Trade Integration and the Trade Balance in China

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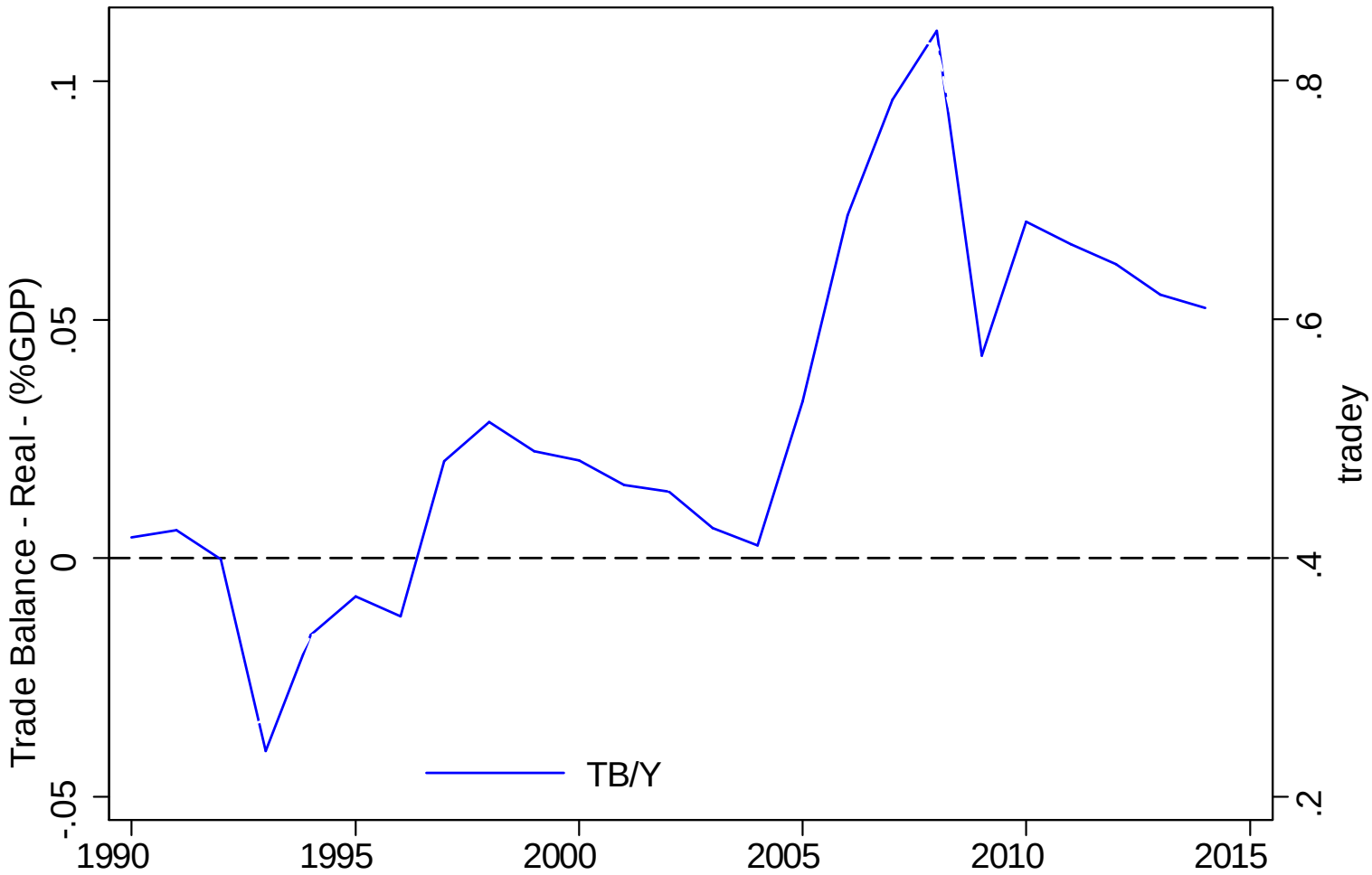
https://sites.google.com/site/georgealessandria2/ACL-201606.pdf

Main Question

What accounts for China's trade balance over last 25 years?

Suspects - productivity, monetary, fiscal, demographic, risk, trade

Figure 1: China Real Trade balance



Main Question

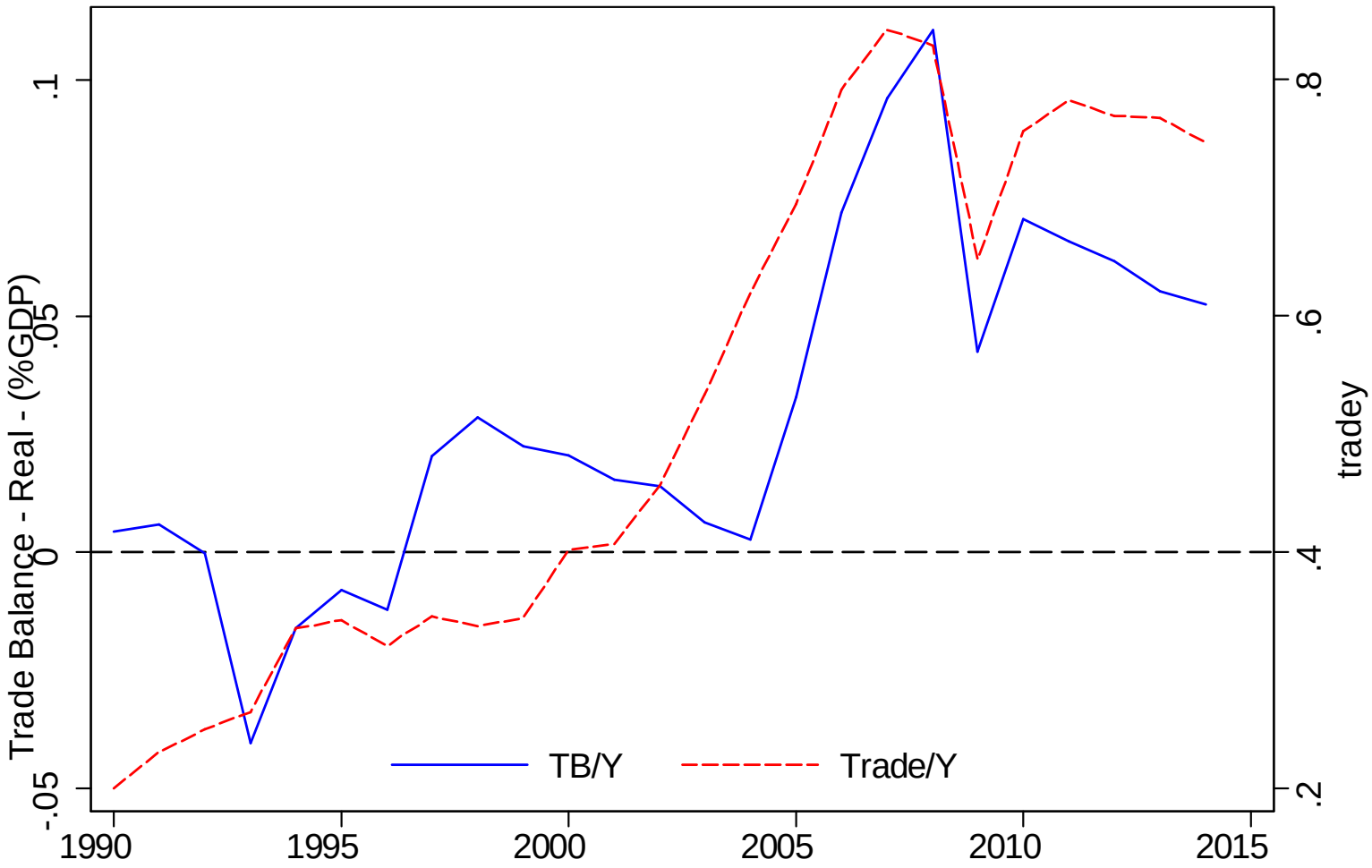
What accounts for China's trade balance dynamics over last 25 years?

Suspects - productivity, monetary, fiscal, demographic, risk, trade

Short Answer: Trade integration key driver

1. Lower trade barriers - easier to run deficits/surpluses
2. Temporary and Asymmetric Δ in barrier - source of deficits/surplus

China Real Trade balance & Trade share of GDP



Quadrupling of trade $\Rightarrow$ big $\Delta's$ in trade barriers/tastes

Trade Integration - Mechanical Decomposition

$$TB/Y = \frac{X-M}{X+M}\frac{X+M}{Y} = tbtr * try$$

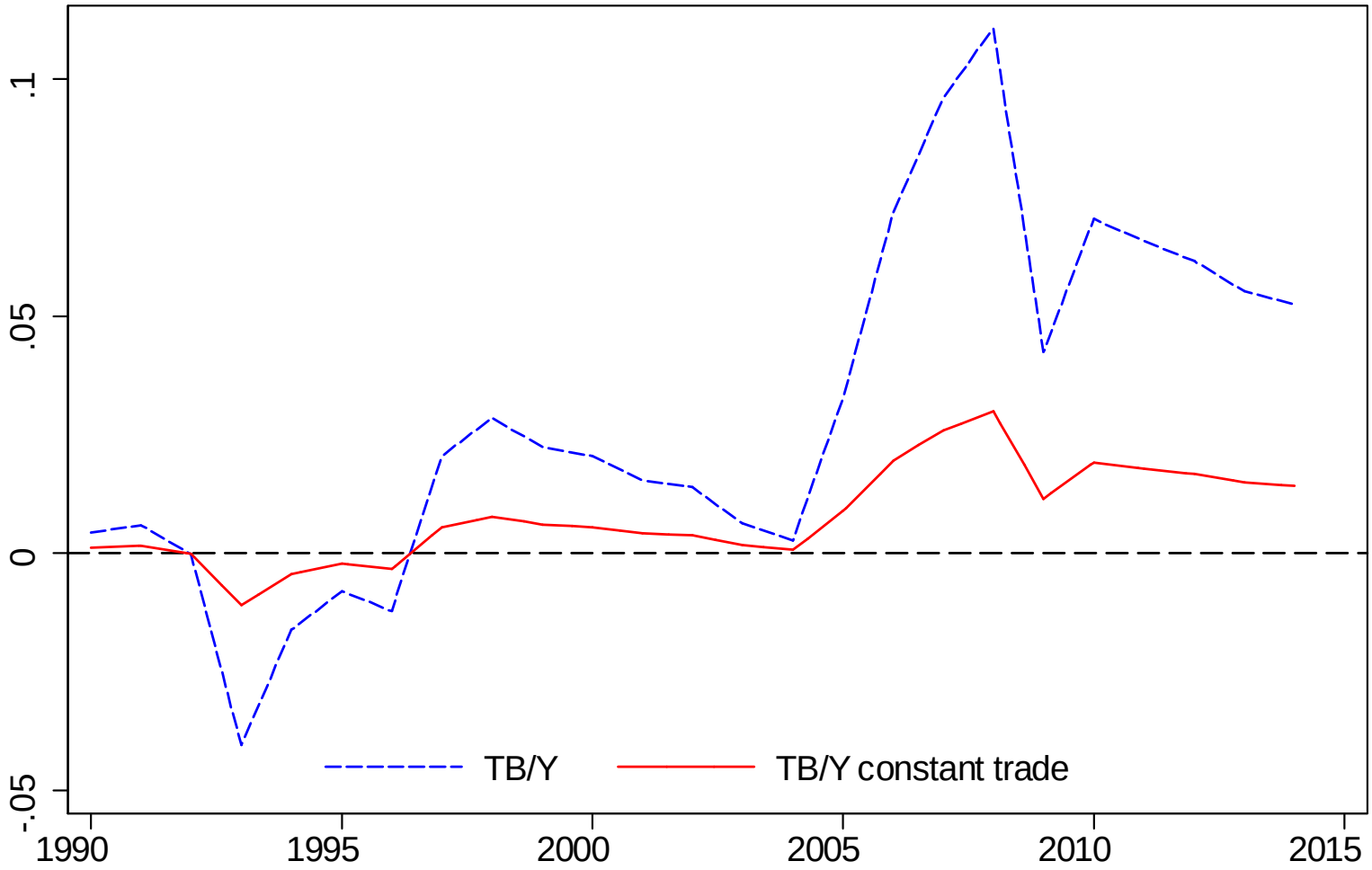
Trade Integration - Mechanical Decomposition

$$TB/Y = \frac{X-M}{X+M}\frac{X+M}{Y} = tbtr * try$$

Consider "counterfactual" holding *try* at level in early 90s

$$\widetilde{TB/Y} = \frac{X-M}{X+M}\frac{X_{90s}+M_{90s}}{Y_{90s}} = tbtr * \overline{try}$$

Figure 1: China's Real TB/Y



1. mid-2000's trade surplus not so large
2. Trade integration shocks will also affect *tbtr*

Preview

- Build unified model of China's growth, trade integration, and borrowing/lending.
  - Emphasize changes in trade barriers as source of foreign asset accumulation
- Trade matters for the trade balance when trade cost "shocks" are **persistent**
  - Asymmetric Δ in trade barriers lead to lending
  - Symmetric Δ in trade barriers lead to net flows with asymmetric countries
- Use model to account for source of integration and dynamics of integration
  - Trade slowdown primarily reflects lack of additional integration shocks rather than outright reversal

Model

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

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

$$P_t C_t + P_t Q_t \left(1 + \frac{\zeta_b}{2}\frac{B_t}{Y_t^N}\right) B_t = W_t P_t L_t + P_t B_{t-1} + \Pi_t,$$

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

- Discount factor shocks capture "savings glut"
- Q_t is bond price and $\frac{\zeta_b}{2}\frac{B_t}{Y_t^N}$ is a bond holding cost.

Aggregators and Prices

Final good produced by competitive retail sector/aggregator sourcing from unit mass domestic producers and set of foreign exporters

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

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

Producers - standard sunk cost model (Dixit, 89)

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

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

Export Entry and Exit Thresholds

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

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

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

- 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

$$\ln \xi_t = \ln \xi_{ct} + 0.5 \ln \xi_{dt},$$

$$\ln \xi_t^* = \ln \xi_{ct} - 0.5 \ln \xi_{dt}.$$

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

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

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

- Transitory: ξ_{ct}: common shock and ξ_{dt}: differential shocks
- Trend common shocks. news aspect - know one-year in advance path of liberalization.

Aggregate Shocks - Fixed Trade Costs

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

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

Constrain $\rho_{f1} = \rho_{f0} = \rho_f$

Calibration/Estimation

Fixed Parameters

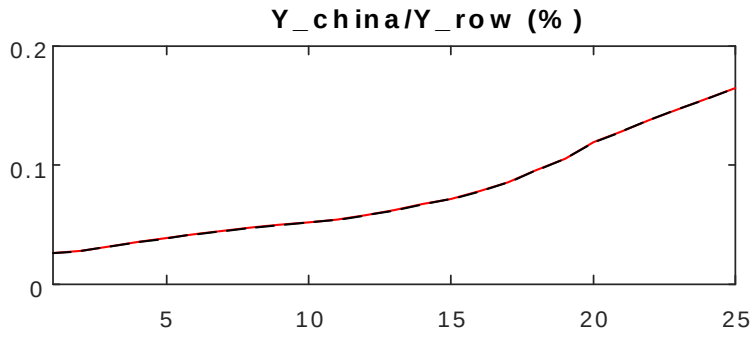
β	ζ_b	γ	a_1	θ
0.96	0.0001	0.30	0.16	5

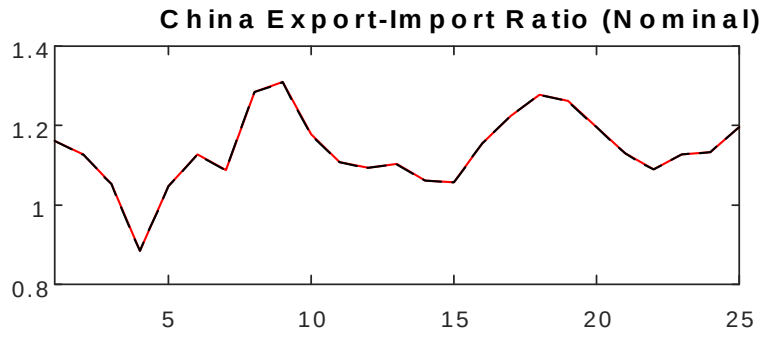
Estimate

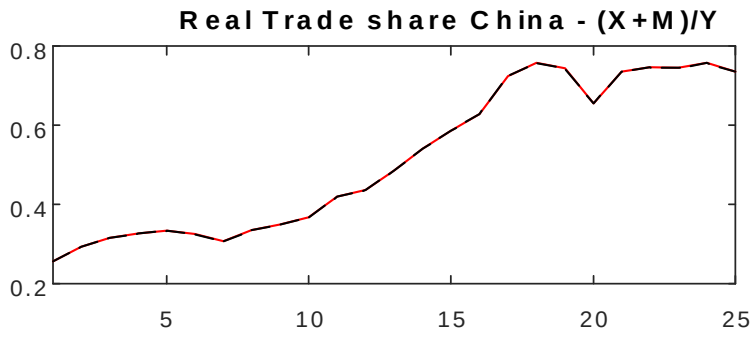
- Shock process: $z_c, z_d, \xi_c, \xi_g, \xi_d, f_0, f_1, b$
- Level of trade costs $\left(\bar{\xi}_c\, \bar{\xi}_d, f_0, f_1\right)$ and technology $\left(\bar{z}, \sigma_\eta\right)$
- Preferences $\left(\sigma, \rho, \zeta_q, \zeta_y\right)$

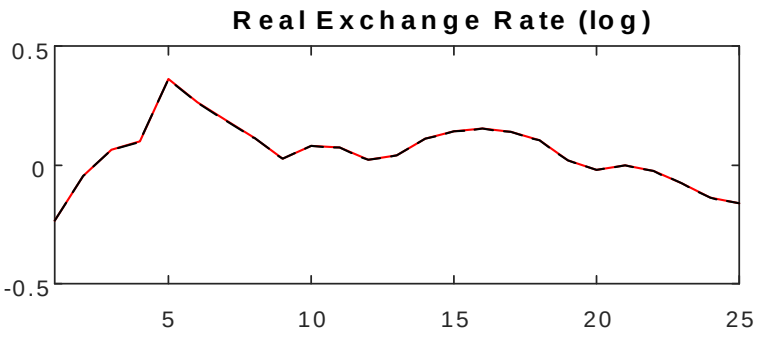
Estimation - Data

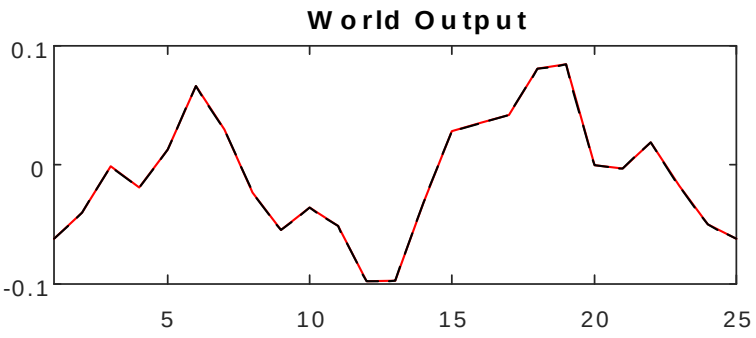
1. Ratio of China-ROW real income
2. Nominal export/import ratio
3. Real trade share in China
4. Real exchange rate
5. Real world output - detrended
6. Chinese exporters participation

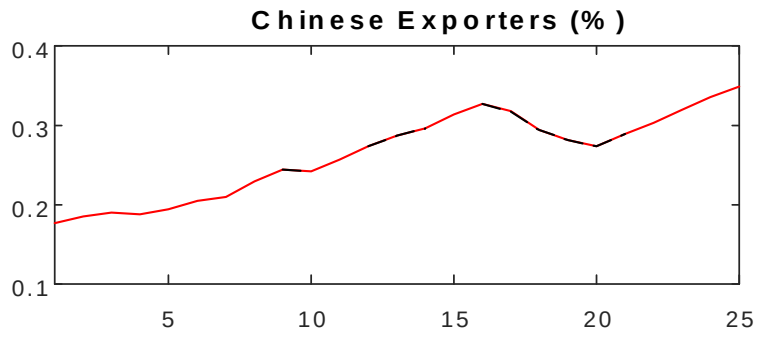






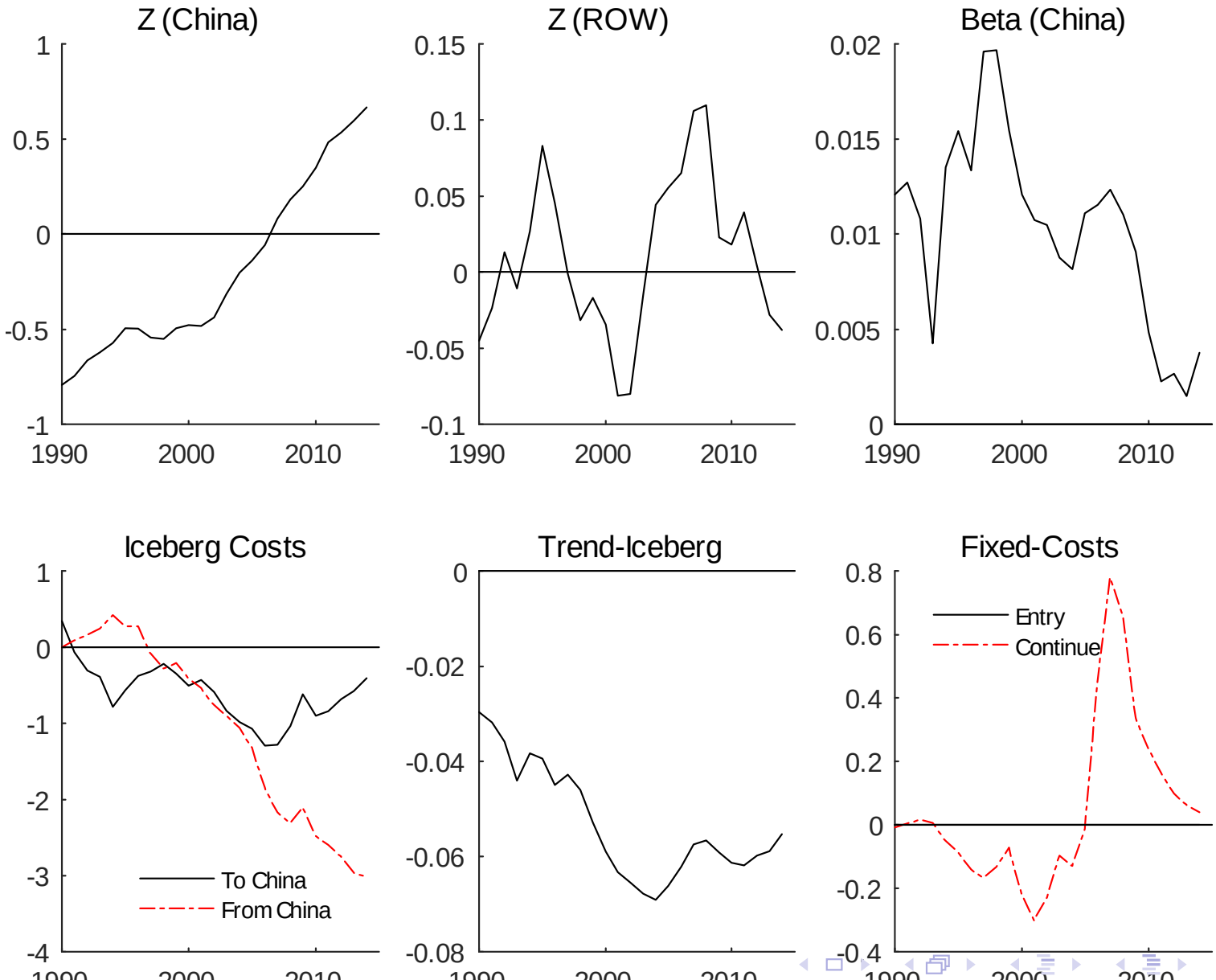






Historical and Smoothed Series

Figure: Deviations from Steady State of Exogenous 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
ρ	2	1.7975	1.8167	1.5194-2.0776	invg	1
σ	5	4.7777	4.4192	3.3591-5.9876	invg	1

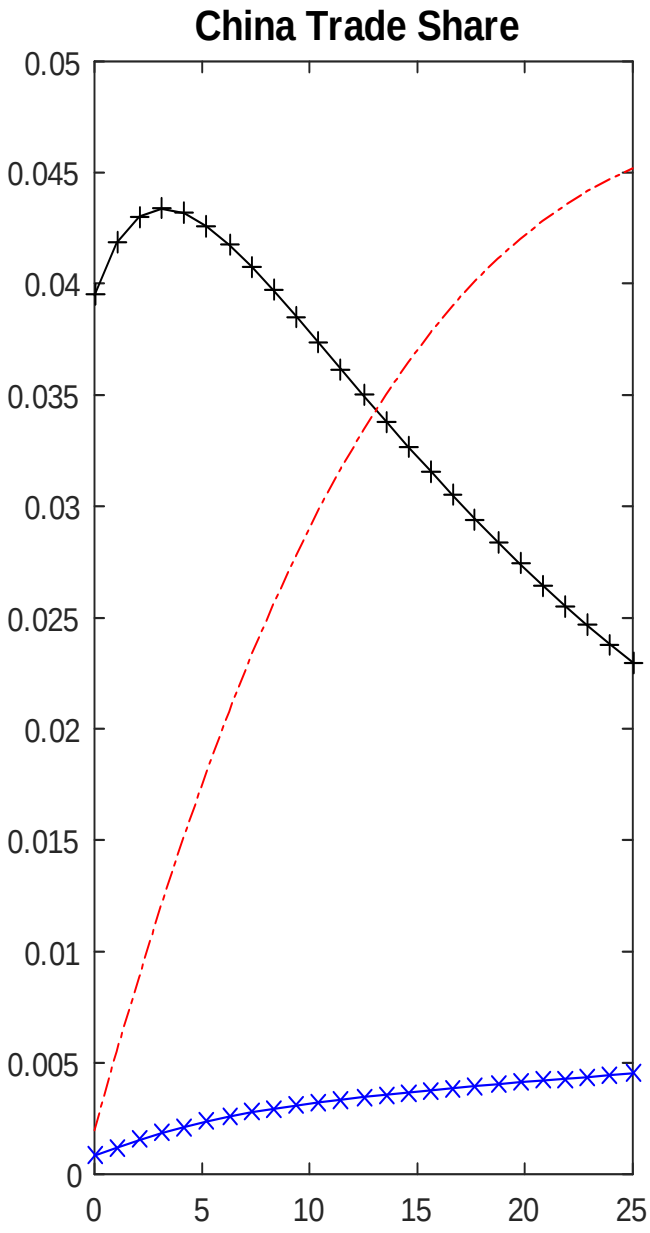
Notes: Based on annual data from 1990 to 2014.

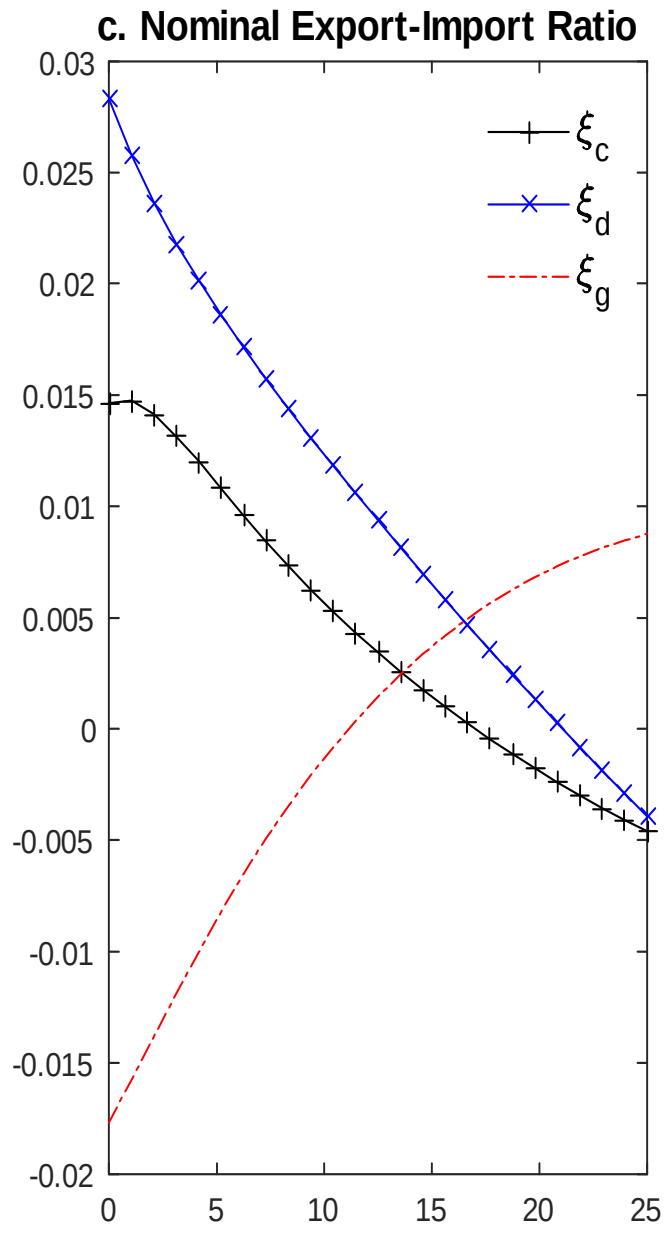
Shocks are persistent but not permanent - rationale for borrowing/lending

Nominal Export-Import Ratio and Trade Shocks

Consider 1 standard deviation shock that increase trade

- Differential trade shock - relatively cheaper for China to export - relatively large impact on net trade flows and weak effect on gross flows

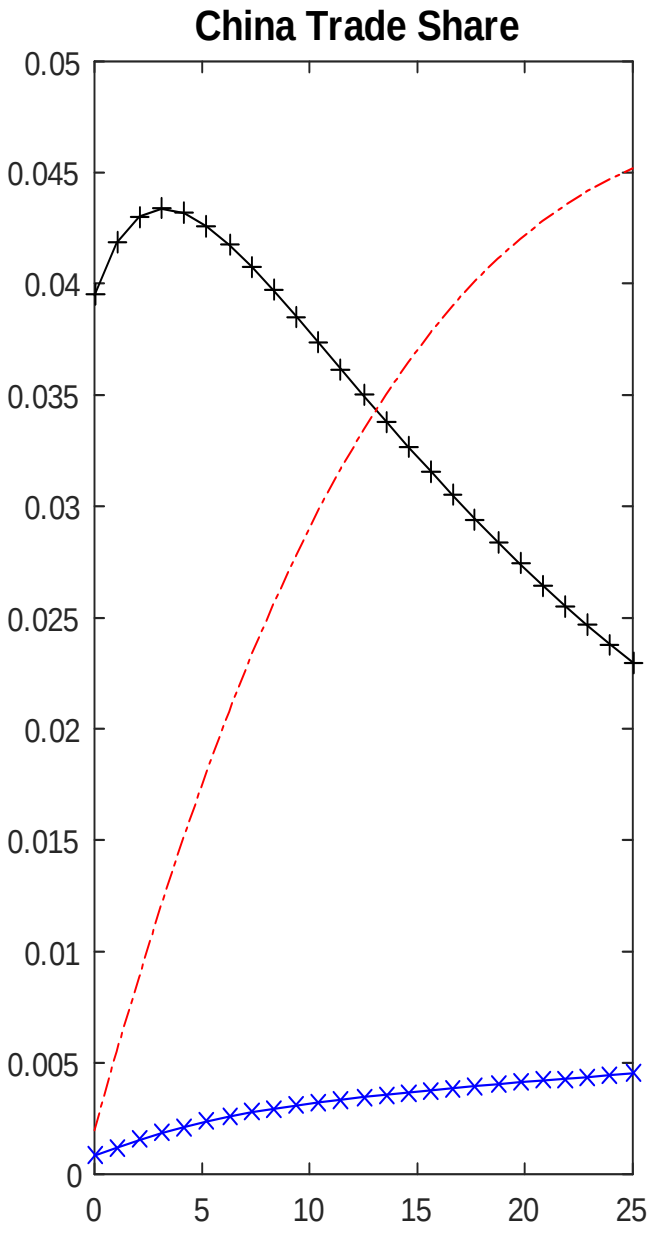

China Trade Share
0.05
0.045
0.04
0.035
0.03
0.025
0.02
0.015
0.01
0.005
0
0
5
10
15
20
25


c. Nominal Export-Import Ratio
0.03
0.025
0.02
0.015
0.01
0.005
0
-0.005
-0.01
-0.015
-0.02
0
5
10
15
20
25
ξ_c
ξ_d
ξ_g

Nominal Export-Import Ratio and Trade Shocks

Consider 1 standard deviation shock that increase trade

- Differential trade shock - relatively cheaper for China to export - relatively large impact on net trade flows and weak effect on gross flows
- Global shocks have an effect on net trade since countries are of different sizes and hence they have wealth effects
  - Persistent shock- China saves to smooth out shock
  - Trend shock - China borrows against future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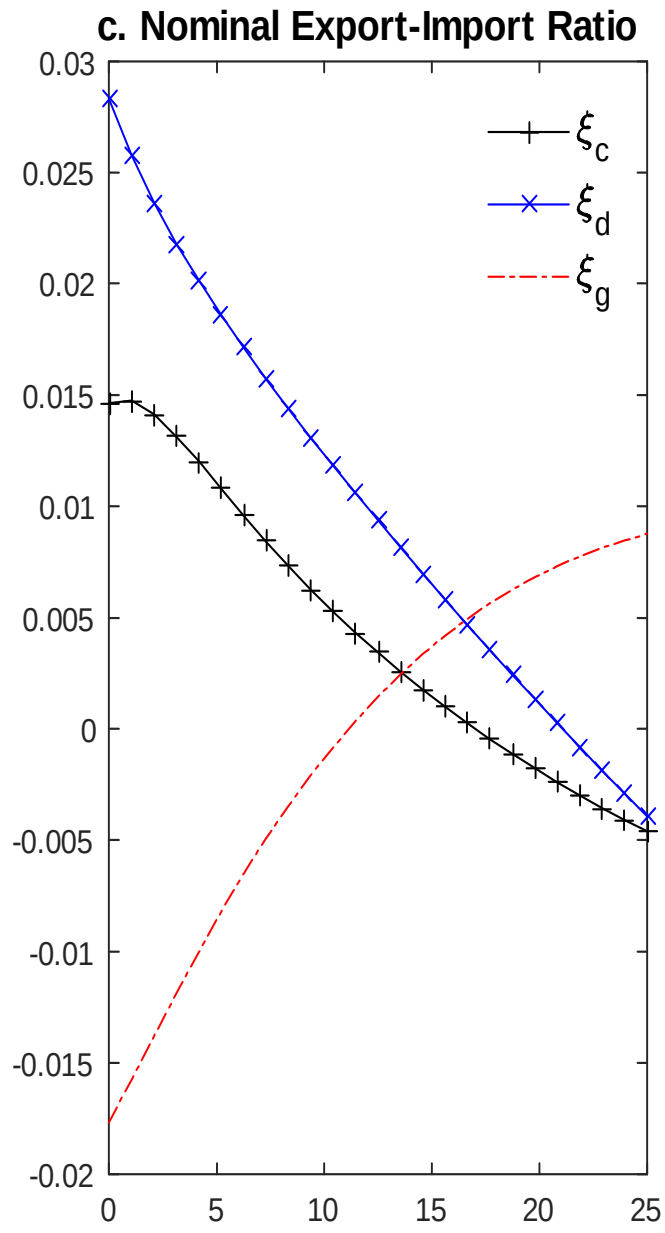
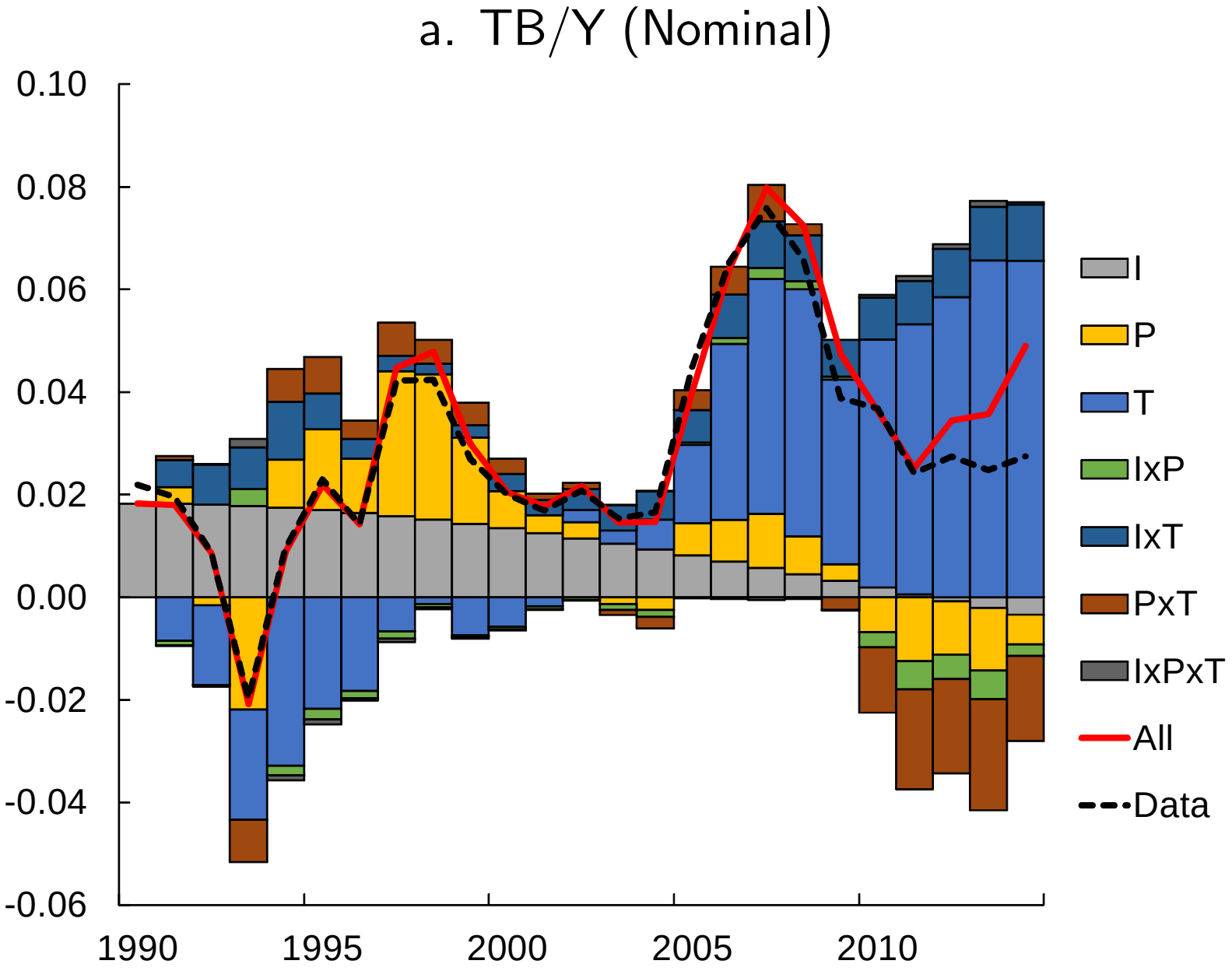

c. Nominal Export-Import Ratio
0.03
0.025
0.02
0.015
0.01
0.005
0
-0.005
-0.01
-0.015
-0.02
0
5
10
15
20
25
ξ_c
ξ_d
ξ_g

Decomposition of Trade Balance to GDP

Construct contribution of shocks to Trade-Balance/GDP from contribution to Export-Import Ratio and Trade-GDP Ratio

- - Need to account for direct and interaction effects (i.e. discount factor shock has bigger impact with a trade cost shock)
  - Group shocks into trade costs (T), productivity & preferences (P), and Initial Conditions (I)



Trade costs were major source of surpluses in since 2003.

Decomposition of Net Foreign Assets to GDP Ratio

- Construct contribution of shocks to NFA/GDP by accumulating TB
- Specifically, take model's initial assets to GDP $(Q_{1990}B_{1990}/Y_{1990})$ and then update Q_tB_t/Y_t using the law of motion

$$\frac{Q_tB_t}{Y_{Nt}} = \left(\frac{Q_{t-1}B_{t-1}}{Y_{Nt-1}}\right)\left(\frac{1}{Q_{t-1}}\right)\left(\frac{Y_{Nt-1}}{Y_{Nt}}\right) + \frac{0.5\ln\left(X_{Nt}/M_{Nt}\right)}{Y_{Nt}},$$

  - Again need to account for direct and interaction effects

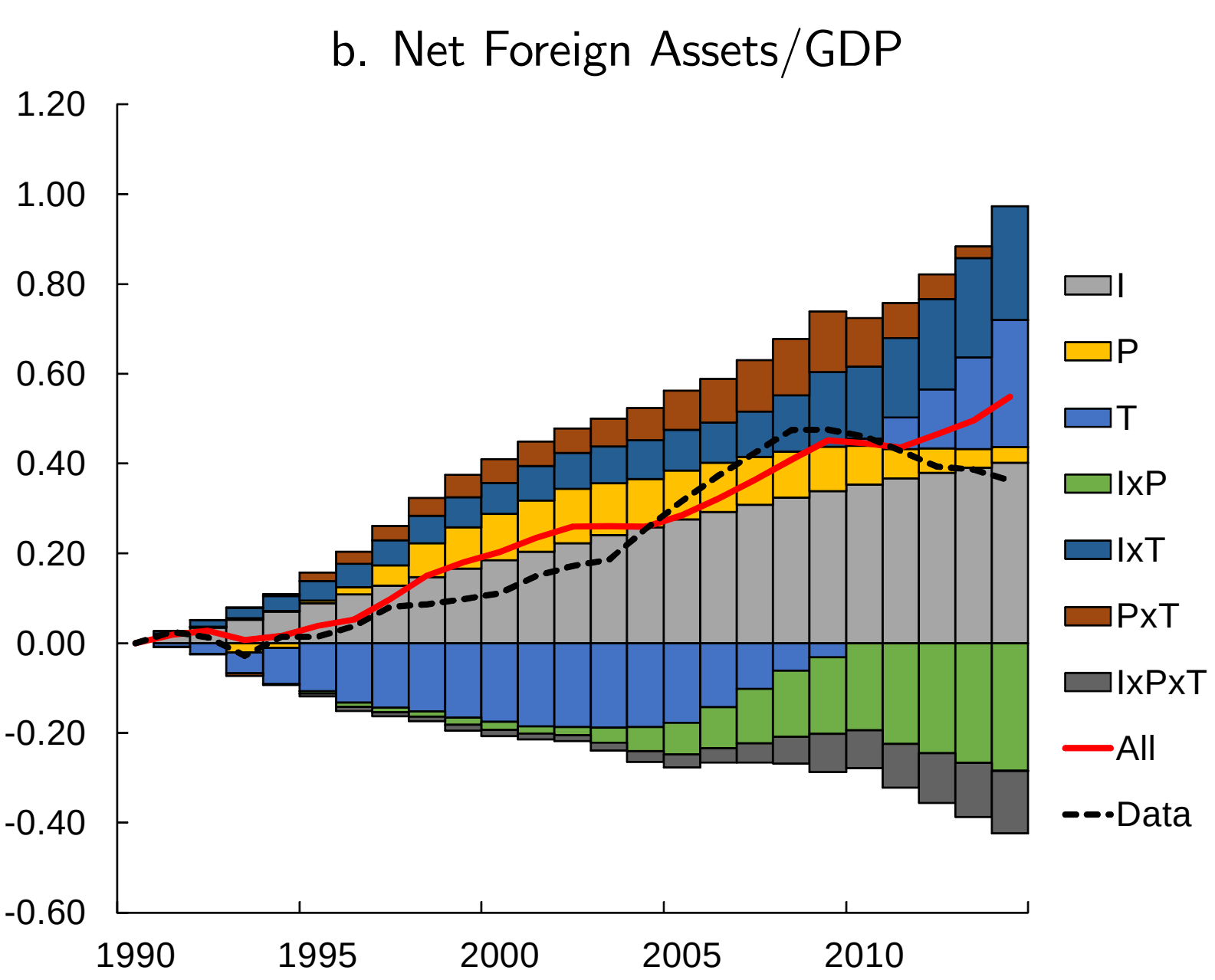

b. Net Foreign Assets/GDP
1.20
1.00
0.80
0.60
0.40
0.20
0.00
-0.20
-0.40
-0.60
1990
1995
2000
2005
2010
I
P
T
IxP
IxT
PxT
IxPxT
All
Data

Table 4: Source of Change in China's Assets-GDP (%)

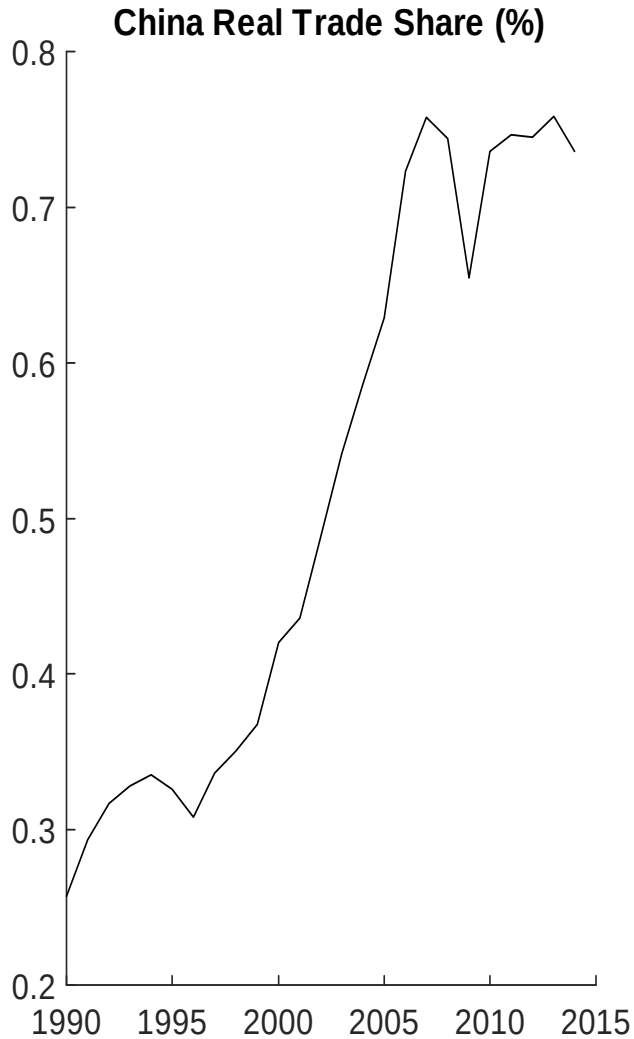
	Benchmark	No PTM	Static
Data	36.2	36.2	36.2
All	54.9	66.7	71.6
Initial (I)	40.2	1.0	1.4
Productivity-Pref. (P)	3.5	0.8	1.7
Trade (T)	28.3	37.4	17.6
IxP	-28.4	22.3	30.2
IxT	25.3	33.6	40.9
PxT	0	-8.4	3.1
IxPxT	-13.9	-20.1	-23.4
IP	15.2	24.1	33.3
IT	93.8	72.0	59.8
PT	31.7	29.9	22.4

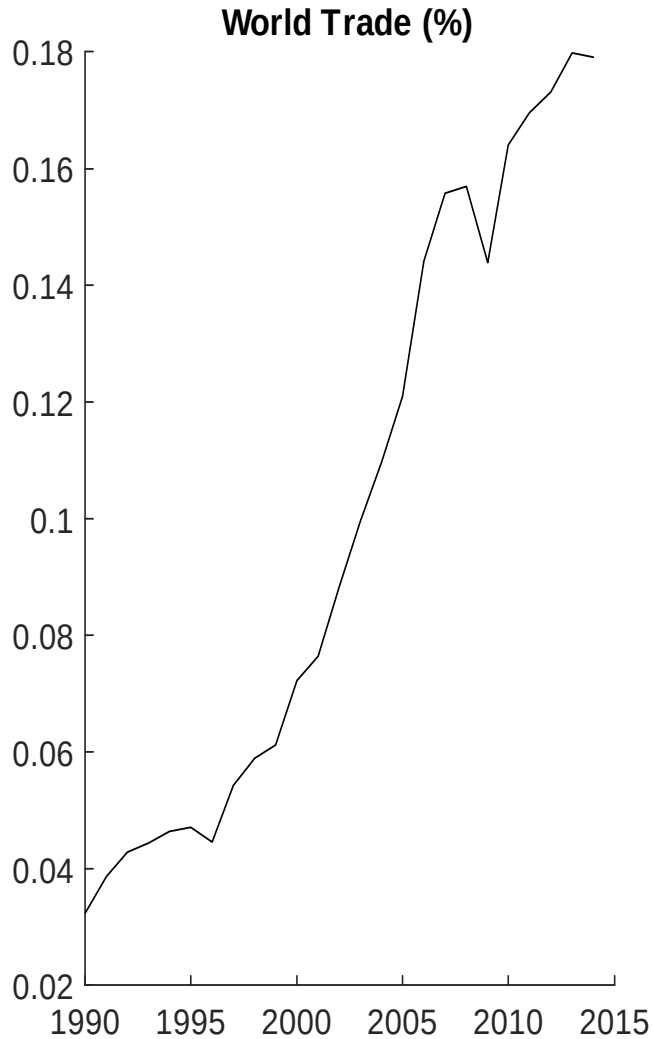
Data is based on WDI. P denotes shocks to (Z_c,Z_d,β), and T denotes shocks to (ξ_c,ξ_d,ξ_g,τ_0,τ_1).

Cross (x) denotes interaction effects while IP, IT, PT denotes impact of two determinants together

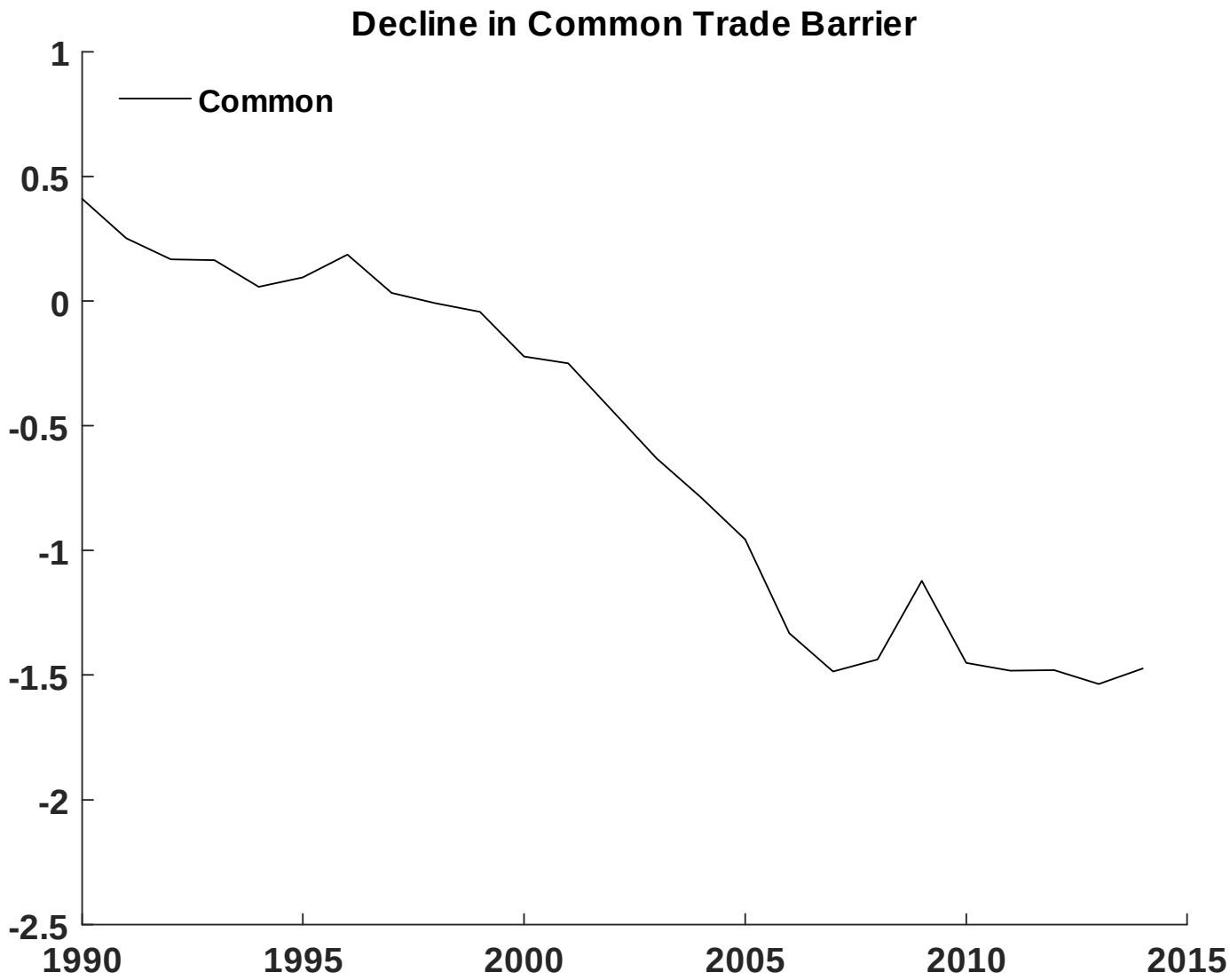
Global Trade Slowdown

Following Trade collapse and recovery global trade integration has been anemic -

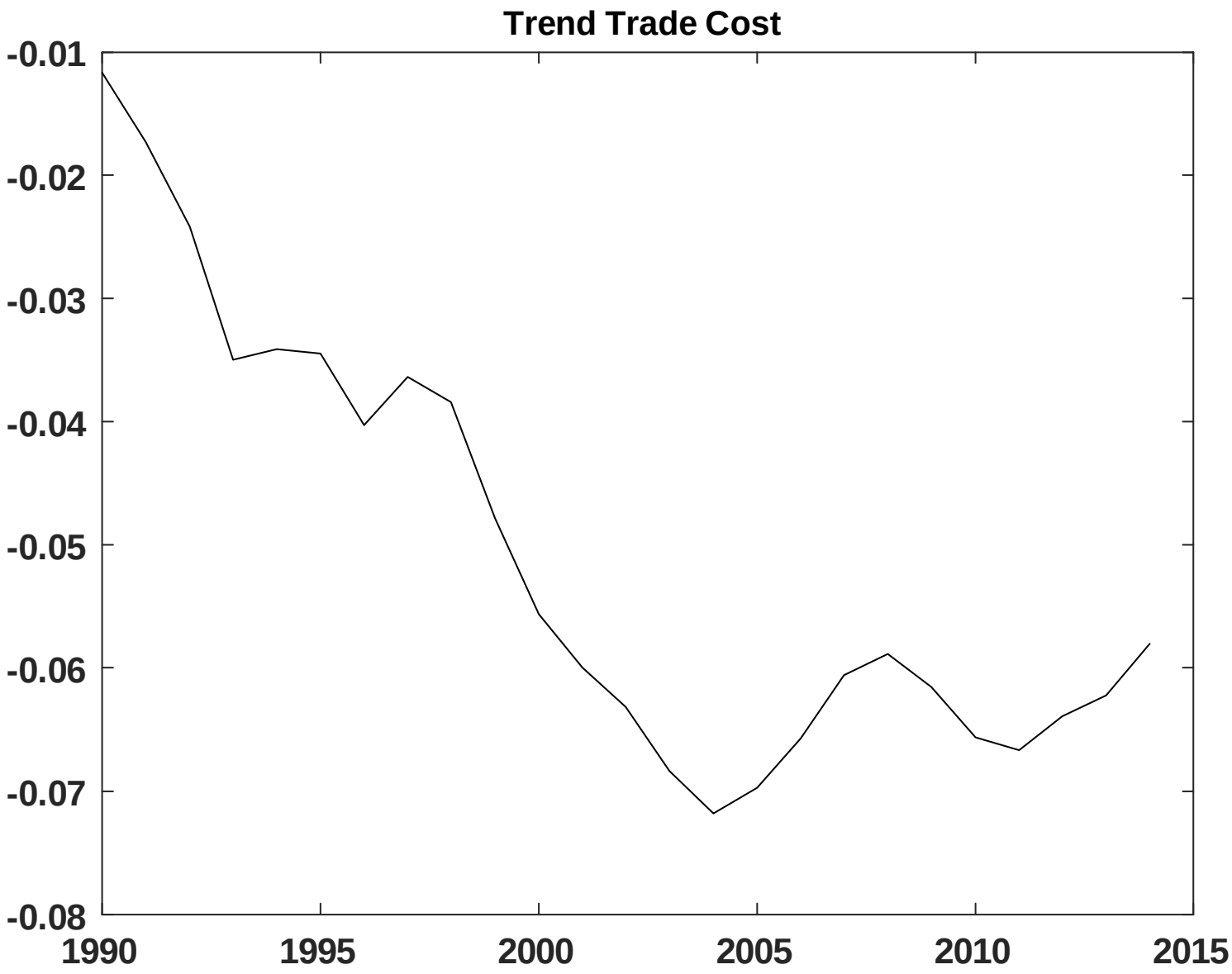




Trade reforms largely complete by 2006

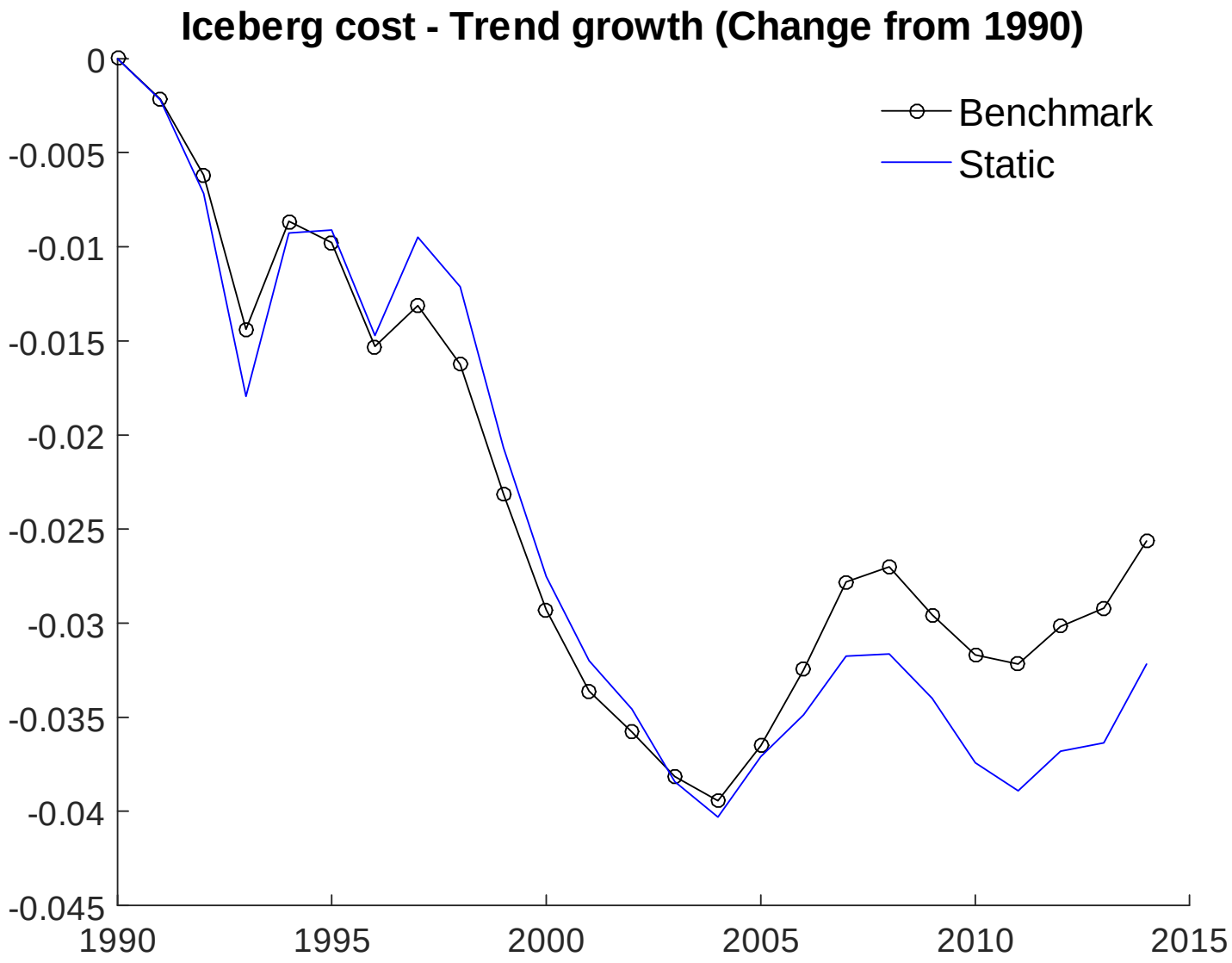


Any continued growth in trade reflects transition effects from past


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

Static vs Dynamic Trade Model: Expected Trade Growth

- Consider how estimated future trade costs depend on model
- Eliminate sunk cost - static exporting model
- Re-estimate model with 1 fixed export cost $f_0 = f_1$



Integration prospects overstated in static models

Summary

- Changes in trade barriers matter for change in net foreign assets
- 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 have diminished but remain similar to 1999 levels

Estimated Preferences and Technology							
	prior mean	posterior mean	posterior mode	90% HPD Interval		prior	prior std.dev.
$\bar{q}$	-1	-1.0459	-1.0518	-1.3639	-0.6777	norm	0.25
$\bar{Y}_w$	-1.335	-1.3198	-1.3273	-1.3958	-1.2479	norm	0.2
ρ	2	1.7975	1.8167	1.5194	2.0776	invg	1
σ	5	4.7777	4.4192	3.3591	5.9876	invg	1
$\bar{z}$	2.42	2.338	2.3449	2.1749	2.4864	norm	0.1
$\bar{\xi}_c$	0.5	0.5031	0.5045	0.4251	0.5742	norm	0.05
$\bar{\xi}_d$	0.1	0.1132	0.1001	-0.0379	0.2631	norm	0.1
ς_q	0	0.0364	0.0526	-0.1515	0.2441	norm	0.15
ς_y	0	-0.0203	-0.0275	-0.113	0.0888	norm	0.15
f_0	0.37	0.3786	0.3681	0.2969	0.4545	invg	0.05
f_1	0.04	0.0422	0.0428	0.0348	0.0498	invg	0.005
σ_η	0.235	0.199	0.186	0.1508	0.2434	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.

Period is 1990 to 2014

Outline

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

Assets-GDP Ratio and Trade cost shocks

Consider 1 standard deviation shock

- Persistent trade cost shocks Δ assets.
- Common increase in trade cost affects China more since it is more open.
  - $+$ transitory $\rightarrow$borrowing
  - $+$ trend shock $\rightarrow$savings
- Differential shocks, temporarily cheaper for ROW to consume$\rightarrow$savings
- Fixed cost shock: temporarily more expensive for ROW to consume$\rightarrow$borrow