

Conditional exchange rate pass-through: evidence from Sweden

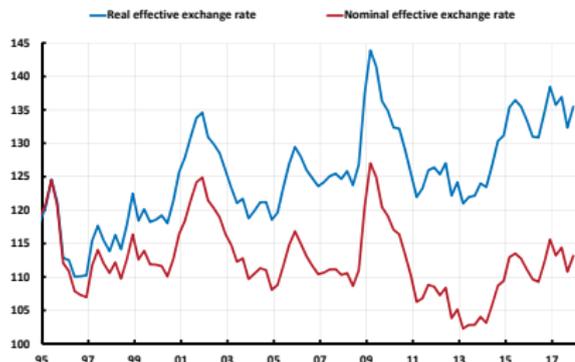
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¹The views expressed are solely the responsibility of the authors and should not to be interpreted as reflecting the views of Sveriges Riksbank.

Weak exchange rate and low inflation in Sweden



- Exchange rate is crucial for Sweden, a small VERY open economy (trade openness index = 82%);
- The impact of the exchange rate on inflation is of first order importance for an inflation targeter like the Riksbank.

Pass-through in DSGE models

- The Riksbank's open economy DSGE model (Ramses) identifies risk premium shocks as main drivers of the weak exchange rate of the last years, while mark-up shocks play a large role for the contemporaneous low inflation (since risk premium shocks feature high pass-through).
- Ramses, like many other open economy DSGE model, features the "exchange rate disconnect" (Obstfeld and Rogoff, 2000): the exchange rate is mostly driven by the risk premium shock (its own shock).

⇒ But a different class of models can tell us a different story...

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Empirical estimation of exchange rate pass-through

- Empirically, ERPT usually derived through univariate regressions:
Gagnon and Ihrig (2004) for consumer prices in Sweden (2%),
Campa and Goldberg (2005) for import prices in Sweden (38%).

BUT the exchange rate movements are due to different shocks and the small average ERPT may hide a different shock-specific picture.

For example, after a positive local demand shock:

- exchange rate appreciates
- import prices cheaper
- demand for goods increases \Rightarrow prices may go up or down
- central bank to respond with tighter or looser policy?

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Question

What is the exchange rate pass-through to consumer and import prices in Sweden conditional on the shock hitting the economy?

Preview of results

We estimate 2 structural BVAR models to gauge the CERPT to consumer prices and import prices, using zero short and long-run restrictions and sign restrictions.

Main results:

- exogenous exchange rate shock is *not* the main driver of exchange rate, while demand shocks are;
- domestic and global demand shock features a "reverse-sign" CERPT to consumer prices.

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Related Literature on BVAR models

- Shambaugh (2008)
- Forbes et al. (2018), extended to Euro Area by Comunale and Kunovac (2017). Similar model estimated also for other economies, including Sweden, by Forbes et al. (2017).

→ we obtain better identified global shocks, due to the inclusion of foreign quantities;

→ we find negative ERPT also for global demand shocks, very important for a SOE.

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Definition

We define the Conditional Exchange Rate Pass-Through as the ratio of the cumulative impulse response of prices to that of the exchange rate after an exogenous shock s in horizon k :

$$CERPT_{s,k} = \frac{\sum_{j=0}^k \Delta Price Index_j}{\sum_{j=0}^k \Delta NEER_j} \quad (1)$$

Data and Estimation

Sample: 1995q2 - 2017q2. Variables in first difference:

- Nominal Effective Exchange Rate of the Krona (KIX weights);
- CPIF;
- Repo rate minus neutral rate (Strid and Bonomolo, forthcoming);
- Relative GDP (SWE/Foreign);
- Foreign GDP (KIX weights);
- Foreign CPI (KIX weights).

BVAR model is written in deviation from steady state, as in Villani (2009), and restrictions are imposed with algorithm proposed by Arias et al. (2014).

Using the relative GDP

We assume that SWE GDP and KIX GDP are cointegrated

⇒ therefore we only need zero long-run restrictions for KIX GDP and they apply also to SWE GDP

⇒ only global supply shock affects GDPs in the long run

this corresponds to the assumption in many SOE DSGE models that permanent technology shocks are global (Adolfson et al. (2007), (Christiano et al., 2011)). [Graph of Relative GDP](#)

Identification

	Exog ER shock	SWE demand shock	SWE mon pol shock	SWE supply shock	Global demand shock	Global supply shock
Short-run restrictions						
SWE nom ER	+	-	-			
SWE CPI	+	+	-	-		
SWE int rate	+	+	+			
Relative GDP		+	-	+		
KIX GDP	0	0	0	0	+	-
KIX CPI	0	0	0	0		+
Long-run restrictions						
SWE nom ER						
SWE CPI						
SWE int rate						
Relative GDP						
KIX GDP					0	
KIX CPI						

Note: The signs on the diagonal are included in the table for clarity, and are only there for normalization purposes. Only for the global supply shock, the (-) sign restriction is imposed for 2 quarters following the shock. KIX CPI and KIX GDP are set as exogenous.

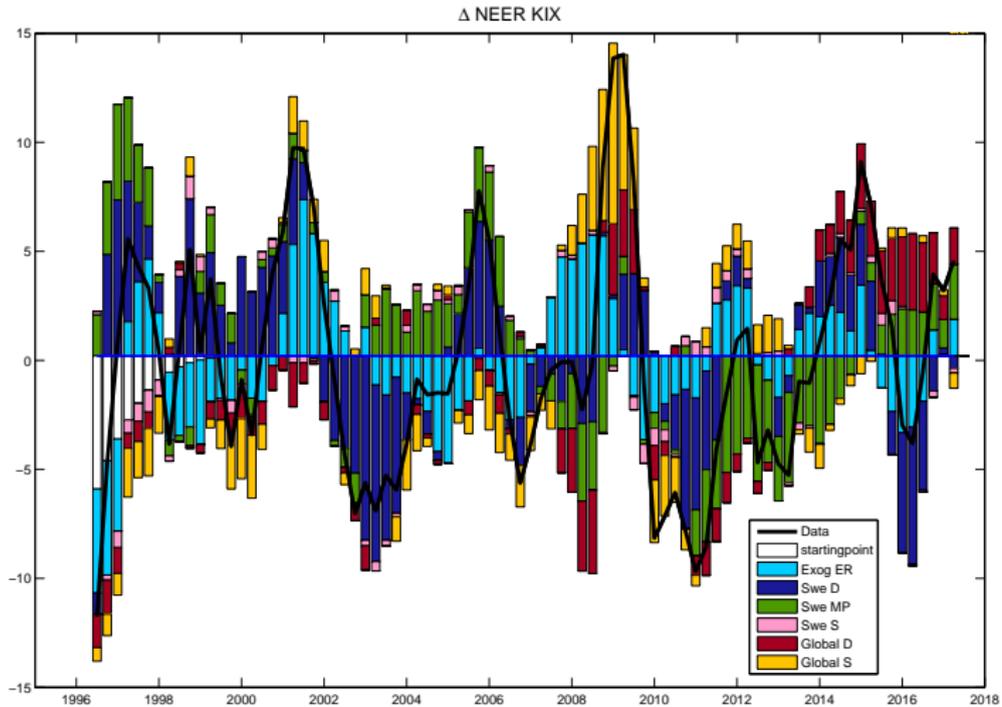
The role of demand shocks for NEER

Table: Forecast error variance decomposition of NEER

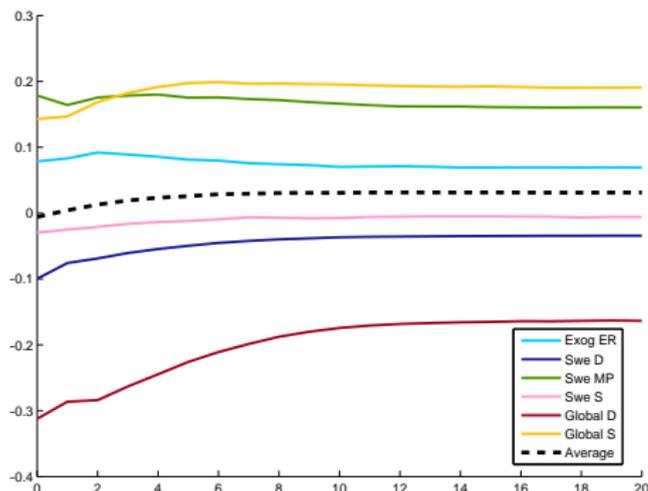
	Exog ER	SWE D	SWE MP	SWE S	Global D	Global S
NEER	22	32	13	13	9	11

Note: The numbers represent percentages of the forecast error variance due to each shock at the 1 year horizon.

Historical Decomposition of NEER

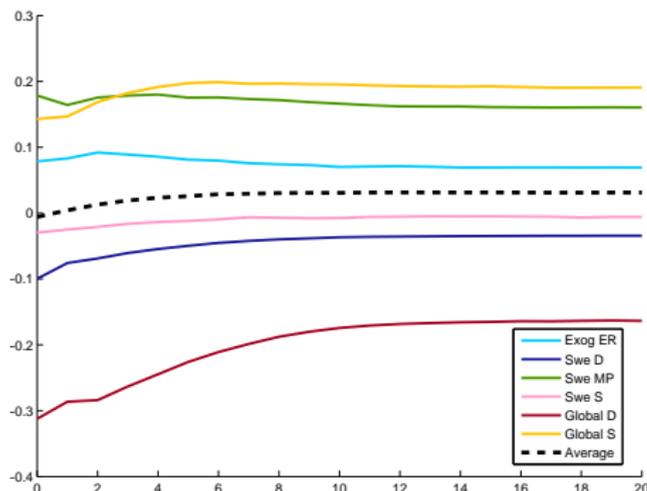


CERPT to consumer prices after 1% depreciation



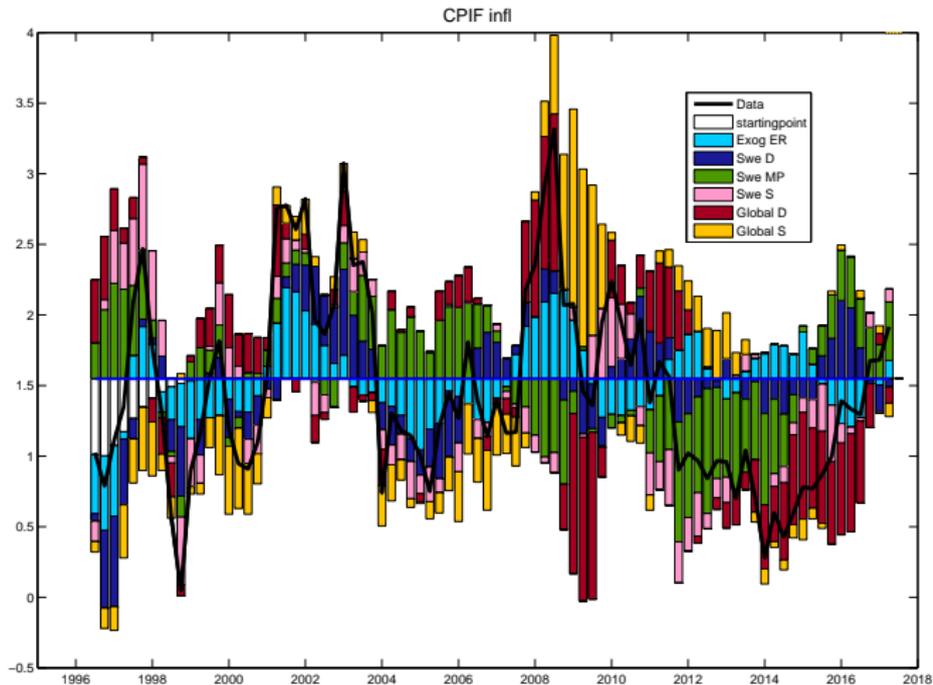
The exchange rate pass-through is negative after demand shocks: despite weaker Krona, firms decrease prices due to weak demand conditions, possibly due to pricing-to-market strategies.

CERPT to consumer prices after 1% depreciation



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Historical Decomposition of CPIF



Data and Estimation

Sample: 1995q2 - 2017q2. Variables in first difference:

- Nominal Effective Exchange Rate of the Krona (KIX weights)
- CPIF
- Repo rate minus neutral rate (Strid and Bonomolo, forthcoming)
- GDP
- Foreign CPI (KIX weights)
- import price index IMPI → robustness: import price deflator

BVAR model is written in deviation from steady state, as in Villani (2009), and restrictions are imposed with algorithm proposed by Arias et al. (2014).

Identification

	Exog ER shock	SWE demand shock	SWE mon pol shock	SWE supply shock	Global demand shock	Global supply shock
Short-run restrictions						
SWE nom ER	+	-	-			
SWE CPIF	+	+	-	-		
SWE int rate	+	+	+			
SWE GDP		+	-	+		-
KIX CPI	0	0	0	0	+	
SWE IM pr	+					+
Long-run restrictions						
SWE nom ER						
SWE CPIF						
SWE int rate						
SWE GDP	0	0	0		0	
KIX CPI	0	0	0	0		
SWE IM pr						

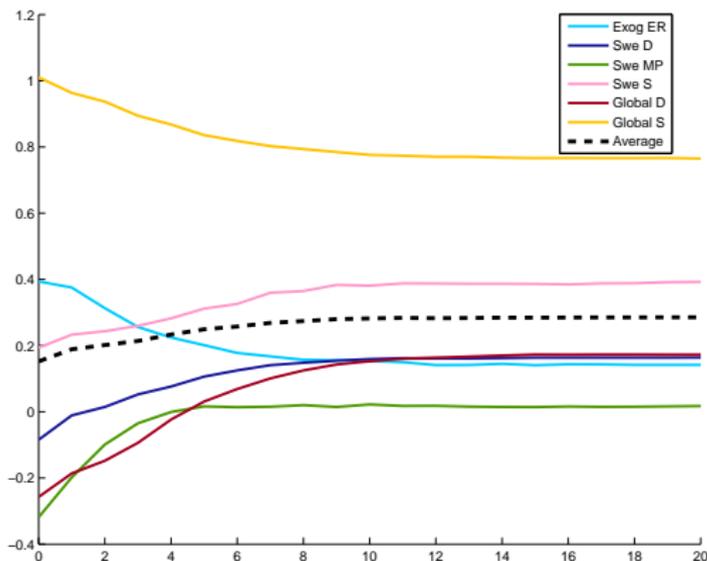
Note: The signs on the diagonal are included in the table for clarity, and are only there for normalization purposes.

FEVD of NEER

	Exog ER	SWE D	SWE MP	SWE S	Global D	Global S
NEER	16	21	8	10	27	18

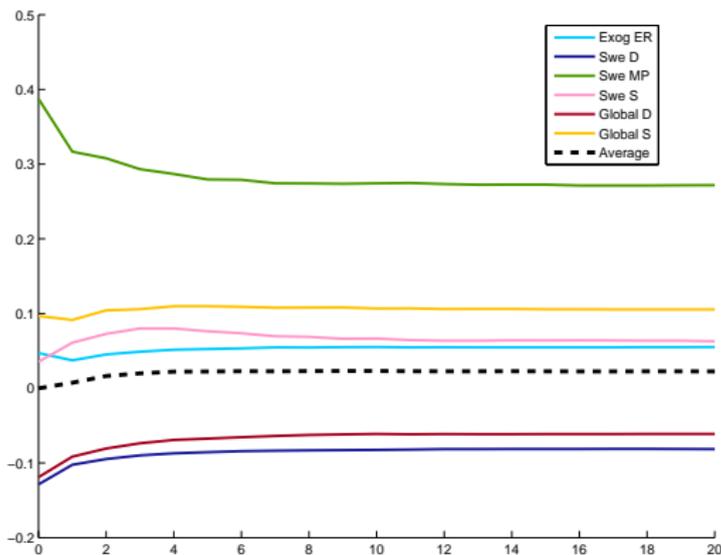
Note: The numbers represent percentages of the forecast error variance due to each shock at the 2 year horizon (there is little variation across horizons).

CERPT to import prices after 1% depreciation



Demand shocks feature low ERPT to import prices.

CERPT to consumer prices after 1% depreciation



Demand shocks feature a negative ERPT to consumer prices.

Robustness checks

Data

- domestic CPIF; CERPT
- imported CPIF; CERPT
- shadow rate to take into account QE from 2015 (De Rezende and Ristinemi, 2018);
- import price deflator and CPI index for imported goods.

Identifying restrictions:

- no restriction for response of exchange rate to domestic demand shock; CERPT
- first-year average (+) response of interest rate to domestic demand shock;
- first-year average (+) response of CPIF to monetary policy shock.

Conclusions

- Exogenous exchange rate shock is not the main driver of the exchange rate and CERPT following ER shocks is low (5–10%);
- Highest CERPT obtained after global supply shocks and monetary policy shocks;
- Local *and* global demand shock feature a negative CERPT to consumer prices.

⇒ This is very important since Sweden is a SOE and global shocks are main drivers of the business cycle (Lindé (2003), Bonomolo et al. (2018)).

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APPENDIX

SWE GDP and KIX GDP cointegrated

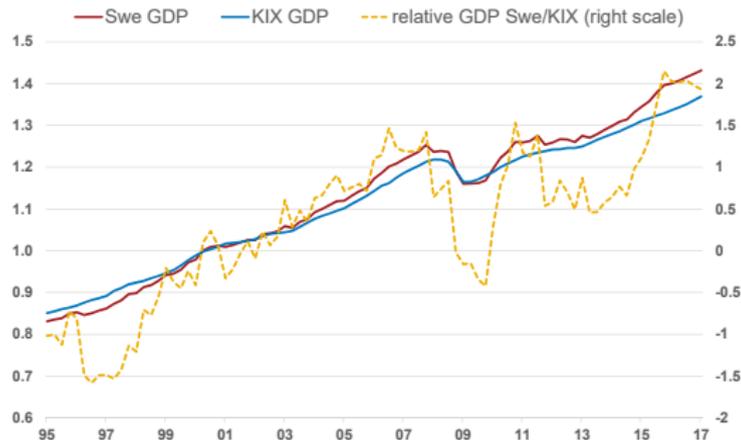
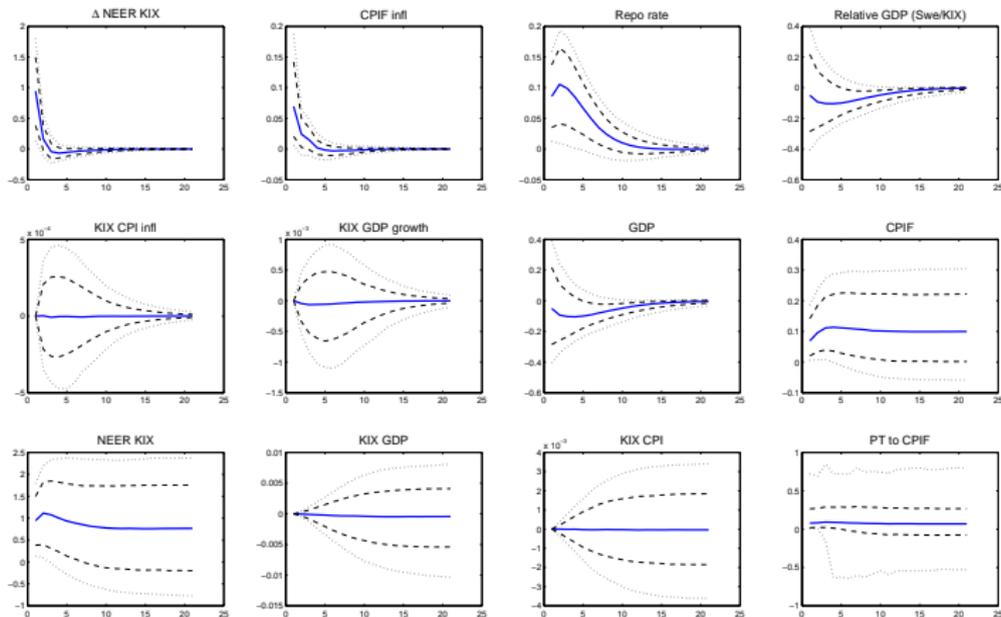


Figure: GDP series are rescaled to the same base year (2000). The relative GDP is in log difference (right scale).

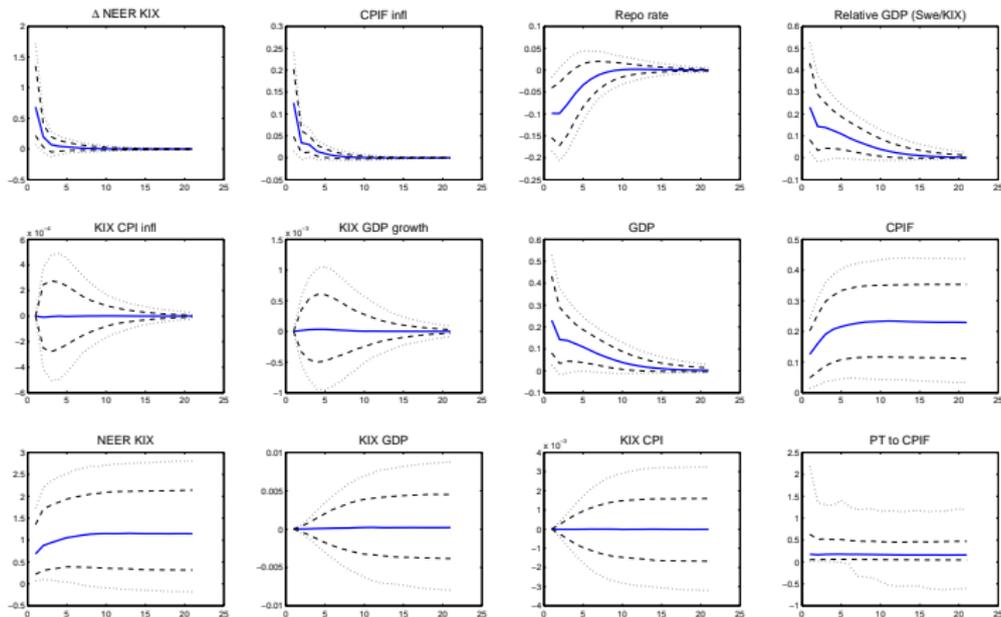
The series is filtered with a quadratic trend at the steady state.

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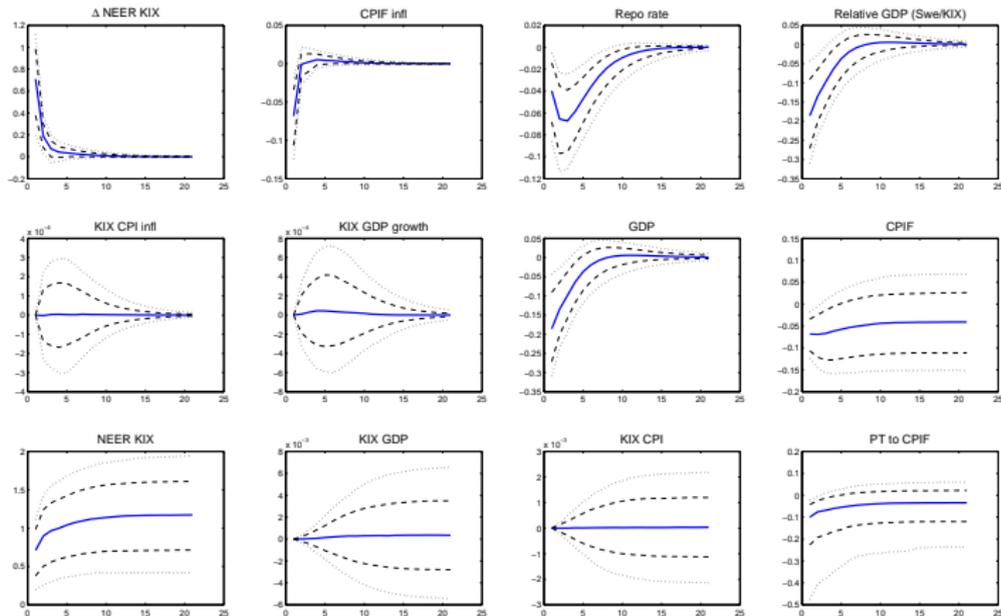
Rescaled IRFs - Exchange rate shock



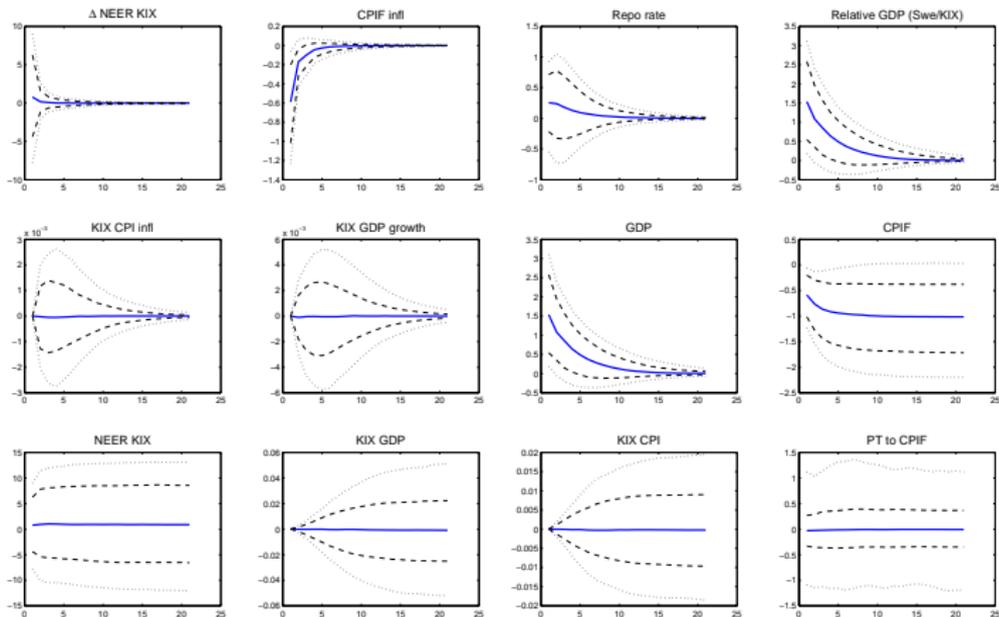
Rescaled IRFs - Swedish monetary policy shock



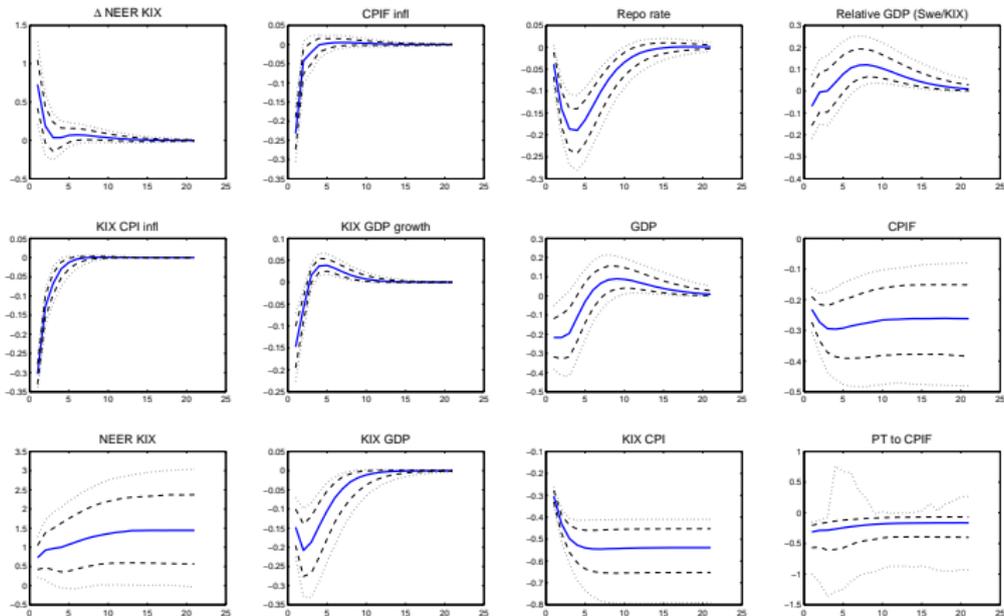
Rescaled IRFs - Swedish demand shock



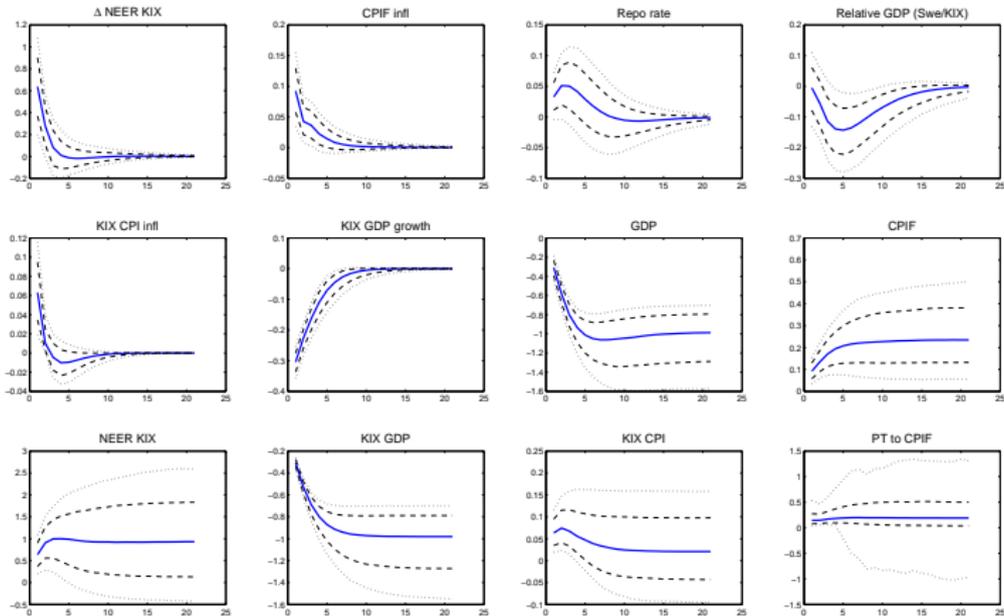
Rescaled IRFs - Swedish supply shock



Rescaled IRFs - Global demand shock

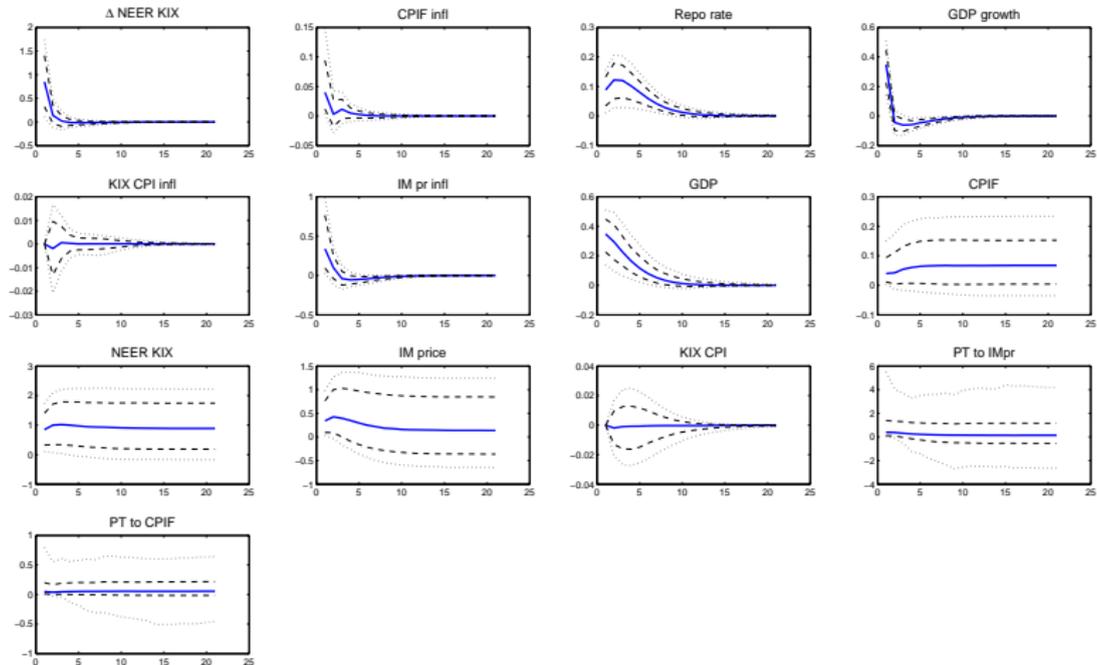


Rescaled IRFs - Global supply shock

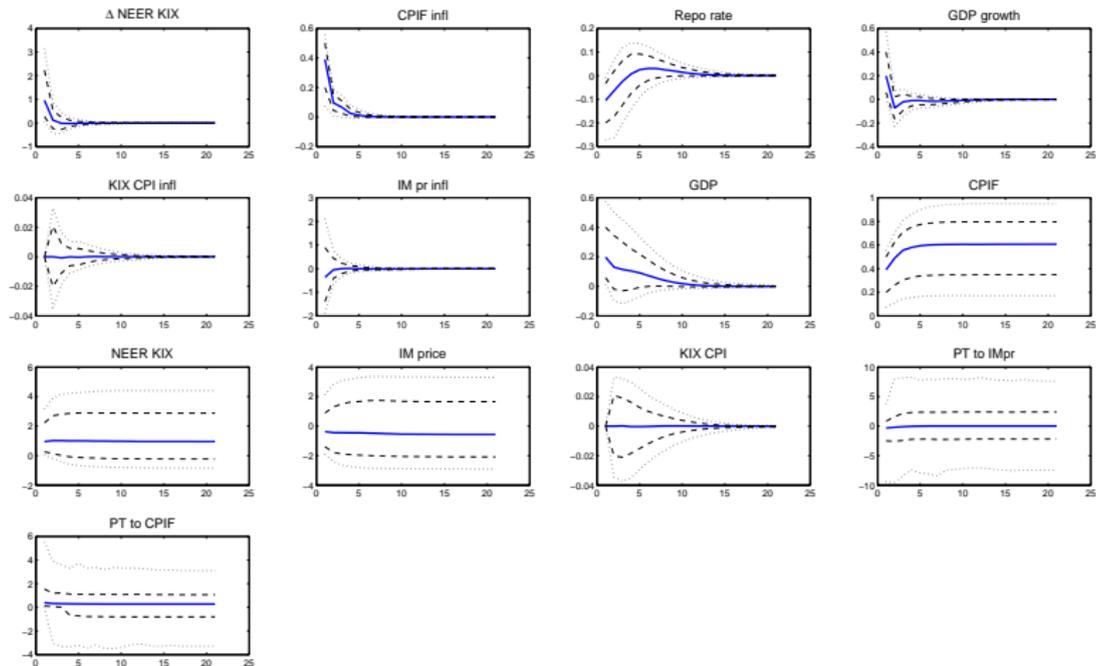


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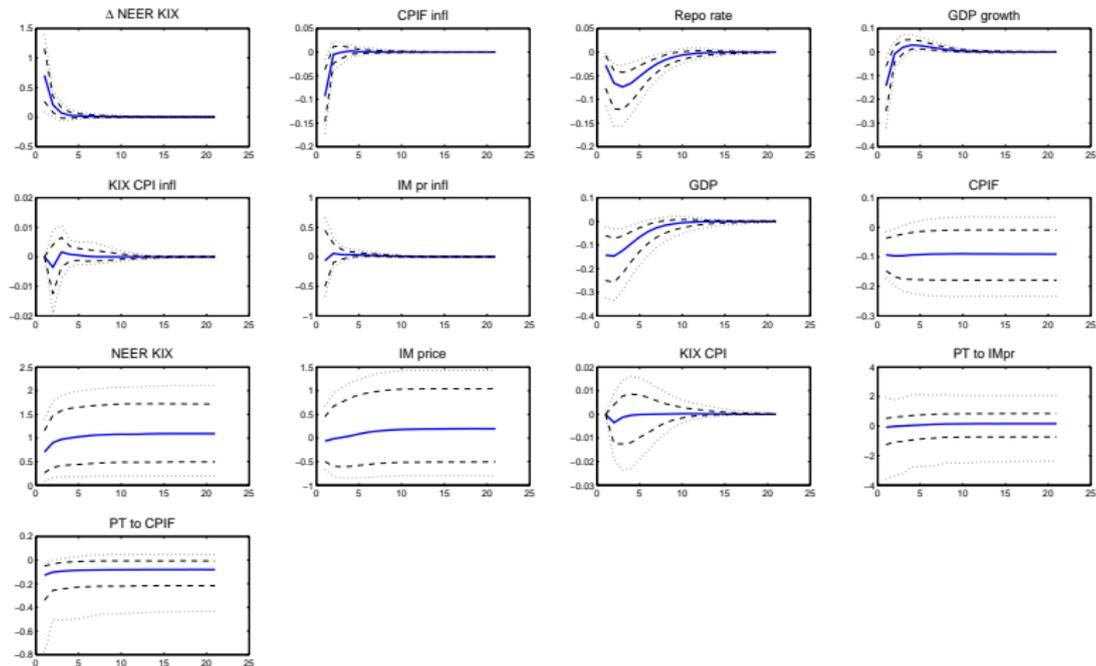
Rescaled IRFs - Exchange rate shock



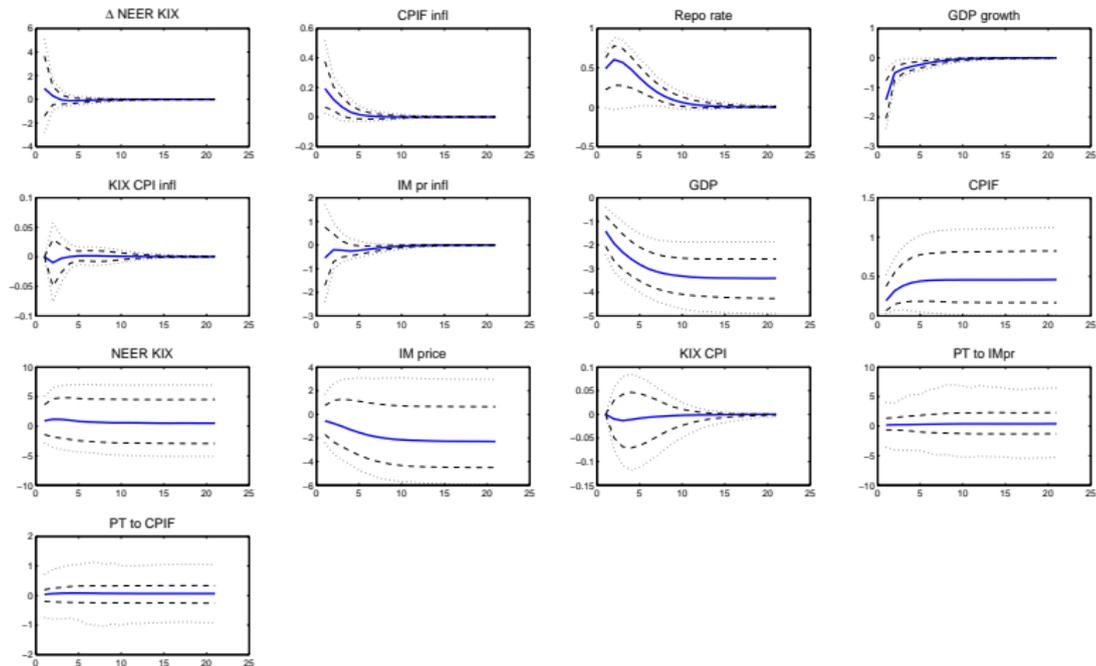
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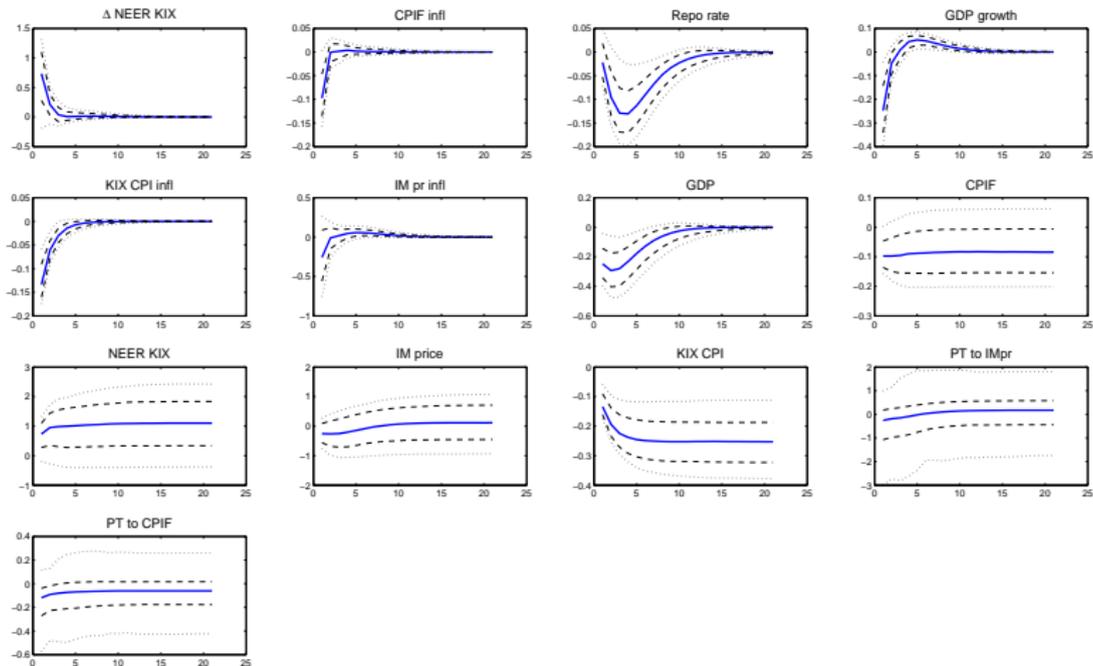
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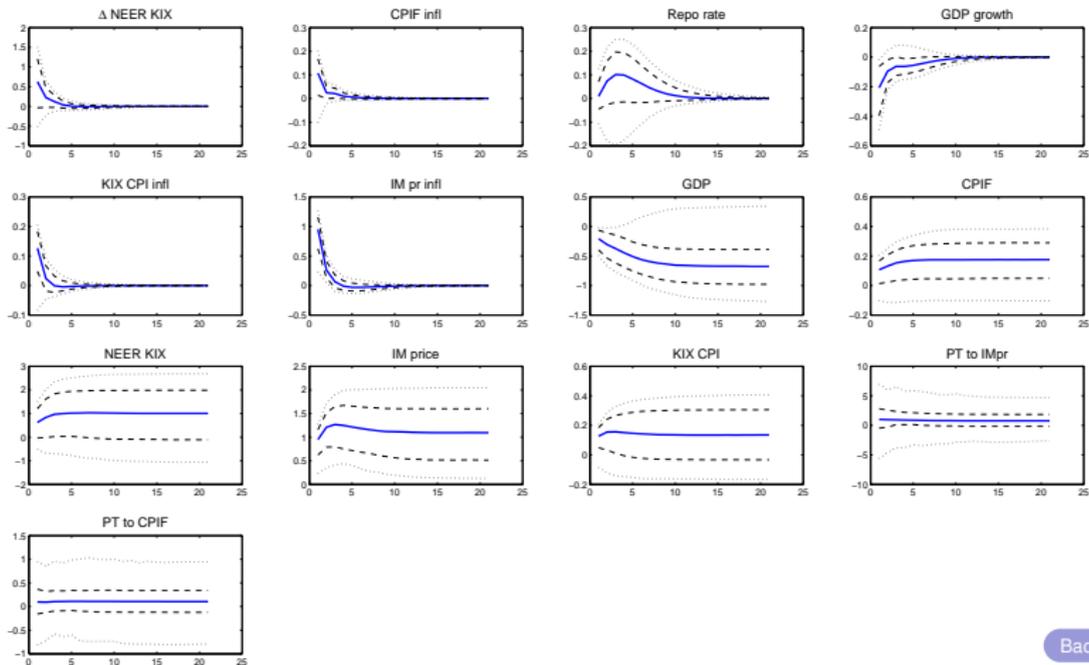
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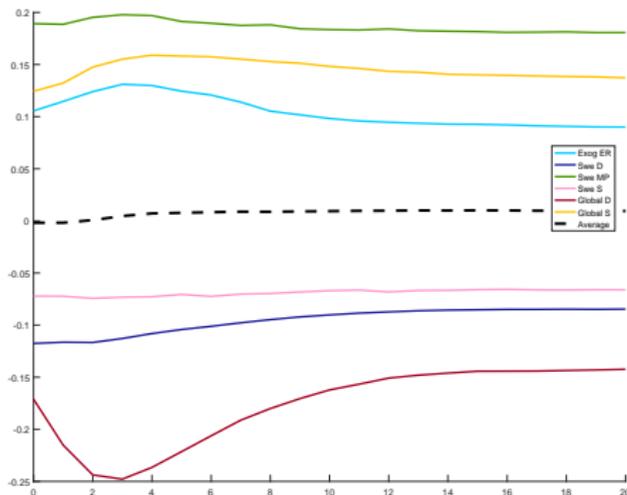


Rescaled IRFs - Global supply shock



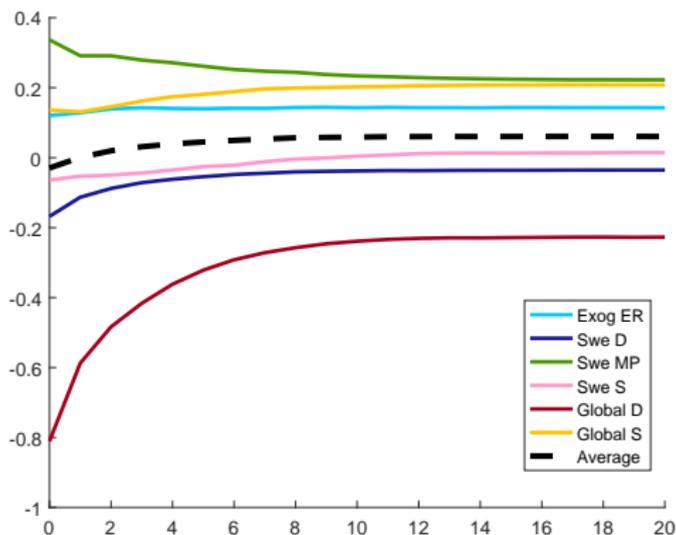
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CERPT to domestic CPIF



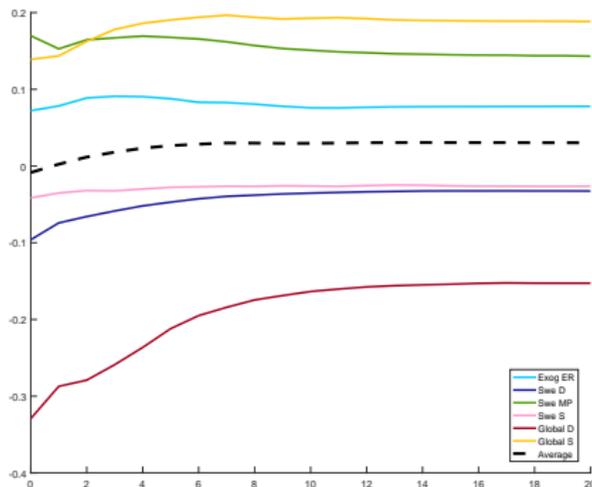
The global demand shock features a less negative CERPT.
The average pass-through is lower.

CERPT to imported CPIF



The global demand shock features a more negative CERPT.
The average ERPT is higher.

CERPT to CPIF without sign restriction for exchange rate following domestic demand shock



The domestic demand shock features a similar negative CERPT.

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