Monetary shocks at high-frequency and their changing FX transmission around the globe

Massimo Ferrari
Bank for International Settlements, UCSC

Jonathan Kearns
Bank for International Settlements

Andreas Schrimpf
Bank for International Settlements

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Unconventional Monetary Policies: A Small Open Economy Perspective

Disclaimer: These views presented are those of the authors and do not necessarily reflect those of the BIS.

The FX channel matters

Has the transmission of monetary policy through the exchange rate changed?

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- *Unconventional* policies have different transmission channels.
- How do we measure unconventional monetary policy shocks?

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Has the transmission of monetary policy through the exchange rate changed?

- *Unconventional* policies have different transmission channels.
- How do we measure unconventional monetary policy shocks?
- Many changes in past decade: liquidity, market vol, asset supply, regulation etc.
- Are central banks relying more on international channels?

Methodology

What is the FX respose to a monetary policy announcement?

We use a high-frequency event study:

Methodology

What is the FX respose to a monetary policy announcement?

We use a high-frequency event study:

- Abstracts from endogeneity.
- Isolates impact from other news in either country during the day.
- Enables estimation of time-varying sensitivity.
- Enables estimation of the impact of different types of news.
- Well established technique: eg Faust et al 2003, Kearns & Manners 2006, Rosa 2011, Glick & Leduc 2013, Gürkaynak & Wright 2013, Rogers et al 2014, etc

Event study

Regress the FX change on indicators of MP news in a narrow window

$$\Delta s_t = \alpha + \beta_{target} MPS_t^{OIS} + \beta_{path} MPS_t^{Bond-OIS} + \epsilon_t$$

Where, for event t:

- MPS_t^{OIS} = **'target' shock** = the change in the 1-month OIS interest rate
- $MPS_t^{Bond-OIS}$ = **'path' shock** = the change in the slope of the yield curve (the yield on 2-year bonds less the 1 month OIS interest rate)

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- Δs_t = basis point change in the FX rate around the event (log change)
- Quotes are 15 min averages, eg $\Delta s_t = \overline{s_{t+20min \to t+5min}} - \overline{s_{t-20min \to t-5min}}$

Events and data

- Exact date and time of monetary policy announcements.
- Type of announcement:
  1. Monetary Policy Decisions (MPD)
  2. Unconventional Monetary Policy (UMP; inc Forward Guidance, FG)
  3. Minutes
- Central banks of seven most traded currencies.
- Minute by minute quotes from Thomson Reuters:
  - USD bilateral exchange rates, 1m OIS, 2- & 10-year bonds
  - Extensive data and event cleaning

Number of monetary policy events

		MPD	UMP	*(o/w FG)*	Minutes	Total
U.S.	05.2004–12.2015	59	25	*(10)*	47	131
Euro Area	04.2004–11.2015	115	32	*(8)*	–	188
Japan	12.2009–11.2015	17	6	*(1)*	40	73
U.K.	09.2007–11.2015	74	16	*(11)*	89	205
Australia	07.2006–15.2015	92	–	–	58	150
Switzerland	09.2010–09.2015	23	–	–	–	23
Canada	01.2007–12.2015	51	–	–	–	51

Notes: MPD = Monetary Policy Decisions
UMP = Unconventional Monetary Policy (of which FG = Forward Guidance)
Minutes = minutes of monetary policy meeting

▸ Data

Baseline results

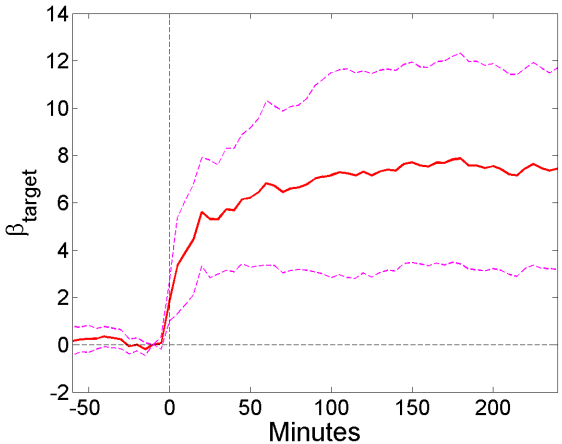
$$\Delta s_t = \alpha + \beta_{target} MPS_t^{OIS} + \beta_{path} MPS_t^{Bond-OIS} + \epsilon_t$$

	U.S.	Euro area	Japan	U.K.	Australia	Switzerland	Canada
β_{target}	4.27	4.03	27.34	6.13	5.63	25.23	6.33
p-val.	(0.00)	(0.03)	(0.04)	(0.00)	(0.00)	(0.00)	(0.00)
β_{path}	2.93	5.63	11.58	6.64	4.78	7.07	7.49
p-val.	(0.04)	(0.00)	(0.20)	(0.00)	(0.00)	(0.07)	(0.00)
R^2	0.21	0.14	0.17	0.45	0.70	0.40	0.72

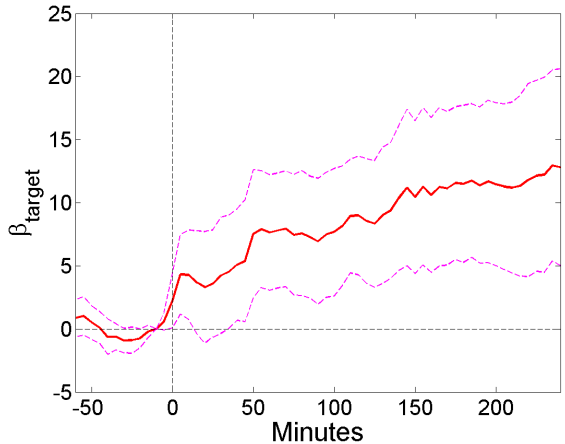
FX response is rapid

$$\Delta s_{[t,t+k]} = \alpha + \beta^{(k)}_{target} MPS^{OIS}_t + \beta^{(k)}_{path} MPS^{Bond-OIS}_t + \epsilon^{(k)}_t$$

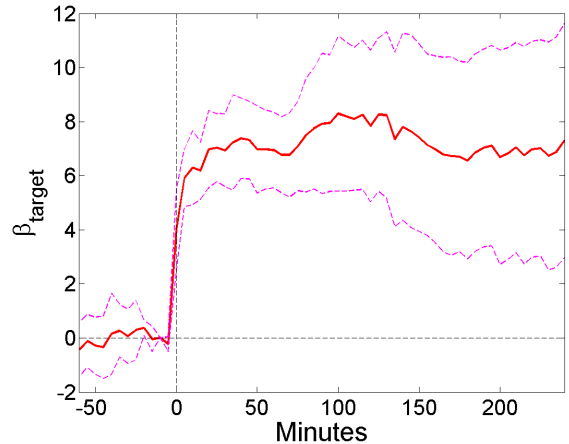
USD β_{target}



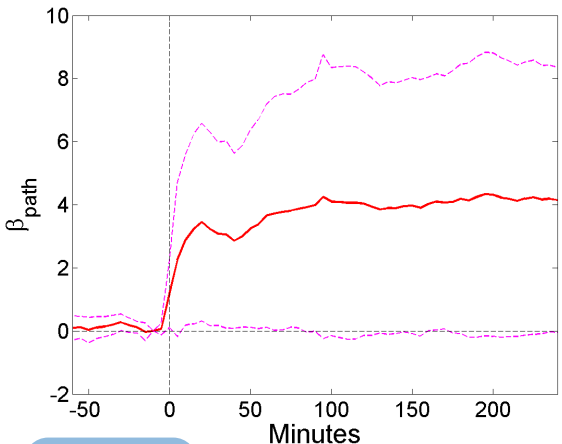
EUR β_{target}



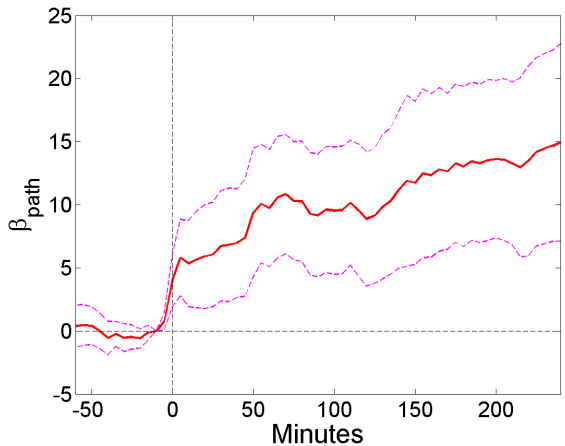
CAD β_{target}



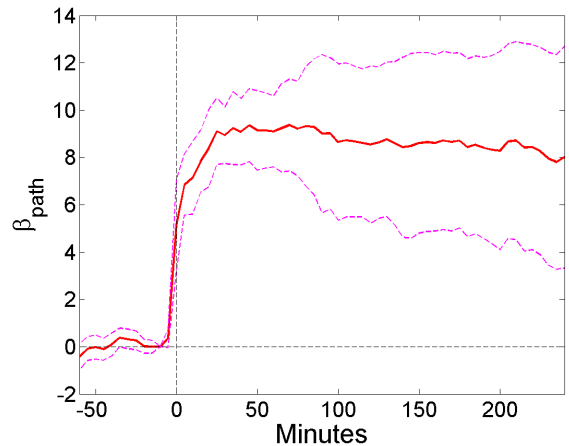
USD β_{path}



EUR β_{path}



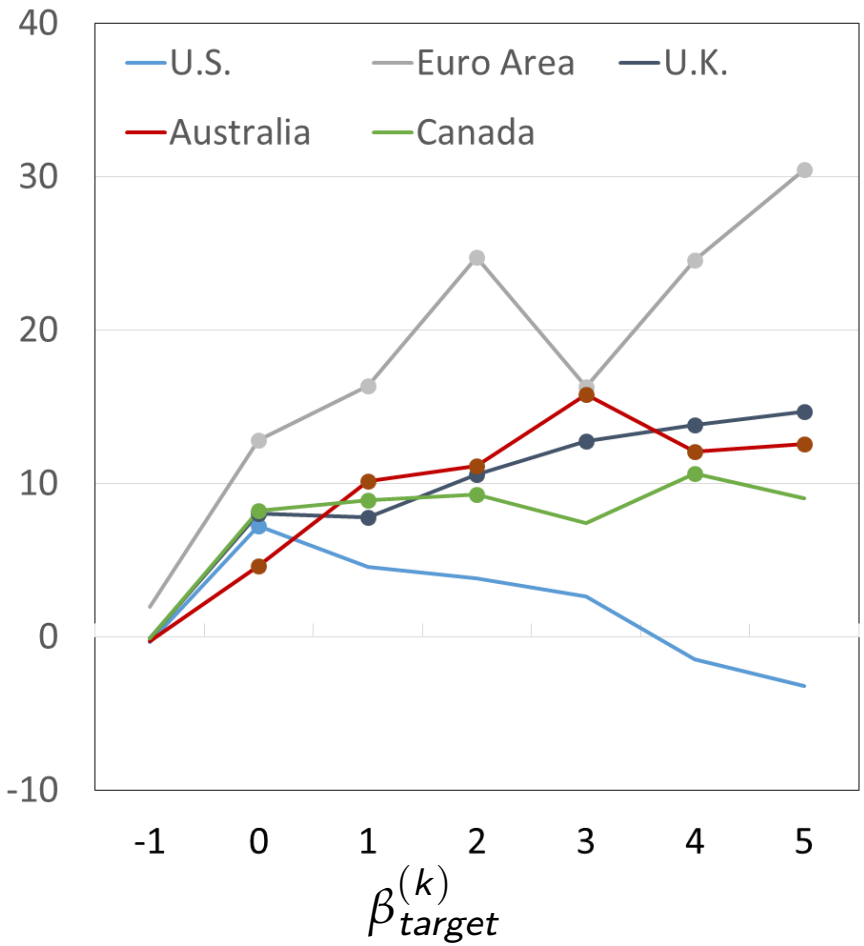
CAD β_{path}

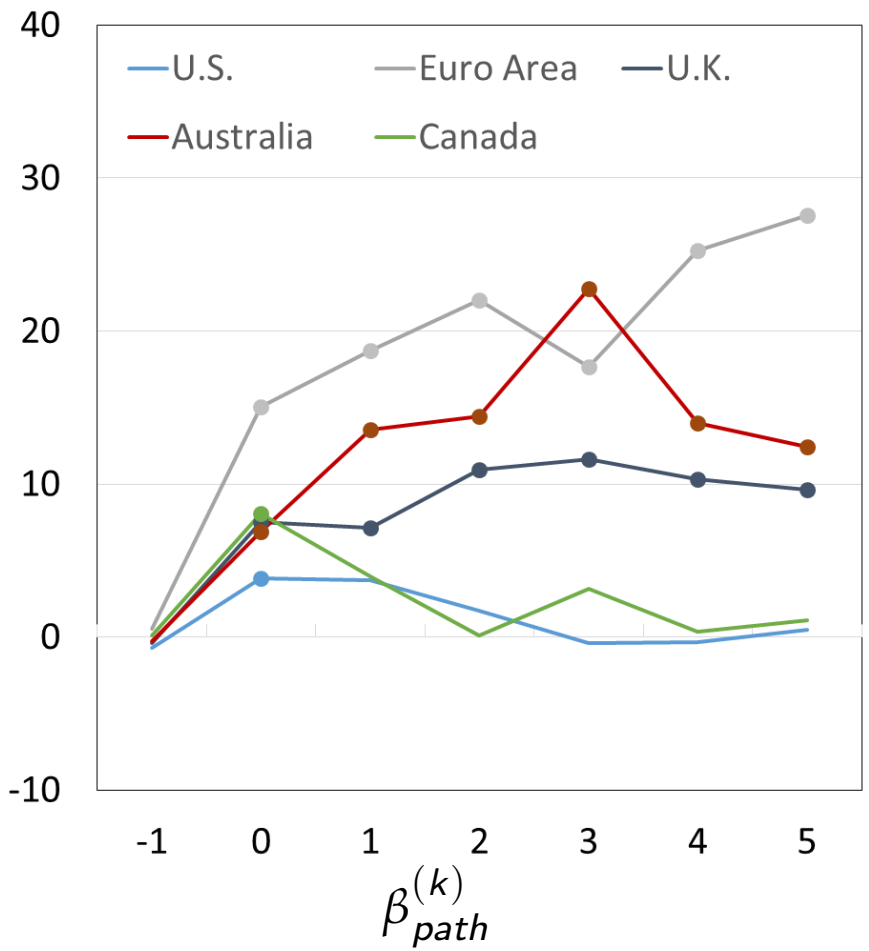


▸ Others

FX response is mostly persistent

$$\Delta s_{[\text{day } t \text{ to day } t+k]} = \alpha + \beta^{(k)}_{target} MPS^{OIS}_t + \beta^{(k)}_{path} MPS^{Bond-OIS}_t + \epsilon^{(k)}_t$$





Note: Dots indicate statistically different from zero.

UMP events don't seem that different

$$\begin{aligned}\Delta s_t &= \alpha + (\beta_{target} + \beta^{UMP}_{target}\mathbb{1}^{UMP})MPS^{OIS}_t \\ &\quad + (\beta_{path} + \beta^{UMP}_{path}\mathbb{1}^{UMP})MPS^{Bond\text{ - }OIS_t} + \epsilon_t\end{aligned}$$

UMP events don't seem that different

$$\begin{aligned}\Delta s_t &= \alpha + (\beta_{target} + \beta_{target}^{UMP} \mathbb{1}^{UMP}) MPS_t^{OIS} \\ &\quad + (\beta_{path} + \beta_{path}^{UMP} \mathbb{1}^{UMP}) MPS^{Bond\ -\ OIS_t} + \epsilon_t\end{aligned}$$

	U.S.	Euro Area	U.K.
β_{target}	3.19	4.57	6.91
p-val.	(0.00)	(0.10)	(0.00)
β_{path}	1.63	6.56	8.29
p-val.	(0.01)	(0.02)	(0.00)
β_{target}^{UMP}	9.76	0.46	-0.35
p-val.	(0.22)	(0.96)	(0.87)
β_{path}^{UMP}	**10.92**	-1.95	-0.97
p-val.	(0.00)	(0.61)	(0.76)
R^2	0.52	0.22	0.51

▸ Others

Has the sensitivity of the exchange rate to MP changed?

Changes in market conditions and operation:

- ZLB, safe asset supply, liquidity, volatility, risk premia.
- QE, high-speed and algo trading.

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Changes in market conditions and operation:

- ZLB, safe asset supply, liquidity, volatility, risk premia.
- QE, high-speed and algo trading.

Estimate time-varying coefficients:

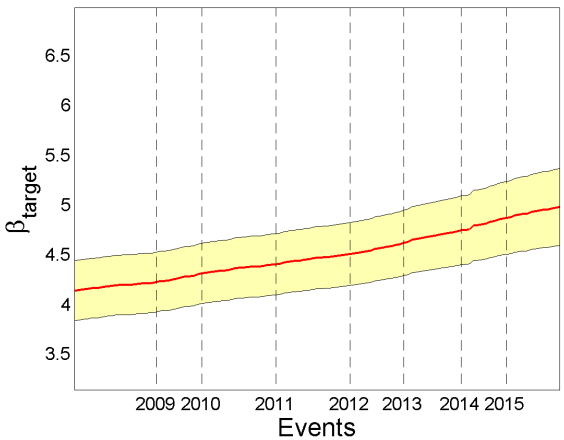
- Non-parametric estimation (Ang & Kristensen 2012).
- Coefficient estimates downweight more distant observations.

$$\Delta s_t = \alpha_t + \beta_{target,t} \cdot MPS_t^{OIS} + \beta_{path,t} \cdot MPS_t^{Bond-OIS} + \epsilon_t,$$

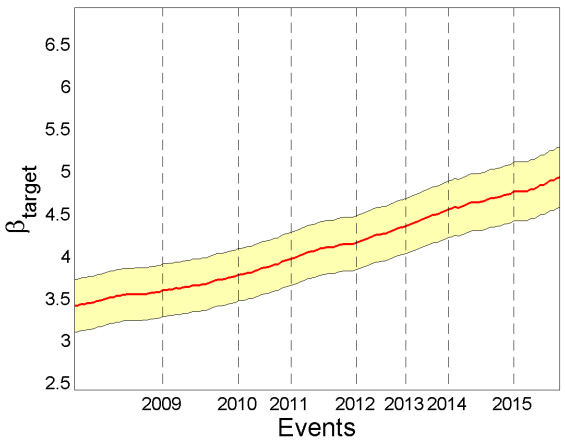
where $\beta_{target,t}$ and $\beta_{path,t}$ are time-varying coefficients

Time-varying coefficients

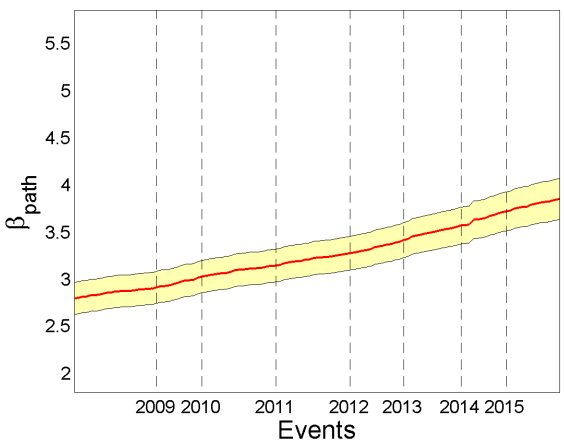
USD β_{target}



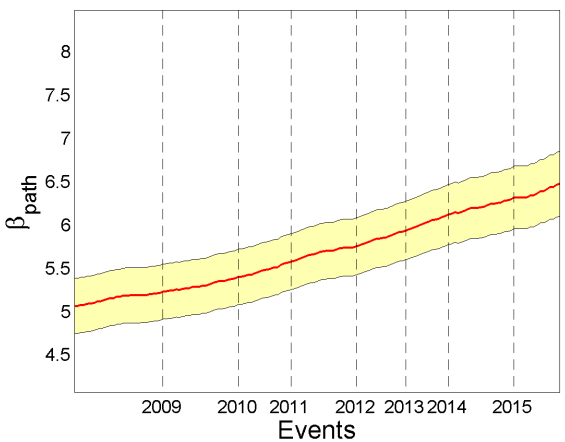
EUR β_{target}



USD β_{path}

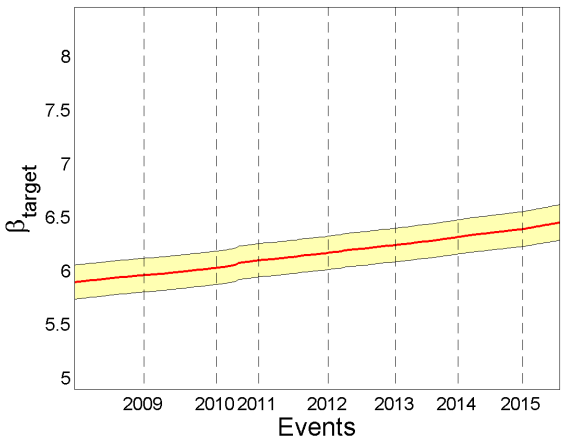


EUR β_{path}

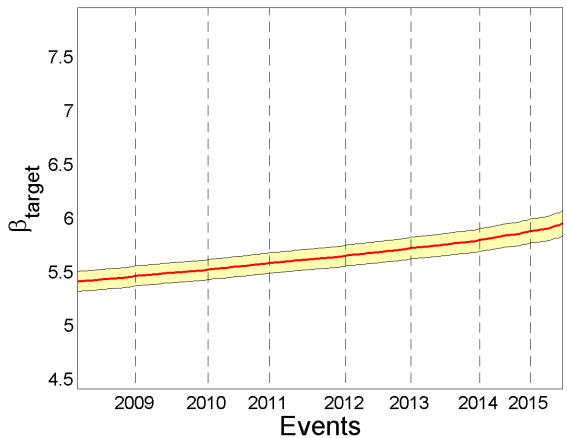


Time-varying coefficients

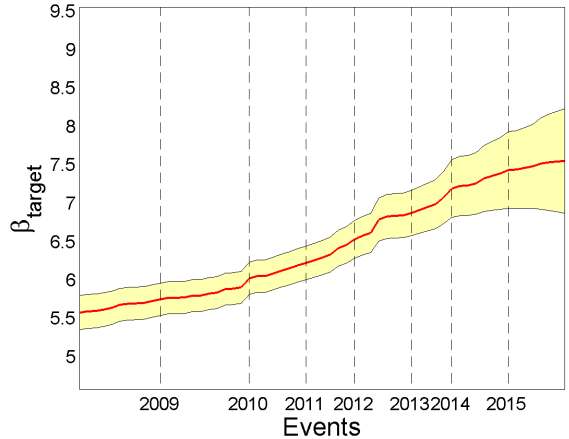
GBP β_{target}



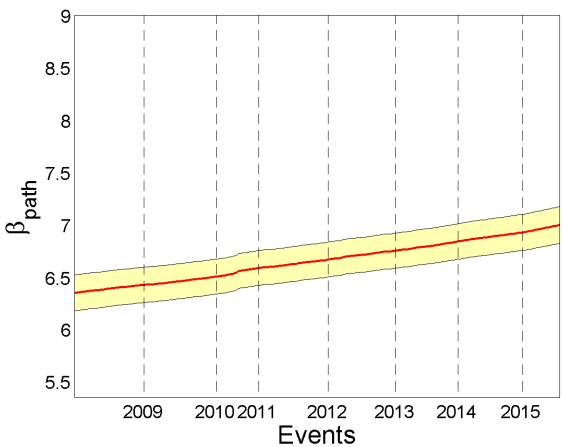
AUD β_{target}



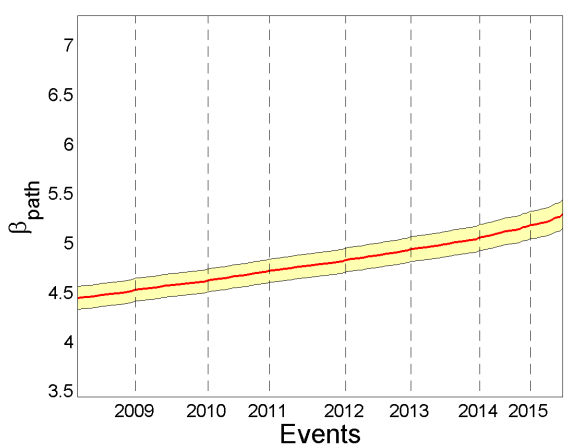
CAD β_{target}



GBP β_{path}



AUD β_{path}



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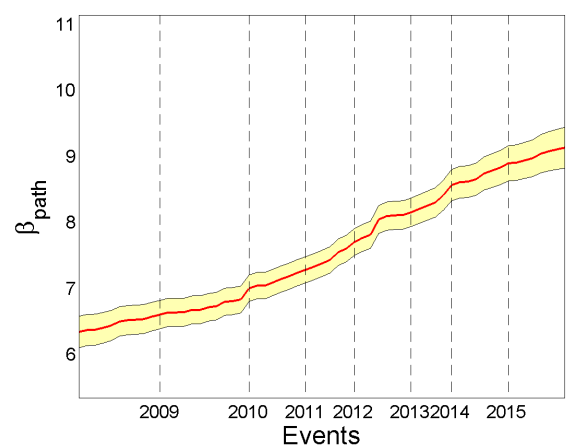


Why is monetary policy having a larger effect on FX?

Mostly it's easier to rule out explanations.

- Not UMP:
  - Increase for Australia and Canada despite no/little UMP.
  - UMP doesn't have a larger impact in Europe or UK.
- The monotonic increase over the sample is inconsistent with:
  - FX risk premia – participants demand greater return for risk.
  - Market liquidity – higher inventory risk when more news.
- Other possible explanations are harder to assess:
  - More information on long-run exchange rate in CB announcements.
  - Changes in market structure – high-frequency and algorithmic trading.
- It could alternatively relate to the low level of interest rates.

Robustness

- Short rates have less explanatory power than long rates ▸ more
- Longer window to measure monetary shocks ▸ more
- 10-year bond (not 2-year bond) to measure path shocks ▸ more
- Define shocks as expectations and term-premium ▸ more
- Outliers – use M-estimator ▸ more
- Other bilateral FX or index for US; EUR/CHF for Switzerland ▸ more
- Release of policy committee meeting minutes ▸ more
- Rolling window OLS with just 2-year bond to measure MPS ▸ more

Conclusions

1. Monetary policy continues to have a significant effect on exchange rates.
   - Long interest rates are important for FX response.
   - Common framework using short and long rates can characterise MP shocks before and at ZLB.
   - Effect of UMP is mostly similar to conventional MP.

Conclusions

1. Monetary policy continues to have a significant effect on exchange rates.
   - Long interest rates are important for FX response.
   - Common framework using short and long rates can characterise MP shocks before and at ZLB.
   - Effect of UMP is mostly similar to conventional MP.
2. The impact of monetary policy on the exchange rate has **increased** over time.
   - Not driven by UMP.
   - Increase is broadly monotonic – doesn't align with changes in liquidity, risk premia etc. changes in market conditions.

Extra slides

Magnitude of market responses around MP events

Absolute average changes in basis points

	Policy Rate	Target	Path	$\Delta y^{(2)}$	$\Delta y_{\perp}^{(10)}$	FX Spot
U.S.	7.8	1.0	2.2	1.7	1.8	17.4
Euro Area	5.5	0.9	1.1	0.8	0.7	12.6
Japan	0.0	0.2	0.3	0.3	0.9	10.3
U.K.	4.9	1.4	2.1	1.6	0.9	16.5
Australia	9.5	2.9	2.8	2.6	0.8	21.8
Switzerland	6.3	0.6	1.2	1.0	0.5	29.1
Canada	7.9	1.9	3.1	2.6	0.8	31.9

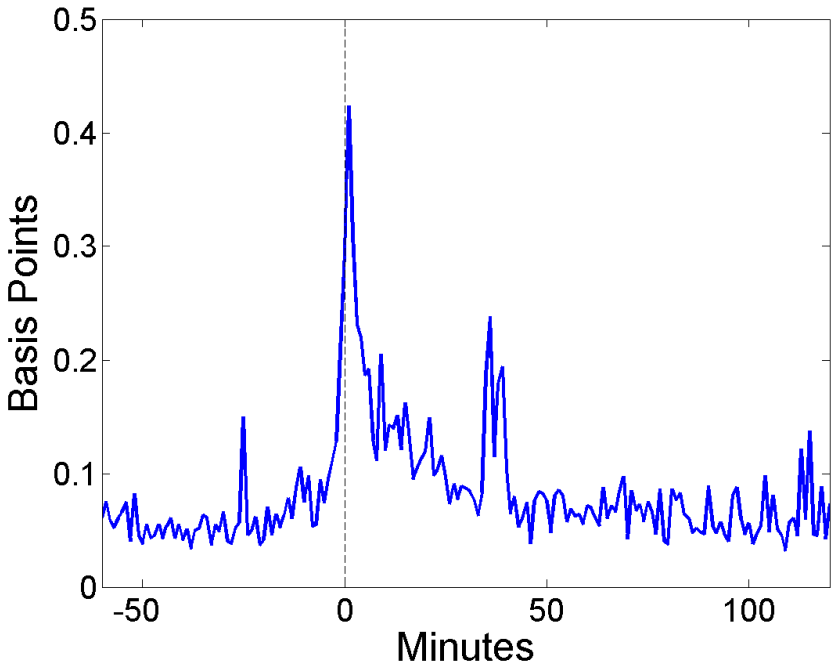
Notes: Target = Δ 1-month OIS; Path = Δ(2-year bonds minus 1-month OIS).
$\Delta y_{\perp}^{(10)}$ is the change in the 10-year bond yield orthogonal to that in the 2-year bond yield.

Go Back

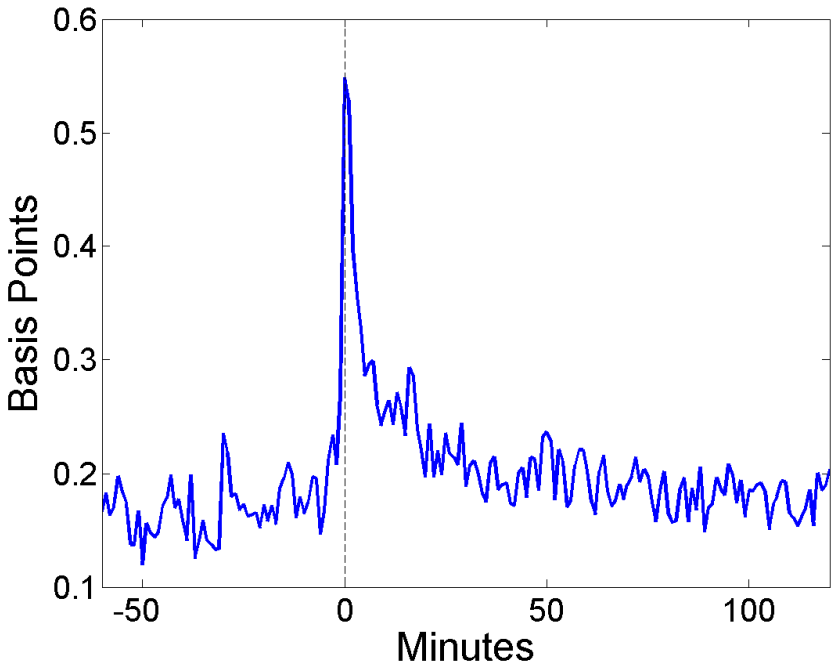
Interest rate variation around announcements

Absolute average change over all announcements

1-month OIS



2-year yield



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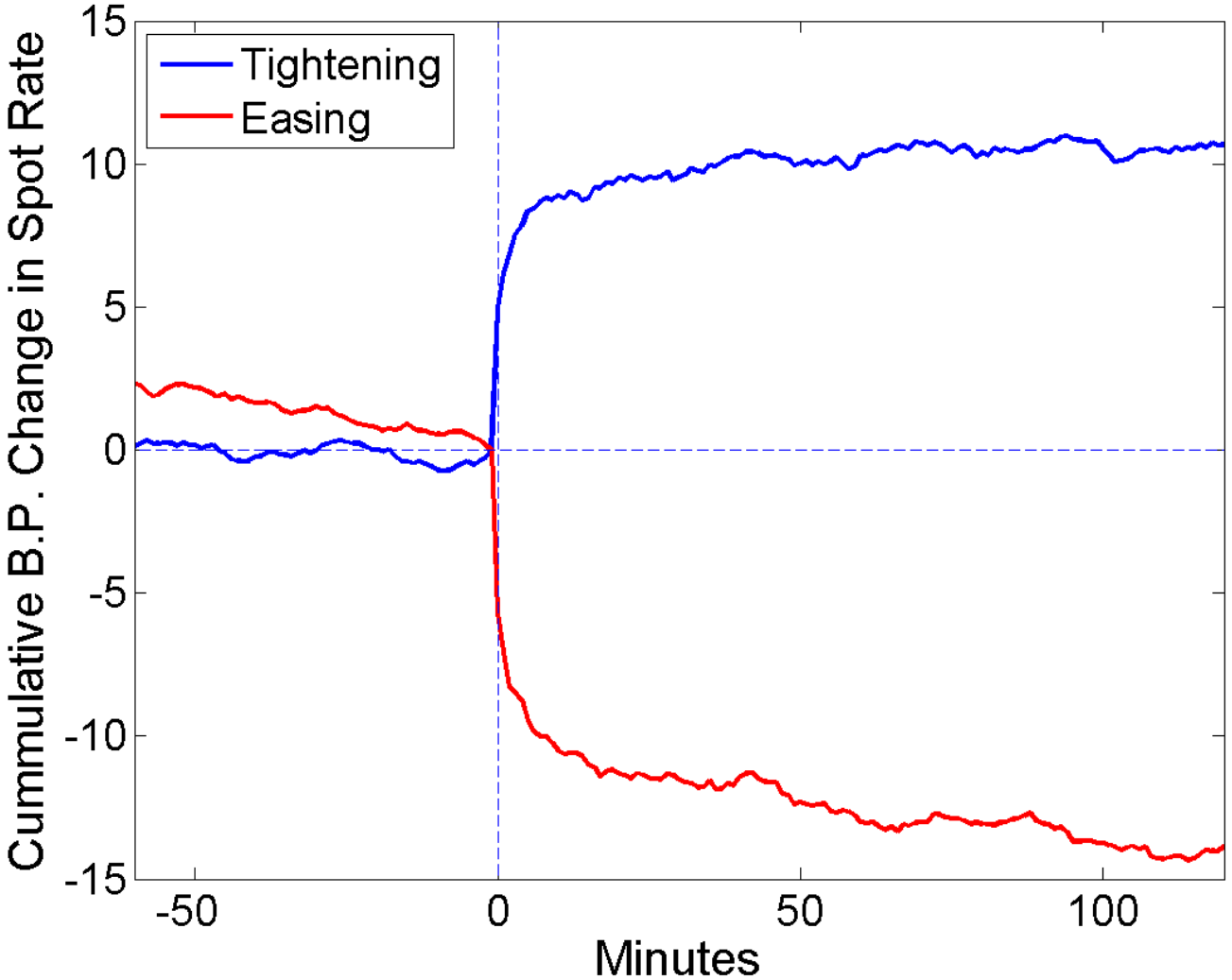
Cumulative FX change around announcements

Average change for positive (tightening) and negative (easing) yield response



Robustness: Expectation and Term Premium shocks

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

Where:

- MPS_t^{2y} = **'expectations' shock** = the change in the 2-year bond yield
- $MPS_t^{10y\perp}$ = **'term premium' shock** = orthogonal component of changes in the 10-year bond yield

Robustness: Expectation and Term Premium shocks

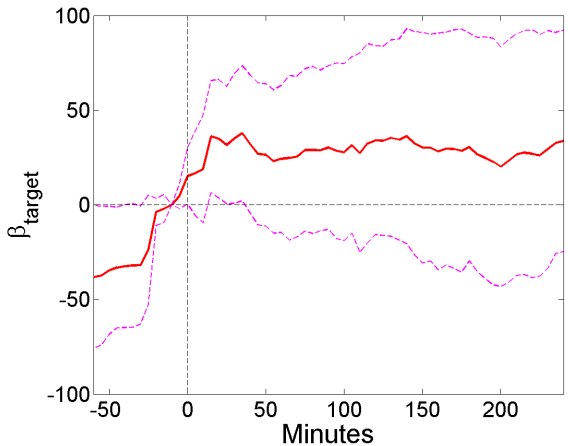
$$\Delta s_t = \alpha + \beta_{exp} MPS_t^{2y} + \beta_{tp} MPS_t^{10y\perp} + \epsilon_t$$

	U.S.	Euro area	Japan	U.K.	Australia	Switzerland	Canada
β_{exp}	3.07	4.66	1.21	3.94	5.41	11.31	7.09
p-val.	(0.00)	(0.00)	(0.38)	(0.00)	(0.00)	(0.00)	(0.00)
β_{tp}	2.65	8.23	-0.10	4.12	4.56	24.33	-0.89
p-val.	(0.00)	(0.00)	(0.87)	(0.04)	(0.00)	(0.00)	(0.73)
R^2	0.36	0.35	0.00	0.45	0.68	0.39	0.67

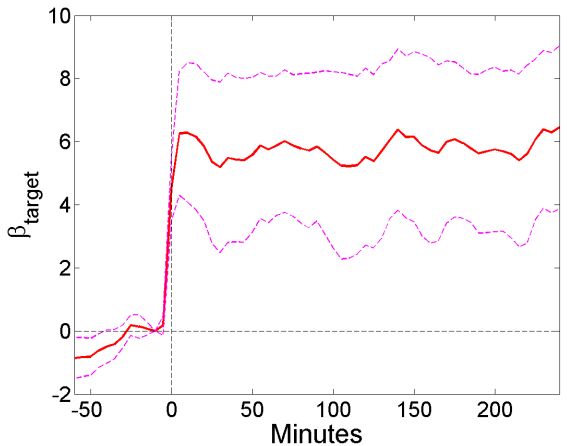
FX response is rapid

$$\Delta s_{[t,t+k]} = \alpha + \beta^{(k)}_{target} MPS^{OIS}_t + \beta^{(k)}_{path} MPS^{Bond-OIS}_t + \epsilon^{(k)}_t$$

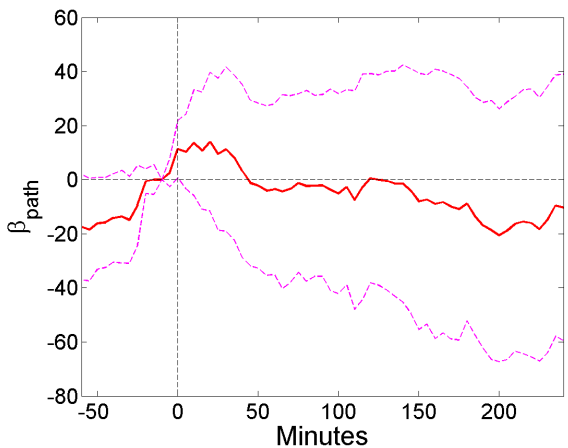
JPY β_{target}



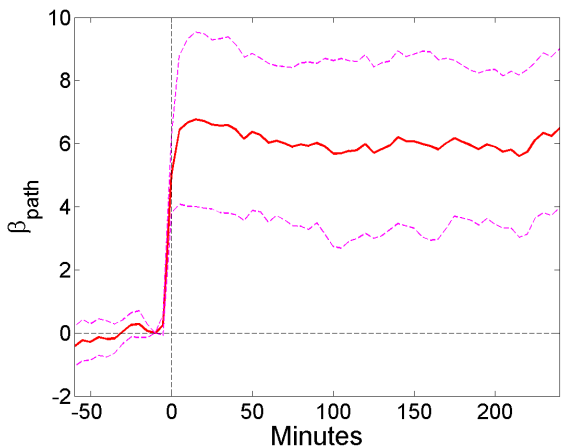
GBP β_{target}



JPY β_{path}



GBP β_{path}

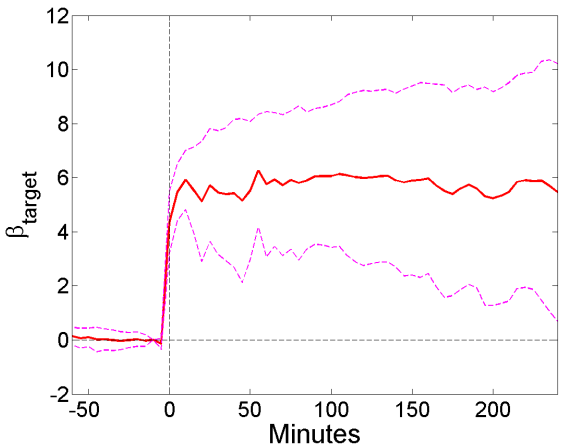


Back

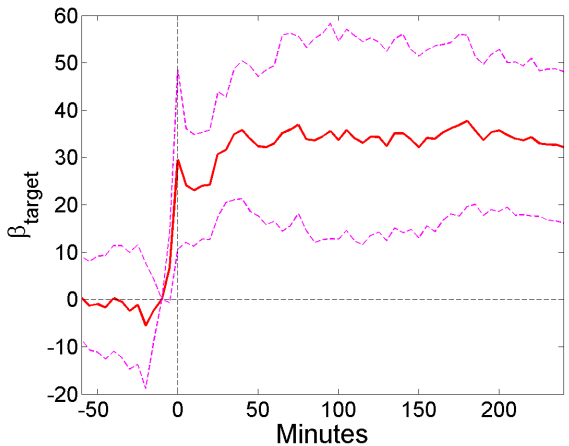
FX response is rapid

$$\Delta s_{[t,t+k]} = \alpha + \beta^{(k)}_{target} MPS^{OIS}_t + \beta^{(k)}_{path} MPS^{Bond-OIS}_t + \epsilon^{(k)}_t$$

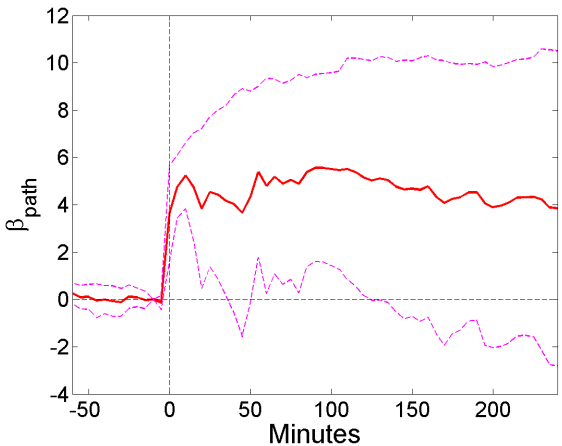
AUD β_{target}



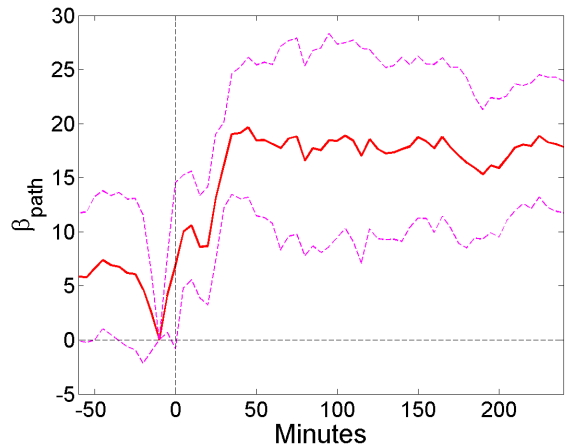
CHF β_{target}



AUD β_{path}



CHF β_{path}



Back

Are UMP events different?

Expectation and Term Premium shocks

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

	U.S.	Euro Area	U.K.
β_{exp}	2.33	4.90	3.72
p-val.	(0.00)	(0.08)	(0.00)
β_{tp}	2.41	7.22	4.16
p-val.	(0.02)	(0.00)	(0.04)
β_{exp}^{UMP}	**7.42**	2.24	0.52
p-val.	(0.00)	(0.49)	(0.83)
β_{tp}^{UMP}	-0.58	0.06	-1.28
p-val.	(0.63)	(0.98)	(0.71)
R^2	0.55	0.38	0.45

Are Forward Guidance events different?

Target and Path shocks

$$\begin{aligned}\Delta s_t &= \alpha + (\beta_{target} + \beta^{FG}_{target}\mathbb{1}^{FG})MPS^{OIS}_t \\ &\quad + (\beta_{path} + \beta^{FG}_{path}\mathbb{1}^{FG})MPS^{Bond\text{ - }OIS_t} + \epsilon_t\end{aligned}$$

	U.S.	Euro Area	U.K.
β_{target}	4.21	4.94	6.28
p-val.	(0.00)	(0.06)	(0.00)
β_{path}	2.84	7.12	7.48
p-val.	(0.08)	(0.01)	(0.00)
β^{FG}_{target}	-3.63	2.83	4.02
p-val.	(0.46)	(0.48)	(0.20)
β^{FG}_{path}	1.91	2.38	1.81
p-val.	(0.37)	(0.39)	(0.46)
R^2	0.23	0.32	0.45

Are Forward Guidance events different?

Expectation and Term Premium shocks

$$\begin{aligned}\Delta s_t &= \alpha + (\beta_{exp} + \beta_{exp}^{FG}\mathbb{1}^{FG})MPS_t^{2y} \\ &\quad + (\beta_{tp} + \beta_{tp}^{FG}\mathbb{1}^{FG})MPS_t^{10y\perp} + \epsilon_t\end{aligned}$$

	U.S.	Euro Area	U.K.
β_{exp}	2.88	5.35	3.62
p-val.	(0.00)	(0.05)	(0.00)
β_{tp}	3.59	7.47	4.01
p-val.	(0.00)	(0.00)	(0.03)
β_{exp}^{FG}	6.29	4.86	4.07
p-val.	(0.09)	(0.08)	(0.06)
β_{tp}^{FG}	3.36	3.50	3.15
p-val.	(0.54)	(0.51)	(0.44)
R^2	0.54	0.40	0.37

Spillovers

- Interest rate changes in large countries (eg US) may affect other countries' rates.
- The FX response then reflects both interest rate changes.
- To check the importance of spillovers we estimate with GMM the system of equations:

$$MPS^{j}_{c,t} = \delta MPS^{j}_{m,t} + \epsilon^{1}_{c,t} \quad (1)$$

$$\Delta s_{cm,t} = \alpha + \beta_1 MPS^{j}_{m,t} + \beta_2 MPS^{j}_{c,t} + \epsilon^{2}_{cm,t} \quad (2)$$

- We find spillovers a very small within our narrow window.

Robustness: Univariate regression results

		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	0.04	4.67	8.74
	P-value	(0.62)	(0.93)	(0.01)	(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

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Robustness: Univariate regression results

		OIS 1-Month	OIS 6-Months	2-Year Bonds	10-Year Bonds
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

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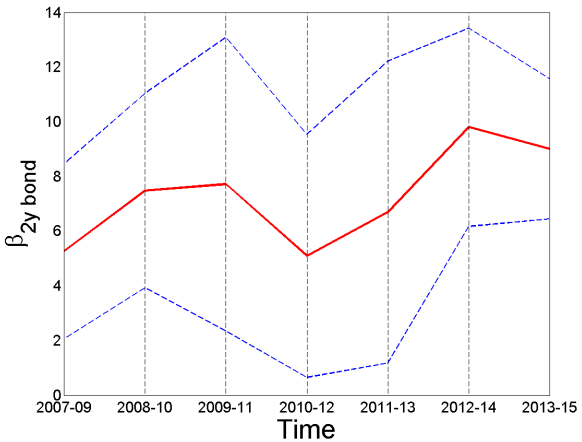
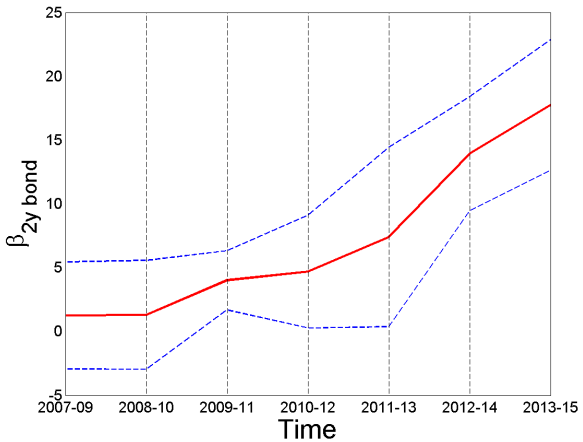
Robustness: Simple rolling window regressions

Three-year windows, 2-year bond: $\Delta s_t = \alpha + \beta MPS_t^{2y\ bond} + \epsilon_t$

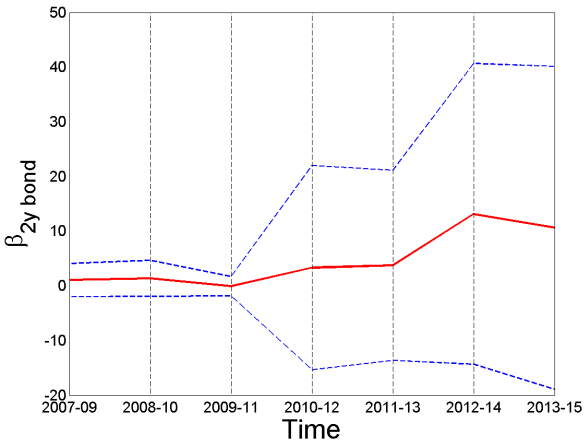
USD



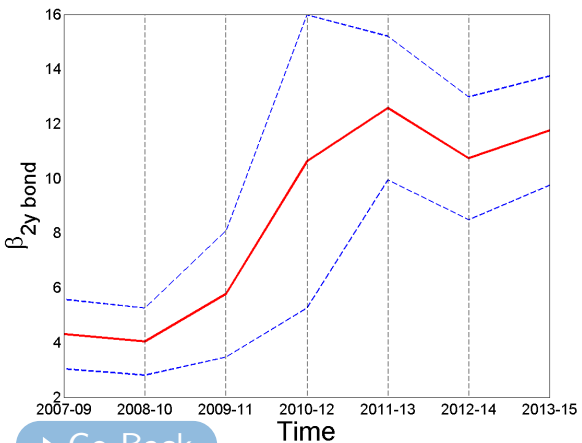
EUR



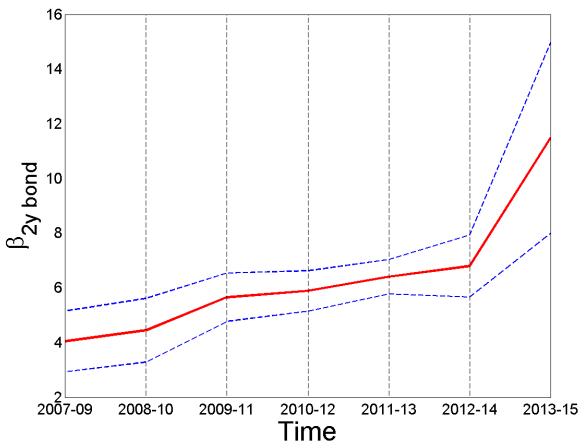
JPY



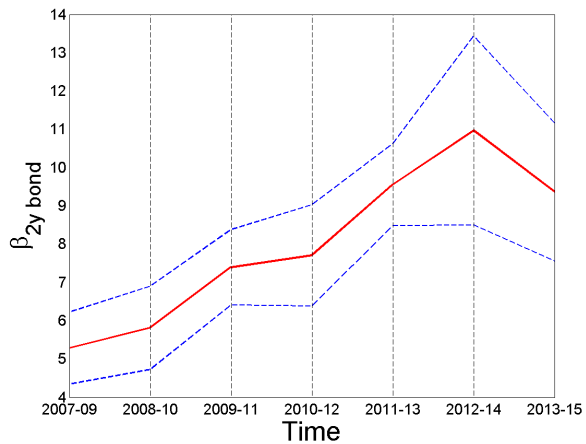
GBP



AUD



CAD



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Robustness: Longer windows to measure MPS

	1m OIS and 2y bond				1m OIS and 10y bond			
Minutes:	20	45	75	105	20	45	75	105
U.S.								
β_{target}	3.95	4.00	4.06	4.08	6.24	5.66	6.13	6.39
p-val.	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
β_{path}	1.53	1.51	1.53	1.52	3.56	2.86	3.25	3.29
p-val.	(0.01)	(0.01)	(0.01)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)
β^{UMP}_{target}	14.21	16.45	17.65	18.75	8.94	20.65	17.55	14.57
p-val.	(0.27)	(0.22)	(0.18)	(0.14)	(0.41)	(0.04)	(0.00)	(0.09)
β^{UMP}_{path}	11.03	10.65	10.46	10.39	0.22	2.07	1.97	1.97
p-val.	(0.00)	(0.00)	(0.00)	(0.00)	(0.81)	(0.02)	(0.03)	(0.14)
R^2	0.53	0.54	0.56	0.57	0.56	0.62	0.64	0.57

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Robustness: Longer windows to measure MPS

	1m OIS and 2y bond				1m OIS and 10y bond			
Minutes:	20	45	75	105	20	45	75	105
Euro Area								
β_{target}	4.57	5.24	6.57	5.66	8.87	9.35	12.93	11.85
p-val.	(0.10)	(0.04)	(0.00)	(0.00)	(0.03)	(0.00)	(0.00)	(0.00)
β_{path}	6.56	6.44	6.79	6.39	8.49	8.86	11.32	10.48
p-val.	(0.02)	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)
β^{UMP}_{target}	0.58	3.07	-3.54	-5.20	3.63	13.24	0.72	3.89
p-val.	(0.94)	(0.67)	(0.21)	(0.13)	(0.63)	(0.01)	(0.80)	(0.27)
β^{UMP}_{path}	-1.92	-0.21	0.89	1.99	-0.52	1.30	-2.07	0.74
p-val.	(0.61)	(0.97)	(0.68)	(0.40)	(0.89)	(0.54)	(0.22)	(0.69)
R^2	0.22	0.22	0.41	0.38	0.36	0.47	0.49	0.50

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Robustness: Longer windows to measure MPS

	1m OIS and 2y bond				1m OIS and 10y bond			
Minutes:	20	45	75	105	20	45	75	105
U.K.								
β_{target}	6.91	4.66	3.44	2.69	4.75	4.15	3.76	2.71
p-val.	(0.00)	(0.00)	(0.00)	(0.04)	(0.06)	(0.07)	(0.03)	(0.12)
β_{path}	8.29	6.84	4.32	3.88	4.59	4.73	3.55	2.82
p-val.	(0.00)	(0.00)	(0.01)	(0.04)	(0.09)	(0.04)	(0.05)	(0.12)
β^{UMP}_{target}	-0.35	-1.56	14.39	10.41	2.73	11.48	16.52	5.96
p-val.	(0.87)	(0.72)	(0.07)	(0.03)	(0.34)	(0.01)	(0.04)	(0.46)
β^{UMP}_{path}	-0.97	0.41	-0.50	3.07	-0.65	-0.33	-1.32	-1.18
p-val.	(0.76)	(0.89)	(0.84)	(0.22)	(0.82)	(0.89)	(0.47)	(0.52)
R^2	0.51	0.35	0.20	0.14	0.42	0.42	0.21	0.11

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Robustness: path shocks based on 10-year yield

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

	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

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Robustness: M-estimator to control for outliers

	U.S.	Euro area	Japan	U.K.	Australia	Switzerland	Canada
OLS							
β_{target}	4.27	4.03	27.34	6.13	5.63	25.23	6.33
p-val.	(0.00)	(0.03)	(0.04)	(0.00)	(0.00)	(0.00)	(0.00)
β_{path}	2.93	5.63	11.58	6.64	4.78	7.07	7.49
p-val.	(0.04)	(0.00)	(0.20)	(0.00)	(0.00)	(0.07)	(0.00)
R^2	0.21	0.14	0.17	0.45	0.70	0.40	0.72
M-estimator							
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

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Robustness: Other US dollar bilateral FX and index

	EUR	JPY	U.K.	AUD	CHF	CAD	**USD Index**	**Long/Short**
Target and path								
β_{target}	4.27	2.19	3.71	5.78	3.69	3.16	**2.23**	**2.15**
p-val.	(0.00)	(0.06)	(0.00)	(0.00)	(0.00)	(0.00)	**(0.06)**	**(0.07)**
β_{path}	2.93	2.98	2.22	2.72	3.35	1.60	**2.97**	**3.00**
p-val.	(0.04)	(0.05)	(0.04)	(0.10)	(0.04)	(0.07)	**(0.05)**	**(0.04)**
R^2	0.21	0.24	0.22	0.15	0.24	0.26	**0.24**	**0.24**
Expectations and term premia								
β_{exp}	3.07	2.96	2.37	2.96	3.41	1.76	**2.96**	**2.99**
p-val.	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	**(0.00)**	**(0.00)**
β_{tp}	2.65	3.08	2.09	2.72	2.45	1.55	**3.06**	**3.10**
p-val.	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	**(0.00)**	**(0.00)**
R^2	0.36	0.55	0.37	0.22	0.39	0.20	**0.55**	**0.54**

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Robustness: Monetary Policy Committee Minutes

	Target and Path				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_{tp}	3.61	(0.00)	
$\beta_{target}^{minutes}$	-3.53	(0.03)		$\beta_{exp}^{minutes}$	-0.41	(0.74)	
$\beta_{path}^{minutes}$	-1.33	(0.39)		$\beta_{tp}^{minutes}$	-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)	

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Robustness: FX response to data releases

$$\Delta s_t = \alpha + \beta_{target} \text{news shock}_t^{OIS} + \beta_{path} \text{news shock}_t^{Bond-OIS} + \epsilon_t$$

	U.S.	Euro area	Japan	U.K.	Australia	Switzerland	Canada
β_{target}	4.16	2.06	8.98	8.25	5.33	9.44	10.70
p-val.	(0.00)	(0.30)	(0.09)	(0.00)	(0.00)	(0.52)	(0.00)
β_{path}	2.22	2.04	7.92	7.72	6.87	11.43	6.52
p-val.	(0.00)	(0.06)	(0.14)	(0.00)	(0.00)	(0.45)	(0.00)
R^2	0.17	0.03	0.28	0.40	0.77	0.00	0.40

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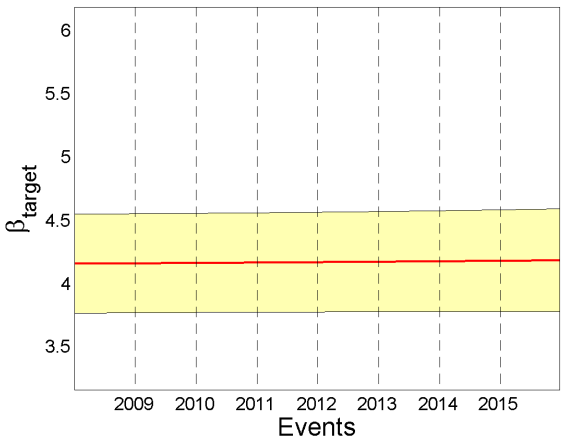
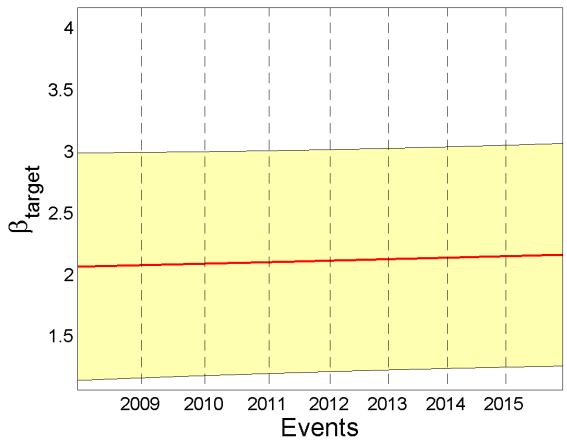
Robustness: FX response to data releases

$$\Delta s_t = \alpha + \beta_{target} \text{news shock}_t^{OIS} + \beta_{path} \text{news shock}_t^{Bond-OIS} + \epsilon_t$$

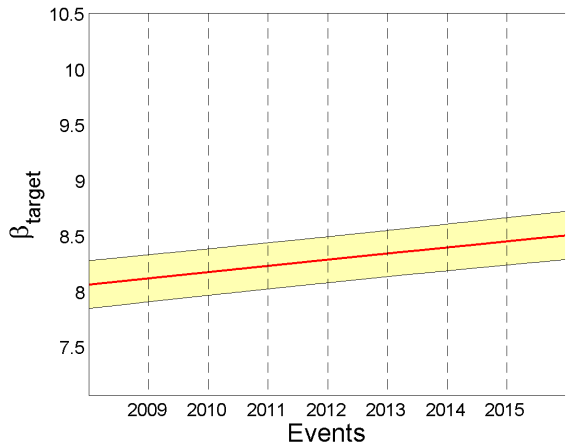
USD target



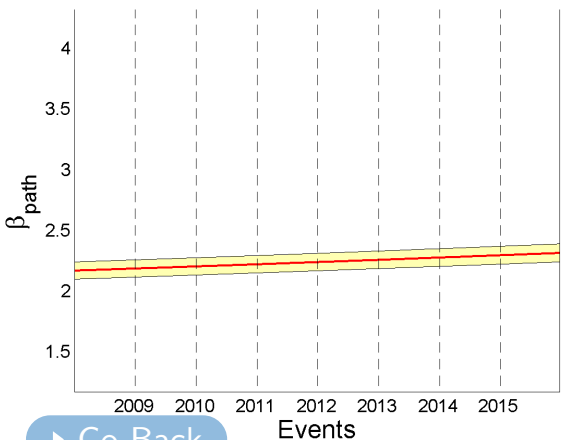
EUR target



GBP target



USD path



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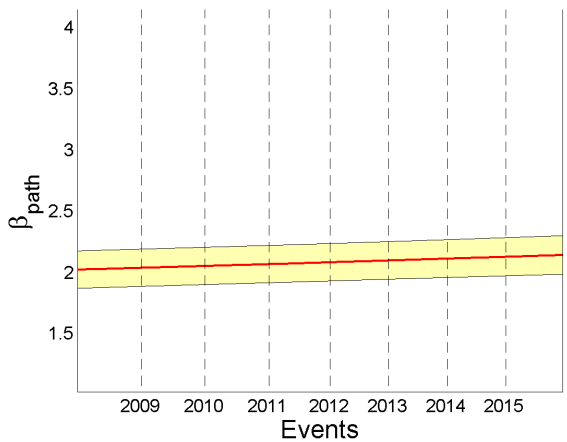

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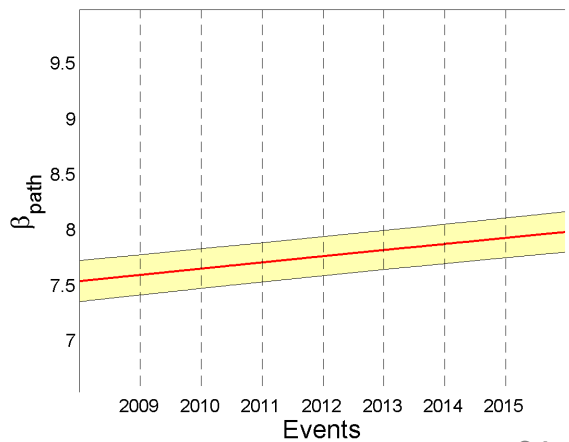

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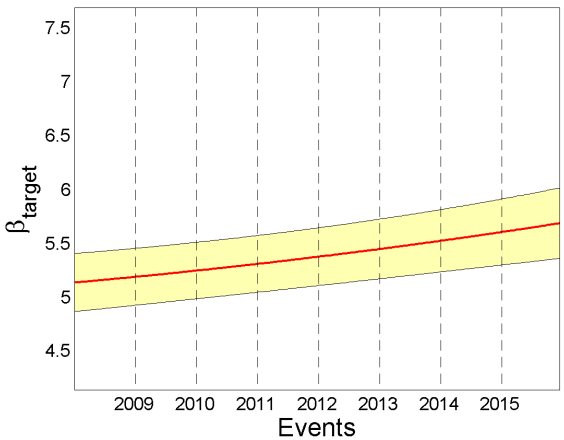
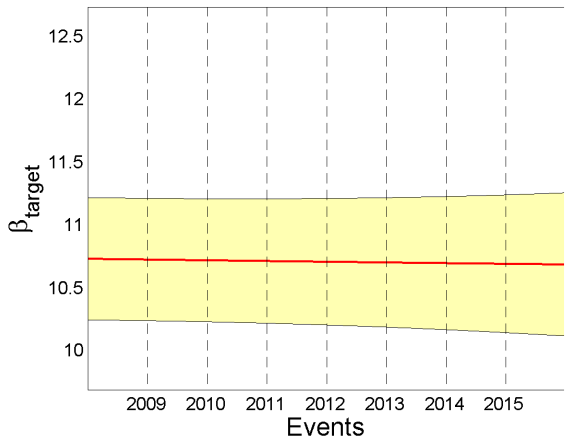
Robustness: FX response to data releases

$$\Delta s_t = \alpha + \beta_{target} \text{news shock}_t^{OIS} + \beta_{path} \text{news shock}_t^{Bond-OIS} + \epsilon_t$$

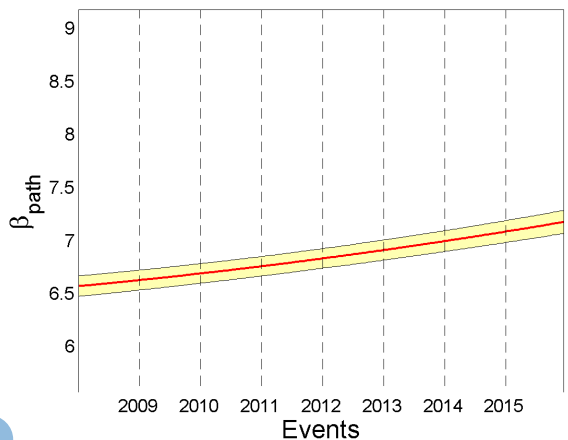
AUD target



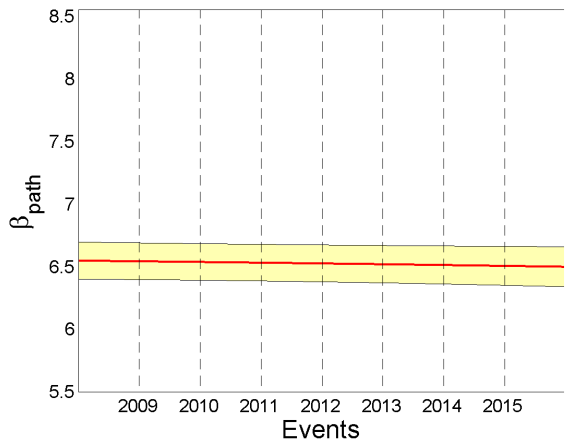
CAD target



AUD path



CAD path



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