

# Monetary News in the United States and Business Cycles in Emerging Economies

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RIDGE Workshop on Macroeconomics and Development  
10/12/2018

# Motivation

- Movements in the U.S. interest rate affect macroeconomic and financial conditions of Emerging Economies (Rey, 2013).
- Empirical evidence: **no consensus on the effects of U.S. interest rate shocks** (Canova, 2005; Mackowiak, 2007; Ilzetzki and Jin, 2013; Dedola et al., 2017).

# Motivation

- Movements in the U.S. interest rate affect macroeconomic and financial conditions of Emerging Economies (Rey, 2013).
- Empirical evidence: **no consensus on the effects of U.S. interest rate shocks** (Canova, 2005; Mackowiak, 2007; Ilzetzki and Jin, 2013; Dedola et al., 2017).
- Many movements in the U.S. interest rate are **anticipated** before they occur.
- In case of anticipation, a VAR with insufficient information fails to capture the dynamics of the variables (Hansen and Sargent, 1991).

# This Paper

## Questions:

1. What are the effects of anticipated and unanticipated U.S. interest rate shocks on business cycles of Emerging Economies?
2. How are these shocks transmitted to Emerging Economies?

## Analysis:

1. Novel identification of anticipated and unanticipated U.S. interest rate shocks.
2. Panel VAR to characterize the response and transmission to Emerging Economies.

## Related Literature

1. **Empirical Macroeconomics:** Canova (2005); Mackowiak (2007); Ilzetzki and Jin (2013); Dedola et al. (2017).

**Contribution:** Identify the effects of anticipated and unanticipated U.S. interest rate shocks.

2. **Global Financial Conditions on Emerging Economies:** Calvo et al. (2006); Rey (2013); Akinci (2013); Albagli et al. (2018).

**Contribution:** Document that anticipated U.S. interest rate shocks affect capital flows significantly.

3. **News Shocks:** Beaudry and Portier (2006); Schmitt-Grohe and Uribe (2012); Milani and Treadwell (2012); Gomes et al. (2013); Ben Zeev et al. (2017).

**Contribution:** Show that anticipation is important for assessing the transmission of U.S. interest rate shocks.

## Preview of Main Findings

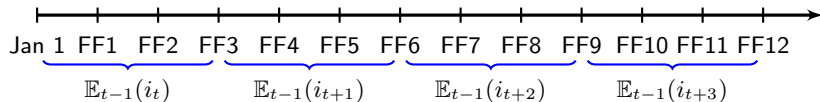
- Anticipation accounts for a significant fraction of Fed Funds fluctuations.
- Emerging Economies **react to the news before any change in the U.S. interest rate materializes.**
- **25 bp contractionary U.S. interest rate shocks** induce a **fall of 0.5% in GDP** from its trend in Emerging Economies.
- U.S. interest rate shocks explain **14% of business cycle fluctuations** in emerging economies.
- **Credit variables** are key for the transmission of both shocks.

# Outline

1. **Identification of Anticipated and Unanticipated U.S. interest rate shocks**
2. Panel VAR: identifying the transmission of U.S. interest rate shocks to Emerging Economies
3. Alternative empirical specifications
4. Conclusions

# Anticipated and Unanticipated Changes

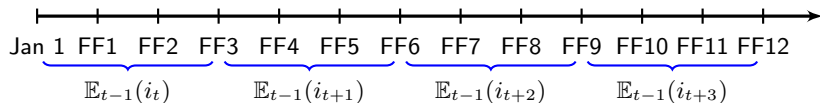
- Proxy for agents' expectations: **CBOT Fed Fund futures**.
- At the beginning of a quarter, the price of Fed Funds futures (FF) is based on the expected average Fed Funds rate for that month.





# Anticipated and Unanticipated Changes

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## Changes in U.S. Interest Rate

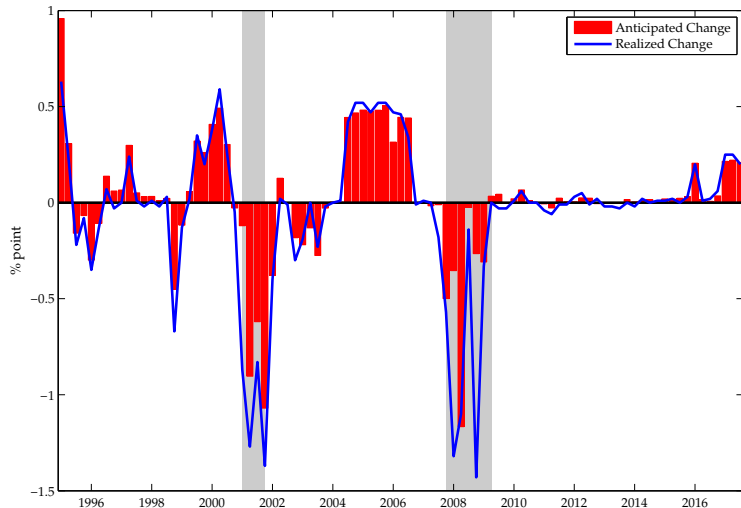
- **Anticipated:**

$$\Delta i_{t,t+j}^a = \mathbb{E}_{t-1}(i_{t+j} - i_{t+j-1}) \quad \forall j = \{0, 1, 2\}$$

- **Unanticipated:**

$$\Delta i_t^u = i_t - \mathbb{E}_{t-1}i_t$$

# Anticipated and Realized Changes



NOTE. Anticipated Change is computed as difference between market expectations regarding the value of the Fed Funds rate in the current quarter and the realized value of the previous quarter. The realized change denotes the change in the average Fed Funds rate with respect to the previous quarter. Shaded areas denote the recessions in the U.S defined by NBER.

● **Anticipation accounts for 80% of Fed Funds fluctuations.**

▶ Ant. Horizon

# Identifying U.S. Interest Rate Shocks

- Some fluctuations are due to changes in U.S. business cycle.

## Identifying Anticipated and Unanticipated shocks

$$\Delta i_t^u = \alpha_0 + \alpha_1 i_{t-1} + \alpha_2 (\hat{y}_t - \mathbb{E}_{t-1} \hat{y}_t) + \alpha_3 (\hat{u}_t - \mathbb{E}_{t-1} \hat{u}_t) + \alpha_4 (\hat{\pi}_t - \mathbb{E}_{t-1} \hat{\pi}_t) + (\epsilon_t - \mathbb{E}_{t-1} \epsilon_t)$$

$$\Delta i_{t,t+j}^a = \gamma_{0,j} + \gamma_{1,j} \mathbb{E}_{t-1} (i_{t+j-1}) + \gamma_{2,j} \mathbb{E}_{t-1} (\hat{y}_{t+j} - \hat{y}_{t+j-1}) + \gamma_{3,j} \mathbb{E}_{t-1} (\hat{u}_{t+j} - \hat{u}_{t+j-1}) + \gamma_{4,j} \mathbb{E}_{t-1} (\hat{\pi}_{t+j} - \hat{\pi}_{t+j-1}) + \mathbb{E}_{t-1} (\epsilon_{t+j} - \epsilon_{t+j-1}) \quad \forall j = \{0, 1, 2\}$$

- Forecasts for GDP ( $\hat{y}_t$ ), inflation ( $\hat{\pi}_t$ ) and unemployment ( $\hat{u}_t$ ): SPF.
- **Residuals are the U.S. interest rate shocks.**
  - ▶ Anticipated shocks:  $s_{t,t+j}^a = \mathbb{E}_{t-1} (\epsilon_{t+j} - \epsilon_{t+j-1})$  for  $i = \{0, 1, 2\}$
  - ▶ Unanticipated shocks:  $s_t^u = \epsilon_t - \mathbb{E}_{t-1} \epsilon_{t-1} = \epsilon_t$

# Outline

1. Identification of Anticipated and Unanticipated U.S. interest rate shocks
2. **Panel VAR: identifying the transmission of U.S. interest rate shocks to Emerging Economies**
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# Empirical Model

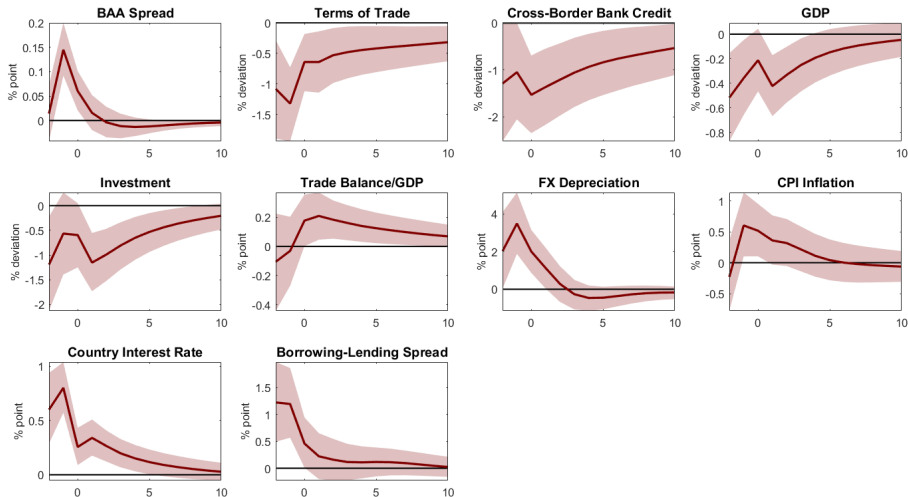
## VAR specification

$$X_{i,t} = B_i + C(L)X_{i,t-1} + D(L)s_t^u + E(L)s_t^a + F s_{t,t+1}^a + G s_{t,t+2}^a + \epsilon_{i,t}$$

$$X_{i,t} = \{BAA_t, ToT_{i,t}, ExtCre_{i,t}, GDP_{i,t}, I_{i,t}, \frac{TB_{i,t}}{GDP_{i,t}}, NEER_{i,t}, \Pi_{i,t}, R_{i,t}, LendSpr_{i,t}\}$$

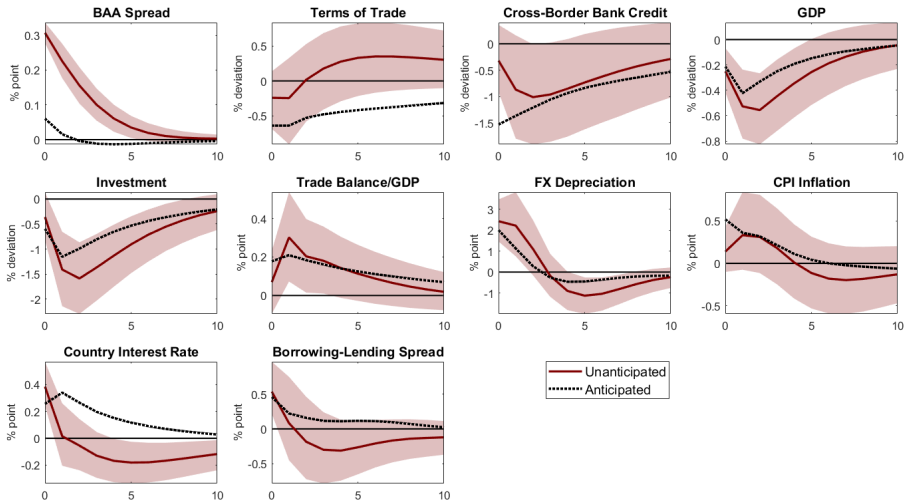
- **Sample period:** 1995:Q1 - 2017:Q3.
- **Baseline sample:** Argentina, Brazil, Chile, Mexico, Philippines, South Africa, Turkey.
- Countries share similar dynamics  $\Rightarrow$  estimate using the **Least Square Dummy Variable (LSDV)** estimator.
  - ▶  $C(L), D(L), E(L), F, G$  are the same across countries.
  - ▶ Time dimension is large  $\Rightarrow$  LSDV is preferred to GMM.

# IRF to an Anticipated Shock



NOTE. IRFs to a 2 quarters ahead anticipated 25bp contractionary interest rate shock. Solid lines denote point estimates of impulse responses; 90% confidence bands are depicted with light-red shaded areas.  $t = 0$  denotes the period when the U.S. interest rate increases. The previous two periods show the adjustment of the variables before the change in the U.S. materializes (i.e.  $s_{t-2,t}^a = 0.25$ ,  $s_{t-1,t}^a = 0.25$  and  $s_{t,t}^a = 0.25$ ). Confidence bands are computed through 10,000 bootstrap replications. Horizon is in quarters.

# IRF to an Unanticipated Shock



NOTE. IRFs to an unanticipated 25bp contractionary interest rate shock. Solid red line denotes point estimates of impulse responses; 90% confidence bands are depicted with light-red. Dotted black line denotes the median impulse response to an anticipated shock after  $t = 0$ . Confidence bands are computed through 10,000 bootstrap replications. Horizon is in quarters.

▶ IRF U.S.    ▶ IRF Developed

## Effects and Transmission Channels

- **Contractionary U.S. interest rate shocks** induce a **fall in GDP** and investment in Emerging Economies.
- Anticipated shocks: significant **reaction before there is a change in the U.S. interest rate.**



# Effects and Transmission Channels

- **Contractionary U.S. interest rate shocks** induce a **fall in GDP** and investment in Emerging Economies.
- Anticipated shocks: significant **reaction before there is a change in the U.S. interest rate**.
- Open questions:
  - ▶ How much do U.S. interest rate shocks explain of business cycle fluctuations in Emerging Economies?
  - ▶ Which is the role of each credit channel for the transmission of U.S. interest rate shocks?
    1. **Foreign corporate bond credit**: compute IRFs assuming that U.S. BAA corporate spread does not react.
    2. **Bank credit**: compute IRFs assuming that banking variables do not react.
    3. **No TOT**: compute the IRFs assuming that terms of trade do not react.

▶ IRF Channels

# Forecast Error Variance

Spec	Shock	BAA	TOT	Cre	GDP	I	TB	NER	CPI	R	LSp
Base	Ant	10.1	8.4	9.9	9.0	8.9	3.7	11.9	2.3	26.4	10.4
	Surp	31.1	0.4	1.7	5.0	6.3	1.9	3.7	0.4	2.4	0.9
	Total	41.2	8.8	11.6	14.0	15.2	5.6	15.6	2.7	28.8	11.3
No BAA	Ant	–	9.4	7.8	7.0	6.9	3.5	11.5	3.7	29.2	10.8
	Surp	–	0.1	0.2	1.1	2.6	1.4	2.4	2.2	1.3	0.5
	Total	–	9.5	8.0	8.1	9.5	4.9	13.9	5.9	30.5	11.3
No Bank	Ant	10.1	8.4	–	6.6	6.0	2.3	9.1	1.1	25.2	–
	Surp	31.1	0.4	–	5.0	6.4	1.7	3.0	0.2	2.3	–
	Total	41.2	8.8	–	11.6	12.4	4.0	12.1	1.3	27.5	–
No TOT	Ant	8.4	–	7.1	7.7	7.3	2.6	10.6	2.8	26.4	11.1
	Surp	31.0	–	1.7	5.0	6.3	1.8	3.4	0.4	2.4	0.9
	Total	39.4	–	8.8	12.7	13.6	4.4	14.0	3.2	28.8	12.0

NOTE. Estimated contribution of the Anticipated (Ant) and Unanticipated (Surp) U.S. interest rate shocks and of both shocks to explain the two year variation in the variables included in the baseline VAR (Base), and the baseline when U.S. BAA corporate spread does not react to the shocks (No BAA), when banking variables (total cross-border credit and banking sector borrowing-lending spread) do not react (No Bank), and when the terms of trade do not react to the shocks (No TOT). Shares are expressed in percent. Column variables are: BAA corporate spread (BAA), terms of trade (TOT), cross-border bank credit (Cre), output (GDP), investment (I), trade balance to GDP ratio (TB), annualized nominal exchange rate depreciation (NEER), annualized consumer price inflation (CPI), the country interest rate (R), and the borrowing-lending spread (LSp).

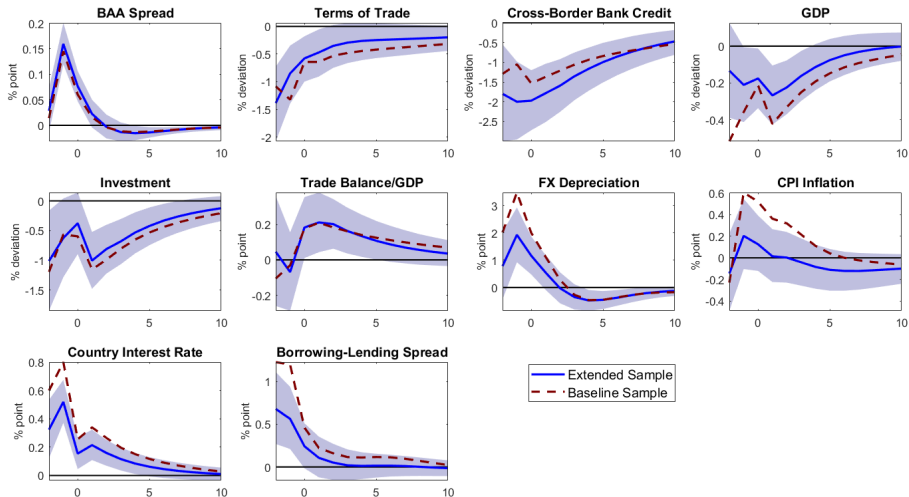
# Outline

1. Identification of Anticipated and Unanticipated U.S. interest rate shocks
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# Alternative Specifications

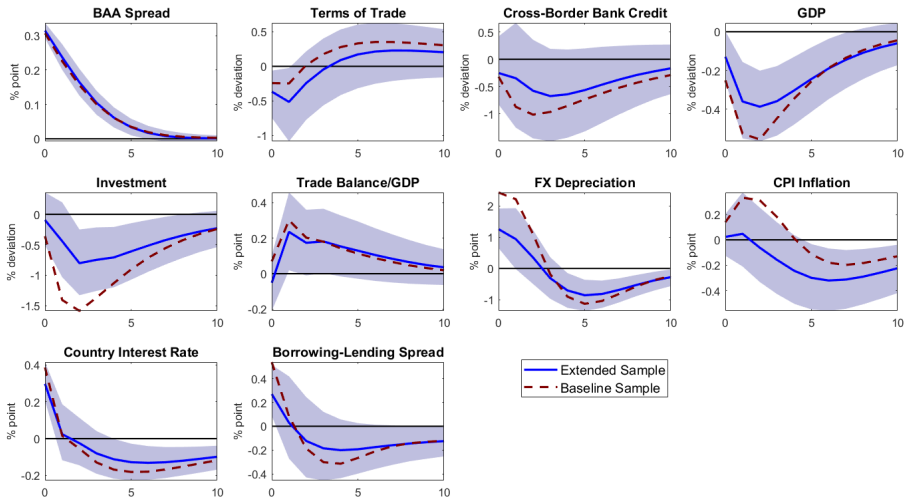
- **Small scale VAR:** VAR with 6 variables. [▶ IRF Small VAR](#)
- **Alternative measures of external credit:** firms have increasingly accessed to financial markets directly. [▶ IRF Eq. Inflows](#)
- **Pre-ZLB sample:** the FED has implemented unconventional monetary policy which may affect the estimated responses. [▶ IRF Pre-ZLB](#)
- **Non-orthogonalized Interest Rate shocks:** use the expected and unexpected evolution of the U.S. interest rate, without controlling for U.S. business cycle conditions. [▶ IRF Alt. Shock](#)
- **Global factors:** control for world GDP and VIX. [▶ IRFs Global Factors](#)
- **No outliers:** redefine the sample by removing one emerging economy at the time. [▶ No Outliers](#)
- **Exchange rate regime:** estimate the system only for countries with fixed exchange rate regime. [▶ IRF Fixed FX](#)

# IRF to an Anticipated Shock - Extended Sample



NOTE. IRFs to anticipated 25bp contractionary interest rate shock for a sample of 13 Emerging Economies: Baseline + Bulgaria, Colombia, Hungary, Korea, Malaysia, Peru.  $t = 0$  denotes the period when the U.S. interest rate increases. The previous two periods show the adjustment of the variables before the change in the U.S. materializes (i.e.  $s_{t-2,t}^a = 0.25$ ,  $s_{t-1,t}^a = 0.25$  and  $s_{t,t}^a = 0.25$ ). 90% confidence bands for pre-crisis are depicted with light-red shaded areas. Confidence bands are computed through 10,000 bootstrap replications. Horizon is in quarters.

# IRF to an Unanticipated Shock - Extended Sample



NOTE. IRFs to unanticipated 25bp contractionary interest rate shock for a sample of 13 Emerging Economies: Baseline + Bulgaria, Colombia, Hungary, Korea, Malaysia, Peru. Solid lines denote the point estimate of impulse responses for baseline Emerging Economies. 90% confidence bands for pre-crisis are depicted with light-red shaded areas. Confidence bands are computed through 10,000 bootstrap replications. Horizon is in quarters.

# Conclusions

- Anticipated shocks account for a significant fraction of Fed Funds fluctuations.
- **Monetary news about the U.S. interest rate induce an immediate response** in Emerging Economies.
- Anticipated and unanticipated **contractionary shocks** induce a **fall in GDP and Investment in Emerging Economies**.
- U.S. interest rate shocks explain **14% of GDP fluctuations** in Emerging Economies.
- The amplification through the **U.S. BAA corporate spread** is key for the transmission of both shocks.

**Thank you!**



# Appendix

# Anticipation Horizon of U.S. Interest Rate

- Regress realized changes in U.S. Interest Rate on anticipated changes.

	$\Delta i_t$			
	$\Delta i_{t,t}^a$	$\Delta i_{t-1,t}^a$	$\Delta i_{t-2,t}^a$	$\Delta i_{t-3,t}^a$
Adj $R^2$	0.80	0.31	0.09	0.01
F-Stat	357.0	41.4	9.4	1.9

**Note.** OLS results of  $\Delta i_t$  on the forecasts made  $i$  quarters in advance.

- **The anticipation horizon is two quarters.** ◀ Anticipation

## Comparison with Narrative Series of MP Shocks

- Correlation with the Narrative series of MP shocks (Tenreyro and Thwaites, 2015):

Series	TT(2015)	$s_t^u$	$s_{t,t}^a$	$s_{t-1,t}^a$	$s_{t-2,t}^a$
$s_t^u$	0.52***				
$s_{t,t}^a$	0.70***	0.11			
$s_{t-1,t}^a$	0.52***	0.17	0.61***		
$s_{t-2,t}^a$	0.20	0.12	0.27***	0.54***	

**Note.** \*\*\*, \*\*, \* denote significance at 1%, 5%, and 10%, respectively.

- Narrative series is positively correlated with unanticipated and anticipated shocks.
- 47% of the Narrative series of MP shocks is anticipated before it occurs.**

# Comparison with Narrative Series of MP Shocks

$$TT_t = \alpha + \beta \text{AntShock}_t + \epsilon_t$$

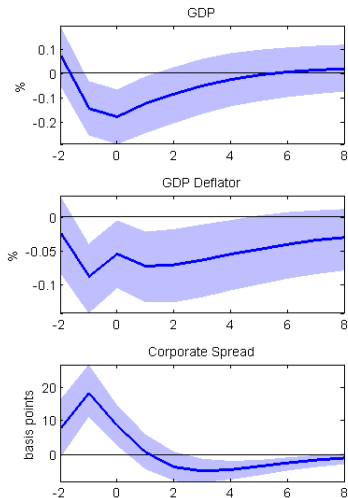
	TT(2015)	TT(2015)	TT(2015)	TT(2015)
$s_{t,t}^a$	0.73*** (0.11)			0.55*** (0.15)
$s_{t-1,t}^a$		0.53*** (0.13)		0.32* (0.18)
$s_{t-2,t}^a$			0.40 (0.27)	-0.13 (0.25)
Adj. $R^2$	0.47	0.24	0.02	0.46
F-Stat	45.74***	16.54***	2.23	12.96***
Obs	52	51	50	50

**Note.** \*\*\*, \*\*, \* denote significance at 1%, 5%, and 10%, respectively.

**Anticipated shocks explain 47% of the Narrative series.** [◀ Shocks](#)

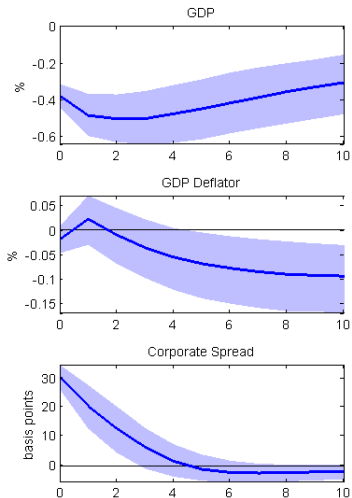
# IRF to U.S. Interest Rate Shocks - U.S. Economy

## Anticipated Shock



## Unanticipated Shock

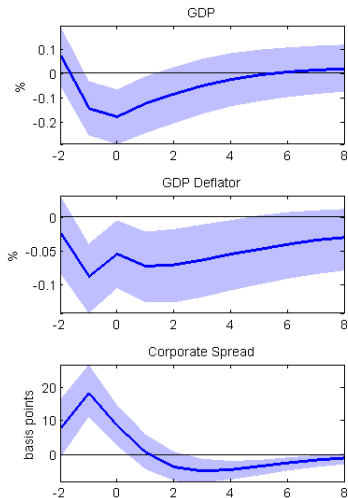
◀ Shocks



NOTE. IRFs to a two quarters ahead anticipated (left column) and unanticipated (right column) 25bp contractionary U.S. interest rate shock. Solid lines denote point estimates of impulse responses; 68% confidence bands are depicted with light-blue shaded areas. Confidence bands are computed through 1,000 bootstrap replications. Horizon is in quarters.

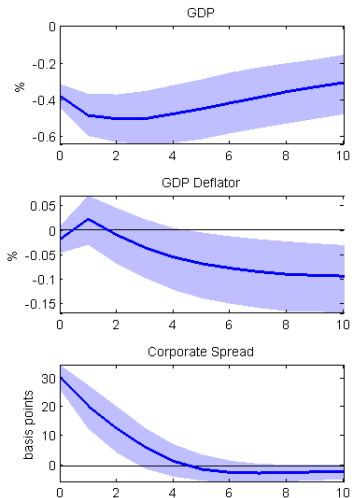
# IRF to U.S. Interest Rate Shocks - U.S. Economy

## Anticipated Shock



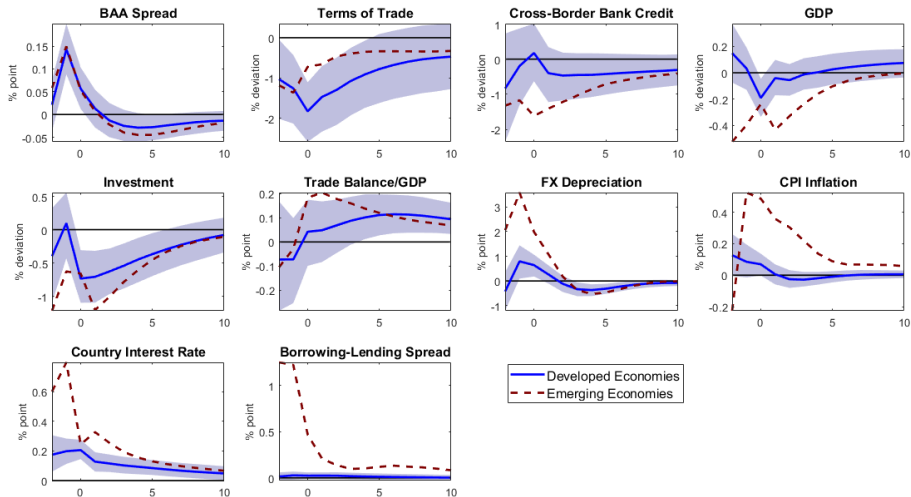
## Unanticipated Shock

◀ IRFs



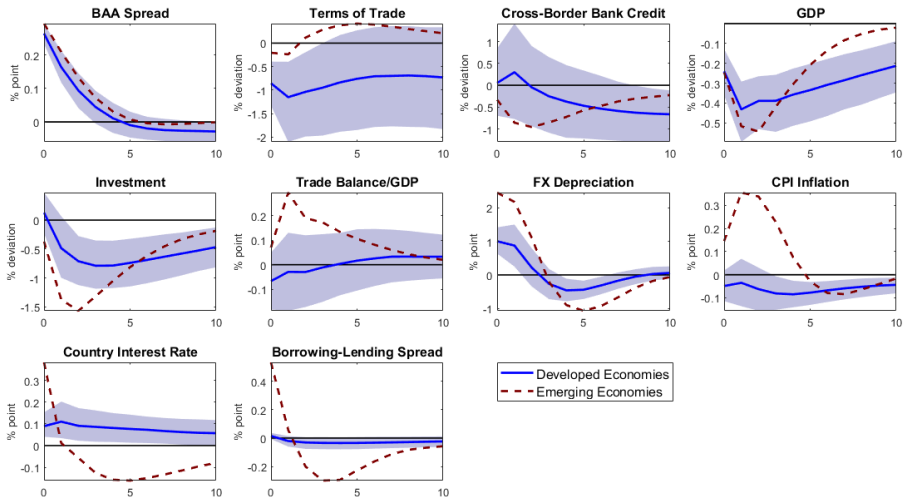
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# IRF to an Anticipated Shock - Developed Econ.



NOTE. Solid blue and red lines denote the point estimate of impulse responses for Developed (Australia, Canada, Denmark, New Zealand, Norway, and Sweden) and Emerging Economies, respectively.  $t = 0$  denotes the period when the U.S. interest rate increases. The previous two periods show the adjustment of the variables before the change in the U.S. materializes (i.e.  $s_{t-2,t}^a = 0.25$ ,  $s_{t-1,t}^a = 0.25$  and  $s_{t,t}^a = 0.25$ ). 90% confidence bands are depicted with light-blue shaded areas. Confidence bands are computed through 1,000 bootstrap replications. Horizon is in quarters.

# IRF to an Unanticipated Shock - Developed Econ.

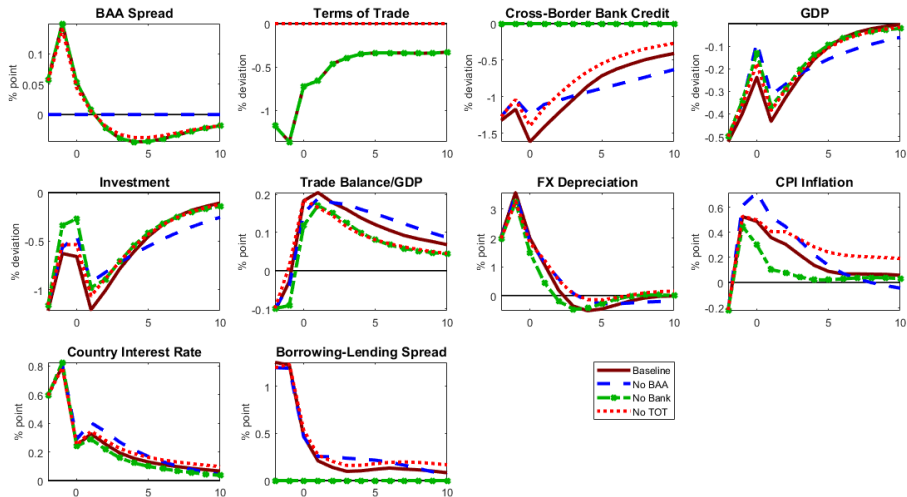


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◀ IRF Emerging

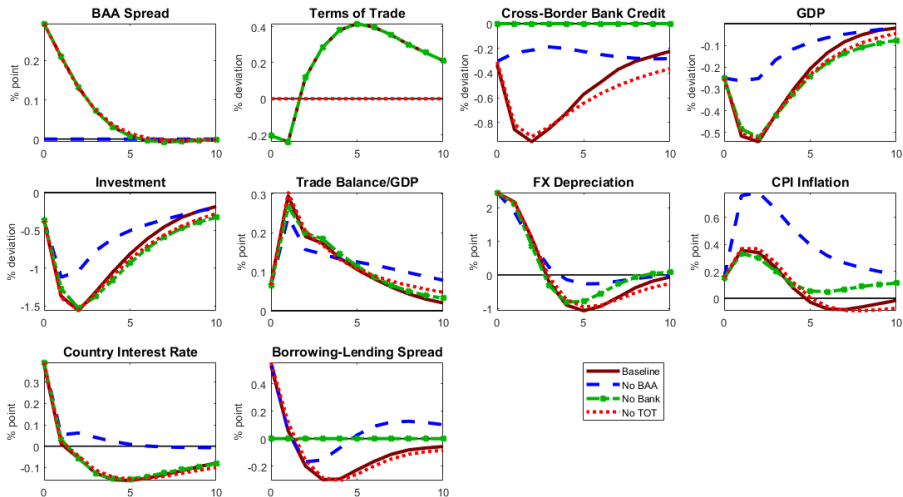


# IRF to an Anticipated Shock - Credit Channels



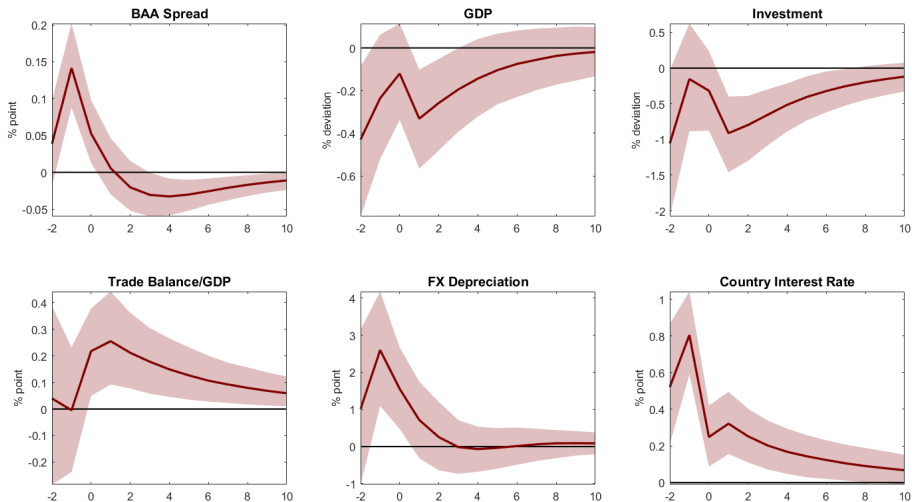
NOTE. The lines correspond to the mean baseline IRFs and assuming that U.S. BAA corporate spread does not react to any of the shocks ("No BAA"), that the banking variables do not react to any of the shocks ("No Bank"), and the ones where the terms of trade do not react to the shock ("No TOT").  $t = 0$  denotes the period when the U.S. interest rate increases. The previous two periods show the adjustment of the variables before the change in the U.S. materializes (i.e.  $s_{t-2,t}^a = 0.25$ ,  $s_{t-1,t}^a = 0.25$  and  $s_{t,t}^a = 0.25$ ). Horizon is in quarters.

# IRF to an Unanticipated Shock - Credit Channels



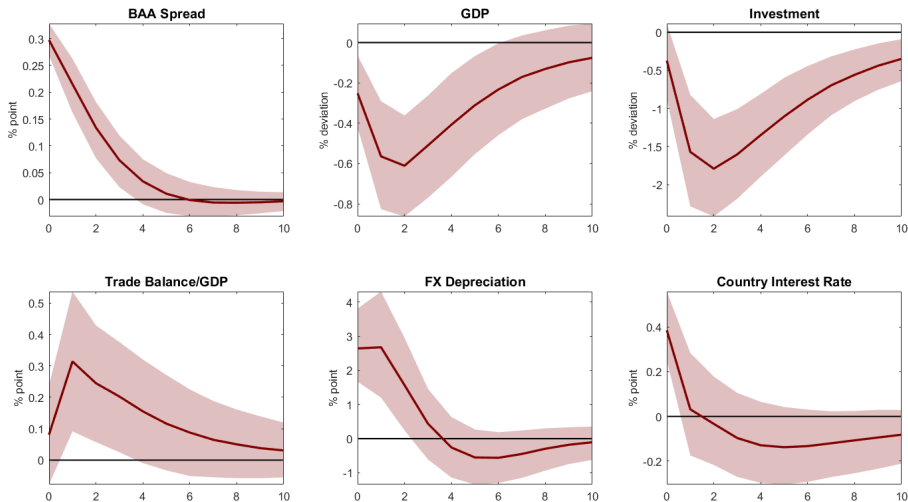
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# IRF to an Anticipated Shock - Small Scale VAR



NOTE. IRFs to anticipated 25bp contractionary interest rate shock. Solid lines denote the point estimate of impulse responses for Emerging Economies using full sample. 90% confidence bands for pre-crisis are depicted with light-red shaded areas.  $t = 0$  denotes the period when the U.S. interest rate increases. The previous two periods show the adjustment of the variables before the change in the U.S. materializes (i.e.  $s_{t-2,t}^a = 0.25$ ,  $s_{t-1,t}^a = 0.25$  and  $s_{t,t}^a = 0.25$ ). Confidence bands are computed through 1,000 bootstrap replications. Horizon is in quarters.

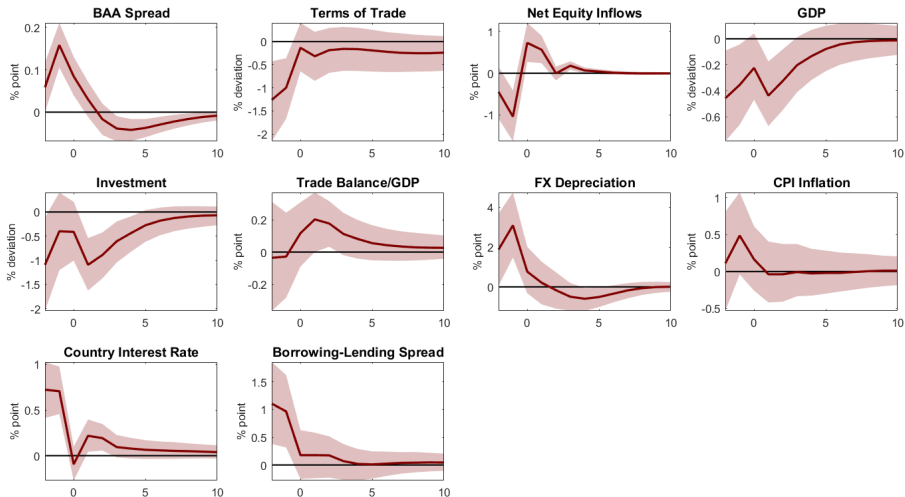
# IRF to an Unanticipated Shock - Small Scale VAR



NOTE. IRFs to unanticipated 25bp contractionary interest rate shock. Solid lines denote the point estimate of impulse responses for Emerging Economies using full sample. 90% confidence bands for pre-crisis are depicted with light-red shaded areas. Confidence bands are computed through 1,000 bootstrap replications. Horizon is in quarters.

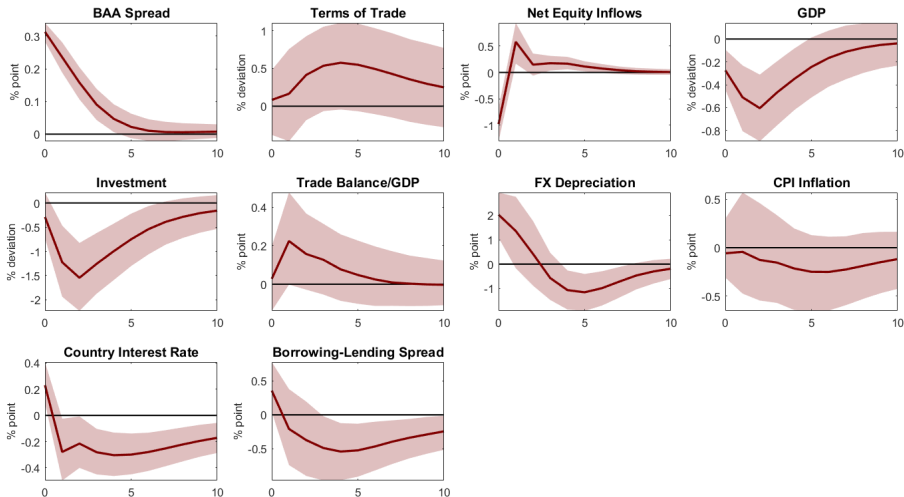
◀ Results

# IRF to an Anticipated Shock - Equity Inflows



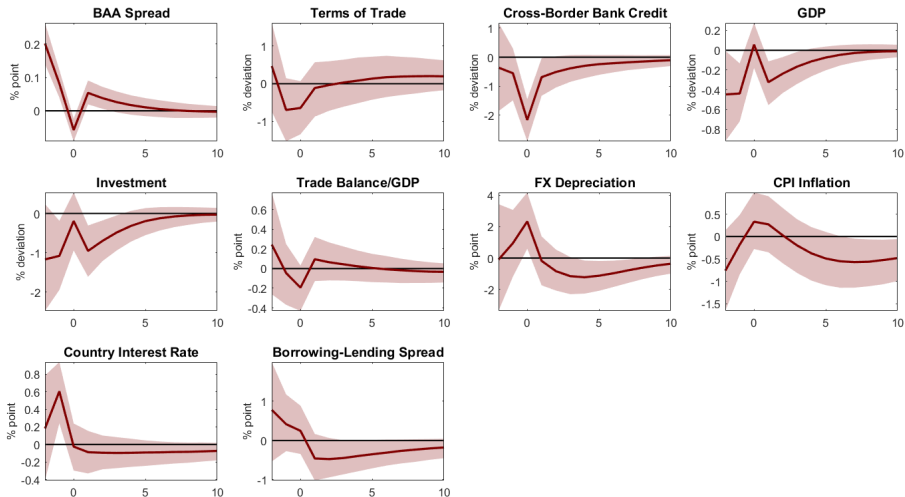
NOTE. IRFs to anticipated 25bp contractionary interest rate shock. Solid lines denote the point estimate of impulse responses for Emerging Economies using full sample. 90% confidence bands for pre-crisis are depicted with light-red shaded areas. Equity inflows is expressed as a share of total equity.  $t = 0$  denotes the period when the U.S. interest rate increases. The previous two periods show the adjustment of the variables before the change in the U.S. materializes (i.e.  $s_{t-2,t}^a = 0.25$ ,  $s_{t-1,t}^a = 0.25$  and  $s_{t,t}^a = 0.25$ ). Confidence bands are computed through 1,000 bootstrap replications. Horizon is in quarters.

# IRF to an Unanticipated Shock - Equity Inflows



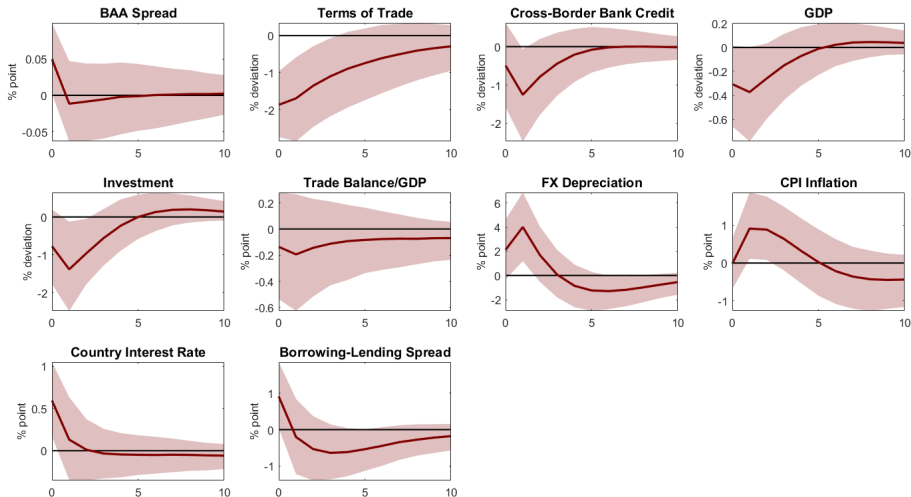
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# IRF to an Anticipated Shock - Pre-ZLB Sample



NOTE. IRFs to anticipated 25bp contractionary interest rate shock 1995-2007. Solid lines denote the point estimate of impulse responses for Emerging Economies using pre-crisis (1995-2007) sample.  $t = 0$  denotes the period when the U.S. interest rate increases. The previous two periods show the adjustment of the variables before the change in the U.S. materializes (i.e.  $s_{t-2,t}^a = 0.25$ ,  $s_{t-1,t}^a = 0.25$  and  $s_{t,t}^a = 0.25$ ). 90% confidence bands are depicted with light-red shaded areas. Confidence bands are computed through 1,000 bootstrap replications. Horizon is in quarters.

# IRF to an Unanticipated Shock - Pre-ZLB Sample

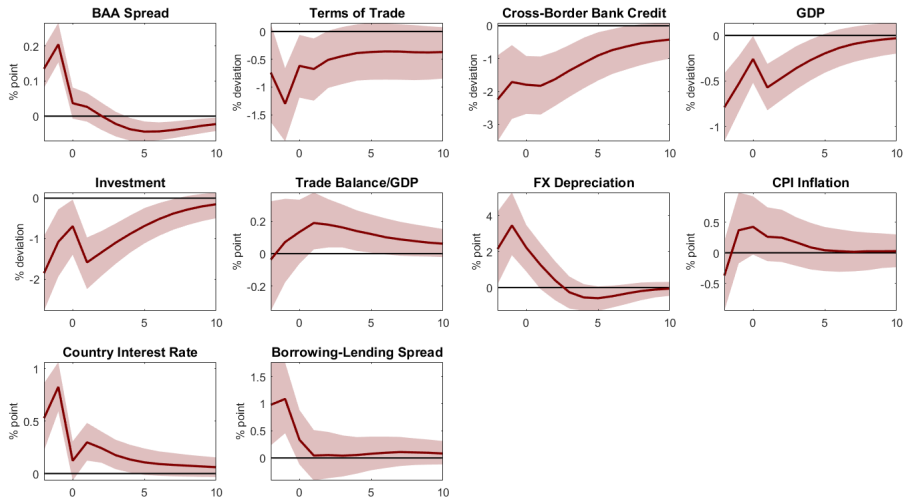


NOTE. IRFs to unanticipated 25bp contractionary interest rate shock 1995-2007. Solid lines denote the point estimate of impulse responses for Emerging Economies using pre-crisis (1995-2007) sample, respectively. 90% confidence bands are depicted with light-red shaded areas. Confidence bands are computed through 1,000 bootstrap replications. Horizon is in quarters.

◀ Results



# IRF to an Anticipated Change



NOTE. IRFs to a 2 quarters ahead anticipated 25bp contractionary interest rate change. Solid lines denote point estimates of impulse responses; 90% confidence bands are depicted with light-red shaded areas.  $t = 0$  denotes the period when the U.S. interest rate increases. The previous two periods show the adjustment of the variables before the change in the U.S. materializes (i.e.  $s_{t-2,t}^a = 0.25$ ,  $s_{t-1,t}^a = 0.25$  and  $s_{t,t}^a = 0.25$ ). Confidence bands are computed through 1,000 bootstrap replications. Horizon is in quarters

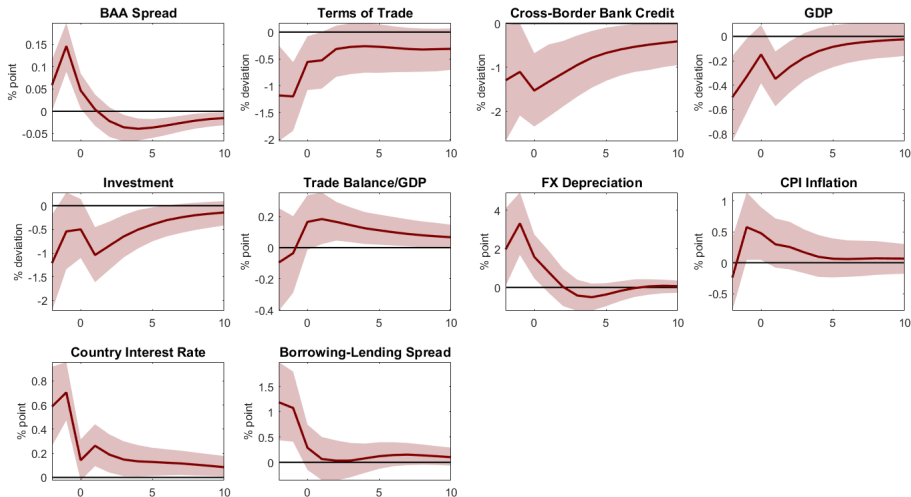
# IRF to an Unanticipated Change



NOTE. IRFs to an unanticipated 25bp contractionary interest rate change. Solid lines denote point estimates of impulse responses; 90% confidence bands are depicted with light-red shaded areas. Confidence bands are computed through 1,000 bootstrap replications. Horizon is in quarters.

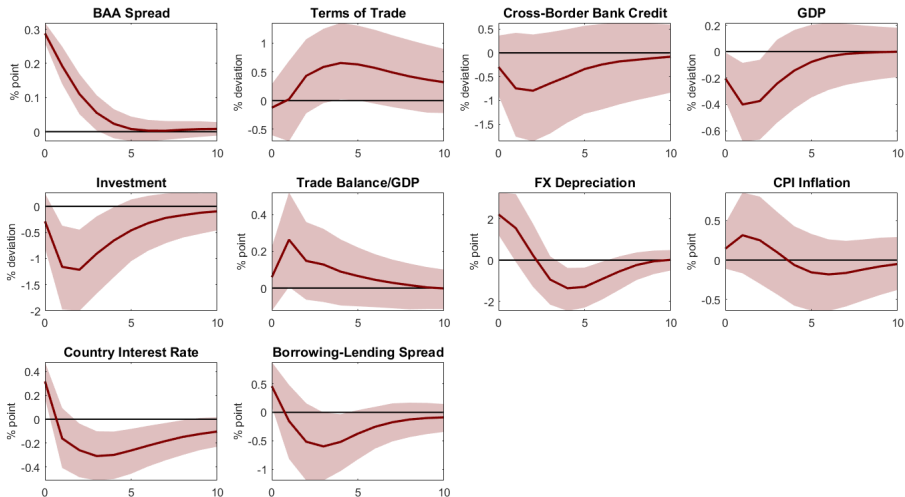
[← Results](#)

# IRF to an Anticipated Shocks - WGDP



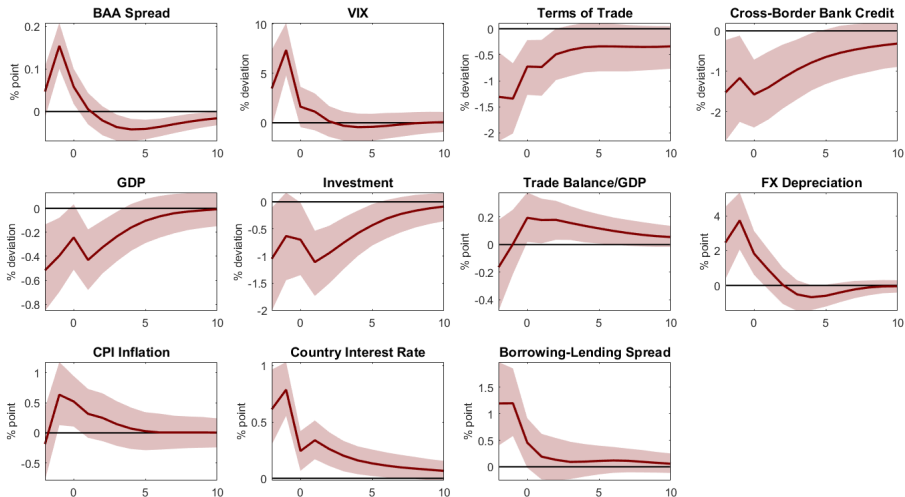
NOTE. IRFs to a 2 quarters ahead anticipated 25bp contractionary interest rate shock including World GDP in an exogenous block. Solid lines denote point estimates of impulse responses; 90% confidence bands are depicted with light-red shaded areas.  $t = 0$  denotes the period when the U.S. interest rate increases. The previous two periods show the adjustment of the variables before the change in the U.S. materializes (i.e.  $s_{t-2,t}^a = 0.25$ ,  $s_{t-1,t}^a = 0.25$  and  $s_{t,t}^a = 0.25$ ). Confidence bands are computed through 1,000 bootstrap replications. Horizon is in quarters

# IRF to an Unanticipated Shock - WGD



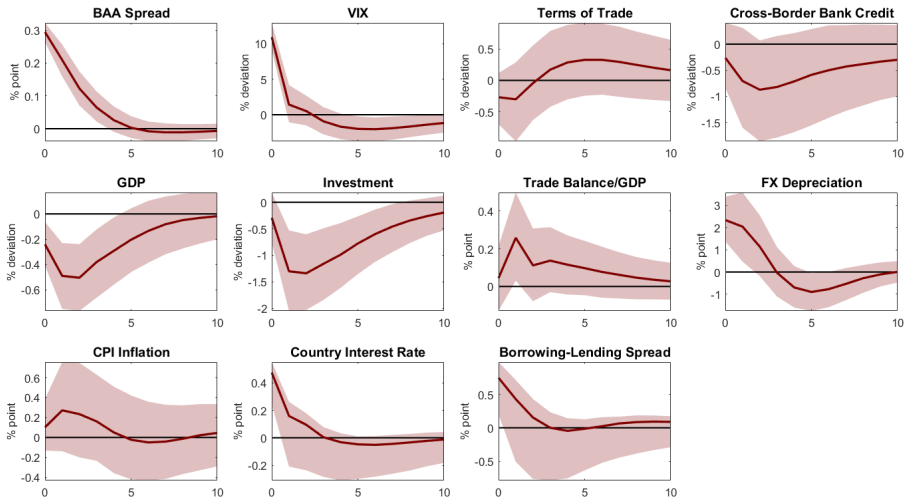
NOTE. IRFs to an unanticipated 25bp contractionary interest rate shock including World GDP in an exogenous block. Solid lines denote point estimates of impulse responses; 90% confidence bands are depicted with light-red shaded areas. Confidence bands are computed through 1,000 bootstrap replications. Horizon is in quarters.

# IRF to an Anticipated Shock - VIX



NOTE. IRFs to a 2 quarters ahead anticipated 25bp contractionary interest rate shock including VIX. Solid lines denote point estimates of impulse responses; 90% confidence bands are depicted with light-red shaded areas.  $t = 0$  denotes the period when the U.S. interest rate increases. The previous two periods show the adjustment of the variables before the change in the U.S. materializes (i.e.  $s_{t-2,t}^a = 0.25$ ,  $s_{t-1,t}^a = 0.25$  and  $s_{t,t}^a = 0.25$ ). Confidence bands are computed through 1,000 bootstrap replications. Horizon is in quarters

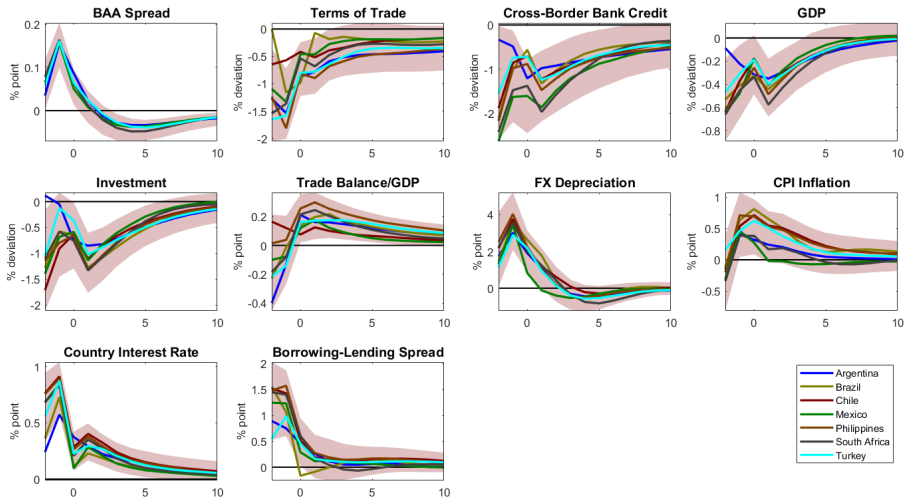
# IRF to an Unanticipated Shock - VIX



NOTE. IRFs to an unanticipated 25bp contractionary interest rate shock including VIX. Solid lines denote point estimates of impulse responses; 90% confidence bands are depicted with light-red shaded areas. Confidence bands are computed through 1,000 bootstrap replications. Horizon is in quarters.

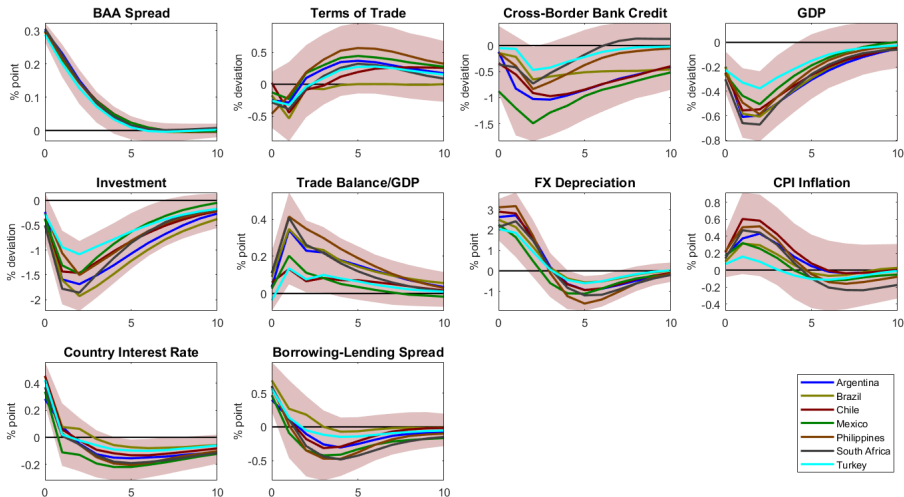
[← Results](#)

# IRF to an Anticipated Shock - Outliers Analysis



NOTE. Each continuous line denotes the mean IRF computed using the baseline sample but dropping the country that corresponds to that color; 90% confidence bands are depicted with light-red shaded areas.  $t = 0$  denotes the period when the U.S. interest rate increases. The previous two periods show the adjustment of the variables before the change in the U.S. materializes (i.e.  $s_{t-2,t}^a = 0.25$ ,  $s_{t-1,t}^a = 0.25$  and  $s_{t,t}^a = 0.25$ ). Confidence bands are computed through 1,000 bootstrap replications. Horizon is in quarters

# IRF to an Unanticipated Shock - Outliers Analysis

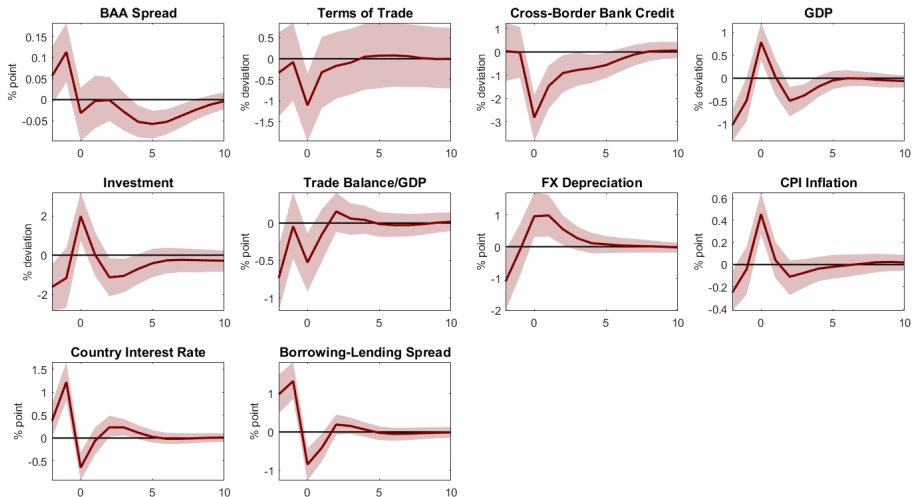


NOTE. Each continuous line denotes the mean IRF computed using the baseline sample but dropping the country that corresponds to that color; 90% confidence bands are depicted with light-red shaded areas. Confidence bands are computed through 1,000 bootstrap replications. Horizon is in quarters

◀ Results

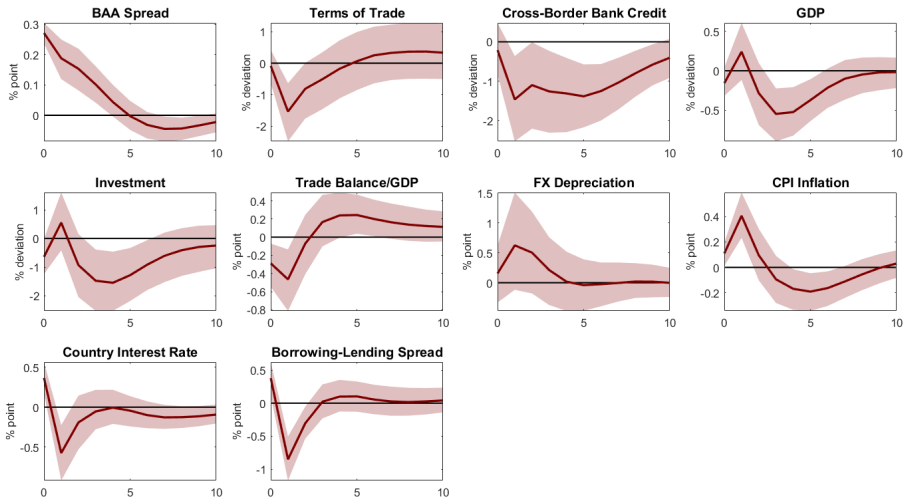


# IRF to an Anticipated Shock - Fixed FX



NOTE. IRFs to anticipated 25bp contractionary interest rate shock for countries with fixed exchange rate. Solid lines denote the point estimate of impulse responses for Emerging Economies. 68% confidence bands for pre-crisis are depicted with light-red shaded areas.  $t = 0$  denotes the period when the U.S. interest rate increases. The previous two periods show the adjustment of the variables before the change in the U.S. materializes (i.e.  $s_{t-2,t}^a = 0.25$ ,  $s_{t-1,t}^a = 0.25$  and  $s_{t,t}^a = 0.25$ ). Confidence bands are computed through 1,000 bootstrap replications. Horizon is in quarters.

# IRF to an Unanticipated Shock - Fixed FX



NOTE. IRFs to unanticipated 25bp contractionary interest rate shock for countries with fixed exchange rate. Solid lines denote the point estimate of impulse responses for Emerging Economies. 68% confidence bands for pre-crisis are depicted with light-red shaded areas. Confidence bands are computed through 1,000 bootstrap replications. Horizon is in quarters.