Effects of U.S. Quantitative Easing on Emerging Market Economies

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Motivation

- With the short-term interest rate at the ZLB since late 2008, the Federal Reserve of the US engaged in quantitative easing (QE) policy
- This paper aims to study both domestic and international spillover effects of QE
- "Among the advanced economies, the mutual benefits of monetary easing are clear. The case of emerging market economies is more complicated." (former Federal Reserve Chairman Ben Bernanke in a speech in 2013)
- "Fragile Five" countries (Brazil, India, Indonesia, South Africa, and Turkey) thought to be particularly vulnerable to the withdrawal of QE
  - "This (economic) crisis...will not be overcome ... through quantitative easing policies that have triggered what can only be described as a monetary tsunami, have led to a currency war, and have introduced new and perverse forms of protectionism in the world." (former President of Brazil, Dilma Rousseff in a speech in 2012)
  - Were they more sensitive to QE? If yes, why?

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- Literature largely focuses on "announcement effects" of QE
  - Analyze effects around narrow 1/2-day windows following policy announcements
  - Advantages: easy to establish causality/exogeneity
  - Disadvantages: high-frequency financial variables only; dynamic effects?

- Employ a framework suitable for
  - Inferring both real and financial implications of US QE policies
  - Analyzing dynamic effects

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What we do

- Bayesian structural VAR for the US
  - Balance sheet variable as a policy instrument
  - Non-recursive short-run restrictions to identify the US QE shock
- Using the US QE shock as an external shock, assess effects on EM countries in a panel VAR
  - Panel of 13 EM countries: Brazil, India, Indonesia, South Africa, Turkey + Chile, Colombia, South Korea, Malaysia, Mexico, Peru, Taiwan, Thailand
- Monthly data for the period from January 2008 through November 2014

Related literature

- Announcement effects
  - Gagnon et al (2010); Krishnamurthy and Vissing-Jorgensen (2011)
- VAR based identification
  - Gambacorta et al (2014); Baumeister and Benati (2011); Wright (2011)
- Purchase effects
  - D'Amico and King (2013)
- International effects of US QE policies
  - Neely (2010); Chen et al (2011); Glick and Leduc (2011); Bauer and Neely (2013); Rogers et al (2014)
- Effects on emerging markets/Fragile Five of taper scare
  - Eichengreen and Gupta (2013); Dahlhaus and Vasistha (2014); Aizenman et al (2014)

US VAR

- Structural VAR for the US economy

$$A_0 y_t = A_1 y_{t-1} + \cdots + A_p y_{t-p} + \varepsilon_t$$

  where $\varepsilon_t \sim N(0, I_m)$

- y_t includes
  - Output, prices, long-term Treasury yields, equity prices
  - Securities held outright

QE policy rule

- The Fed's QE policy is approximated by a linear policy rule
  - Analogous to the Taylor-type reaction function for conventional monetary policy
- The policy instrument is the securities held outright on the Fed's balance sheet
  - Holdings of Treasury securities, federal agency debt securities, and mortgage-backed securities
  - Measure of size, not composition of assets
  - Approach similar to Gambacorta et al (2014)
- The Fed observes/responds to current long-term Treasury yields
  - Other variables only with lags
- The non-systematic component of policy is isolated as a QE shock

US QE shock identification

- Use non-recursive restrictions on A_0 for identification of the QE shock $\varepsilon_{QE,t}$
  - Restrictions on short-run responses of the variables
- Sims and Zha (2006a,b) and Leeper, Sims, and Zha (1996)
  identification table
- We add to the Gertler and Karadi (2011) model a QE reaction function similar to our empirically identified one and assess the transmission of the QE shock.

Domestic effects of QE Shock

- A positive shock to asset purchase by the central bank leads to a positive effect on output, inflation, asset price and a negative effect on interest rate spreads
- Empirical IRF, Model-based IRF
- Our effects smaller than effects of QE 1 programs but similar to those of QE 2 programs Magnitude

Panel VAR for EM countries

- The estimated US QE shock $\varepsilon_{QE,t}$ as an external shock in a panel VAR for EM countries
- An equation for the i-th country in the panel VAR

$$z_{i,t} = \sum_{h=1}^{p} B_{i,h} z_{i,t-h} + \sum_{h=0}^{q} D_{i,h} \varepsilon_{QE,t-h} + \sum_{j=1}^{k} C_{i,j} x_{j,t} + u_{i,t}$$

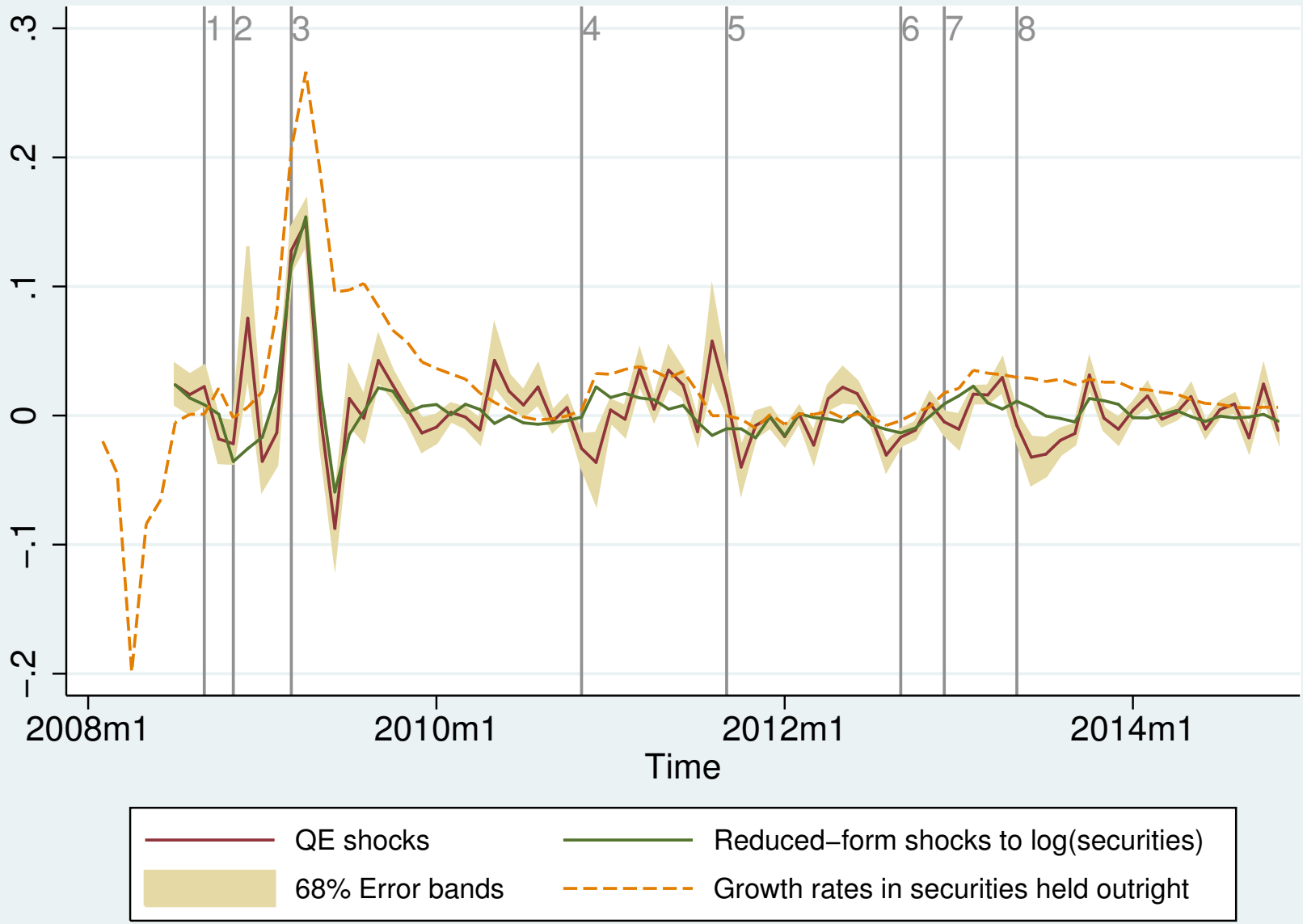
  where $u_{i,t} \sim N(0, \Sigma_i)$
- Dynamic heterogeneity but random coefficients around the common mean
  - Partially pool cross-sectional information (Canova (2007), Canova and Ciccarelli (2013))

Panel VAR for EM countries

- We include
  - Baseline 4 variables (IP, CPI, USD exchange rate, and M2) for $z_{i,t}$
  - US QE shock $\varepsilon_{QE,t}$ as an external shock, and
  - World demand and price for commodities are controlled for
- After baseline estimation, we add one additional variable at a time
  - Stock price, long-term yields, EMBI, cumulative equity flows, net exports to the US
- Also a panel VAR with financial variables only
  - USD exchange rate, stock price, long-term yields, cumulative equity flows

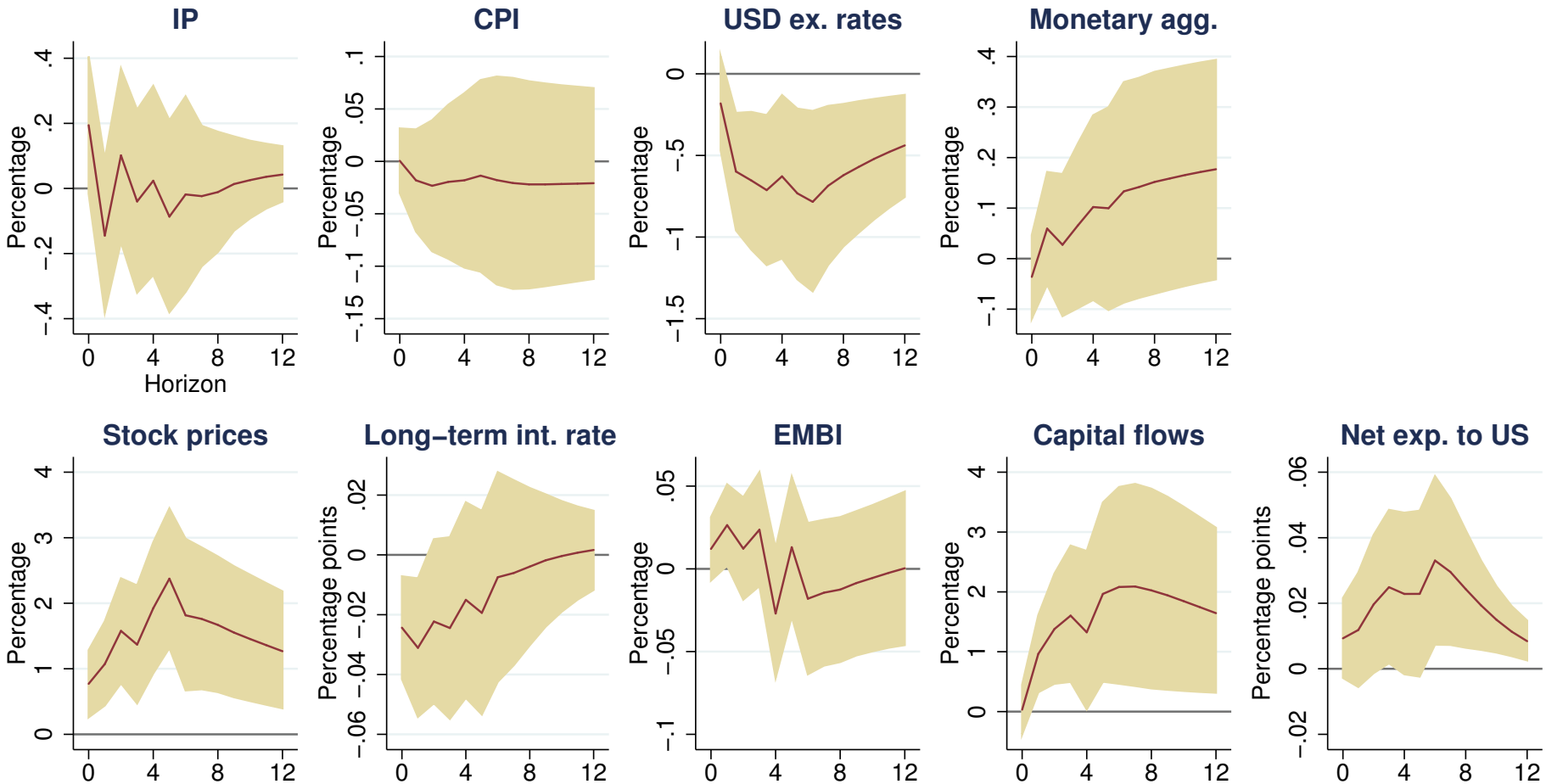
US QE shock

Shock series and growth in securities held outright



Spillover effects of US QE shock

Baseline variables + one variable at a time of all countries



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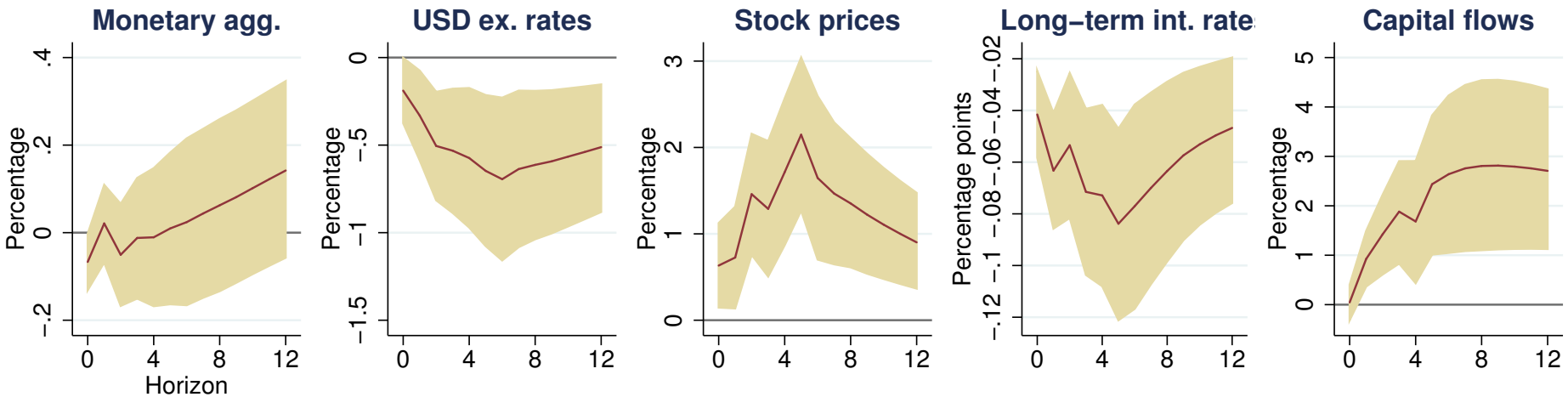
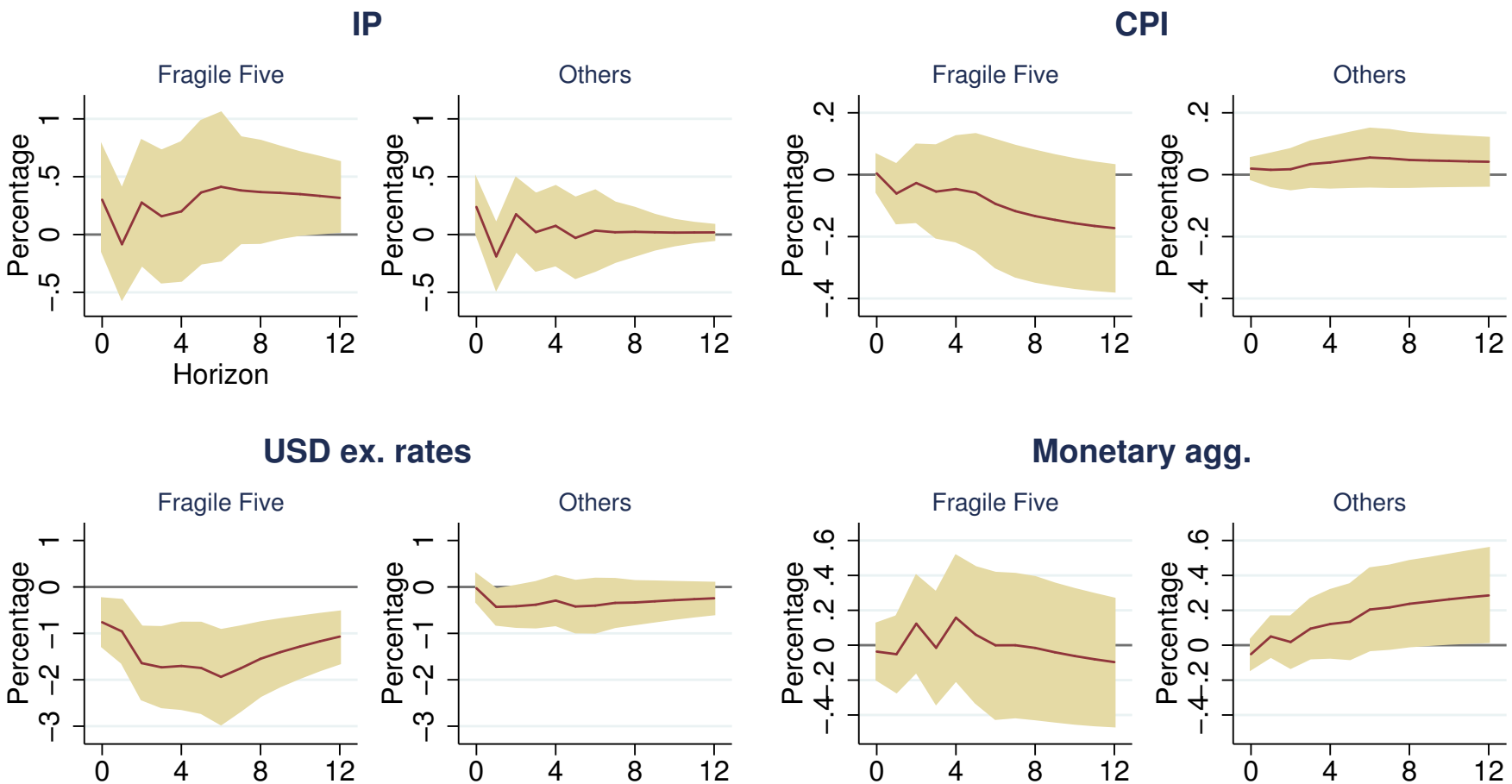


Spillover effects of US QE shock

Baseline variables + one variable at a time for the Fragile Five vs. Non-Fragile Five (I)



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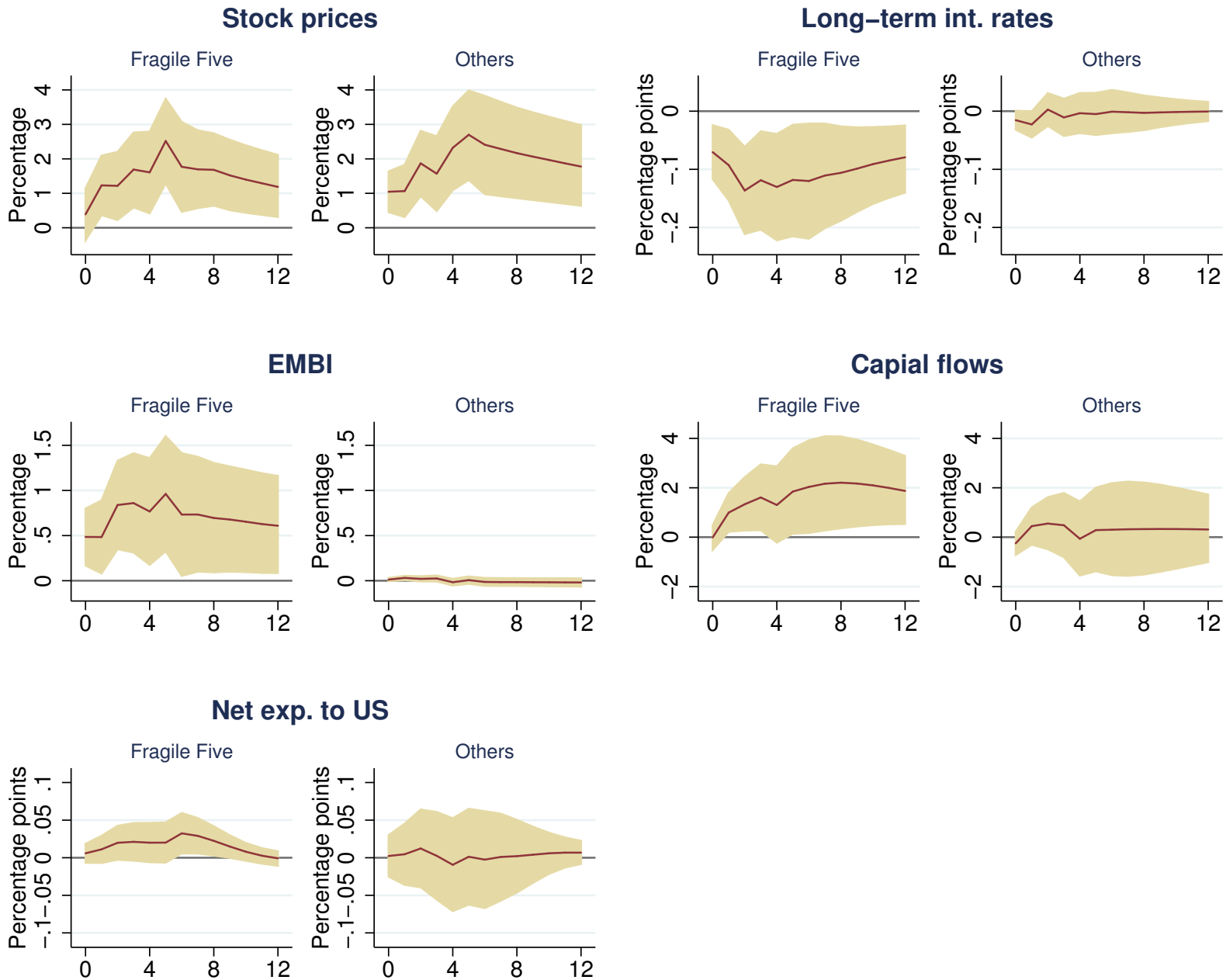


Spillover effects of US QE shock

- Spillover of QE into international financial markets
- Financial variables in the "Fragile Five" responded stronger
- Similar results including Mexico in the Fragile Five group, allowing for short term interest rate as policy instrument or different lag lengths, and by using a shadow rate shock
  - Why did "Fragile Five" respond stronger?
  - Real effects?

Why did the Fragile Five respond stronger?

- Asset markets offering higher returns prior to the crisis

	Fragile Five	Rest of EM
Long-term interest rates	15.02	4.96
Stock prices	2.15	1.73

- Suggests the "reaching for yield" or "risk-taking" channel of the international monetary policy transmission

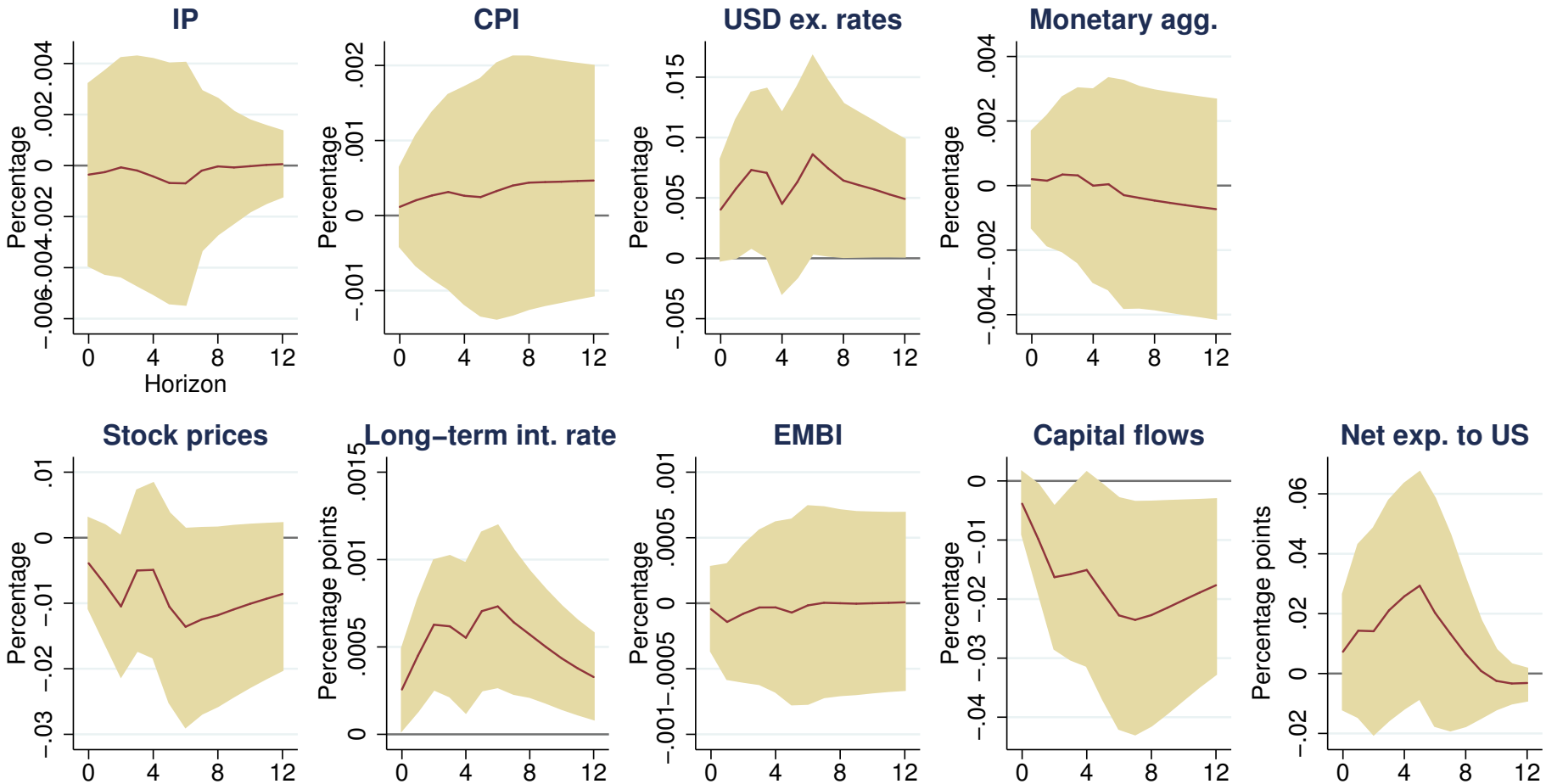
What makes financial markets of the Fragile Five "fragile"?

- The Fragile Five countries also had more imbalances prior to the crisis

	Fragile Five	Rest of EM
Current Account to GDP	-0.57	2.58
Fiscal Balance to GDP	-3.66	-1.05
Government Debt to GDP	59.7	34.5

Spillover effects of shadow rate shock

Baseline variables + one variable at a time of all countries

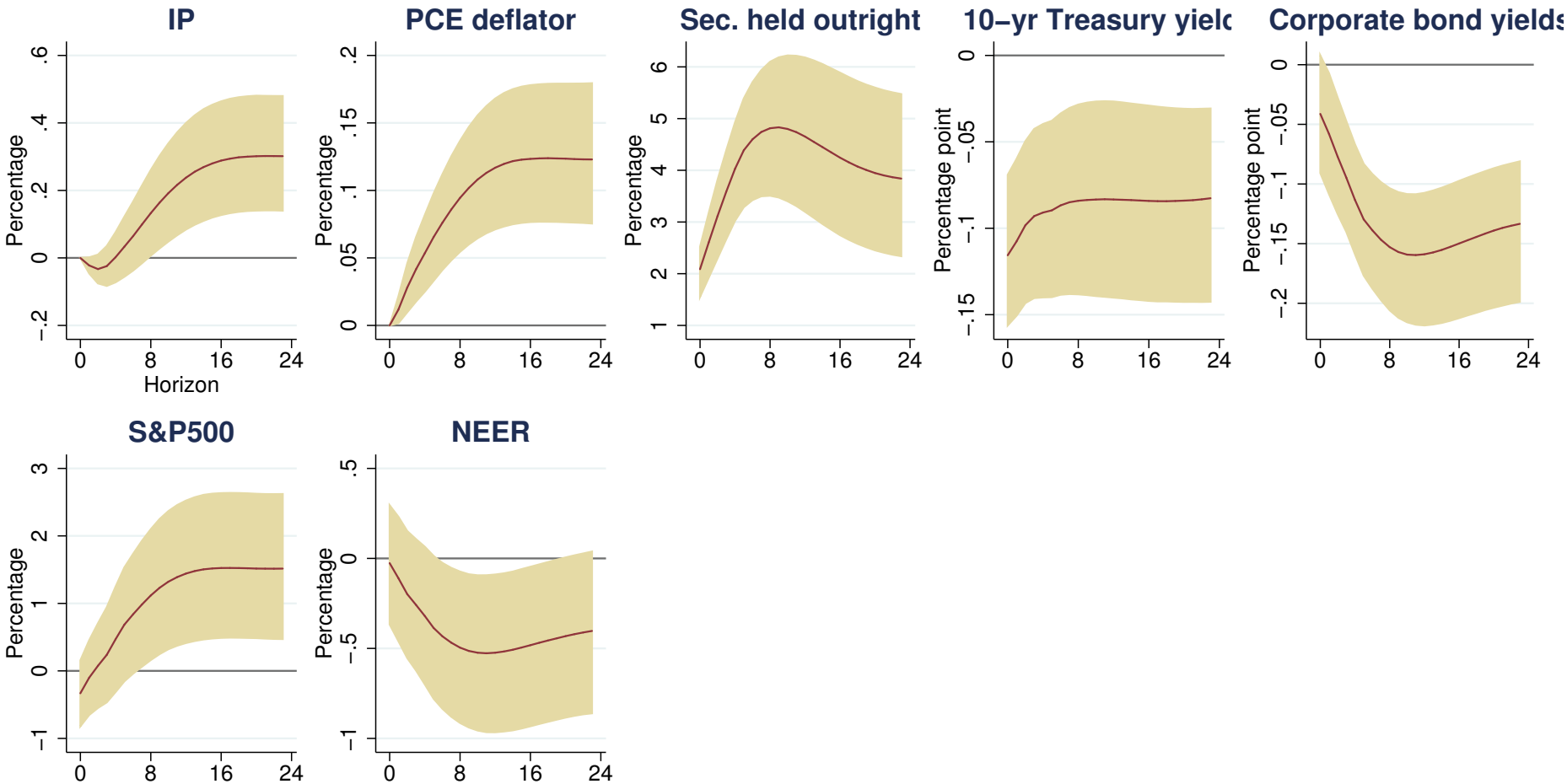


Extensions and Robustness of US QE Shock

- Extended 7 variable US VAR: private sector yields and other asset prices
- Alternate measures of output, prices, and long-term Treasury yields in baseline US VAR
- Effects on consumption and housing market
- Role of the liquidity prior

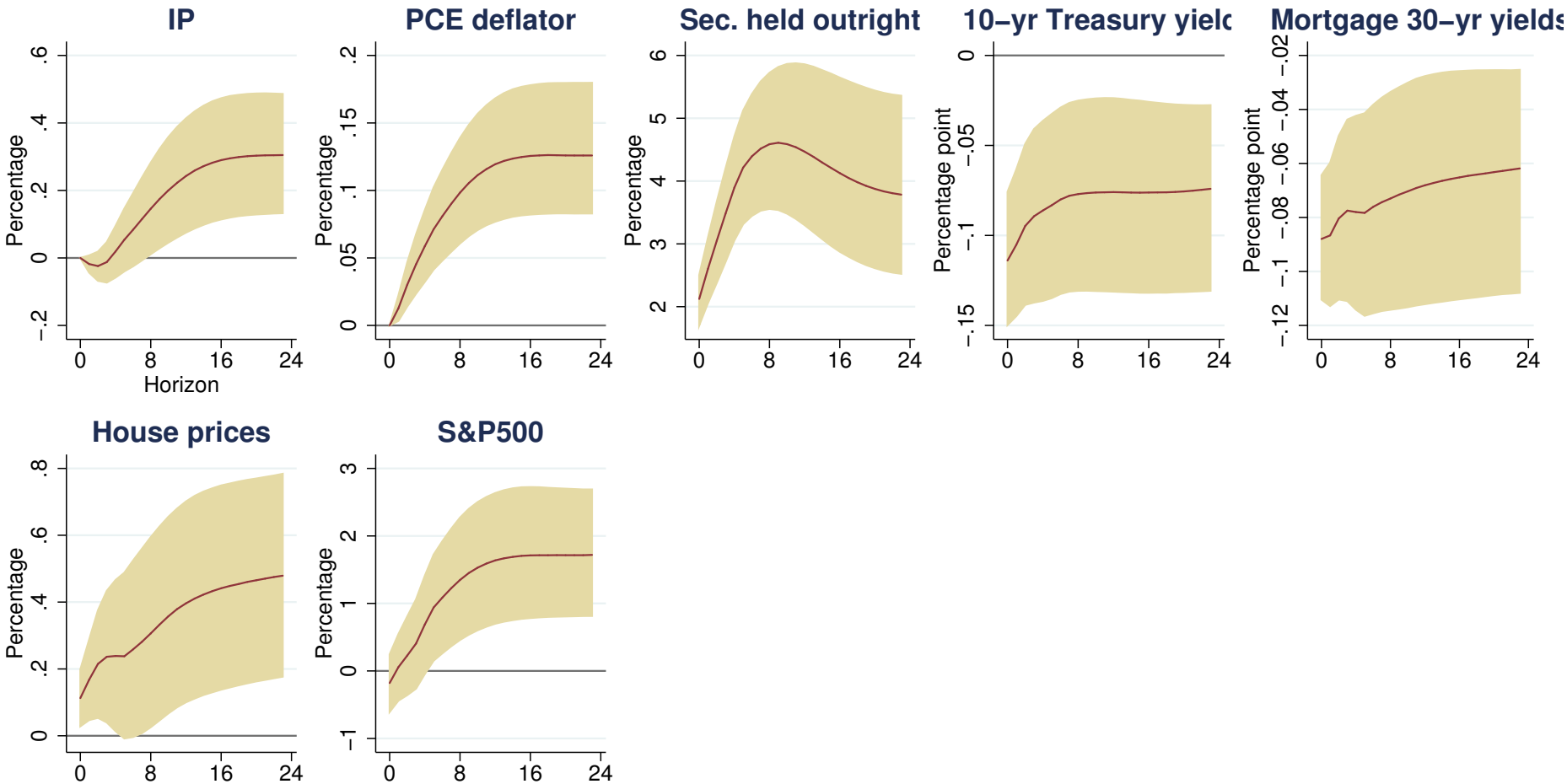
A larger US VAR

Corporate yields plus NEER



A larger US VAR

Mortgage yields plus housing prices



Robustness

Additional robustness checks and extensions

- Alternate output measures: real GDP, Coincident index, non-farm payroll
- Alternate price measures: CPI
- Alternate long-term interest rates: 5- and 20- year Treasury yields
- Durable and nondurable consumption in addition to output

Conclusion

- Strong and consistent effects on both real and financial variables of the US economy. The QE shock is estimated to
  - Increase IP and PCE Deflator
  - Lower long-term yields
  - Increase stock prices
- Relatively strong spillover effects on financial variables but weak effects on macro variables
  - Appreciation against USD
  - Reduction in long-term yields
  - Stock market boom
  - More inflows to the equity markets
  - No significant effect on IP and CPI
- The Fragile Five countries appear to respond more strongly than others

US QE shock identification

- Restrictions on A_0 (similar to Sims and Zha 2006)

	Industrial production	PCE deflator	Securities held-outright	10-year Treasury yields	S&P500 index
Prod1	X				
Prod2	X	X			
I	X	X	X	X	X
F	X	X	a_1	a_2	
MP			a_3	a_4	

- "X": the corresponding coefficient of A_0 is not restricted
- Blanks: the corresponding coefficient of A_0 is restricted to zero
- "a"s: weakly restricted with the liquidity priors, $Corr(-a_1, a_2) = -0.8$ and $Corr(a_3, -a_4) = 0.8$
- Mainslides

US QE shock

Effects in terms of the size of intervention

- Baseline estimates suggest 40 billion dollars in securities purchased by the Fed reduces 10-year treasury yields by 10 bp on impact
- Comparison with "announcement effects" estimates is tricky as the measure of policy shock is different
- Krishnamurthy and Vissing-Jorgensen (2011)
  - Estimate effects on 10-year Treasury yields around QE 1 and QE 2 dates
- Our effects smaller than effects of QE 1 programs but similar to those of QE 2 programs
- Main slides

QE reaction function

- We consider the following QE reaction function: $\psi_t = \rho_\psi \psi_{t-1} + (1 - \rho_\psi)[(\kappa E_t(R_{k,t+1} - R_{t+1}) - \kappa_\pi \pi_{t-1} - \kappa_y(y_{t-1} - y_{t-2}))] + \varepsilon_{\psi,t}$
  - ψ_t reflects actual asset purchases/credit intermediation by the central bank
  - $E_t(R_{k,t+1} - R_{t+1})$ is the expected interest rate spread (between returns to capital and a safe interest rate) in the model
  - $\pi_t$is inflation, and $y_t - y_{t-1}$ is output growth
  - Main slides

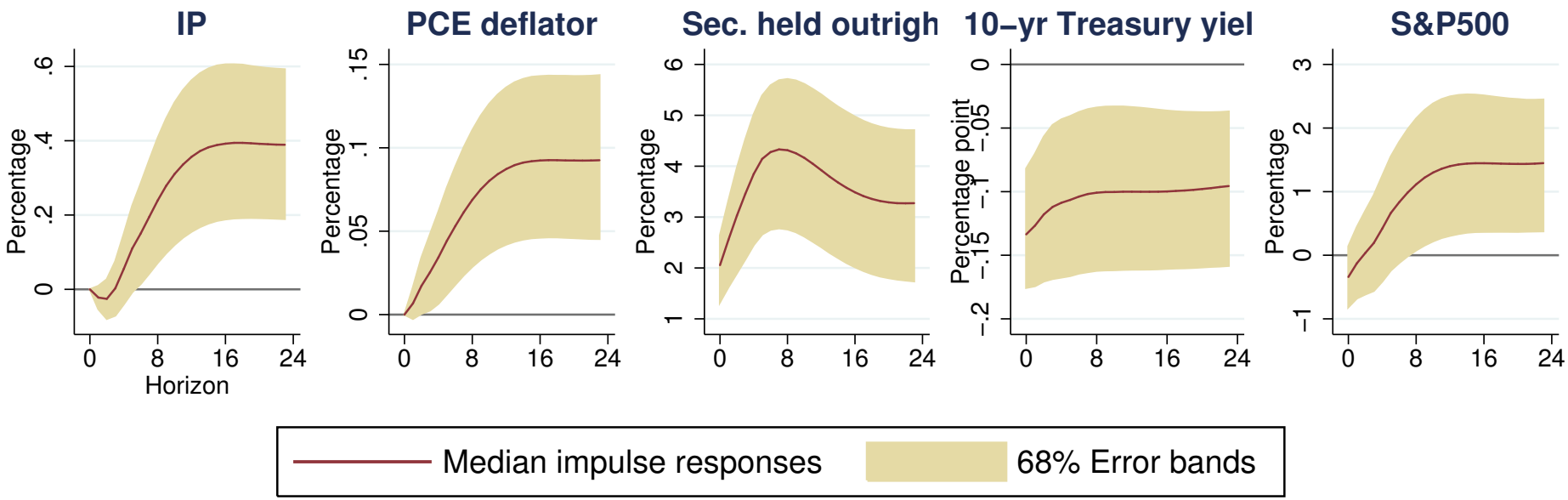
Variance decomposition of US VAR

Contribution of US QE shock (%)

	IP	PCE Deflator	Securities held-outright	10-year Treasury yields	S&P500 index
Impact	0	0	55	31	3
	[0,0]	[0,0]	[33, 78]	[10,51]	[0, 6]
3 months	1	3	51	17	6
	[0, 1]	[0, 5]	[29, 74]	[2, 33]	[1, 12]
6 months	4	7	50	17	12
	[0, 8]	[2, 13]	[28, 72]	[1, 33]	[2, 21]
12 months	15	15	38	18	18
	[4, 26]	[5, 26]	[19,57]	[2,36]	[4,33]

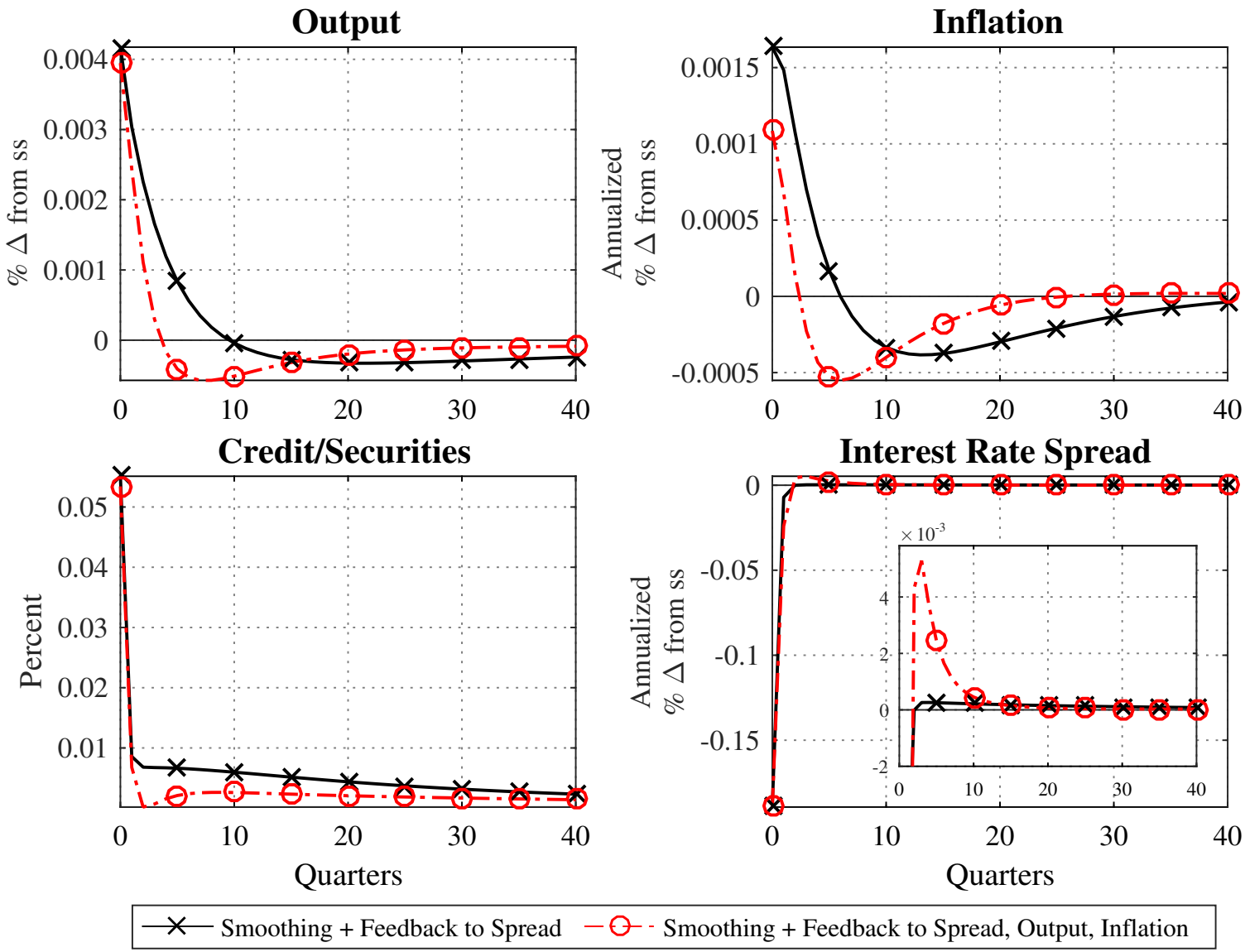
***Notes*:** Mean and [16%, 84% quantiles].

IRFs of US variables to a unit QE shock



Main slides

Model-based IRFs of US variables to a unit QE shock



Main slides

A larger US VAR

- Identifying restrictions on extended 7-variable VAR

	IP	PCE Deflator	Securities held outright	10-year yields	Private yields	S&P500 index	Asset Price
Prod1	X						
Prod2	X	X					
I1	X	X	X	X	X	X	
I2	X	X	X	X	X	X	X
F1	X	X	a_1	a_2			
F2	X	X	X	X	X		
MS			a_3	a_4			

- Private sector yields: BoFA Merril Lynch US corporate 10-15 year index, 30 year conventional mortgage rates
- Additional asset prices: effective exchange rate, Core Logic house price index