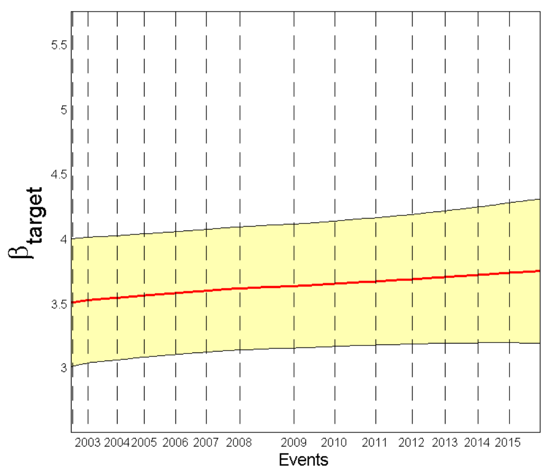
(e) AUD response to 2 year bond shock ($\beta_{2y\ bond}$)



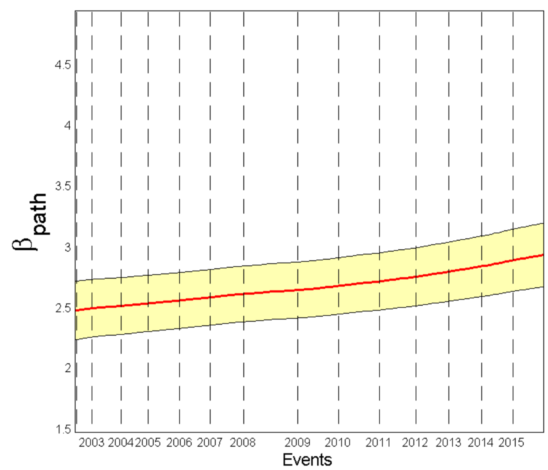
(f) CAD response to 2 year bond shock ($\beta_{2y\ bond}$)

Notes: The Figure depicts estimates of the sensitivity of the exchange rate to monetary policy shocks based on a three-year rolling window regression. The monetary shock is proxied by the change in the 2-year bond yield around the monetary policy event.

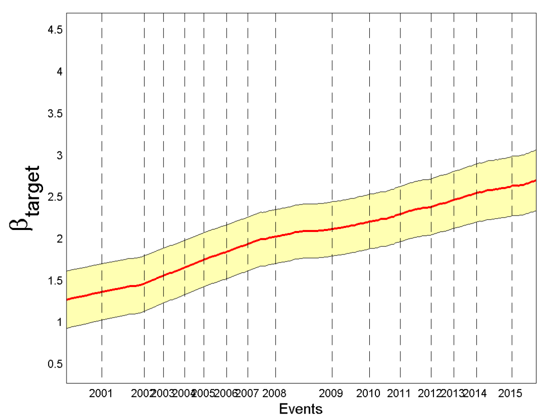
Figure A.III: Time-varying impact of monetary policy shocks using daily data



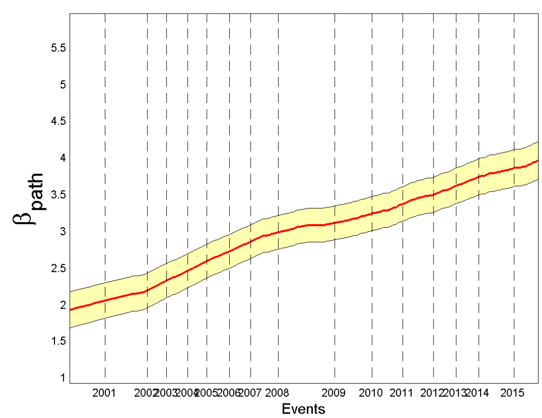
(a) USD estimation of β_{target} by time



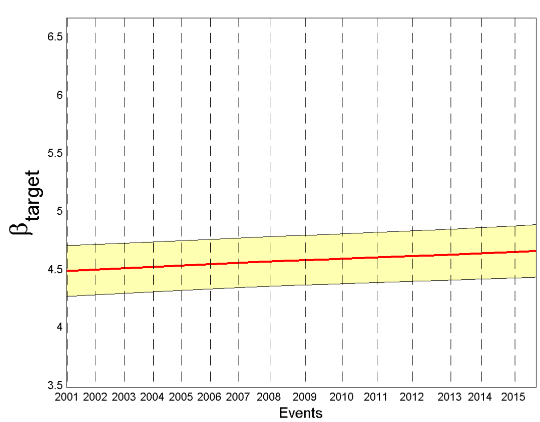
(b) USD estimation of β_{path} by time



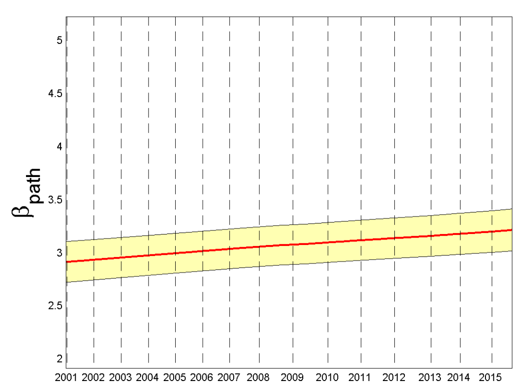
(c) EUR estimation of β_{target} by time



(d) EUR estimation of β_{path} by time

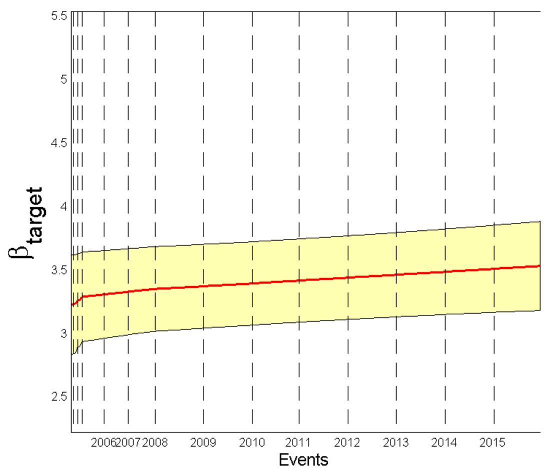


(e) GBP estimation of β_{target} by time

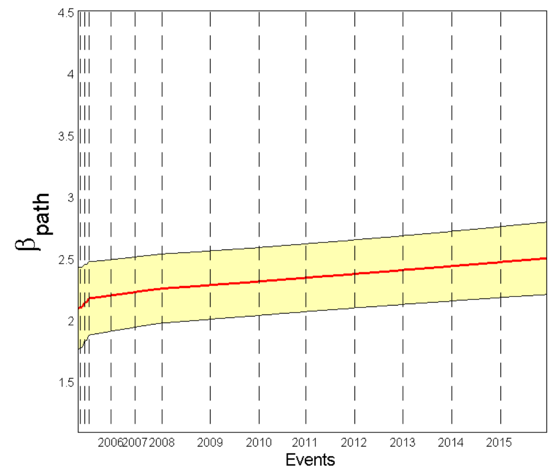


(f) GBP estimation of β_{path} by time

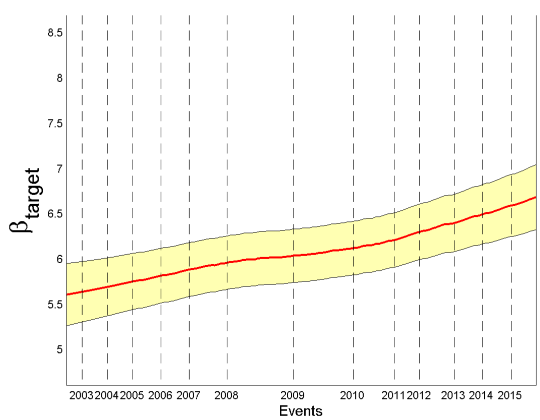
Figure A.III cont. Time-varying impact of monetary policy shocks using daily data



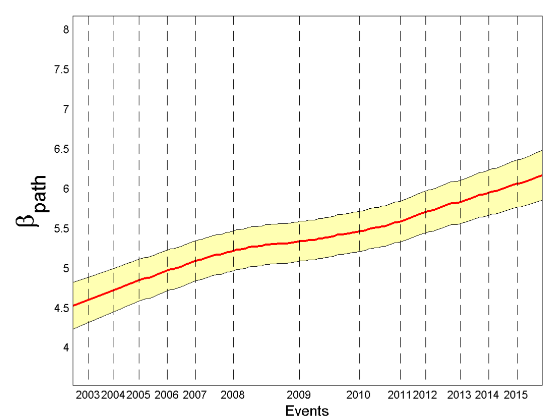
(g) AUD estimation of β_{target} by time



(h) AUD estimation of β_{path} by time



(i) CAD estimation of β_{target} by time



(j) CAD estimation of β_{path} by time

Notes: The figure depicts the time-varying impact of target and path monetary policy shock on the exchange rate. Time-varying coefficient estimates are obtained via the non-parametric regression given by Equation (4). The path shock is computed based on the 2-year bond yield. Data are at daily frequency.

Table A.I: Sample period and summary statistics monetary Policy Decisions (MPDs)

	Sample Period	Policy Rate	2-Year Bonds	10-Year Bonds	FX	No. of events
U.S.	05.2004-5.2015	7.7	3.2	3.1	30.3	220
Euro Area	04.2004-11.2015	5.6	0.7	0.6	10.6	302
Japan	04.2004-11.2015	0.5	0.2	0.3	6.4	347
U.K.	04.2004-11.2015	5.1	1.6	1.2	12.9	335
Australia	12.2005-12.2015	9.0	4.0	1.8	31.0	200
Switzerland	09.2010-09.2015	6.5	0.7	0.6	22.6	32
Canada	01.2007-12.2015	7.9	3.3	1.4	35.3	115

	Sample Period	Policy Rate	OIS 1-Month	OIS 6-Months	FX	No. of events
U.S.	12.2003-5.2015	7.7	1.7	2.2	30.6	226
Euro Area	01.2000-11.2015	5.7	2.5	1.2	10.9	392
Japan	12.2009-11.2015	0.0	0.1	0.0	9.5	178
U.K.	09.2007-11.2015	4.9	2.1	1.6	13.8	253
Australia	07.2006-12.2015	9.5	3.9	4.4	30.7	194
Switzerland	11.2008-09.2015	7.3	1.0	1.6	24.4	42
Canada	09.2004-12.2015	8.3	1.8	2.7	39.5	137

Notes: For all monetary policy decision events, the Table reports average absolute changes in the policy rate, FX Spot, bond yields and OIS rates in the 25 minute window. Column 3 reports the average absolute change in the policy rate at the MPD events of each central bank.

Table A.II: Regression results using intraday vs daily data

	U.S.		Euro Area		Japan		U.K.		Australia		Switzerland		Canada	
	Intraday	Daily	Intraday	Daily	Intraday	Daily	Intraday	Daily	Intraday	Daily	Intraday	Daily	Intraday	Daily
Target vs Path shock - 2 year bonds														
β_{target}	4.27	3.89	4.46	3.89	27.34	-74.66	6.13	5.15	5.63	3.27	25.23	13.28	6.33	6.02
p-val.	(0.00)	(0.05)	(0.03)	(0.01)	(0.04)	(0.23)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
β_{path}	2.93	2.16	6.10	6.64	11.58	11.28	6.64	4.06	4.78	1.35	7.07	1.42	7.49	6.02
p-val.	(0.04)	(0.33)	(0.00)	(0.00)	(0.20)	(0.40)	(0.00)	(0.00)	(0.00)	(0.57)	(0.07)	(0.70)	(0.00)	(0.00)
R^2	0.21	0.06	0.16	0.22	0.17	0.06	0.45	0.12	0.70	0.06	0.40	0.28	0.72	0.39
Target vs Path shock - 10 year bonds														
β_{target}	6.24	8.02	9.48	7.41	17.20	-87.27	5.53	4.54	11.02	1.57	33.90	12.45	14.14	6.08
p-val.	(0.00)	(0.01)	(0.00)	(0.00)	(0.14)	(0.20)	(0.00)	(0.00)	(0.00)	(0.30)	(0.00)	(0.00)	(0.00)	(0.00)
β_{path}	3.53	2.56	9.00	7.15	1.67	9.39	5.23	2.51	9.27	-1.41	16.98	-3.41	14.39	1.95
p-val.	(0.00)	(0.02)	(0.00)	(0.00)	(0.76)	(0.15)	(0.00)	(0.01)	(0.00)	(0.26)	(0.00)	(0.06)	(0.00)	(0.19)
R^2	0.39	0.08	0.35	0.24	0.16	0.08	0.44	0.08	0.67	0.05	0.50	0.33	0.43	0.14
Expectations vs Term Premium shock														
β_{exp}	3.07	2.75	5.02	5.68	1.21	-6.28	3.94	4.16	5.41	2.83	11.31	4.50	7.09	5.78
p-val.	(0.00)	(0.07)	(0.00)	(0.00)	(0.38)	(0.02)	(0.00	(0.00))	(0.00)	(0.10)	(0.00)	(0.26)	(0.00)	(0.00)
β_{tp}	2.65	1.90	8.25	4.79	-0.10	-0.39	4.12	-0.76	4.56	-1.57	24.33	-2.26	-0.89	1.27
p-val.	(0.00)	(0.05)	(0.00)	(0.02)	(0.20)	(0.87)	(0.85)	(0.04)	(0.50)	(0.00)	(0.00)	(0.17)	(0.73)	(0.42)
R^2	0.36	0.09	0.35	0.25	0.00	0.00	0.45	0.11	0.68	0.08	0.39	0.07	0.67	0.35

Notes: The Table reports coefficient estimates of Equation (1) and Equation (2). Equations are estimated both with intraday data and daily data. Coefficients describe the impact on the exchange rate (in basis points) of "target" and "path" or "expectations" (exp) and "term premia" (tp) monetary policy shocks (also measured in basis points). P-values (in parentheses) are computed with HAC standard errors.

Table A.III: Univariate results based on shocks for individual instruments – all events

$$\Delta s_t = \alpha + \beta MPS_t^j + \epsilon_t$$

		OIS 1-Month	OIS 6-Months	2-Year Bonds	10-Year Bonds
U.S.	β	2.36	4.20	3.07	3.26
	P-value	(0.00)	(0.00)	(0.01)	(0.00)
	R^2	0.04	0.10	0.19	0.30
Euro area	β	-0.04	0.07	5.01	8.73
	P-value	(0.63)	(0.88)	(0.02)	(0.00)
	R^2	0.00	0.00	0.11	0.35
Japan	β	15.27	-0.33	1.21	0.16
	P-value	(0.18)	(0.83)	(0.42)	(0.60)
	R^2	0.15	0.00	0.00	0.00
U.K.	β	0.57	1.15	3.95	5.38
	P-value	(0.00)	(0.03)	(0.01)	(0.00)
	R^2	0.02	0.03	0.29	0.41
Australia	β	3.62	3.47	5.41	11.25
	P-value	(0.00)	(0.00)	(0.00)	(0.00)
	R^2	0.38	0.50	0.65	0.57
Switzerland	β	2.39	4.67	11.31	23.68
	P-value	(0.09)	(0.05)	(0.00)	(0.00)
	R^2	0.04	0.07	0.26	0.38
Canada	β	2.66	6.35	7.09	13.10
	P-value	(0.10)	(0.00)	(0.00)	(0.00)
	R^2	0.08	0.48	0.68	0.39

Notes: The table reports regression results based on a univariate specification, where monetary shocks are measured via the high-frequency reaction of the indicated interest rate. Coefficients describe the impact of monetary policy shock (in basis points) on the exchange rate (also measured in basis points). P-values (in parentheses) reported below coefficients computed with HAC standard errors. This specification pools all events (MPD, UMP and minutes).

Table A.IV: Univariate results based on shocks for individual instruments – only MPDs

$$\Delta s_t = \alpha + \beta MPS_t^j + \epsilon_t$$

		OIS 1-Month	OIS 6-Months	2-Year Bonds	10-Year Bonds
U.S.	β	2.22	4.18	2.65	3.90
	P-value	(0.00)	(0.00)	(0.10)	(0.00)
	R^2	0.05	0.13	0.18	0.55
Euro area	β	-0.02	0.06	4.77	8.76
	P-value	(0.74)	(0.95)	(0.08)	(0.00)
	R^2	0.00	0.00	0.18	0.34
Japan	β	-13.14	-4.84	2.40	-5.43
	P-value	(0.01)	(0.78)	(0.49)	(0.06)
	R^2	0.14	0.00	0.00	0.05
U.K.	β	0.50	0.79	2.24	4.83
	P-value	(0.00)	(0.00)	(0.10)	(0.01)
	R^2	0.04	0.05	0.19	0.29
Australia	β	3.79	3.47	5.60	12.37
	P-value	(0.00)	(0.00)	(0.00)	(0.00)
	R^2	0.40	0.51	0.70	0.63
Switzerland	β	2.39	4.67	12.84	21.96
	P-value	(0.09)	(0.05)	(0.00)	(0.00)
	R^2	0.04	0.07	0.45	0.45
Canada	β	2.57	6.56	7.53	15.87
	P-value	(0.09)	(0.00)	(0.00)	(0.00)
	R^2	0.08	0.51	0.71	0.47

Notes: The table reports regression results based on a univariate specification, where monetary shocks are measured via the high-frequency reaction of the indicated interest rate. Coefficients describe the impact of a monetary policy shock (in basis points) on the exchange rate (also measured in basis points). P-values (in parentheses) reported below coefficients computed with HAC standard errors. This specification considers only monetary policy decisions MPDs.

Table A.V: Response of the exchange rate using 10-year bond in path shock

$$\Delta s_t = \alpha + \beta_{target} MPS_t^{\textit{1m OIS}} + \beta_{path} \left(MPS_t^{\textit{10y bond – 1m OIS}} \right) + \epsilon_t$$

	U.S.	**Euro area**	**Japan**	**U.K.**	**Australia**	**Switzerland**	**Canada**
β_{target}	6.24	9.48	17.20	5.53	11.02	33.90	14.14
p-val.	(0.00)	(0.00)	(0.14)	(0.00)	(0.00)	(0.00)	(0.00)
β_{path}	3.53	9.00	1.67	5.23	9.27	16.98	14.39
p-val.	(0.00)	(0.00)	(0.76)	(0.00)	(0.00)	(0.00)	(0.00)
R^2	0.39	0.35	0.16	0.44	0.67	0.50	0.43

Notes: Estimated coefficients of Equation (1). Coefficients describe the impact of the exchange rate (in basis points) to "target" or "path" monetary policy shocks (also measured in basis points). P-values (in parentheses) are computed with HAC standard errors. The path shock is computed using the 10-year bond yield.

Table A.VI: Response of the exchange rate to monetary policy announcements, M-estimator

$$(A) \quad \Delta s_t = \alpha + \beta_{target} MPS_t^{OIS} + \beta_{path} MPS_t^{Bond\text{-}OIS} + \epsilon_t$$

$$(B) \quad \Delta s_t = \alpha + \beta_{exp} MPS_t^{2y} + \beta_{tp} MPS_t^{10y\perp} + \epsilon_t$$

Panel A	**U.S.**	**Euro area**	**Japan**	**U.K.**	**Australia**	**Switzerland**	**Canada**
β_{target}	4.44	4.32	6.21	6.76	5.64	19.43	6.07
P-Value	(0.00)	(0.03)	(0.32)	(0.00)	(0.00)	(0.01)	(0.00)
β_{path}	3.49	5.84	3.73	6.70	5.04	10.70	7.26
P-Value	(0.00)	(0.00)	(0.51)	(0.00)	(0.00)	(0.00)	(0.00)
R^2	0.21	0.14	0.04	0.45	0.70	0.36	0.72

Panel B	**U.S.**	**Euro area**	**Japan**	**U.K.**	**Australia**	**Switzerland**	**Canada**
β_{exp}	3.99	6.12	0.08	4.63	5.32	12.69	7.04
P-Value	(0.92)	(0.00)	(0.38)	(0.00)	(0.00)	(0.00)	(0.00)
β_{tp}	2.29	7.15	-0.15	4.33	3.28	24.51	-0.22
P-Value	(0.56)	(0.00)	(0.87)	(0.04)	(0.00)	(0.01)	(0.90)
R^2	0.34	0.33	0.00	0.44	0.68	0.38	0.67

Notes: Panel A reports estimated coefficients of Equation (1) and Panel B reports estimated coefficients of Equation (2), both with huber M estimator. The path shock is computed using the 2 year bond yield. We proxy for expectations shocks via the change in the 2-year bond yield and for term premium shocks via the change in the 10-year yield orthogonalized against the change in the 2-year bond yield.

Table A.VII: Persistence of the impact of monetary policy on the exchange rate

End of day:	–1	0	+1	+2	+3	+4	+5
U.S.							
β_{target}	-0.34	7.23	4.55	3.79	2.63	-1.50	-3.20
p-val.	(0.78)	(0.01)	(0.20)	(0.51)	(0.70)	(0.85)	(0.74)
β_{path}	-0.70	3.83	3.73	1.72	-0.39	-0.33	0.46
p-val.	(0.50)	(0.05)	(0.29)	(0.59)	(0.87)	(0.90)	(0.86)
R^2	0.00	0.11	0.03	0.01	0.00	0.00	0.00
Euro Area							
β_{target}	1.27	12.92	19.35	26.06	17.5	24.04	29.09
p-val.	(0.61)	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)
β_{path}	-0.2	15.17	22.13	23.6	19.08	24.46	25.58
p-val.	(0.94)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
R^2	0.01	0.09	0.08	0.10	0.06	0.06	0.07
Japan							
β_{target}	62.55	2.19	27.48	49.16	3.85	8.37	-30.26
p-val.	(0.27)	(0.97)	(0.73)	(0.67)	(0.98)	(0.94)	(0.81)
β_{path}	57.85	-13.5	15.74	20.59	-28.28	-24.06	-64.67
p-val.	(0.23)	(0.81)	(0.84)	(0.85)	(0.8)	(0.81)	(0.58)
R^2	0.03	0.03	0.01	0.03	0.03	0.03	0.04

Notes: The Table reports coefficient estimates of Equation (1). Coefficients describe the impact on the exchange rate (in basis points) of "target" or "path" monetary policy shocks (also measured in basis points). Estimation is performed using 2-year bonds to calculate the path shock and with the policy shocks measured using the narrow 25 minute window and the exchange rate changes are measured as daily changes using end-day quotes. P-values (in parentheses) are computed with HAC standard errors.

Table A.VII cont. Persistence of the impact of monetary policy on the exchange rate

End of day:	–1	0	+1	+2	+3	+4	+5
U.K.							
β_{target}	-0.11	8.05	7.78	10.6	12.74	13.81	14.68
p-val.	(0.93)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
β_{path}	-0.42	7.52	7.14	10.95	11.64	10.34	9.61
p-val.	(0.68)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)
R^2	0.00	0.14	0.06	0.07	0.07	0.08	0.10
Australia							
β_{target}	-0.28	4.61	10.12	11.12	15.78	12.05	12.58
p-val.	(0.72)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
β_{path}	-0.25	6.91	13.58	14.42	22.74	13.97	12.45
p-val.	(0.74)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)
R^2	0.00	0.10	0.22	0.18	0.23	0.11	0.09
Switzerland							
β_{target}	-0.50	39.26	17.22	29.14	26.12	-2.75	-25.27
p-val.	(0.93)	(0.01)	(0.14)	(0.12)	(0.17)	(0.96)	(0.61)
β_{path}	-5.03	5.78	1.67	1.38	-22.49	-37.52	-35.04
p-val.	(0.01)	(0.07)	(0.56)	(0.74)	(0.01)	(0.31)	(0.38)
R^2	0.07	0.40	0.05	0.09	0.26	0.10	0.05
Canada							
β_{target}	-0.13	8.2	8.91	9.27	7.41	10.64	9.05
p-val.	(0.91)	(0.01)	(0.01)	(0.04)	(0.16)	(0.04)	(0.13)
β_{path}	0.08	8.06	3.99	0.08	3.13	0.32	1.12
p-val.	(0.95)	(0.01)	(0.22)	(0.99)	(0.58)	(0.96)	(0.82)
R^2	0.00	0.37	0.13	0.12	0.04	0.08	0.05

Notes: The Table reports coefficient estimates of Equation (1). Coefficients describe the impact on the exchange rate (in basis points) of "target" or "path" monetary policy shocks (also measured in basis points). Estimation is performed using 2-year bonds to calculate the path shock and with the policy shocks measured using the narrow 25 minute window and the exchange rate changes are measured as daily changes using end-day quotes. P-values (in parentheses) are computed with HAC standard errors.

Table A.VIII: Regular monetary policy decisions vs release of minutes

$$(A) \quad \Delta s_t = \alpha + (\beta_{target} + \beta_{target}^{minutes} \mathbb{1}^{minutes}) MPS_t^{OIS} + (\beta_{path} + \beta_{path}^{UMP} \mathbb{1}^{minutes}) MPS^{Bond\text{ - }OIS_t} + \epsilon_t$$

$$(B) \quad \Delta s_t = \alpha + (\beta_{exp} + \beta_{exp}^{UMP} \mathbb{1}^{minutes}) MPS_t^{2y} + (\beta_{tp} + \beta_{tp}^{minutes} \mathbb{1}^{minutes}) MPS_t^{10y\perp} + \epsilon_t$$

	Panel A. Target and Path				Panel B. Expectations and Term Premium Shocks		
	Coefficient	P-Value	R^2		Coefficient	P-Value	R^2
U.S.							
β_{target}	4.14	(0.00)	0.23	β_{exp}	2.79	(0.00)	0.52
β_{path}	2.81	(0.08)		β_{exp}	3.61	(0.00)	
$\beta_{target}^{minutes}$	-3.53	(0.03)		β_{exp}	-0.41	(0.74)	
$\beta_{path}^{minutes}$	-1.33	(0.39)		β_{exp}	-2.79	(0.00)	
U.K.							
β_{target}	6.42	(0.00)	0.50	β_{exp}	3.65	(0.00)	0.47
β_{path}	7.64	(0.00)		β_{tp}	4.10	(0.02)	
$\beta_{target}^{minutes}$	2.65	(0.06)		$\beta_{exp}^{minutes}$	1.22	(0.25)	
$\beta_{path}^{minutes}$	0.88	(0.66)		$\beta_{tp}^{minutes}$	4.20	(0.03)	
Australia							
β_{target}	5.67	(0.00)	0.70	β_{exp}	5.56	(0.00)	0.70
β_{path}	4.86	(0.00)		β_{tp}	5.40	(0.04)	
$\beta_{target}^{minutes}$	-2.44	(0.01)		$\beta_{exp}^{minutes}$	-4.80	(0.00)	
$\beta_{path}^{minutes}$	-2.31	(0.03)		$\beta_{tp}^{minutes}$	-2.11	(0.48)	

Notes: $\mathbb{1}^{Minutes}$ is a dummy that takes value equal to 1 if the event type is a FG event. $\beta_{target}^{Minutes}$ and $\beta_{path}^{Minutes}$ ($\beta_{exp}^{Minutes}$, $\beta_{tp}^{Minutes}$) measure the additional impact on the exchange rate of FG events. Coefficients describe the impact on the exchange rate (in basis points) of a monetary policy shock "target", "path", "expectation" or "term premium" monetary policy shock (also measured in basis points). P-values (in parentheses) are computed with HAC standard errors. The estimation uses monetary policy decisions and minutes releases only.

Table A.IX: UMP effects using longer windows

	Target vs path shocks					Expectations vs term premium shocks			
Minutes:	20	45	75	105		20	45	75	105
U.S.									
β_{target}	3.95	4.00	4.06	4.08	β_{exp}	2.33	2.14	2.69	2.99
p-val.	(0.00)	(0.00)	(0.00)	(0.00)	p-val.	(0.00)	(0.00)	(0.00)	(0.00)
β_{path}	1.53	1.51	1.53	1.52	β_{tp}	2.41	2.22	2.50	2.25
p-val.	(0.01)	(0.01)	(0.01)	(0.01)	p-val.	(0.02)	(0.10)	(0.03)	(0.05)
β_{target}^{UMP}	14.21	16.45	17.65	18.75	β_{exp}^{UMP}	7.42	5.83	6.69	9.00
p-val.	(0.27)	(0.22)	(0.18)	(0.14)	p-val.	(0.00)	(0.04)	(0.00)	(0.00)
β_{path}^{UMP}	11.03	10.65	10.46	10.39	β_{tp}^{UMP}	-0.58	1.08	0.48	-1.16
p-val.	(0.00)	(0.00)	(0.00)	(0.00)	p-val.	(0.63)	(0.50)	(0.76)	(0.50)
R^2	0.53	0.54	0.56	0.57	R^2	0.66	0.66	0.67	0.64
Euro Area									
β_{target}	4.57	5.25	6.54	5.63	β_{exp}	5.13	7.25	7.21	6.79
p-val.	(0.09)	(0.03)	(0.00)	(0.00)	p-val.	(0.06)	(0.00)	(0.00)	(0.00)
β_{path}	6.55	6.45	6.78	6.36	β_{tp}	7.21	6.45	5.51	6.53
p-val.	(0.02)	(0.00)	(0.00)	(0.00)	p-val.	(0.00)	(0.00)	(0.01)	(0.00)
β_{target}^{UMP}	6.76	12.74	-2.86	-4.95	β_{exp}^{UMP}	4.93	5.38	0.96	0.16
p-val.	(0.36)	(0.01)	(0.27)	(0.10)	p-val.	(0.20)	(0.03)	(0.53)	(0.92)
β_{path}^{UMP}	3.38	7.48	1.30	1.67	β_{tp}^{UMP}	-0.96	0.78	2.58	3.01
p-val.	(0.50)	(0.09)	(0.57)	(0.47)	p-val.	(0.68)	(0.79)	(0.28)	(0.19)
R^2	0.27	0.35	0.43	0.37	R^2	0.39	0.51	0.56	0.55

Notes: The left panel reports estimated coefficients from Equation (1) using 2 year bond yields to compute the path shock. The right hand panel reports estimated coefficients from Equation (2) using expectation and term premia shocks. Policy and exchange rate shocks are measured averaging from 20 to 5 minutes before each event and from 5 to k minutes after each events, with $k \in [20, 45, 75, 105]$. P-values (in parentheses) are computed with HAC standard errors.

Table A.IX cont. UMP effects using longer windows

	Target vs path shocks					Expectations vs term premium shocks			
Minutes:	20	45	75	105		20	45	75	105
U.K.									
β_{target}	6.91	4.66	3.44	2.69	β_{exp}	3.72	4.27	3.77	3.15
p-val.	(0.00)	(0.00)	(0.00)	(0.04)	p-val.	(0.00)	(0.00)	(0.00)	(0.01)
β_{path}	8.29	6.84	4.32	3.88	β_{tp}	4.16	4.38	2.65	2.13
p-val.	(0.00)	(0.00)	(0.01)	(0.04)	p-val.	(0.04)	(0.06)	(0.07)	(0.09)
β_{target}^{UMP}	-0.35	-1.56	14.39	10.41	β_{exp}^{UMP}	0.52	1.27	3.79	2.68
p-val.	(0.87)	(0.72)	(0.07)	(0.03)	p-val.	(0.83)	(0.54)	(0.08)	(0.37)
β_{path}^{UMP}	-0.97	0.41	-0.50	3.07	β_{tp}^{UMP}	-1.29	-1.16	-0.46	-1.31
p-val.	(0.76)	(0.89)	(0.84)	(0.22)	p-val.	(0.71)	(0.64)	(0.77)	(0.35)
R^2	0.51	0.35	0.20	0.14	R^2	0.45	0.38	0.27	0.17

Notes: The left panel reports estimated coefficients from Equation (1) using 2 year bond yields to compute the path shock. The right hand panel reports estimated coefficients from Equation (2) using expectation and term premia shocks. Policy and exchange rate shocks are measured averaging from 20 to 5 minutes before each event and from 5 to k minutes after each events, with $k \in [20, 45, 75, 105]$. P-values (in parentheses) are computed with HAC standard errors.

Table A.X: Regressions with ZLB dummy

$$(A) \quad \Delta s_t = \alpha + (\beta_{target} + \beta_{target}^{ZLB} \mathbb{1}^{ZLB}) MPS_t^{OIS} + (\beta_{path} + \beta_{path}^{ZLB} \mathbb{1}^{ZLB}) MPS^{Bond\text{ - }OIS_t} + \epsilon_t$$

$$(B) \quad \Delta s_t = \alpha + (\beta_{exp} + \beta_{exp}^{ZLB} \mathbb{1}^{ZLB}) MPS_t^{2y} + (\beta_{tp} + \beta_{tp}^{ZLB} \mathbb{1}^{ZLB}) MPS_t^{10y\perp} + \epsilon_t$$

	U.S.	**Euro area**	**U.K.**	**Canada**
(A) Target and Path				
β_{target}	1.20	2.23	1.02	5.81
P-Value	(0.18)	(0.23)	(0.37)	(0.00)
β_{path}	1.71	3.85	0.55	6.73
P-Value	(0.05)	(0.02)	(0.69)	(0.00)
β_{target}^{ZLB}	7.13	22.09	6.63	-0.80
P-Value	(0.00)	(0.00)	(0.00)	(0.77)
β_{path}^{ZLB}	6.47	12.71	6.77	3.32
P-Value	(0.00)	(0.00)	(0.00)	(0.02)
R^2	0.43	0.32	0.49	0.74
(A) Target and Path - 10 year bond				
β_{target}	4.42	7.20	4.75	12.60
P-Value	(0.02)	(0.04)	(0.00)	(0.00)
β_{path}	3.90	7.25	4.46	12.860
P-Value	(0.01)	(0.01)	(0.01)	(0.00)
β_{target}^{ZLB}	1.62	14.56	0.92	20.56
P-Value	(0.60)	(0.00)	(0.63)	(0.05)
β_{path}^{ZLB}	0.21	3.15	0.80	-5.41
P-Value	(0.90)	(0.31)	(0.693)	(0.48)
R^2	0.52	0.42	0.44	0.50
(B) Expectations and term premia				
β_{exp}	2.18	3.43	3.91	6.45
P-Value	(0.00)	(0.08)	(0.00)	(0.00)
β_{tp}	2.21	7.25	5.09	0.35
P-Value	(0.03)	(0.00)	(0.00)	(0.87)
β_{exp}^{ZLB}	3.73	11.14	3.04	2.36
P-Value	(0.00)	(0.00)	(0.11)	(0.01)
β_{tp}^{ZLB}	0.41	-0.76	-4.42	-5.00
P-Value	(0.69)	(0.72)	(0.08)	(0.49)
R^2	0.56	0.41	0.48	0.69

Notes: Estimated coefficients of Equation. Coefficients describe the impact on the exchange rate (in basis points) of a 1 basis point "target" or "path" monetary policy shock. ZLB is a dummy that takes value of 1 if the economy is at the zero lower bound. The estimation pools all types of monetary policy events. The path shock is computed using the 2 or 10 year bond yield.