International Strategic Spillovers of Monetary Policy

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Introduction: Strategic Spillovers

Research Question

Does monetary policy create multilateral externalities?
If so, how do countries *react* to these spillovers?

This Paper

- Study international transmission of monetary policy through global financial networks
- Spatial/network model of *strategic interdependence*
- Examine role of capital account & exchange rate policies

Results

- Empirical evidence of strong *strategic complementarities*
- Implies amplification in equilibrium
- Evidence that capital controls increase policy autonomy

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Background


CURRENCY WARS
USA
JAPAN
EU
IT WAS LESS SCARY WHEN THEY JUST USED LIGHTSABERS.
Rogerdahl@aol.com
DAHL

Background

Debate on international spillovers

- Concern with externalities from *self-oriented* macro policy
- e.g. Currency Wars debate
- Huge literature on macro effects of US m-policy:
  - Output spillovers (e.g. Georgiadis, 2016)
  - Capital flows (e.g. Bruno and Shin, 2015)
  - Exchange rate (e.g. Chen et al, 2016)
  - Exports (e.g. Lin and Ye, 2017)

"Impossible Trinity" debate

- Capital mobility, fixed XR, monetary autonomy $\rightarrow$ choose two!
- Evidence on Mundellian Trilemma
  - Shambaugh (2004), Obstfeld et al (2005), Aizenman et al (2013), Klein and Shambaugh (2015)

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Background

Strategic interactions?

- Little attention on how domestic policy reacts to neighbors' policy
- Endogenous reactions may **amplify initial spillover**
- Theoretical literature: *international policy coordination*
  - First-wave: Niehans (1968), Hamada (1979)
  - Contemporary: Korinek (2016), Blanchard (2016)

My contribution

- First paper to study *contemporaneous* strategic reactions
- Evidence that higher-order network effects matter
- Combination implies strong amplification in equilibrium

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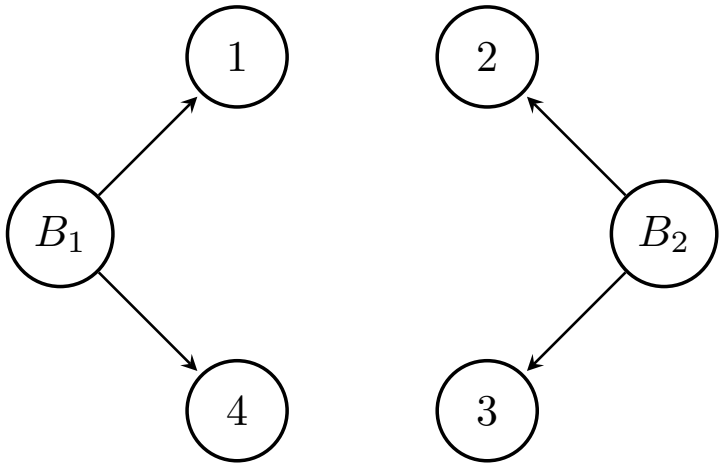
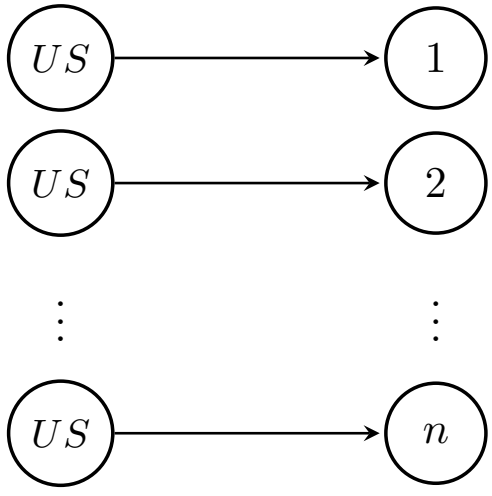
Taxonomy of previous studies

(a) "Base country" studies



- Periphery countries linked to base (e.g. through peg)
- Base country is exogenous

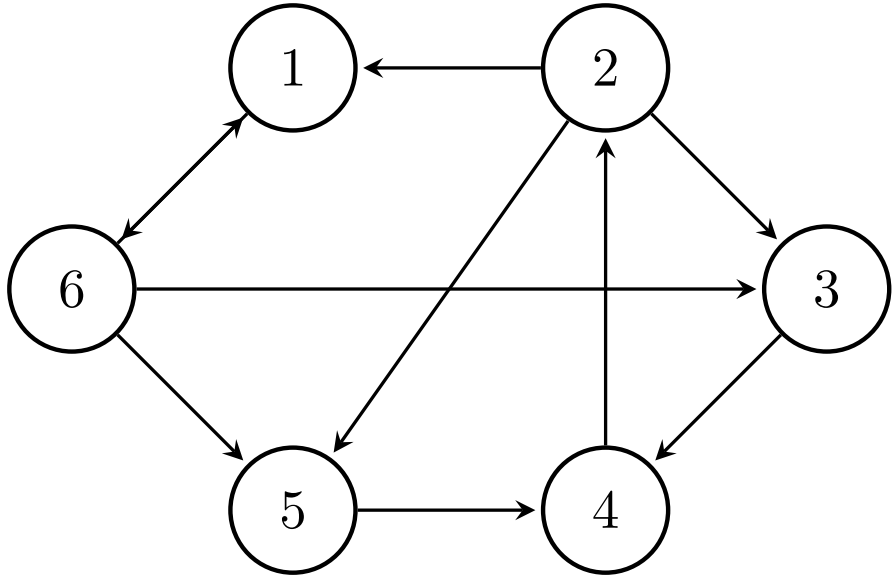
(b) "Bilateral" studies



- Each bilateral spillover estimated individually
- Typically, bilateral VARs

This paper

Spatial / Network Model



- General structure of linkages between countries
- M-policy is endogenous in every country
- Possibility of third-country / higher-order effects

Conceptual Framework

Consider a central bank in country i with the following loss function:

$$\min_{r_i} \mathcal{L}_i = \frac{1}{2} \sum_{k=1}^{K} \alpha_{ik} \left(Y_{ik} - \bar{Y}_{ik} \right)^2$$

subject to

$$Y_{ik} = Y_{ik}(\boldsymbol{r}, \boldsymbol{X}) \quad \text{for } k = 1, 2, \ldots, K$$

- Policy rate: $\boldsymbol{r} = \{r_1, r_2, \ldots, r_N\}$
- Macro variable: Y_{ik} (e.g. employment)
- Exogenous observable: $\boldsymbol{X}$
- **Macro spillover:** $\partial Y_{ik} / \partial r_\ell \neq 0$

Conceptual Framework

First order condition for r_i:

$$\sum_{k=1}^{K} \alpha_{ik} \left(Y_{ik} - \bar{Y}_{ik} \right) \frac{\partial Y_{ik}}{\partial r_i} = 0$$

Implies Nash / Cournot equilibrium:

$$r_i^* = f_i(\{r_j^*\}_{j \neq i}, \boldsymbol{X}) \qquad \text{for all } i = \{1, 2, \ldots, N\}$$

Note:

- Domestic policy rate depends on foreign rates and *domestic* $\boldsymbol{X}$
- **Strategic spillover**: $\partial r_i / \partial r_\ell \neq 0$

Econometric Model

Consider the following N-country Network Model:

$$r_{it} = \delta \sum_{j=1}^{N} w_{ij} r_{jt} + \beta \boldsymbol{X}_{it} + u_{it}$$

- **Spatial lag:** $\bar{r}_{it} = \sum_{j=1}^{N} w_{ij} r_j$
- **Weighting Matrix:** $\boldsymbol{W}$
- Predetermined macro variables $\boldsymbol{X}$
- Clearly, foreign rates $r_{j \neq i}$ are endogenous (i.e. $\mathbb{E}\{\boldsymbol{Wru}\} \neq 0$)
- OLS estimate of δ will be inconsistent

Identification Strategy

Reduced form solution:

$$\boldsymbol{r}_t = (\boldsymbol{I} - \delta \boldsymbol{W})^{-1} \beta \boldsymbol{X}_t + (\boldsymbol{I} - \delta \boldsymbol{W})^{-1} \boldsymbol{u}_t$$

Neighbors' monetary policy:

$$E\{\boldsymbol{W}\boldsymbol{r}_t | \boldsymbol{X}_t\} = \boldsymbol{W}\beta \boldsymbol{X}_t + \delta \boldsymbol{W}^2 \beta \boldsymbol{X}_t + \delta^2 \boldsymbol{W}^3 \beta \boldsymbol{X}_t + \ldots$$

- where $(\boldsymbol{I} - \delta \boldsymbol{W})^{-1} = \sum_{k=0}^{\infty} \delta^k \boldsymbol{W}^k$
- Assuming $E(\boldsymbol{u}|\boldsymbol{X}) = 0$ holds
- $\boldsymbol{W}\boldsymbol{X}$, $\boldsymbol{W}^2\boldsymbol{X}$, $\boldsymbol{W}^3\boldsymbol{X}$ ... are valid instruments
- **Intuition:** use neighbors' characteristics to instrument foreign monetary policy

Data and Estimation Details

Data

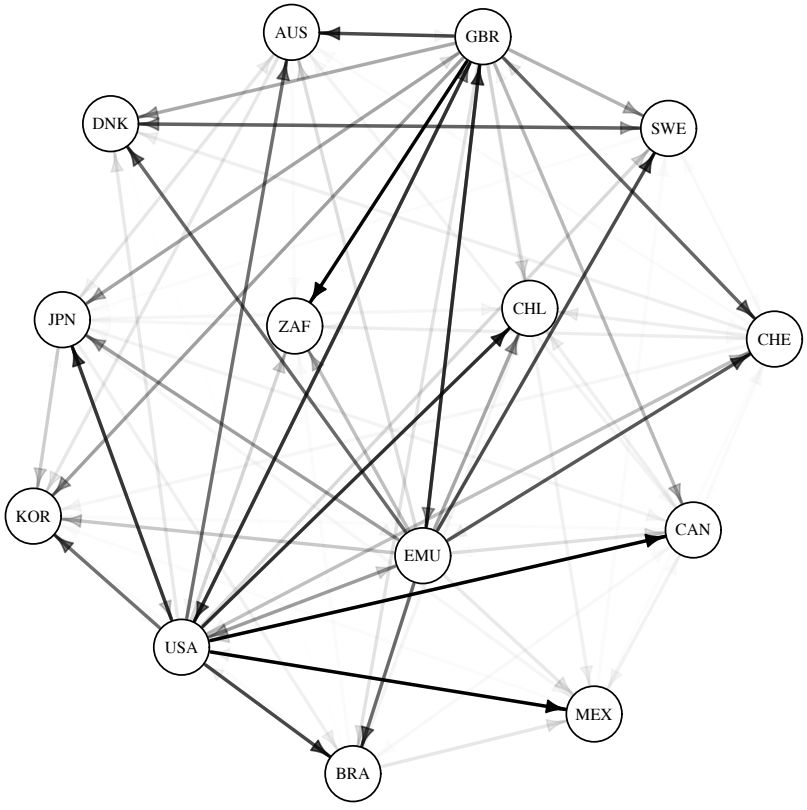
- Sample of 33 advanced and EMEs
- Quarterly frequency, 1999Q1 to 2016Q4
- Mix of narrative policy interest rates and shadow rates
- Large set of macro variables
- Forecast data to deal with expectational effects
- Stationarity properties

Estimation

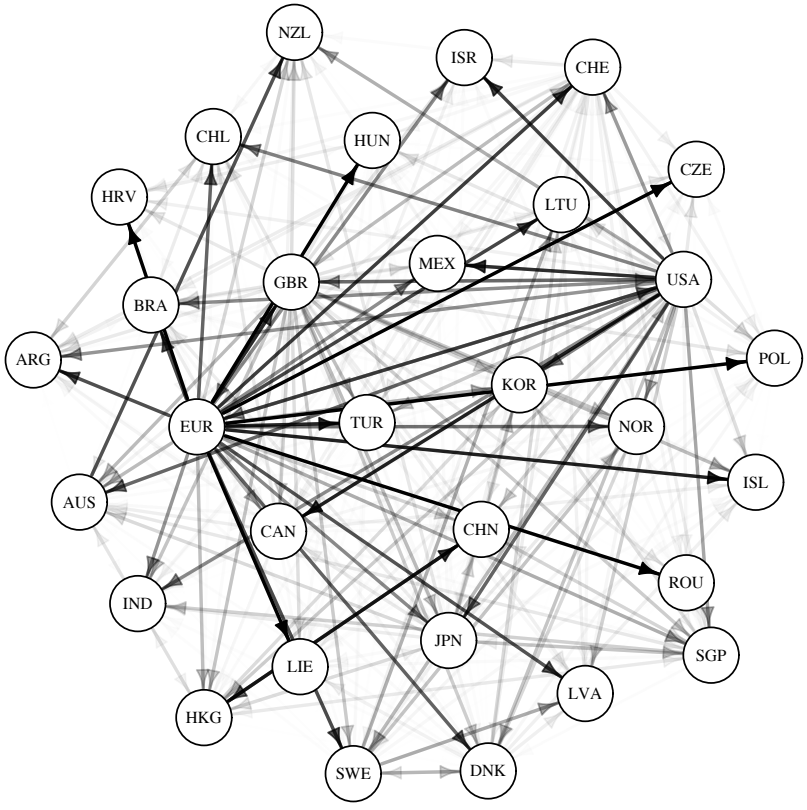
- Mostly Two-step GMM
- Control functions for non-linear effects
- Inference: Driscoll and Kraay (1998) standard errors
- Robust to heteroskedasticity, temporal and cross-sectional correlation

Weighting Matrices (W)

(a) Bank positions

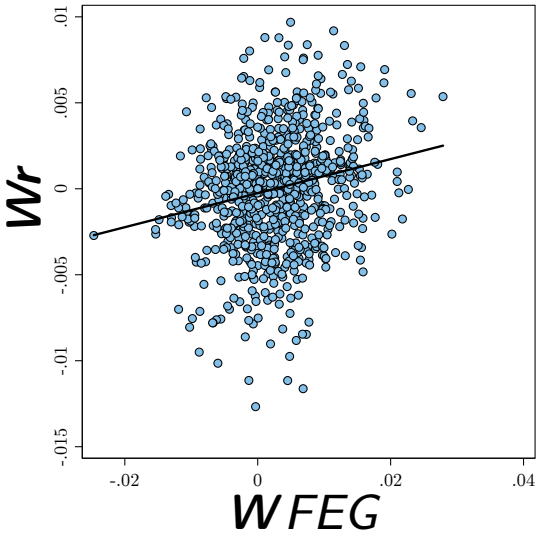


(b) Investment positions

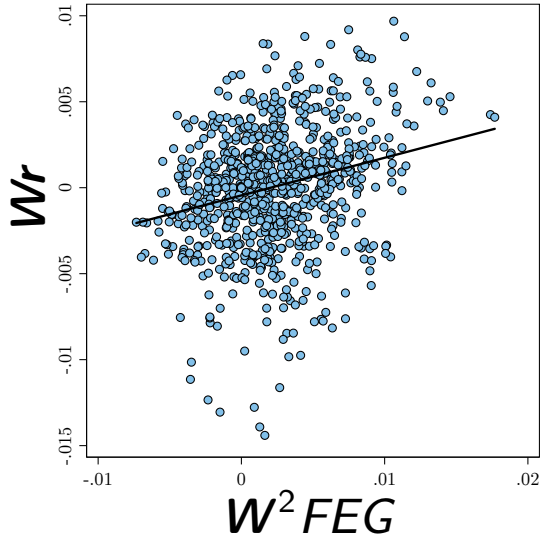


First-Stage

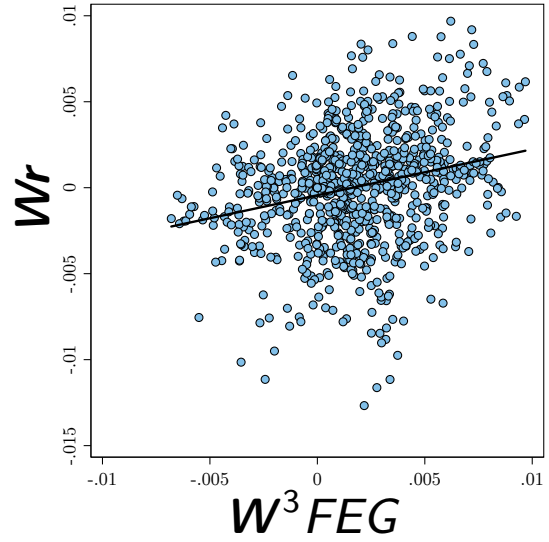
(a) 1st-order lag



(b) 2nd-order lag



(c) 3rd-order lag



- Growth forecast errors: *FEG*
- Instrument ***Wr*** using spatial lags of *FEG*

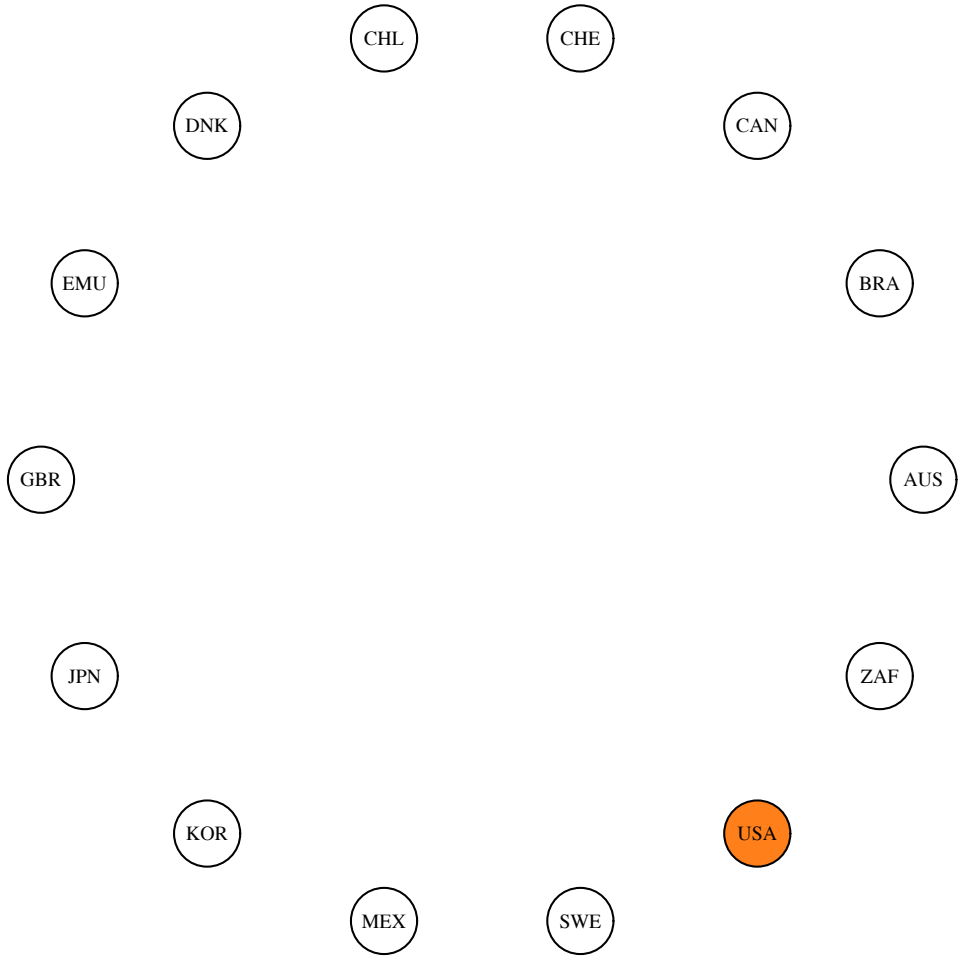
Strategic spillovers: $\hat{\delta}$

Weighting Matrix ($\boldsymbol{W}$): Bilateral bank positions						
				dropping outliers		
	(1)	(2)	(3)	(4)	(5)	(6)
First-Stage Results						
$\boldsymbol{W} \cdot FEG$	0.122^{***}			0.119^{***}		
	(0.040)			(0.029)		
$\boldsymbol{W}^2 \cdot FEG$		0.215^{***}			0.230^{***}	
		(0.065)			(0.054)	
$\boldsymbol{W}^3 \cdot FEG$			0.276^{***}			0.281^{***}
			(0.078)			(0.063)
Second-Stage Results						
$\boldsymbol{Wr}$	0.708^{***}	0.823^{**}	0.782^{***}	0.814^{***}	0.778^{***}	0.836^{***}
	(0.214)	(0.338)	(0.242)	(0.240)	(0.300)	(0.265)
Observations	1008	1008	1008	928	932	937
Kleibergen-Paap F-stat	9.135	10.833	12.384	16.492	17.801	19.356
Anderson-Rubin test (χ^2)	3.945	4.835	5.018	5.393	4.295	4.762
p-value	0.047	0.028	0.025	0.020	0.038	0.029

- $\boldsymbol{X}$: lagged growth & inflation forecast errors, RER appreciation
- Global Financial Crisis dummy
- 2S-GMM, Driscoll-Kraay standard errors

more

Anatomy of a spillover: *USA*



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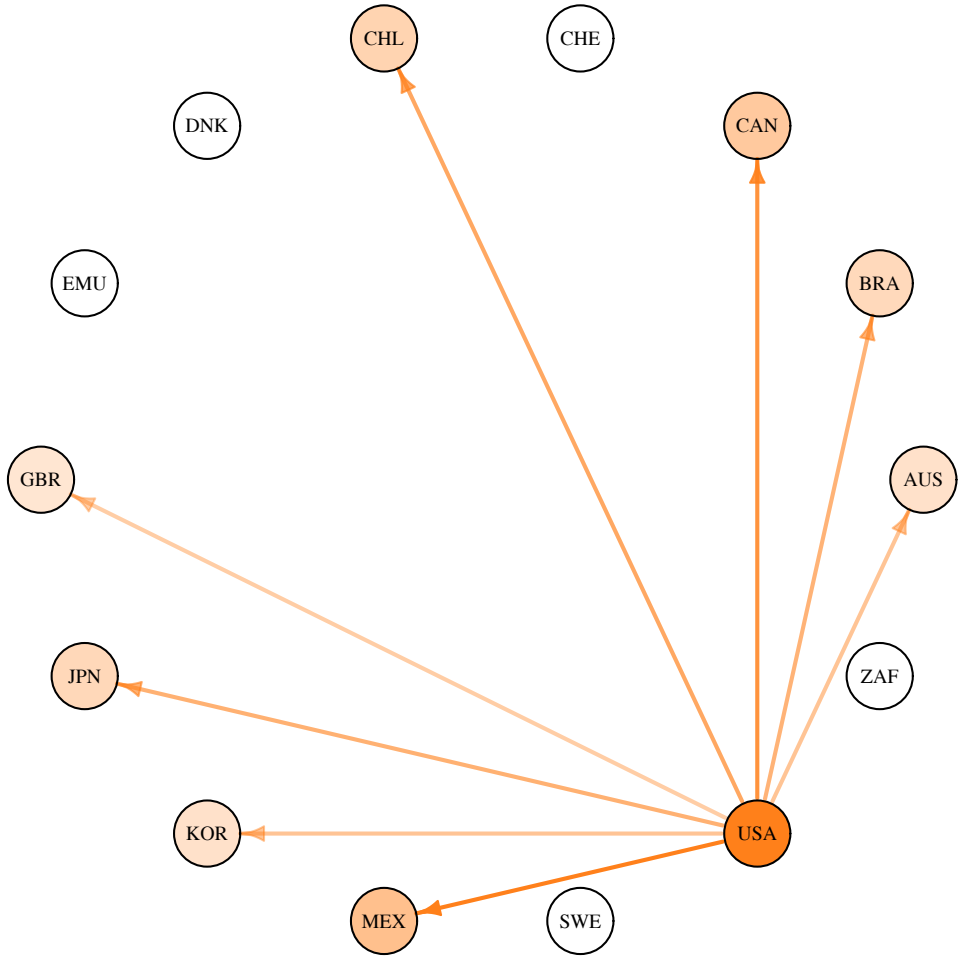

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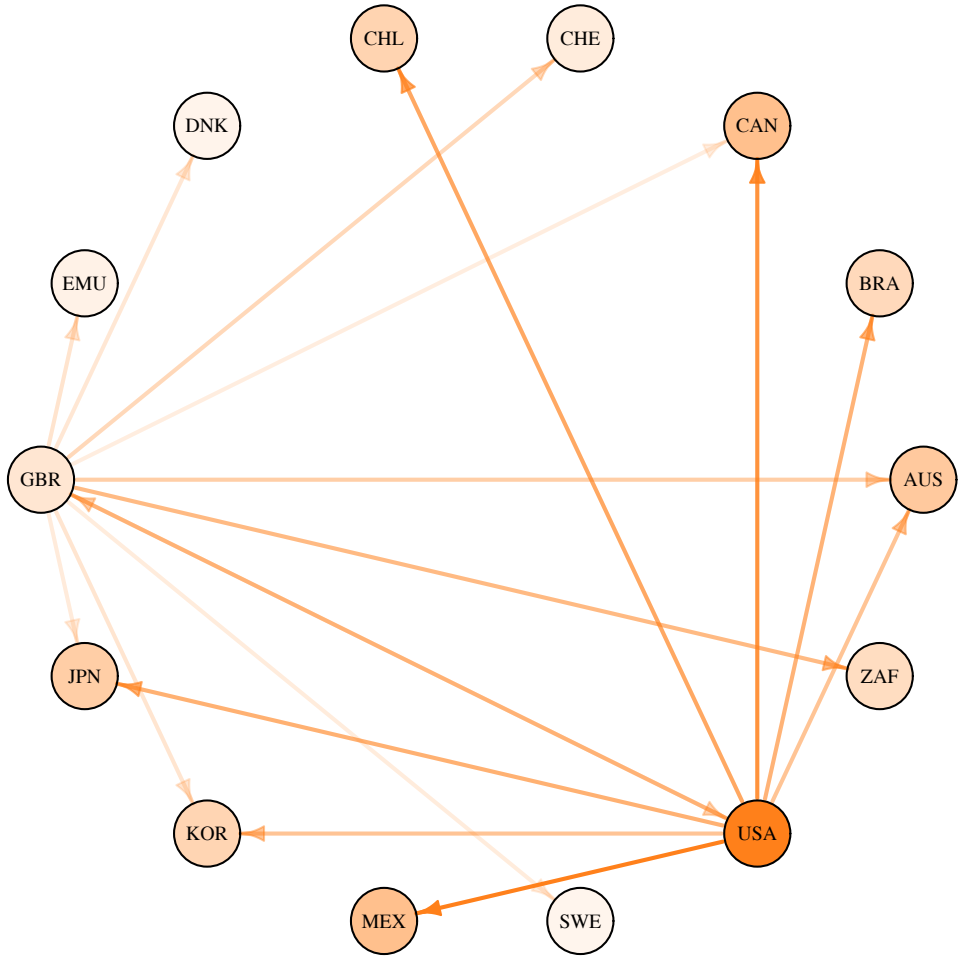

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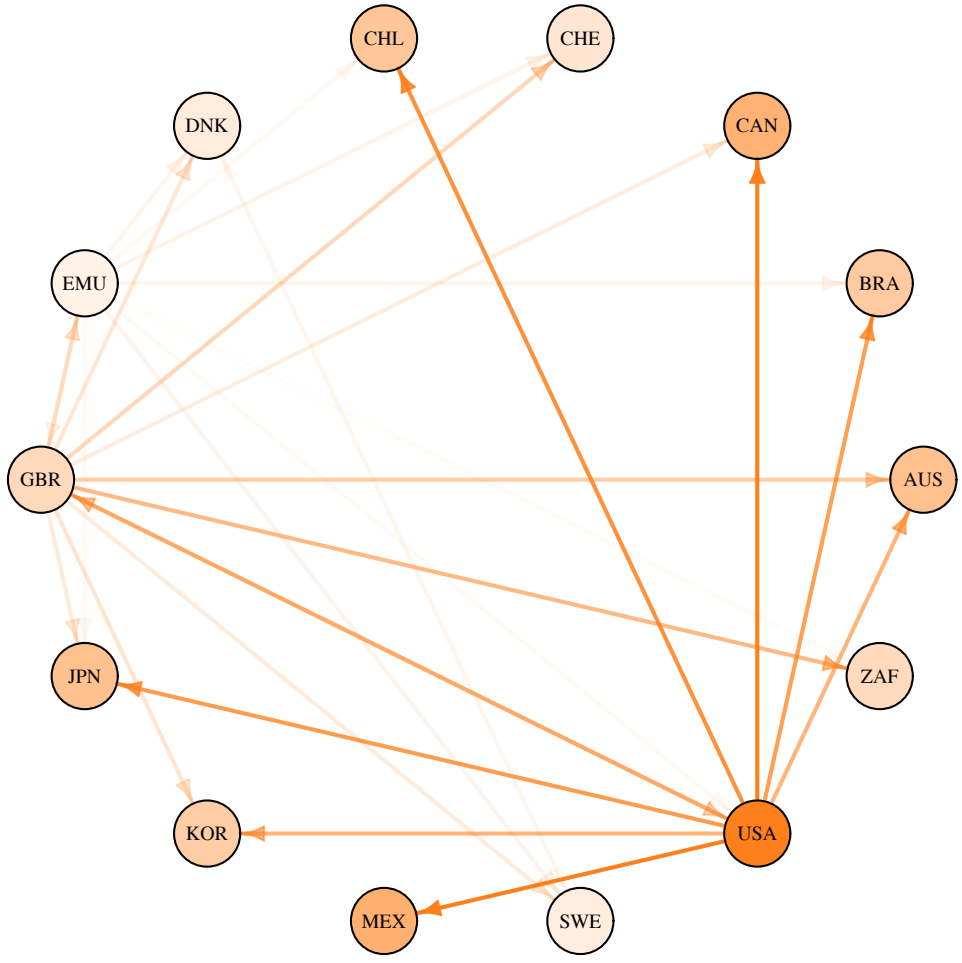
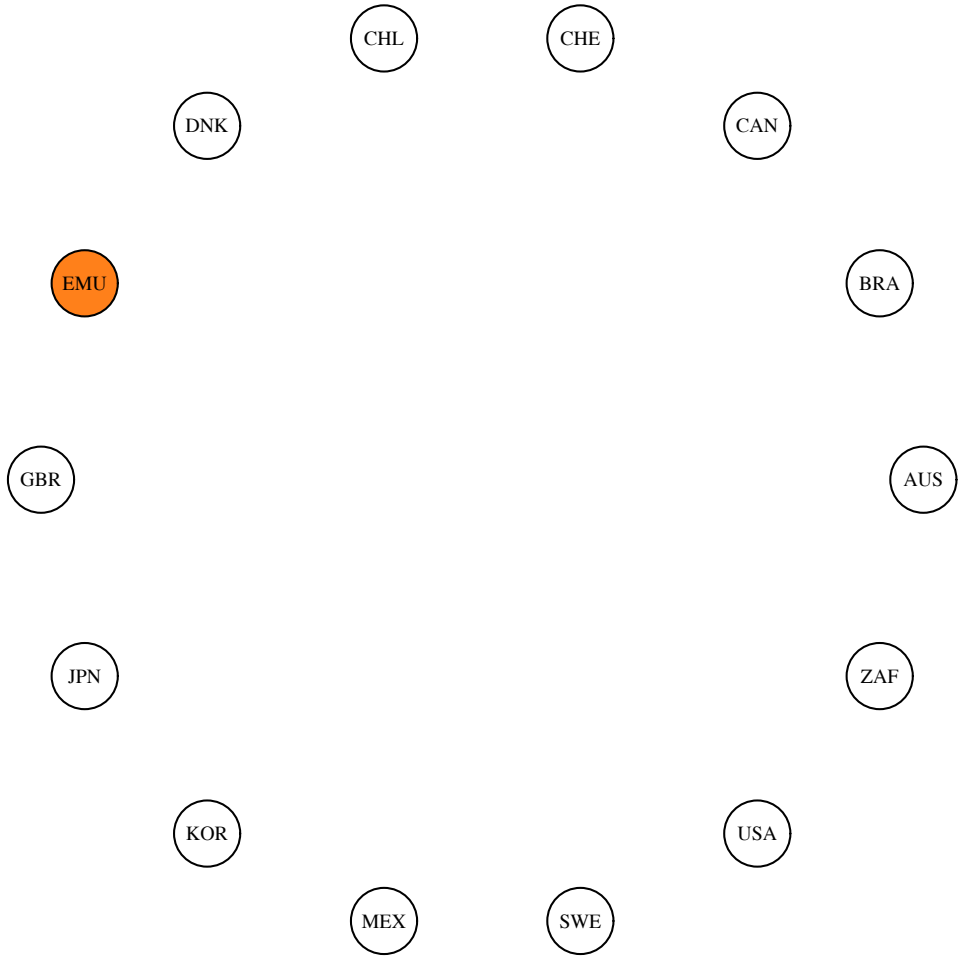


Anatomy of a spillover: *Eurozone*



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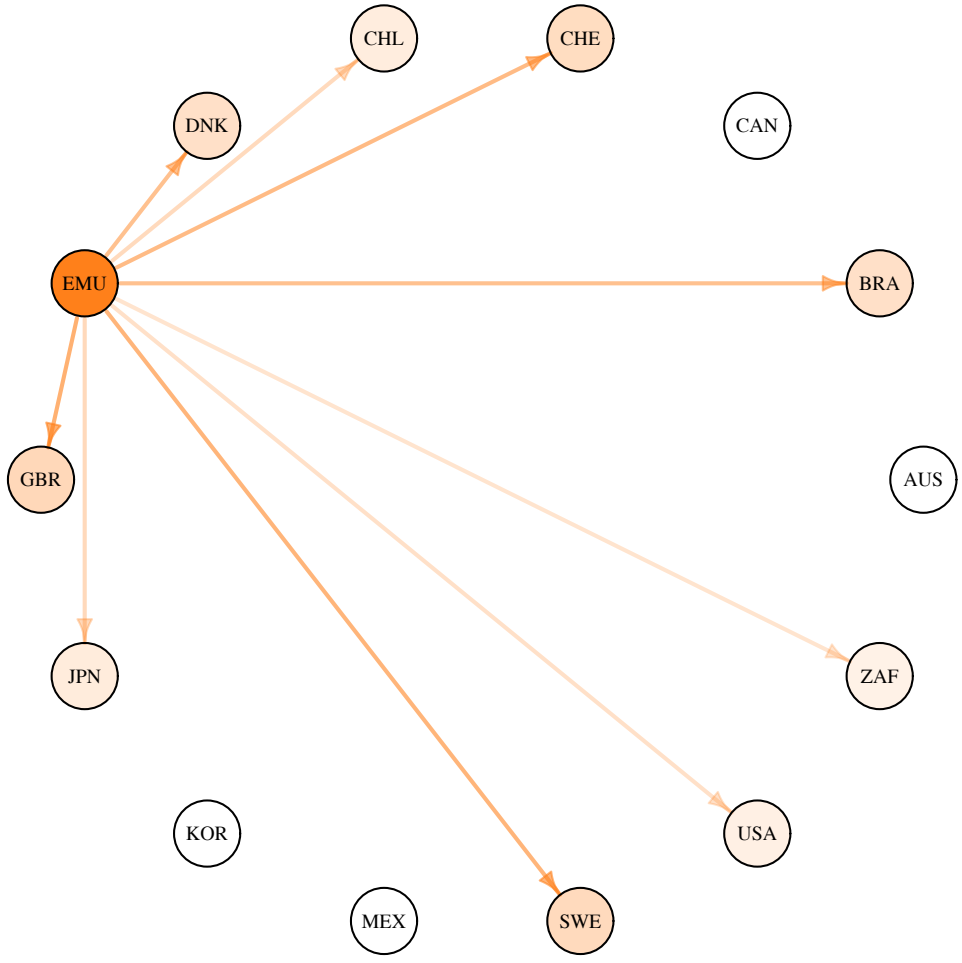

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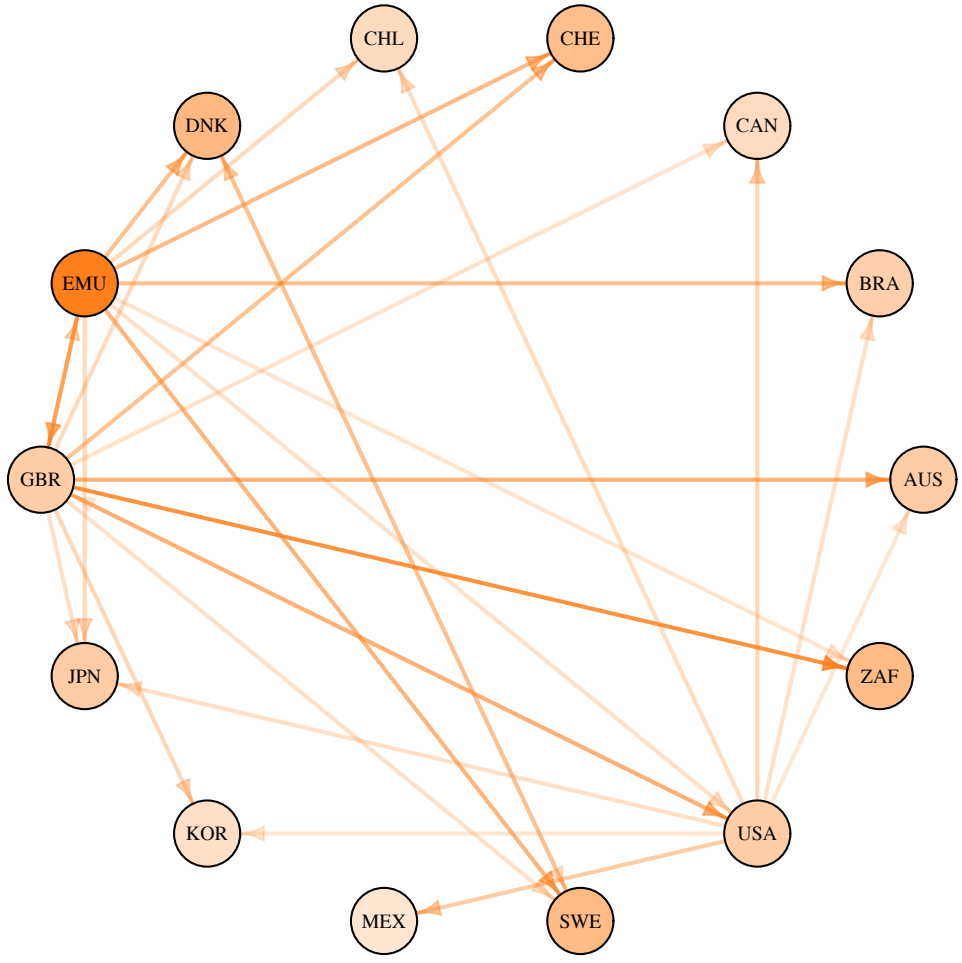

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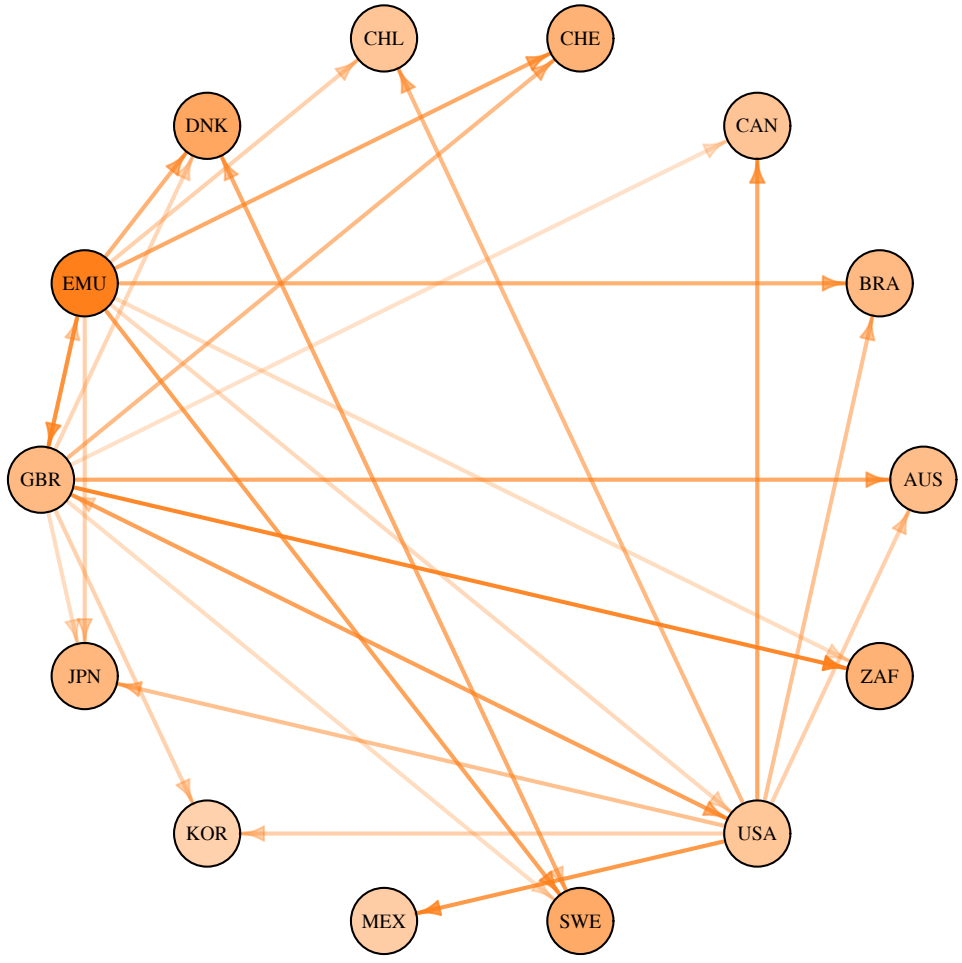

Comparison of Spillover Specifications

Average spillover across alternative models

	United States		United Kingdom		Eurozone		Japan	
	dr_i/dr_B	SE	dr_i/dr_B	SE	dr_i/dr_B	SE	dr_i/dr_B	SE
(1) *Base-country*	0.175^{***}	(0.056)	0.223^{**}	(0.098)	0.155^{***}	(0.050)	0.142^{**}	(0.060)
Network model								
(2) *OLS*	0.117^{**}	(0.057)	0.099^{*}	(0.055)	0.107^{*}	(0.057)	0.019^{*}	(0.012)
(3) *2S-GMM*	0.325^{***}	(0.096)	0.335^{***}	(0.121)	0.337^{***}	(0.113)	0.072^{**}	(0.028)
Higher-order effects								
(4) *Avg. multiplier*	1.384^{***}	(0.106)	1.977^{***}	(0.284)	1.767^{***}	(0.204)	2.442^{***}	(0.413)
(5) *Share of total*	0.277^{***}	(0.055)	0.494^{***}	(0.073)	0.434^{***}	(0.065)	0.591^{***}	(0.069)

- Naive "base-country" specification:

$$r_{it} = \gamma_B r_{Bt} + \boldsymbol{\beta} \boldsymbol{X}_{it} + u_{it}$$

- Spillover estimates $\hat{\gamma}_B$ are biased!

Partial and General Equilibrium Effects

Consider the network model:

$$\boldsymbol{r} = \delta \boldsymbol{W}\boldsymbol{r} + \beta \boldsymbol{X} + \boldsymbol{u}$$

- Let $\boldsymbol{B} = (\boldsymbol{I} - \hat{\delta}\boldsymbol{W})^{-1}$
- Let $\boldsymbol{A}_\ell$ denote the ℓ-th column of a matrix $\boldsymbol{A}$
- Suppose there's a shock du_ℓ to country ℓ's policy rate...

Direct / PE effects:

$$d\boldsymbol{r}_{PE} = \hat{\delta}\boldsymbol{W}_\ell du_\ell$$

Indirect / GE effects:

$$d\boldsymbol{r}_{GE} = \boldsymbol{B}_\ell du_\ell$$

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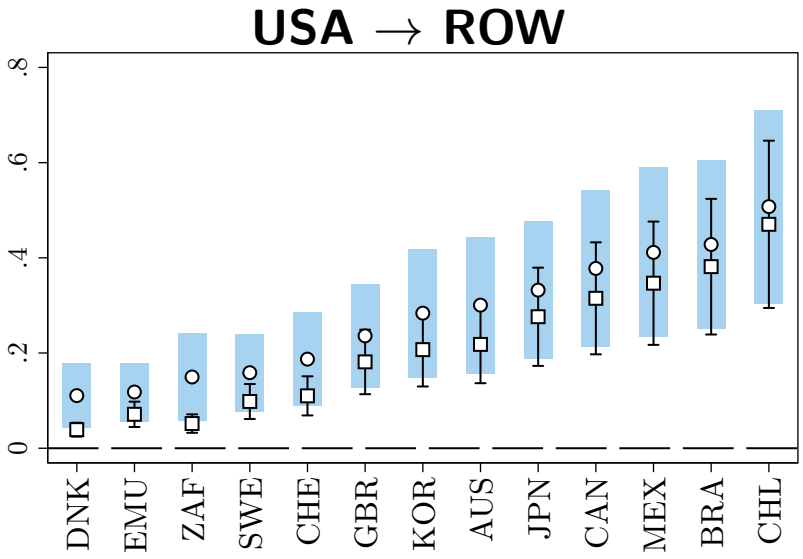

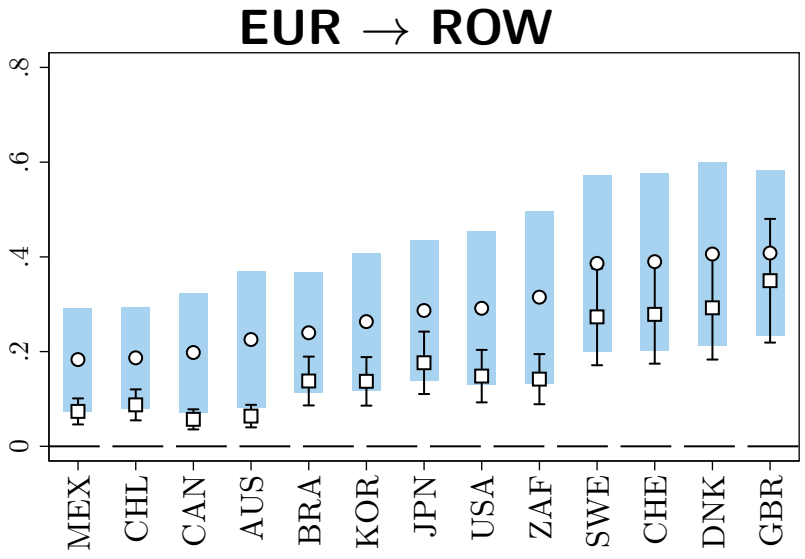

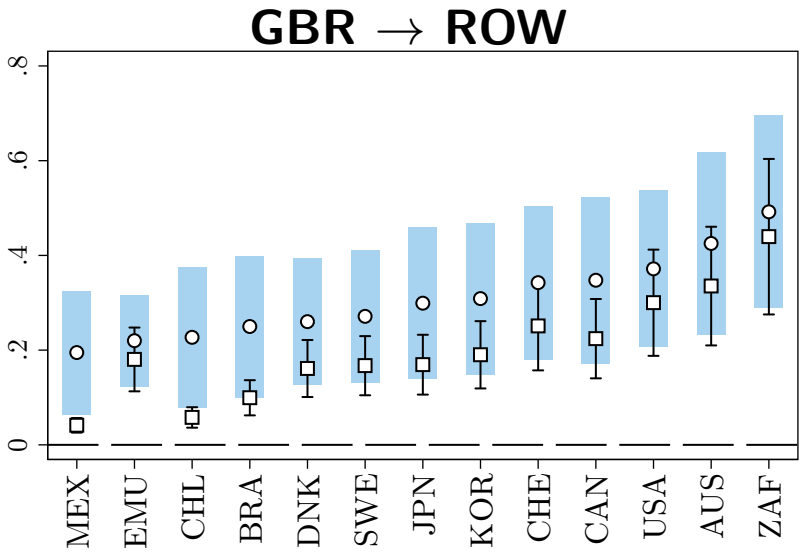

Weighting matrix (***W***):
Gross bilateral bank positions

▸ extras

Capital Account and Exchange Rate Policies

$$r_{it} = (\delta_0 + \boldsymbol{\theta} \boldsymbol{K}_{it}) \cdot \bar{r}_{it} + \boldsymbol{\beta} \boldsymbol{X}_{it} + u_{it}$$

- Heterogeneity / non-linearities captured by interactions
- $\boldsymbol{\theta}$ measures reaction difference relative to base level δ_0
- $\boldsymbol{K}$: Capital controls & reserve accumulation
- *Intuition:* Can interventions provide insulation?

Capital Account and Exchange Rate Policies

Weighting Matrix ($\boldsymbol{W}$): Gross bilateral bank positions						
	(1)	(2)	(3)	(4)	(5)	(6)
$\boldsymbol{Wr}$	0.817***	0.867***	0.876***	0.835***	0.878***	0.890***
	(0.170)	(0.174)	(0.150)	(0.164)	(0.172)	(0.150)
$\boldsymbol{Wr} \cdot K_{CI}$	-0.589**			-0.622**		
	(0.285)			(0.277)		
$\boldsymbol{Wr} \cdot K_{SCH}$		-0.721**			-0.733***	
		(0.298)			(0.269)	
$\boldsymbol{Wr} \cdot K_{IN}$			-0.952***			-0.973***
			(0.321)			(0.331)
$\boldsymbol{Wr} \cdot RES$				-0.032	-0.025	-0.027
				(0.032)	(0.021)	(0.020)
Closed capital account spillover						
$\hat{\delta}_0 + \hat{\theta}_1$	0.229	0.145	-0.076	0.213	0.145	-0.084
	(0.240)	(0.228)	(0.293)	(0.238)	(0.200)	(0.291)
Observations	952	884	884	952	884	884

Capital Account and Exchange Rate Policies

Takeaways. . .

- Spillover effect is lower in countries with capital controls
- *Interpretation:* Insulation against foreign shocks
- $\Rightarrow$ Increase in policy autonomy

Other heterogeneity?

- Financial integration: *increase* spillovers
- Inflation targeting: *no effect*
- Business cycle: *mixed*

Capital Account and Exchange Rate Policies

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Dynamics

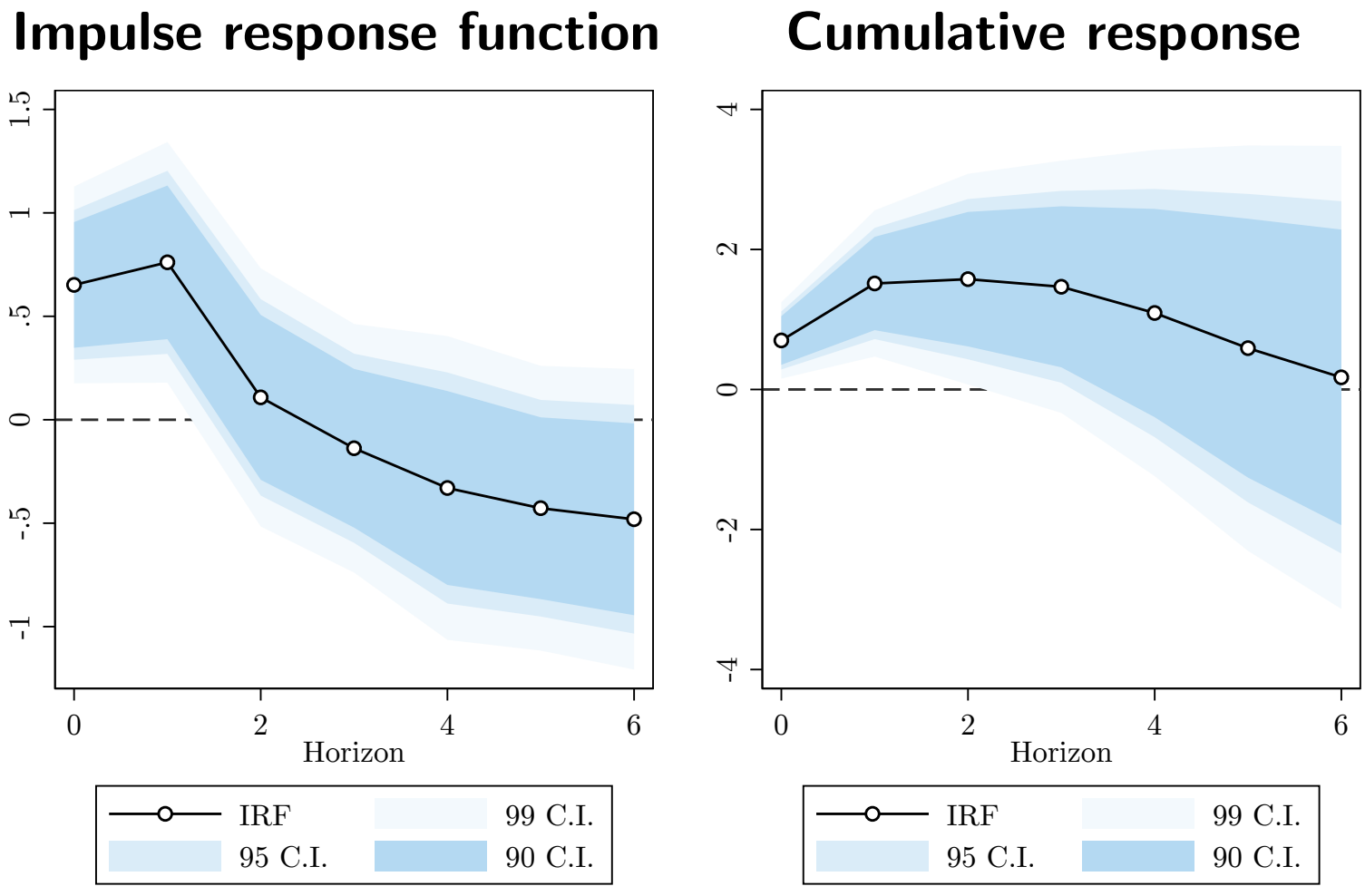
How do countries react *over time*?

- Estimate impulse response using *local projection* (Jordà, 2005)
- IV methods to identify endogenous effects
- Consider the following local projection:

$$\boldsymbol{r}_{t+h} = \delta_h \boldsymbol{W}\boldsymbol{r}_t + \boldsymbol{\beta}_h \boldsymbol{X}_t + \boldsymbol{u}_t$$

- Estimate for each *horizon* $h = \{1, 2, \ldots, H\}$
- Coefficient $\hat{\delta}_h$ measures the impulse response after h quarters

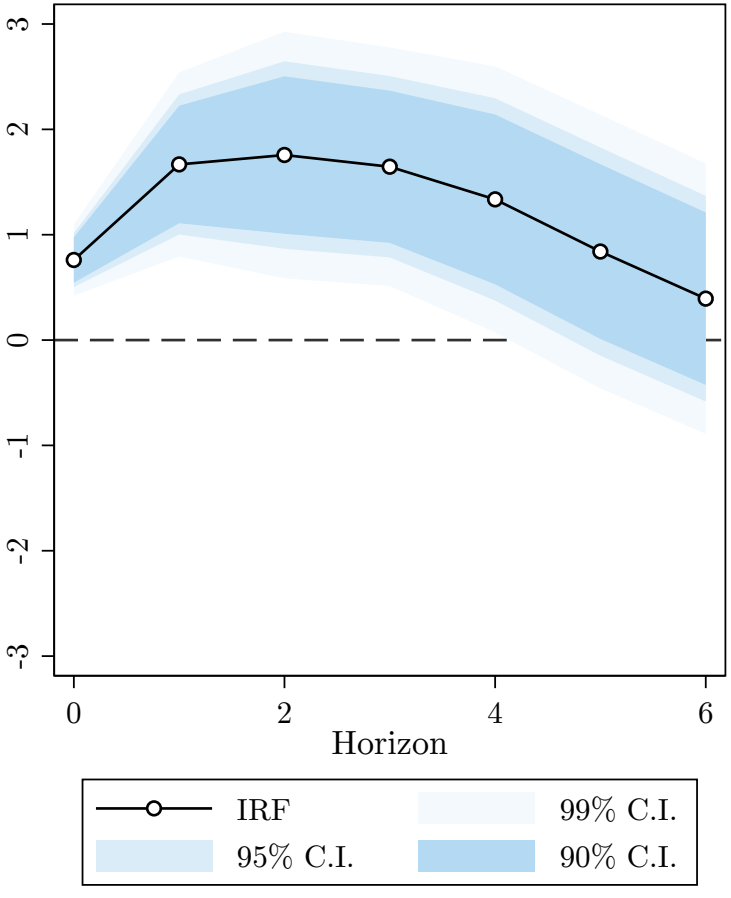
Dynamics



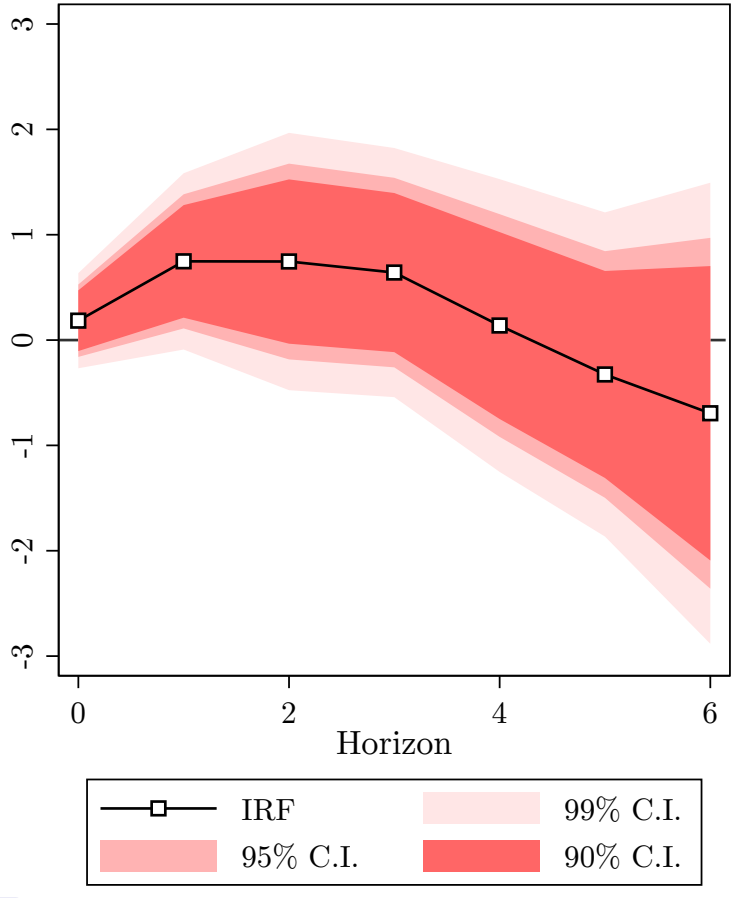
▸ extras

Dynamics: Capital Controls

Open capital account



Closed capital account



▸ extras

Robustness Exercises

1. **Alternative specifications/estimators**
   - Network structures ($\boldsymbol{W}$)
   - Overidentified models
   - CUE estimator

2. **High-Dimensional / LASSO Methods**
   - Data driven selection of 1st stage instruments
   - High-dimensional controls

3. **Placebo Networks**
   - Assess role of $\boldsymbol{W}$ misspecification by randomizing network
   - Probability that result is driven by misspecification is low

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Thank You :)

High-Dimensional Instruments

$$E\{\boldsymbol{W}\boldsymbol{r}_t|\boldsymbol{X}_t\} = \boldsymbol{W}\beta\boldsymbol{X}_t + \delta\boldsymbol{W}^2\beta\boldsymbol{X}_t + \delta^2\boldsymbol{W}^3\beta\boldsymbol{X}_t + \dots$$

- In principle, there are an infinite number of valid instruments
- Rule of thumb: use $\boldsymbol{WX}$, $\boldsymbol{W}^2\boldsymbol{X}$, and $\boldsymbol{W}^3\boldsymbol{X}$
- Alternative: LASSO shrinkage estimator
- Chernozukhov, Hansen, Splinder (2015) – model for high-dimensional IVs
- Post-LASSO 2SLS / GMM: use selected instruments in standard estimator

back

High-Dimensional Instruments

CHS / Post-LASSO GMM Estimates of $\hat{\delta}$

Penalty Loading Cluster:	*Year*		*Country*	
Estimator:	LASSO	S-LASSO	LASSO	S-LASSO
	(1)	(2)	(3)	(4)
(a) Weighting Matrix (W): Gross bilateral bank positions				
Orthogonalized 2SLS	0.571^{*}	0.437	0.765^{***}	0.663^{**}
	(0.310)	(0.267)	(0.258)	(0.286)
Post-LASSO GMM	0.667^{**}	0.475^{**}	0.557^{***}	0.530^{***}
	(0.331)	(0.207)	(0.119)	(0.140)
Anderson-Rubin Weak Inst. Test (χ^2)	2.863	3.007	7.967	7.037
AR (p-value)	0.091	0.083	0.019	0.030
(b) Weighting Matrix (W): Gross bilateral trade				
Orthogonalized 2SLS	0.983^{**}	0.790^{**}	1.087^{***}	1.069^{***}
	(0.390)	(0.372)	(0.339)	(0.361)
Post-LASSO GMM	1.058^{***}	0.767^{***}	0.588^{***}	0.724^{***}
	(0.328)	(0.195)	(0.174)	(0.181)
Anderson-Rubin Weak Inst. Test (χ^2)	5.902	6.745	8.093	10.365
AR (p-value)	0.015	0.009	0.017	0.006

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Placebo Network Tests

- How likely would it be to obtain $\hat{\delta}$ from a *random* network?
- $\boldsymbol{W}$ misspecification problem
  - Measurement error?
  - Incorrect network?
- Direction of bias is not obvious

Randomized Placebo Networks:

1. Reshuffle weight matrix $\boldsymbol{W}$ to obtain $\widetilde{\boldsymbol{W}}$
2. Construct placebo spatial lag of the policy rate $\tilde{\boldsymbol{r}} = \widetilde{\boldsymbol{W}}\boldsymbol{r}$
3. Estimate $\boldsymbol{r} = \delta\tilde{\boldsymbol{r}} + \beta\boldsymbol{X} + \boldsymbol{u}$ to obtain placebo spillover $\tilde{\delta}$
4. Repeat P times

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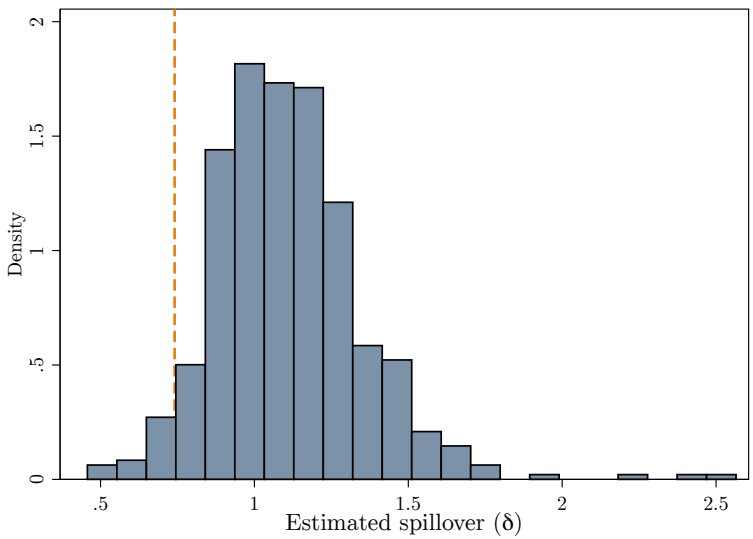
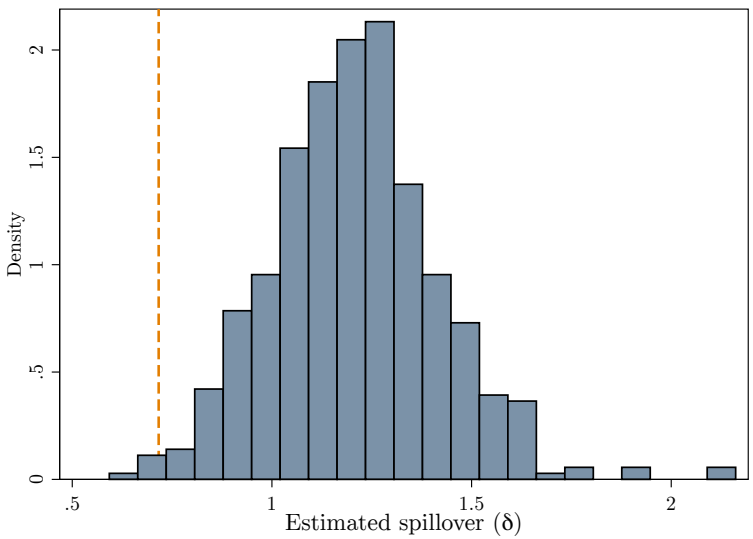
Placebo Network Tests

Distribution of placebo spillovers

(a) Common factors



(b) Time FE



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Data: Summary statistics and variable definitions

Variable Description	*Mean*	*Sd*	*Min*	*Min*
Policy rate (first-difference)	-0.002	0.012	-0.220	0.130
Real GDP Growth (Y-o-Y)	0.031	0.032	-0.155	0.187
Inflation rate	0.038	0.056	-0.025	0.774
Real exchange rate appreciation	0.001	0.083	-0.599	0.291
Stock Market Index	2.213	0.863	0.141	4.937
VIX Global volatility index	0.846	7.924	-10.278	38.010
Price of oil (log US$)	3.955	0.619	2.407	4.811
Price of agricultural raw materials (log US$)	4.708	0.162	4.437	5.104
Year-ahead growth forecast	0.028	0.025	-0.106	0.115
Year-ahead inflation forecast	0.040	0.069	-0.092	1.037
Inverse Chinn-Ito liberalization index	0.325	0.328	0.000	1.000
Schindler index of capital controls	0.382	0.333	0.000	1.000
Schindler index of inflows controls	0.356	0.315	0.000	1.000
Change in reserves (% of GPD)	0.694	3.523	-29.777	40.811
Observations		2233		

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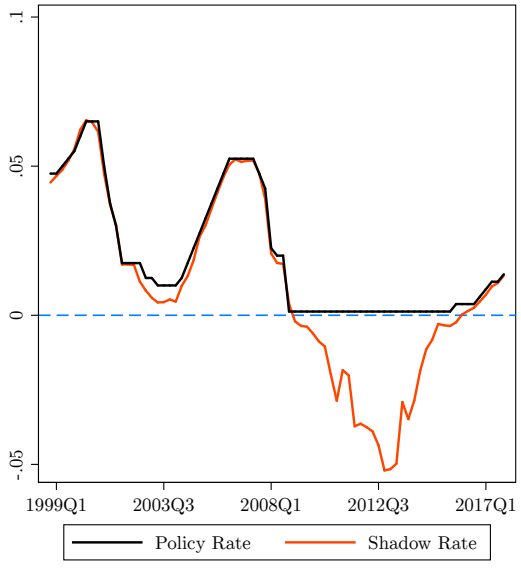
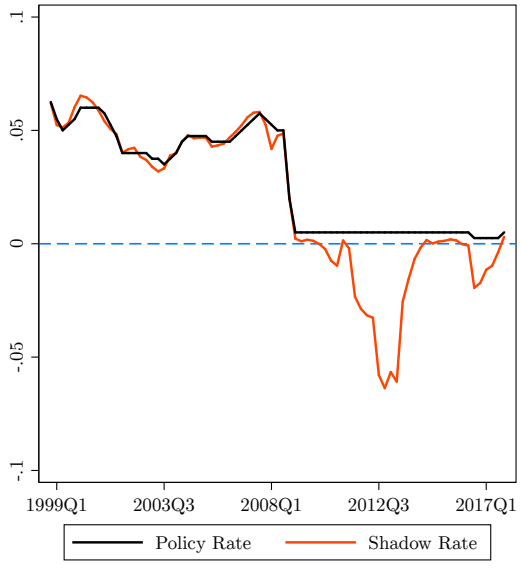
Data: policy rates vs. shadow rates

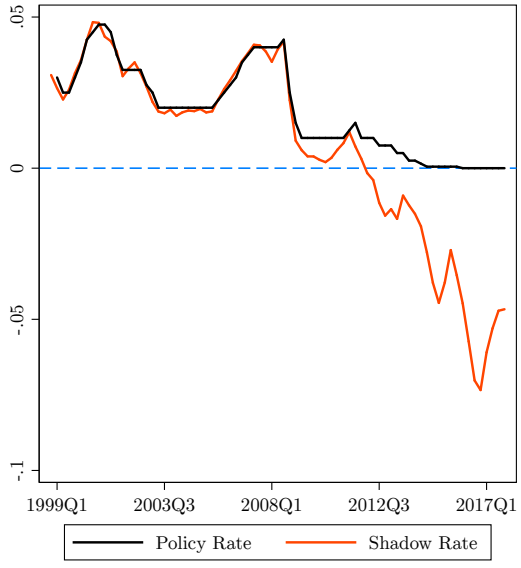
(a) United States



(b) United Kingdom



(c) Eurozone



- Narrative policy rates (BIS)
- Shadow rates (Krippner, 2012)
- Use *shadow rates* if policy rate $\approx$ zero

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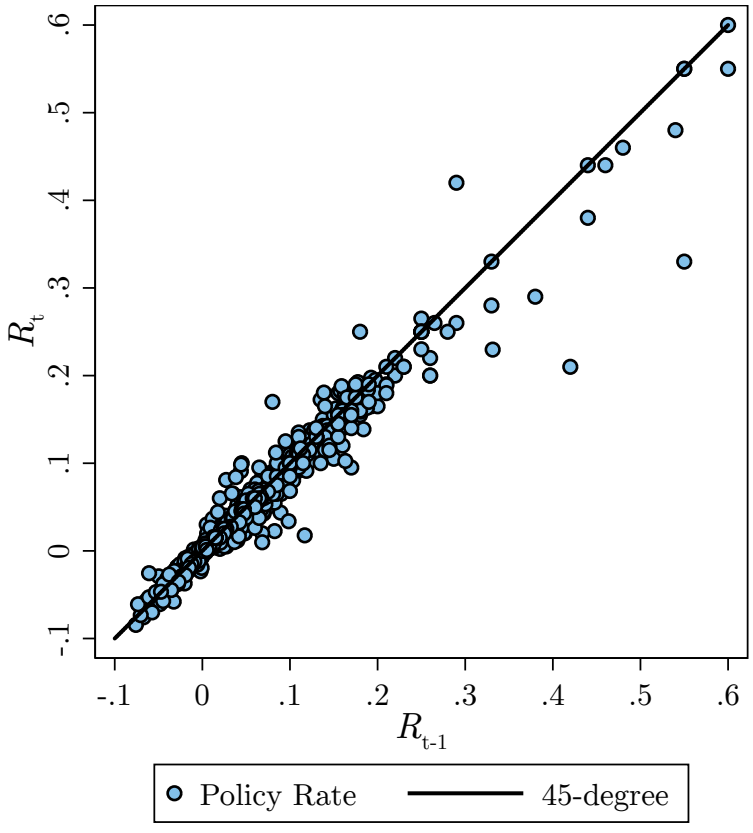
Data: Unit Root?

(a) Policy rate persistence



(b) Panel unit root tests

	Statistic	*p-value*
Homogenous tests		
Levin-Lin-Chu (adj t)	-1.486	(0.069)
Harris-Tzavalis (Z)	-1.388	(0.083)
Breitung (λ)	0.082	(0.533)
Heterogeneous tests		
Im-Pesaran-Shin ($\bar{W}_t$)	-0.956	(0.169)
Fisher (Z)	-0.998	(0.159)
Pesaran CADF ($\bar{z}_t$)	-2.239	(0.013)
Stationarity test		
Hadri LM (z)	22.368	(0.000)

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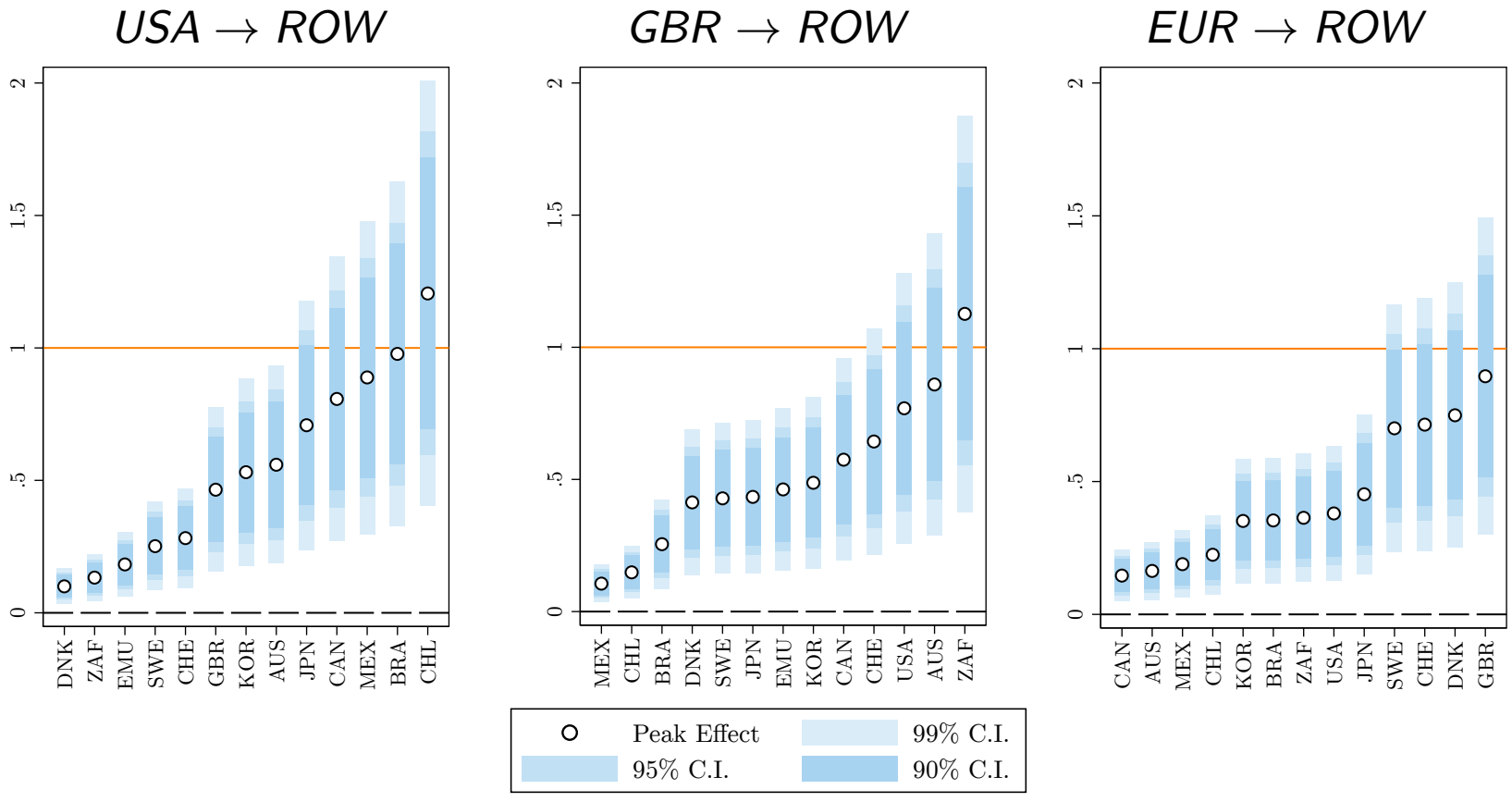
Peak reactions



Peak effect:

$$\boldsymbol{dr}_{peak} = \hat{\delta}\boldsymbol{W}_{\ell}du_{\ell}$$

Full passthrough?

$$\boldsymbol{dr}_{peak} = 1$$

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Strategic spillovers: alternative specifications

(a) Weighting Matrix (W): Gross bilateral bank positions						
	(1)	(2)	(3)	(4)	(5)	(6)
$\boldsymbol{Wr}$	0.882^{***}	0.767^{***}	0.782^{***}	0.781^{***}	0.666^{***}	0.733^{***}
	(0.236)	(0.195)	(0.242)	(0.244)	(0.143)	(0.201)
Observations	1008	966	1008	1008	1008	948
Kleibergen-Paap F-stat	6.801	7.783	12.384	12.493	10.669	15.369
Anderson-Rubin test (χ^2)	2.473	3.783	5.018	4.769	3.363	4.914
p-value	0.116	0.052	0.025	0.029	0.067	0.027
(b) Weighting Matrix (W): Gross bilateral investment position						
	(1)	(2)	(3)	(4)	(5)	(6)
$\boldsymbol{Wr}$	0.896^{***}	0.834^{***}	0.694^{***}	0.690^{***}	0.725^{***}	0.685^{***}
	(0.173)	(0.159)	(0.231)	(0.241)	(0.141)	(0.218)
Observations	1715	1647	1715	1715	1715	1537
Kleibergen-Paap F-stat	6.286	8.236	11.996	11.688	13.242	16.193
Anderson-Rubin test (χ^2)	3.786	5.056	4.433	3.947	3.488	3.983
p-value	0.052	0.025	0.035	0.047	0.062	0.046
Common factors?	No	Yes	No	No	No	No
Common GFC effects?	No	No	Yes	No	No	No
Country-specific GFC effects?	No	No	No	Yes	No	No
Time FE?	No	No	No	No	Yes	Yes
Additional covariates?	No	No	No	No	No	Yes
Drop outliers?	No	No	No	No	No	Yes

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Overidentified models

(a) Weighting Matrix (W): Gross bilateral bank positions						
	(1)	(2)	(3)	(4)	(5)	(6)
$\boldsymbol{Wr}$	0.804^{***}	0.731^{***}	0.731^{***}	0.693^{***}	0.637^{***}	0.638^{***}
	(0.133)	(0.141)	(0.194)	(0.191)	(0.117)	(0.162)
Observations	1008	966	1008	1008	1008	950
Kleibergen-Paap F-stat	2.400	1.978	3.408	3.378	5.114	6.937
Overidentification test	0.182	0.673	0.129	0.347	0.240	0.517
Anderson-Rubin test (χ^2)	3.476	4.609	5.633	5.518	3.971	5.189
p-value	0.482	0.330	0.228	0.238	0.410	0.268
(b) Weighting Matrix (W): Gross bilateral investment						
	(1)	(2)	(3)	(4)	(5)	(6)
$\boldsymbol{Wr}$	0.838^{***}	0.814^{***}	0.720^{***}	0.628^{***}	0.672^{***}	0.632^{***}
	(0.117)	(0.114)	(0.216)	(0.182)	(0.123)	(0.174)
Observations	1715	1647	1715	1715	1715	1540
Kleibergen-Paap F-stat	2.962	2.631	3.894	4.269	4.227	5.144
Overidentification test	1.631	1.451	1.704	2.125	2.361	1.296
Anderson-Rubin test (χ^2)	5.420	7.970	6.105	5.049	5.848	5.561
p-value	0.247	0.093	0.191	0.282	0.211	0.234
Common factors?	No	Yes	No	No	No	No
Common GFC effects?	No	No	Yes	No	No	No
Country-specific GFC effects?	No	No	No	Yes	No	No
Time FE?	No	No	No	No	Yes	Yes
Additional covariates?	No	No	No	No	No	Yes
Drop outliers?	No	No	No	No	No	Yes

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CUE Estimation

(a) Weighting Matrix ($\boldsymbol{W}$): Gross bilateral bank positions						
	(1)	(2)	(3)	(4)	(5)	(6)
$\boldsymbol{Wr}$	0.882^{***}	0.767^{***}	0.782^{***}	0.781^{***}	0.666^{***}	0.733^{***}
	(0.236)	(0.195)	(0.242)	(0.244)	(0.143)	(0.201)
Observations	1008	966	1008	1008	1008	948
Kleibergen-Paap F-stat	6.801	7.783	12.384	12.493	10.669	15.369
Anderson-Rubin test (χ^2)	2.473	3.783	5.018	4.769	3.363	4.914
p-value	0.116	0.052	0.025	0.029	0.067	0.027
Common factors?	No	Yes	No	No	No	No
Common GFC effects?	No	No	Yes	No	No	No
Country-specific GFC effects?	No	No	No	Yes	No	No
Time FE?	No	No	No	No	Yes	Yes
Additional covariates?	No	No	No	No	No	Yes
Drop outliers?	No	No	No	No	No	Yes

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Alternative network structures W

(a) Weighting Matrix (W): Gross bilateral trade						
	(1)	(2)	(3)	(4)	(5)	(6)
Wr	1.078***	0.980***	1.046***	1.034***	0.881***	0.898***
	(0.201)	(0.186)	(0.270)	(0.264)	(0.136)	(0.207)
Observations	1757	1693	1757	1757	1757	1589
Kleibergen-Paap F-stat	9.747	10.790	15.259	15.732	9.853	11.360
Anderson-Rubin test (χ^2)	3.819	5.810	8.585	8.214	4.279	4.342
p-value	0.051	0.016	0.003	0.004	0.039	0.037
(b) Weighting Matrix (W): Relative output size						
	(1)	(2)	(3)	(4)	(5)	(6)
Wr	1.144***	1.070***	1.116***	1.092***	0.893***	0.664***
	(0.216)	(0.202)	(0.357)	(0.351)	(0.161)	(0.237)
Observations	1757	1693	1757	1757	1757	1568
Kleibergen-Paap F-stat	6.647	8.919	7.497	7.324	8.393	5.730
Anderson-Rubin test (χ^2)	3.691	5.069	5.489	4.973	3.912	3.765
p-value	0.055	0.024	0.019	0.026	0.048	0.052
Common factors?	No	Yes	No	No	No	No
Common GFC effects?	No	No	Yes	No	No	No
Country-specific GFC effects?	No	No	No	Yes	No	No
Time FE?	No	No	No	No	Yes	Yes
Additional covariates?	No	No	No	No	No	Yes
Drop outliers?	No	No	No	No	No	Yes

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Heterogeneous local projections

Horizon	$\boldsymbol{Wr}$		$\boldsymbol{Wr} \cdot K_{SCH}$		K_{SCH}	
	$\hat{\delta}_{0,h}$	SE	$\hat{\theta}_{1,h}$	SE	η_h	SE
$h = 0$	0.760***	(0.124)	-0.576**	(0.228)	-0.001	(0.001)
$h = 1$	1.667***	(0.332)	-0.920***	(0.319)	-0.001	(0.001)
$h = 2$	1.757***	(0.463)	-1.011**	(0.431)	-0.001	(0.002)
$h = 3$	1.645***	(0.427)	-1.004***	(0.370)	-0.001	(0.002)
$h = 4$	1.335***	(0.475)	-1.197***	(0.427)	-0.001	(0.003)
$h = 5$	0.840*	(0.495)	-1.167**	(0.481)	-0.001	(0.003)
$h = 6$	0.393	(0.509)	-1.088	(0.707)	-0.001	(0.003)
$h = 7$	0.107	(0.617)	-1.018	(0.803)	-0.002	(0.003)
$h = 8$	0.067	(0.655)	-0.799	(0.845)	-0.002	(0.003)

$$\boldsymbol{R_h} - \boldsymbol{R_{t-1}} = (\delta_h + \theta_h K_t) \cdot \boldsymbol{Wr}_t + \eta_h K_t + \boldsymbol{\beta}_h \boldsymbol{X}_t + \boldsymbol{u}_t$$

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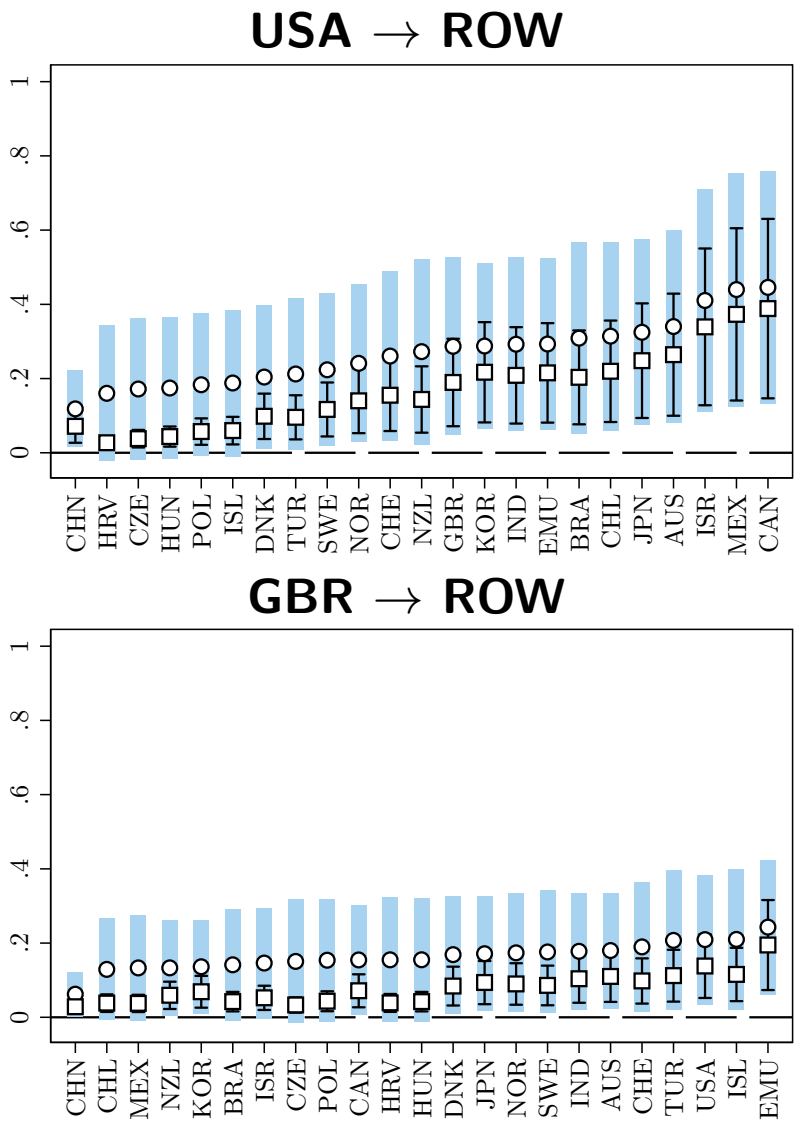
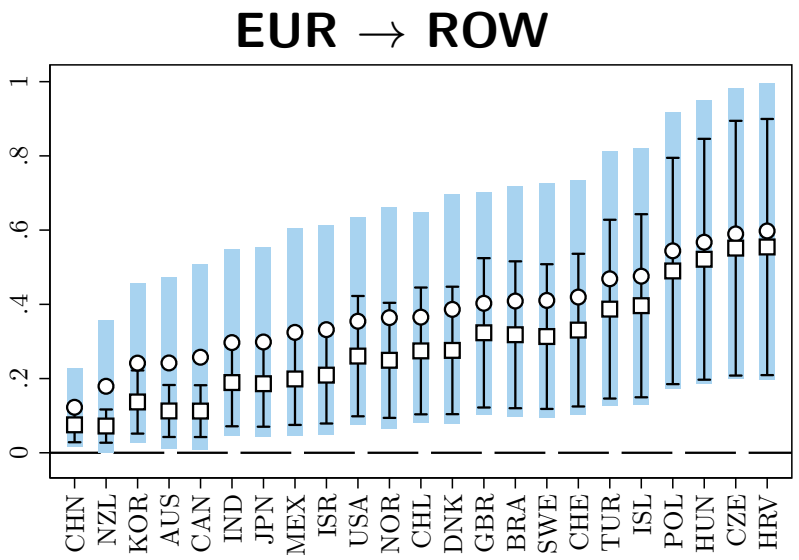
Partial and General Equilibrium Effects





Weighting matrix ($\boldsymbol{W}$):
Gross bilateral investment position

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