E pluribus plures

Shock dependency of the USD pass-through to real and financial variables

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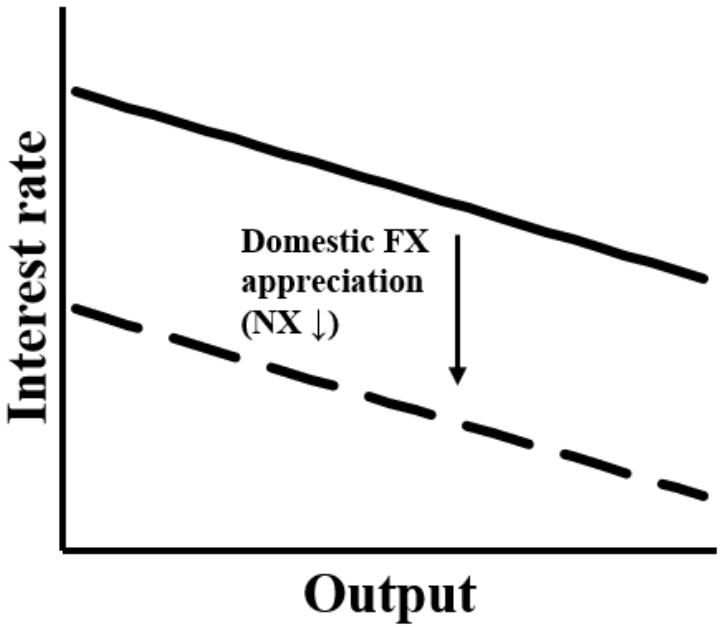
What are the implications of a USD appreciation?



From the IS-LM model:

$$Y = C + I + G + NX$$

$$NX = \phi^1 e + \phi^2 Y^f - \phi^3 Y$$

with $\phi^1 > 0$, i.e. Marshall–Lerner condition.
Casas et al. (2017) and Boz et al. (2020) show that $\phi^1 \approx 0.6$.

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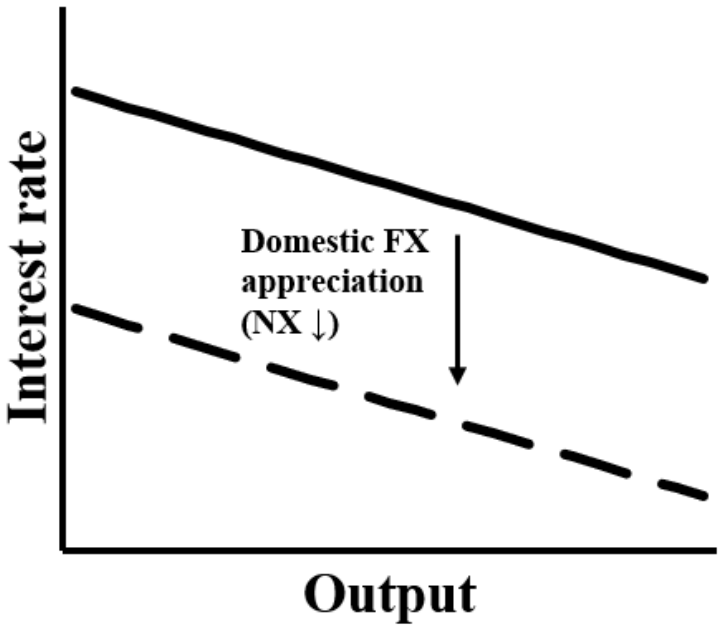

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But what if the exchange rate is **endogenous**? i.e. $\frac{\partial Y^f}{\partial e} \neq 0$, $\frac{\partial Y}{\partial e} \neq 0$?

Our contribution

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- ✓ explain the heterogeneity based on second-stage regressions
  - → after a real shock the "global demand" and the "exchange rate" channel offset each other
  - → with financial shocks the two channels push in the same direction
  - → other determinants of FX pass-through also matter

Shock-dependent pass-through estimates

Identifying US shocks by means of Bayesian VAR with 4 macro US variables:

$$Y_t = A_0 + \sum_{i=1}^{N} A_i Y_{t-1} + B\mathcal{E}_t \tag{1}$$

Table: Sign restriction table

	US Demand shock	US Monetary policy shock	Risk shock	US supply shock
Real GDP	-	-	-	-
10-year yield	-	+	-	+
USD NEER	-	+	+	
CPI	-	-	-	+

Notes: "+" indicates a positive response of the variable to the shock on impact; "-" a negative response and empty cells indicate unrestricted responses.

▸ Historical Decomposition.

How to compute conditional PT coefficients?

Following Forbes et al. (2018) conditional pass-through coefficients are defined as:

$$\Phi_{y,z}(k) = \left[\frac{\sum_{k=0}^{K} \frac{\partial y_{t+k}}{\partial \epsilon_t^x}}{\sum_{k=0}^{K} \frac{\partial z_{t+k}}{\partial \epsilon_t^x}} \right] \tag{2}$$

$\Phi_{y,z}(k)$ is the "dynamic multiplier" of of variable z to variable y, at horizon k conditional on the shock ϵ^x. Requires to have two impulse responses (of z and y) to the same shock. Empirically this can be done by:

- Local projections $\rightarrow$ non-linear but subject to significant sample biases and large residuals, see Herbst & Johannsen (2020)
- VAR-X $\rightarrow$ linearity assumption, but less prone to biases in small samples and smaller residuals

Impulse responses—Advance economy (DEU)

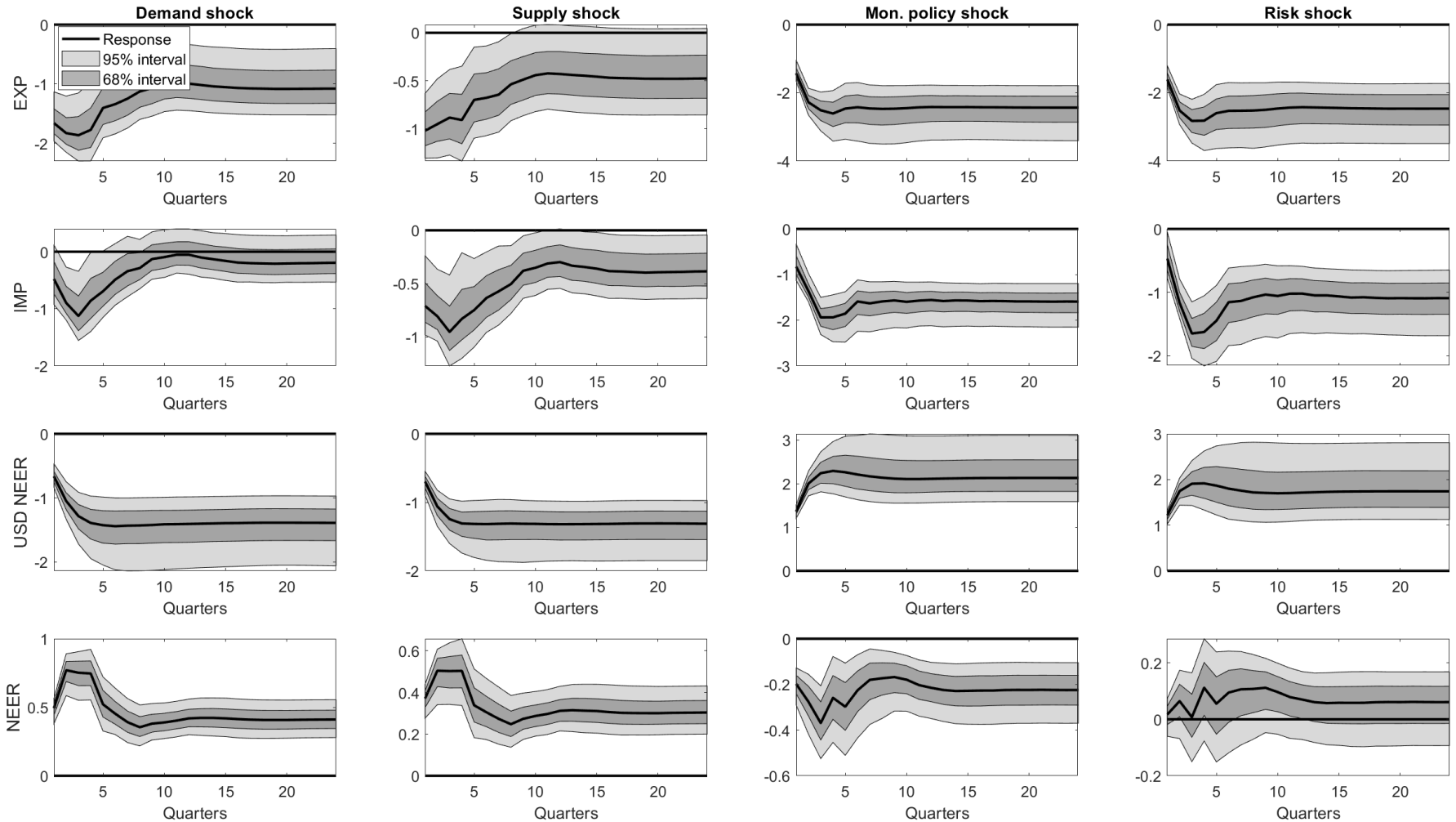

Figure: Accumulated IRFs for Germany.**Notes:** response to 1 standard deviation shock.

Impulse responses—EME (CHN)

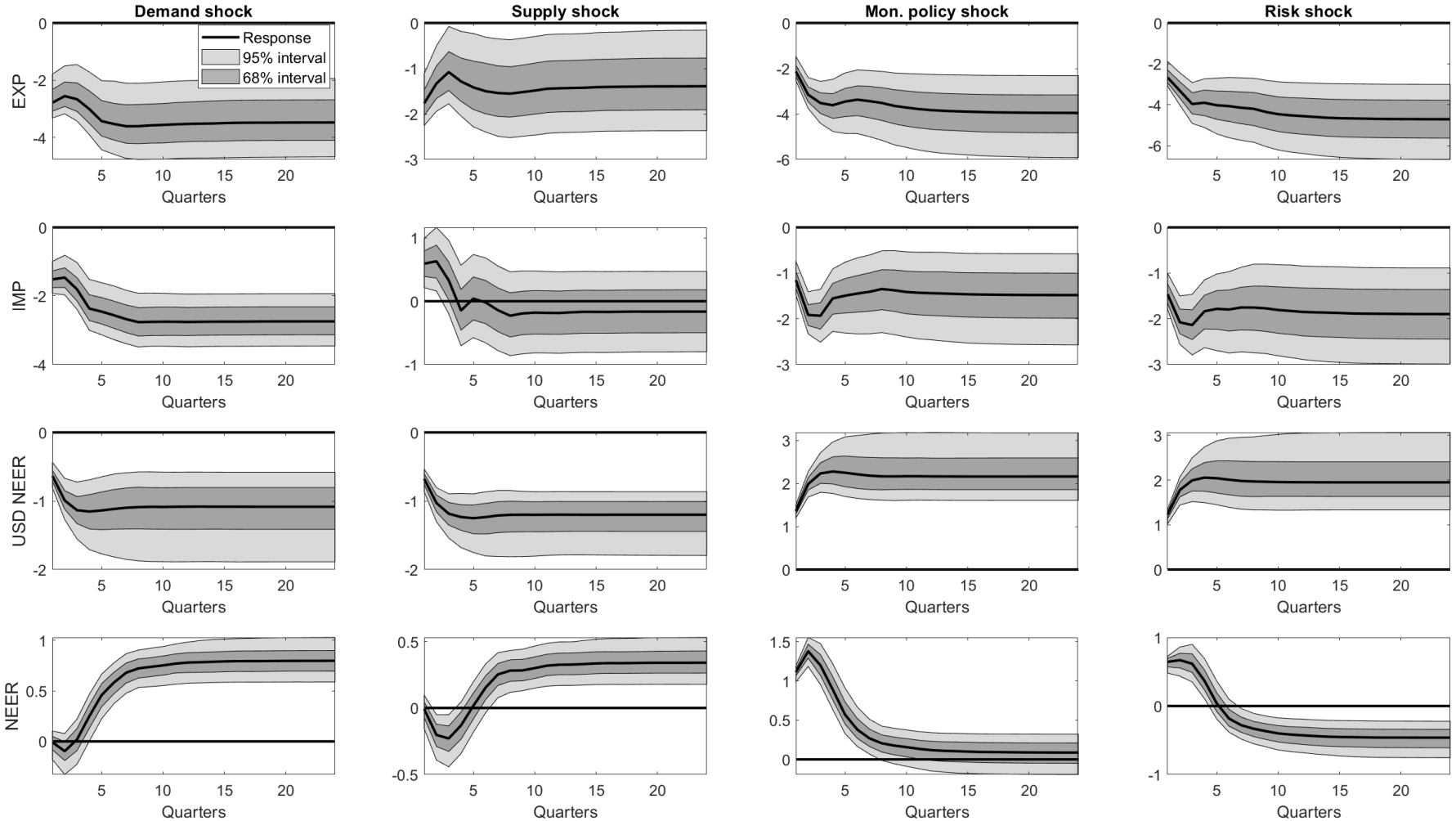

Figure: Accumulated IRFs for China. **Notes:** response to 1 standard deviation shock.

Conditional exchange rate pass-through—Exports

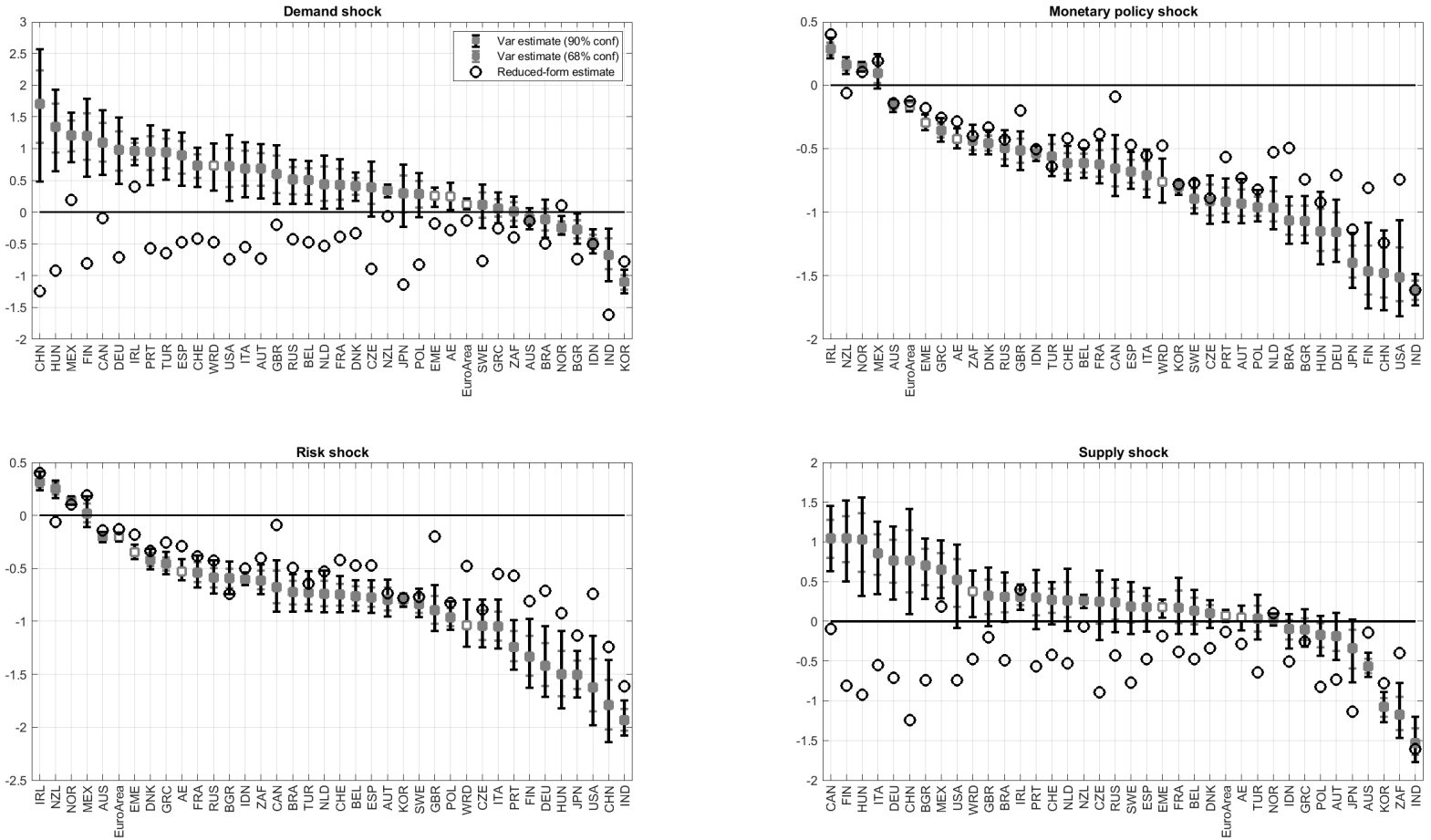

Figure: Country-specific estimates of pass-through to export volumes.

Notes: pass-through coefficients are estimated separately for each country and describe the elasticity of imports (in percent points) to a 1% USD appreciation. Black dots are the reduced-form pass-through estimates from Equation 2.

Taking stock

→ the shock matters! Reduced-form estimate differ significantly from conditional coefficients

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these hypothesis can be tested by checking the correlation of PT coefficients with observable variables.

Determinants of exchange rate pass-through – trade

	Exports				Imports			
	Demand	Mon. policy	Risk	Supply	Demand	Mon. policy	Risk	Supply
Exp. USD invoicing	**-0.021*****	**-0.003**	**-0.002**	**-0.022*****				
	(0.00)	(0.47)	(0.74)	(0.01)				
Exp. to US/GDP	0.195***	0.047	0.104*	0.301***	-0.260	-0.085	0.011	-0.436
	(0.00)	(0.33)	(0.08)	(0.00)	(0.60)	(0.64)	(0.96)	(0.50)
Net USD liab.	-0.004	-0.007*	-0.005	0.002	-0.017	-0.010**	-0.007	-0.018
	(0.47)	(0.07)	(0.33)	(0.76)	(0.15)	(0.03)	(0.31)	(0.22)
Exported fuel share	0.001	0.013**	0.016**	0.011				
	(0.92)	(0.03)	(0.03)	(0.21)				
VAX	1.103	-0.228	-0.887	-0.783	-0.255	0.090	-0.281	-2.621
	(0.53)	(0.84)	(0.51)	(0.82)	(0.95)	(0.96)	(0.90)	(0.61)
Spread vs. US	0.019	0.043	-0.021	0.097	-0.383**	0.048	-0.057	-0.424*
	(0.85)	(0.57)	(0.84)	(0.47)	(0.03)	(0.44)	(0.58)	(0.06)
Imp. USD invoicing					**-0.042****	**-0.009**	**-0.004**	**-0.051***
					(0.03)	(0.16)	(0.65)	(0.07)
Imported fuel share					0.064	0.042*	0.024	0.107
					(0.24)	(0.10)	(0.47)	(0.17)
R-squared	0.54	0.57	0.42	0.44	0.66	0.45	0.21	0.56
Observations	28	28	28	28	27	27	27	27

Notes: The Table reports coefficient estimates of $reg_static with robust standard errors in parenthesis$.

The US are excluded from the sample. Controls not reported are ΔGDP and ΔCPI. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$, + $p < 0.15$.

▸ Financial variables.

DCP and monetary policy shocks (1)

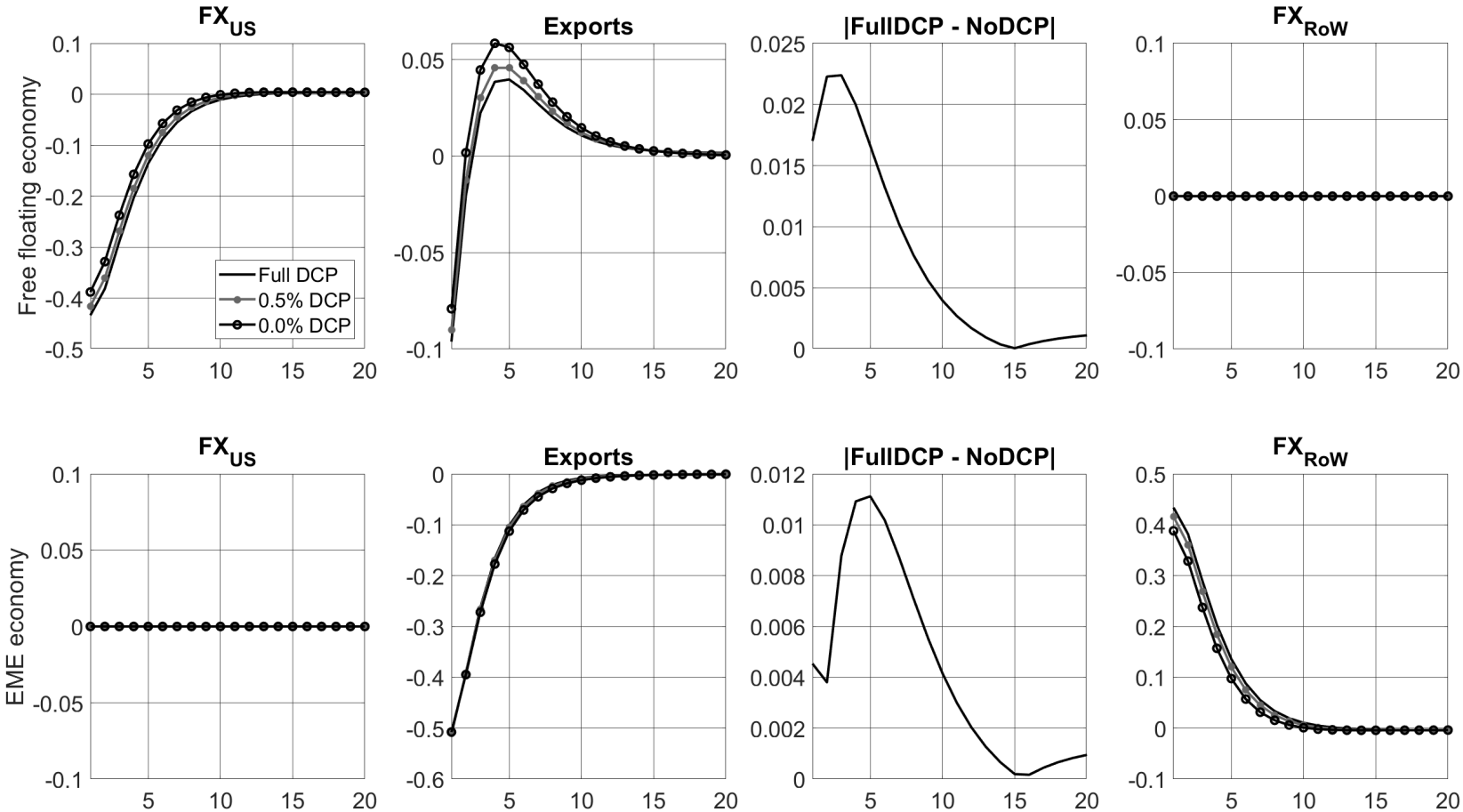


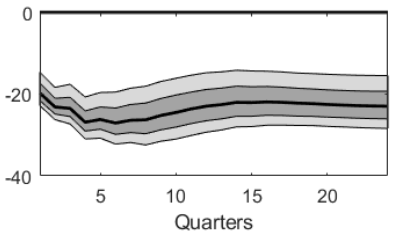
Figure: Impulse responses under different monetary policy reaction functions.

Notes: Impulse responses from Boz et all. (2020) for different DCP shares and two different reaction functions of the open economy central bank: free floating of the exchange rate (upper panel), direct response to US shocks (lower panel).

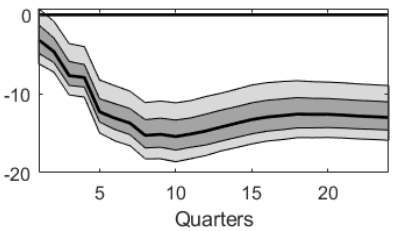
DCP and monetary policy shocks (2)

Response of 2-year rate in Germany:

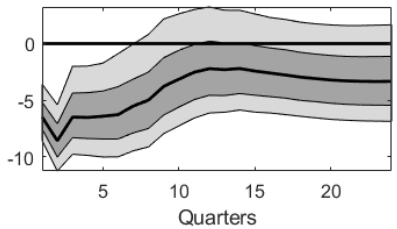
Demand shock



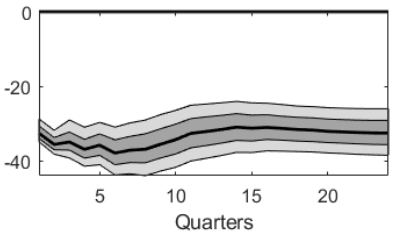
Supply shock



Mon. policy shock



Risk shock



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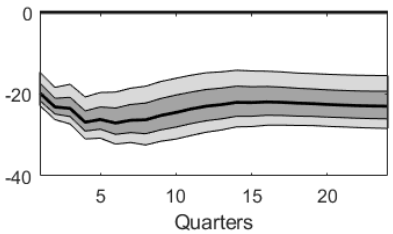

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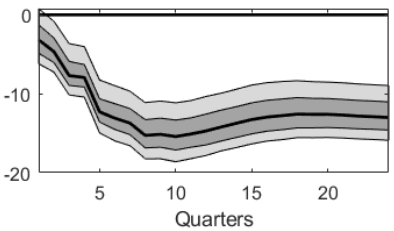

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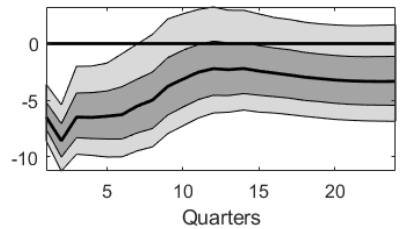
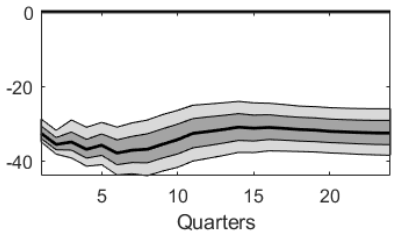
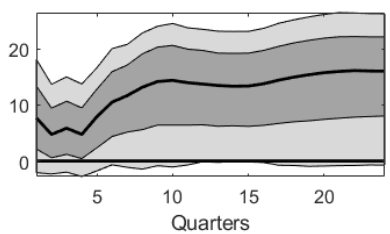


Risk shock

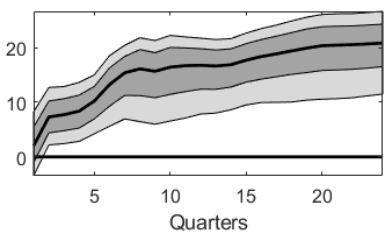


Response of 2-year rate in China:

Demand shock



Supply shock



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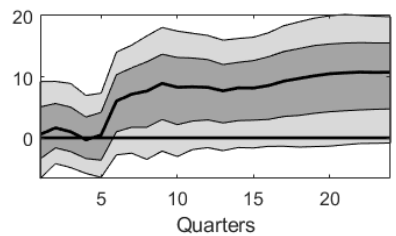
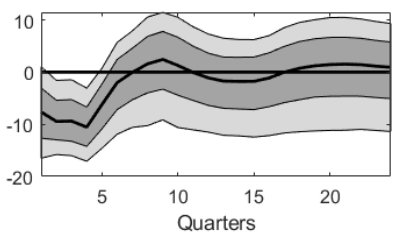


Risk shock



Conclusion

- We provide an estimate of shock-dependency and cross-country heterogeneity of US dollar pass-through to trade and financial variables
- Pass-through is highly shock dependent
  - Reduced-form regression are driven by mix of shocks
- Large degree of cross country heterogeneity
  - Country characteristics matter: trade and financial linkages and invoicing
  - Size and sign of determinants vary across shocks and variables depending on specific transmission channels
  - In EMEs domestic policy reacts to monetary policy induced US dollar appreciations
- Policy implications: Appropriate policy reaction to US dollar movements depends on underlying shock driving US dollar

Appendix

Reduced-form estimates

Similar to Boz et al. (2020) we estimate the USD pass-through to export and import volumes as:

$$\Delta x_t = \alpha + \beta \Delta e_t + \sum_{i=1}^{N} X_{t-i}\Gamma + \varepsilon_t \tag{3}$$

where: Δx_t is the real export (import) change, Δe_t the USD nominal effective exchange rate change and X_{t-i} a set of control variables to capture the economic cycle.

The coefficient β is the trade elasticity to a USD appreciation.

Reduced-form estimates — real exports

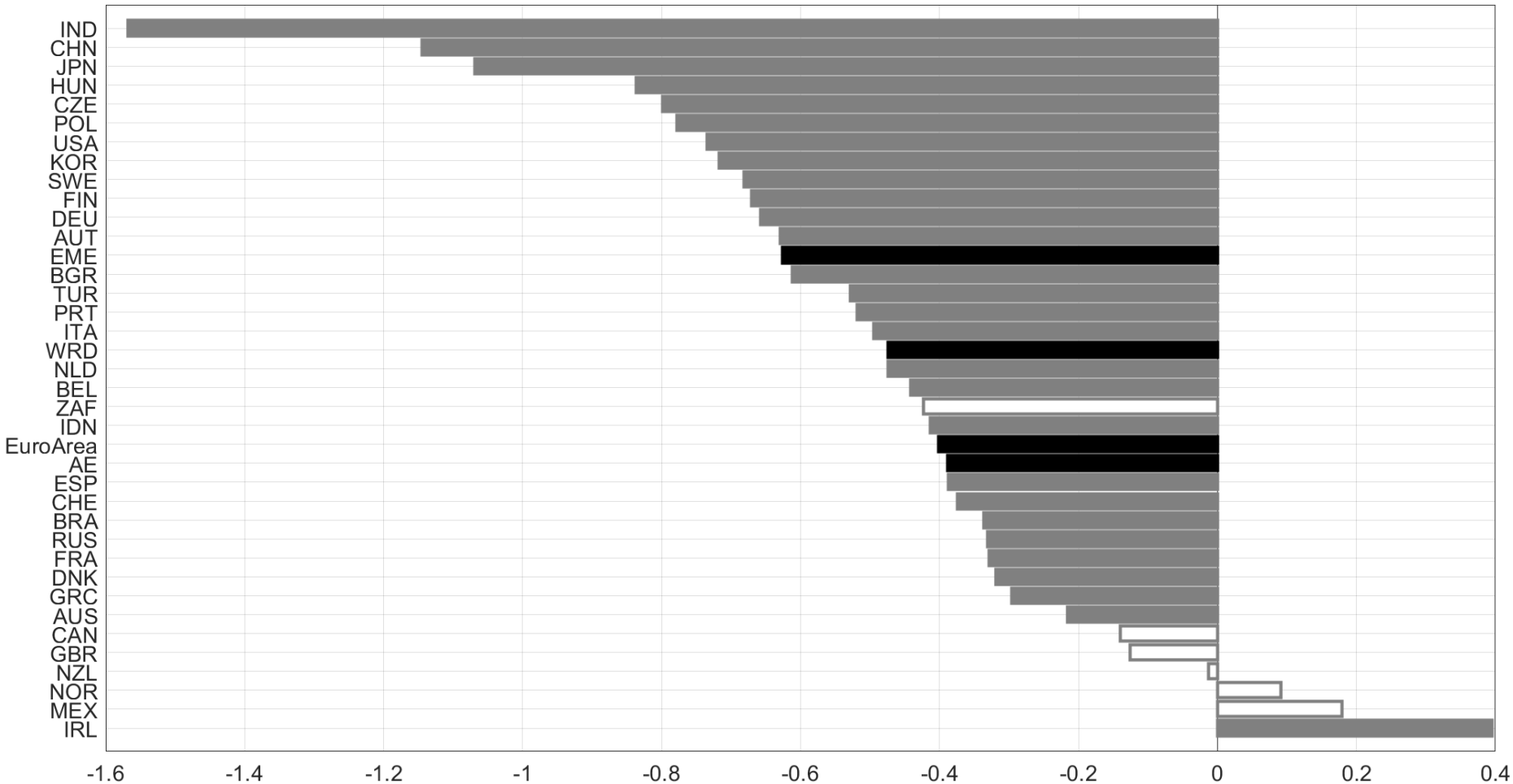


Figure: Estimates of β for real exports.
Notes: white bars indicate insignificant coefficients, black bars indicate country aggregates.

Reduced-form estimates — real imports

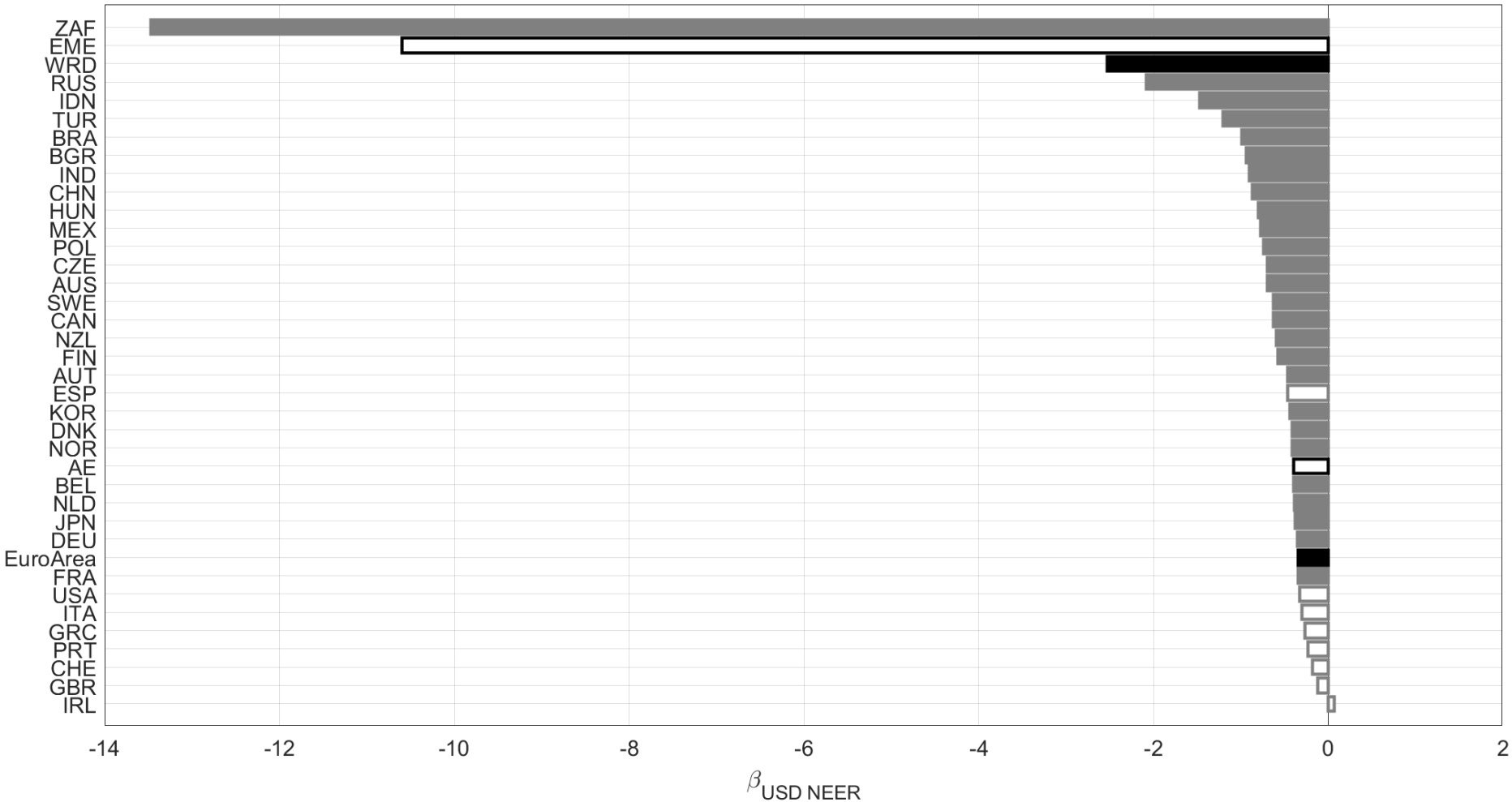


Figure: Estimates of β for real imports.

Notes: white bars indicate insignificant coefficients, black bars indicate country aggregates.

Shocks statistics

Table: Description of US variables and structural shocks

	QoQ RGDP	QoQ 10-year	QoQ USD	QoQ CPI
Mean	0.55	-0.05	0.29	-0.01
Std	1.36	0.35	2.45	0.52
	Demand	Mon. policy	Risk	Supply
Mean	0.00	0.00	0.00	0.00
Std	0.85	0.85	0.82	0.81

Notes: US variables are expressed in pecent quarter on quarter changes. Structural shocks are the median identified shocks.

Table: Correlation across structural shocks

	Demand shock	Mon. policy shock	Supply shock	Risk shock
Demand shock	1.000	-0.006	0.066	0.006
		(0.952)	(0.520)	(0.953)
Mon. policy shock		1.000	0.007	-0.039
			(0.943)	(0.702)
Supply shock			1.000	-0.103
				(0.314)
Risk shock				1.000

Notes: correlation between median structural shocks. P-values for the null-hypothesis of $\neq 0$ correlation are reported in parenthesis below correlation coefficients.

Go back.

Impulse responses

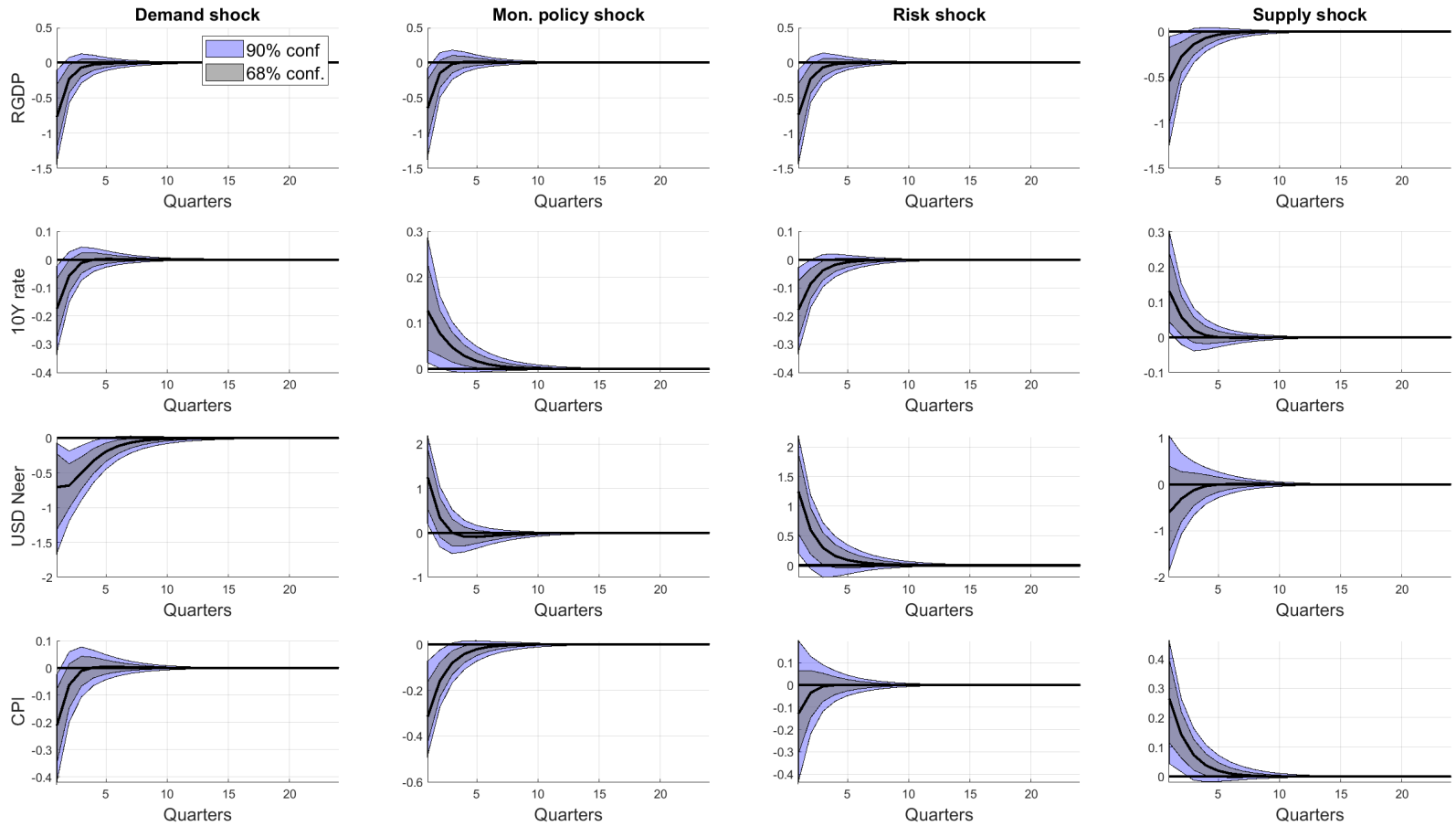


Figure: Impulse responses (in percent) of the VAR described by Equation 1.

Go back.

Historical decomposition—USD NEER

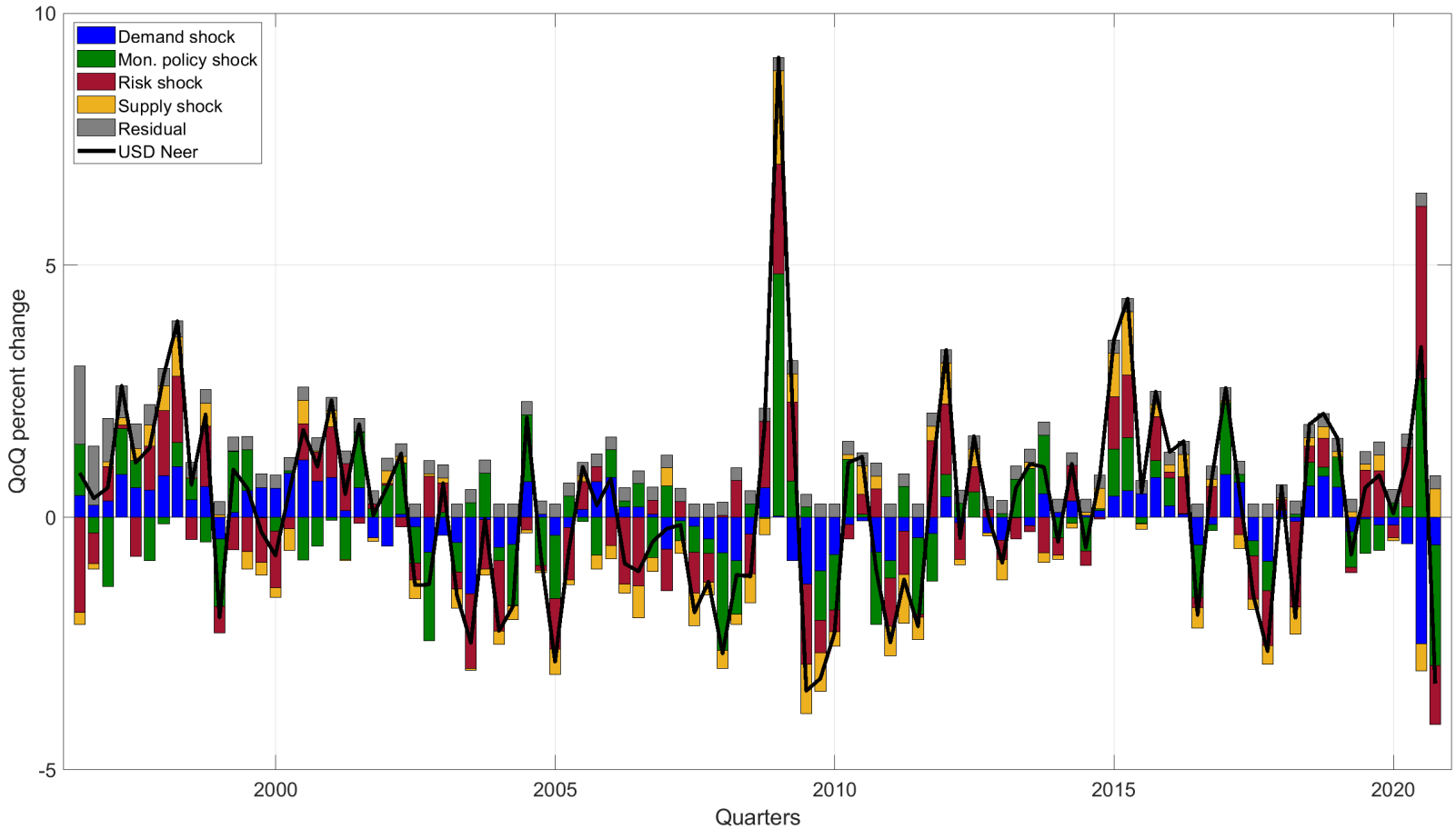
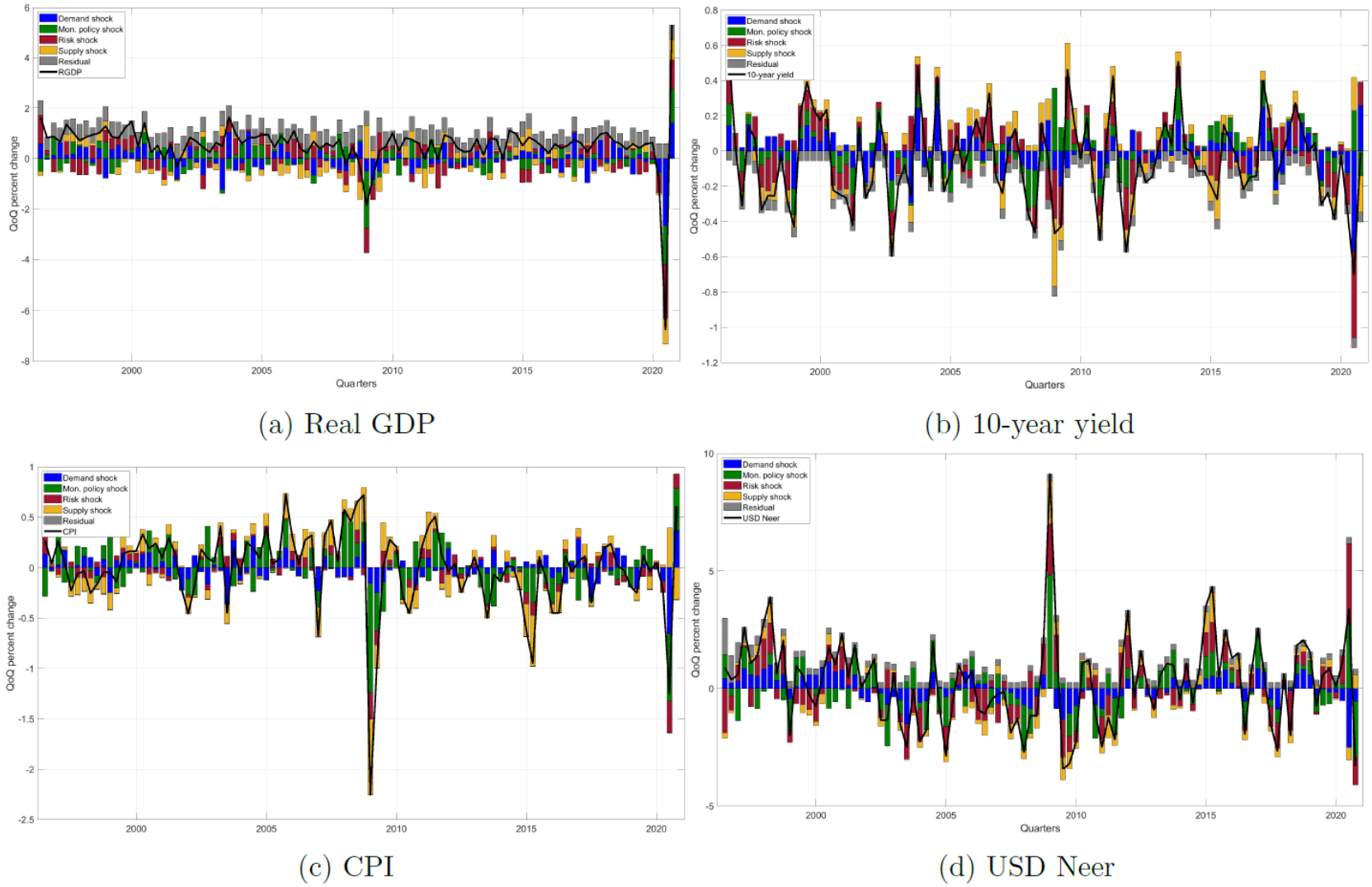


Figure: Historical decomposition of the US dollar nominal effective exchange rate.

▸ Shocks statistics. ▸ Other variables. ▸ Impulse responses. ▸ Go back.

HD – all variables



(a) Real GDP

(b) 10-year yield

(c) CPI

(d) USD Neer

Figure: Historical decomposition – all variables.

Go back

Computing responses

If S is a shock, the dynamic response to S can be computed as:

$$Y_t = A_0 + \sum_{i=1}^{N} A_i Y_{t-1} + CS_t + B\mathcal{E}_t \tag{4}$$

because S is the variable of interest, no identification assumptions on B are needed. A_0, A_i and C can be estimated in reduced-form. We estimate:

- ✓ all identified shocks from Equation 1 are included in S
- ✓ because S is generated, confidence intervals are computed by drawing 1000 times from the posterior of Equation 1
- ✓ we estimate a "real" and a "financial" VAR for each country
- ✓ in the "real" VAR $Y = [\Delta EXP, \Delta IMP, \Delta NEER_{USD}, \Delta NEER_k, \Delta RGDP]$
- ✓ in the "financial" VAR $Y = [\Delta Stock, \Delta 10Y, \Delta NEER_{USD}, \Delta NEER_k, \Delta RGDP]$

Go back.

Conditional exchange rate pass-through—Imports

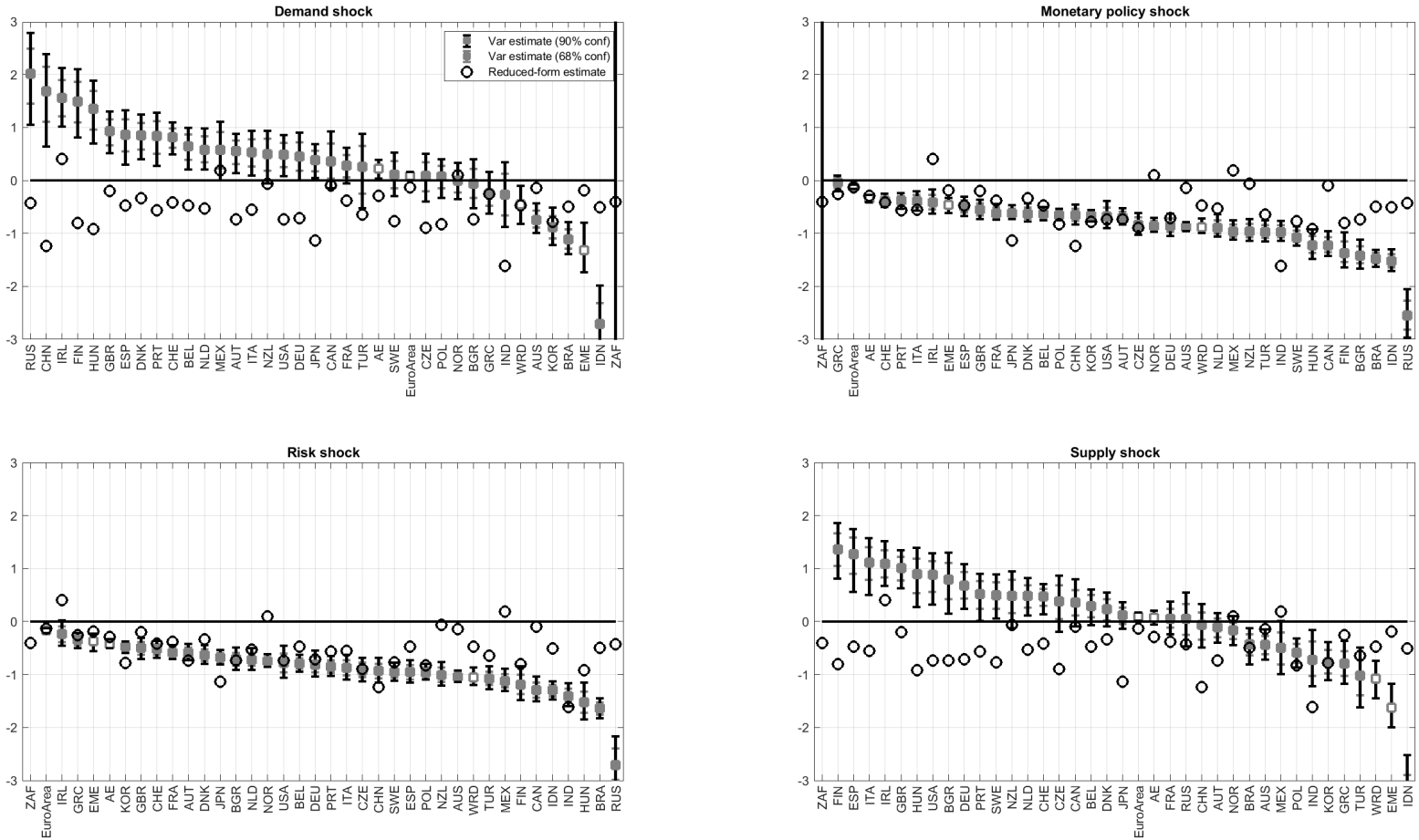


Figure: Country-specific estimates of pass-through to import volumes.

Notes: pass-through coefficients are estimated separately for each country and describe the elasticity of imports (in percent points) to a 1% USD appreciation. Black dots are the reduced-form pass-through estimates from Equation 3.

Conditional exchange rate pass-through—Equity

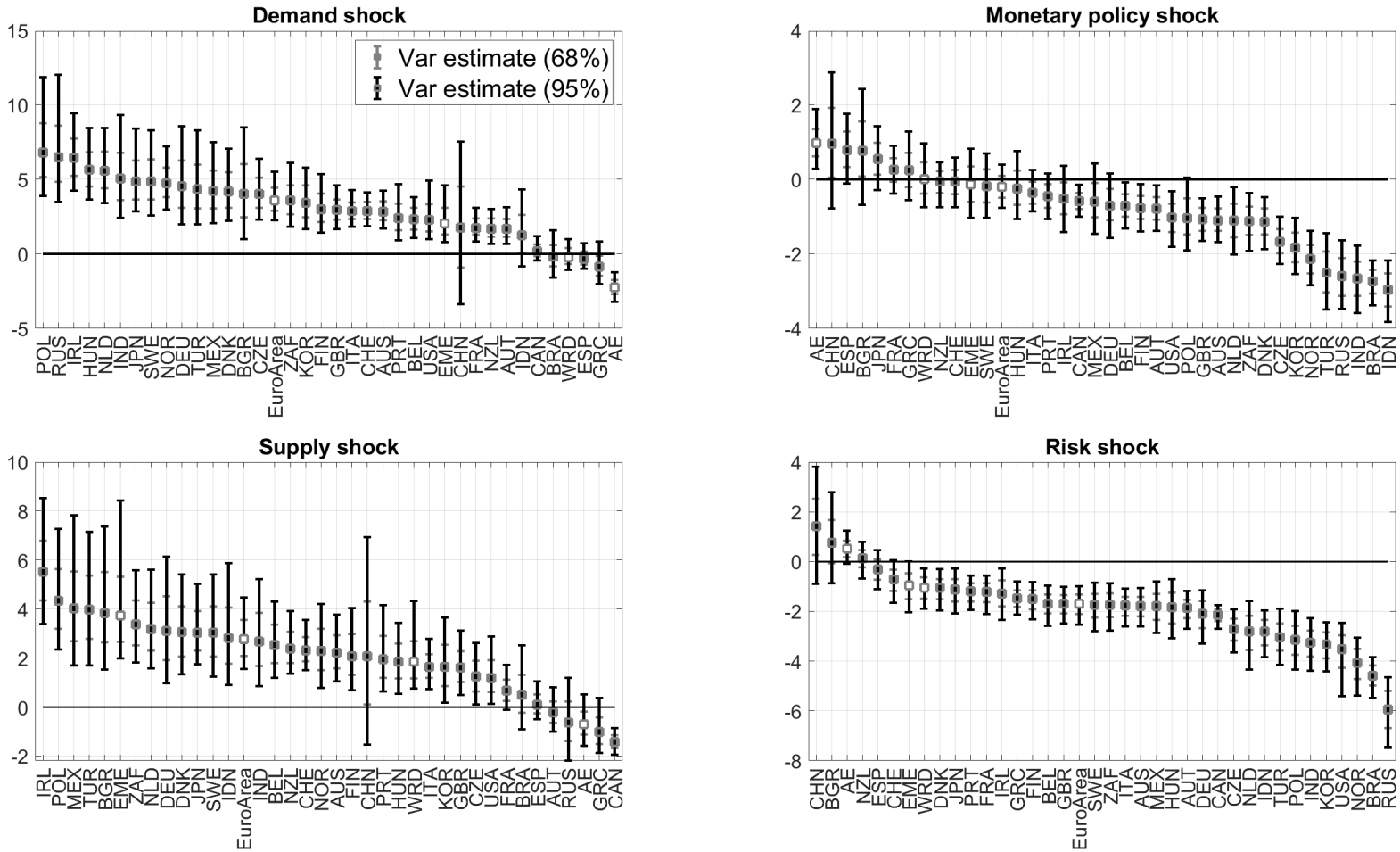


Figure: Country-specific estimates of the pass-through to equity prices.

Notes: pass-through coefficients are estimated separately for each country and describe the elasticity of equity indices (in percent points) to a 1% USD appreciation.

Conditional exchange rate pass-through— 10-year yield

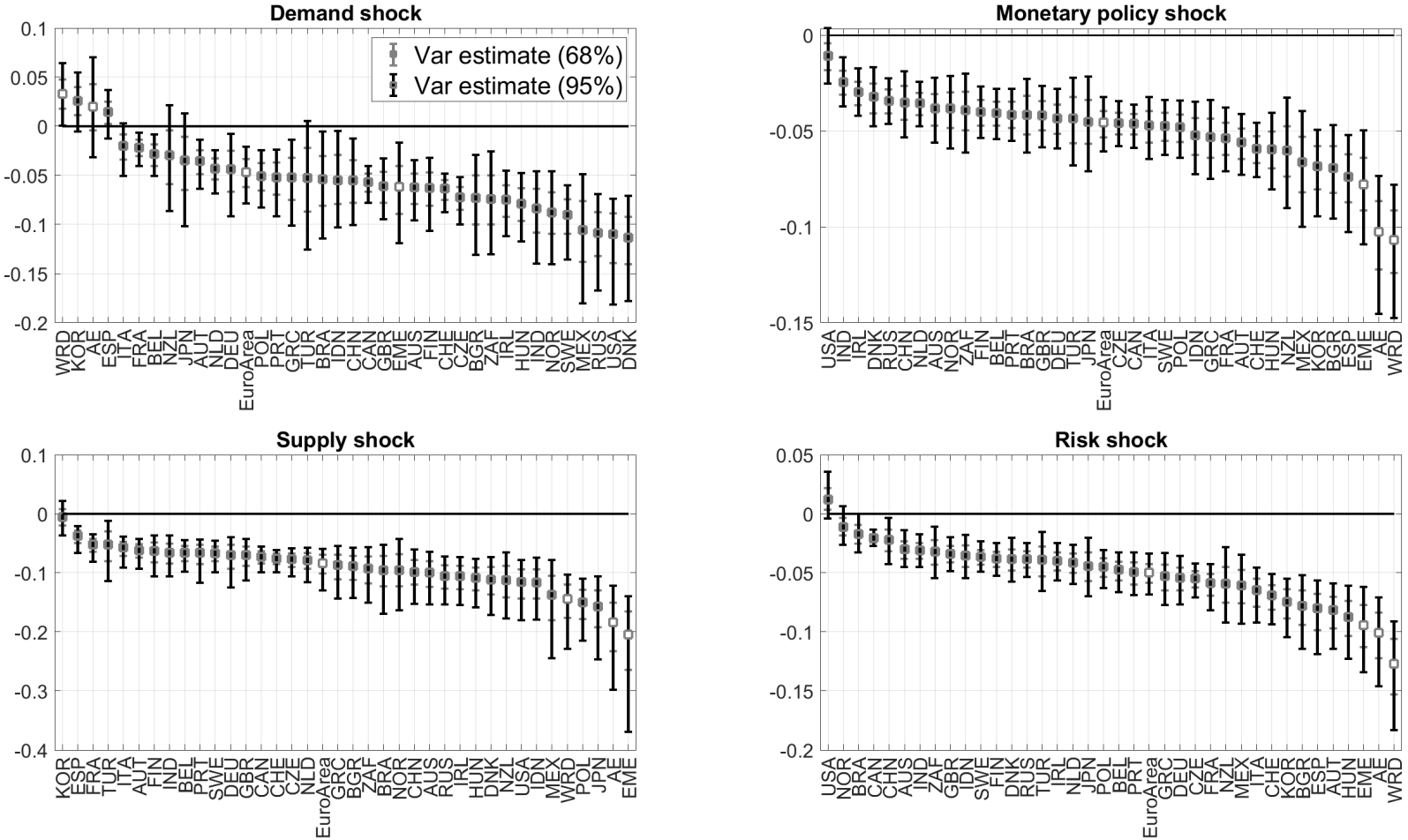


Figure: Country-specific estimates of the pass-through to FCIs.

Notes: pass-through coefficients are estimated separately for each country and describe the

Determinants of exchange rate pass-through – financial markets

	Equity prices				10-year yields			
	Demand	Mon. policy	Risk	Supply	Demand	Mon. policy	Risk	Supply
Exp. USD invoicing	0.056*	-0.019*	-0.007	0.063**	0.012	-0.002	-0.001	-0.021
	(0.06)	(0.09)	(0.63)	(0.05)	(0.52)	(0.55)	(0.49)	(0.43)
Exp. to US/GDP	-0.700**	0.274**	0.151	-0.771	-0.063	0.019	0.008	0.073
	(0.02)	(0.04)	(0.42)	(0.27)	(0.68)	(0.48)	(0.62)	(0.71)
Net USD liab.	-0.020	-0.000	-0.017	-0.058	-0.000	0.001	0.001	-0.002
	(0.29)	(0.98)	(0.23)	(0.21)	(0.99)	(0.49)	(0.41)	(0.87)
Exported fuel share	0.004	-0.031***	-0.039***	-0.002	-0.007	0.003	0.003	0.012
	(0.86)	(0.00)	(0.01)	(0.96)	(0.66)	(0.23)	(0.20)	(0.55)
VAX	-16.995*	3.919	-1.187	-26.695**	2.312	-0.830	-0.291	1.843
	(0.06)	(0.29)	(0.79)	(0.03)	(0.49)	(0.16)	(0.56)	(0.68)
Spread vs. US	-0.708	-0.009	-0.010	-0.576	0.645	-0.161**	-0.080	-0.405
	(0.18)	(0.97)	(0.96)	(0.39)	(0.18)	(0.02)	(0.16)	(0.56)
R-squared	0.46	0.36	0.59	0.43	0.43	0.63	0.47	0.32
Observations	27	27	27	27	27	27	27	27

Notes: The Table reports coefficient estimates of reg$_s$*taticwithrobuststandarderrorsinparenthesis*.

The US are excluded from the sample. Controls not reported are ΔGDP and ΔCPI. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$, + $p < 0.15$.

Go back.