Bank of England

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1. FX tail risk data

Daily mean returns are close to zero and the standard variation is much larger suggesting the daily variation is considerable.[1] Moreover, the daily minimum and maximum returns fluctuate widely, suggestive of tail risk. This is further confirmed by the kurtosis parameters well in excess of 3. Visual depiction of the time series of excess returns for the 20 currencies split into two groups is shown in Figure 1. Note the larger number of tail events, particularly on the downside for non-G9 currencies.

[Figure 1]

Figure 2 shows the excess return correlations for the 20 currencies. The size of the circle corresponds to the magnitude of the correlation coefficient while the color of the circle corresponds to the proximity of the correlation coefficient to perfect positive (in red) or negative (in blue) correlation. Note the strength of the correlations, albeit with different signs, of those (G7 currencies plus DKK, SEK, CHF, AUD, NZD) currencies in the top left-hand corner. Interestingly, these currencies display relatively strong correlations with non-G9 currencies, depicted in the top right-hand corner. The correlations of non-G9 currencies with each-other on the other hand, although positive seem to be considerably weaker.

[Figure 2]

Figure 3 shows the plot of the explained variance by the first three principal components. Note that the first three components account for 52.76% of the variance. Figure 3 also shows a plot of the contribution of each variable to the first two components (or dimensions) - note that arrows in the same direction imply stronger positive correlation.

[1] These results are available from the authors upon request.

[Figure 3]

Figures 4 and 5 show the currency excess return coordinates for the first nine principal components and the time-series variance portion explained by the first three PCs as well as their empirical sistribution respectively. It is clear that largest proportion of variance for all currencies is accounted for by the first two components with the third having a considerably smaller but still noticeable impact. Beyond this, the incremental ability of the components to explain the variation of the currency returns becomes negligible.

[Figures 4 and 5]

Figure 6 shows the joint distribution of the excess returns and aggregate systematic risk factor for each currency where the dashed lines demarcate the benchmark case of 5% quantile. Note that, for comparison, the scale is the same across the nine distributions.

The figure also shows the estimated asset pricing model. Clearly currencies differ as regards to how closely their returns cluster around the prediction of the asset pricing model. Some currency returns (e.g. DKK) cluster much more tightly around the asset pricing line than other currency returns (e.g. JPY). Moreover, some tail events are a lot more extreme for some currencies such as AUD or NZD relative to other currencies (such as DKK).

[Figure 6]

2. Technical description of the GVAR model

We consider N countries, indexed by $i = 1, ..., N$. All countries relative to the United States are small open economies, and we use country-specific vector autoregressive model with foreign variables (VARX*) to build the GVAR. All country specifications, except for the United States, incorporate the systematic component of the tail risk, the conventional monetary policy announcements, and the unconventional monetary policy announcements (or any of its components).[2]

The model for country i is

$$\Phi_i(L, p_i)\mathbf{x}_{it} = \mathbf{a}_{i0} + \mathbf{\Gamma}_i(L, q_i)\mathbf{x}^*_{it} + \mathbf{u}_{it}$$

where $\mathbf{x}_{it}$ is a $k_i \times 1$ vector of domestic variables, $\mathbf{x}^*_{it}$ is a $k_i \times 1$ vector of foreign variables, time is $t = 1, 2, ..., T$, $\mathbf{a}_{i0}$ is a $k_i \times 1$ vector of fixed intercept, and $\mathbf{u}_{it}$ is a $k_i \times 1$ vector of country-specific shocks such that $\mathbf{u}_{it} \sim i.i.d(0, \Sigma_{i,i})$.[3] Additionally, $\Phi_i(L, p_i) = I - \Sigma_{i=1}^{p_i}\Phi_i L^i$ and $\mathbf{\Gamma}_i(L, q_i) = \Sigma_{i=0}^{q_i}\Gamma_i L^i$ are the matrix lag polynomial of coefficients associated with domestic and foreign variables. Finally, p_i and q_i are the corresponding lag orders for domestic and foreign variables. For this particular case we assume it's equivalent for five working days, results are robust to including lags up to ten working days.

Country-specific foreign variables are cross-country averages of domestic variables using bilateral trade data as weights, i.e. $\mathbf{x}^*_{ij} = \Sigma_j^N \omega_{ij}\mathbf{x}_{jt}$. For this project we use bilateral trade date from 2000-2012 borrowed from Dovern, Feldkircher, and Huber, 2016.

Once country-specific individual estimation is complete, all endogenous variables are collected in vector $\mathbf{x}_t = (\mathbf{x}'_{1t}, \mathbf{x}'_{2t}, ..., \mathbf{x}'_{Nt})'$ and simultaneously solved exploit-

[2]The models follow closely the work of Dovern, Feldkircher, and Huber, 2016 and Mohaddes and Raissi, 2019.

[3]The exogenous variables could be included here, although in our case we restrain from that.

ing the relationship through the country-specific weights. Following Mohaddes and Raissi, 2019, it is possible to construct a compact expression of the full model as $G(L,p)\mathbf{x}_t = \psi_t$ where $\mathbf{G}(L,p) = (\mathbf{A}_1(L,p)\mathbf{W}_1, \mathbf{A}_2(L,p)\mathbf{W}_2, ..., \mathbf{A}_N(L,p)\mathbf{W}_N)'$, $\mathbf{A}_i(L,p) = \mathbf{\Phi}_i(L,p_i) - \mathbf{\Gamma}_i(L,q_i)$,[4] $\psi_t = (\psi_{1t}, \psi_{2t}, ..., \psi_{Nt})'$ and $\psi_{it} = \mathbf{a}_{i0} + \mathbf{u}_{it}$.

For all countries, except for the United States, the domestic endogenous variables are

$$\mathbf{x}_{it} = [Syst\_Tail_{it}, CMP_{it}, NTM_{it}]'$$

or we replace NTM_{it} with APP_{it}. Foreign variables are

$$\mathbf{x}^*_{it} = [Syst\_Tail^*_{it}, CMP^*_{it}, NTM^*_{it}]'$$

or we replace NTM^*_{it} with APP^*_{it}. Finally, exogenous variables are $[UScmp_{it}, USntm_{it}]'$.

For the United States, the domestic variables are $[UScmp_{it}, USntm_{it}]'$, or we replace $USntm_{it}$ with $USapp_{it}$. The foreign variables are the weighted average of the systematic tail-risk ($Syst\_Tail^*_{it}$), and the weighted average of NTM (NTM^*_{it}) or any of it's components. For this project we are using equal weights for all countries.[5]

This approach to capturing the United States requires a few remarks. We do not model U.S. (or any other) monetary policy akin to a Taylor rule. For example, there is no proxy for the GDP or inflation gap in our framework. Instead, this way of modelling assumes that the U.S. strategically responds to the systematic tail-risk component of the rest of the block, as well as to their NTM decisions. Because our interest lies in the FX/financial cross-border effects only, this is a reasonable approximation without complicating the (already large) GVAR model too much. However, we recognise that this is a reduced-form approach and assumes away any

[4]Note $\mathbf{A}(\mathbf{L},\mathbf{p})$ depends on p. The latter is $p = \max\{p_1, p_2, .., p_N, q_1, q_2, .., q_N\}$ and augmenting the $p - p_i$ or $p - q_i$ addtional terms in the power lag of the operator by zeros.

[5]We could amend that to reflect their individual trade volumes or market power in the FX market, but the conclusions would hold.

indirect cross-border channels going through the real economy (trade or UIP).

Identification of country-specific shocks is through sign restrictions. They are of cross-sectional and dynamic nature, as in Feldkircher, Gruber, and Huber, 2020. In particular we employ three such restrictions: (*i*) From our panel data analysis we observe that NTM or APP increase the systematic component, so we impose a five-days increase[6] within each country. (*ii*) Since the beginning of the NTM episode, the (bank) policy rate has remained very stable and close to zero. So, within each country, we assume that NTM or APP does not affect CMP announcement for five days. (*iii*) Finally, previous literature (see reference at the beginning of the document) suggest that NTM appreciates the currency of other countries. This evidence is mostly between small groups of advanced economies, e.g. U.S. vs EUR. Thus, we assume NTM or APP decreases the systematic component for one day. This will only be applied to the following cohort of countries: Japan, Euro Area and the UK.

Identification of U.S. shocks is also through sign restrictions. The panel analysis shows that NTM or APP has a positive effect on the systematic tail risk. We therefore assume a five-days positive shock for all countries.

The country models in the GVAR are estimated using Bayesian shrinkage priors. For the country-specific VARs, the priors consist of standard non-conjugate Minnesota (see Koop, Korobilis, et al., 2010 or Litterman, 1986 and Normal-Gamma priors (Feldkircher and Huber, 2016) combined with Stochastic Search Variable Selection prior as in George, Sun, and Ni, 2008. To find the impulse responses, the impulse function draws rotation matrices using the algorithm provided in Rubio-Ramirez, Waggoner, and Zha, 2010. Finally, the FEVD are based on the posterior median of the corresponding rotation matrix that fulfills all sign restrictions at the point estimate of the posterior median of the reduced form coefficients.

[6] Also tested up to ten days and results hold.

3. Asset Purchase Programs

Next, we contrast the impact of QE shocks. Figures 7 to 13 report the IRFs for domestic APP shocks. The results are qualitatively similar to those of NTM, although the responses seem somewhat more persistent. The only difference is that in the two-shock scenario, the largest responses arise when the shocks are UK- and Euro Area-specific. This means that the largest cross-border QE transmission comes from these two economies. This is in line with the intuition since these two central banks are amongst those that have most actively used this tool. Yet, when we sequentially add shocks, we find a slightly different behaviour compared to the NTM case. In particular, the largest increase in responses occurs when we add Canadian APP shock, suggesting that Canadian QE has had significant spill-overs. A New Zealand APP shock leads to a mixed picture. While the IRFs of New Zealand, UK and Japan increase, those of Euro Area and Canada decrease.

[Figures 7 to 13]

Turning to the global APP shock in Figure 14, the responses are again smaller compared to the domestic shocks, yet larger than those for the global NTM shock. Also this time, UK and Japan respond heaviest to a U.S. QE shock, followed by the Euro Area and Switzerland. Therefore, Fed's QE policy has had a wider and larger cross-border impact, disproportionally contributing to the international transmission of the latter.

[Figure 14]

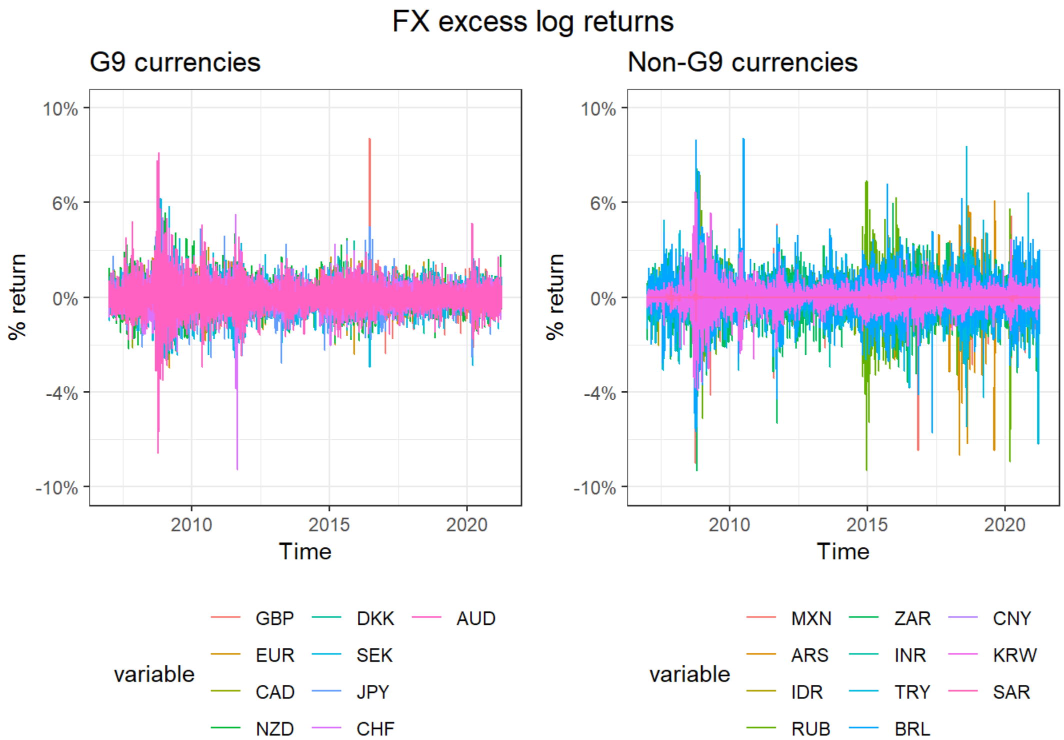
Ceteris paribus, the responses to a QE shock are larger than those following an NTM shock. This implies a stronger cross-border transmission of a QE shock compared to the average NTM shock. We take this as evidence that QE increases considerably the (systematic) tail risk in the FX market, which may give rise to financial stability concerns, either through a global portfolio effect, or through common FX exposure.

3.0.1. Forecast Error Variance Decomposition

Figures 15 to 19 report the same exercise but with a domestic QE shock. Overall, a QE shock explains less of the variation in (systematic) tail risk compared to the NTM shock. That is true for all except Euro Area and Canada, where it somewhat outperforms the NTM shock at lower horizons. Yet, the largest difference is for UK, where QE explains around 70% less of the total variation in the measure after horizon 1. At horizon 1, the reduction is around 40%. This implies that comparatively, QE has mattered less for the variation in GBP tail compared to e.g. Switzerland or Canada, after controlling for the Fed QE.

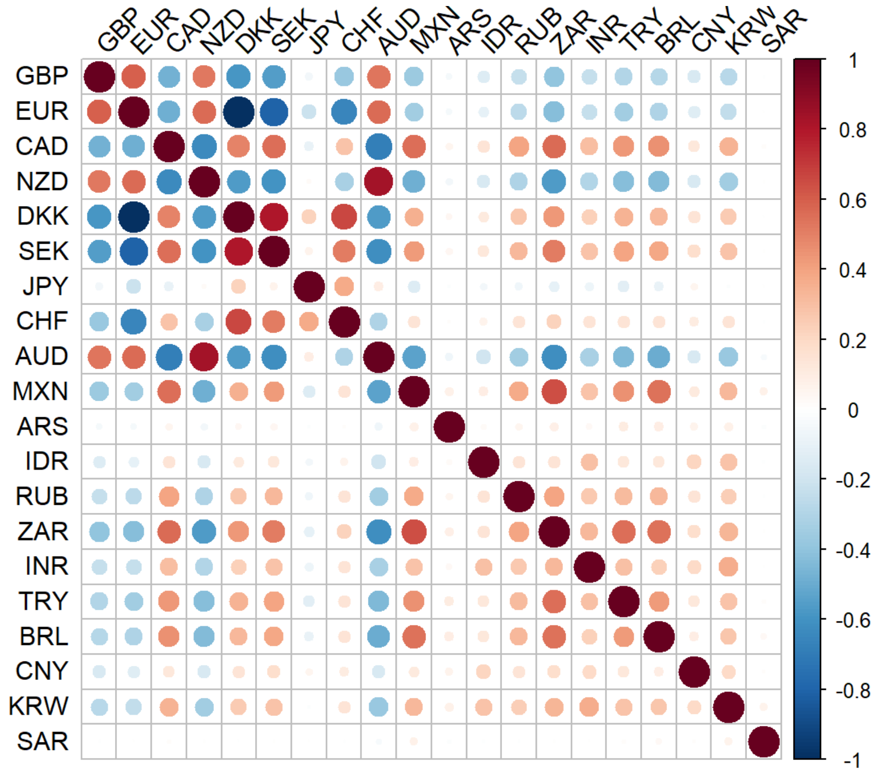
[Figures 15 to 19]

Figure 1: Currency Excess Returns



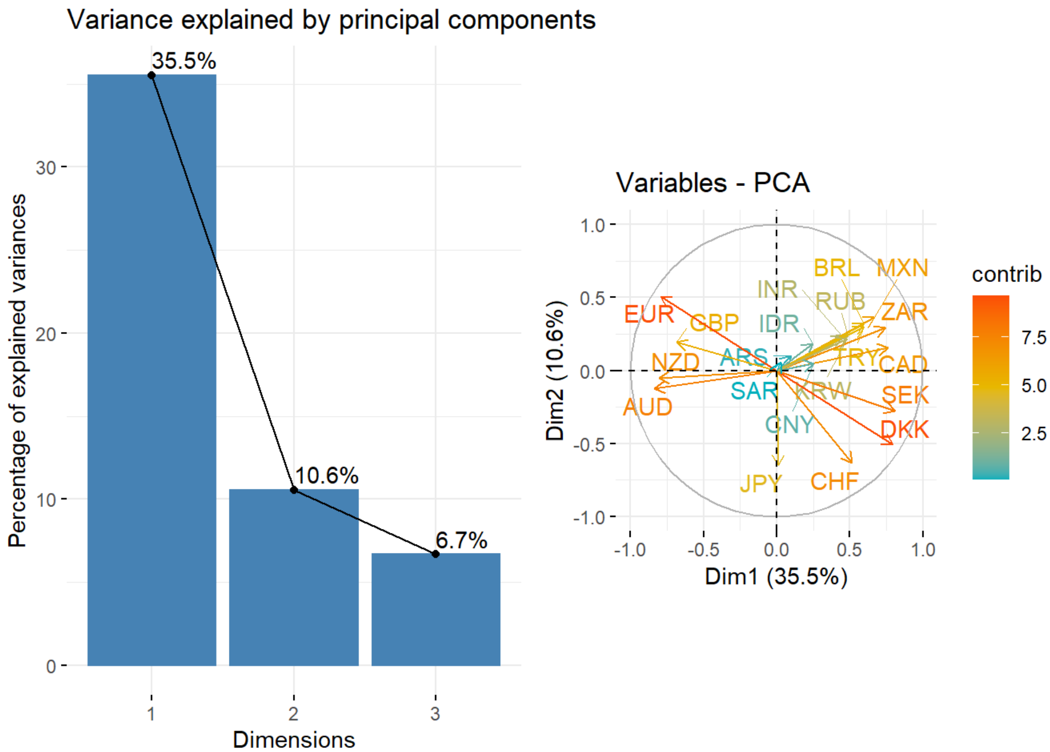
This figure shows excess returns for the 20 currencies split into two groups. The first group, labelled G9 currencies depicted in the left-hand side panel, contains the currencies of developed economies against USD. The second group, labelled non-G9 currencies depicted in the right-hand side panel, contains the currencies of the remaining 11 developing economies against USD. This group displays considerably higher volatility and more tail events, particularly on the downside.

Figure 2: Currency Excess Return Correlations



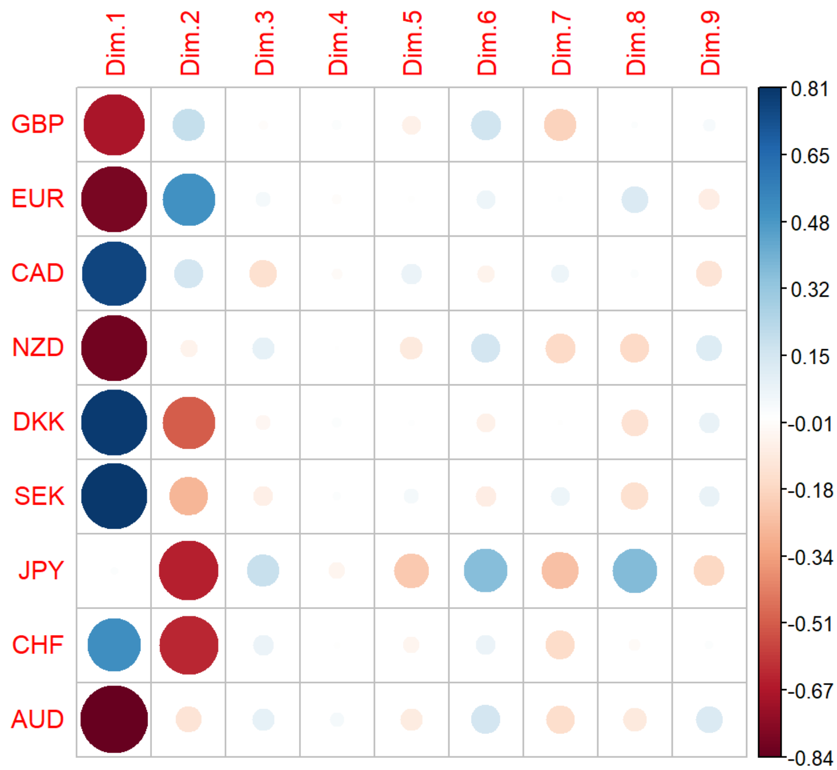
This figure shows the excess return correlations for the 20 currencies. The size of the circle corresponds to the magnitude of the correlation coefficient - the bigger the circle, the stronger the correlation between the two currencies. The color of the circle corresponds to the proximity of the correlation coefficient to perfect positive and negative correlation - the deeper the red color, the closer the correlation between two currencies is to +1 and the deeper the blue color, the closer that correlation is to -1. Note the strength of the correlations, albeit with different signs, of the G9 currencies in the top left-hand corner.

Figure 3: The Main Principal Components



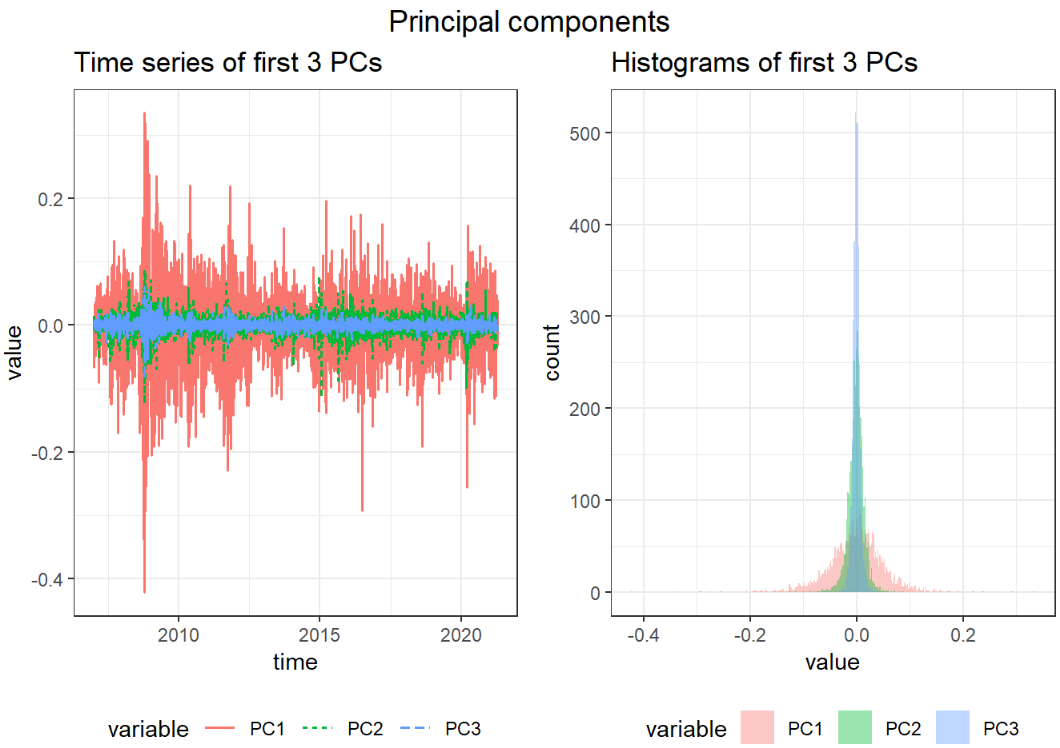
The left-hand side panel of this figure shows the proportion of variance of currency excess returns explained by the first three principal components. The right-hand side panel of the figure shows the contribution of each currency to the first two principal components (or dimensions). Note that arrows in the same direction show stronger positive correlation.

Figure 4: Principal Components Coordinates



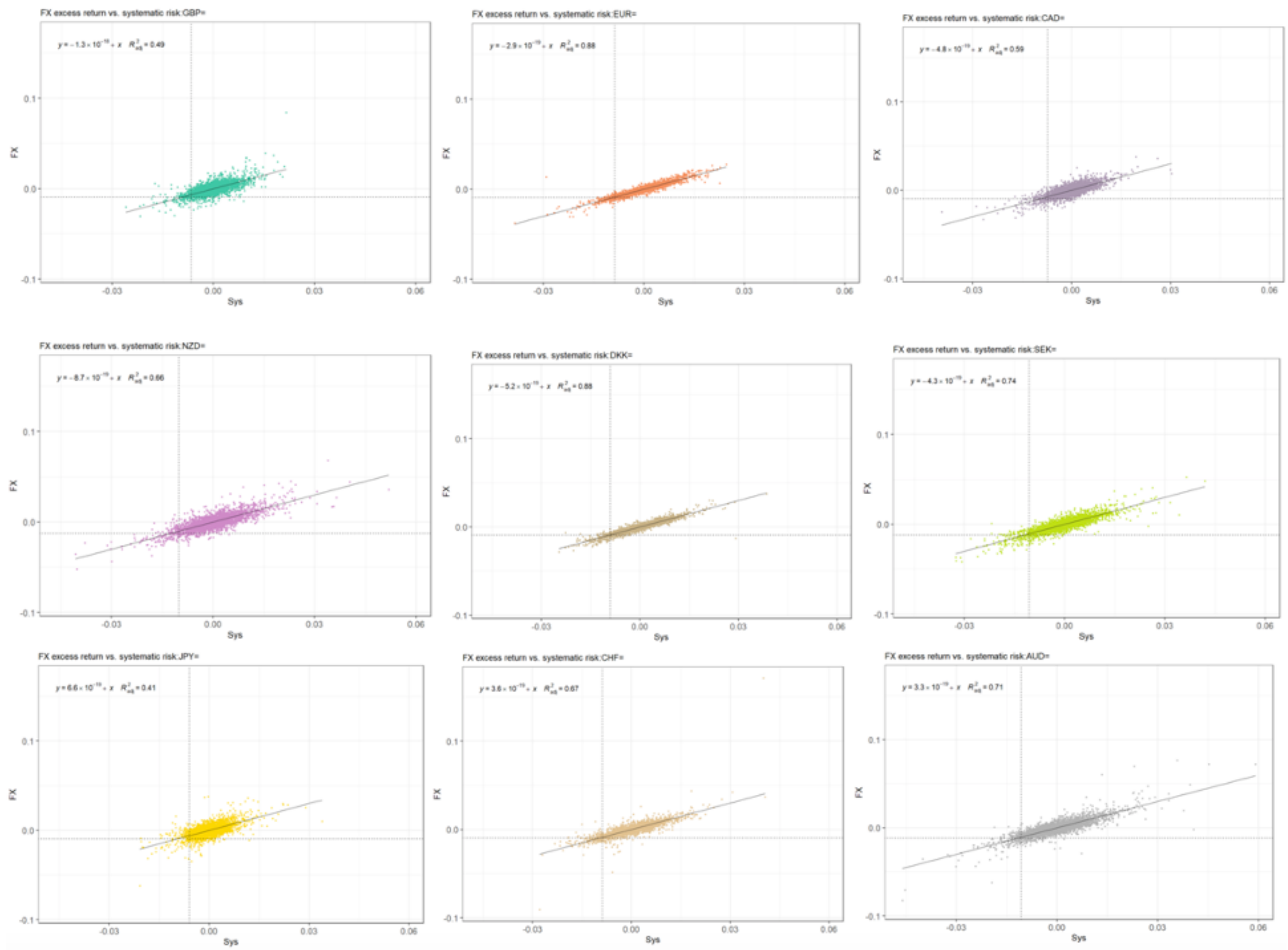
The figure shows the coordinates of principal components for G9 currencies.The PCs have been computed using the full set of 20 currencies.

Figure 5: The Time-Series and the Empirical Distribution of the First Three PCs



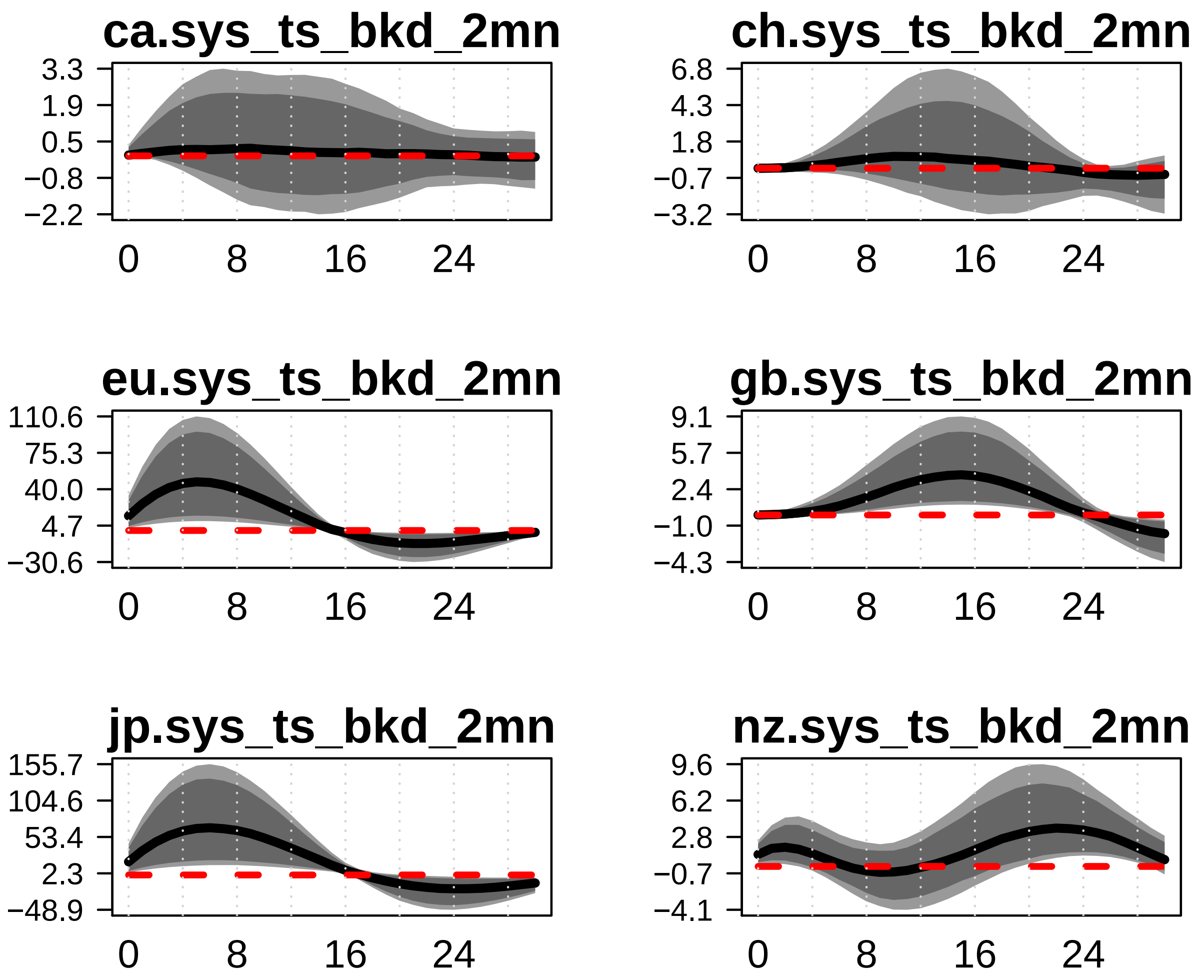
The left-hand side panel of this figure shows the time-series of the first three principal components computed using the full set of 20 currencies while the right-hand side panel of the figure shows their empirical distribution.

Figure 6: The Joint Distribution of Currencies with their Aggregate Systematic Risk Factor



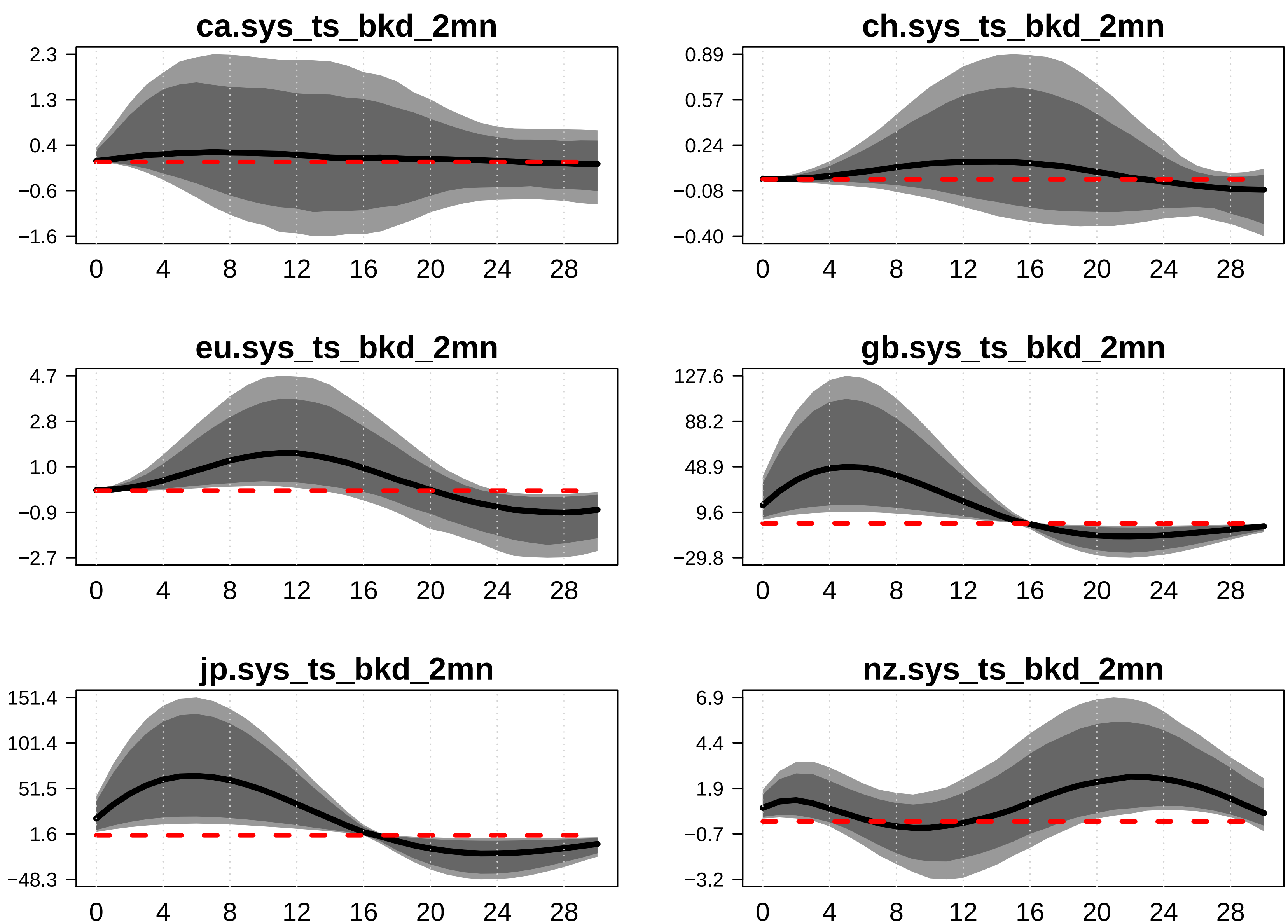
This figure shows the joint distribution of each currency with its aggregate systematic risk factor. The dash lines depict the 5% quantiles.

Figure 7: QE: domestic shocks to Euro Area and Japan only



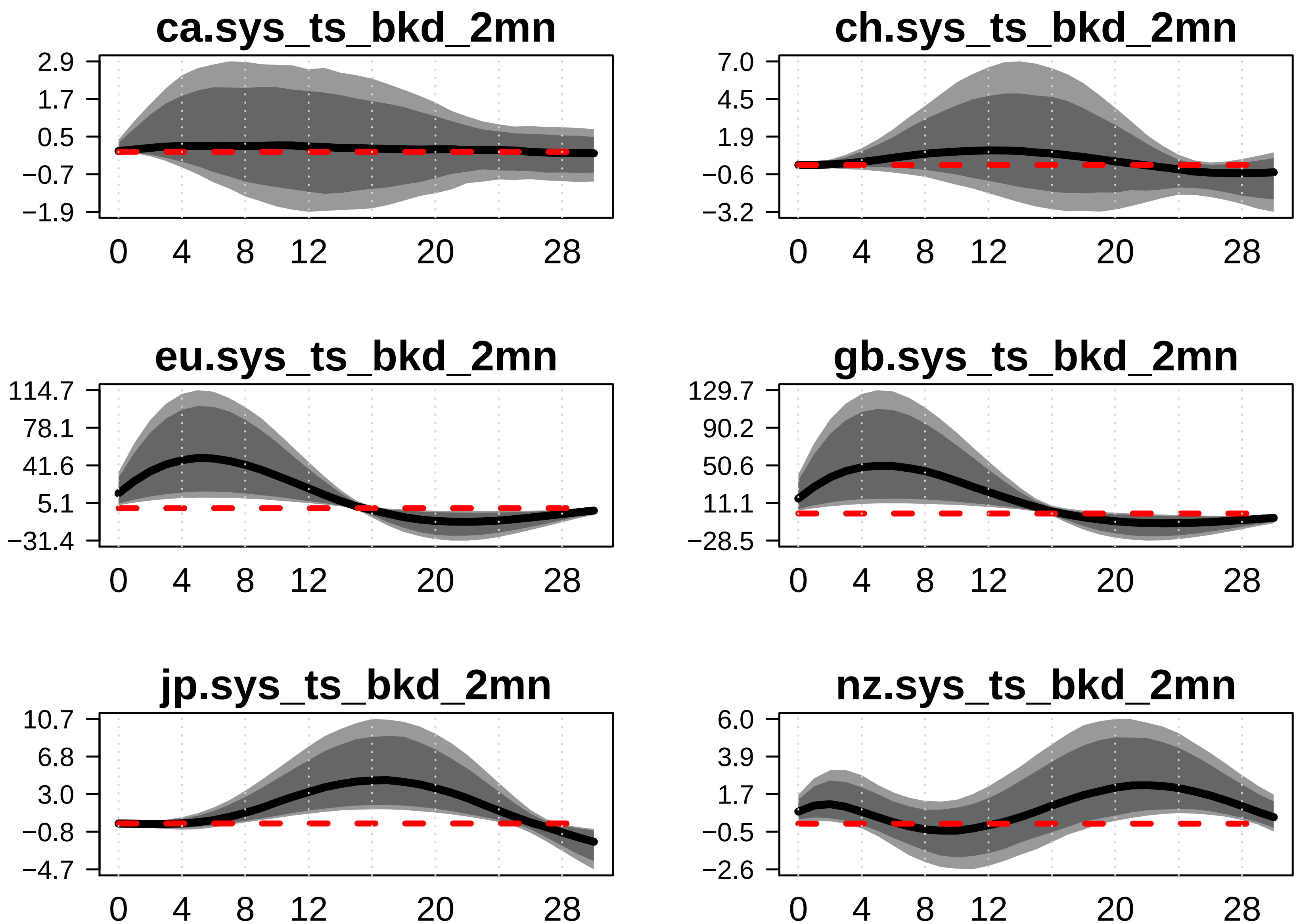
We report the responses to a domestic APP shock in Euro Area and Japan. The figures represent the IRFs of (from top-left to right-and-down): Canada, Switzerland, Euro Area, UK, Japan and New Zealand. The solid line is the median response, the dark (light) grey shaded area represents the 68% (95%) confidence intervals. The dotted red line is the zero-line.

Figure 8: QE: domestic shocks to UK and Japan only



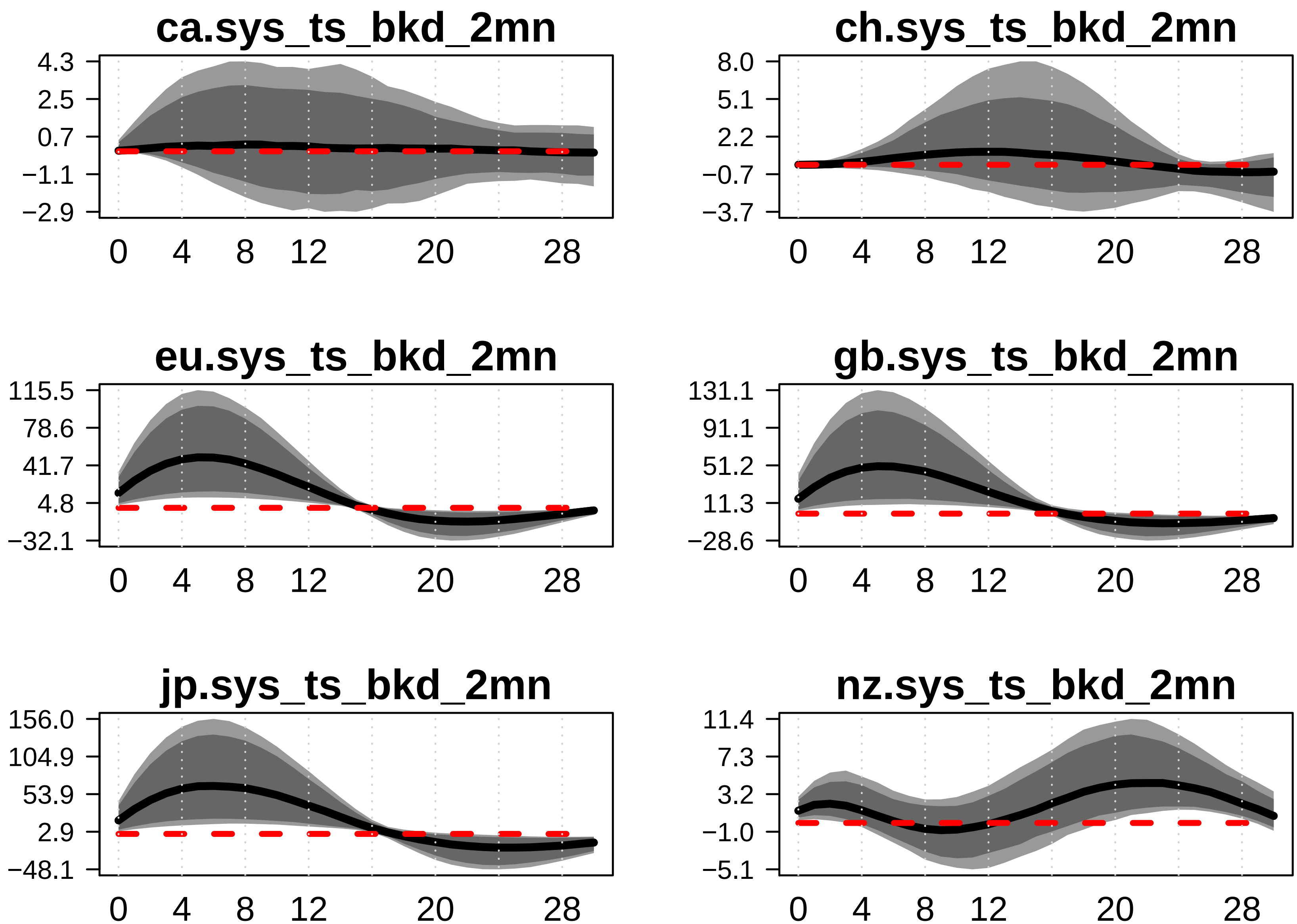
We report the responses to a domestic APP shock in UK and Japan. The figures represent the IRFs of (from top-left to right-and-down): Canada, Switzerland, Euro Area, UK, Japan and New Zealand. The solid line is the median response, the dark (light) grey shaded area represents the 68% (95%) confidence intervals. The dotted red line is the zero-line.

Figure 9: QE: domestic shocks to UK and Euro Area only



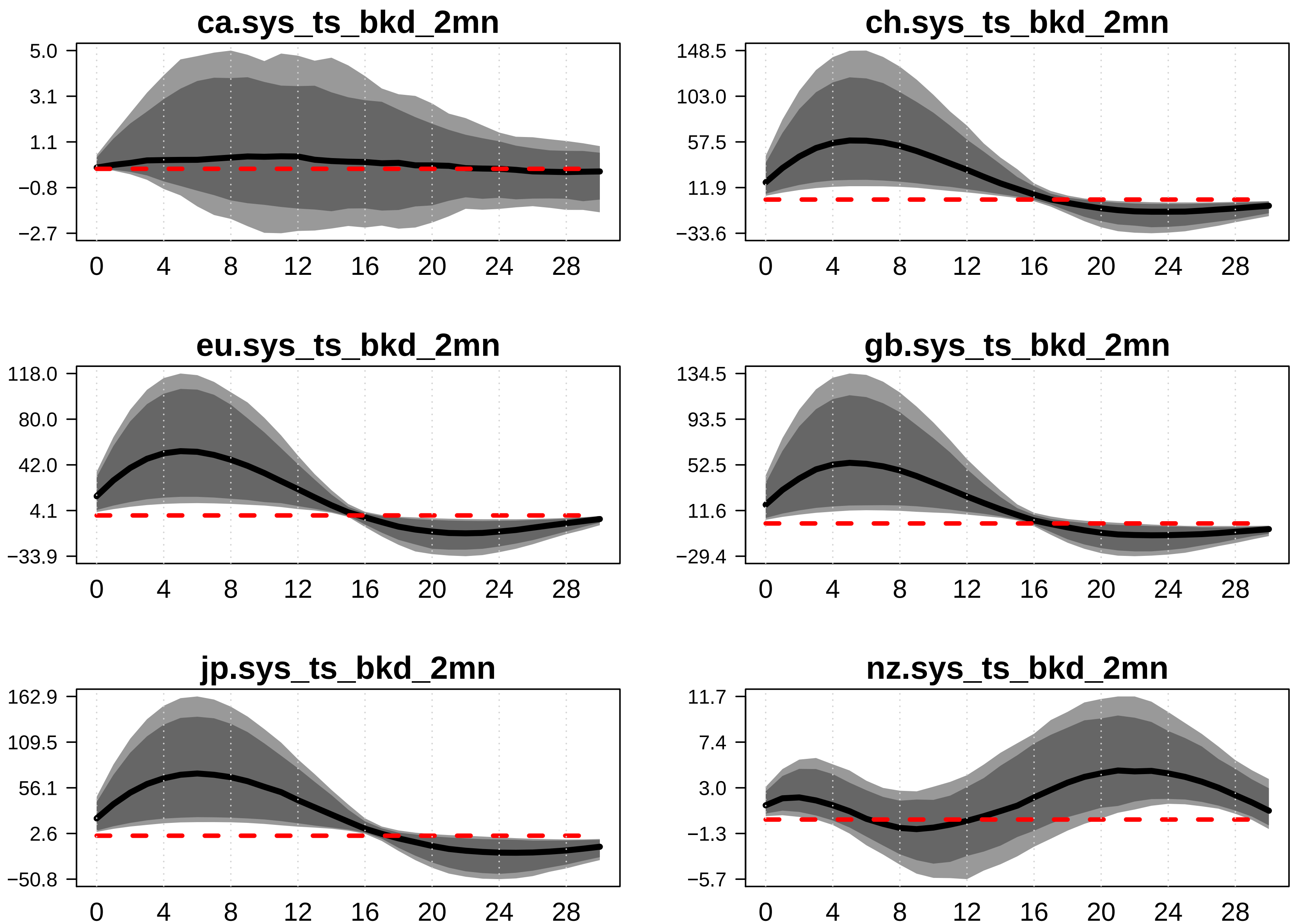
We report the responses to a domestic APP shock in UK and Euro Area. The figures represent the IRFs of (from top-left to right-and-down): Canada, Switzerland, Euro Area, UK, Japan and New Zealand. The solid line is the median response, the dark (light) grey shaded area represents the 68% (95%) confidence intervals. The dotted red line is the zero-line.

Figure 10: QE: domestic shocks to UK, Euro Area and Japan only



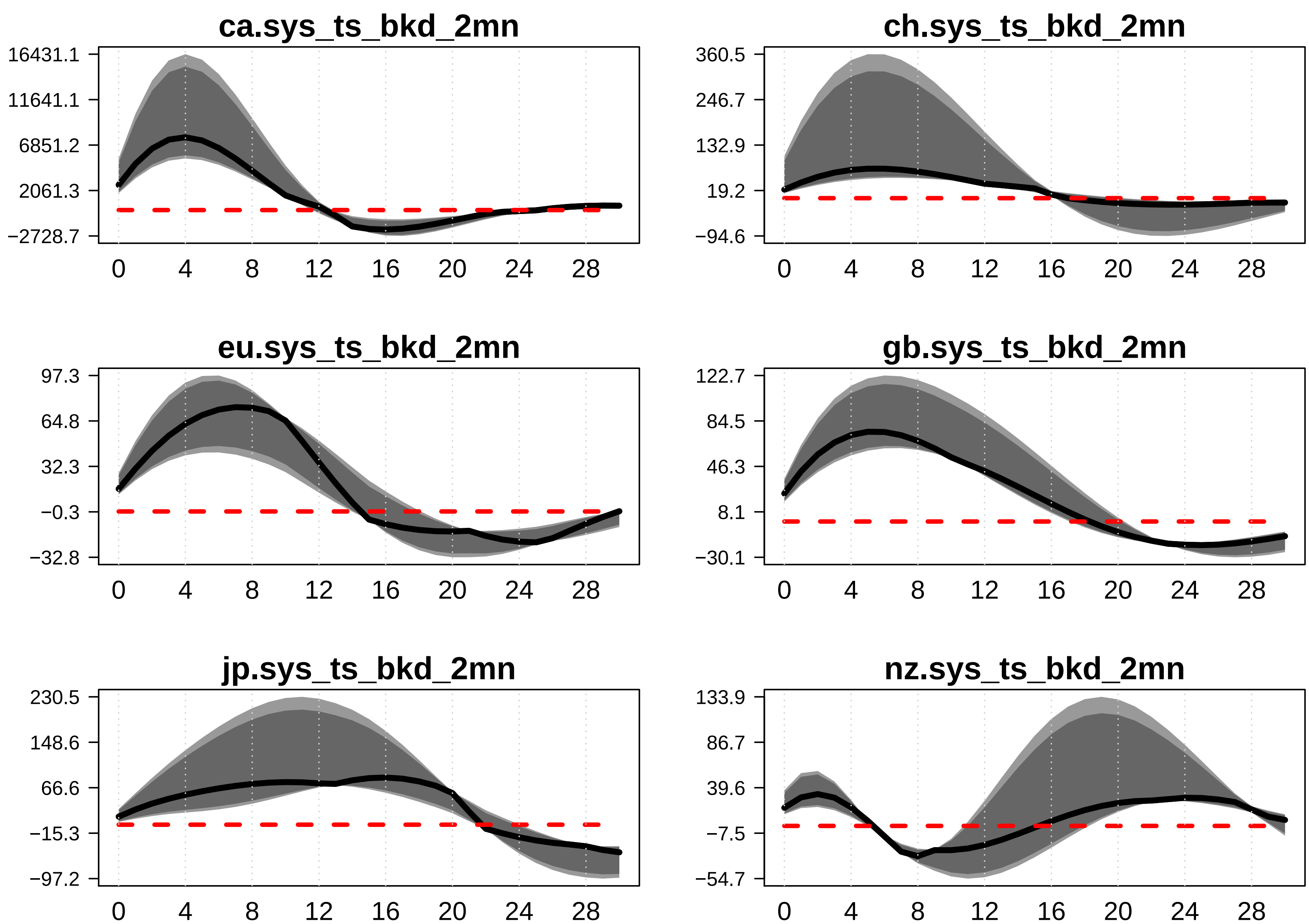
We report the responses to a domestic APP shock in UK, Euro Area and Japan. The figures represent the IRFs of (from top-left to right-and-down): Canada, Switzerland, Euro Area, UK, Japan and New Zealand. The solid line is the median response, the dark (light) grey shaded area represents the 68% (95%) confidence intervals. The dotted red line is the zero-line.

Figure 11: QE: domestic shocks to UK, Euro Area, Japan and Switzerland.



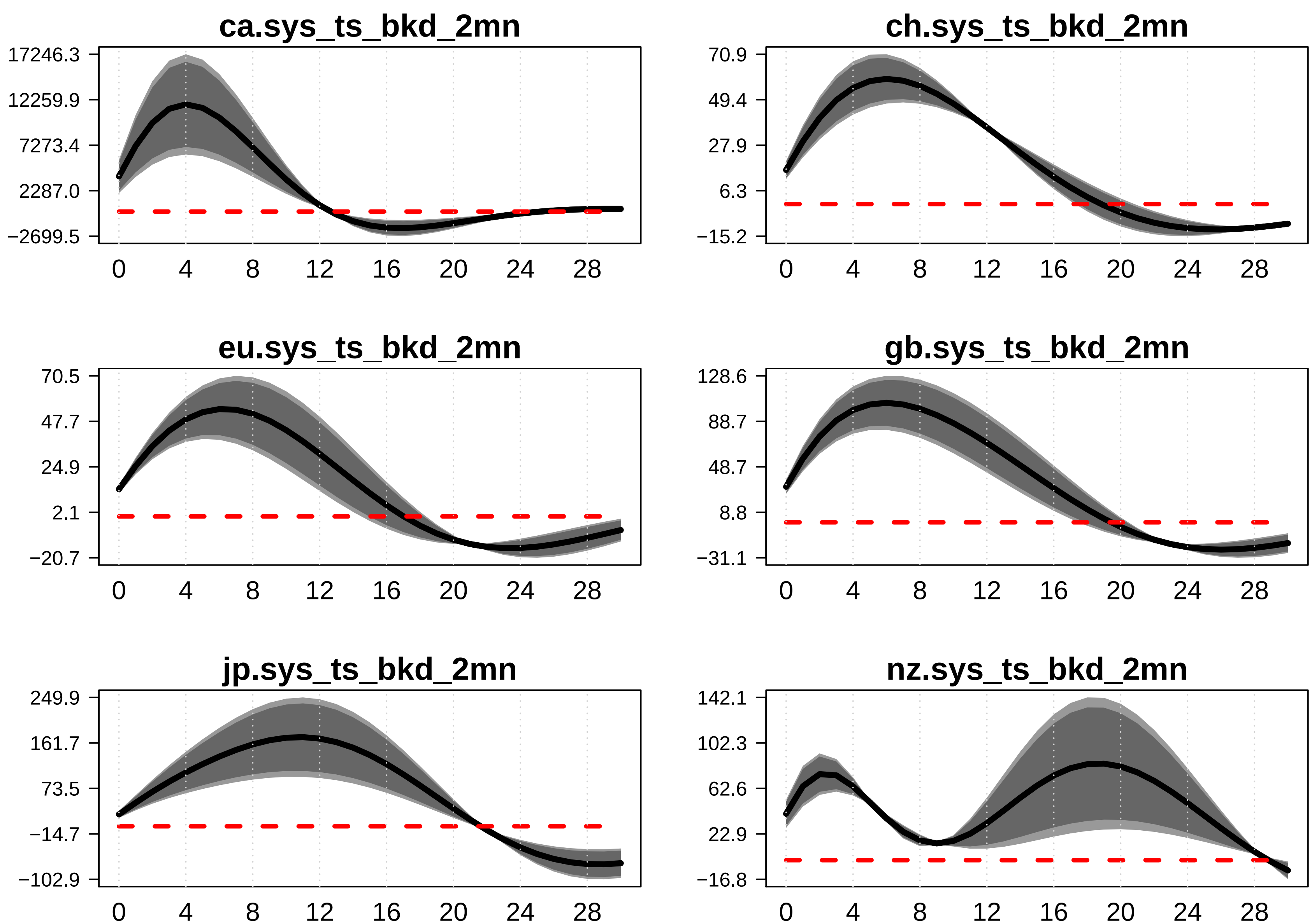
We report the responses to a domestic APP shock in UK, Euro Area, Japan and Switzerland. The figures represent the IRFs of (from top-left to right-and-down): Canada, Switzerland, Euro Area, UK, Japan and New Zealand. The solid line is the median response, the dark (light) grey shaded area represents the 68% (95%) confidence intervals. The dotted red line is the zero-line.

Figure 12: QE: domestic shocks to all except for New Zealand



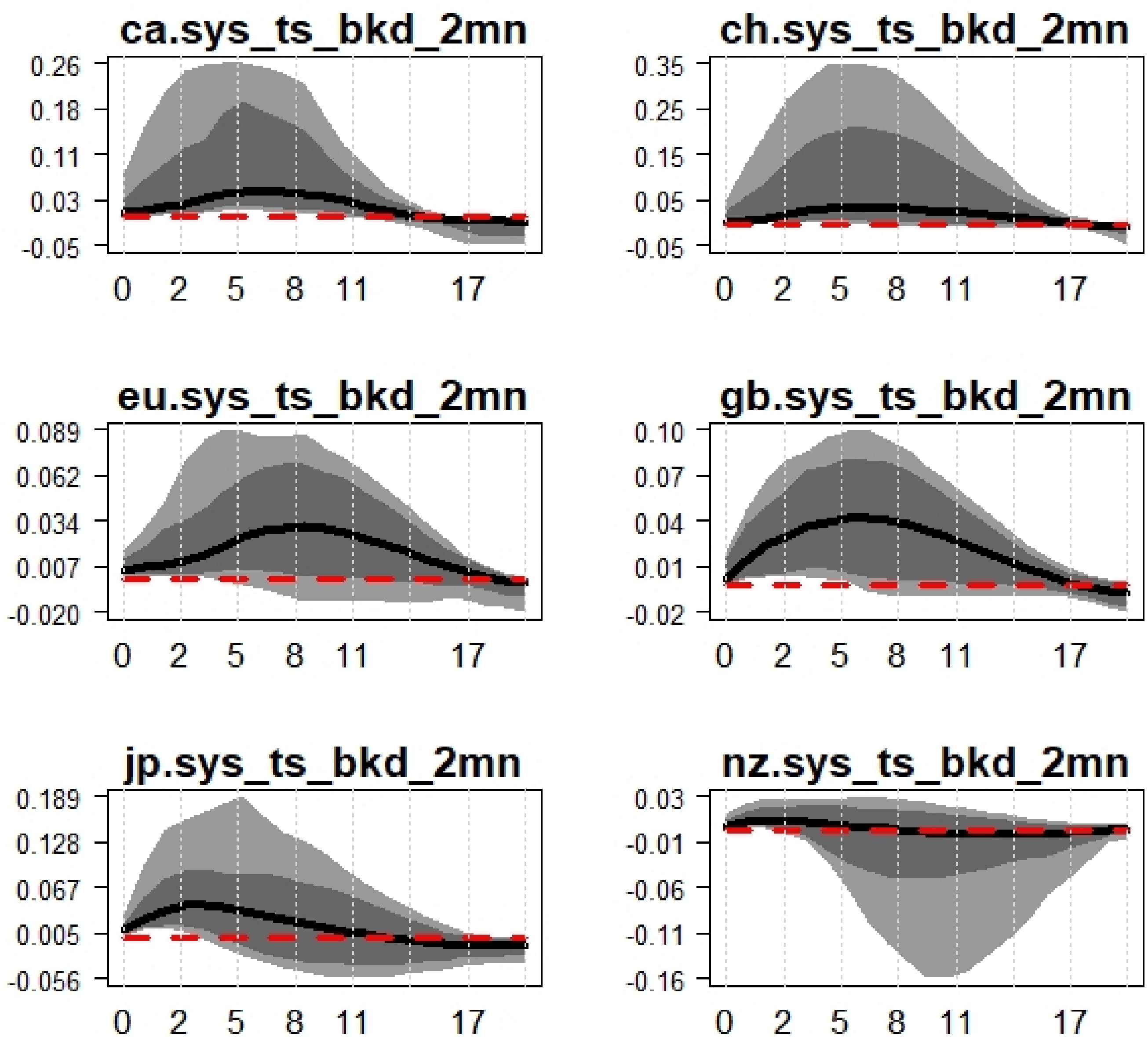
We report the responses to a domestic APP shock in all except New Zealand. The figures represent the IRFs of (from top-left to right-and-down): Canada, Switzerland, Euro Area, UK, Japan and New Zealand. The solid line is the median response, the dark (light) grey shaded area represents the 68% (95%) confidence intervals. The dotted red line is the zero-line.

Figure 13: QE: domestic shocks to all



We report the responses to a domestic APP shock in all countries. The figures represent the IRFs of (from top-left to right-and-down): Canada, Switzerland, Euro Area, UK, Japan and New Zealand. The solid line is the median response, the dark (light) grey shaded area represents the 68% (95%) confidence intervals. The dotted red line is the zero-line.

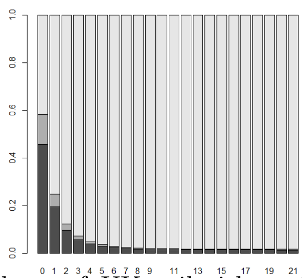
Figure 14: QE Global shock



We report the responses to a global APP shock. The figures represent the IRFs of (from top-left to right-and-down): Canada, Switzerland, Euro Area, UK, Japan and New Zealand. The solid line is the median response, the dark (light) grey shaded area represents the 68% (95%) confidence intervals. The dotted red line is the zero-line.

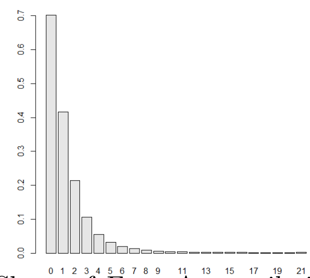
Forecast Error Variance Decomposition (FEVD) - QE

Figure 15: FEVD: UK domestic APP shock



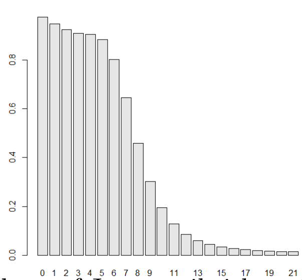
Share of UK tail risk variation explained by the domestic APP shock.

Figure 16: FEVD: Euro Area domestic APP shock



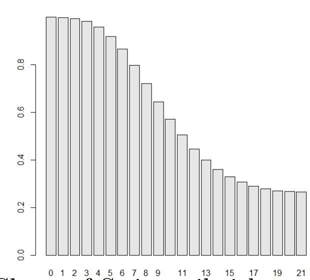
Share of Euro Area tail risk variation explained by the domestic APP shock.

Figure 17: FEVD: Japan domestic APP shock



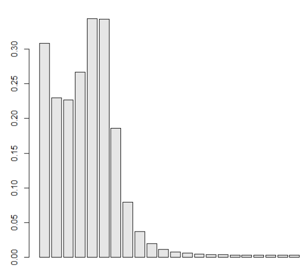
Share of Japan tail risk variation explained by the domestic APP shock.

Figure 18: FEVD: Switzerland domestic APP shock



Share of Swiss tail risk variation explained by the domestic APP shock.

Figure 19: FEVD: Canada domestic APP shock



Share of Canadian tail risk variation explained by the domestic APP shock.

Table 1: Causation through IV: daily frequency

The table reports the estimated parameters of the short panel correcting for endogenous regressor, and their corresponding standard errors in square brackets. The dependent variable is the systematic component of the tail risk calculated with the last year of observations. Variables of interest are the daily changes of implied yields from future contracts at monetary policy announcements dates. We also include three days posterior to the announcements. We use as IV the daily change of implied yields of future contracts of 10 year treasury bonds. Dummy variables for QE implementations, different type of forward guidance and effective lower bound are included. Additional controls are daily changes of implied yields from future contracts at conventional and unconventional monetary policy announcements dates from the United States. Country, month and year fixed effects are included, as well as their triple interaction. We are using weekly data from January 1, 2000 to July 30, 2020. Standard errors are Driscoll-Kraay adjusted with 2 lags. The symbols *,**,*** denote significance at the 10%, 5% and 1% level, respectively.

	5y		2y		2m		1m		2m(r)		1m(r)	
NTM	0.010		0.012*		0.015**		0.015**		0.015**		0.016**	
	[0.007]		[0.007]		[0.006]		[0.006]		[0.006]		[0.006]	
CMP	-0.010	-0.008	-0.009	-0.007	-0.012	-0.010	-0.012	-0.008	-0.011	-0.009	-0.011	-0.007
	[0.009]	[0.009]	[0.010]	[0.010]	[0.012]	[0.012]	[0.010]	[0.010]	[0.012]	[0.012]	[0.010]	[0.010]
APP		0.028***		0.028***		0.029***		0.028***		0.029***		0.028***
		[0.009]		[0.008]		[0.008]		[0.008]		[0.008]		[0.008]
Collateral		-0.041		-0.039		-0.003		-0.031		-0.000		-0.028
		[0.074]		[0.079]		[0.062]		[0.066]		[0.062]		[0.064]
Forward G.		0.006		0.007		0.007		0.007		0.007		0.007
		[0.007]		[0.008]		[0.008]		[0.009]		[0.008]		[0.009]
Fund		-0.000		0.000		0.000		0.004		0.002		-0.003
		[0.013]		[0.016]		[0.017]		[0.016]		[0.017]		[0.018]
Swap		-0.068*		-0.116*		-0.094		-0.058		-0.186*		-0.146
		[0.041]		[0.063]		[0.067]		[0.051]		[0.111]		[0.123]
ZLB	-0.011**	-0.011**	-0.011**	-0.011**	-0.012**	-0.012**	-0.012**	-0.012**	-0.012**	-0.012**	-0.012**	-0.012**
	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]
FG_{sg}	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003
	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]
FG_{og}	0.025***	0.025***	0.025***	0.025***	0.025***	0.025***	0.025***	0.025***	0.025***	0.025***	0.025***	0.025***
	[0.007]	[0.007]	[0.007]	[0.007]	[0.007]	[0.007]	[0.007]	[0.007]	[0.007]	[0.007]	[0.007]	[0.007]
FG_{tg}	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003
	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]
QE	-0.019	-0.019	-0.019	-0.019	-0.019	-0.019	-0.019	-0.019	-0.019	-0.019	-0.019	-0.019
	[0.023]	[0.023]	[0.023]	[0.023]	[0.023]	[0.023]	[0.023]	[0.023]	[0.023]	[0.023]	[0.023]	[0.023]
Obs	30,720	30,720	30,720	30,720	30,720	30,720	30,720	30,720	30,720	30,720	30,720	30,720
U.S. Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
C_M_Y FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Table 2: Causation through IV: Before GFC

The table reports the estimated parameters of the short panel correcting for endogenous regressor, and their corresponding standard errors in square brackets. The dependent variable is the weekly average systematic component of the tail risk calculated with the last year of observations. Variables of interest are the sum of daily changes of implied yields from future contracts at monetary policy announcements dates. We also include three days posterior to the announcements. We use as IV the sum of daily change of implied yields of future contracts of 10 year treasury bonds. Dummy variables for QE implementations, different type of forward guidance and effective lower bound are included. Additional controls are the sum of daily changes of implied yields from future contracts at conventional and unconventional monetary policy announcements dates from the United States. Country, month and year fixed effects are included, as well as their triple interaction. We are using weekly data from January 1, 2000 to July 30, 2020. Standard errors are Driscoll-Kraay adjusted with 2 lags. The symbols *,**,*** denote significance at the 10%, 5% and 1% level, respectively.

Before GFC	5y		2y		2m		1m		2m(r)		1m(r)	
NTM	0.008		0.008		-0.006		0.018		-0.005		0.018	
	[0.009]		[0.010]		[0.016]		[0.013]		[0.017]		[0.013]	
CMP	0.009	0.009	0.011	0.010	0.018	0.017	0.008	0.006	0.017	0.018	0.009	0.007
	[0.013]	[0.013]	[0.014]	[0.014]	[0.021]	[0.021]	[0.016]	[0.016]	[0.019]	[0.019]	[0.015]	[0.015]
APP		-0.019		-0.012		0.038		0.039		0.032		0.038
		[0.046]		[0.051]		[0.084]		[0.075]		[0.079]		[0.075]
Collateral		0.042		0.043		0.021		-0.017		0.025		-0.031
		[0.044]		[0.045]		[0.067]		[0.044]		[0.072]		[0.045]
Forward G.		0.010		0.009		0.014		0.007		0.015		0.008
		[0.011]		[0.013]		[0.021]		[0.015]		[0.022]		[0.015]
Fund		0.002		0.000		0.028		0.076		0.020		0.095
		[0.024]		[0.024]		[0.056]		[0.064]		[0.058]		[0.078]
Swap		-0.013		-0.014		-0.379		0.039		-0.313		0.008
		[0.075]		[0.084]		[0.275]		[0.133]		[0.218]		[0.121]
ZLB	-0.037***	-0.037***	-0.036***	-0.036***	-0.036***	-0.036***	-0.037***	-0.037***	-0.036***	-0.036***	-0.037***	-0.037***
	[0.007]	[0.007]	[0.007]	[0.007]	[0.007]	[0.007]	[0.007]	[0.007]	[0.007]	[0.007]	[0.007]	[0.007]
FG_{og}	0.044***	0.044***	0.044***	0.044***	0.044***	0.044***	0.044***	0.044***	0.044***	0.044***	0.044***	0.044***
	[0.010]	[0.010]	[0.010]	[0.010]	[0.010]	[0.010]	[0.010]	[0.010]	[0.010]	[0.010]	[0.010]	[0.010]
QE	-0.008	-0.008	-0.008	-0.008	-0.008	-0.008	-0.008	-0.007	-0.008	-0.008	-0.008	-0.007
	[0.013]	[0.013]	[0.013]	[0.013]	[0.013]	[0.013]	[0.013]	[0.012]	[0.013]	[0.013]	[0.013]	[0.012]
Obs	13,758	13,758	13,758	13,758	13,758	13,758	13,758	13,758	13,758	13,758	13,758	13,758
R-squared	0.006	0.006	0.006	0.005	0.005	-0.015	0.004	-0.009	0.005	-0.009	0.004	-0.015
U.S. Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
C_M_Y FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Table 3: Causation through IV: After GFC

The table reports the estimated parameters of the short panel correcting for endogenous regressor, and their corresponding standard errors in square brackets. The dependent variable is the weekly average systematic component of the tail risk calculated with the last year of observations. Variables of interest are the sum of daily changes of implied yields from future contracts at monetary policy announcements dates. We also include three days posterior to the announcements. We use as IV the sum of daily change of implied yields of future contracts of 10 year treasury bonds. Dummy variables for QE implementations, different type of forward guidance and effective lower bound are included. Additional controls are the sum of daily changes of implied yields from future contracts at conventional and unconventional monetary policy announcements dates from the United States. Country, month and year fixed effects are included, as well as their triple interaction. We are using weekly data from January 1, 2000 to July 30, 2020. Standard errors are Driscoll-Kraay adjusted with 2 lags. The symbols *,**,*** denote significance at the 10%, 5% and 1% level, respectively.

After GFC	5y		2y		2m		1m		2m(r)		1m(r)	
NTM	0.011		0.013*		0.013*		0.013*		0.014**		0.014*	
	[0.008]		[0.008]		[0.007]		[0.008]		[0.007]		[0.008]	
CMP	-0.024*	-0.020	-0.022*	-0.018	-0.025*	-0.024	-0.025*	-0.020	-0.025*	-0.024	-0.025*	-0.020
	[0.014]	[0.014]	[0.013]	[0.013]	[0.015]	[0.016]	[0.014]	[0.014]	[0.015]	[0.015]	[0.014]	[0.014]
APP		0.029***		0.029***		0.031***		0.029***		0.031***		0.029***
		[0.009]		[0.008]		[0.009]		[0.008]		[0.009]		[0.008]
Collateral		-0.081		-0.086		0.029		-0.066		0.041		-0.061
		[0.109]		[0.123]		[0.084]		[0.105]		[0.084]		[0.101]
Forward G.		0.002		0.003		0.001		0.003		0.001		0.003
		[0.009]		[0.011]		[0.009]		[0.011]		[0.009]		[0.011]
Fund		0.003		0.003		0.007		0.000		0.005		-0.000
		[0.017]		[0.022]		[0.021]		[0.017]		[0.020]		[0.017]
Swap		-0.085*		-0.145*		-0.094		-0.097*		-0.142*		-0.144*
		[0.051]		[0.079]		[0.060]		[0.059]		[0.076]		[0.076]
ZLB	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]
FG_{sg}	-0.003	-0.004	-0.003	-0.004	-0.003	-0.003	-0.004	-0.004	-0.003	-0.003	-0.004	-0.004
	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]
FG_{og}	0.015**	0.014**	0.015**	0.015**	0.015**	0.015**	0.015**	0.015**	0.015**	0.015**	0.015**	0.015**
	[0.006]	[0.007]	[0.006]	[0.006]	[0.006]	[0.006]	[0.006]	[0.006]	[0.006]	[0.006]	[0.006]	[0.006]
FG_{tg}	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.003
	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]
QE	-0.028	-0.027	-0.028	-0.027	-0.028	-0.027	-0.027	-0.027	-0.028	-0.027	-0.027	-0.027
	[0.040]	[0.039]	[0.039]	[0.039]	[0.039]	[0.039]	[0.039]	[0.039]	[0.039]	[0.039]	[0.039]	[0.039]
Obs.	16,956	16,956	16,956	16,956	16,956	16,956	16,956	16,956	16,956	16,956	16,956	16,956
U.S. Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
C_M_Y FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Table 4: Causation through IV: Subperiods GFC

The table reports the estimated parameters of the short panel correcting for endogenous regressor, and their corresponding standard errors in square brackets. The dependent variable is the weekly average systematic component of the tail risk calculated with the last year of observations. Variables of interest are the sum of daily changes of implied yields from future contracts at monetary policy announcements dates. We also include three days posterior to the announcements. We use as IV the sum of daily change of implied yields of future contracts of 10 year treasury bonds. Dummy variables for QE implementations, different type of forward guidance and effective lower bound are included. Additional controls are the sum of daily changes of implied yields from future contracts at conventional and unconventional monetary policy announcements dates from the United States. Country, month and year fixed effects are included, as well as their triple interaction. We are using weekly data from January 1, 2000 to July 30, 2020. Standard errors are Driscoll-Kraay adjusted with 2 lags. The symbols *,**,*** denote significance at the 10%, 5% and 1% level, respectively.

	Oct 2009 - June 2012						July 2012 - Dec 2018						After Jan 2019					
	5y	2y	2m	1m	2m(r)	1m(r)	5y	2y	2m	1m	2m(r)	1m(r)	5y	2y	2m	1m	2m(r)	1m(r)
CMP	-0.004	-0.005	-0.009	-0.006	-0.007	-0.005	-0.020	-0.019	-0.030	-0.022	-0.030	-0.022	-0.035	-0.048	-0.028	-0.029	-0.040	-0.041
	[0.021]	[0.022]	[0.027]	[0.024]	[0.025]	[0.023]	[0.020]	[0.018]	[0.023]	[0.020]	[0.023]	[0.019]	[0.030]	[0.041]	[0.032]	[0.033]	[0.035]	[0.036]
APP	0.028	0.029	0.034	0.032	0.034	0.033	0.034***	0.032***	0.035***	0.032***	0.035***	0.032***	-0.010	-0.009	-0.027	-0.029	-0.025	-0.027
	[0.040]	[0.042]	[0.044]	[0.042]	[0.043]	[0.041]	[0.010]	[0.010]	[0.012]	[0.010]	[0.013]	[0.010]	[0.026]	[0.033]	[0.035]	[0.036]	[0.036]	[0.038]
COLL	-0.057	-0.058	-0.074	-0.071	-0.078	-0.074	-0.111	-0.122	0.134	-0.096	0.159	-0.073	0.062	0.180	0.254	0.329	0.273	0.315*
	[0.068]	[0.069]	[0.079]	[0.073]	[0.083]	[0.077]	[0.160]	[0.188]	[0.169]	[0.173]	[0.169]	[0.151]	[0.121]	[0.382]	[0.226]	[0.255]	[0.168]	[0.184]
FG	-0.035	-0.036*	-0.040	-0.036*	-0.040	-0.036*	0.007	0.009	-0.000	0.012	-0.000	0.012	0.018	0.022	0.019	0.020	0.021	0.022
	[0.021]	[0.021]	[0.027]	[0.022]	[0.027]	[0.022]	[0.012]	[0.015]	[0.010]	[0.016]	[0.010]	[0.016]	[0.021]	[0.023]	[0.024]	[0.025]	[0.025]	[0.025]
Fund	0.006	0.008	-0.000	0.005	0.000	0.005	0.071	0.084	0.114	0.094	0.120	0.096	0.012	-0.019	0.019	0.021	0.010	0.011
	[0.021]	[0.022]	[0.029]	[0.021]	[0.028]	[0.020]	[0.061]	[0.078]	[0.109]	[0.096]	[0.123]	[0.105]	[0.037]	[0.060]	[0.038]	[0.038]	[0.039]	[0.039]
Swap	-0.052	-0.059	-0.062	-0.063	-0.064	-0.065	-0.287**	-0.330**	-0.373**	-0.387**	-0.399**	-0.417**	0.010	1.532	0.007	0.007	0.023	0.023
	[0.068]	[0.076]	[0.081]	[0.081]	[0.086]	[0.086]	[0.125]	[0.144]	[0.159]	[0.162]	[0.178]	[0.182]	[0.024]	[1.419]	[0.022]	[0.022]	[0.056]	[0.056]
Obs	4,302	4,302	4,302	4,302	4,302	4,302	10,176	10,176	10,176	10,176	10,176	10,176	2,484	2,484	2,484	2,484	2,484	2,484
R-squared	0.004	0.004	0.004	0.004	0.004	0.004	0.002	0.003	-0.032	0.002	-0.045	0.001	0.004	-0.003	0.001	0.001	-0.000	-0.000
U.S. Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
C_M_Y FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Table 5: Causation through IV: weekly frequency

The table reports the estimated parameters of the short panel correcting for endogenous regressor, and their corresponding standard errors in square brackets. The dependent variable is the weekly average systematic component of the tail risk calculated with the last year of observations. Variables of interest are the sum of daily changes of implied yields from future contracts at monetary policy announcements dates. We also include three days posterior to the announcements. We use as IV the sum of daily change of implied yields of future contracts of 10 year treasury bonds. Dummy variables for QE implementations, different type of forward guidance and effective lower bound are included. Additional controls are the sum of daily changes of implied yields from future contracts at conventional and unconventional monetary policy announcements dates from the United States. Country, month and year fixed effects are included, as well as their triple interaction. We are using weekly data from January 1, 2000 to July 30, 2020. Standard errors are Driscoll-Kraay adjusted with 2 lags. The symbols *,**,*** denote significance at the 10%, 5% and 1% level, respectively.

	5y		2y		2m		1m		2m(r)		1m(r)	
NTM	0.007		0.008		0.009		0.009		0.010		0.009	
	[0.007]		[0.008]		[0.008]		[0.008]		[0.008]		[0.008]	
CMP	-0.007	-0.007	-0.007	-0.007	-0.006	-0.008	-0.006	-0.006	-0.006	-0.008	-0.006	-0.005
	[0.015]	[0.015]	[0.018]	[0.018]	[0.022]	[0.023]	[0.020]	[0.020]	[0.022]	[0.022]	[0.019]	[0.020]
APP		0.016		0.017		0.017		0.016		0.017		0.016
		[0.012]		[0.013]		[0.013]		[0.013]		[0.013]		[0.013]
Collateral		0.009		0.013		0.031		0.006		0.028		0.003
		[0.053]		[0.055]		[0.089]		[0.055]		[0.098]		[0.062]
Forward G.		0.003		0.004		0.004		0.003		0.004		0.004
		[0.011]		[0.012]		[0.012]		[0.014]		[0.012]		[0.014]
Fund		0.013		0.018		0.025		0.015		0.027		0.015
		[0.028]		[0.032]		[0.038]		[0.027]		[0.038]		[0.028]
Swap		-0.058		-0.089		-0.076		-0.080		-0.111		-0.109
		[0.044]		[0.069]		[0.065]		[0.072]		[0.091]		[0.097]
ZLB	-0.010	-0.010	-0.010	-0.010	-0.009	-0.009	-0.009	-0.009	-0.009	-0.009	-0.009	-0.009
	[0.007]	[0.008]	[0.007]	[0.007]	[0.007]	[0.007]	[0.007]	[0.007]	[0.007]	[0.007]	[0.007]	[0.007]
FG_{sg}	-0.010	-0.009	-0.009	-0.009	-0.009	-0.009	-0.010	-0.010	-0.009	-0.009	-0.010	-0.010
	[0.011]	[0.011]	[0.011]	[0.011]	[0.011]	[0.011]	[0.011]	[0.011]	[0.011]	[0.011]	[0.011]	[0.011]
FG_{og}	0.071***	0.071***	0.071***	0.071***	0.071***	0.071***	0.071***	0.071***	0.071***	0.071***	0.071***	0.071***
	[0.016]	[0.016]	[0.016]	[0.016]	[0.016]	[0.016]	[0.016]	[0.016]	[0.016]	[0.016]	[0.016]	[0.016]
FG_{tg}	-0.011	-0.011	-0.010	-0.011	-0.010	-0.011	-0.010	-0.011	-0.010	-0.011	-0.010	-0.011
	[0.007]	[0.007]	[0.007]	[0.007]	[0.007]	[0.007]	[0.007]	[0.007]	[0.007]	[0.007]	[0.007]	[0.007]
QE	-0.024**	-0.023**	-0.024**	-0.024**	-0.024**	-0.024**	-0.023**	-0.024**	-0.024**	-0.024**	-0.023**	-0.024**
	[0.012]	[0.012]	[0.012]	[0.012]	[0.012]	[0.012]	[0.012]	[0.012]	[0.012]	[0.012]	[0.012]	[0.012]
Obs	7,126	7,126	7,126	7,126	7,126	7,126	7,126	7,126	7,126	7,126	7,126	7,126
R-squared	0.015	0.015	0.016	0.016	0.016	0.016	0.015	0.014	0.016	0.016	0.015	0.013
U.S. Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
C_M_Y FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Table 6: Causation through IV: weekly frequency before GFC

The table reports the estimated parameters of the short panel correcting for endogenous regressor, and their corresponding standard errors in square brackets. The dependent variable is the weekly average systematic component of the tail risk calculated with the last year of observations. Variables of interest are the sum of daily changes of implied yields from future contracts at monetary policy announcements dates. We also include three days posterior to the announcements. We use as IV the sum of daily change of implied yields of future contracts of 10 year treasury bonds. Dummy variables for QE implementations, different type of forward guidance and effective lower bound are included. Additional controls are the sum of daily changes of implied yields from future contracts at conventional and unconventional monetary policy announcements dates from the United States. Country, month and year fixed effects are included, as well as their triple interaction. We are using weekly data from January 1, 2000 to July 30, 2020. Standard errors are Driscoll-Kraay adjusted with 2 lags. The symbols *,**,*** denote significance at the 10%, 5% and 1% level, respectively.

	5y		2y		2m		1m		2m(r)		1m(r)	
NTM	0.009		0.011		0.001		0.018		-0.000		0.017	
	[0.018]		[0.019]		[0.029]		[0.022]		[0.029]		[0.021]	
CMP	0.006	0.005	0.009	0.008	0.023	0.019	0.019	0.010	0.019	0.020	0.016	0.005
	[0.024]	[0.024]	[0.028]	[0.028]	[0.040]	[0.041]	[0.031]	[0.033]	[0.036]	[0.037]	[0.029]	[0.030]
APP		-0.059		-0.106		0.449		-0.197		0.579		-0.285
		[0.224]		[0.217]		[0.918]		[0.463]		[1.014]		[0.487]
Collateral		0.093		0.105		0.116		0.155		0.137		0.220
		[0.102]		[0.103]		[0.141]		[0.115]		[0.174]		[0.177]
Forward G.		0.020		0.024		0.017		0.020		0.013		0.019
		[0.021]		[0.024]		[0.038]		[0.029]		[0.038]		[0.029]
Fund		-0.036		-0.034		-0.116		-0.041		-0.091		-0.039
		[0.047]		[0.043]		[0.087]		[0.043]		[0.088]		[0.041]
Swap		-0.082		-0.063		-0.066		0.189		-0.120		0.189
		[0.081]		[0.082]		[0.212]		[0.166]		[0.314]		[0.172]
ZLB	-0.026**	-0.026**	-0.025**	-0.026**	-0.025**	-0.023**	-0.025**	-0.024**	-0.025**	-0.023**	-0.025**	-0.025**
	[0.010]	[0.010]	[0.010]	[0.010]	[0.011]	[0.011]	[0.011]	[0.011]	[0.011]	[0.011]	[0.011]	[0.011]
FG_{og}	0.024***	0.025***	0.024***	0.024***	0.024***	0.024***	0.024***	0.024***	0.024***	0.024***	0.024***	0.024***
	[0.006]	[0.006]	[0.006]	[0.006]	[0.006]	[0.006]	[0.006]	[0.006]	[0.006]	[0.006]	[0.006]	[0.006]
QE	-0.060***	-0.061***	-0.060***	-0.061***	-0.061***	-0.058***	-0.060***	-0.061***	-0.061***	-0.057***	-0.060***	-0.061***
	[0.016]	[0.016]	[0.016]	[0.016]	[0.016]	[0.017]	[0.016]	[0.016]	[0.016]	[0.017]	[0.016]	[0.016]
Obs	3,192	3,192	3,192	3,192	3,192	3,192	3,192	3,192	3,192	3,192	3,192	3,192
R-squared	0.019	0.020	0.019	0.019	0.022	0.017	0.021	0.014	0.021	0.012	0.021	0.010
U.S. Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
C_M_Y FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Table 7: Causation through IV: weekly frequency after GFC

The table reports the estimated parameters of the short panel correcting for endogenous regressor, and their corresponding standard errors in square brackets. The dependent variable is the weekly average systematic component of the tail risk calculated with the last year of observations. Variables of interest are the sum of daily changes of implied yields from future contracts at monetary policy announcements dates. We also include three days posterior to the announcements. We use as IV the sum of daily change of implied yields of future contracts of 10 year treasury bonds. Dummy variables for QE implementations, different type of forward guidance and effective lower bound are included. Additional controls are the sum of daily changes of implied yields from future contracts at conventional and unconventional monetary policy announcements dates from the United States. Country, month and year fixed effects are included, as well as their triple interaction. We are using weekly data from January 1, 2000 to July 30, 2020. Standard errors are Driscoll-Kraay adjusted with 2 lags. The symbols *,**,*** denote significance at the 10%, 5% and 1% level, respectively.

	5y		2y		2m		1m		2m(r)		1m(r)	
NTM	0.006		0.007		0.007		0.006		0.007		0.006	
	[0.008]		[0.008]		[0.008]		[0.009]		[0.008]		[0.009]	
CMP	-0.014	-0.014	-0.015	-0.015	-0.015	-0.018	-0.017	-0.017	-0.017	-0.017	-0.018	-0.016
	[0.018]	[0.019]	[0.022]	[0.023]	[0.026]	[0.028]	[0.025]	[0.026]	[0.027]	[0.028]	[0.025]	[0.026]
APP		0.018		0.018		0.019		0.017		0.019		0.018
		[0.013]		[0.013]		[0.013]		[0.013]		[0.013]		[0.013]
Collateral		-0.041		-0.046		-0.025		-0.049		-0.032		-0.055
		[0.063]		[0.068]		[0.115]		[0.067]		[0.124]		[0.070]
Forward G.		-0.003		-0.004		-0.004		-0.007		-0.004		-0.007
		[0.012]		[0.013]		[0.012]		[0.015]		[0.012]		[0.015]
Fund		0.040		0.053		0.056		0.041		0.057		0.041
		[0.036]		[0.046]		[0.047]		[0.040]		[0.049]		[0.043]
Swap		-0.043		-0.109		-0.051		-0.050		-0.071		-0.071
		[0.053]		[0.122]		[0.062]		[0.061]		[0.083]		[0.081]
ZLB	0.022**	0.022***	0.022**	0.022***	0.022**	0.022***	0.022**	0.022***	0.022**	0.022**	0.022**	0.022***
	[0.009]	[0.009]	[0.009]	[0.009]	[0.009]	[0.009]	[0.009]	[0.009]	[0.009]	[0.009]	[0.009]	[0.009]
FG_{sg}	-0.010	-0.010	-0.010	-0.009	-0.009	-0.009	-0.010	-0.010	-0.009	-0.009	-0.010	-0.010
	[0.010]	[0.010]	[0.010]	[0.010]	[0.010]	[0.010]	[0.010]	[0.010]	[0.010]	[0.010]	[0.010]	[0.010]
FG_{og}	0.088***	0.088***	0.088***	0.088***	0.088***	0.088***	0.088***	0.088***	0.088***	0.088***	0.088***	0.088***
	[0.019]	[0.019]	[0.019]	[0.019]	[0.019]	[0.019]	[0.019]	[0.019]	[0.019]	[0.019]	[0.019]	[0.019]
FG_{tg}	-0.011	-0.011	-0.011	-0.011	-0.011	-0.011	-0.011	-0.011	-0.011	-0.011	-0.011	-0.011
	[0.010]	[0.010]	[0.009]	[0.010]	[0.009]	[0.009]	[0.009]	[0.010]	[0.009]	[0.009]	[0.009]	[0.010]
QE	0.002	0.003	0.002	0.001	0.002	0.000	0.002	0.001	0.002	0.000	0.002	0.001
	[0.015]	[0.015]	[0.015]	[0.015]	[0.015]	[0.016]	[0.015]	[0.016]	[0.015]	[0.016]	[0.015]	[0.016]
Obs	3,934	3,934	3,934	3,934	3,934	3,934	3,934	3,934	3,934	3,934	3,934	3,934
R-squared	0.034	0.034	0.037	0.037	0.038	0.036	0.036	0.036	0.038	0.035	0.036	0.036
U.S. Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
C_M_Y FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Table 8: Causation through IV: Tail Risk and daily frequency

The table reports the estimated parameters of the short panel correcting for endogenous regressor, and their corresponding standard errors in square brackets. The dependent variable is the tail risk calculated with the last year of observations. Variables of interest are the daily changes of implied yields from future contracts at monetary policy announcements dates. We also include three days posterior to the announcements. We use as IV the daily change of implied yields of future contracts of 10 year treasury bonds. Dummy variables for QE implementations, different type of forward guidance and effective lower bound are included. Additional controls are daily changes of implied yields from future contracts at conventional and unconventional monetary policy announcements dates from the United States. Country, month and year fixed effects are included, as well as their triple interaction. We are using weekly data from January 1, 2000 to July 30, 2020. Standard errors are Driscoll-Kraay adjusted with 2 lags. The symbols *,**,*** denote significance at the 10%, 5% and 1% level, respectively.

	5Y		2Y		2m		1m		2m(r)		1m(r)	
NTM	-0.021**		-0.023**		-0.023**		-0.026**		-0.024**		-0.026**	
	[0.010]		[0.011]		[0.011]		[0.011]		[0.011]		[0.011]	
CMP	0.006	0.002	0.008	0.005	0.002	0.002	0.012	0.007	0.003	0.002	0.012	0.008
	[0.022]	[0.022]	[0.023]	[0.023]	[0.029]	[0.029]	[0.025]	[0.025]	[0.028]	[0.029]	[0.024]	[0.025]
APP		-0.059***		-0.058***		-0.055***		-0.056***		-0.055***		-0.055***
		[0.022]		[0.021]		[0.021]		[0.020]		[0.021]		[0.020]
Collateral		-0.018		-0.019		0.020		-0.006		0.022		-0.005
		[0.079]		[0.085]		[0.107]		[0.083]		[0.109]		[0.084]
Forward G.		0.008		0.008		0.006		0.012		0.006		0.012
		[0.011]		[0.012]		[0.010]		[0.014]		[0.010]		[0.014]
Fund		-0.014		-0.010		-0.037		-0.027		-0.036		-0.029
		[0.025]		[0.025]		[0.035]		[0.031]		[0.037]		[0.035]
Swap		0.043		0.047		0.060		0.026		0.091		-0.019
		[0.027]		[0.044]		[0.045]		[0.035]		[0.074]		[0.116]
ZLB	0.010***	0.010***	0.010***	0.010***	0.010***	0.010***	0.010***	0.010***	0.010***	0.010***	0.010***	0.010***
	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]
FG_sc	0.014**	0.014**	0.014**	0.014**	0.013**	0.014**	0.014**	0.014**	0.014**	0.014**	0.014**	0.014**
	[0.006]	[0.006]	[0.006]	[0.006]	[0.006]	[0.006]	[0.006]	[0.006]	[0.006]	[0.006]	[0.006]	[0.006]
FG_oe	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002
	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]
FG_tc	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007
	[0.006]	[0.006]	[0.006]	[0.006]	[0.006]	[0.006]	[0.006]	[0.006]	[0.006]	[0.006]	[0.006]	[0.006]
QE	0.066	0.065	0.066	0.065	0.066	0.065	0.065	0.065	0.066	0.065	0.065	0.065
	[0.097]	[0.097]	[0.097]	[0.097]	[0.097]	[0.097]	[0.097]	[0.097]	[0.097]	[0.097]	[0.097]	[0.097]
Obs.	30,720	30,720	30,720	30,720	30,720	30,720	30,720	30,720	30,720	30,720	30,720	30,720
U.S. Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
C_M_Y FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Table 9: Causation through IV: Idiosyncratic tail risk component and daily frequency

The table reports the estimated parameters of the short panel correcting for endogenous regressor, and their corresponding standard errors in square brackets. The dependent variable is the idiosyncratic tail risk component calculated with the last year of observations. Variables of interest are the daily changes of implied yields from future contracts at monetary policy announcements dates. We also include three days posterior to the announcements. We use as IV the daily change of implied yields of future contracts of 10 year treasury bonds. Dummy variables for QE implementations, different type of forward guidance and effective lower bound are included. Additional controls are daily changes of implied yields from future contracts at conventional and unconventional monetary policy announcements dates from the United States. Country, month and year fixed effects are included, as well as their triple interaction. We are using weekly data from January 1, 2000 to July 30, 2020. Standard errors are Driscoll-Kraay adjusted with 2 lags. The symbols *,**,*** denote significance at the 10%, 5% and 1% level, respectively.

	5Y		2Y		2m		1m		2m(r)		1m(r)	
NTM	-0.031**		-0.036**		-0.038**		-0.041***		-0.039**		-0.042***	
	[0.015]		[0.016]		[0.016]		[0.016]		[0.016]		[0.016]	
CMP	0.016	0.010	0.018	0.011	0.014	0.012	0.024	0.016	0.014	0.011	0.023	0.015
	[0.027]	[0.027]	[0.027]	[0.027]	[0.035]	[0.035]	[0.029]	[0.030]	[0.034]	[0.034]	[0.029]	[0.029]
APP		-0.087***		-0.086***		-0.085***		-0.084***		-0.085***		-0.084***
		[0.027]		[0.027]		[0.027]		[0.026]		[0.027]		[0.026]
Collateral		0.023		0.020		0.024		0.025		0.022		0.023
		[0.074]		[0.081]		[0.122]		[0.085]		[0.124]		[0.087]
Forward G.		0.001		0.001		-0.000		0.005		-0.001		0.004
		[0.015]		[0.016]		[0.015]		[0.018]		[0.015]		[0.018]
Fund		-0.014		-0.010		-0.037		-0.030		-0.038		-0.026
		[0.032]		[0.032]		[0.046]		[0.040]		[0.048]		[0.045]
Swap		0.111**		0.163**		0.154		0.084		0.278*		0.126
		[0.051]		[0.074]		[0.094]		[0.064]		[0.145]		[0.143]
ZLB	0.021***	0.021***	0.021***	0.021***	0.022***	0.022***	0.022***	0.022***	0.022***	0.022***	0.022***	0.022***
	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]
FG_sc	0.016**	0.016**	0.016**	0.016**	0.016**	0.016**	0.016**	0.016**	0.016**	0.016**	0.016**	0.016**
	[0.007]	[0.007]	[0.007]	[0.007]	[0.007]	[0.007]	[0.007]	[0.007]	[0.007]	[0.007]	[0.007]	[0.007]
FG_oe	-0.027***	-0.027***	-0.027***	-0.027***	-0.027***	-0.027***	-0.027***	-0.027***	-0.027***	-0.027***	-0.027***	-0.027***
	[0.010]	[0.010]	[0.010]	[0.010]	[0.010]	[0.010]	[0.010]	[0.010]	[0.010]	[0.010]	[0.010]	[0.010]
FG_tc	0.009	0.009	0.009	0.010	0.009	0.010	0.009	0.010	0.009	0.010	0.009	0.010
	[0.007]	[0.007]	[0.007]	[0.007]	[0.007]	[0.007]	[0.007]	[0.007]	[0.007]	[0.007]	[0.007]	[0.007]
QE	0.084	0.084	0.085	0.084	0.085	0.084	0.084	0.084	0.085	0.084	0.084	0.084
	[0.119]	[0.119]	[0.119]	[0.119]	[0.119]	[0.119]	[0.119]	[0.119]	[0.119]	[0.119]	[0.119]	[0.119]
Obs.	30,720	30,720	30,720	30,720	30,720	30,720	30,720	30,720	30,720	30,720	30,720	30,720
U.S. Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
C_M_Y FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Table 10: Instrumental Variable Tests

Panel A presents Angrist - Pischke weak IV test for estimates using daily frequency data. Panel B presents Angrist - Pischke weak IV test for estimates using weakly frequency data. Also, panels A and B present present Kleibergen - Paap underidentification test. Panel C presents Kleibergen - Paap weak identification test for estimates using daily and weekly frequency data. The symbols *,**,*** denote significance at the 10%, 5% and 1% level, respectively.

	Panel A: Angrist - Pischke Weak IV with Daily Frequency											
	5 years		2 years		2 months		1 month		2 months (r)		1 month (r)	
NTM	85299		5272.6		4161.82		4338.73		4443.05		4568.48	
CMP	18906.93	3039.57	10065.88	1130.11	197.66	105.9	900.59	187.27	340.12	110.01	1966.28	153.55
APP		2.90E+05		1.20E+05		9568.04		51120.75		8880.09		39894.11
Collateral		790.19		234.16		8.82		81.69		8.04		75.4
Forward G.		2886.72		587.49		83.27		126.52		74.49		111.53
Fund		4577.99		252.68		362.98		757.37		489.84		1325.33
Swap		1360.62		134.67		15.13		227.29		10.13		164.27
Stock-Yogo (5% Max IV bias)	21.01	21.01	21.01	21.01	21.01	21.01	21.01	21.01	21.01	21.01	21.01	21.01
Stock-Yogo (10% Max IV bias)	11.52	11.52	11.52	11.52	11.52	11.52	11.52	11.52	11.52	11.52	11.52	11.52
Underident. (K-P)	115.68***	94.99***	354.35***	37.99***	74.01***	17.86***	297.37***	8.67	64.76***	17.66***	290.88***	8.19
	Panel B: Angrist - Pischke Weak IV with Weekly Frequency											
	5 years		2 years		2 months		1 month		2 months (ita)		1 month (ita)	
NTM	1631.26		178.3		32.64		75.71		30.25		77.09	
CMP	368.88	541.7	148.87	217.91	46.59	76.01	66.59	100.63	41.4	65.41	56.33	87.26
APP		114.41		35.74		19.16		13.71		19.2		13.39
Collateral		253.89		92.02		10.93		21.8		11.02		13.07
Forward G.		1470.78		245.31		16.59		75.16		16.42		76.91
Fund		991.05		40.23		30.96		26.89		19.58		23.32
Swap		437.36		10.69		12.86		9.27		14.04		7.27
Stock-Yogo (5% Max IV bias)	21.01	21.01	21.01	21.01	21.01	21.01	21.01	21.01	21.01	21.01	21.01	21.01
Stock-Yogo (10% Max IV bias)	11.52	11.52	11.52	11.52	11.52	11.52	11.52	11.52	11.52	11.52	11.52	11.52
Underident. (K-P)	108.99***	100.69***	104.16***	24.95***	47.55***	16.15***	106.73***	14.43***	46.86***	15.14***	104***	13.28**
	Panel C: Weak Identification Test (Kleibergen - Paap)											
	5 years		2 years		2 months		1 month		2 months (r)		1 month (r)	
	Daily	Weekly	Daily	Weekly	Daily	Weekly	Daily	Weekly	Daily	Weekly	Daily	Weekly
CMP, NTM	220.19	306.57	202.01	110.22	3803.29	29.52	3941.84	44.85	4078.71	27.5	4182.39	41.42
Stock-Yogo (5% Max IV bias)	19.4	19.4	19.4	19.4	19.4	19.4	19.4	19.4	19.4	19.4	19.4	19.4
Stock-Yogo (10% Max IV bias)	10.78	10.78	10.78	10.78	10.78	10.78	10.78	10.78	10.78	10.78	10.78	10.78

Other estimation results

Table 11: Correlation: daily frequency

The table reports the estimated parameters of the short panel without correcting for endogenous regressor, and their corresponding standard errors in square brackets. The dependent variable is the systematic component of the tail risk calculated with the last year of observations. Variables of interest are the daily change of implied yields from future contracts at monetary policy announcements dates. We also include three days posterior to the announcements. Additional controls are daily changes of implied yield from future contracts at conventional and unconventional monetary policy announcements dates from the United States. Country, month and year fixed effects are included, as well as their triple interaction. We are using daily data from January 1, 2000 to July 30, 2020. Standard errors are Driscoll-Kraay adjusted with 2 lags. The symbols *,**,*** denote significance at the 10%, 5% and 1% level, respectively.

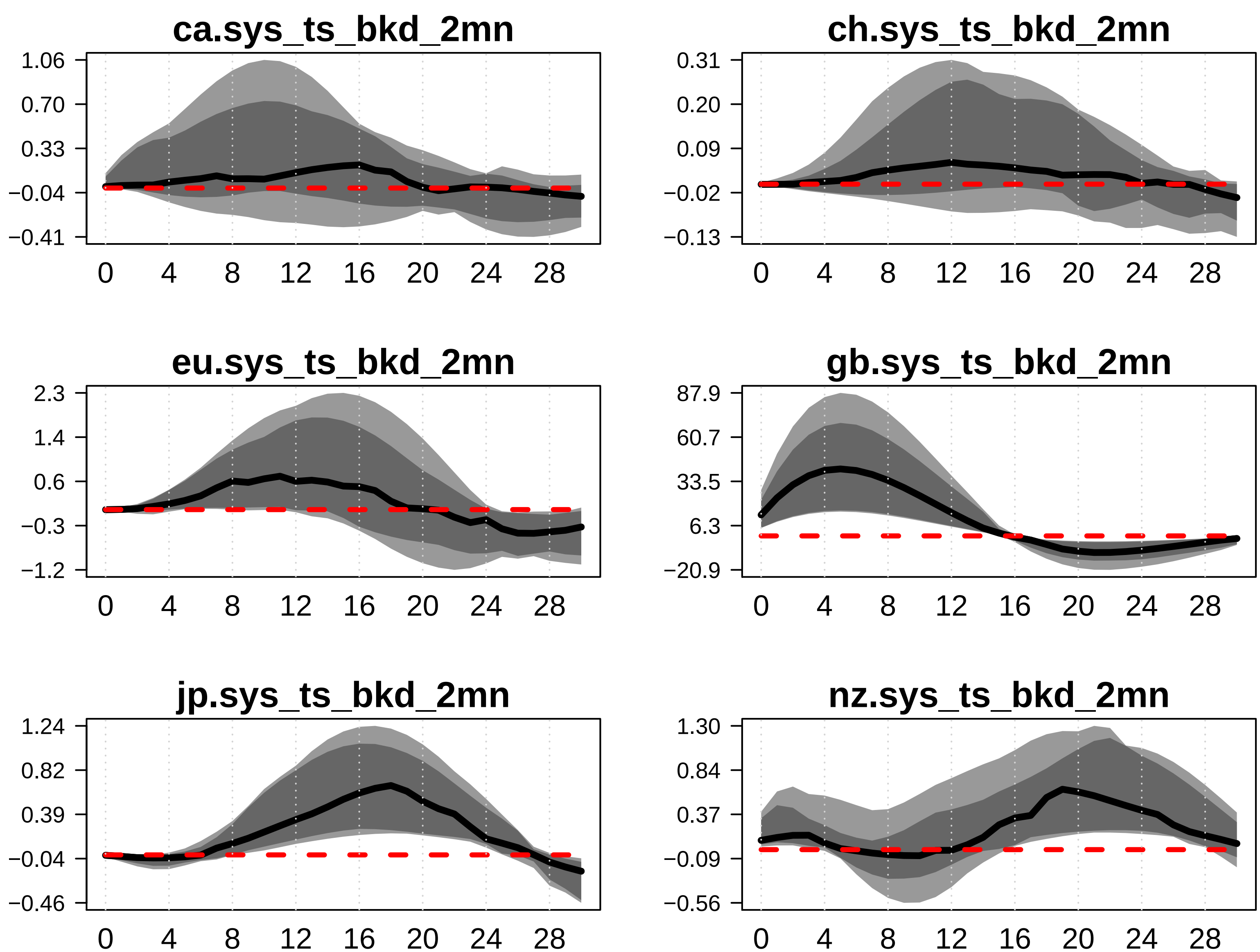
	10y	5y	2y	2m	1m	2m(r)	1m(r)
APP	0.031***	0.025***	0.024***	0.026***	0.025***	0.026***	0.025***
	[0.010]	[0.009]	[0.008]	[0.008]	[0.008]	[0.008]	[0.008]
Collateral	-0.042	-0.044	-0.027	-0.024**	-0.032	-0.024***	-0.039
	[0.068]	[0.041]	[0.039]	[0.009]	[0.031]	[0.009]	[0.030]
Forward G.	0.006	0.003	0.009	0.002	0.001	0.002	0.002
	[0.007]	[0.004]	[0.009]	[0.002]	[0.002]	[0.002]	[0.002]
Fund	-0.001	-0.001	0.006	0.002	0.002	0.000	0.001
	[0.012]	[0.012]	[0.015]	[0.009]	[0.007]	[0.008]	[0.007]
Swap	-0.066*	-0.063*	-0.081*	-0.049**	-0.003	-0.050**	-0.001
	[0.038]	[0.034]	[0.046]	[0.021]	[0.019]	[0.023]	[0.019]
CMP	-0.006	-0.001	-0.009	-0.012*	-0.010	-0.010*	-0.009
	[0.008]	[0.002]	[0.007]	[0.007]	[0.007]	[0.006]	[0.005]
Obs	30,720	30,720	30,720	30,720	30,720	30,720	30,720
C_M_Y FE	YES	YES	YES	YES	YES	YES	YES

Table 12: Correlation: weekly frequency

The table reports the estimated parameters of the short panel without correcting for endogenous regressor, and their corresponding standard errors in square brackets. The dependent variable is the weekly average systematic component of the tail risk calculated with the last year of observations. Variables of interest are the sum of daily change of implied yields from future contracts at monetary policy announcements dates. We also include three days posterior to the announcements. Additional controls are the sum of daily changes of implied yield from future contracts at conventional and unconventional monetary policy announcements dates from the United States. Country, month and year fixed effects are included, as well as their triple interaction. We are using weekly data from January 1, 2000 to July 30, 2020. Standard errors are Driscoll-Kraay adjusted with 2 lags. The symbols *,**,*** denote significance at the 10%, 5% and 1% level, respectively.

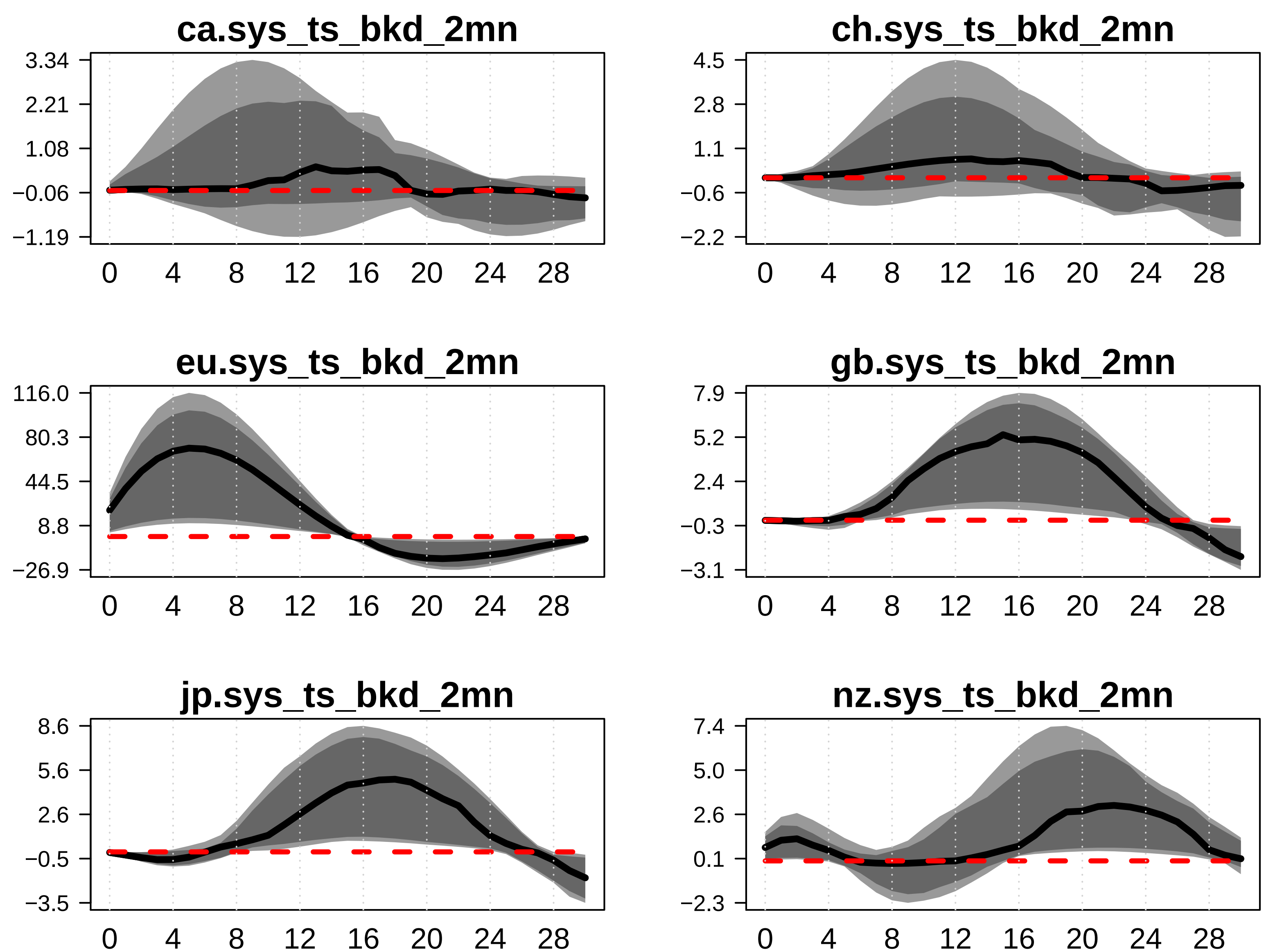
	10y	5y	2y	2m	1m	2m(r)	1m(r)
APP	-0.035	-0.032	-0.017	0.004	-0.001	0.002	-0.001
	[0.035]	[0.033]	[0.024]	[0.013]	[0.015]	[0.014]	[0.015]
Collateral	-0.050	-0.061	-0.060	0.014	-0.020	0.017	-0.033
	[0.082]	[0.079]	[0.070]	[0.018]	[0.053]	[0.019]	[0.055]
Forward G.	0.021	0.014	0.026	0.021***	0.006	0.021***	0.007
	[0.023]	[0.022]	[0.023]	[0.007]	[0.023]	[0.007]	[0.022]
Fund	0.050	0.044	0.036	-0.024	0.009	-0.039	-0.008
	[0.042]	[0.042]	[0.045]	[0.045]	[0.028]	[0.038]	[0.027]
Swap	-0.133	-0.125*	-0.147*	-0.132***	-0.032	-0.119**	-0.016
	[0.083]	[0.071]	[0.083]	[0.050]	[0.047]	[0.049]	[0.042]
CMP	-0.043	0.008	-0.060**	-0.017	-0.026	-0.016	-0.021
	[0.030]	[0.012]	[0.028]	[0.029]	[0.027]	[0.023]	[0.022]
Obs	7,147	7,147	7,147	7,147	7,147	7,147	7,147
C_M_Y FE	YES	YES	YES	YES	YES	YES	YES

Figure 20: QE: domestic UK shock



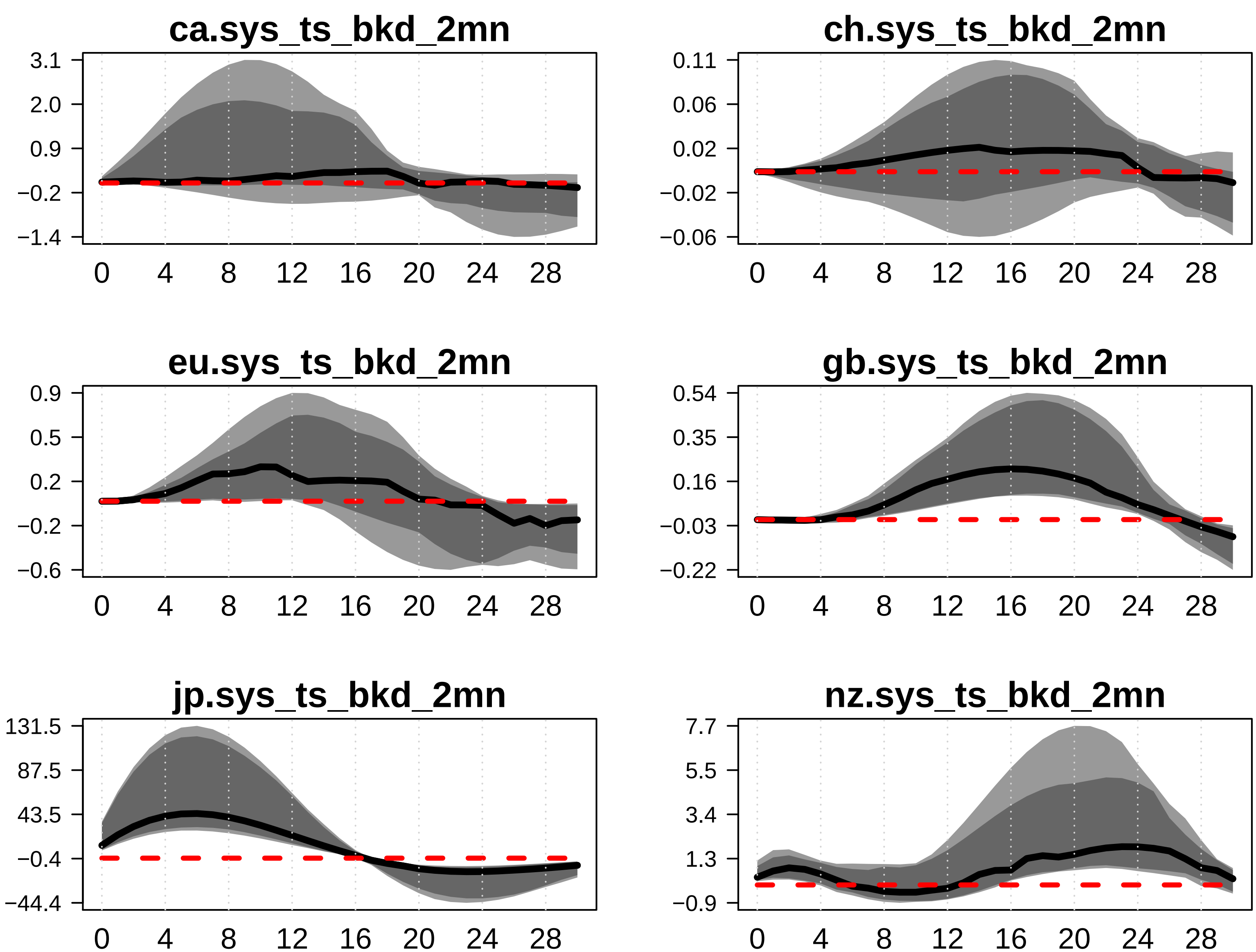
We report the responses to a domestic APP shock in UK. The figures represent the IRFs of (from top-left to right-and-down): Canada, Switzerland, Euro Area, UK, Japan and New Zealand. The solid line is the median response, the dark (light) grey shaded area represents the 68% (95%) confidence intervals. The dotted red line is the zero-line.

Figure 21: QE: domestic Euro Area shock



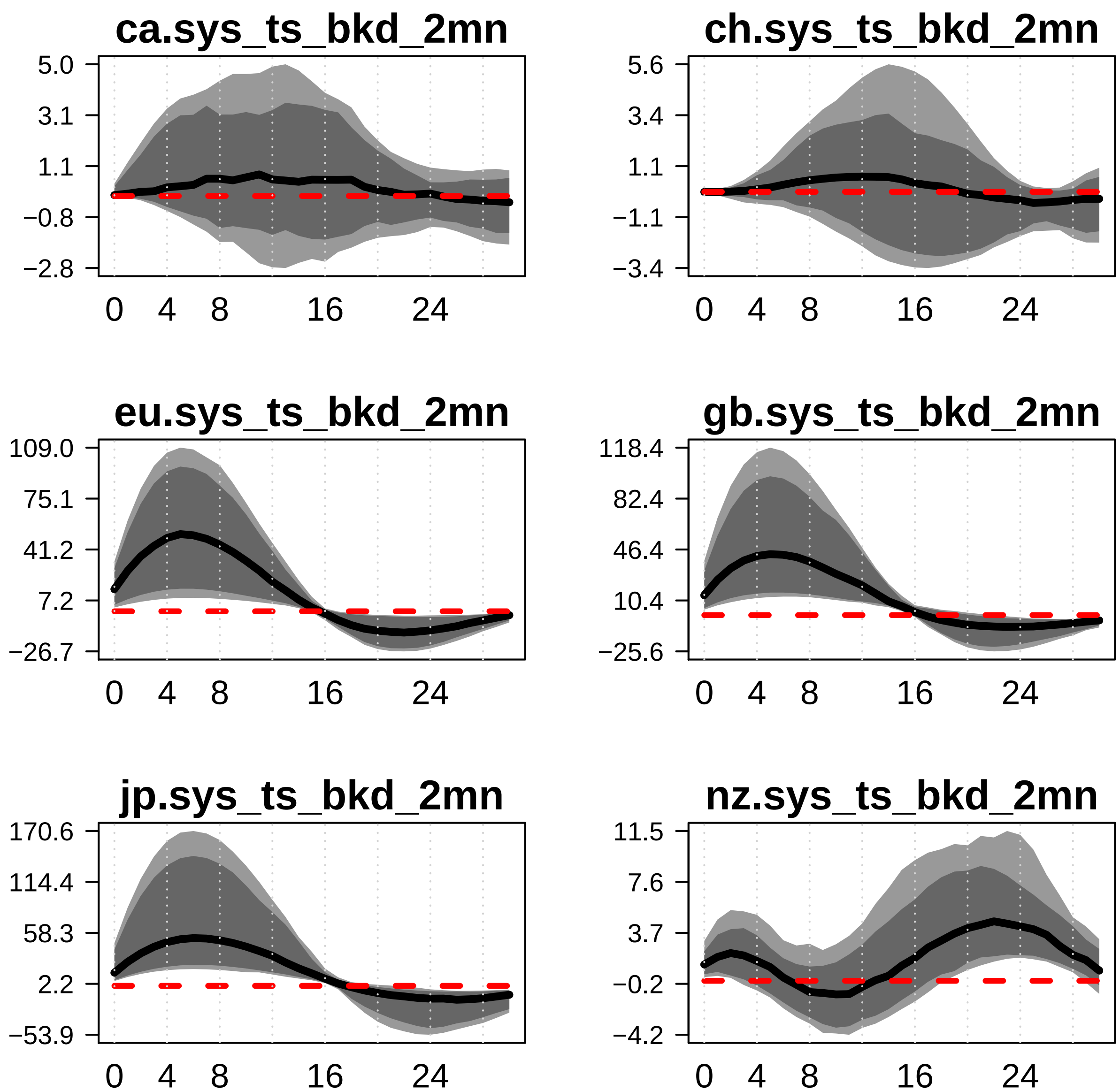
We report the responses to a domestic APP shock in Euro Area. The figures represent the IRFs of (from top-left to right-and-down): Canada, Switzerland, Euro Area, UK, Japan and New Zealand. The solid line is the median response, the dark (light) grey shaded area represents the 68% (95%) confidence intervals. The dotted red line is the zero-line.

Figure 22: QE: domestic Japan shock



We report the responses to a domestic APP shock in Japan. The figures represent the IRFs of (from top-left to right-and-down): Canada, Switzerland, Euro Area, UK, Japan and New Zealand. The solid line is the median response, the dark (light) grey shaded area represents the 68% (95%) confidence intervals. The dotted red line is the zero-line.

Figure 23: QE: Global shock



We report the responses to a global APP shock, with 30.000 iterations. The figures represent the IRFs of (from top-left to right-and-down): Canada, Switzerland, Euro Area, UK, Japan and New Zealand. The solid line is the median response, the dark (light) grey shaded area represents the 68% (95%) confidence intervals. The dotted red line is the zero-line.

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