Global Spillover Effects of US Uncertainty

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CEBRA International Finance and Macroeconomics Meeting
November, 2018

Motivation

- ▶ Large literature on macroeconomic effects of US uncertainty/VIX
  - ▶ Bloom (2009, 2014), Bloom, Baker, and Davis (2016), ...
- ▶ Rey (2013) argues for large spillover effects of US VIX
  - ▶ A global financial/capital flow cycle exists and co-moves with VIX
- ▶ Rey (2013) posits drastic policy implications for Emerging market economies (EMEs)
  - ▶ Policy dilemma instead of the traditional trilemma
  - ▶ Need for capital controls even with flexible exchange rates

Research questions

- ▶ We study spillover effects of US uncertainty on EMEs
  - ▶ How does US financial uncertainty transmit to the macro and financial sectors of the EMEs?
  - ▶ Is there heterogeneity in responses across sub-groups of EMEs?
  - ▶ Does the EME monetary policy response matter?
- ▶ First step in assessing policy dilemma vs. trilemma
  - ▶ Understand macro effects
  - ▶ Non-trivial tradeoffs for policy due to the global financial cycle?

Related literature

- ▶ Dilemma instead of Trilemma
  - ▶ Rey (2013)
- ▶ Implications of US uncertainty
  - ▶ Bloom (2009, 2014), Carriere-Swallow and Felipe Cespedes (2013), Gourio et al (2013), ...
- ▶ Panel VAR with random coefficients
  - ▶ Canova (2007), Canova and Ciccarelli (2013)
- ▶ SOE model with external shock
  - ▶ Uribe and Yue (2006), Neumeyer and Perri (2005), Fernandez-Villaverde et al (2011), ...

US uncertainty shock
US BVAR

- ▶ Use a monthly BVAR to extract a US uncertainty shock
  - ▶ "Reduced form" shock
- ▶ Baseline US variables: VIX, Industrial production, PCE deflator
- ▶ Extensions: Different orderings; Larger BVAR and ordering as in Bloom (2009); Bloom (2009) large changes identification approach; Larger BVAR that includes global variables; Alternative measure of financial uncertainty (Ludvigson, Ma, and Ng (2015))

Spillover effects of US uncertainty shock
Panel BVAR with external shock

- For N countries indexed by i, dynamics given by

$$z_{i,t} = \sum_{j=1}^{p} B_{i,j} z_{i,t-j} + \sum_{j=0}^{q} D_{i,j} \varepsilon_{VIX,t-j} + C_i x_t + u_{i,t},$$

where $z_{i,t}$ is an $m_z \times 1$ vector of endogenous variables, $\varepsilon_{VIX,t}$ is the US uncertainty shock, x_t is an $m_x \times 1$ vector of other exogenous variables, and $u_{i,t}$ is an $m_z \times 1$ vector of shocks

- Allow for heterogeneous dynamics

Spillover effects of US uncertainty shock
Random coefficients with static interdependence

- Collect $B_i = \begin{pmatrix} B_{i,1} & \cdots & B_{i,p} \end{pmatrix}'$ and $D_i = \begin{pmatrix} D_{i,0} & \cdots & D_{i,q} \end{pmatrix}'$ and let $\gamma_i = \text{vec} \begin{pmatrix} B_i' & D_i' & C_i \end{pmatrix}'$

- Assume that for $i = 1, \cdots, N$,

$$\gamma_i = \bar{\gamma} + v_i,$$

  where $v_i \sim \mathbb{N}\left(\mathbf{0}_{m_\gamma \times 1}, \Sigma_i \otimes \underline{\Sigma}_i\right)$

- For $\mathbf{u}_t = \left(u'_{1,t}, \cdots, u'_{N,t}\right)'$,

$$\mathbf{u}_t | \mathbf{z}_{t-1}, \cdots, \mathbf{z}_{t-p}, \varepsilon_{VIX,t}, \cdots, \varepsilon_{VIX,t-q}, x_t \sim \mathbb{N}\left(\mathbf{0}_{Nm_z \times 1}, \mathbf{\Sigma}\right),$$

  where $\mathbf{z}_t = \left(z'_{1,t}, \cdots, z'_{N,t}\right)'$ and $\mathbf{\Sigma}$ is an $Nm_z \times Nm_z$ pos def matrix

Spillover effects of US uncertainty shock
Average and sub-group IRFs

- ▶ Focus on average effects across EMEs and so compute impulse responses based on $\bar{\gamma}$
  - ▶ Weighted average of individual effects based on γ_i
  - ▶ Partial-pooling while allowing for heterogeneity
- ▶ Also assess heterogeneity across sub-groups

$$\gamma_i = \bar{\gamma}_1 \times I_1(i) + \bar{\gamma}_2 \times [1 - I_1(i)] + v_i$$

where $I_1(i) = 1$ if country i is in group 1, and $= 0$ otherwise

- ▶ Sub-group estimation is joint and errors correlated across all countries

Spillover effects of US uncertainty shock
EME Data sample

- ▶ 15 EMEs: Brazil, Chile, Colombia, Indonesia, India, Mexico, Malaysia, Peru, Philippines, Russia, South Africa, South Korea, Taiwan, Thailand, Turkey
- ▶ EME variables: IP, CPI, Interest rates (Short, Long-term spread), NEER/REER, Stock prices, Net exports/GDP, Capital inflows/GDP
- ▶ Sample period: Jan 2004-Dec 2014 (floating exchange rates, integration into global capital markets, no crisis)
- ▶ Data sources: EPFR, Datastream, Comtrade, Bloomberg
- ▶ Extensions: Several alternate macro, financial, and external variables

US uncertainty shock

Shock series
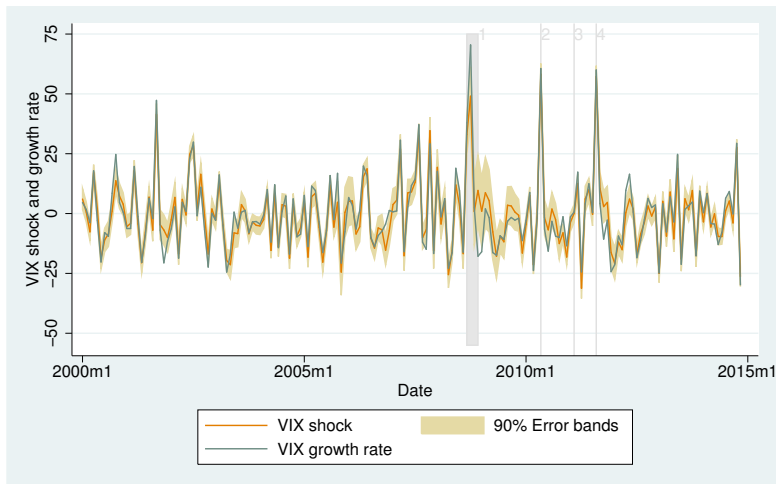
Spillover effects of US uncertainty shock
Macro and financial variables (1% US VIX shock)
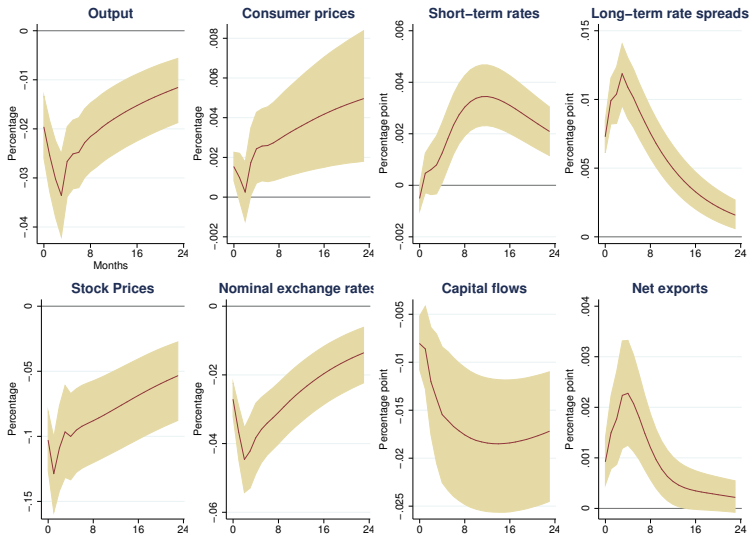
Spillover effects of US uncertainty shock
Macro and financial variables

- ▶ The EME financial markets affected adversely
    - ▶ US uncertainty shock triggers a "flight to safety or quality"
    - ▶ Financial conditions worsen for EMEs
    - ▶ Interest rate spread rises and exchange rate depreciates
- ▶ The EME macroeconomy also affected adversely
    - ▶ Decrease in capital inflows/increase in net exports (reduction in aggregate spending, as in a "sudden stop")
    - ▶ Output falls and consumer prices rise
- ▶ Several policy trade-offs for central banks of these countries
    - ▶ Output vs. capital flows
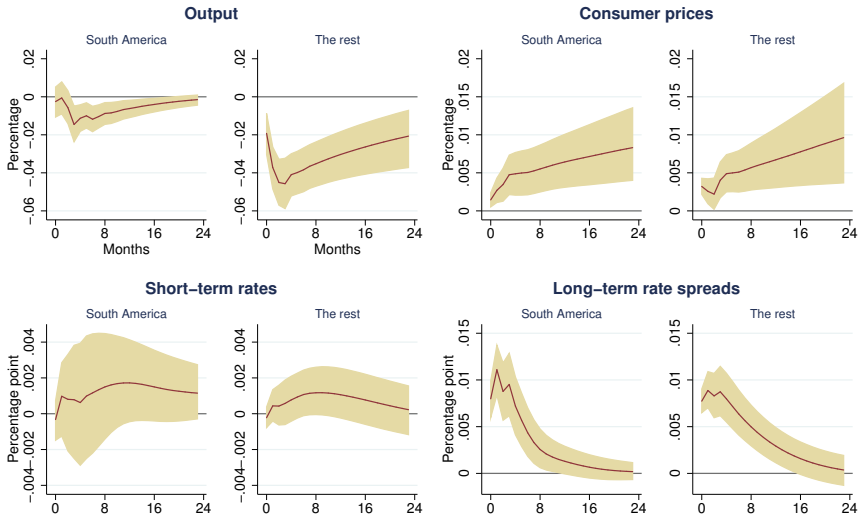   - ▶ (Output vs. consumer prices)

Spillover effects of US uncertainty shock
Subgroup analysis

- Subgroup analysis: South American countries and the rest of EMEs
- Close connections between the US and South American countries
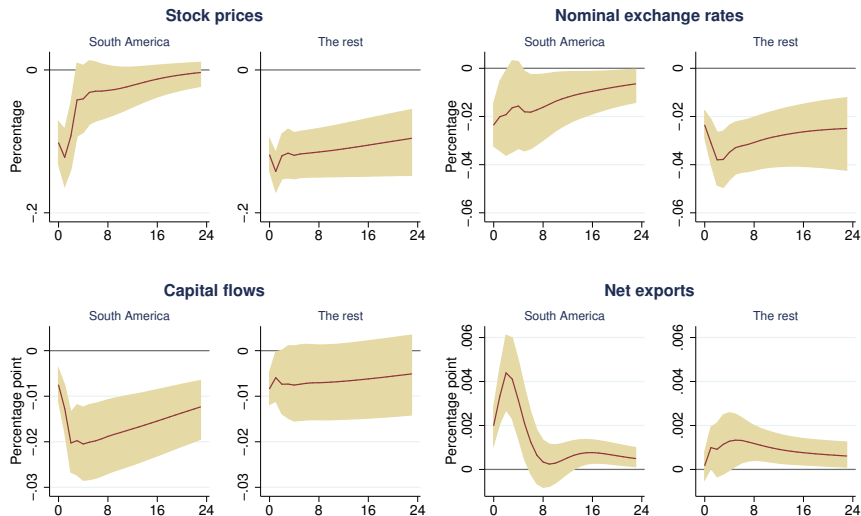- Previous work on US spillovers to South America (Canova (2005), ...)

Spillover effects of US uncertainty shock

Subgroup impulse responses (1)

Spillover effects of US uncertainty shock

Subgroup impulse responses (2)

Spillover effects of US uncertainty shock
Subgroup analysis

- ▶ The impulse responses qualitatively similar across groups
- ▶ But heterogeneous quantitative effects
  - ▶ Effects on output bigger and more persistent for the rest of EMEs
  - ▶ Effects on capital and trade flows bigger and more persistent for South American countries
- ▶ Effects on consumer prices and response of policy instrument similar
  - ▶ Why don't rest of EMEs follow more counter-cyclical policy?
- ▶ Differential monetary policy response to output vs. capital flows?
  - ▶ "Fear of capital flows" similar to "fear of floating" of the past?

SOE model
Two good SOE model

- Two countries, Home (H) and Foreign (F), and two traded goods
  - The home country is a small open economy (SOE) while the foreign country represents the rest of the world (ROW)
  - The two goods are imperfect substitutes of each other
  - The composite good used for consumption and investment is the same bundle of the home and foreign goods
- Monetary policy at home determined by an interest-rate rule
- International risk-sharing is incomplete
  - A one-period non-state contingent nominal bond denominated in the foreign currency
- Firms are subject to a working capital constraint and face a price adjustment cost

SOE model

- Similar to Uribe and Yue (2006) with some new components
- Two good model with c_t a CES aggregate

$$c_t = \left[(1-\chi)^{\frac{1}{\varepsilon}} c_{H,t}^{\frac{\varepsilon-1}{\varepsilon}} + \chi^{\frac{1}{\varepsilon}} c_{F,t}^{\frac{\varepsilon-1}{\varepsilon}} \right]^{\frac{\varepsilon}{\varepsilon-1}}$$

- The home good $c_{H,t}$ and the foreign good $c_{F,t}$ are a CES aggregate of differentiated varieties in each country
- Law of one price but PPP does not hold

SOE model

- Sticky prices imply home inflation influenced by marginal costs
- An interest-rate feedback rule for monetary policy

$$\beta I_t = [\beta I_{t-1}]^{\rho_I} \left[\left(\frac{\Pi_t}{\Pi} \right)^{\phi_\pi} \left(\frac{y_t}{y_{t-1}} \right)^{\phi_y} (\beta R_t)^{\phi_{RI}} \right]^{(1-\rho_I)}$$

- Model the "fear of capital flows" via ϕ_{RI}
    - Response to foreign interest rate R_t
    - Heterogeneity in ϕ_{RI} to connect to empirical findings

SOE model

- Interest rate spread R_t^s

$$R_t^s \equiv R_t - R_t^*$$

  follows an exogenous process (R_t^*, the ROW rate constant)
- Baseline: First-moment shock to R_t^s
- Extension: Allow time-varying volatility in R_t^s
- Extension: Foreign income and price shocks

SOE model

- Most parameter values from Uribe and Yue (2006)
- Several values for new parameters: χ=0.3, 0.35, 0.4 and ε=0.7, 1.5, 4
- Monetary policy: $\rho_I = 0.8$, $\phi_\pi = 1.5$, $\phi_y = 0.5/12$, $\phi_{RI} = 0, 0.5/12$
- Non-linear deterministic simulation with the foreign interest rate shock process exactly matching the empirical IRF
  - Economy starts in the deterministic steady-state and following an one-time unexpected shock, transitions back to it in the long-run

Impulse responses

Impulse responses to a shock to the foreign interest rate spread ($\phi_{RI} = 0$)
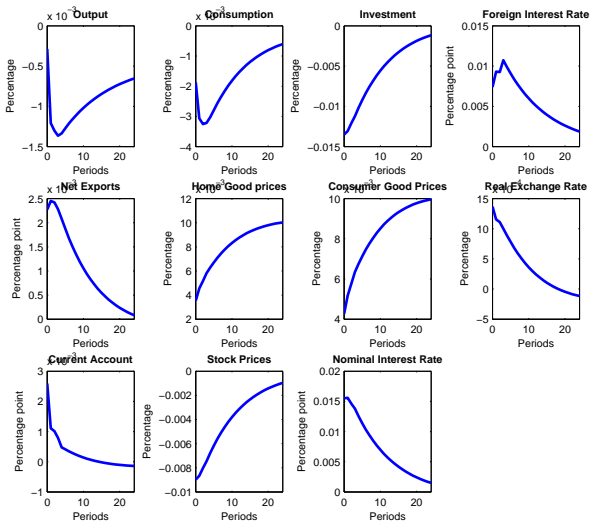
Impulse responses
Transmission of foreign financial conditions

- Increase in foreign interest rate/spread produces dynamics qualitatively consistent with empirical results
- Increased cost of borrowing drives consumption/investment down
  - Net exports increase due to reduction in total spending
- Fall in demand for home good implies a real exchange rate depreciation
- Stock prices decline as firm profits fall
- Home good prices increase because of marginal cost increase
  - Due to real exchange rate depreciation
  - Home inflation depends on current and future marginal costs (in home goods prices)

Impulse responses

Impulse responses to a shock to the foreign interest rate spread ($\phi_{RI} = 0.5/12$)
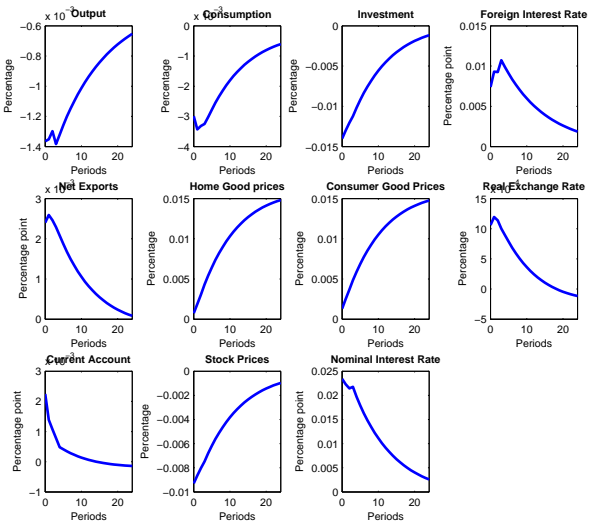
Impulse responses

- Monetary policy response of the SOE can alter the transmission
- "Fear of capital flows" in SOE monetary policy leads to heterogeneity in responses qualitatively similar to empirical findings
  - Output, consumption, and investment respond more negatively
  - Stock prices falls more
  - Current account increases by less as SOE reduces borrowing

Discussion/Extensions

- Discussion
  - External evidence for EME monetary policy concerns regarding capital flows (global uncertainty)?
  - Is transmission through interest rate spread the right channel?
- Extensions
  - Several different ways of identifying US uncertainty shock
  - Several alternative macro/financial variables in the EME panel VAR
  - Alternate shocks in the SOE model

EME capital flow concern

▶ Some narrative evidence that EME monetary policy decisions (differentially) affected by capital flow (and global uncertainty) concerns?

▶ The research network of Asian central banks has an expert group on capital flows whose "main objectives are: to develop a regional framework to promote information sharing on capital flows among members; and to draw up concrete and practical proposals that members can implement individually or collectively to enhance the management of capital flows"

▶ More detailed analysis using EME monetary policy minutes

EME capital flow concern

- Despite a decline in aggregate economic activity and a fall in inflation, the Central Bank of Turkey tightened policy in Nov, 2016:

  The slowdown in aggregate demand contributes to the fall in inflation. However, the recent exchange rate movements resulting from increased global uncertainty and high volatility limit the improvement in inflation outlook ...The increased global uncertainty driven by the US presidential election can send emerging financial markets into turbulence, inducing portfolio outflows... The Committee decided to implement monetary tightening

- Facing similar external considerations, the Central Reserve Bank of Peru kept the same policy in Nov, 2016:

  This decision is consistent with an inflation forecast in which inflation is converging .. and takes into account that: i) 12 month inflation expectations are within the target range; ... iii) Local economic activity has been growing at a rate close to its potential growth level, and iv) The global economy continues showing mixed signals of recovery in production and employment, as well as increased uncertainty in international financial markets. In this scenario, the Peruvian economy maintains sound fundamentals ...

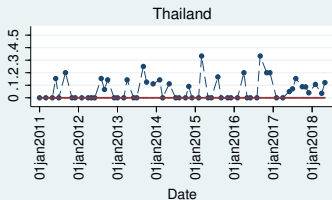# EME capital flow concern: a textual analysis of monetary policy minutes
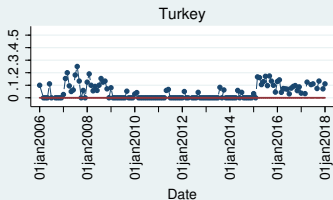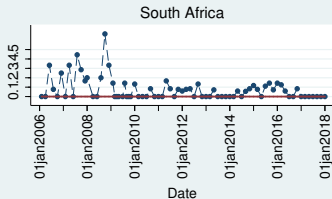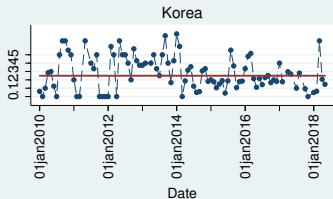

Rel. Frequency of Capital Flow Words in Central Bank Minutes
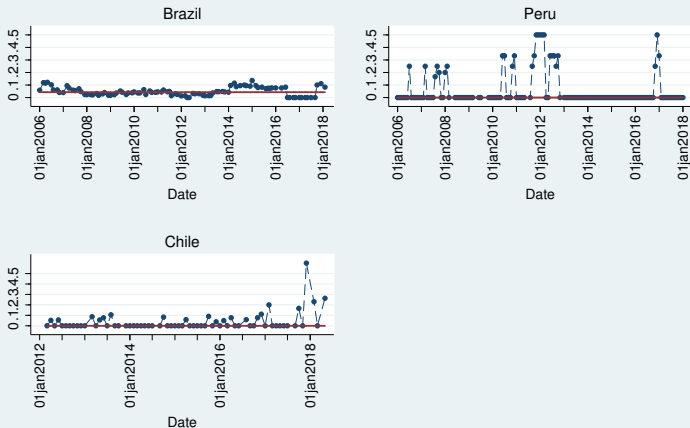
The red line denotes the median frequency for the country over the period

EME capital flow concern: a textual analysis of monetary policy minutes

Rel. Frequency of Capital Flow Words in Central Bank Minutes

The red line denotes the median frequency for the country over the period

EME capital control measures

- Does this fear of capital flows manifest in other policy choices?
- Do rest of EMEs use direct capital control measures more?
- Use capital control indices constructed by Fernandez et al (2015) from 2004-2013
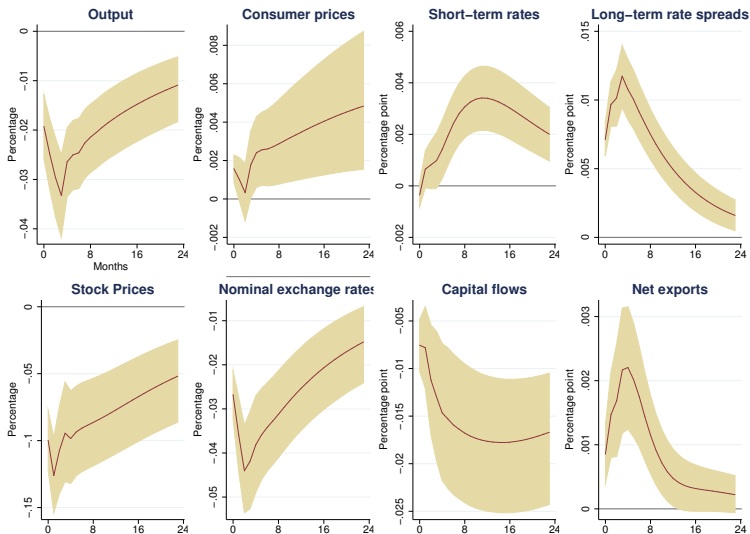
Table: Capital control indices for the EMEs

Sub-group	Aggregate Flows	Inflows	Outflows
South America	0.46	0.46	0.46
Rest	0.66	0.60	0.72

Bloom identification approach
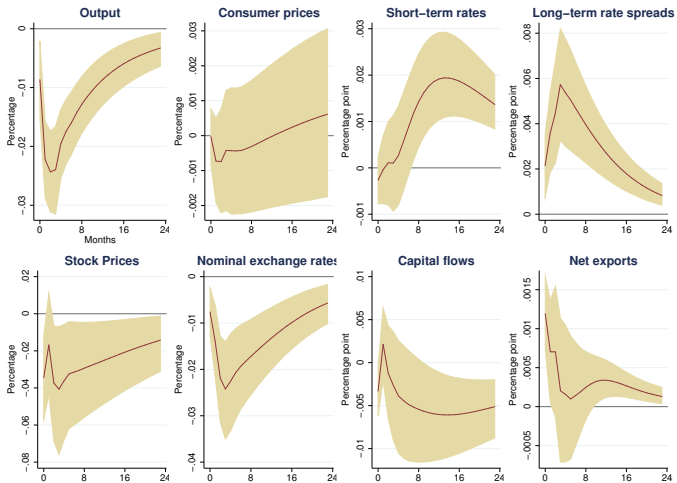
Include global variables

- Use US VIX shock from a 7 variable VAR that includes global variables

Robustness

- Use financial uncertainty measure from Ludvigson, Ma, and Ng (2015) instead of VIX
- Use realized EM stock market volatility in panel VAR
- Standard macro variables using interpolated data
- Alternate financial and external balance variables
- In the model Foreign interest volatility shock as an alternate external shock and Foreign income shock as an alternate external shock

Conclusion

- ▶ Changes in US financial uncertainty have significant effects on EMEs
- ▶ These changes lead to new trade-offs for EME central banks
- ▶ Monetary policy response by EMEs can alter the transmission
  - ▶ Both empirically and theoretically
  - ▶ Narrative evidence for difference in capital flow concern among emerging economies