China's Imbalances: Trade Integration in a DSGE Model

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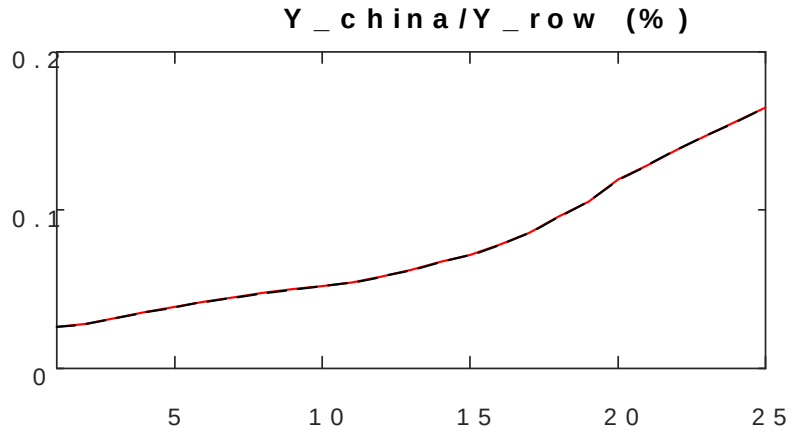
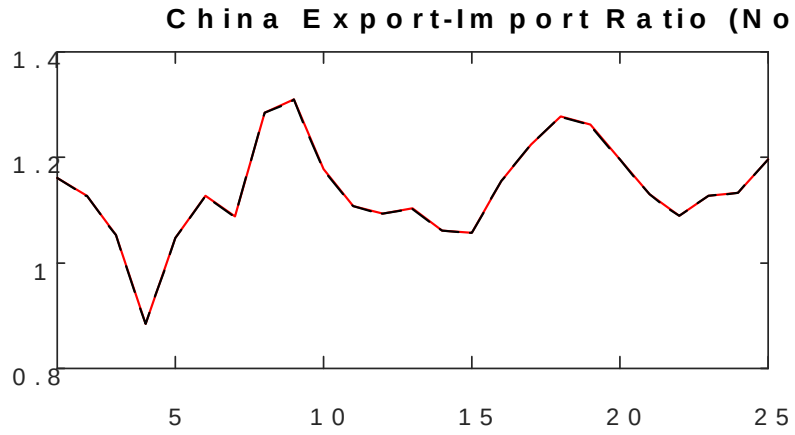
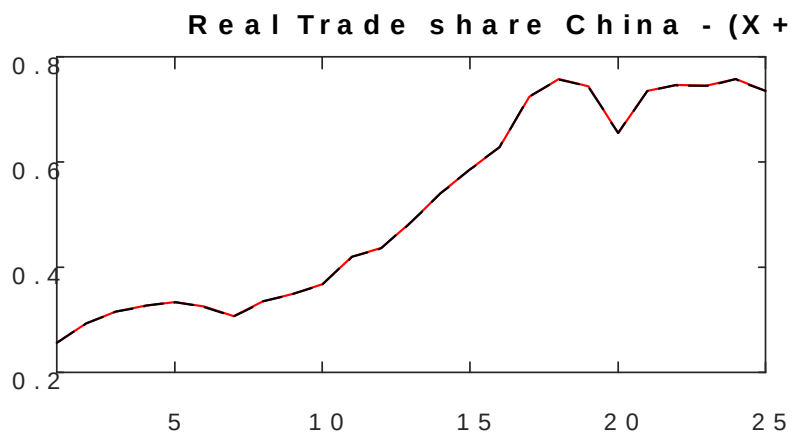
https://sites.google.com/site/georgealessandria2/ACL-201606.pdf

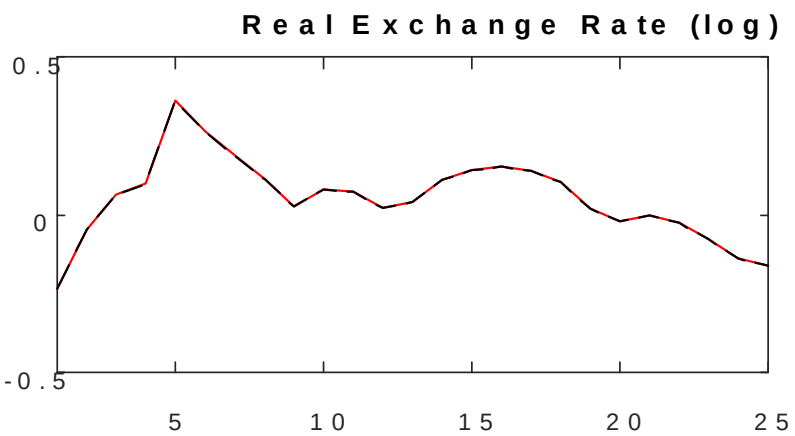
Introduction

- China's growth & integration definitive economic event of last twenty-five years
- Uneven process - characterized by swings in real exchange rate, trade balance, and accumulation of substantial foreign assets and trade integration.
  - Additionally, pace of trade integration has slowed.


Y_china/Y_row (%)
0.2
0.1
0
5
10
15
20
25


China Export-Import Ratio (Nomir
1.4
1.2
1
0.8
5
10
15
20
25


Real Trade share China - (X+M)/Y
0.8
0.6
0.4
0.2
5
10
15
20
25


Real Exchange Rate (log)
0.5
0
-0.5
5
10
15
20
25

Introduction

- China's growth & integration definitive economic event of last twenty-five years
- Uneven process - characterized by swings in real exchange rate, trade balance, and accumulation of substantial foreign assets and trade integration.
  - Additionally, pace of trade integration has slowed.
- Build unified model to account for borrowing/lending, trade integration, and growth.
  - Emphasize the role of changes in various trade barriers in the accumulation of assets.

Preview of Main Findings

- Persistent trade cost "shocks" key to China's foreign assets
  - Symmetric Δ in trade barriers lead to lending
  - Asymmetric Δ in trade barriers lead to lending
- Trade integration (% of gdp): fall common barriers (49%), Chinese export barriers (19%), and China growth (18%)
- Trade slowdown primarily reflects lack of additional integration shocks rather than reversals
  - Current expectations about future trade cost path similar to when China joined WTO.

Outline

- Model
- Estimation
- Results - decomposition of
  - Net Foreign Assets
  - Trade Integration
  - Trade Slowdown

Model

- Two countries, final NT consumption good, non-contingent bond
- Heterogeneous producers with dynamic exporting decision (sunk cost)
  - SR/LR trade adjustment (Alessandria/Choi 07, 15)
- Pricing-to-market: exporter's demand elasticity depends on RER and relative income.
- Aggregate shocks: productivity, trade costs, and discount factor (China-specific & global)

Consumers

$$\max E_0 \sum_{t=0}^{\infty} \Theta_t \frac{\left[C^{\gamma}\left(1-L\right)^{1-\gamma}\right]^{1-\sigma}}{1-\sigma},$$

subject to

$$P_t C_t + P_t Q_t B_t = W_t P_t L_t + P_t B_{t-1} + \Pi_t,$$

$$\ln\left(\Theta_{t+1}/\Theta_t\right) = \ln \beta_t = \left(1-\rho_b\right)\ln \overline{\beta} + \rho_b \ln \beta_{t-1} + \varepsilon_{\beta},$$

- Discount factor shocks capture "savings glut" story

Aggregators and Prices

Final good produced by competitive retail sector/aggregator

$$
\begin{aligned}
C_t &= \left(Y_{Ht}^{\frac{\rho-1}{\rho}} + a^{\frac{1}{\rho}} Y_{Ft}^{\frac{\rho-1}{\rho}} \right)^{\frac{\rho}{\rho-1}}, \\
Y_{Ht} &= \left(\int_0^1 Y_{hit}^{\frac{\theta-1}{\theta}} di \right)^{\frac{\theta}{\theta-1}}, \\
Y_{Ft} &= \left(\int_{i \in \mathcal{E}_t^*} Y_{fit}^{\frac{\theta_t-1}{\theta_t}} di \right)^{\frac{\theta_t}{\theta_t-1}}.
\end{aligned}
$$

- $\theta_t = \theta\left(q, y/y^*\right)$ captures pricing-to-market

Producers - standard sunk cost model (Dixit, 89)

$$V_t(\eta, m) = \max_{m', p, p^*} pc_t(p) + m' p^* c_t(\xi^* p^*) - Wl - m' Wf_{m,t} + Q_t EV_{t+1}(\eta', m')$$

- m_{it}: exporting status
- $y_{it} = e^{z_t + \eta_{it}} l_{it}$, $\eta_{it} \overset{iid}{\sim} N\left(0, \sigma_\eta^2\right)$
- $\xi_t^* > 1$: variable trade costs for home exporters
- $W_t f_{0,t}$: sunk cost to start
- $W_t f_{1,t}$: sunk cost to continue.

Export Entry and Exit Thresholds

$$W_t f_{0,t} - \pi_t^* (\eta_{0t}) = Q_t E_t \Delta V_{t+1} (\eta')$$

$$W_t f_{1,t} - \pi_t^* (\eta_{1t}) = Q_t E_t \Delta V_{t+1} (\eta')$$

$$\Delta V_t (\eta) = V_t (\eta, 1) - V_t (\eta, 0)$$

- Endogenous entry/exit & hysteresis ($\eta_{1t} < \eta_{0t}$ when $f_1 < f_0$)
- Distribution of exporters is state variable & gradual entry
- With iid shocks,

$$N_{t+1} = \Pr (\eta \geq \eta_{1t}) N_t + \Pr (\eta \geq \eta_{0t}) (1 - N_t)$$

Aggregate Shocks - Productivity

$$\begin{aligned}
\ln z_t^* &= \rho_z^* \ln z_{t-1}^* + \varepsilon_{zt}^*,\ \varepsilon_{zt} \overset{iid}{\sim} N(0, \sigma_z^*) \\
\ln z_{dt} &= \rho_z^d \ln z_{dt-1} + \varepsilon_{zt}^d,\ \varepsilon_{zt}^d \overset{iid}{\sim} N\left(0, \sigma_z^d\right) \\
\ln z_t &= \ln z_t^* + \ln z_{d,t} - \bar{z}
\end{aligned}$$

- z_t^* : Global productivity
- $z_{d,t}$: China-specific productivity
- $\bar{z}$: China's productivity disadvantage.

Aggregate Shocks - Variable Trade Costs

$$\ln \xi_t = \ln \xi_{ct} + \frac{1}{2} \ln \xi_{dt},$$

$$\ln \xi_t^* = \ln \xi_{ct} - \frac{1}{2} \ln \xi_{dt}.$$

$$\ln \xi_{ct} = \left(1 - \rho_{\xi_c}\right) \ln \bar{\xi}_c + \rho_{\xi_c} \ln \xi_{ct-1} + \ln \xi_{gt-1} + \varepsilon_{\xi_c t},$$

$$\ln \xi_{gt} = \rho_{\xi_g} \ln \xi_{gt-1} + \varepsilon_{\xi_g t},$$

$$\ln \xi_{dt} = \left(1 - \rho_{\xi_d}\right) \ln \bar{\xi}_d + \rho_{\xi_d} \ln \xi_{dt-1} + \varepsilon_{\xi_d t}.$$

- ξ_{ct}: common shock
- Transitory and trend shocks. Trend shocks have news aspect
- ξ_{dt}: differential shocks

Aggregate Shocks - Fixed Trade Costs

$$\ln f_{0t} = (1-\rho_{f0})\ln f_0 + \rho_{f0}\ln f_{0t-1} + \varepsilon_{f0,t},$$

$$\ln f_{1t} = (1-\rho_{f1})\ln f_1 + \rho_{f1}\ln f_{1t-1} + \varepsilon_{f1,t}.$$

Calibration/Estimation

Fixed Parameters

β	ζ_b	γ	a_1	θ
0.96	0.0001	0.30	0.16	5

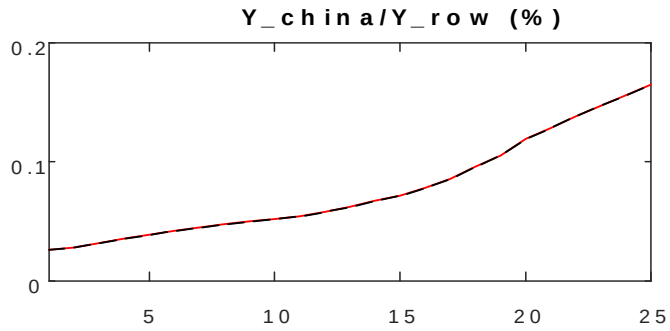
Estimate

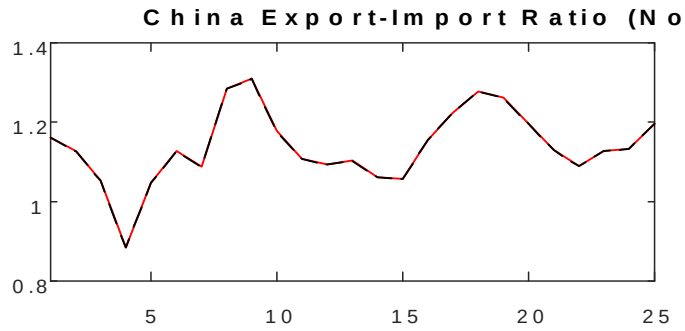
- Shock process: $z_c, z_d, \xi_c, \xi_g, \xi_d, f_0, f_1, b$
- Level of trade costs $\left(\bar{\xi}_c\, \bar{\xi}_d, f_0, f_1\right)$ and technology $\left(\bar{z}, \sigma_\eta\right)$
- Preferences $\left(\sigma, \rho, \zeta_q, \zeta_y\right)$

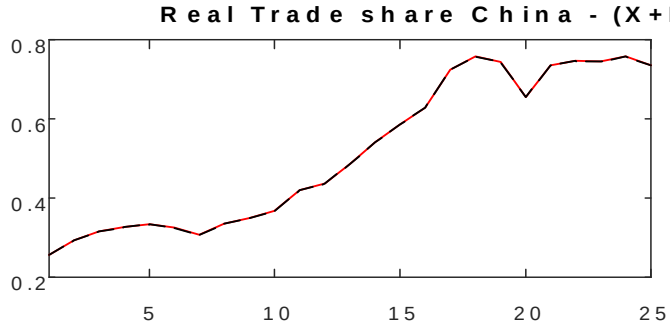
Estimation - Data

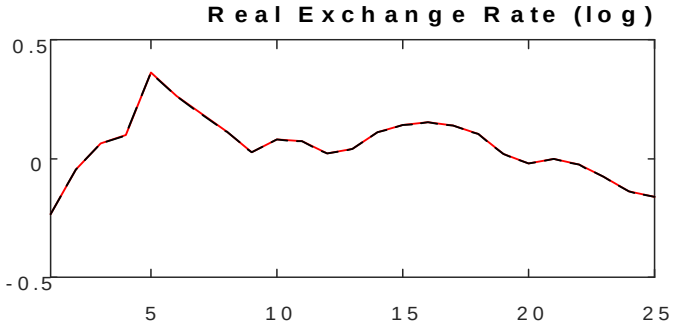
1. Ratio of China-ROW real income
2. Nominal export/import ratio
3. Real trade share in China
4. Real exchange rate
5. Real world output - detrended
6. Chinese exporters participation

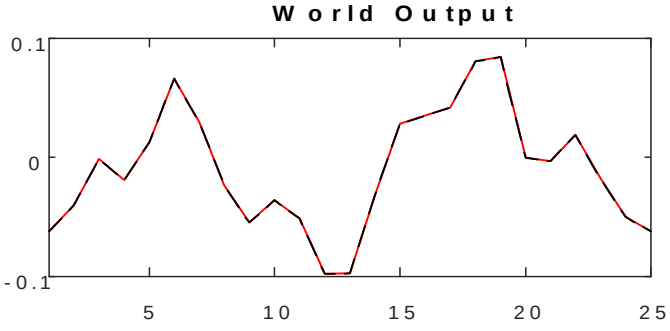
Figure: Historical and Smoothed Series











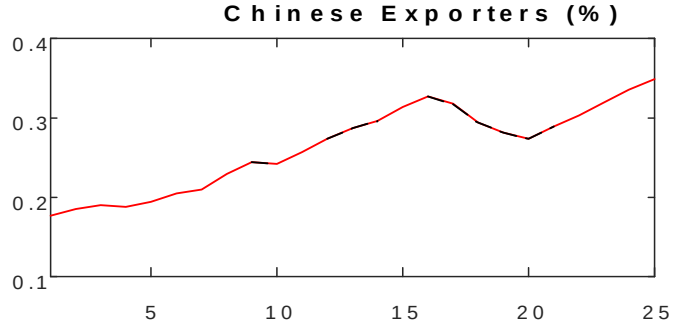
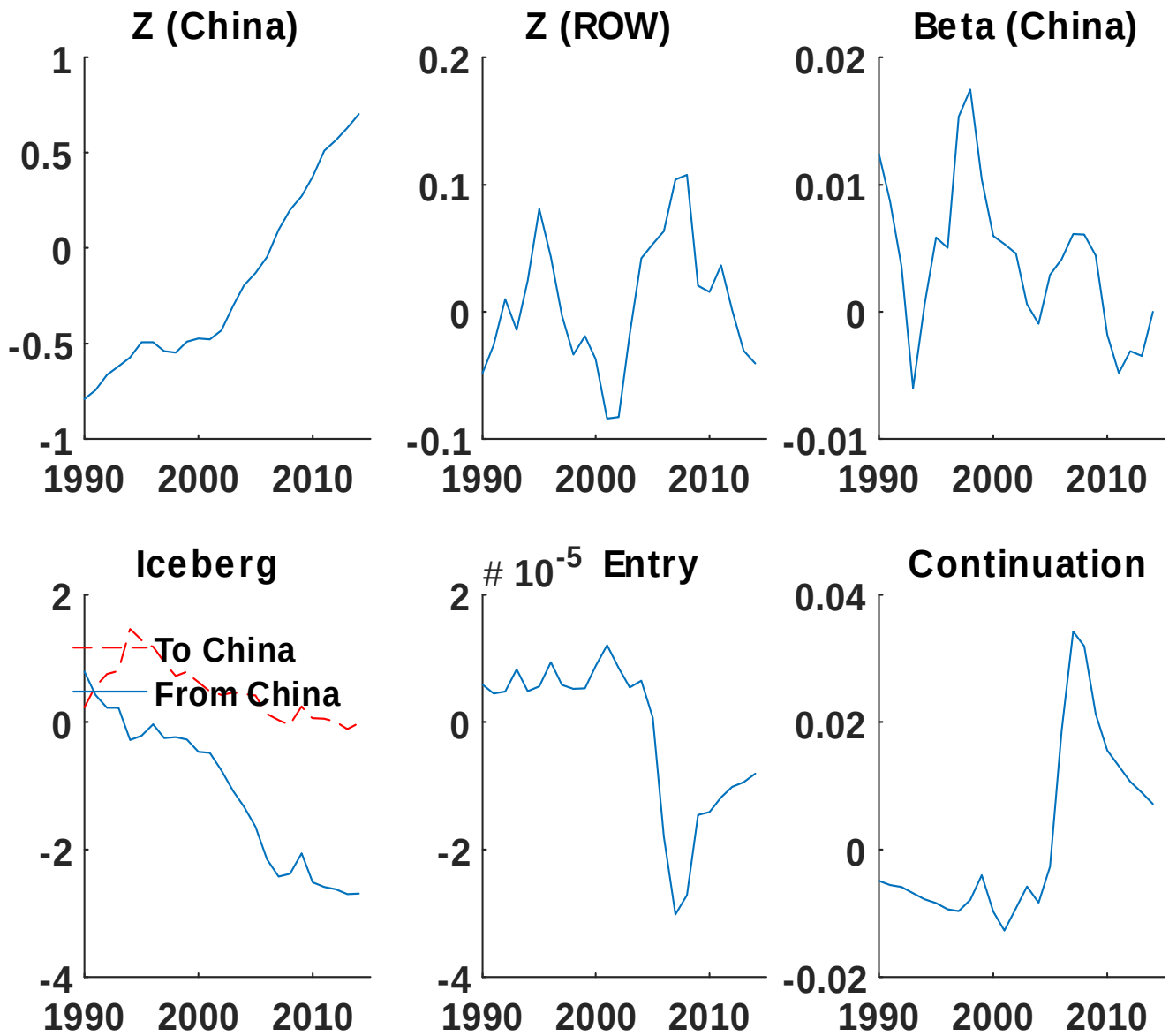


Figure: Deviations from Steady State of State Variables



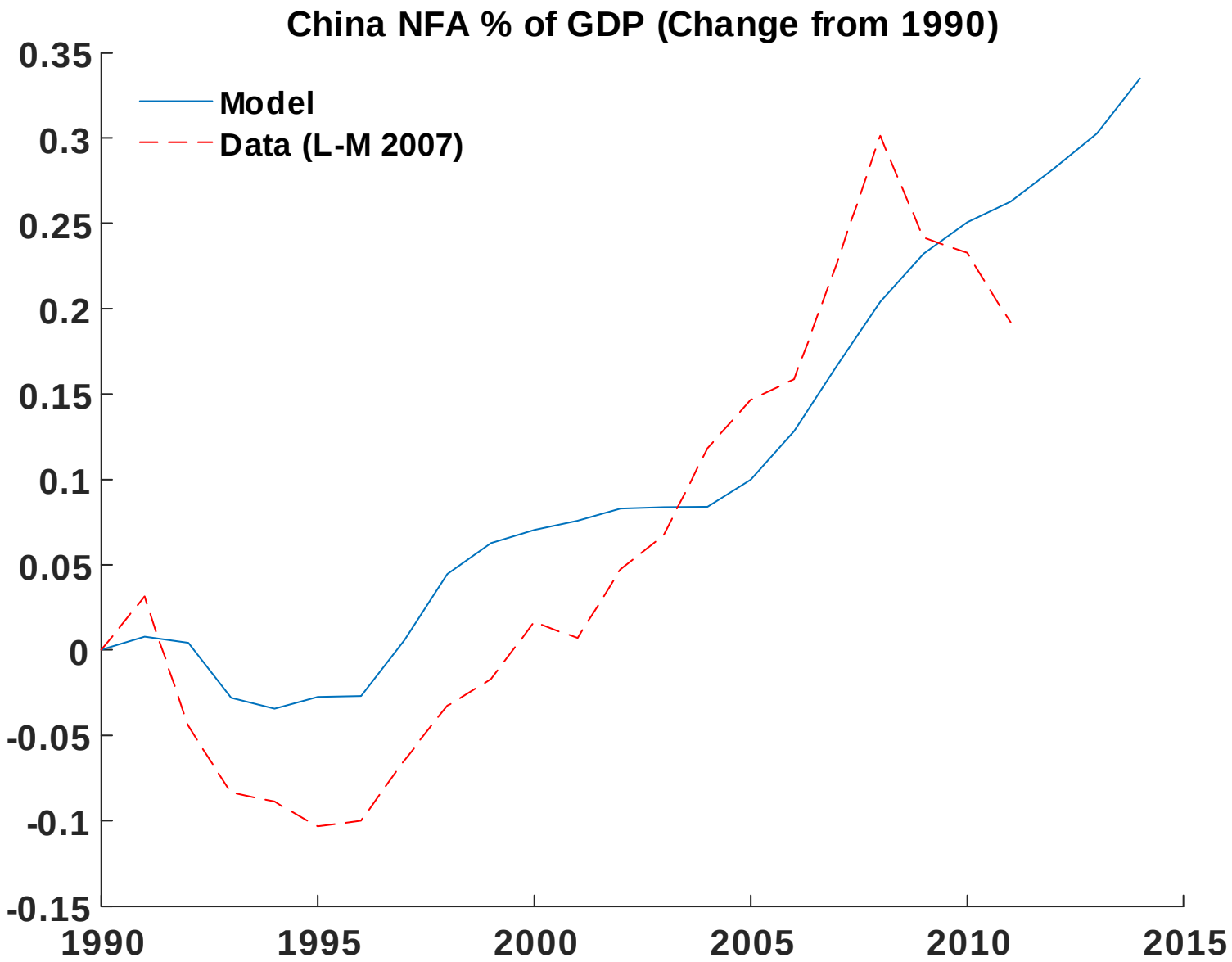
Estimated Persistence of Shocks

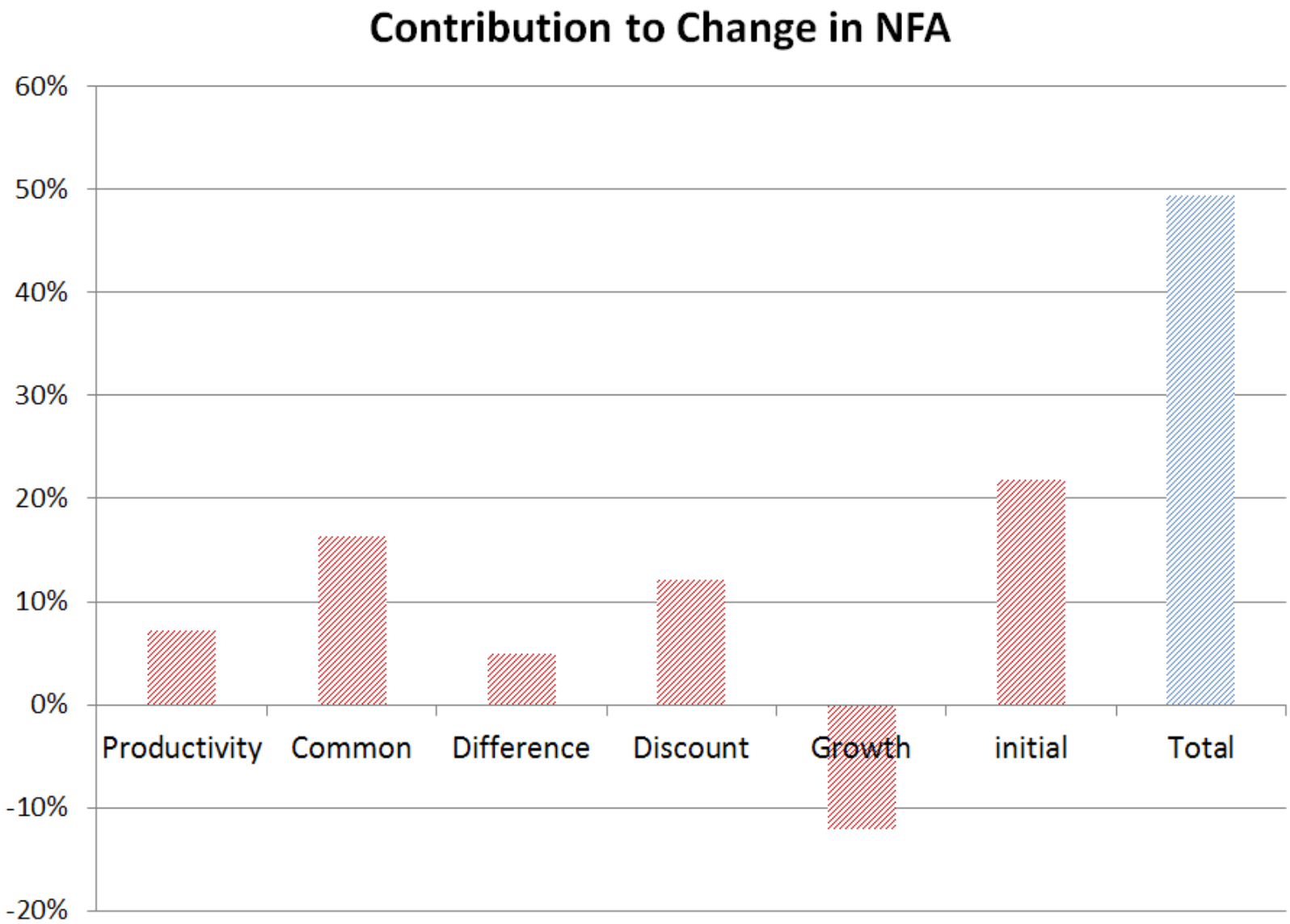
	prior mean	posterior mean	posterior mode	90% HPD - interval	prior	prior std.dev.
ρ_{z_d}	0.95	0.996	0.999	0.9905 - 1	unif	0.5
ρ_{z_c}	0.7	0.747	0.731	0.5586 - 0.954	unif	0.5
ρ_{ξ_c}	0.79	0.917	0.962	0.8099 - 0.9981	unif	0.5
ρ_{ξ_d}	0.95	0.978	0.992	0.9578 - 0.9998	unif	0.5
ρ_b	0.945	0.948	0.953	0.9158 - 0.98	norm	0.025
ρ_{ξ_g}	0.8	0.895	0.975	0.7423 - 0.9978	unif	0.5
ρ_f	0.9	0.820	0.853	0.666 - 0.9939	unif	0.5

Notes: Based on annual data from 1990 to 2014.

Shocks are persistent but not permanent - rationale for borrowing/lending

Figure 7: Decomposition of China Net Foreign Assets (Model)

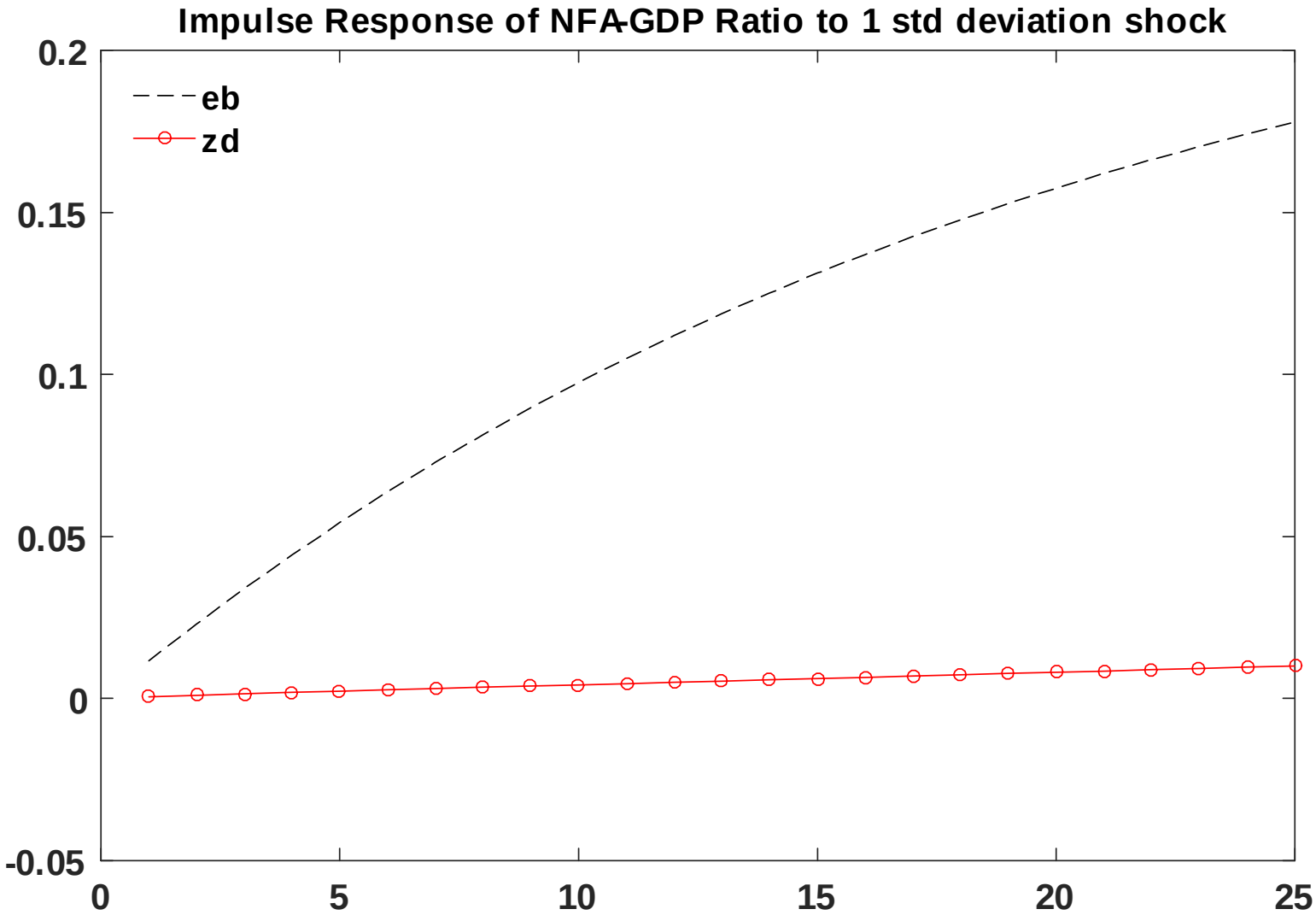



Contribution to Change in NFA
60%
50%
40%
30%
20%
10%
0%
-10%
-20%
Productivity
Common
Difference
Discount
Growth
initial
Total

Assets-GDP Ratio and Shocks

Consider 1 standard deviation shock

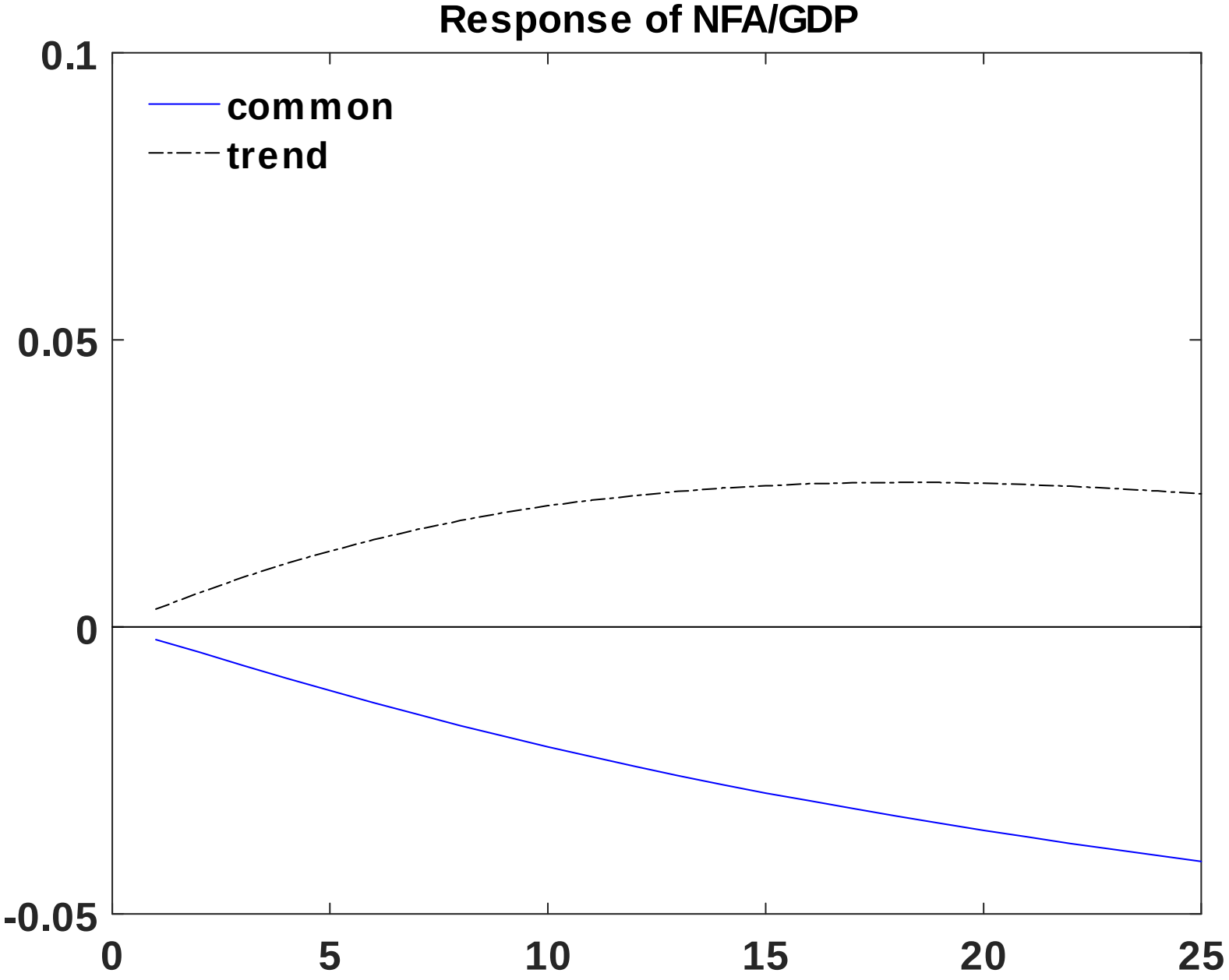
- Productivity shocks ($\approx$unit root): minor impact on assets
- Discount factor: increase assets

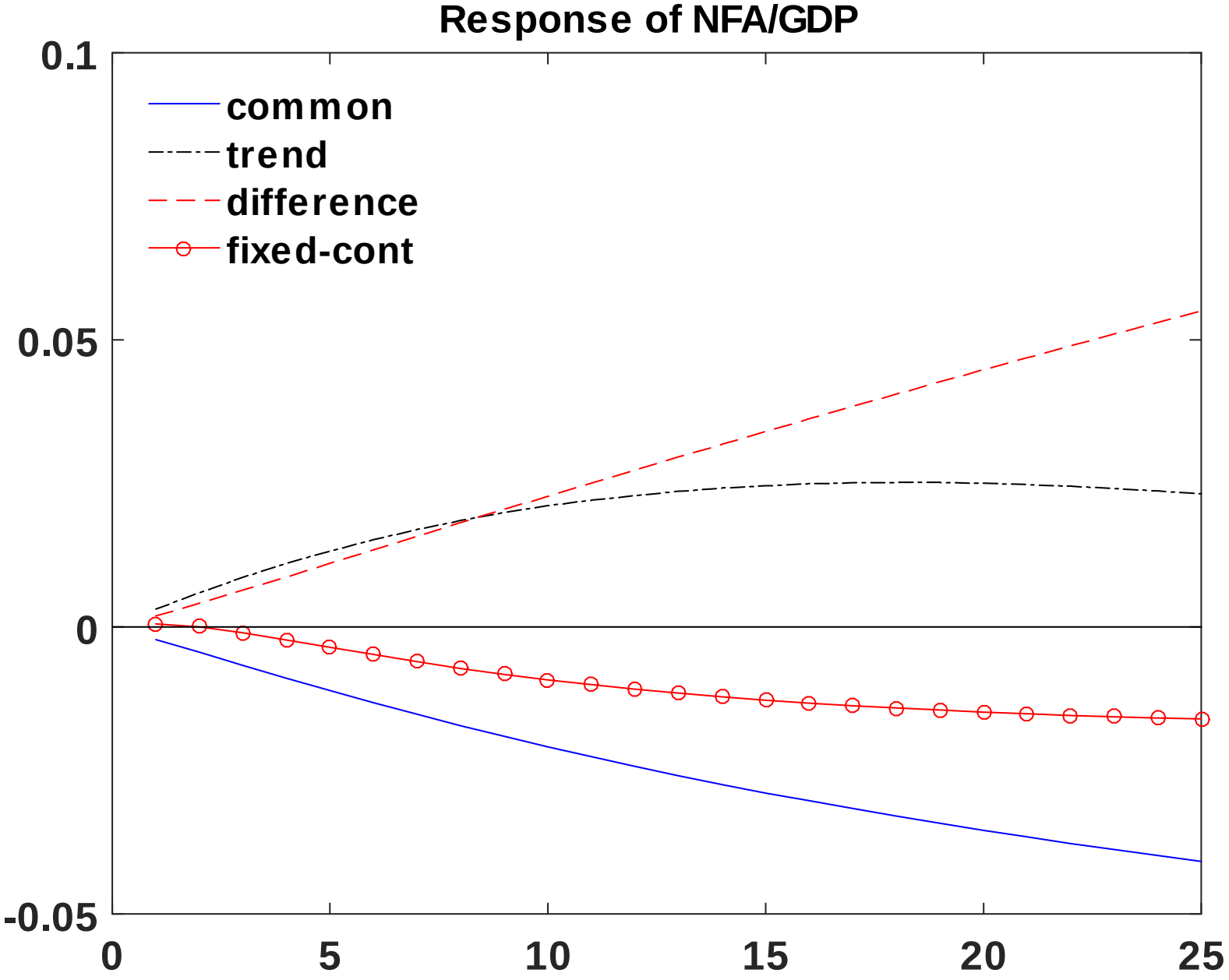

Impulse Response of NFA-GDP Ratio to 1 std deviation shock
eb
zd
0.2
0.15
0.1
0.05
0
-0.05
0
5
10
15
20
25

Assets-GDP Ratio and Trade cost shocks

Consider 1 standard deviation shock

- Persistent trade cost shocks Δ assets.
- Common shocks to trade costs affect China more since it is more open.
  - $+$ transitory $\rightarrow$borrowing
  - $+$ trend shock $\rightarrow$savings
- Differential shocks, temporarily cheaper for ROW to consume$\rightarrow$savings


Response of NFA/GDP
0.1
0.05
0
-0.05
0
5
10
15
20
25
common
trend


Response of NFA/GDP
0.1
0.05
0
-0.05
0
5
10
15
20
25
common
trend
difference
fixed-cont

Growth in Trade between China and ROW

- Focus on nominal trade share

$$tr = \frac{P_x X + P_m M}{P_y Y}$$

- Consider contribution of shocks to change
  - over whole period (90 to 14)
  - slow-down - compare 11-14 to 97-07

Source of Change in ROW Trade-GDP (1990 to 2014)

	ROW	China
Initial	15.0%	38.7%
Productivity	18.1%	-45.0%
Trade		
Common	23.3%	70.1%
Difference	19.0%	-38.5%
Trend	25.7%	77.0%
Fixed	-1.2%	-2.1%
Total	**22.8%**	**23.8%**

Each entry measures the share of the total change in nominal trade to GDP from 1990 to 2014 from that shock alone

Source of the slow-down in 11-14 (comparing to 97-07)		
	ROW	China
Initial	6.4%	6.6%
Productivity	-10.6%	10.3%
Trade		
Common	80.9%	98.4%
Difference	14.9%	-14.0%
Trend	7.5%	-3.7%
Fixed	7.5%	6.6%
Total	**-0.94%**	**-2.43%**

Each entry measures the share of the difference in the average annual contribution from 2011 to 2014 minus that from 1997 to 2007


Growth in Trade Barriers
To China
From China
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
1995
2000
2005
2010
2015


Trend Trade Cost
-0.01
-0.02
-0.03
-0.04
-0.05
-0.06
-0.07
-0.08
1990
1995
2000
2005
2010
2015

Summary

- Decline in trade barriers matter for China's savings
- Chinese trade integration attributed equally to trend, common, differential and productivity.
- Trade slow-down mostly reflects lack of barrier reductions, rather than reversal, and waning influence of past reforms.
  - Expectations for integration haven't diminished much.

Estimated Preferences and Technology

	prior mean	posterior mean	posterior mode	90% HPD - interval	prior	prior std.dev.
ρ	2	1.6964	1.7364	1.4745 - 1.9236	invg	1
σ	5	4.7231	4.3826	3.3182 - 5.9365	invg	1
$\bar{z}$	2.42	2.3378	2.368	2.1776 - 2.4633	norm	0.1
$\bar{\xi}_c$	0.5	0.4926	0.5026	0.4113 - 0.5683	norm	0.05
$\bar{\xi}_d$	0.1	0.1197	0.1	-0.0286 - 0.2856	norm	0.1
ς_q	-0.3	-0.3067	-0.2923	-0.5041 - -0.0797	norm	0.15
ς_y	-0.15	-0.156	-0.1633	-0.2827 - -0.034	norm	0.15
f_0	0.37	0.387	0.3728	0.3087 - 0.473	invg	0.05
f_1	0.039	0.0427	0.0407	0.031 - 0.0536	invg	0.01
σ_η	0.235	0.1959	0.1824	0.1662 - 0.2269	invg	0.05

Notes: Based on annual data from 1990 to 2014.

Estimated Shock Std. Deviation

	prior mean	posterior mean	posterior mode	90% HPD - interval	prior	prior std.dev.
σ_{z_d}	0.07	0.0699	0.0678	0.0527 - 0.0871	invg	0.025
σ_{z_c}	0.033	0.0355	0.0333	0.0267 - 0.043	invg	0.025
σ_{ξ_c}	0.2	0.1602	0.1549	0.1209 - 0.1984	invg	0.05
σ_{ξ_d}	0.124	0.1653	0.1531	0.1276 - 0.2018	invg	0.05
σ_{ξ_g}	0.016	0.0339	0.0118	0.0052 - 0.0692	invg	0.02
σ_{f_0}	0.01	0.007	0.0047	0.0025 - 0.0119	invg	0.05
σ_{f_1}	0.22	0.2213	0.2193	0.2075 - 0.2378	invg	0.01
σ_b	0.005	0.0055	0.0044	0.0029 - 0.0082	invg	0.01

Notes: Based on annual data from 1990 to 2014.