The Global Effects of U.S. Monetary Policy

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Annual Conference Chaire Banque de France
23 September 2019, Paris

Spillovers from US Monetary Policy?

How Does U.S. MP Affect the Rest of the World?

- **Exchange Rate Channel**
- **Demand Channel**
- **Financial Channels** – 'Risk Taking' Channel, 'Credit' Channel

Implications:

- **Dilemma vs Trilemma** / Monetary Sovereignty
- Global Financial Cycle
- **Policy spillovers** / Policy Coordinations / Currencies Wars

Important question ... yet **limited empirical literature!**

What do we know?

Paper	Countries	Identification	CPI	IP/GDP	Short-term rates
Dedola et al. (2018)	18 EME, 18 AE	Sign restriction	$-$	$-$	AE: $-$; EME: mixed
Iacoviello, Navarro (2019)	50 countries	Cholesky	na	$-$	$+$
Kim (2001)	G7	Cholesky	insign.	$-$	$+$
Canova (2005)	Latin America	Sign restriction	$+$	mixed	$+$
Mackowiak (2007)	EME	Sign restriction	$+$	mixed	$+$
Miniane, Rogers (2007)	26 countries	Zero restrictions	$-*$	$-$	$+$
Di Giovanni, Shambaugh (2008)	IFS countries	none	na	$-$ for peggers	na
Bluedorn, Bowdler (2011)	AE	Romer and Romer	$-*$	$-*$	$+$
Akinci (2013)	6/10 EME	panel VAR + Cholesky	na	$-*$	na
Rey (2015)	UK, CAN, SWE, NZ	IV SVAR	mixed	mixed	mixed
Passari, Rey (2015)	UK	IV SVAR	insign.	insign.	insign.
Georgiadis (2016)	EME and AE	Sign restriction	na	$-$	na
Bhattarai et al. (2017)	15 EME	Cholesky	insign.	$-$	$+$
Vicondoa (2019)	13 EME	Cholesky	$+$	$-$	$+$
Miranda-Agrippino, Rey (2019)	US, EU, UK	IV SVAR	$-$	$-$	$-$

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Challenges to Measuring US MP Global Spillovers

Bernanke, Mundell-Fleming Lecture (2015)

1. **Policy actions** are a **signal** about **US and global fundamentals**

2. **Large heterogeneity across countries** both in terms of **cyclical position**, financial markets conditions and **'structural features'**

3. Need of high frequency **data on leverage, risk appetite, capital flows, ...**

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Challenges to Measuring US MP Global Spillovers

Our Approach

1. **Policy actions** are a **signal** about **US and global fundamentals**
   $\Longrightarrow$ **High Frequency Identification** for **conventional MP shocks** ...
   $\Longrightarrow$ ... **robust to signalling effects** of MP actions
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   - $\Longrightarrow$ **Rich monthly dataset** of **15 ADV** and **15 EME**
   - $\Longrightarrow$ Efficient big data techniques with **bilateral Large BVARs**
   - $\Longrightarrow$ Global macro and financial aggregates
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   - $\Longrightarrow$ Dataset of financial conditions indexes (**CBC Global Liquidity dataset**) CBC Data
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4. Potential **misspecifications**, **nonlinearities** and **asymmetries**
   $\Longrightarrow$ **Bayesian Local Projections** and direct study of asymmetries

Our Results

- Strong **nominal effects**
- Sizeable **real effects**
- Global response of **capital flows** and **risk appetite**
- Oil and commodities play an important role in CPI movements
- Some evidence of **asymmetric effects**

Related Literature

- **HF Identification MP Shocks:** Rudebush (1989), Kuttner (2001), Gürkaynak et al (2005), Gertler and Karadi (2015), Caldara and Herbst (2016), Jarociński and Karadi (2018), Cieslak and Schrimpf (2018), Andrade and Ferroni (2016), Miranda-Agrippino and Ricco (2015)
- **Global Effects US MP:** Kim (2001), Canova (2005), Mackowiak (2007), Miniane, Rogers (2007), Di Giovanni, Shambaugh (2008), Bluedorn, Bowdler (2011), Akinci (2013), Miranda-Agrippino, Rey (2019), Rey (2015, 2016), Passari, Georgiadis (2016), Bhattarai et al. (2017), Gerko and Rey (2017), Stravakeva and Tang (2018), Dedola et al. (2018), Iacoviello, Navarro (2019), Vicondoa (2019), Gilchrist et al. (2019), Kalemli-Özcan (2019)
- **Spillovers through Banks:** Correa and Murry (2009), Cetorelli and Goldberg (2012), Temesvary et al. (2017), Correa et al. (2015), Buch et al. (2018), International Banking Research Network (IBRN)
- **Dominant Currency:** Gourinchas and Rey (2007), Rey (2015), Bernanke (2015), Casas et al. (2017), Gourinchas et al (2017)

The Identification of US MP Shocks

The HFI of Monetary Policy Shocks

Kuttner (2001), Sack (2004), Gürkaynak, Sack, Swanson (2005)

- Interest rates futures for agents' expectations

$$p_t^{(h)} = \mathbb{E}_t \left(i_{t+h} \right) + \zeta_t^{(h)}$$

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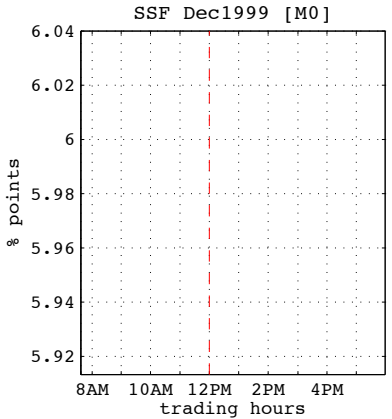
- Revision in **30 min window** price around **announcements**



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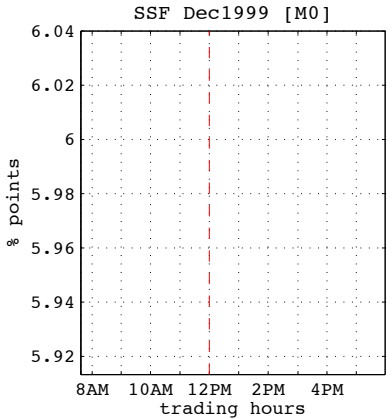

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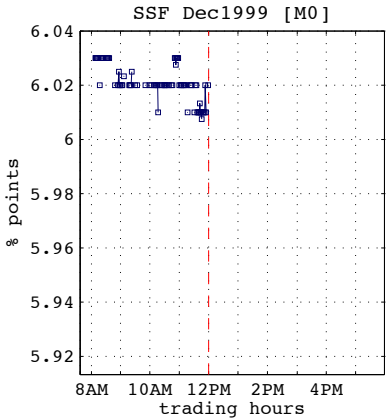

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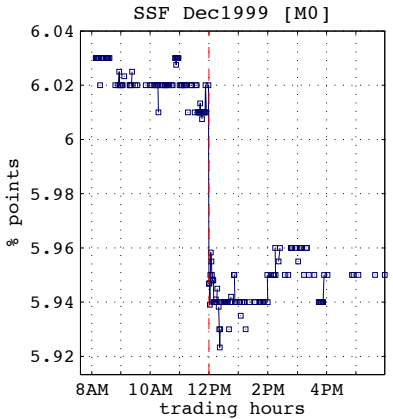

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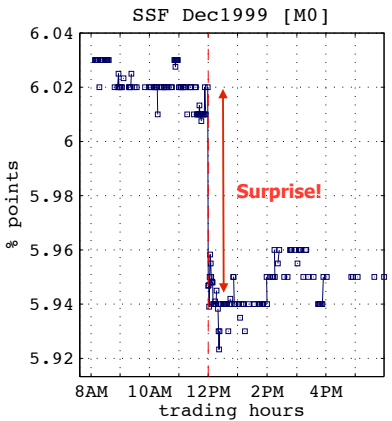
- Revision in **30 min window** price around **announcements**
  $\Longrightarrow$ **MP surprise**



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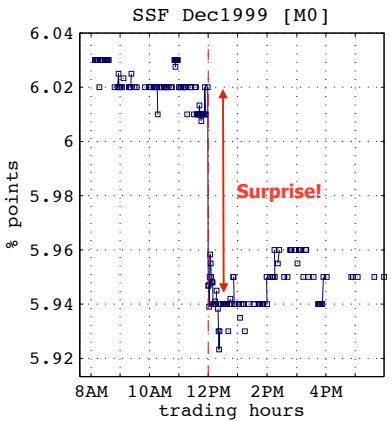

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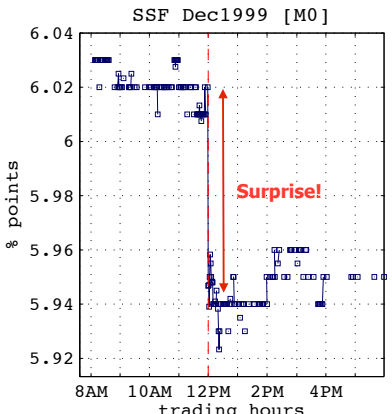
- Revision in **30 min window** price around **announcements**
- Information or MP shock?
  Interest rate hike
  - **MP shock**
    $\Longrightarrow$ lower output and inflation
  - **Endogenous reaction** to demand shocks
    $\Longrightarrow$ higher output and inflation



An Informationally Robust HFI

Miranda-Agrippino and Ricco (2018)

1. At FOMC frequency $\Longrightarrow$ **Signaling Channel**

$$FF4_m = \alpha_0 + \sum_{j=-1}^{3} \theta_j F_t^{cb} x_{q+j} + \sum_{j=-1}^{2} \vartheta_j \left[F_t^{cb} x_{q+j} - F_{t-1}^{cb} x_{q+j} \right] + MPI_m$$

An Informationally Robust HFI

Miranda-Agrippino and Ricco (2018)

2. Monthly aggregation

$$\overline{MPI}_t = \sum_{m \in t} MPI_m$$

An Informationally Robust HFI

Miranda-Agrippino and Ricco (2018)

3. At monthly frequency $\Longrightarrow$ **Slow Absorption of Information**

$$\overline{MPI}_t = \phi_0 + \sum_{j=1}^{12} \phi_j \overline{MPI}_{t-j} + MPI_t$$

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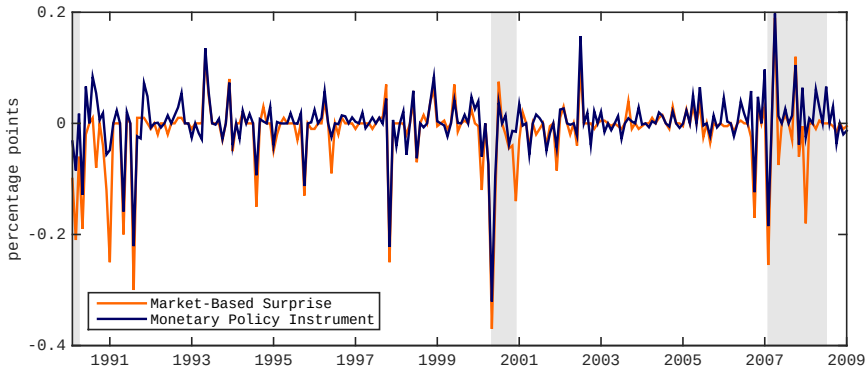
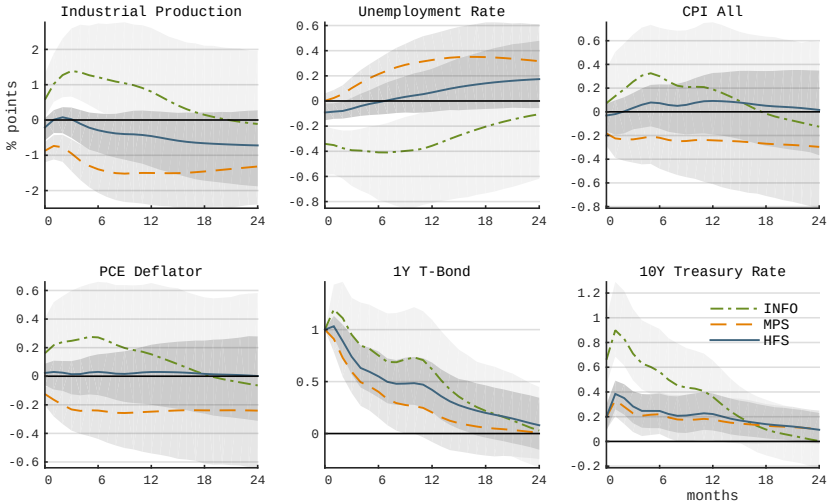


Information vs MP Shocks

Miranda-Agrippino and Ricco (2018)



Large Bayesian VARs

- Large **Bayesian VAR(12)**
  - 27 variables in global set
  - 28 variables in advanced set
  - 28 variables in emerging set
- **IV-SVAR** (Stock and Watson 2012, 2018, Mertens and Ravn 2013)
- **Standard macro priors** (Normal-Inverse-Wishart)
- **Optimal prior selection** (Giannone, Lenza, Primiceri, 2015)

VARs and Local Projections

VAR-IRFS

$$y_{t+1} = By_t + u_{t+1}$$

$$\text{IRF}_h^{VAR} = B^h A_0^{-1}$$

- optimal and consistent only if the VAR captures the DGP

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LP-IRFS

$$y_{t+h} = \widetilde{B}^{(h)} y_t + v_{t+h}$$

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- robust to misspecification but high estimation uncertainty

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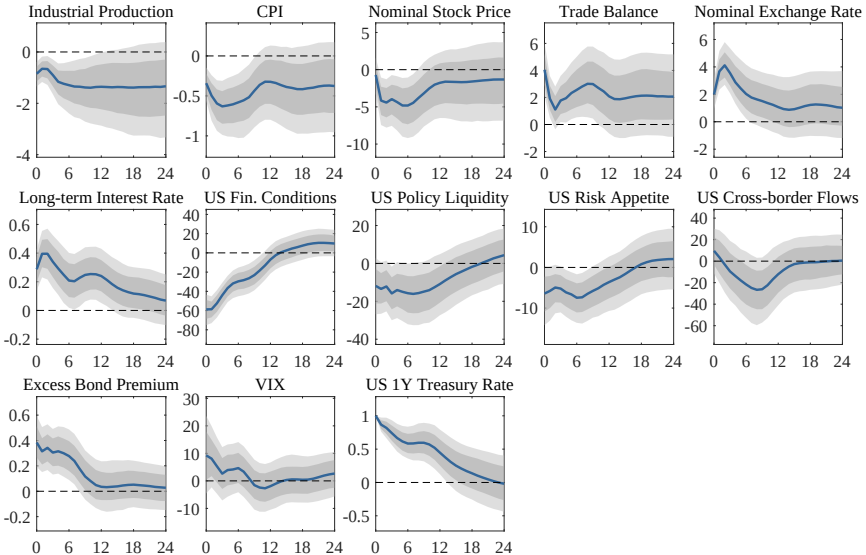
- optimal and consistent only if the VAR captures the DGP
- robust to misspecification but high estimation uncertainty
- Selecting between the two methods: empirical problem choosing between **bias** and **estimation variance**...
- **Idea:** Regularise LP with NIW priors centred around VAR coefficients (pre-sample)

$$\widetilde{B}^{(h)} \longleftrightarrow B^{(\text{VAR},h)} = B^h$$

Global Spillovers

Domestic Effects of U.S. Monetary Policy (BVAR)

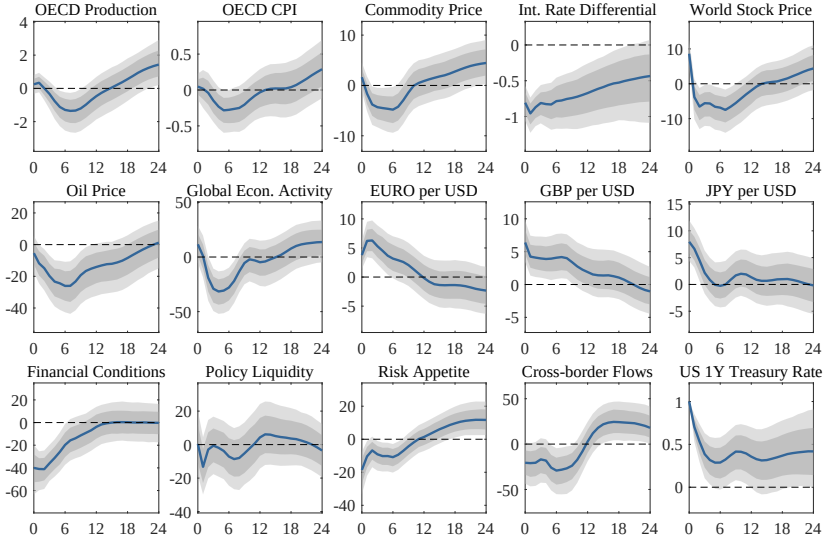


Information Set

Global set	Log	RW Prior	U.S. set	Log	RW Prior
Industrial Production Index, OECD countries	•	•	US Industrial Production Index	•	•
CPI Index, OECD countries	•	•	US Consumer Price Index	•	•
CRB Commodity Price Index	•	•	US Nominal Stock Price Index	•	•
Short-term Interest Differential			US Trade Balance		
World Stock Price index (excl. North America)	•	•	US Nominal Effective Exchange Rate	•	•
Global price of Brent Crude ($/BBL)	•	•	US Financial Conditions Index, CBC	•	
Kilian (2019) Global Economic Activity Index			US Policy Liquidity Index, CBC	•	
Euro per US Dollar Exchange rate	•		US Risk Appetite, CBC		
British pound per US Dollar Exchange rate	•		US Cross-border Flows Index, CBC	•	
Japanese Yen per US Dollar Exchange rate	•		Gilchrist-Zakrajsek Excess Bond Premium		
Global Financial Conditions Index, CBC	•		CBOE VIX	•	
Global Policy Liquidity Index, CBC	•		US 10-Year Treasury Constant Maturity Rate		
Global Risk Appetite, CBC			US 1-Year Treasury Constant Maturity Rate		
Global Cross-border Flows Index, CBC	•				

Notes: Sample: 1990:1 – 2018:8. OECD variables are weighted by the previous year's GDP (PPP adjusted).

Global Spillovers (BVAR)



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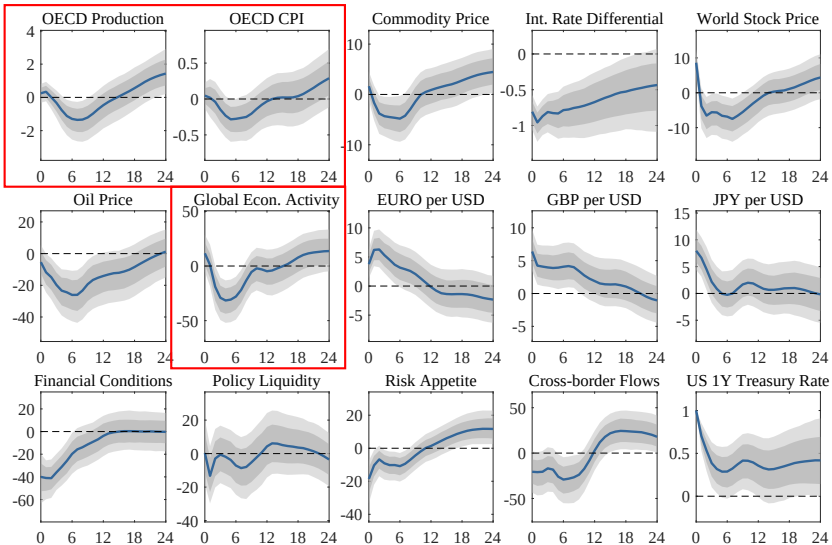

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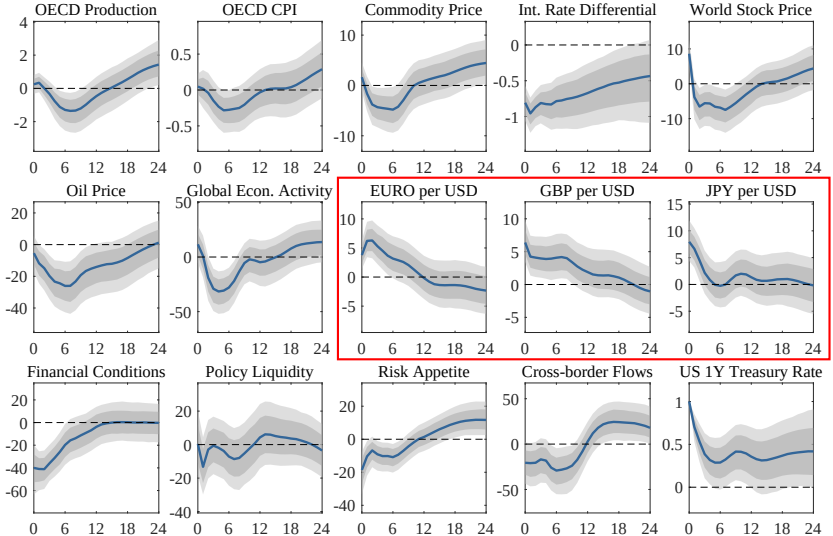

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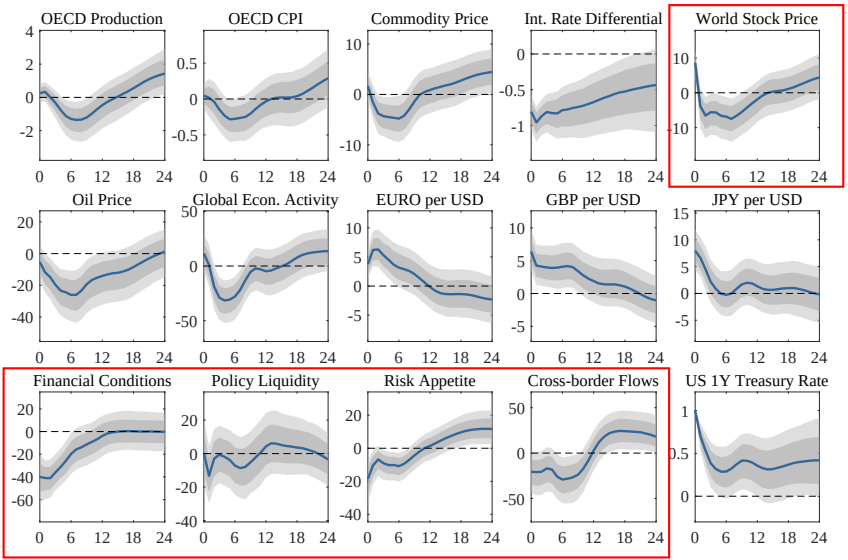

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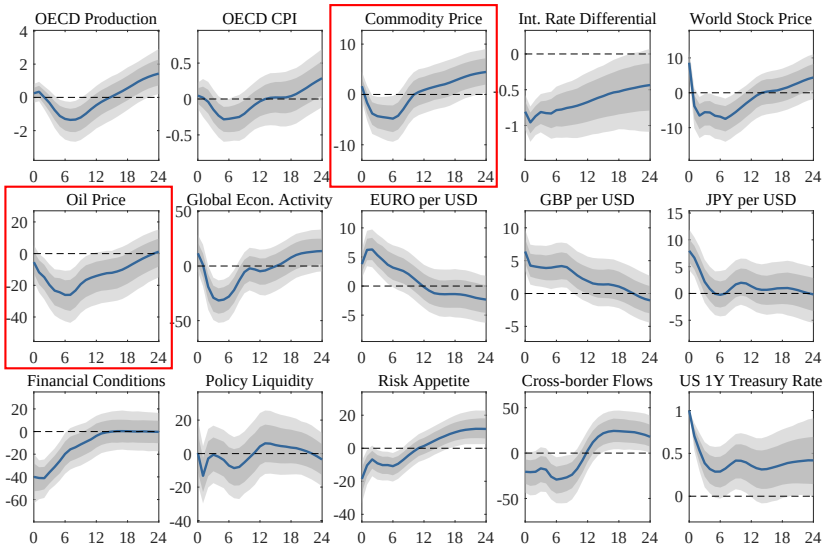
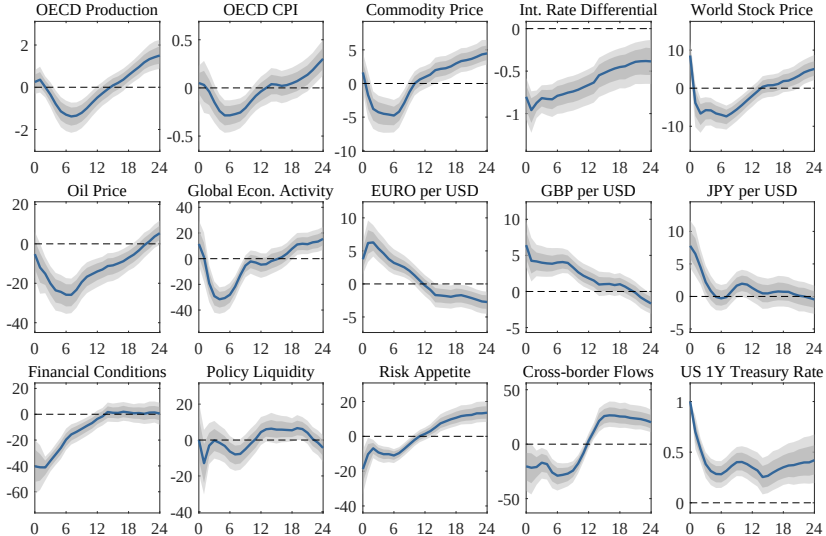
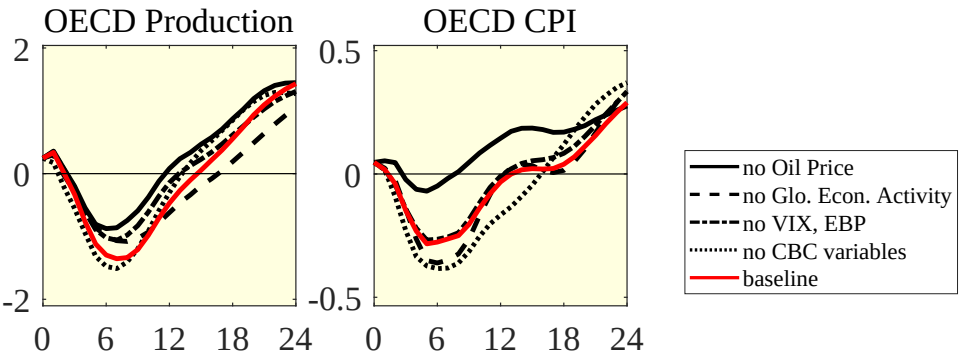


Global variables (BLP)



Channels of Transmission



Advanced Economies

Countries and Data Coverage

Countries	Data coverage
Australia	Jan 1990 - Aug 2018
Austria	Jan 1990 - Aug 2018
Belgium	Jan 1990 - Aug 2018
Canada	Jan 1990 - Aug 2018
Denmark	Jan 1990 - Aug 2018
Finland	Jan 1990 - Aug 2018
France	Jan 1990 - Aug 2018
Germany	Jan 1990 - Aug 2018
Italy	Jan 1990 - Aug 2018
Japan	Jan 1990 - Aug 2018
Netherlands	Jan 1990 - Aug 2018
Norway	Jan 1990 - Aug 2018
Spain	Jan 1990 - Aug 2018
Sweden	Jan 1990 - Aug 2018
UK	Jan 1990 - Aug 2018

Bilateral VARs

$$Y_{it} = c_i + \sum_{j=1}^{p} A_{ij} Y_{i,t-j} + u_{it}, \quad p = 12$$

$$Y_{it} = \begin{bmatrix} y_{i,t} \\ y_{US,t} \\ x_t \end{bmatrix}, \quad y_{i,t} = \begin{bmatrix} IP_{i,t} \\ CPI_{i,t} \\ \vdots \end{bmatrix}, \quad x_t = \begin{bmatrix} POIL_t \\ GEAI_t \\ VIX_t \end{bmatrix}$$

Bilateral VAR for country *i*:

- Standard Normal-Inverse Wishart macro priors
- Optimal prior selection (GLP, 2015)
- IV SVAR identification

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Foreign set	Logs	RW Prior	U.S. set	Logs	RW Prior
Industrial Production Index	•	•	US Industrial Production Index	•	•
Consumer Price Index	•	•	US Consumer Price Index	•	•
Core CPI Index	•	•	US Core CPI Index	•	•
Nominal Stock Price Index	•	•	US Nominal Stock Price Index	•	•
Trade Balance			US Trade Balance		
Nominal USD Exchange Rate	•	•	US Nominal Effective Exchange Rate	•	•
Short-term Interest Rate			US 10-Year Treasury Constant Maturity Rate		•
Policy Rate			US Financial Conditions Index, CBC	•	
Long-term Interest Rate			US Policy Liquidity Index, CBC	•	
Financial Conditions Index, CBC	•		US Risk Appetite, CBC		
Policy Liquidity Index, CBC	•		US Cross-Border Flows Index, CBC	•	
Risk Appetite, CBC			US 1-year Treasury constant maturity rate		•
Cross-Border Flows Index, CBC	•				
Global price of Brent Crude	•	•			
Kilian (2019) Global Economic Activity Index					
CBOE VIX	•				

Aggregation into Mean Economy

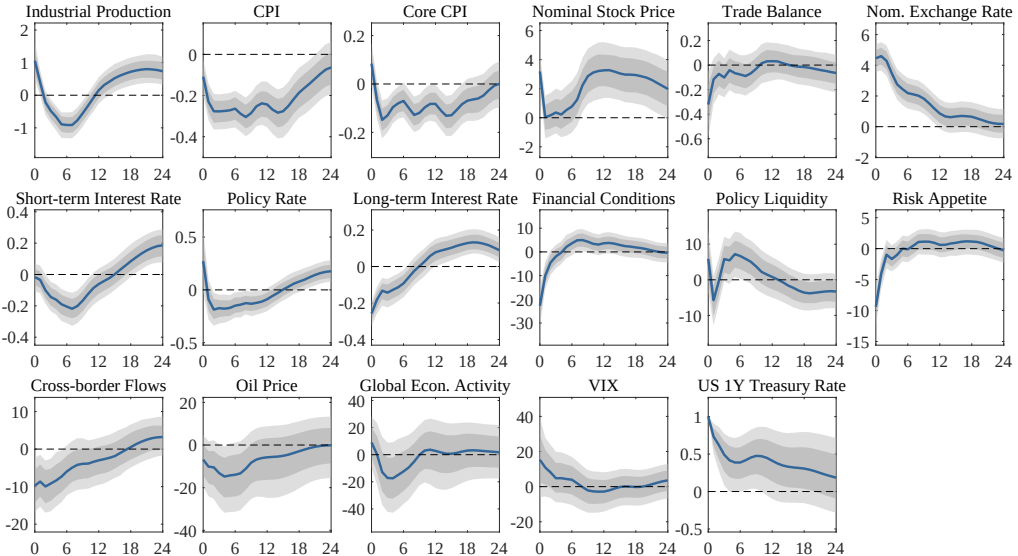
- Country $i \in N$ IRFs for variable y at horizon h

$$IRF^{h}_{y,\,i} = \frac{\partial y_{i,\,t+h}}{\partial \epsilon^{MP}_{US,\,t}}$$

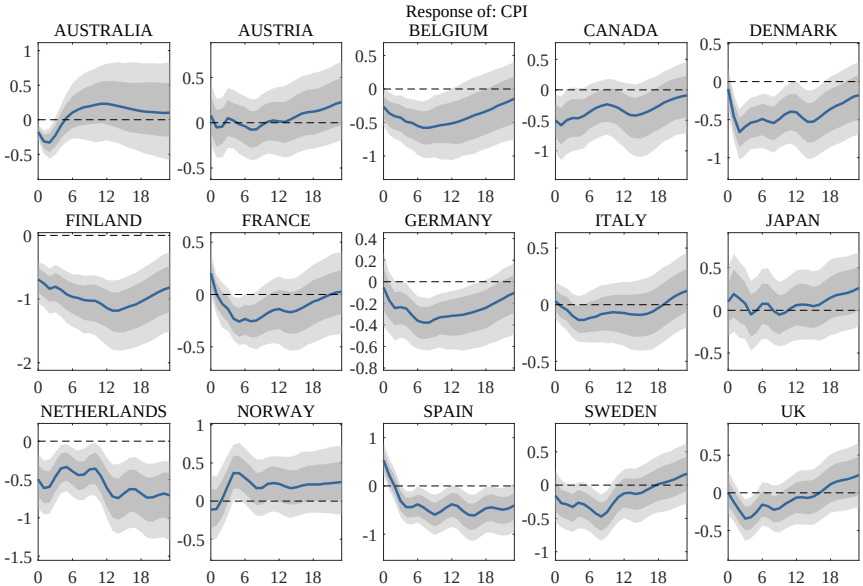
- Mean country response

$$IRF^{h}_{y} = \frac{1}{N} \sum_{i} IRF^{h}_{y,\,i}$$

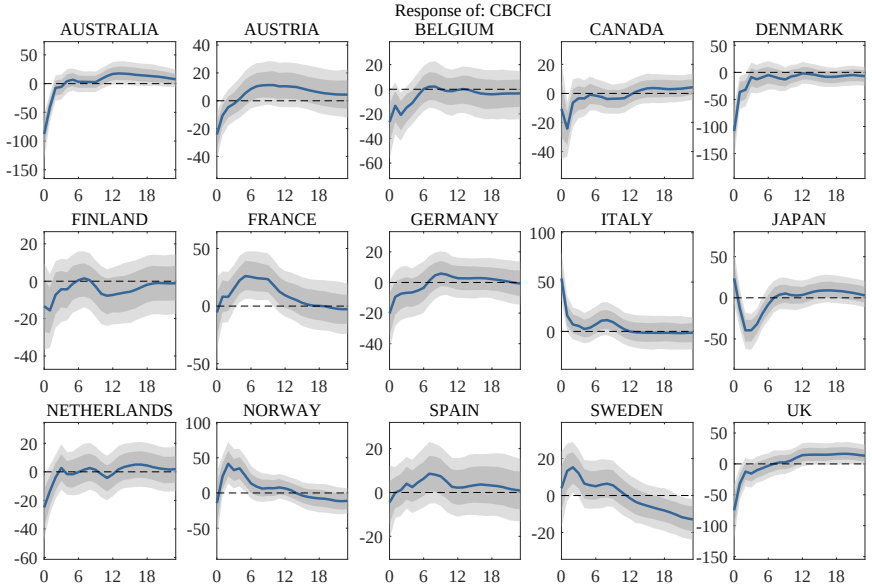
Mean Advanced Economy (BVAR)



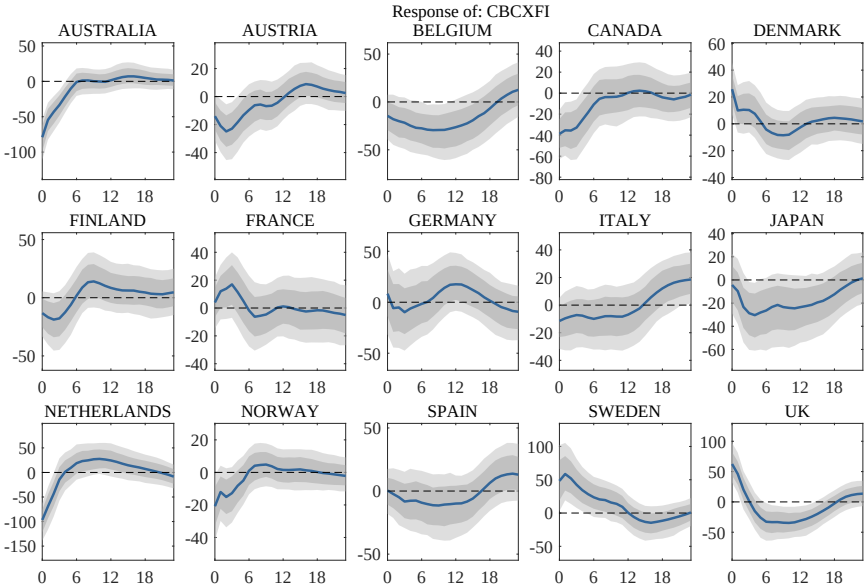
CPI (BVAR)


Response of: CPI
AUSTRALIA
AUSTRIA
BELGIUM
CANADA
DENMARK
FINLAND
FRANCE
GERMANY
ITALY
JAPAN
NETHERLANDS
NORWAY
SPAIN
SWEDEN
UK

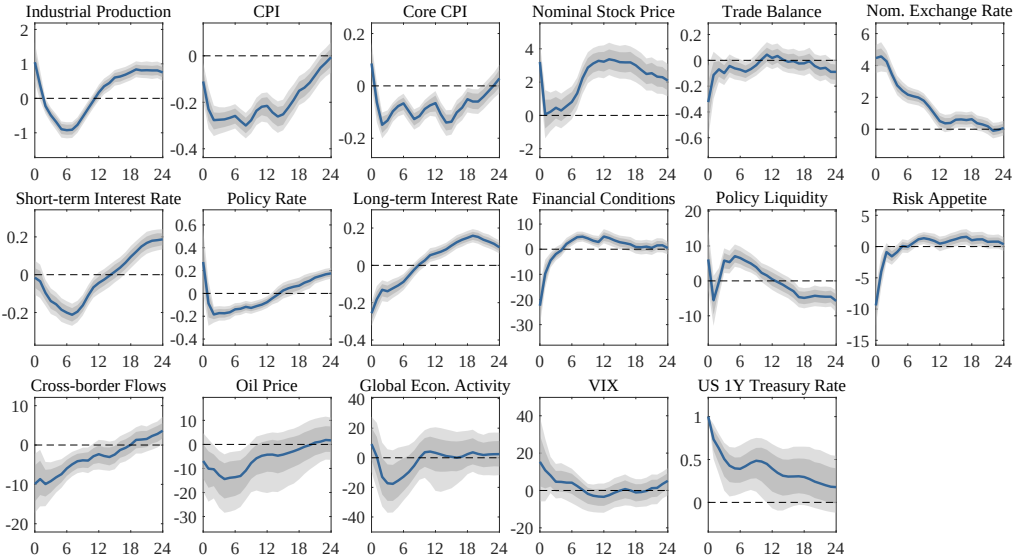
Financial Conditions (BVAR)



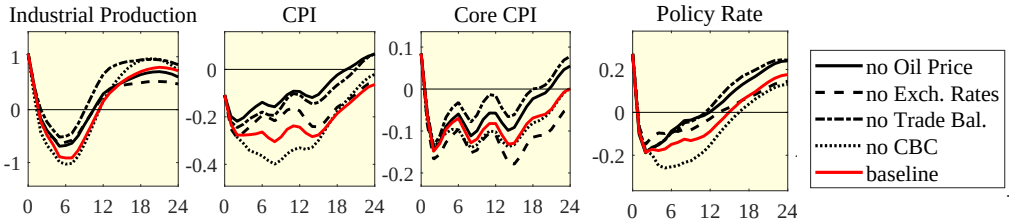
Cross-border Flows (BVAR)



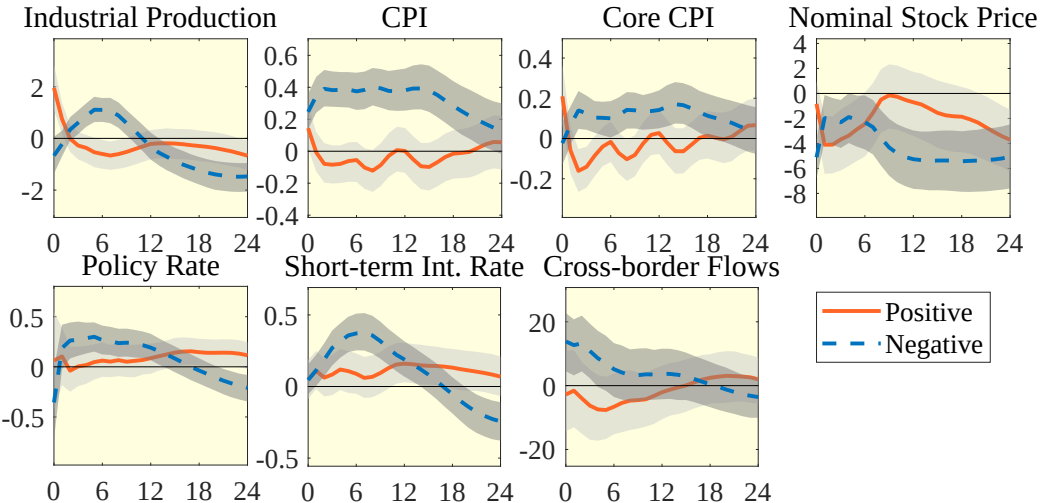
Mean Advanced Economy (BLP)



Channels of Transmission (BVAR)



Asymmetric Responses (BVAR)



Emerging Economies

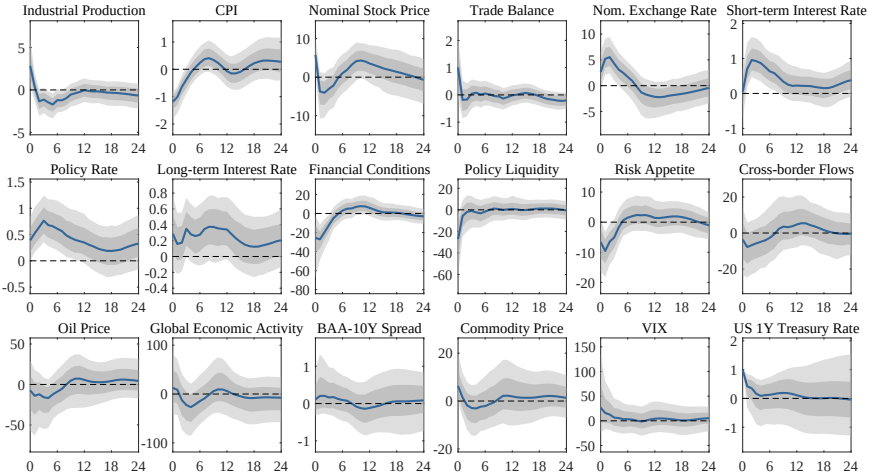
Countries and Data Coverage

Country	Data coverage with Core CPI	Data coverage without Core CPI
Brazil	Dec 1999 - Aug 2018	Dec 1999 - Aug 2018
Chile	May 1995 - Nov 2013	May 1995 - Nov 2013
China		Aug 1994 - Aug 2018
Colombia	Sep 2002 - Aug 2018	Sep 2002 - Aug 2018
Czech Republic	Apr 2000 - Aug 2018	Apr 2000 - Aug 2018
Hungary	Feb 1999 - Aug 2018	Feb 1999 - Aug 2018
India		May 1994 - Apr 2018
Malaysia		Jan 1996 - Dec 2017
Mexico	Nov 1998 - Feb 2018	Nov 1998 - Feb 2018
Philippines	Jan 2000 - Feb 2018	Feb 1999 - Feb 2018
Poland	Jan 2001 - Aug 2018	Jan 2001 - Aug 2018
Russia	Jan 2003 - Jun 2018	Jan 1999 - Jun 2018
South Africa	Jan 2002 - Aug 2018	Jan 1990 - Aug 2018
Thailand	Jan 1999 - May 2018	Jan 1999 - May 2018
Turkey	Jun 2000 - Aug 2018	Jun 2000 - Aug 2018

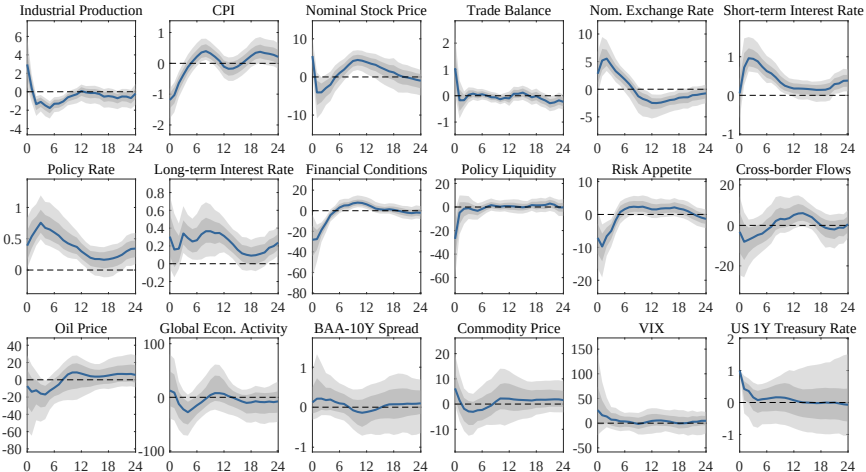
Information Set

Foreign set	Logs	RW Prior	U.S. set	Logs	RW Prior
Industrial Production Index	•	•	US Industrial Production Index	•	•
Consumer Price Index	•	•	US Consumer Price Index	•	•
Nominal Stock Price Index	•	•	US Nominal Stock Price Index	•	•
Trade Balance			US Trade Balance		
Nominal USD Exchange Rate	•	•	US Nominal Effective Exchange Rate	•	•
Short-term Interest Rate			US 10-Year Treasury Constant Maturity Rate		•
Policy Rate			US Financial Conditions Index, CBC	•	
Long-term Interest Rate			US Policy Liquidity Index, CBC	•	
Financial Conditions Index, CBC	•		US Risk Appetite, CBC		
Policy Liquidity Index, CBC	•		US Cross-Border Flows Index, CBC	•	
Risk Appetite, CBC			US 1-year Treasury constant maturity rate		•
Cross-Border Flows Index, CBC	•				
Global price of Brent Crude	•	•			
Kilian (2019) Global Economic Activity Index					
BAA spread (corporate minus 10Y Treasury CM)					
CRB Commodity Price Index	•	•			
CBOE VIX	•				

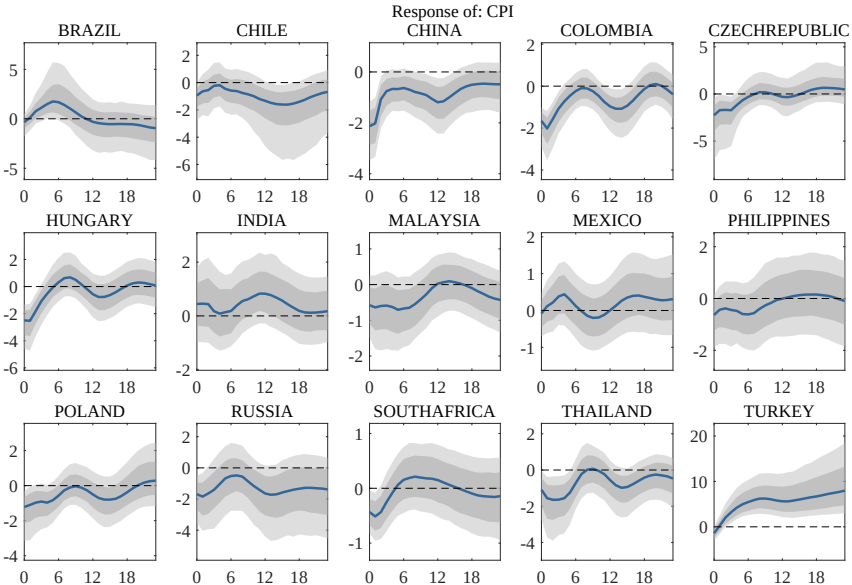
Mean Emerging Economy (BVAR)



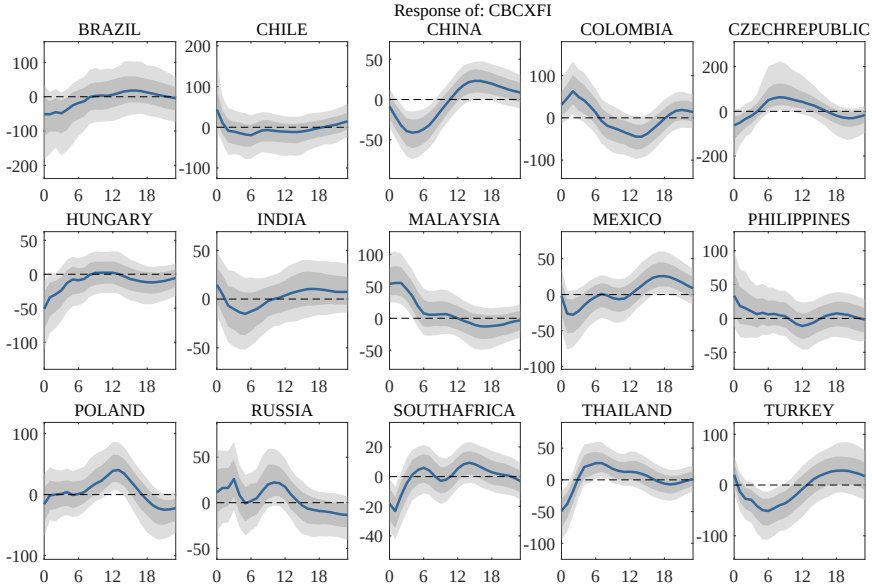
Mean Emerging Economy (BLP)



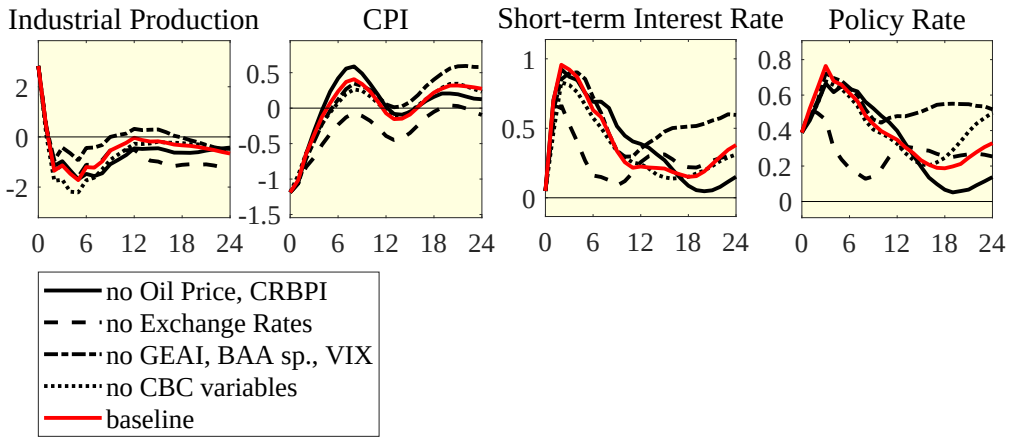
CPI (BVAR)


Response of: CPI
BRAZIL
CHILE
CHINA
COLOMBIA
CZECHREPUBLIC
HUNGARY
INDIA
MALAYSIA
MEXICO
PHILIPPINES
POLAND
RUSSIA
SOUTHAFRICA
THAILAND
TURKEY
0 6 12 18

Cross-border flows (BVAR)



Channels of Transmission



Capital Controls

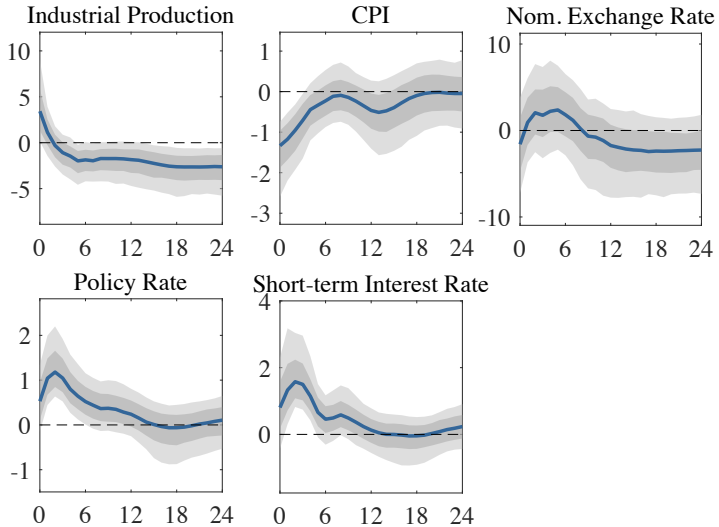
Classification

Chinn-Ito Index, 1990-2015 Average					
ADVANCED	AUSTRALIA	0.814	EMERGING	BRAZIL	0.262
	AUSTRIA	0.965		CHILE	0.517
	BELGIUM	0.965		CHINA	0.147
	CANADA	1		COLOMBIA	0.272
	DENMARK	0.993		CZECH REP.	0.839
	FINLAND	0.965		HUNGARY	0.653
	FRANCE	0.944		INDIA	0.166
	GERMANY	1		MALAYSIA	0.513
	ITALY	0.944		MEXICO	0.640
	JAPAN	0.988		PHILIPPINES	0.393
	NETHERLANDS	1		POLAND	0.315
	NORWAY	0.886		RUSSIA	0.432
	SPAIN	0.898		SOUTH AFRICA	0.169
	SWEDEN	0.942		THAILAND	0.338
	UK	1		TURKEY	0.310
ADVANCED	MEDIAN	0.965	EMERGING	MEDIAN	0.338

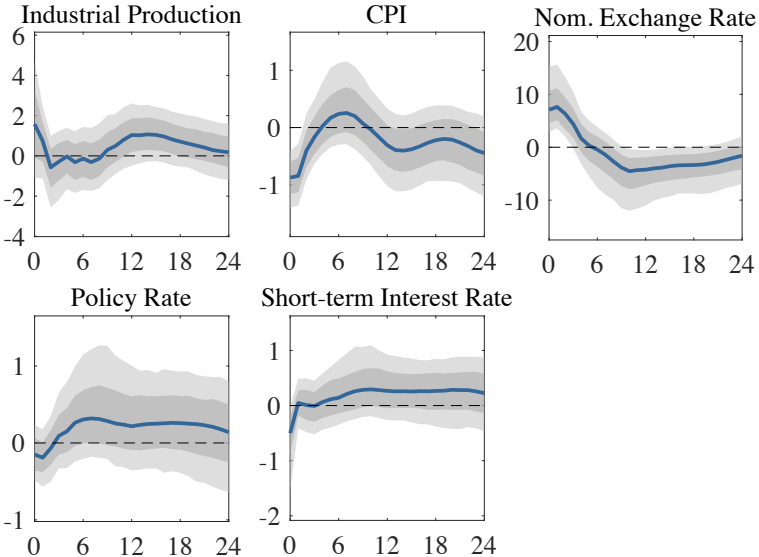
Classification

	Advanced		Emerging	
	Open (Top 33%)	Less Open (Bottom 33%)	Open (Top 33%)	Less Open (Bottom 33%)
	CANADA	AUSTRALIA	CHILE	BRAZIL
	DENMARK	ITALY	CZECH REP.	CHINA
	GERMANY	NORWAY	HUNGARY	COLOMBIA
	NETHERLANDS	SPAIN	MALAYSIA	INDIA
	UK	SWEDEN	MEXICO	SOUTH AFRICA
Average	0.998	0.897	0.632	0.203

The Relatively Financially Open Emerging Economy...



...vs. the Relatively Financially Closed Emerging Economy



Conclusions – The Global effects of U.S. Monetary Policy

- US monetary policy has large and pervasive effects
- **Spillovers** to both **prices and real economy**
- Strong evidence of financial channels
- Affect both **Advanced Economies** and **Emerging Markets**
- Initial evidence of **asymmetric effects**

Appendix

Standardisation (z-scores)

Method is the “standard” for Financial Stability Boards:

$$z_t = \frac{x_t - MA(x_t,\, 40)}{SD(x_t,\, entire\, period)}$$

- 40 months moving average trends
- SD over entire period to account for rare events
- Expressed in percentiles (50 is trend)

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Financial Conditions Index

- AKA: Credit Spreads
- Index of very short-term credit spreads (e.g. deposit loan spreads)
- Derived from the z-scores of each sub-variable, which are equally weighted and then normalised
- Varies between 0 and 100 with 50 indicating “neutral” relative to a 40-month MA

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Policy Liquidity Index

- AKA: Central Bank Money
- Measures size of CB balance sheets and changes in their composition
- Derived from the z-scores of each sub-variable, which are equally weighted and then normalised
- Varies between 0 and 100 with 50 indicating “neutral” relative to a 40-month MA

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Cross-border Flows Index

- AKA: Foreign Liquidity
- Comprises all financial flows into a currency (incl. banking flows, bonds and equities)
- Estimated from national trade and current account data, foreign exchange reserve movements and (interpolated) quarterly data on net FDI flows
- Derived from the “normalised” z-score of the value of cross-border flows. The resulting index varies between 0 and 100 with 50 indicating “neutral” relative to a 40-month moving average
- **In the Global version, US weight is 24.81%**

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Risk Appetite

- Difference between the Equity Exposure Index and the Bond Exposure Index
- **Equity Exposure Index:** AKA Equity Market Sentiment
  - Based on the balance sheet exposure of all investors (by type) in the asset class.
  - Derived from a z-score of the current portfolio share away from its 5-year trend, e.g. equity holdings as a percentage of all financial assets
- **Bond Exposure Index:** AKA Bond Market Sentiment
  - Equivalent of the equity exposure index for bonds

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