

Discussion of “Technology Shocks: Novel Implications for International Business Cycles”

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- My goal:
 - Investigate the role of model elements, mechanisms, and explore other implications of the model (esp. cross-country comovement)
 - Questions and suggestions on the estimation of IST shock, along with a few other comments

International Business Cycle puzzles (Backus, Kehoe, Kydland 1995)

- Prices:

- excessive volatility in RER
- excessive volatility in TOT
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- $0 < Corr(c, c^*) < Corr(y, y^*)$ (consumption/output anomaly)

IST shocks help to resolve the Price Anomaly

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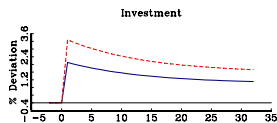
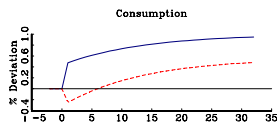
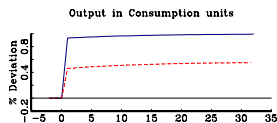
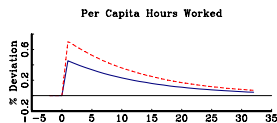
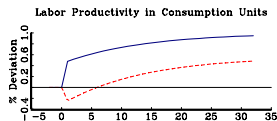
Minimum perturbation from prototypical IRBC (*BKK*)

- Low elasticity of substitution: $\sigma = 0.5$
- GHH preferences + investment adjustment cost
- Capital utilization
- IST + neutral technology innovations

- Neutral technology innovations affect all capital (as well as labor)
- IST innovations affect output only through the formation of new capital stock
- Since the old capital stock is unaffected, the economy must invest to realize the benefits

I-shock vs N-shock in Closed Economy, Fisher (2006)

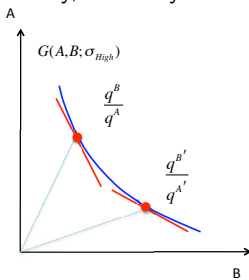
- $u(C, N) = \log(C) - N$
- $C + \frac{I}{e^v} = Y$



--- I-shock, — N-shock

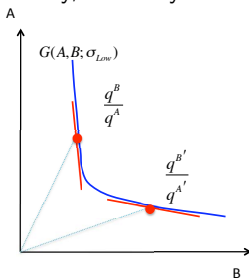
Elements of this model

- Open economy: $C_t + \frac{I_t}{e^{v_t}} = G(A_t, B_t) = q_t^A Y_t - NX_t$
 - IST does not affect output directly, demand shock $\Rightarrow q^A \uparrow \Rightarrow$ marginal products of factor inputs in consumption unit $\uparrow \Rightarrow S$ and $L \uparrow$
 - lower investment price $\Rightarrow S \uparrow$
- home bias + low elasticity of substitution ($\sigma = 0.5$)
 - resources shift to Home country, optimal to increase import more than export, $NX \downarrow$
 - With lower price elasticity, volatility of TOT \uparrow



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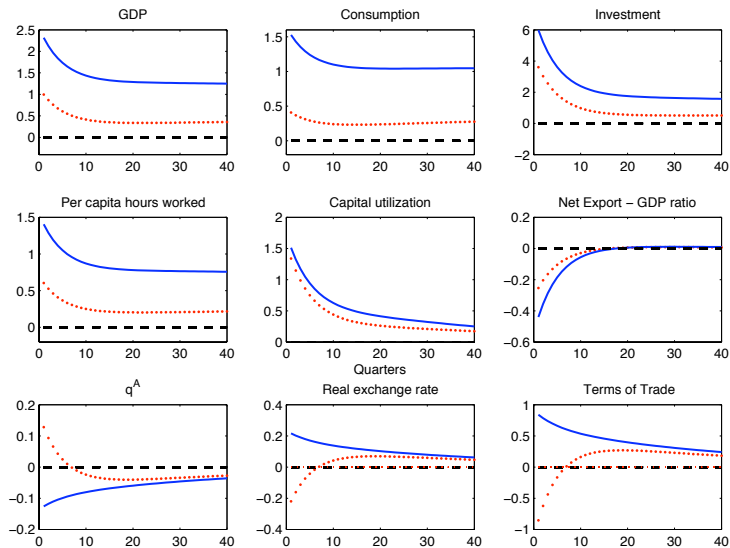
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Elements of this model

- Variant capital utilization
 - increases MPL, N responds further
 - crucial to generate domestic comovement of C and Y
- GHH + investment adjustment cost
 - no wealth effect on labor supply, inducing large response in labor
 - crucial to solve Backus-Smith puzzle

I-shock vs. N-shock in Open Economy



..... I-shock, — N-shock

Real Exchange Rate is not volatile enough

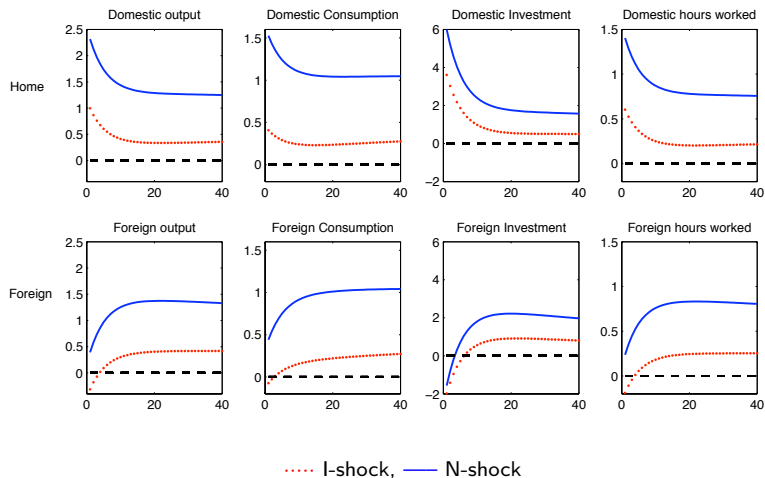
- With Law of One Price and only traded goods

$$\widehat{RER} = (1 - 2s)\widehat{TOT}$$

- $s = 0.15 \Rightarrow std(RER) = 0.7std(TOT)$
- data: $std(RER) = 1.4std(TOT)$
- *Introducing deviations from Law of One Price may increase volatility of RER e.g. distribution margin, nontraded goods*

Question 1: What about cross-country comovement?

I-shock alone generates *negative* cross-country correlation in C, Y, I, L, while N-shock generates *positive* correlations in C, Y, L



Question 1: What about cross-country comovement?

- This paper considers a combination of I-shock and N-shock to generate positive cross-country comovement in C , Y , L .
- This implies the model's prediction of cross-country comovement would be sensitive to the relative magnitude and parameterization of the shock processes
- It would be interesting to see whether introducing I-shock mitigates or exacerbates the cross-country consumption-output anomaly

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 - *Using data on P_I/P_C (1947:1-2005:4), $\sigma_v = 0.00229$*

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 - *Again, data suggests $\rho_{vv} = 0.84$*
- $\sigma_{z_i, v_i} = 0.40$
 - *Why should the innovations to all capital and labor positively correlated to innovations only applied to new capital formation? Is there empirical support?*

Questions about calibration

- Difficulties of using direct data on I-shock and TFP
 - lack of quality adjusted investment price data for other countries. Data on investment and consumption deflators exists.
 - It would be useful to explore the model behavior using existing data evidence as starting points

Questions about calibration

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 - lack of quality adjusted investment price data for other countries. Data on investment and consumption deflators exists.
 - It would be useful to explore the model behavior using existing data evidence as starting points
- Alternatively, use GMM or Bayesian estimation utilizing data on quantity /prices to estimate shocks and the key parameter – the elasticity of substitution.

Question 3: what is the implication on stock prices?

- FOCs imply shadow price of an additional unit of capital carried over to $t+1$:

$$p_{k,t} = e^{-v_t} [1 - \Psi'(I_t/K_t)]^{-1}$$

$$p_{k,t} = E_t \frac{u_{c,t+1}}{u_{c,t}} (r_{t+1}^c + p_{k,t+1} r_{t+1}^k)$$

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- IST triggers two offsetting effects on the stock price
 - It may be interesting to explore whether the model, with a proper adjustment cost parameter, can generate the procyclical stock price w.r.t. the IST shock*

Question 4: how important are GHH preferences?

- Consider Jaimovich-Rebelo(2008) utility function

$$u(C_t, N_t) = \frac{(C_t - \psi N_t^\theta X_t)^{1-\sigma} - 1}{1-\sigma}$$

$$X_t = C_t^\gamma X_{t-1}^{1-\gamma}$$

- $\gamma = 0$, GHH
 - $\gamma = 1$, King, Plosser and Rebelo (1988)
 - suggestion: parameterize the strength of the short-run wealth effects on the labor supply, γ , to gauge the importance of GHH on the behavior of the model.
-
- Downside of GHH: high $Corr(prod, N)$, while data: -0.04

Minor thoughts

- Data on real variable: used CPI (?) as deflator.
However, model counterpart, should be deflated by the price for the nondurable goods and service when there is IST.
- One sector model implicitly assumes perfect mobility of factors across consumption and investment production.
- How is IST introduced into the model
 - Endogenous vs. exogenous IST
 - Suppose there are nontradable and tradable sectors, with different capital share. TFP increases in tradable sector will manifest itself as IST shock, but generates opposite effect on terms of trade.

Summary

- Theoretically explored the role of capital embodied technology changes as a potential driving force in open economy
- Model neatly nests a few key elements and improves standard IRBC
- Providing further and deeper empirical understanding of I-shock in an open economy would be valuable