The Effects of Anticipated and Surprise Technology Changes on International Relative Prices and Trade

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Preview

- In SVARs, We decompose changes in US total factor productivity (TFP) into
  - Surprise changes (contemporaneous shocks)
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  - International relative prices
  - International trade
- An example of news and contemporaneous shocks

$$a_{t+1} = \rho_a a_t + x_{t-p} + \varepsilon_{a,t+1},$$

$$x_{t+1} = \rho_x x_t + \varepsilon_{x,t+1}$$

  - Contemporaneous shock $\varepsilon_{a,t+1}$ changes TFP immediately.
  - News shock $\varepsilon_{x,t+1}$ affects TFP only in the future.

Motivation

- Revived interest on news shocks in driving business cycles
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  - News TFP shocks are empirically important in driving US business cycles: Beaudry and Portier (2006), Barsky and Sims (2011), Beaudry, Nam, and Wang (2012), among others.
- Our paper compares the international transmission of news and surprise TFP shocks.
  - International relative prices: the real exchange rate and TOT
  - International trade

Motivation

- Studies on international transmission of US technology shocks focus on surprise shocks.
  - BKK (1992, 1994)
  - Corsetti, Dedola, and Leduc (2006 and forthcoming)
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  - Juvenal (2011)
- Distinguishing news and contemporaneous TFP shocks reconciles puzzling findings in previous studies.

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  - The news shock is more important in driving exchange rate movements.
  - Two shocks lead to different dynamics for trade variables.
- It is important to distinguish these two shocks when discussing the international spill-over of technology changes.
- Standard international business cycle models fail to replicate these empirical findings.

Three steps to achieve these goals

- Step one: benchmark identification method
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- Step three: robustness check
  - Identify shocks from SVAR using the sign restrictions method.
  - Relate our results with other studies.

Identification Strategy (Barsky and Sims, 2011)

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  - News shocks: orthogonal to the contemporaneous shock and contributes to the variation in future TFP as much as possible.

Data

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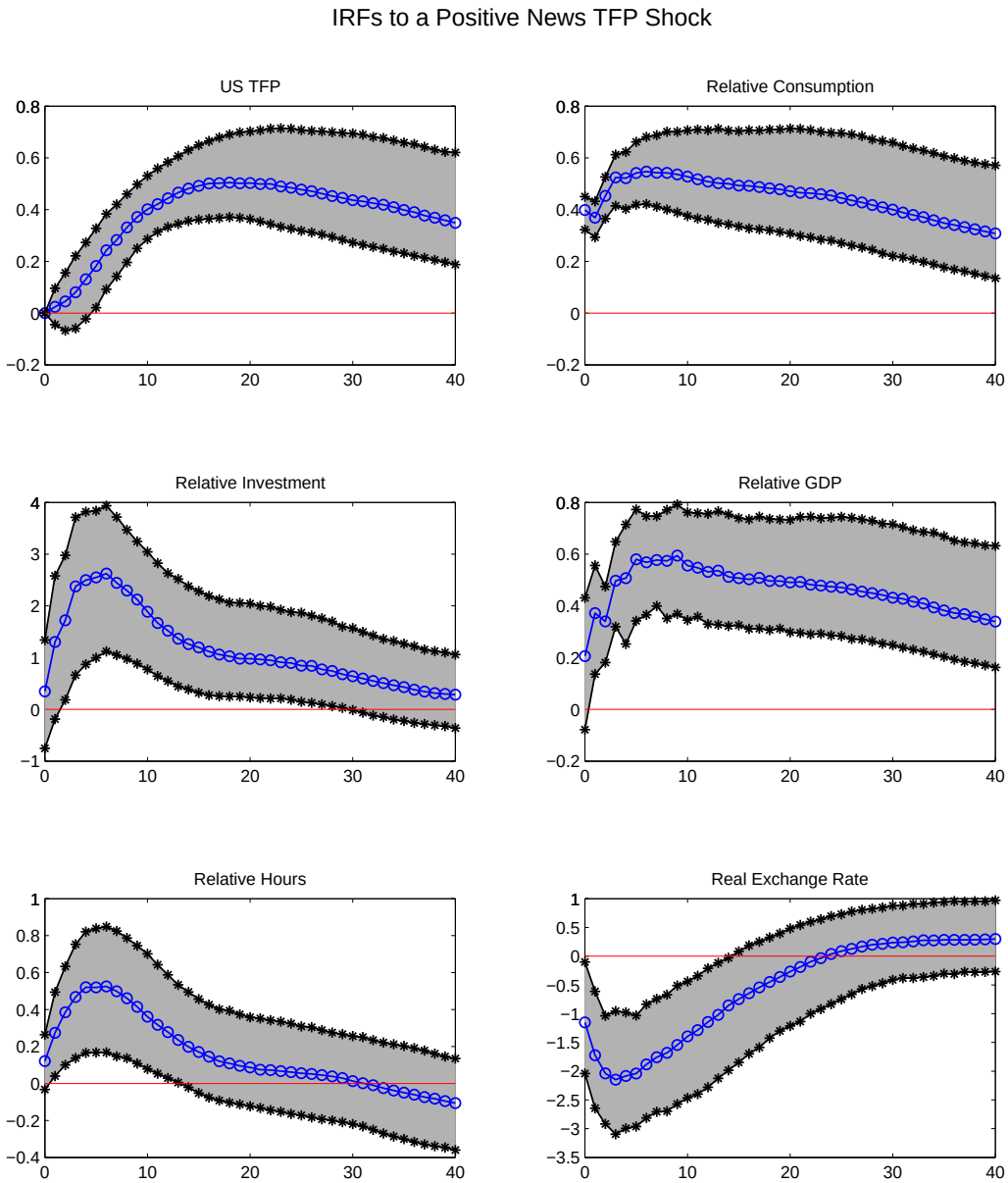
  - US-ROW data
    - Real consumption
    - Real investment
    - Real GDP
    - Hours worked
    - The real exchange rate
- Most data are from OECD, IMF, BEA, and BLS.

IRFs to a positive news TFP shock



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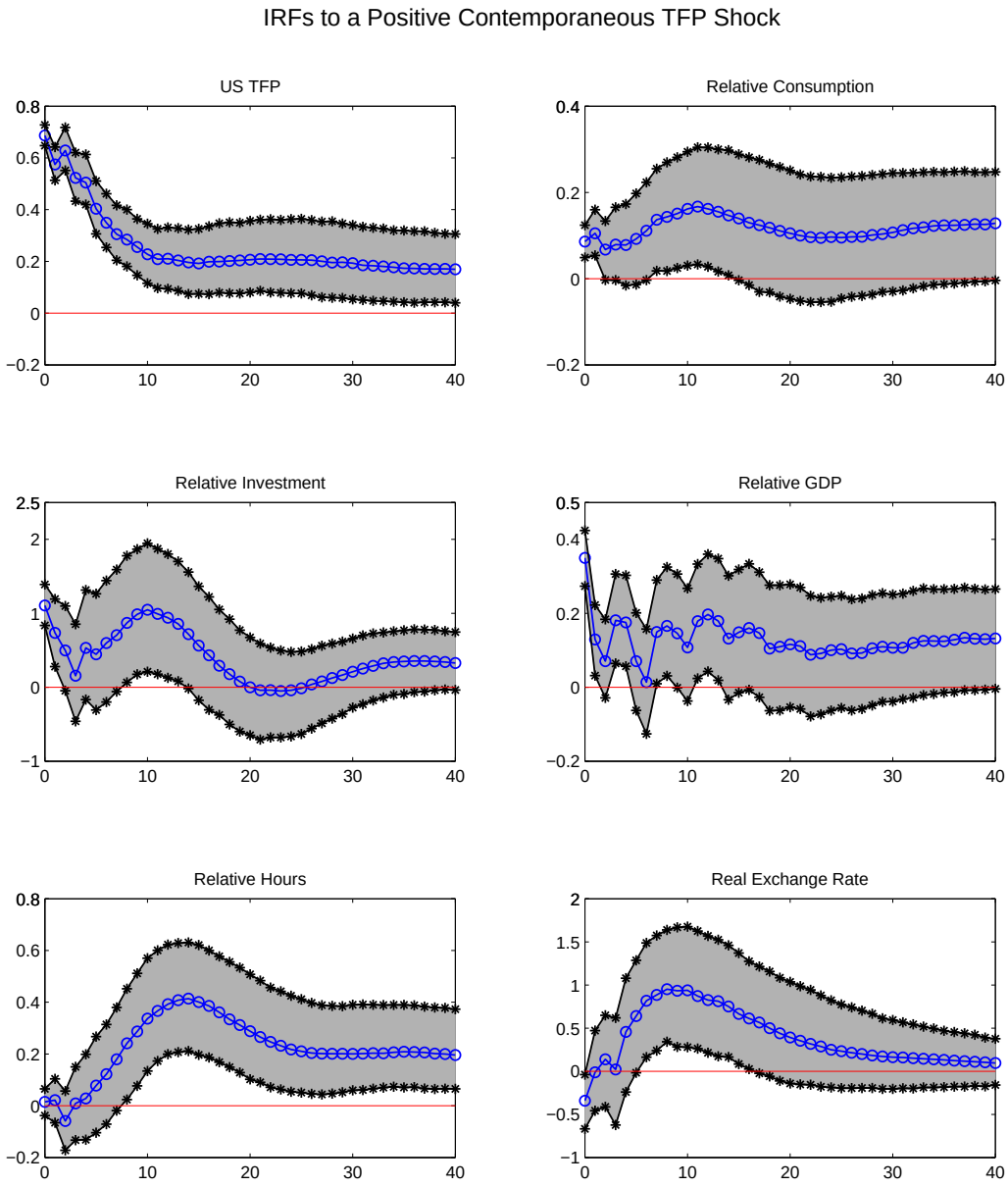

Effects of shocks on trade

- Seven-variable VAR
- Replace the real exchange rate in the benchmark VAR with the TOT
- Add one of the
  - Real export
  - Real import
  - Trade balance (nominal trade balance divided by nominal GDP)

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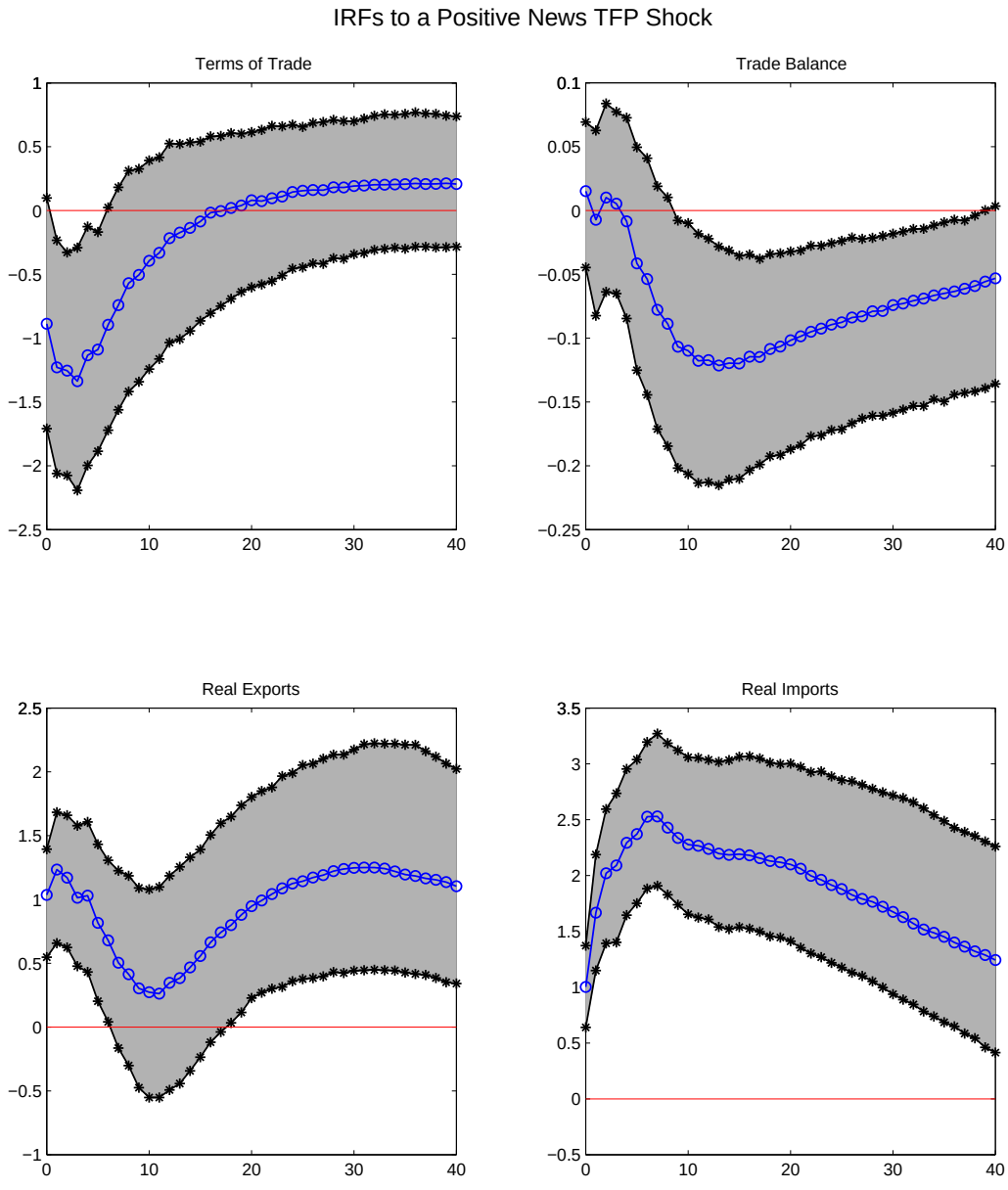

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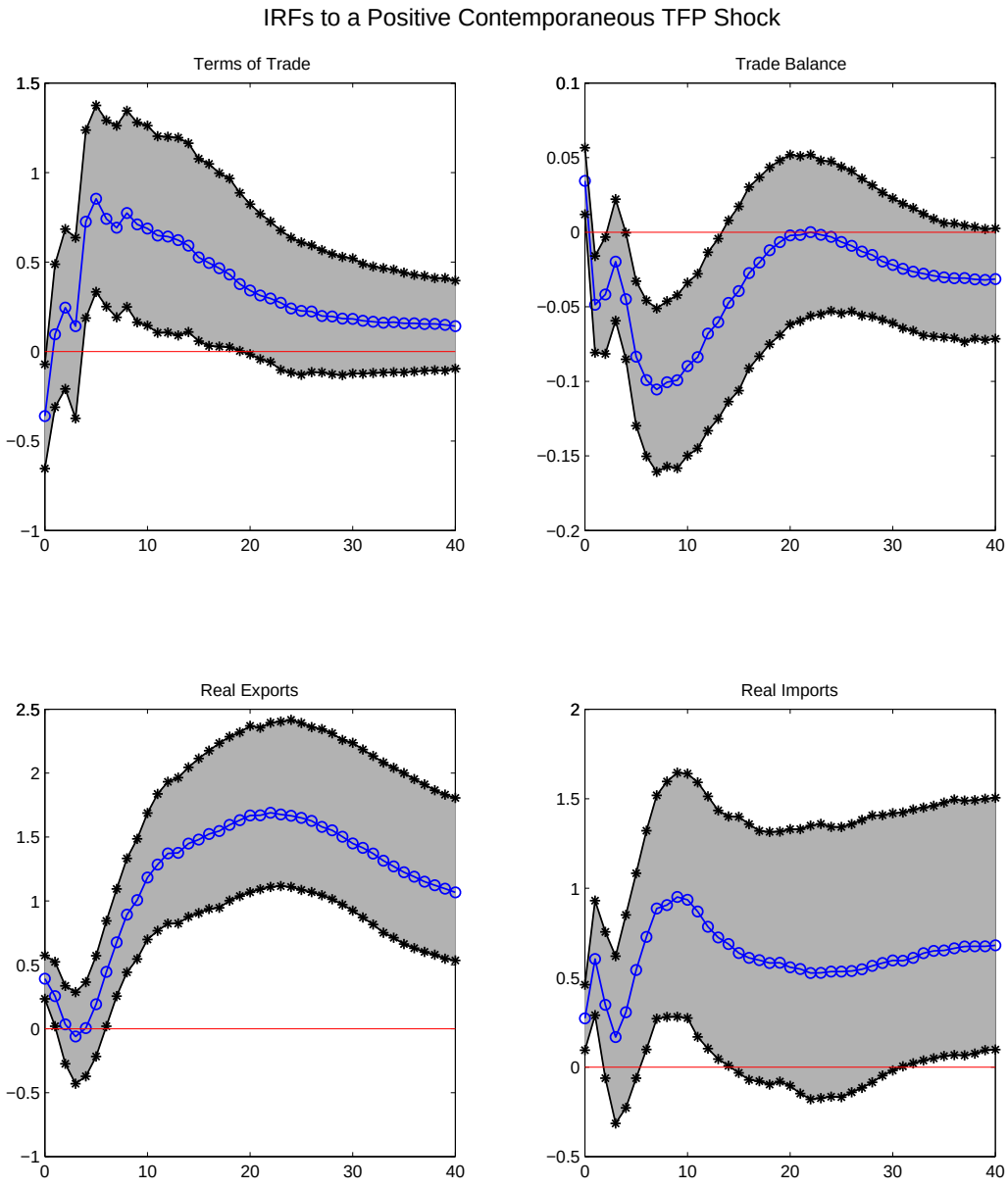

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  - 40% of the FEV of the exchange rate for horizons more than 8 quarters.
  - 10% for horizons less than 4 quarters.
  - Other shocks drive short-run exchange rate movement: demand, monetary, risk premium, etc.

Section 2: Evaluation of a Theoretical Model

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- Evaluate the model's performance.

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- Final goods are used for domestic consumption and capital formation.
- The model shares many features widely used in the literature.
  - Variable capital utilization rate
  - Capital adjustment costs
  - Calvo type sticky prices in PCP or LCP

TFP Process

- Two-factor model for $a_t = log(A_t)$ (Ferrero, Gertler, and Svensson 2010)
  - $a_t = a_t^u - a_t^s$

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  - $a_t = a_t^u - a_t^s$
  - $a_t^u = \xi^u a_{t-1}^u + \varepsilon_t^c + \varepsilon_{t-p}^n$
  - $a_t^s = \xi^s a_{t-1}^s + \varepsilon_{t-p}^n$
  - where $\xi^u > \xi^s$
- ε_{t-p}^n is a news shock

Estimation Strategy

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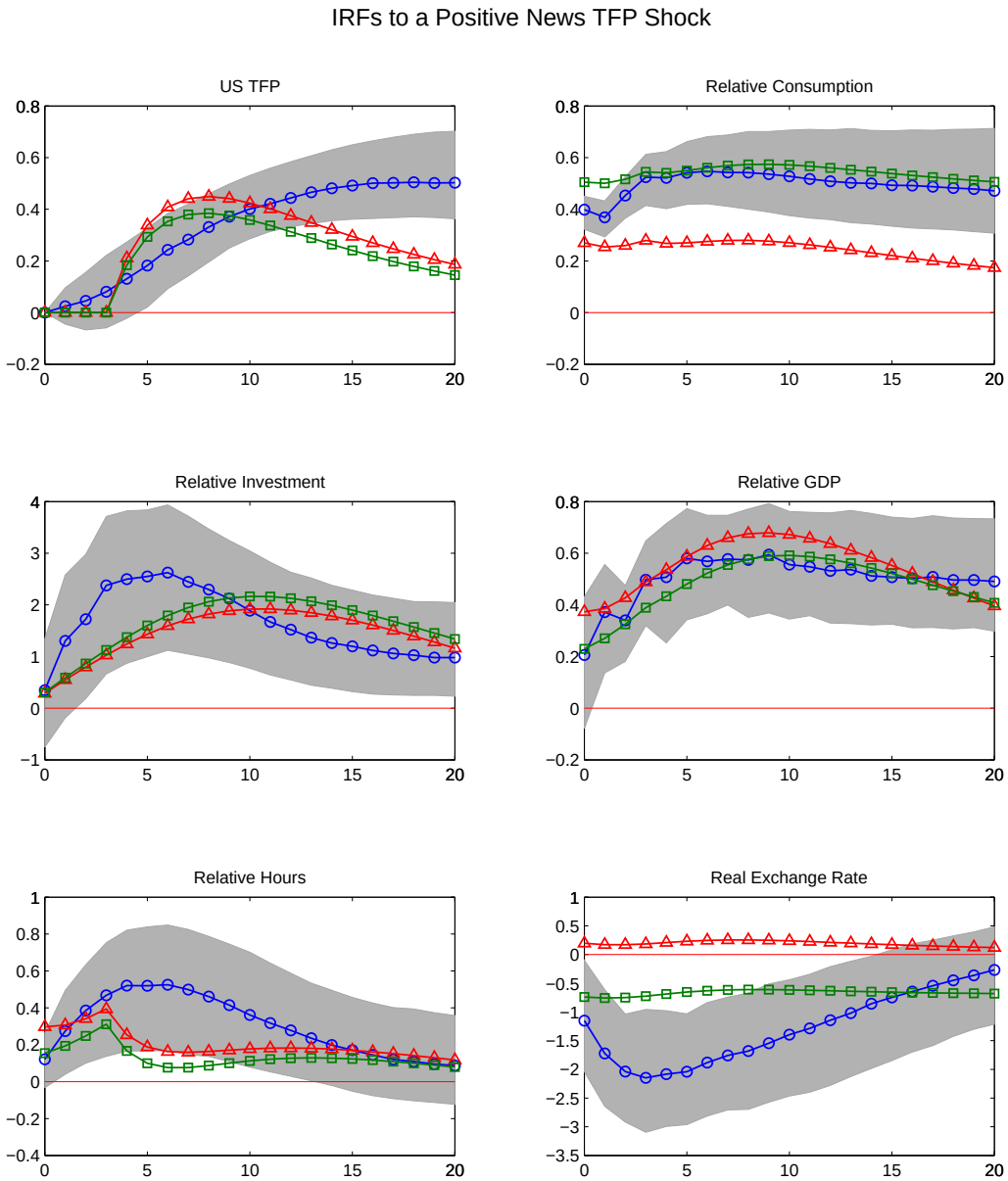
- Estimate the rest of parameters by solving
  - $\min_{\zeta} \left(\widehat{M} - M(\zeta)\right)' W \left(\widehat{M} - M(\zeta)\right)$
  - $\widehat{M}$ contains VAR IRFs in the data
  - $M(\zeta)$ are theoretical IRF in the model

Estimation Results

Table: Estimated Parameter Values

Parameter	Description	Matching IRFs to Both TFP Shocks Value	Matching IRFs to News TFP Shocks Value	Matching IRFs to Cont. TFP Shocks Value
ϕ	Investment adjustment costs	4.00	2.73	4.00
δ_2/δ_1	Sensitivity of capital utilization to rental rate of capital	0.20	0.84	0.01
θ	Trade price elasticity	1.51	0.30	1.53
α_I	Calvo parameter	0.80	0.79	0.80
ψ_I	Degree of price indexation	0.11	0.01	0.00
Θ_i	Interest smoothing coefficient	0.71	0.73	0.60
Θ_π	Inflation targeting coefficient	1.57	1.97	1.63
Θ_y	Output gap coefficient	0.00	0.33	0.00
ξ^u	Persistence of contemporaneous TFP shocks	0.91		0.87
σ_{ε^c}	Standard deviation of contemporaneous TFP shocks	0.51		0.58
ξ^s	Degree of diffusion of news TFP shocks	0.70	0.70	
σ_{ε^n}	Standard deviation of news TFP shocks	0.99	0.93	

Evaluation of the Model



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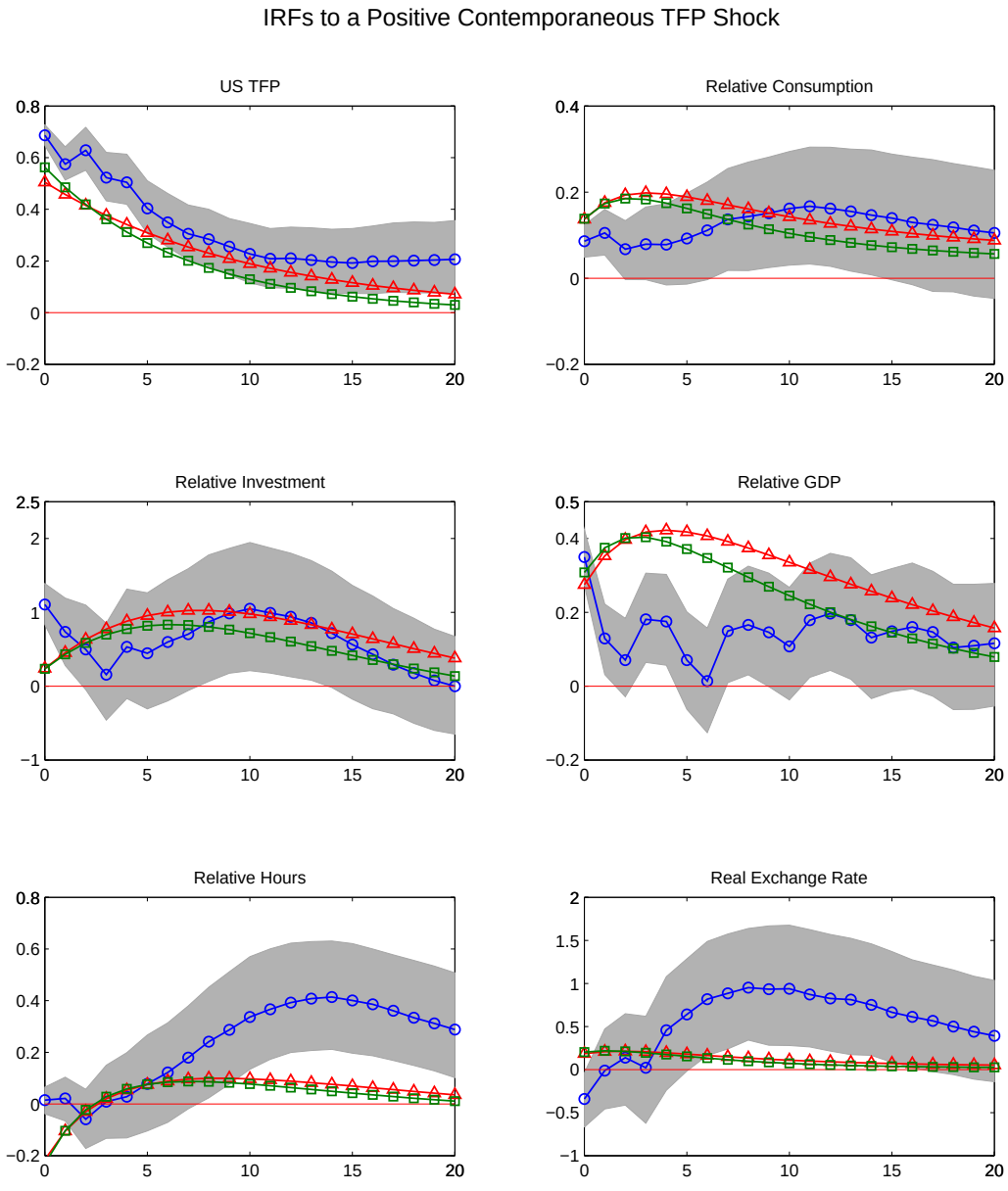

Summary of Section 2

- Standard international RBC models fail to replicate the dynamics of the real exchange rate following news and contemporaneous TFP shocks.

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- Standard international RBC models fail to replicate the dynamics of the real exchange rate following news and contemporaneous TFP shocks.
- This is true even if we allow the model has different parameter values under different shocks.

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  - Relate our findings with other studies using the sign restrictions.

Sign Restrictions to Identify Shocks

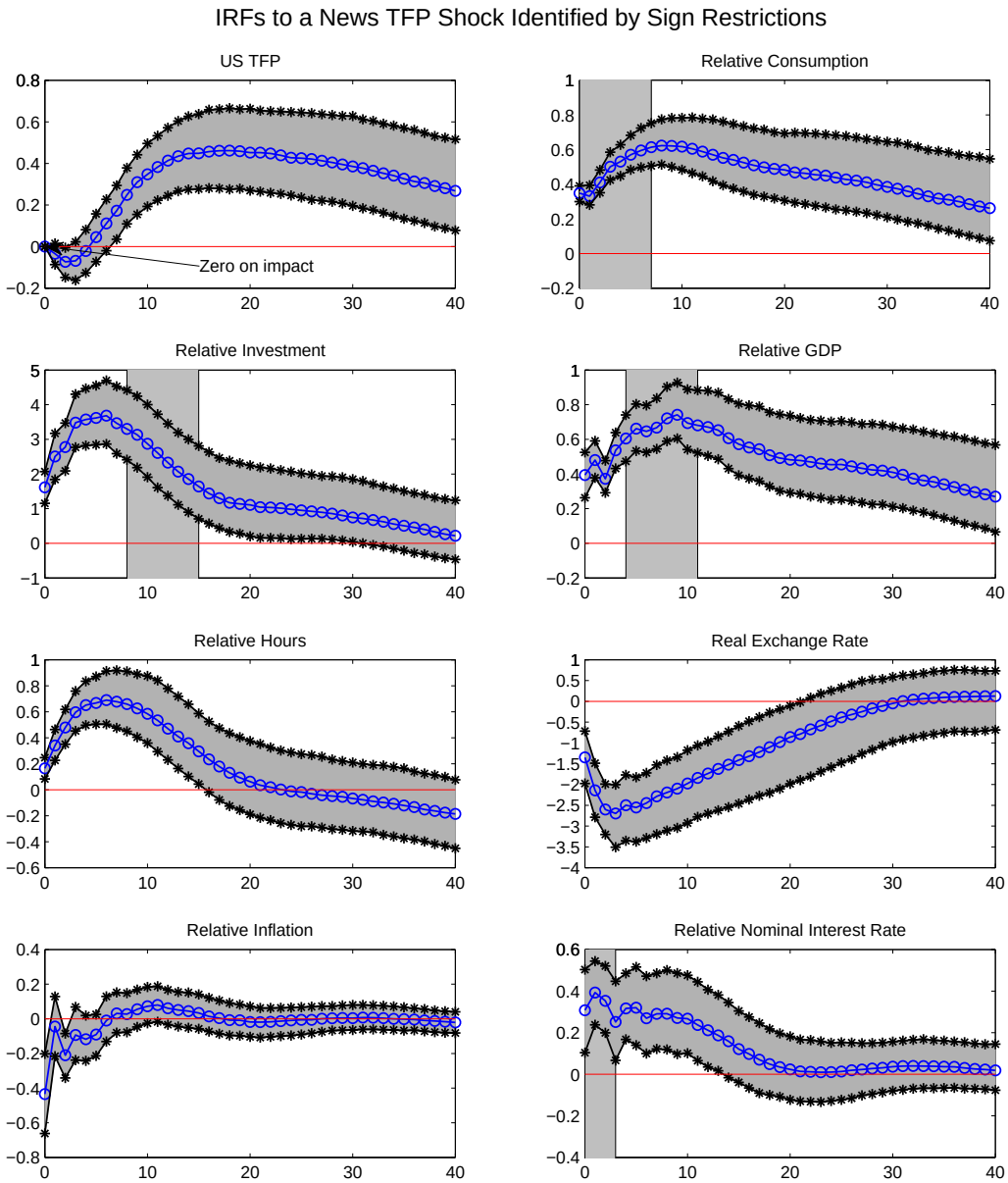
A. Sign Restrictions

	US TFP	Relative Consumption	Relative Investment	Relative GDP	Relative Inflation	Relative Interest Rate
News TFP Shocks	0 [0, 0]	+ [0, 7]	+ [8, 15]	+ [4, 11]		+ [0, 3]
Contemporaneous TFP Shocks	+ [0, 27]	+ [1, 8]	+ [0, 7]	+ [0, 7]	- [0, 2]	- [0, 5]

B. Alternative Sign Restrictions for Identifying News TFP Shock

	US TFP	Relative Consumption	Relative Investment	Relative GDP	Relative Inflation	Relative Interest Rate
Identification I		+ [0, 7]	+ [8, 15]	+ [4, 11]		
Identification II		+ [0, 7]	+ [8, 15]	+ [4, 11]		+ [0, 3]
Identification III	0 [0, 0]	+ [0, 7]	+ [8, 15]	+ [4, 11]		

Results of the Sign Restrictions Method



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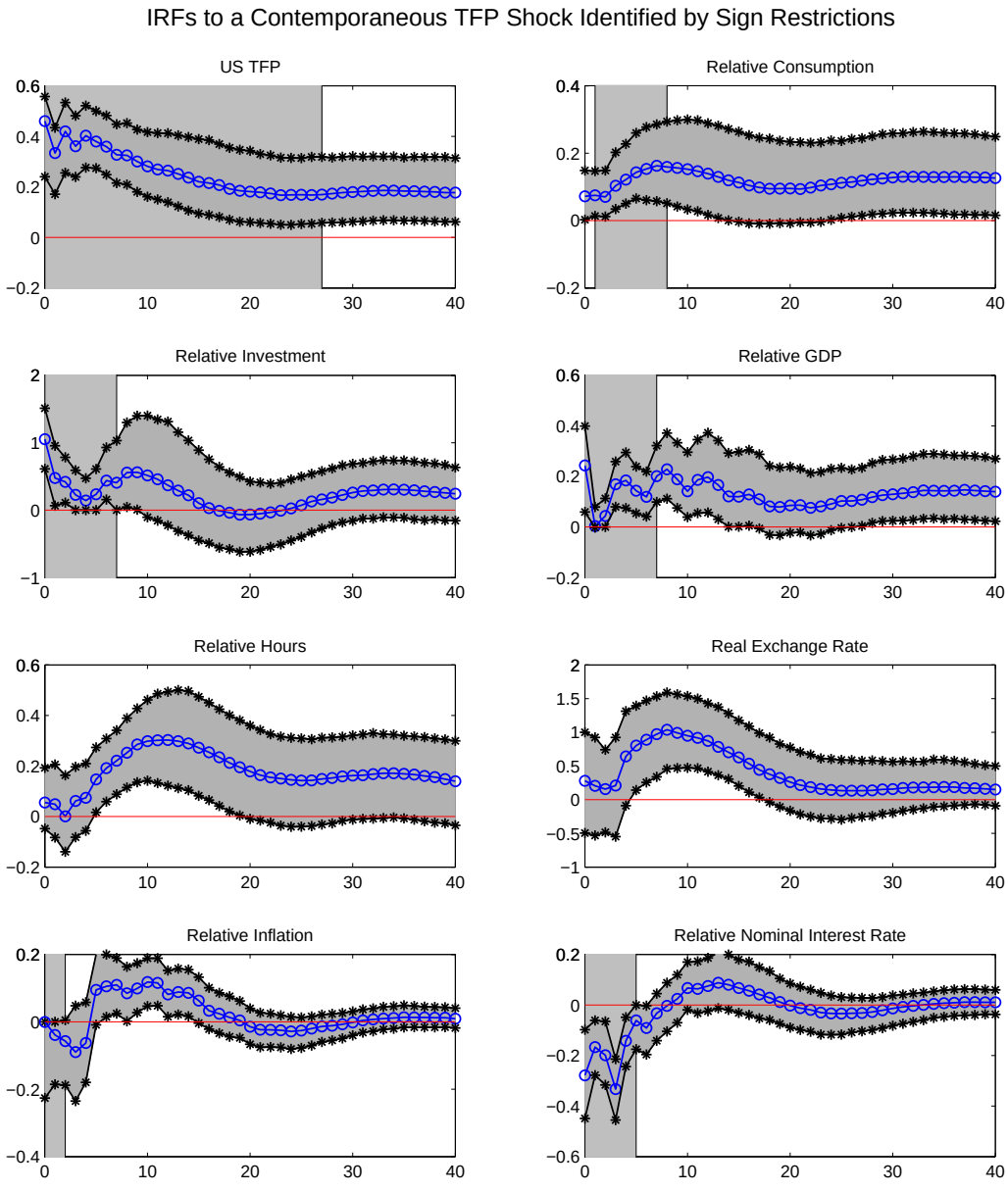

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  - IRF of the real exchange rate is hump-shaped.
  - Different from other studies using long-run restrictions method (Enders and Muller, 2009).
- Juvenal (2011) also impose restrictions to identify contemporaneous TFP shocks
  - TFP shocks are not important (less than 10%) for exchange rate movement.
  - But Juvenal (2011) only identifies part of TFP shocks.

Conclusion

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  - Incomplete or even misleading results if two shocks are not separated.