Housing Cycles and Macroeconomic Fluctuations: A Global Perspective

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Three lessons from the global financial crisis

- Housing market fluctuations may induce business fluctuations in advanced (AEs) and emerging (EMEs) economies alike
- Increased importance of emerging economies for global growth
- Movements in AEs house prices may display high international comovement

Main questions

- This paper answers the following questions

  1. Are international housing prices really correlated across countries? Is there a common factor driving a global housing cycle?

  2. How are house price shocks transmitted to the real economy?
     - What is the impact of a US housing demand shock on domestic and foreign GDP?
     - Do synchronized housing demand shocks reinforce each other? How do they compare to other asset price shocks?

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How?

- Global VAR model for the world economy
- New house price data set and other macro–financial variables for 33 AEs and EMEs covering more than 90 percent of world GDP
- Impulse response functions to identified housing demand shocks for the investigation of the spillover effects

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Filling the gap

- Empirical models on the international transmission of housing shocks
  - IMF (2004), Otrok and Terrones (2005), and Beltratti and Morana (2010), use dynamic factor models to understand international linkages between "global" housing factors and macroeconomic fluctuations → EMEs are not considered!
- Identification of shocks in the GVAR
  - Literature has so far relied on generalized impulse response functions to non-identified disturbances → Not adequate for analysis of financial shocks!

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Preview of the results

- Real house price returns can display high cross–country correlation, in particular when considering AEs and EMEs separately
- US house price shocks have strong impact on AEs real economy but not on EMEs
- Synchronized regional shocks to asset prices reinforce each other and have deeper and more long-lasting impact than country-specific shocks, especially in the case of house prices

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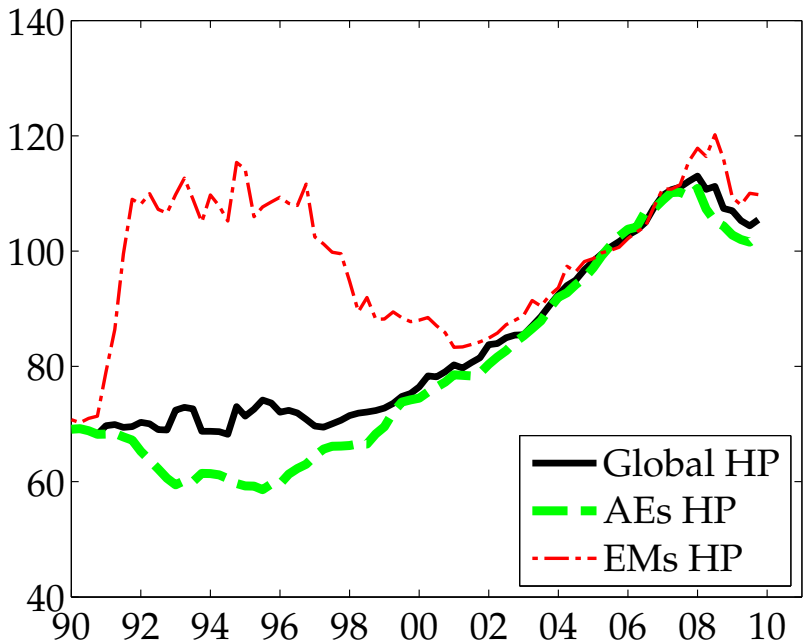
Outline

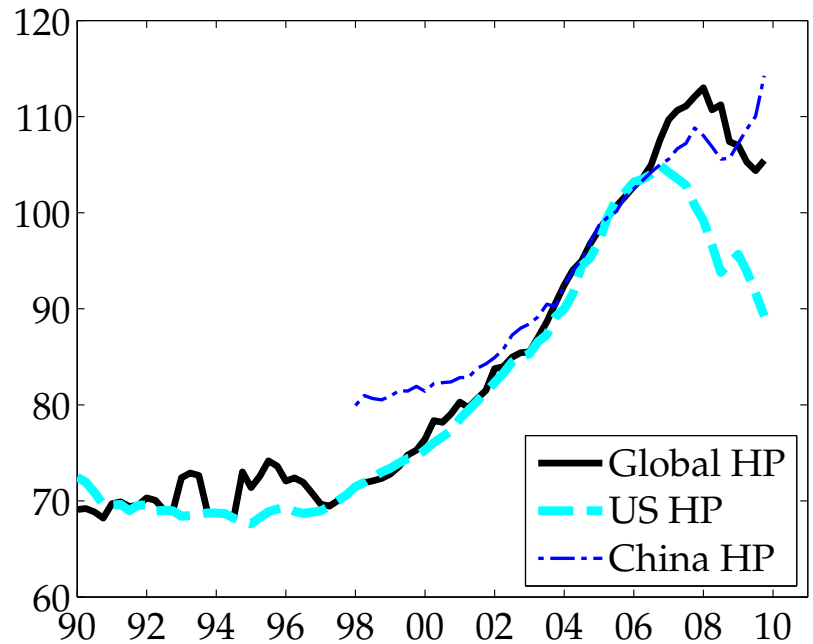
1. **Are Housing Cycles Really Correlated? Three Facts**
2. GVAR Model
3. Identification Strategy
4. Results
5. Conclusion

Fact 1. Taking into account EMEs can make a difference

Figure: Real House Price Indices (Median across all series within each group; constant prices; index; sample period: 1990-Q1 to 2009-Q4)



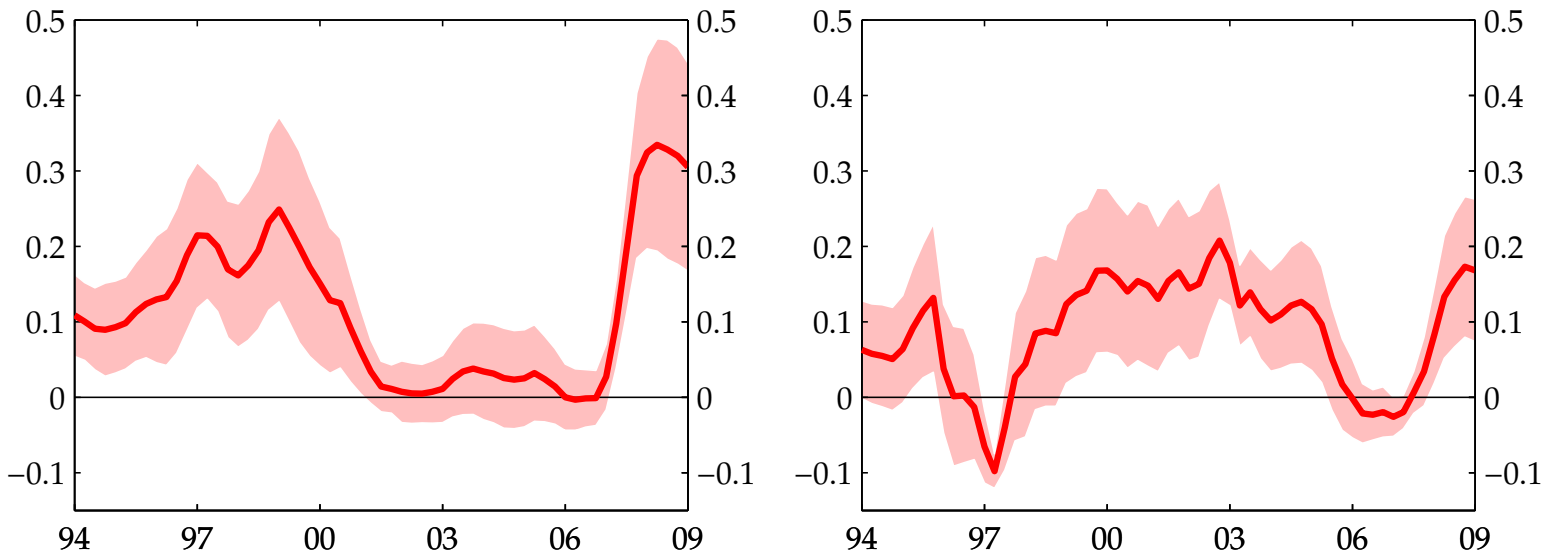
(a) Global, AEs, and EMEs



(b) Global, US, and China

Fact 2. Synchronization of house prices varies significantly over time

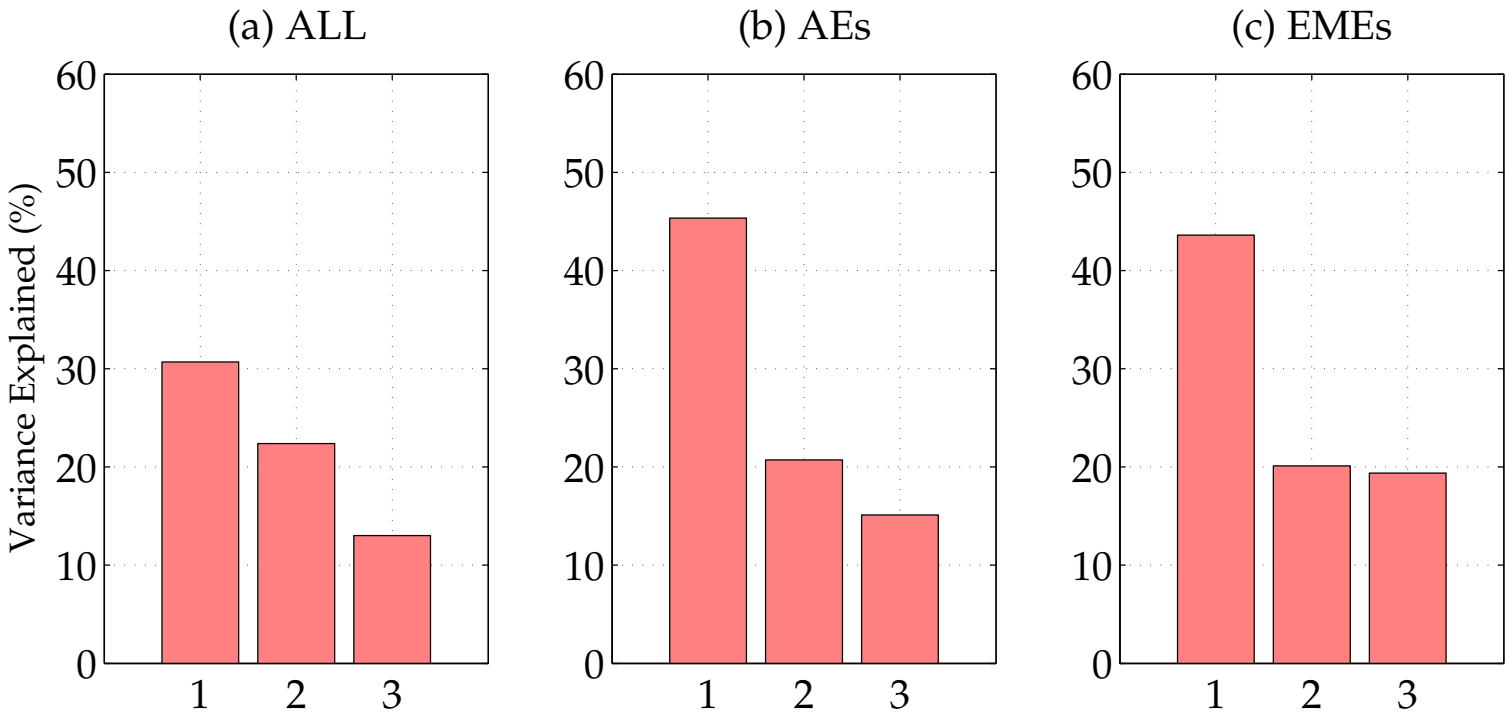
Figure: Average Moving Pair-wise Correlation of Annual House Price Inflation (Constant prices; annual growth rates; sample period: 1990-Q1 to 2009-Q4)



(a) AEs (b) EMEs

Fact 3. Both global and group–specific factors are likely to be important

Figure: Principal Component Analysis on Annual House Price Inflation
(Explained variance of the principal components; constant prices; annual growth rates; sample period: 1990-Q1 to 2009-Q4)



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GVAR model - Pesaran et al., (2004, 2007, 2010)

Two steps

- Step 1. Estimation of N country specific models
  - Augmented VAR: domestic variables are related to country–specific foreign (weak exogenous) variables
  - Estimate each model allowing for cointegration

- Step 2. Solution of the global model
  - Collect all the endogenous variables in a global vector
  - Get a reduced form VAR–style model

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GVAR model

Step 1. Country specific VARX model

- Country specific VARX$(1,1)$ model for the i^{th} economy

$$x_{i,t} = \Phi_i x_{i,t-1} + \Lambda_{0i} x^*_{i,t} + \Lambda_{0i} x^*_{i,t-1} + u_{it},$$

- Country specific foreign variables $x^*_{i,t}$ defined as cross–section averages with fixed weights

$$x^*_{i,t} = \sum_{j=0}^{N} W_{ij} x_{j,t} = W_i \mathbf{x}_t$$

  - $\mathbf{x}_t = (x'_{0,t}, x'_{1,t}, ..., x'_{N,t})'$ is the vector of all endogenous variables
  - $W_i = (W_{i0}, W_{i1}, ..., W_{iN})$ is the $k^*_i \times k$ matrix of fixed weights

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GVAR model

Step 2. The global model - Combining the VARX

- Define a $k_i \times k$ selection matrix S_i such that $x_{i,t} = S_i \mathbf{x}_t$

$$\begin{aligned} S_i \mathbf{x}_t &= \Phi_i S_i \mathbf{x}_{t-1} + \Lambda_{i0} W_i \mathbf{x}_t + \Lambda_{i1} W_i \mathbf{x}_{t-1} + u_{it}, \\ G_i \mathbf{x}_t &= H_i \mathbf{x}_{t-1} + u_{it}, \end{aligned}$$

where $G_i = S_i - \Lambda_{i0} W_i$ and $H_i = \Phi_i S_i + \Lambda_{i1} W_i$

- and stack each country-specific model for $i = 0, 1, ..., N$

$$\mathbf{G}\mathbf{x}_t = \mathbf{H}\mathbf{x}_{t-1} + \mathbf{u}_t,$$

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GVAR model

Model Setup

- Estimation period: 1983Q1 to 2009Q4
- 33 country–specific VARX models

Table: Countries and Regions in the GVAR Code

Advanced Economies		Emerging Economies	
Australia	Netherlands	Argentina	Peru
Austria	Norway	Brazil	Philippines
Belgium	New Zealand	China	South Africa
Canada	Spain	Chile	Saudi Arabia
Finland	Sweden	India	Singapore
France	Switzerland	Indonesia	Thailand
Germany	UK	Korea	Turkey
Italy	US	Malaysia	
Japan		Mexico	

GVAR model

VARX* Specification

- Country-specific models include the following endogenous and foreign variables

Table: Variables Specification of the Country-specific VARX* Models

Non-US Models		US Model	
Domestic	Foreign	Domestic	Foreign
y_i	y_i^*	y_{US}	y_{US}^*
π_i	π_i^*	π_{US}	π_{US}^*
q_i	q_i^*	q_{US}	-
hp_i	hp_i^*	hp_{US}	hp_{US}^*
ρ_i^S	ρ_i^{S*}	ρ_{US}^S	-
ρ_i^L	ρ_i^{L*}	ρ_{US}	-
$(e-p)_i$	-	-	$(e-p)_{US}^*$
-	p^o	p^o	-

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Identification of shocks in the GVAR

- Literature has largely relied on Generalized Impulse Response Functions (Koop et al., 1996)
  - GIRFs are obtained by ordering the shocked variable first in a recursive VAR $\longrightarrow$ Improper for asset price shocks

- Proposed identification procedure consist of two steps
  - A set of orthogonal country–specific shocks is derived following Sims (1980)
  - The identified shocks are coherently introduced in the GVAR model

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Identification of shocks in the GVAR

Step1. Within–Country Identification

- Housing demand shock
  - Real house price increase
  - Nominal short-term interest rate does not fall $\longrightarrow$ To rule out expansionary monetary policy shocks
  - No contemporaneous impact on GDP and CPI inflation $\longrightarrow$ To rule out more fundamental expansionary shocks

- Operationally, the identification is achieved with a standard Cholesky decomposition

- For the ordering, I closely follow the literature (Musso et al., 2012, Aspachs and Rabanal, 2011)

$$x_{it} = \left(y_i', \pi_i', r_i^S, hp_i', r_i^{L\prime}, (e-p)_i', q_i'\right)'$$

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Identification of shocks in the GVAR

Step2. GVAR Identification

- Let P_0 be lower triangular Cholesky factor of the residuals covariance matrix of country 0, then the GVAR model can be written as

$$\mathbf{G}\mathbf{x}_t = \mathbf{H}\mathbf{x}_{t-1} + \mathbf{P}^G\mathbf{v}_t.$$

where $\mathbf{v}_t = (\mathbf{P}^G)^{-1}\mathbf{u}_t$ and

$$\mathbf{P}^G = \begin{bmatrix} P_0 & 0 & \cdots & 0 \\ 0 & I_{k_1} & \cdots & 0 \\ \vdots & \cdots & \ddots & \vdots \\ 0 & 0 & \cdots & I_{k_N} \end{bmatrix}, \quad \mathbf{v}_t = \begin{bmatrix} v_0 \\ u_1 \\ \vdots \\ u_N \end{bmatrix}, \quad \Sigma_v = \begin{bmatrix} I & \Sigma_{v_0 u_1} & \cdots & \Sigma_{v_0 u_N} \\ \Sigma_{u_1 v_0} & \Sigma_{u_{1t}} & \cdots & \Sigma_{u_1 u_N} \\ \vdots & \cdots & \ddots & \vdots \\ \Sigma_{u_N v_0} & \Sigma_{u_N u_1} & \cdots & \Sigma_{u_{Nt}} \end{bmatrix}$$

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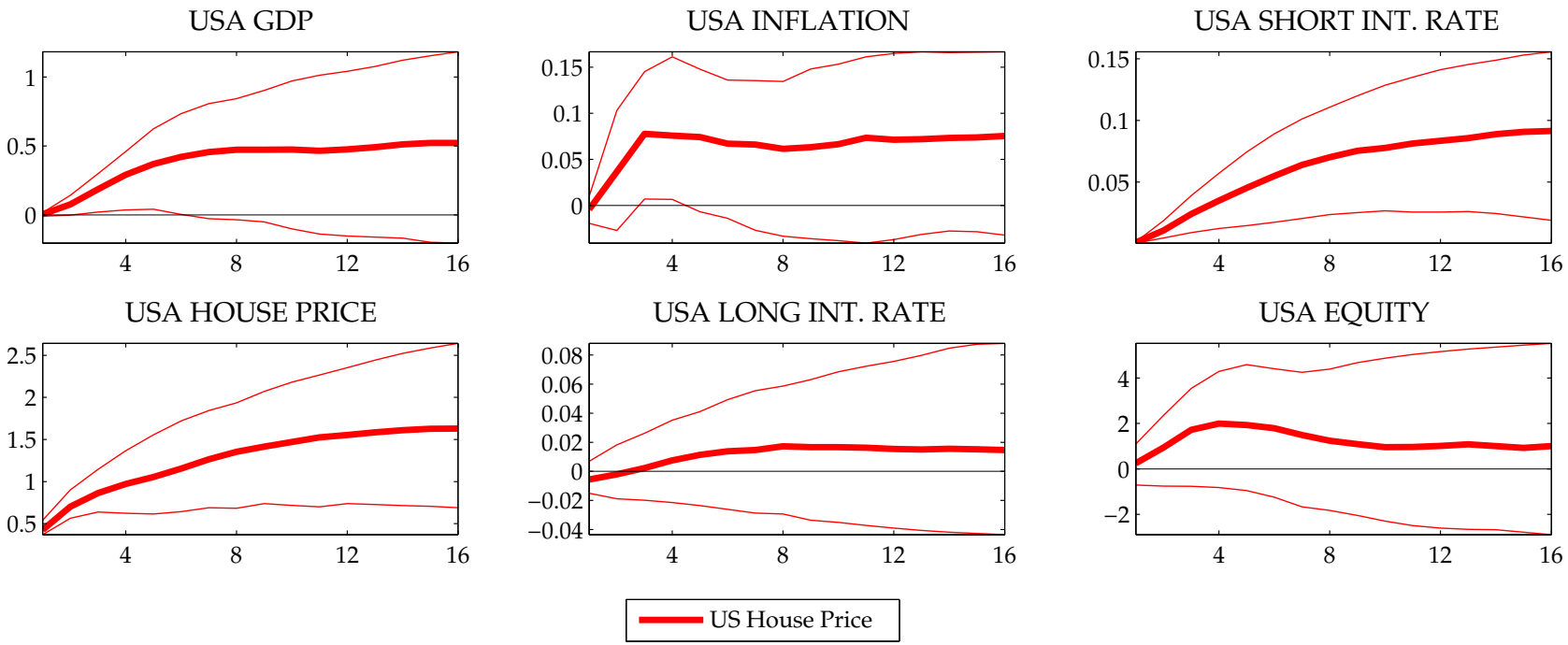
Relevant shocks

- Consider one country specific shocks and two regional shocks
  - A US housing demand shock
  - A synchronized housing demand shock originated in AEs
  - A synchronized equity price shock originated in AEs

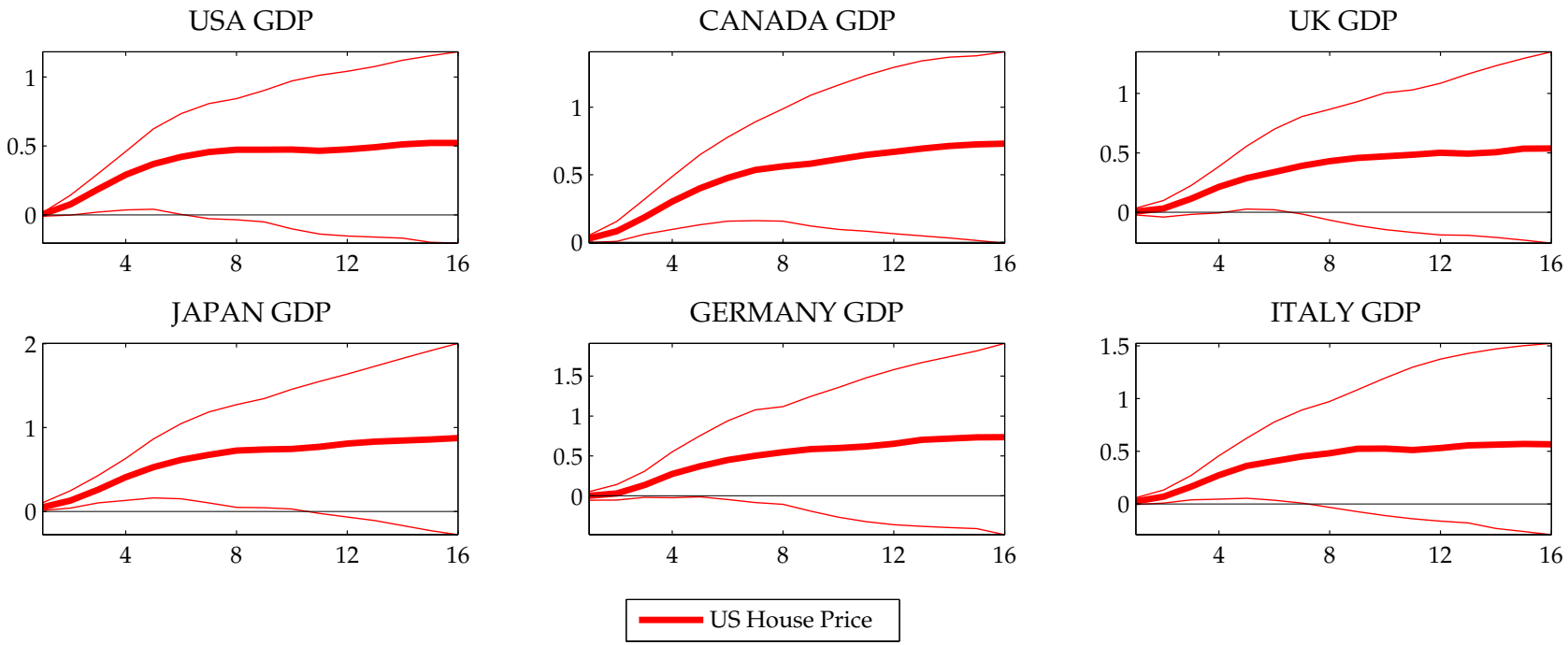
The US housing demand shock leads to an expansion in the US economy

Figure: US House Price Shock - Transmission to the US Economy



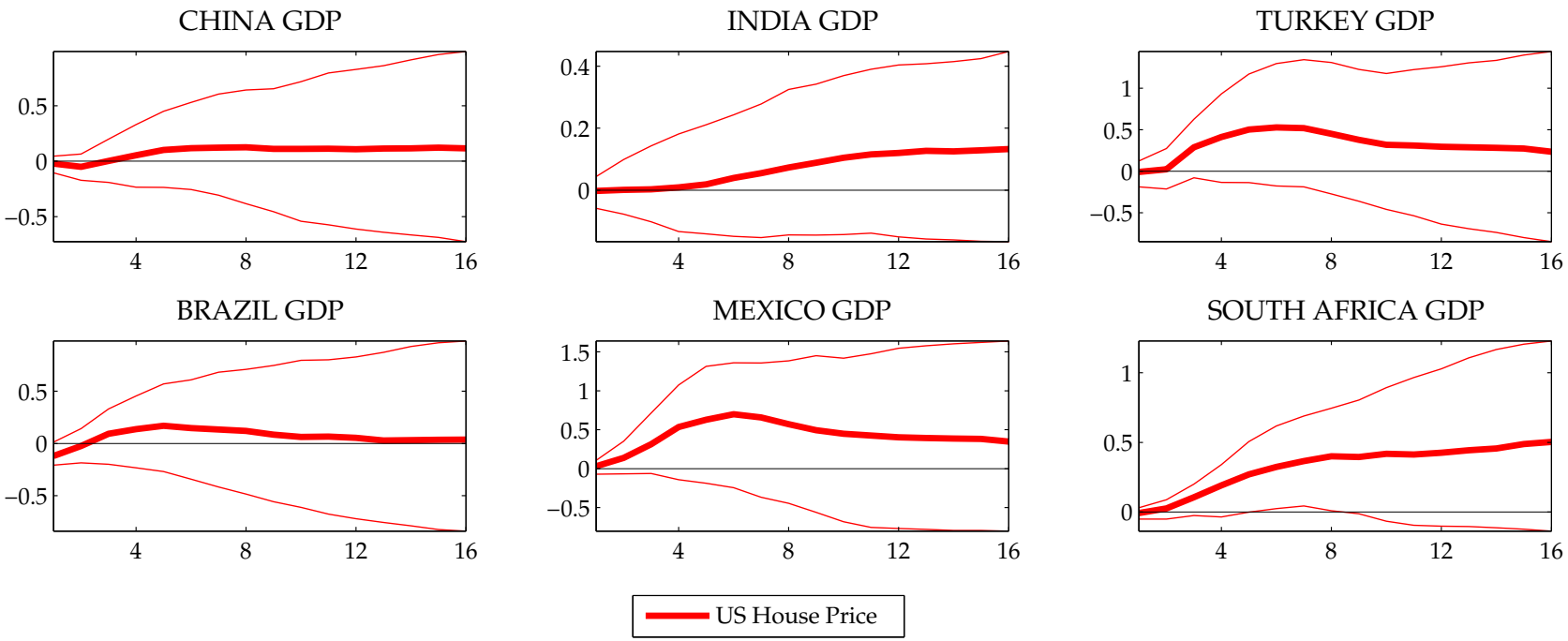
US housing demand shock has significant spillovers on AEs...

Figure: US Housing Demand Shock - Transmission to AEs Real GDP



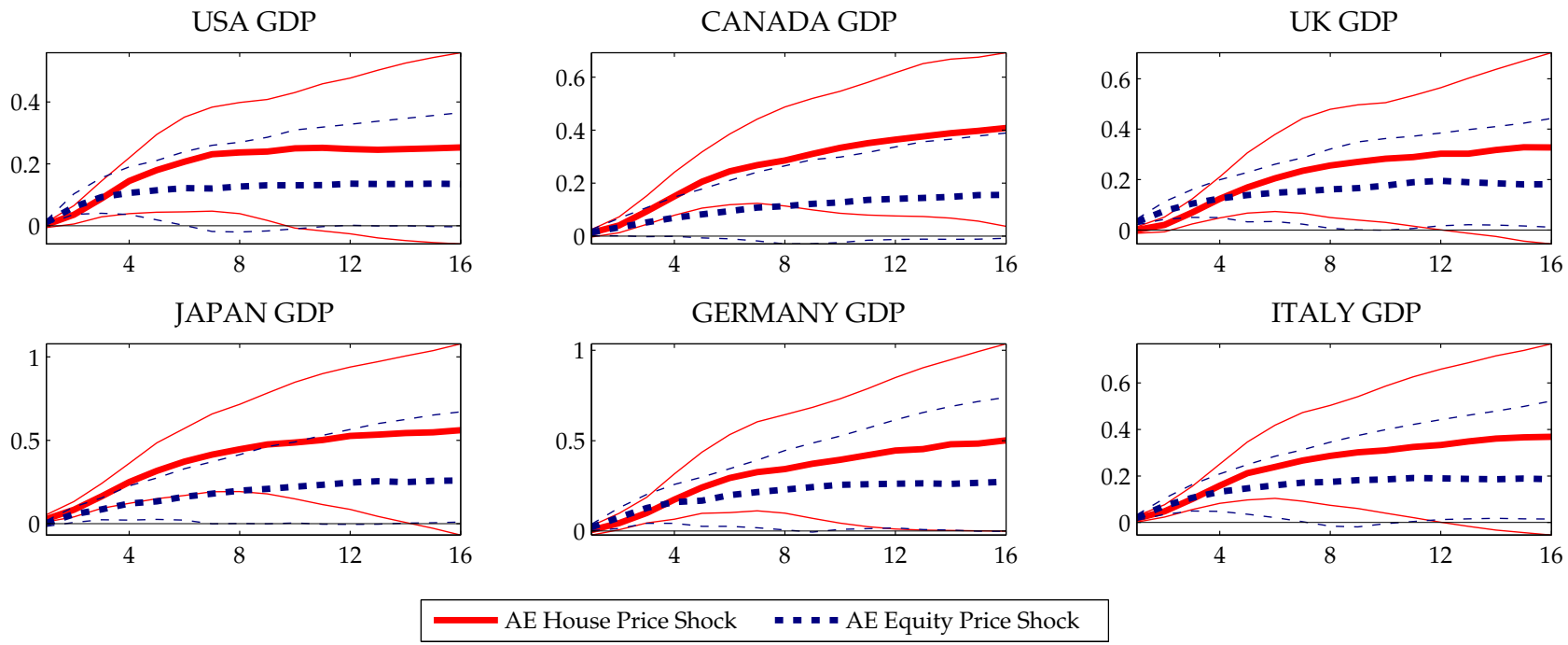
...while EMEs response is heterogeneous

Figure: US Housing Demand Shock - Transmission to EMEs Real GDP



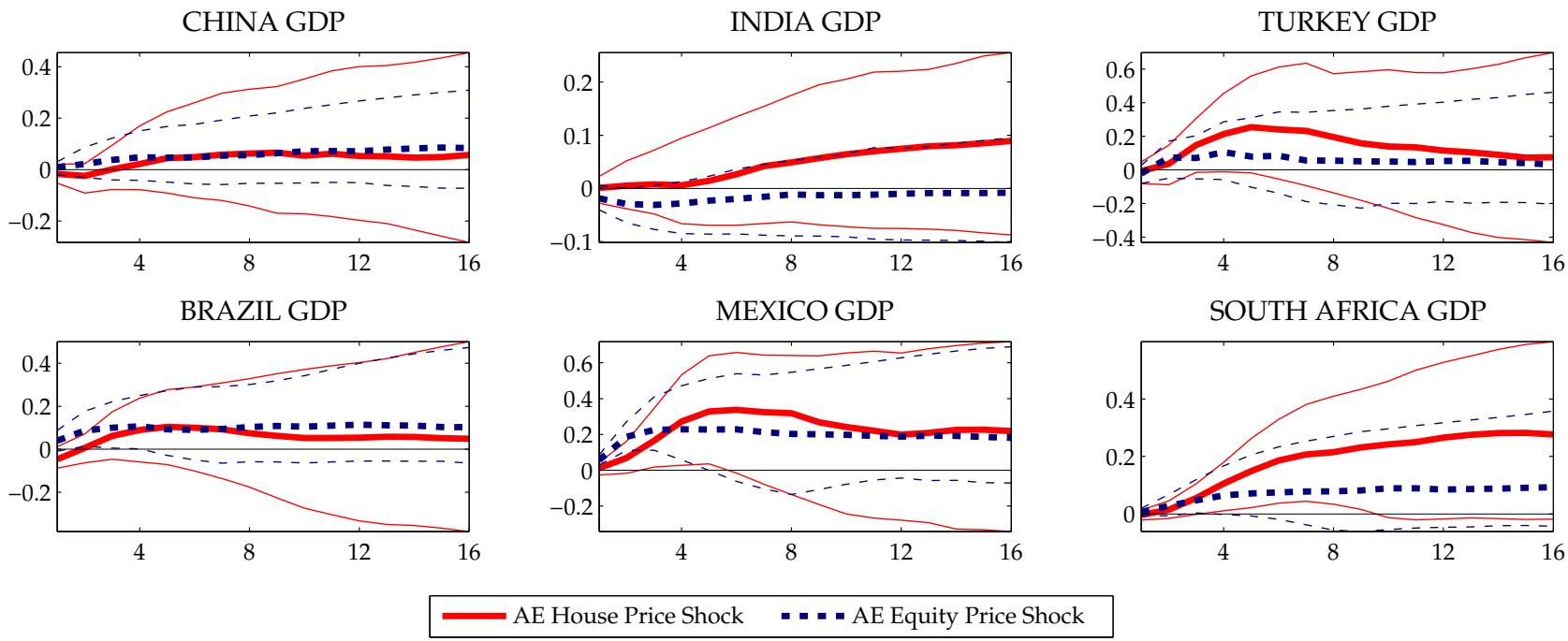
Synchronized AEs house price shocks have deeper impact than equity price...

Figure: AEs Regional House Price and Equity Price Shock - Transmission to AEs Real GDP



...while EMEs evidence again is mixed

Figure: AEs Regional House Price and Equity Price Shock - Transmission to EMEs Real GDP



Conclusions

- This paper investigates international housing cycles in advanced and emerging economies
- Main findings:
  1. House price returns can be highly correlated at global level, but even more at group–specific level
  2. A US housing demand shock is transmitted to most AEs but has no impact on four large EMEs
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Implications

- Regionalization hypothesis advanced by Hirata, Kose and Otrok (2011)
  - Business cycle synchronization has increased among AEs and among EMEs separately while the relative importance of the global factor has declined
  - Some EMEs have become more resilient to shocks originated in AEs
- Decreased importance of US shocks in the global economy (Yeyati and Williams, 2012)
  - Rather than decoupling from the world economy, many EMEs shifted their loading from the US into other EMEs

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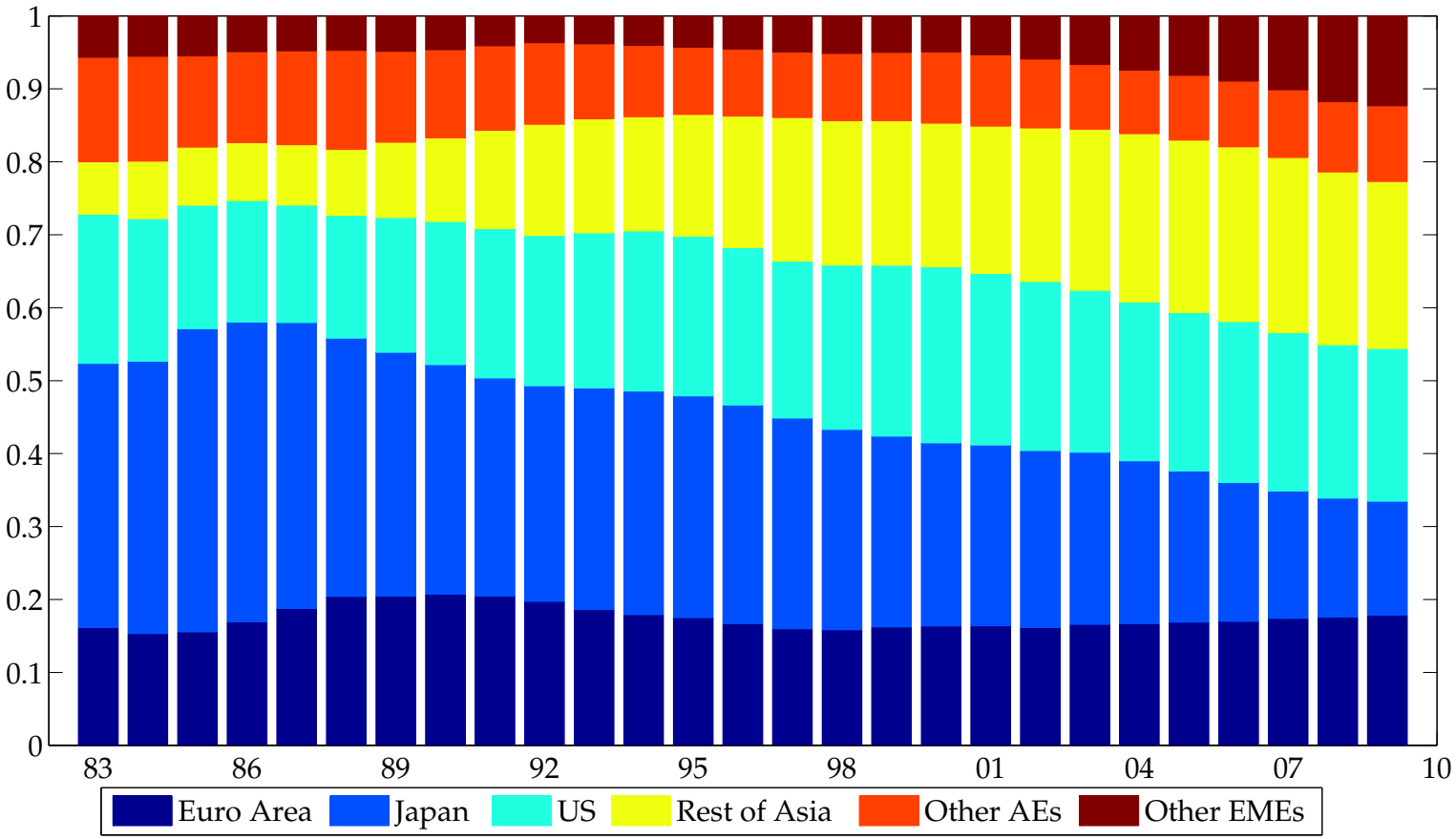
Thank you

Additional results

Evolution of trade flows

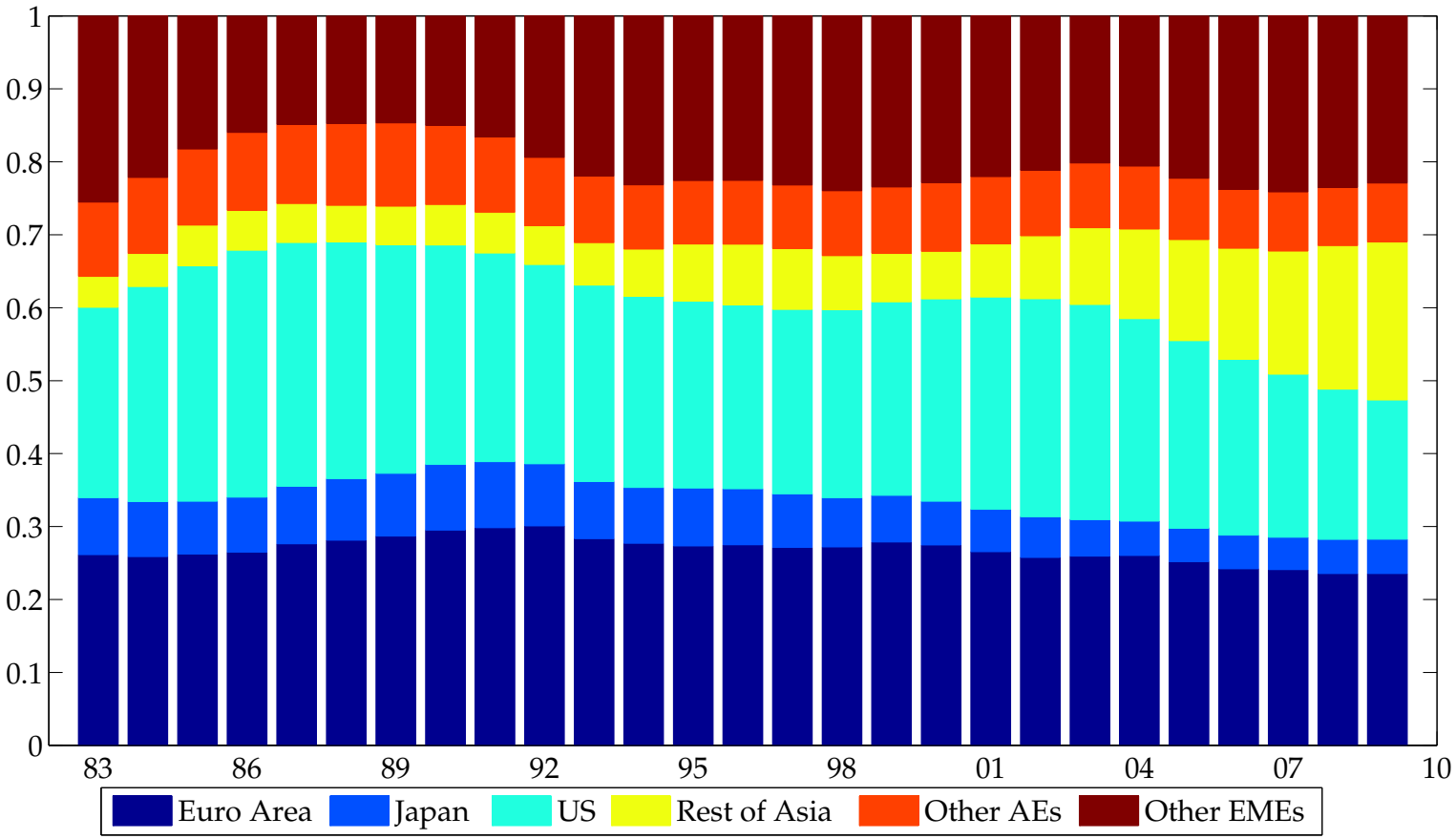
Figure: Evolution of China's Trade Flows



Additional results

Evolution of trade flows

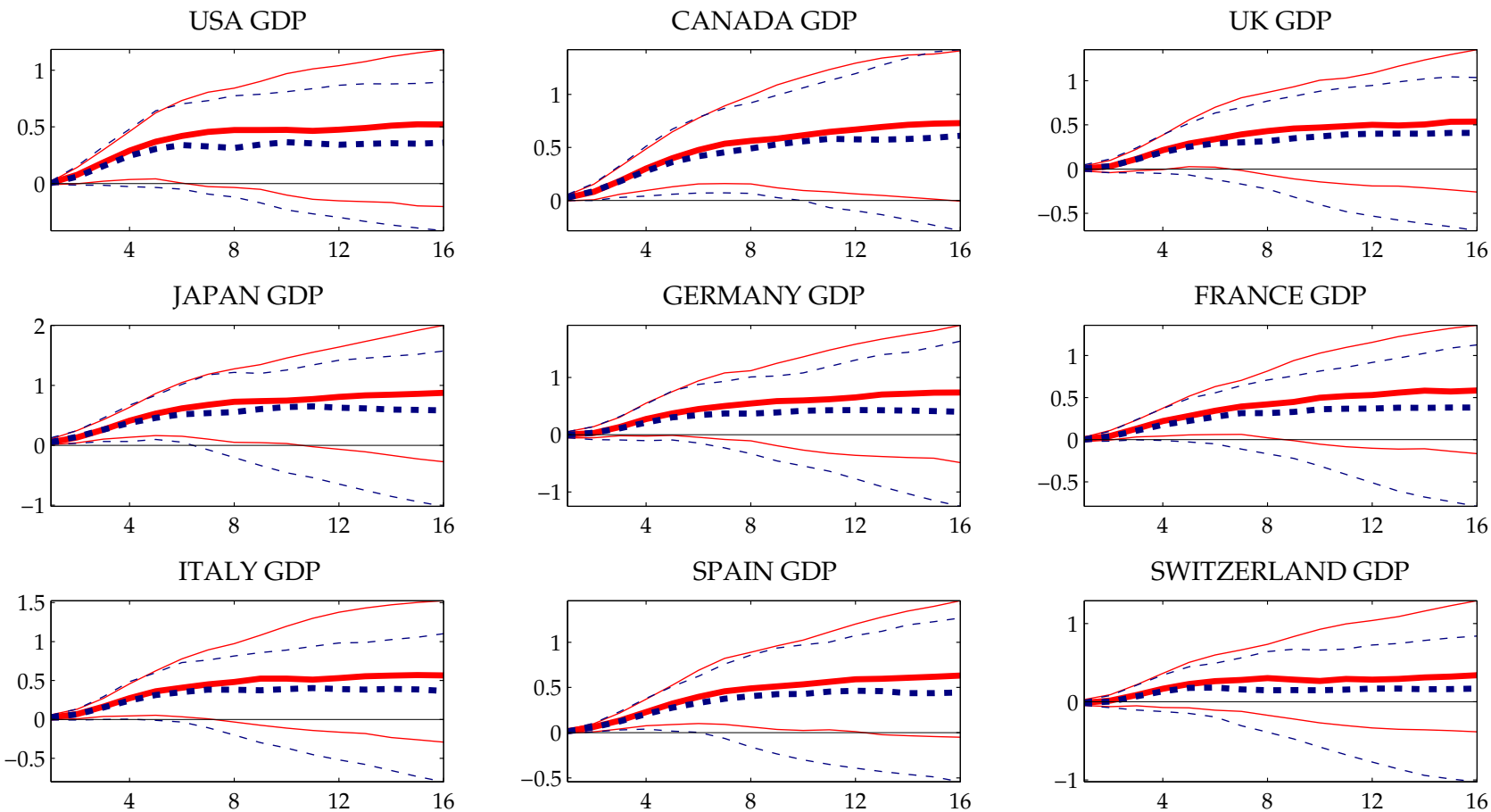
Figure: Evolution of Brazil's Trade Flows



Robustness

Alternative Orderings of US Variables

Figure: US Housing Demand Shock



Robustness

Sample VS Block Diagonal Covariance Matrix

Figure: US Housing Demand Shock