China's Imbalances: Trade Integration in a Dynamic General Equilibrium Model*

Preliminary

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Abstract
We study the factors that have led to both the large rise in Chinese gross trade flows and net trade flows, summarized by the large positive net foreign asset position, in a dynamic stochastic general equilibrium model of China and the Rest of the World with endogenous trade participation, pricing-to-market, aggregate fluctuations, and incomplete financial markets. The model features an endogenous time-varying trade elasticity from producer-level investments in export market access. We estimate the changes in technology, trade costs, and preferences accounting for the changes in China's gross and net trade flows, real gdp, and real exchange rate. We find trade integration has proceeded in an uneven manner with a gap in the trade barriers between Chinese exports and imports opening and closing over time. Shocks to this gap are estimated to be persistent, but not permanent, providing a motive for intertemporal trade and thus account for a substantial share of China's accumulated net foreign assets in 2014. We also find that the stagnation in trade growth since 2010 to primarily reflect the completed transition to past trade reforms rather than increase in trade barriers.
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1. Introduction

China's economic growth and integration with the world economy has been an important and defining economic event of the last twenty-five years. It has been characterized by a substantial rise in income, a large increase in international trade, the accumulation of substantial net foreign assets, and important swings in the real exchange rate.[1]

Studies of the role of Chinese integration have generally been undertaken in static trade models with exogenous imbalances, and analyses of Chinese imbalances have often abstracted from gross trade flows and relative prices. Our main interest is in studying the joint determination of trade integration and trade imbalances.

China has been growing fast for decades and yet despite this, it runs a current account surplus, accumulating a large stock of foreign assets. We study the sources of its growth, trade integration, and trade imbalances through the lens of a two-country dynamic stochastic general equilibrium model with incomplete asset markets, heterogeneous producers, and endogenous trade participation featuring a dynamic decision. We consider the role of persistent changes in trade barriers, technology, and preference. The preference shock affects the discount factor and is designed to capture the often discussed Chinese "savings glut." We estimate the process for these shocks using data on gross and net trade flows, the real exchange rate and output in China and the rest of the world, and the dynamics of producer-level export participation. Then we study the contribution of these shocks on the Chinese and world economy.

In contrast to most analyses of Chinese trade integration, we focus on a model in which trade barriers make exporting an explicitly forward looking decision. The baseline model includes heterogenous producers facing trade costs that depend on their past export history as in Dixit (1989), Baldwin-Krugman (1988), Das, Roberts, and Tybout (2007), Alessandria and Choi (2007,14a,b) and Alessandria, Choi, and Ruhl (2014). These types of dynamic models have been shown to best explain producer level export participation as well as the dynamics of trade integration. The model allows for a different short-run and long-run trade elasticity and thus allows us to more accurately assess the sources of trade integration.

The model is calibrated to capture some salient features of producer involvement in international

[1] Two striking features of China's economic growth over the last twenty years have been a sustained trade integration, with imports and exports expanding at roughly double the pace of economic activity, and large trade surpluses. For instance, China's share of US trade (exports and imports) has grown from 2.5 percent in 1992 to 10.6 percent in 2013. This growth has been unbalanced with Chinese exports to the US on average 3 times Chinese imports from the US. Indeed, China has grown from being a slight debtor to the rest of the world of about 5 percent of its GDP in 1992 to being creditor of about 21 percent of its GDP in 2011 (Lane and Milesi-Ferreti 2007).

trade from the Chinese Census of Manufactures and US Exporter Profile. Particularly, we find that export participation among Chinese producers peaked in 2006 and has since fallen while export participation to China has steadily risen and only leveled off since 2011. The dynamics of export participation allow us to separately identify changes in variable versus fixed trade barriers.

We find trade integration shocks have had an important impact on net exports and the real exchange rate, consistent with the findings of Alessandria and Choi (2015) for the US. Trade integration shocks generate large wings in net exports through two mechanisms. First, transitory differences in bilateral trade barriers provide a motive for borrowing and lending by change the terms of trade in a predictable way. Second, changes in worldwide trade barriers can also have an effect on borrowing and lending. With more trade, the scale of borrowing and lending in response to changes in non-trade related shocks is expanded. Quite simply, a closed economy can not borrow and lend while and open economy can. Additionally, in an asymmetric world, common trade costs have a larger effect on the smaller, more open, country generating an additional motive for borrowing and lending following a persistent change in common trade costs. We find this last, and novel, margin to have contributed to about an increase in China's assets to gdp of 8 percentage points.

Our model is also well-suited to evaluate the dynamics of trade intensity in China and the rest of the world. We use the model to account for the rise in trade intensity leading up to the Great Recession, the Great Trade Collapse and Rebound, and the Trade Slowdown since the Rebound. Specifically, we allow for both persistent shocks to common trade costs as well as persistent shocks to the growth rate of common trade costs. Shocks to the growth rate of trade costs are a parsimonious way to capture the tendency of trade pacts to have a phase-in period. We find that the growth in trade intensity in the 2000s reflected a persistent negative shock to the growth rate of worldwide trade barriers starting in 1999 and a series of reductions to Chinese variable and worldwide trade barriers. We find the Great Trade Collapse reflects a transitory rise in worldwide trade barriers but no persistent increase in the growth rate of trade barriers. We find that most of the slow-down in trade since the Great Trade Recovery reflects the waning influence of past trade agreements, and the lack of new innovations, rather than an outright reversal.

The next section describes some related literature. Section 3 describes some salient features of Chinese integration. Section 4 builds a dynamic general equilibrium model. Section 5 describes the solution and estimation of the model. Section 6 summarizes the results of the estimation. Section 7 reports the sensitivity of our results to our modelling assumptions. Section 8 concludes.

2. Related Literature

A key contribution of this paper is to study Chinese trade integration and imbalances in a unified manner. Previous analyses of the role of Chinese imbalances have often abstracted from gross trade flows and relative prices. Some examples are Caballero, Farhi, and Gourinchas, (2008), Song, Storesletten and Zillibotti (2011), Buera and Shin (2009), Quadrini, Mendoza, and Rios-Rull (2009). Similarly, studies of Chinese integration have generally been undertaken in static trade models with exogenous imbalances (di Giovanni, Levchenko and Zhang, 2012 Tombe and Zhu 2013, Autor, Dorn and Hanson 2013, 2015).

Our approach to measuring changes in trade barriers is consistent with the larger Gravity literature (see a survey by Anderson 2011) which uses changes in bilateral trade flows and a model to infer changes in trade costs. Examples of recent work in this spirit that examines the role of changes in trade costs in aggregate fluctuations (Levchenko, Lewis, and Tesar, 2010, Jacks, Meissner, and Novy, 2011, Eaton, Kortum, Neiman and Romalis, 2014). Unlike this work, we use a two-country dynamic trade model to infer the changes in trade barriers as in Alessandria and Choi (2014) and Alessandria, Kaboski and Midrigan, (2010, 2011, 2013). By using a dynamic model of trade, we are able to capture the well-known lagged effect of relative prices and trade barriers on trade flows[2] through the internal propagation of the model rather than an exogenous shock process.

3. Evidence

We begin by summarizing some salient features of China's integration into world markets. We focus on the period beginning in 1990 and ending in 2014. We move from the more aggregate features to disaggregate aspects. While most of the evidence we present is well-known, it serves as a useful foundation for the model and quantification.

Rapid catchup: Over the last twenty five years, China's real GDP increased by 900 percent, with an annual growth rate 9.6 percent, while the average annual growth rate was 2.4 percent for the US during this period. The sustained high economic growth makes China the world's second largest economy after the United States. Panel (a) of figure 1 shows the real GDP of China relative to the US, and relative to the rest of the world.

Rapid trade integration: Meanwhile, trade growth has been phenomenal. Average annual

[2] There is a long tradition of considering the dynamic response of aggegrate trade flows and relative prices (Magee, 1973, Junz and Rhomberg, 1973, Meade, 1988, Backus, Kehoe and Kydland, 1994). Examples of papers that estimate the dynamic response to relative prices include Hooper, Johnson and Marquez, 2000, and Gallaway, McDaniel, and Rivera, 2003.

growth in China's real exports and imports has been about 14 percent (14.2 percent for real exports and 13.7 percent for real imports). As a result, China trade's volume are 30 times higher than 25 years ago. Panel (b) of figure 1 shows total trade (measured as total real exports and imports) relative to real GDP. We see relatively stable trade integration from 1990 to 1996, a rapid integration between 1996 to 2007, followed by stable trade from 2007 to 2014. In the period of rapid integration, the trade share rose from 31 percent to 76 percent. Since 2007 it has held roughly steady around 75 percent.

Substantial trade surpluses and deficits: The growth of trade integration has been unbalanced, and China ran substantial trade surpluses during this period. Panel (c) of figure 1 shows the real trade balance as share of GDP (using the decomposition that $\frac{x-m}{y} = \frac{x-m}{x+m} \times \frac{x+m}{y} \approx 0.5 \times \ln(\frac{x}{m}) \times \frac{x+m}{y}$). China was running a small deficit in 1990s and the real trade surplus increased to 12 percent of GDP in 2008, then flattened during recent years. We decompose the movements in the trade balance to GDP ratio into the movements in the ratio of trade balance to trade ($\frac{x-m}{x+m}$) and trade to GDP ($\frac{x+m}{y}$), and Panel (d) of figure 1 shows the trade balance to GDP ratio and the counterfactual by holding the trade share constant at its level in 1996. We see that the surge in trade surpluses around 2004 primarily reflects an increase in openness rather than more unbalanced trade.

Important role for the extensive margin: China has been expanding its export in several dimensions. China exports much more varieties and to more destinations over time. Panel (a) of figure 2 shows that among the HS10 products the US import, China exports 45 percent of those product categories in 1992 and 80 percent in 2014. China's value share of US imports had grown from 5 percent in 1992 to 19 percent in 2014. Panel (b) of figure 2 shows the overall number of countries and HS 6 digit product pair in Chinese exports. It increased to 374324 in 2014 and is 4 times larger than in 1992.

Producer level export participation and intensity display similar dynamics. The Chinese Annual Survey of Enterprises 1998-2012 conducted by the Chinese National Bureau of Statistics includes all the manufacturing (and very few mining and service firms, we excluded them from the sample) State-Owned and non-SOEs firms with sales over 5 million RMB (about 600,000 US dollars), yielding 133,426 firms in 1998. This number rises to 381,739 in 2008 and drops to 320,391 in 2010.

The expanding of the sample could be due to firms' entry, or more firms have nominal value of sales higher than the survey threshold over time, or the survey has been expanding its coverage. To deal with the sampling problem, we run a linear probability model of firms export participation on firms size, controlling for industry and year fixed effects, then we calculate the unconditional export participation for year 1998-2010.

From the Chinese survey and data from the US Exporter Profile, we see a rapid expansion in export participation. For Chinese firms, panel (c) of figure 2 shows the dynamics of export participation for the period 1998 to 2010. Export participation grew consistently from 1998 to 2005 from 24.4 percent of firms to 32.7 percent. From 2005 to 2009 it contracted to 27.3 percent of firms and in 2010 it rose to 28.8 percent. To measure the increase in exporters selling to China we use data from the US. Here we see that only about 0.8 percent of US firms exported to China in 1992 and that this has grown to about 6 percent in 2014, with expansion leveling off since 2010 (panel (d) of figure 2).

4. Model

We now develop a two country dynamic stochastic general equilibrium model with heterogenous producers entering and exiting the export market with aggregate shocks to productivity, trade costs, and the discount factor. The model combines features of the heterogenous producer trade models with features of standard international macro models. It is a variation of the equilibrium dynamic export participation model of Alessandria and Choi (2007, 2015) that includes shocks to trade costs, variable markups, an endogenous discount factor, and incomplete asset markets. We assume that trade cost shocks are exogenously given rather than being the outcome of some trade agreement among nations.

In each country, consumers consume a non-tradeable good made by combining a different mix of tradable intermediates, make a labor-leisure choice, and trade a non-contingent bond. Home and foreign prices are normalized to 1: $P_t = P_t^* = 1$, and the real exchange rate is defined as the relative price of a basket of foreign to home goods (a depreciation is an increase). The home country is China and the foreign country is the rest of the world.

Consumers: Consumers maximize the discounted sum of utility.

$$\max E_0 \sum_{t=0}^{\infty} \Theta_t U\left(C_t, L_t\right),$$

subject to

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

where $U(C,L) = \left[C^{\gamma}(1-L)^{1-\gamma}\right]^{1-\sigma} / (1-\sigma)$, Π_t is the dividend payments from home firms and T_t is a lump-sum rebate of revenue from trade barriers. They trade a noncontingent bond with the ROW with a small bond holding cost of $\frac{\zeta_b}{2}\left(\frac{V_t B_t}{Y_t^N}\right)$ for home with Y_t^N being nominal home GDP and $\frac{\zeta_b}{2}\left(\frac{V_t B_t^*}{q_t Y_t^{N*}}\right)$ for foreign. We also allow the discount factor to vary over time.

$$\begin{aligned}\ln(\Theta_{t+1}/\Theta_t) &= \ln \beta_t \\ &= (1-\rho_b)\ln \overline{\beta} + \rho_b \ln \beta_{t-1} + \varepsilon_{\beta},\end{aligned}$$

where $\overline{\beta}$ is the steady state β and $\varepsilon_{\beta,t}$ is a shock. In a standard model with $\Theta_t = \beta^t$. These types of shocks to the discount factor were introduced into international macro models by Stockman and Tesar (1995) and have been used extensively to explain the high savings rate of China (Kehoe, Ruhl and Steinberg, 2014) as well as crises episodes (Eggertson and Woodford, 2003, Christiano, Eichenabum, and Rebelo 2013).

Aggregation Technology or Consumption Index: In each country, a competitive retail sector combines a continuum of domestic goods with a set of available imported goods to produce the final good. We assume there is a unit mass of producers in each country. The aggregators are as follows:

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

The Armington elasticity is ρ and a is a measure of the taste for imported goods. The elasticity of substitution for imported goods is allowed to be time varying, $\theta_t = \theta q_t^{-\zeta_q} y_r^{-\zeta_y}$ $\theta_t^* = \theta q_t^{\zeta_q} y_r^{\zeta_y}$ with q_t being the real exchange rate in terms of home aggregate (a rise in q means real depreciation of home) and $y_r = Y_H/Y_F$ measuring relative income. The parameters (ζ_q, ζ_y) allow the markup on imported goods to vary systematically with the real exchange rate and relative income. This is a parsimonious way of embedding pricing-to-market that allows for incomplete exchange rate pass-through and systematic deviations from the law of one price with income. It can be microfounded using search frictions as in Alessandria (2009), Alessandria and Kaboski (2011), or Drozd and Nosal (2013). The price indices for the aggregates are

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

In equilibrium $D_t = C_t$.

Firms: We assume each country has a unit mass of producers each specialized in producing a differentiated variety using just labor. Producers are heterogenous and face idiosyncratic and aggregate shocks to productivity and trade costs. The production function of a firm i is given by

$$Y_{it} = e^{z_t+\eta_{it}} L_{it},$$

where z_t is the country-wide productivity, η_{it} is the producer-specific productivity. The country component of productivity follows an AR1 process which depends on a global and country-specific component.

To export a producer must income both fixed and variable trade costs. To export in the current period producers must hire some domestic labor. The amount of domestic labor depends on a producer's export history. A new exporter will pay $W_t f_{0t}$ to start exporting while a continuing exporters will pay $W_t f_{1t}$. These costs are sunk and cannot be recovered in future periods. Producers also face a (gross) marginal trade cost is given by ξ_t^* for China exporters, and $\xi_{,t}$ for ROW exporters. The fixed export costs is allowed to differ across countries and potentially change over time. The resource constraint for each good is given by

$$Y_{it} = Y_{hit} + m_{it}\xi_t^* Y_{hit}^*,$$

where m_{it} is the exporting status of firm i. The marginal trade cost is stochastic.

The problem of a firm is then

$$\begin{aligned} V_t(\eta, m) &= \max_{m', p, p^*} pc_t(p) + mp^* c_t(\xi^* p^*) - Wl \\ &\quad -m' W f_m + Q_t E V_{t+1}(\eta', m') \end{aligned}$$

where $m = \{0, 1\}$ is an indicator that summarizes past export status and thus the current cost of exporting, f_m.

It is well known that when $W_t f_{0t} > W_t f_{1t}$, the decision to export is forward looking. It is also well-known that there is a threshold technology for exporters to continue exporting (η_{1t}) and a second threshold technology for non-exporters to start exporting (η_{0t}). Firms will move in and out of the export market in response to shocks to idiosyncratic and aggregate shocks. These thresholds satisfy the following equations

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

The left hand side of the first two equations measures the net current cost of exporting and is equal to fixed export cost minus the current profit. The right hand side measures the discounted expected gain in producer value from starting the next period as an exporter rather than the non-exporter. The advantage of starting out as an exporter is related to savings by not having to pay the high entry export cost. When $W_t f_{0t} > W_t f_{1t}$,we have that $\eta_{0t} > \eta_{1t}$ so that new exporters are relative productive compared to continuing exporters and there is what Baldwin and Krugman call exporter hysteresis in that exporter's enter when their costs are relatively low and remain in the market even when their costs are relatively high. When $W_t f_{0t} = W_t f_{1t}$ we have that $\eta_{0t} = \eta_{1t}$ and exporting is a static decision.

The measure of exporters and non-exporters over idiosyncratic productivity in each country is a state variable. It is potentially an infinitely dimensional object. To simplify the state space we follow Alessandria and Choi (2007) by assuming idiosyncratic productivity shocks are iid. This implies that we don't need to keep track of the distribution of productivity of last period's exporters and non-exporters, only the stock of past exporters. The stock of exporters evolves as

$$\begin{aligned} N_t &= N_{t-1} \Pr(\eta \geq \eta_{1t}) + (1 - N_{t-1}) \Pr(\eta \geq \eta_{0t}) \\ N_t^* &= N_{t-1}^* \Pr(\eta \geq \eta_{1t}^*) + \left(1 - N_{t-1}^*\right) \Pr(\eta \geq \eta_{0t}^*) \end{aligned}$$

Aggregate Variables: To take the model to the data we need to define some aggregate variables. Nominal output (GDP) is given by

$$Y_t^N = \int \left(P_{hit} Y_{Hit} + \frac{P_{hit}^*}{q_t} Y_{Hit}^* \right) di.$$

Real GDP is given by

$$Y_t^R = \frac{Y_t^N}{P_{Ht}},$$

where we deflate nominal revenue by the domestic price of goods.

Nominal exports are given by

$$EX_t^N = \int q_t P_{hit}^* Y_{hit}^* di = \frac{a}{q_t} P_{Ht}^{*1-\rho} D_t^*.$$

The export price index is given by

$$P_{Xt} = \frac{P_{Ht}^*}{q_t \xi_t^*}.$$

Real exports are given by

$$EX_t^R = \frac{EX_t^N}{P_{Xt}} = a \xi_t^{*1-\rho} q_t^{-\rho} P_{Xt}^{-\rho} D_t^*.$$

The nominal import is given by

$$IM_t^N = \int P_{fit} Y_{fit} di = a P_{Ft}^{1-\rho} D_t.$$

The nominal trade balance to nominal GDP ratio is given by

$$NXY_t = \frac{EX_t^N - IM_t^N}{Y_t^N}.$$

The import price index is given by

$$P_{Mt} = \frac{P_{Ft}}{\xi_t}.$$

Real imports are given by

$$IM_t^R = \frac{IM_t^N}{P_{Mt}} = a\xi_t^{1-\rho} P_{Mt}^{-\rho} D_t.$$

We define the terms of trade using factory gate prices (i.e. prior to trade costs). We then assume the price index does not account for the benefit of increased varieties (Feenstra, 1994)

$$TOT_t^a = \frac{\frac{1}{N_t^*}\left(\int_{i \in \mathcal{E}_t^*} P_{fit}^{1-\theta_t} di\right)^{\frac{1}{1-\theta_t}}}{\frac{1}{N_t}\left(\int_{i \in \mathcal{E}_t} P_{hit}^{1-\theta_t} di\right)^{\frac{1}{1-\theta_t}}}.$$

5. Solution and Estimation

We solve the model by linearizing it around the steady state. Given that we are dealing with a large model, we fix several parameters to conventional values and estimate the rest using Bayesian techniques. Table 1 reports calibrated and estimated parameters.

The time period is a year and so we set $\beta = 0.96$. The weight on leisure is set so that hours worked in the rest of the world is equal to 1/4. The bond adjustment cost is set to 0.0001. The elasticity of substitution across varieties, ($\theta = 5$), is chosen to yield a 20 percent markup.

The fixed trade costs (f_0, f_1, f_0^*, f_1^*), standard deviation of idiosyncratic productivity shocks $\left(\sigma_\eta, \sigma_\eta^*\right)$, variable trade costs, weight in the aggregator (a), and Armington aggregator (ρ) determine trade flows. We assume steady state fixed costs are the same in China and the ROW. Of course, given that fixed costs are based in units of local labor there will be large differences across countries in the cost of exporting related to the differences in wages. The standard deviation of idiosyncratic shocks is assumed to be the same across countries and constant.

To determine the parameters related to trade and heterogeneity we proceed in two steps. First, we choose the trade costs parameters so that in a symmetric version of our model with no iceberg costs we would have the following characteristics of trade and producers involved in trade:

1. 15 percent of producers export,
2. 12.5 percent trade share of gdp,
3. 2 percent annual exit rate,
4. Exporters that are 2.5 times larger than non-exporters.

This yields an export entry cost that is almost 9 times the cost of staying in the market and a standard deviation of shocks of 23.5 percent. We use these estimates as our prior in our estimation in the second stage.

To clarify the rest of the parameters we estimate, we now describe the shocks.

We assume productivity, trade cost, and discount factor shocks are independent. There is a global and China-specific productivity shock. The global productivity follows an AR1 process,

$$\ln z_{ft} = \rho_z^f \ln z_{ft-1} + \varepsilon_{zt}^f, \ \varepsilon_{zt}^f \overset{iid}{\sim} N\left(0, \sigma_z^f\right)$$

while productivity in China depends on the global component and its country-specific component,

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

where $\bar{z}$ is the productivity disadvantage of China relative to the rest of the world.

We have 6 trade costs split between two variable costs and four fixed costs. We allow the variable trade costs and China's fixed costs to vary. For the iceberg trade costs, we rewrite the country iceberg cost shocks to include a common shock and country specific shock,

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

To mimic the effect of phasing in of trade barrier reductions the common iceberg trade costs is assumed to have both a transitory and more persistent growth rate component, ξ_{gt-1}. It is assumed that the shock to the growth of the common iceberg trade cost is known 1 year in advance of implementation while the transitory common shock occurs contemporaneously. The process for the differential trade cost is also assumed to be persistent,

$$\begin{aligned} \ln \xi_{ct} &= \left(1 - \rho_{\xi_c}\right) \ln \bar{\xi}_c + \rho_{\xi_c} \ln \xi_{ct-1} + \ln \xi_{gt-1} + \varepsilon_{\xi_c t}, \\ \ln \xi_{gt} &= \rho_{\xi_g} \ln \xi_{gt-1} + \varepsilon_{\xi_g t}, \\ \ln \xi_{dt} &= \left(1 - \rho_{\xi_d}\right) \ln \bar{\xi}_d + \rho_{\xi_d} \ln \xi_{dt-1} + \varepsilon_{\xi_d t}. \end{aligned}$$

We assume that the shocks to variable trade costs are independent and have standard deviations $(\sigma_{\xi c}, \sigma_{\xi d}, \sigma_{\xi g})$. We also allow for persistent shocks to China's fixed costs,

$$\begin{aligned} \ln f_{0t} &= (1 - \rho_{f0}) \ln f_0 + \rho_{f0} \ln f_{0t-1} + \varepsilon_{f0,t}, \\ \ln f_{1t} &= (1 - \rho_{f1}) \ln f_1 + \rho_{f1} \ln f_{1t-1} + \varepsilon_{f1,t}. \end{aligned}$$

In total, we have eight shocks $\left(\varepsilon_{zt}^f, \varepsilon_{zt}^d, \varepsilon_{\xi_c}, \varepsilon_{\xi_g}, \varepsilon_{\xi_d}, \varepsilon_{f0}, \varepsilon_{f1}, \varepsilon_b\right)$. We estimate the persistence and standard deviation of these shocks assuming that each is independent. We constrain the persistence of the fixed export costs to be the same. We also estimate the level of variable trade costs and the productivity gap between countries $\left(\bar{\xi}_c, \bar{\xi}_d, \bar{z}\right)$, the pricing-to-market parameters $\left(\zeta_q, \zeta_y\right)$, and the Armington elasticity and risk aversion parameters (ρ, σ). We estimate these using the following six time series from China and the rest of the world for the period 1990 to 2014:

1. China's relative size measured using constant 2005$,
2. The ratio of nominal exports to nominal imports,
3. The real exchange rate (OECD),

4. The share of trade in real gdp (X+M)/GDP,
5. A weighted average of ROW GDP with a linear trend removed,
6. The share of Chinese exporters to the rest of the world (1998 to 2010).

For these parameters we have relatively flat priors (table 1). Figure 3 depicts the series we use to estimate the model and the results from the estimation. Even though we have missing data on Chinese export participation in the 1990s and since 2010, the estimation yields quite reasonable movements in export participation. In particular, it suggests gradual expansion prior to 1998 with some reasonable swings. It also predicts a robust expansion since 2010. Figure 4 shows the estimated innovations to productivity, tastes, and trade costs.

Our estimate of the Armington elasticity is 1.69 and the risk aversion is 4.72 which are consistent with values commonly used in the literature on international business cycles (see Chari, Kehoe and McGrattan, 2002), but the Armington elasticity is a good bit lower than commonly employed in trade integration studies. We also find that the cost of starting to export is about 10 times the cost of continuing in the export market which again is consistent with the literature (see for example Das, Roberts, and Tybout, 2007, or Alessandria and Choi, 2014). We also estimate that there is about twice as much pricing-to-market with the real exchange rate (-0.30) as with relative income (-0.15).

The shocks are estimated to be quite persistent with annual autocorrelations that range between 0.747 and 0.996. The least persistent shock is the detrended global productivity shock with an autocorrelation of about 0.747 while China's productivity is very close to a unit root (0.996). The discount factor shock is quite persistent with an autocorrelation of nearly 0.948. The shocks to the differential trade costs is quite persistent at over 0.978. The transitory common trade cost has an autocorrelation of 0.92 while the persistence of the growth shock is 0.895. Shocks to export fixed costs are also persistent with an autocorrelation of 0.82.

Figure 5 plots productivity, discount factor, and trade costs as deviations from the steady state. China productivity grows quite substantially while ROW productivity fluctuates around zero and there is a substantial decline with the Great Recession. The Chinese discount factor shows some substantial fluctuations over this period with relatively high patience at the beginning of the sample, in the late 90s around the time of the Asian Crisis, and in the period prior to the Great Recession.

Trade costs from China fall substantially more than trade costs to China but there are some interesting variations. In particular, in the early period trade costs to China are actually rising while trade costs from China are falling. These two trade costs start falling in sync in the mid-to-late 1990s and then the trade cost from China starts falling quite quickly in the early 2000s until the Great Recession. Since the Great Recession trade costs from China have stabilized while trade cost to China have continued to fall. We find that fixed export costs are fairly constant until 2005, at which point entry costs fall and continuation costs rise, but have mean reverted. The movements in entry costs are quite minor while the continuation costs rise by at most 4 percent. These costs have mean reverted by 2014, although one should be cautious in interpreting these since we lack evidence on Chinese export participation from 2011 onwards, although some of our variety based measures show an extensive margin expansion in this period (Figure 2).

6. Results

We now use our estimated model to answer a range of question which essentially amount to evaluating the contribution of different shocks to the changes in some key variables. Tables 2 and 3 report a conditional (over the sample) and unconditional variance decomposition of a number of series. Figure 6 plots a shock decomposition of some key aggregate variables. Figure 7 plots the change in China's net foreign assets as a share of GDP and the contribution of different shocks. Figure 8 plots a shock decomposition of trade related variables.

What accounts for the movements in the Chinese trade surplus? Here we focus on the ratio of nominal exports to imports. Our conditional variance decomposition suggests that shocks to the Chinese discount factor are the most important driver at 81.7 percent, while the unconditional variance decomposition suggests China's productivity growth should account for 47 percent. Shocks to differential trade costs account for 5.4 (conditional) to 28 percent (unconditional). However, we see that the shocks to trade costs and productivity have very low frequency movements that do not seem to be accounted for well in the conditional variance decompositions and so we turn to our next question.

What explains the large increase in Chinese net foreign assets? Figure 7 plots the change in China's net foreign assets as a share of gdp in the model and data (from Lane and Milesi-Feretti 2007). As our model captures both the trade balance and trade share of gdp, the main difference between our measure and the data is most likely due differences in returns on foreign and domestic assets. When we consider the evolution of Chinese net foreign assets to gdp, we find that the Chinese saving shock is relatively more important than the differential trade cost shock (83.5 percent vs 7.1 percent). We also find a small role for the common trade costs (5.4 percent) and a very small role for China's productivity growth (3.0 percent). Looking more closely at the shock decomposition in the bottom panel of figure 7 we see that the trade costs are the major source of Chinese accumulation of foreign assets, while the movements in the discount factor actually were a drag on foreign asset accumulation. To capture the cumulative effect of different shocks on Chinese accumulation of assets, in Table 4 we calculate the change in assets to gdp predicted by each shock through 2014. Now, we see that the most important source of asset accumulation was differential trade costs as these shocks alone would have lead China to accumulate assets equal to 43 percent of GDP. We also find that worldwide changes in trade costs to have important effects, with the common shock increasing assets by 10.7 percent and the growth shocks reducing assets by 17.8 percent. Perhaps surprisingly, we find that shocks to preferences would have generally lead China to borrow and not save. This is in contrast to the typical Savings Glut explanation.

How much of the growth in output and consumption in China was from a decline in trade barriers? For output, the decline in trade barriers has almost no impact in China relative to the rest of the world (less than 1 percent) or relative to the world trend (less than 0.5 percent). China's output growth is mostly driven by productivity improvements. This echoes the result in Waugh (2010) about differences in trade costs having a minimal impact on differences in income per capita. We find a more important impact of changes in trade costs on real consumption though, with productivity accounting for about 85 percent of China's consumption fluctuations and trade integration shocks about 14.5 percent.

How have shocks in China affected consumption and output in the rest of the world? We find that shocks to Chinese savings account for 1.4 percent of the variance of rest of the world real output and 0.8 percent of consumption. Uneven trade integration shocks account for slightly less than 0.16 percent of real gdp fluctuations and less than 5.1 percent of real consumption. The common trade cost accounts for nearly 19.0 percent of the variability of real consumption. Surprisingly, only 57 percent of the fluctuations in consumption are explained by the global productivity shock.

What explains the growth in trade in China and the ROW? From the top panel of Table 5, the main source of the 47.9 percentage point rise in China's trade share of GDP (measured in real terms) was the decline in worldwide trade barriers. The gradual reduction of trade costs accounted for 25 percentage points while the common shocks accounted for 22 percentage points. Changes in fixed export costs had a minimal effect on the change in trade. The 22.8 percentage point rise rest of the world trade is roughly equally split between China productivity growth, common and growth rate shocks, and the differential trade cost shocks.

What explains the weak trade growth since 2011? The bottom panel of Table 5 reports the average annual contribution of shocks to trade growth in China and the ROW in the period 2011 to 2014 relative to the expansion period from 1997 to 2007. Overall, we see that trade relative to GDP has grown 0.9 percentage points slower in the ROW and 2.64 percentage points slower in China. The common trade cost is the main source of the slow-down accounting for a reduction in the growth of trade to gdp in the ROW of 0.77 and 2.42 percentage points in China. This primarily reflects the large negative innovations in the earlier period and a lack of any additional negative innovations and mean reversion in the latter period. The differential and trend shocks have also contributed to a slow-down in the pace of trade integration in the ROW. While future reductions in trade barriers are expected from the trend shock (figure 9 plots the dynamics of the trend shock to trade costs). We can see clearly the trend accelerated from 1998 to 2004 but has since retrenched.

How did changes in preferences that encouraged Chinese savings affect Chinese trade integration? Changes in preferences have almost no impact on trade integration as they lead to substitution between imports and exports. Indeed it is an important driver of export participation but works in opposite directions at home and abroad.

7. Sensitivity

We now examine some features of our model by considering the impulse response of assets and trade to the shocks. We also compare the results in our benchmark model with pricing-to-market to an alternative model without pricing-to-market, and another model without pricing-to-market and a static export decision.

A. Impulse Response

Figure 10 plots the dynamics of net foreign assets relative to gdp for a one standard deviation shock to each of our shocks. Common shocks to productivity have no impact on intertemporal trade and shocks to entry costs are omitted since they are too small to have any noticeable impact. Transitory positive shocks to productivity, differential trade costs, and the discount factor lead to the accumulation of assets. A positive shock to the cost of exporting leads to borrowing as this temporarily raises the cost of exporting.

Turning next to a transitory increase in the common trade cost, we find, perhaps surprisingly, that it ultimately leads to the accumulation of debt in China. This effect only arises in an asymmetric economy. It is primarily related to the common trade cost having a bigger effect on consumption in a more open economy. Given the transitory, but persistent, nature of the shock, this creates a motive for consumption smoothing. When the shock is to the growth rate of common trade barriers, we see that China has an incentive to accumulate some minor assets prior to the shock being realized.

Figure 11 plots the dynamics of the trade share in China and the rest of the world following a one standard deviation shock to each of the shocks. The common and common growth rate shocks to trade costs are the only shocks that affect trade in China and the rest of the world in the same direction. Comparing the growth rate shock(xig) to the common shock(xic), we see that the two shocks are equally important after 11 years and that the growth rate shocks effect in year 25 is about equal to the transitory shock in year 1 but about twice as important as the common shock in year 25.

B. Alternative Models

Here we consider the sensitivity of our results to our assumptions about pricing-to-market and the structure of export participation costs. We first estimate a version of our benchmark model with no pricing-to-market $\zeta_q = \zeta_y = 0$ and then a version of this model with a static export decision ($f_0 = f_1$).

Table 6 compares the posterior mode of each of the estimated parameters in each of the models. For the most part the parameters are quite similar. As we move across the three models, we require a higher risk aversion parameter and Armington elasticity, although the differences aren't too large (4.38 to 4.97, and 1.74 to 1.84). The main differences come in our estimated parameters related to producer heterogeneity. In the latter model, only the most productive producers export and so shocks to producer productivity must be much smaller to generate the same amount of trade as in the benchmark model. The shock process is quite similar. The biggest difference comes in the process for the shock to export costs. In the static model it has an autocorrelation of 0.995 compared to 0.85 in the benchmark model.

Table 4 reports the contribution of each shock in these alternative models to the change in assets in China. Eliminating pricing-to-market from our benchmark model, leads to a smaller accumulation of foreign assets in China between 1990 and 2014 (24.0 percent vs 33.5 percent). The reduction in asset accumulation is primarily attributed to the common trade costs shocks leading China to want to borrow. With just the static exporting decision, the model predicts an even smaller rise in foreign assets from 1990 to 2014 of only 10.6 percent. As in our benchmark model, shocks to the differential trade costs are the main driver for savings but these are largely offset by shocks to the growth rate of worldwide trade barriers. The differences in asset accumulation across the models may seem surprising given that we have estimated each of the models to the same aggregate series on the nominal trade balance. The differences in asset accumulation primarily arise because the models require different initial levels of debt and so debt service costs are different and predict different movements in nominal gdp to real gdp.

8. Conclusion

China's economic growth and integration with the world economy has been an important and defining economic event of the last twenty-five years. We study the source of this growth and integration through the lens of a two-country dynamic stochastic general equilibrium model with incomplete asset markets, heterogeneous producers, and endogenous trade participation featuring a dynamic decision and persistent changes in trade barriers, technology, and tastes. We use the model to account for the contribution of these shocks on various aspects China and the Rest of the World economies.

Our dynamic model of trade integration and growth allows for trade integration to influence the dynamics of the trade balance and lead to changes in foreign assets. A key finding is that trade integration has been an important driver of fluctuations in China's trade balance and accumulation of foreign assets. Trade integration operates through two main channels. First, differences in the timing of opening, captured by transitory changes in trade barriers, create a motives for intertemporal trade. Indeed, we find these types of shocks have contributed greatly to the accumulation of China's foreign assets. Second, transitory changes in the common trade costs affect the accumulation of assets by changing the scale of borrowing and lending and because we have considered asymmetric economies. Quantitatively, we find that without these changes in trade integration, China would have accumulated 30 percent fewer assets through 2014.

We also use our model to account for the dynamics of trade integration between China and the Rest of the World. By allowing for both a persistent shock to common trade costs as well as a persistent shock to the future growth rate of common trade costs, we can distinguish between the lagged effects of past trade agreements and new shocks. We find that the growth in trade to GDP from the late 90s to the Great Recession reflected a combination of shocks with reductions in common and differential trade barriers and a persistent decline in rate of trade cost reductions. We find the Great Trade Collapse reflects a transitory rise in worldwide trade barriers but no persistent increase in the growth rate of trade barriers. Indeed, we find that most of the slow-down in trade since the Great Trade Recovery reflects the waning influence of past trade agreements rather than the imposition of new barriers. It is the period from the 90s to the Great Recession that is unusual and not the period since the Great Recession. This suggests the need for new trade agreements to set the world economy off on a new wave of trade integration.

Finally, we have remained agnostic about the source of different trade cost movements following much of the Gravity literature in measuring these as a residual. Having found these may have had important aggregate consequences, a useful next step would be to relate these to actual policy or technological changes.

9. Data

- Time period 1990 to 2014.
- China's relative size is measured using constant 2005$, World Development Indicators - WDI
- The real exchange rate (OECD)
- The ratio of nominal exports to nominal imports (China Statistical Bureau)
- The share of trade in real gdp (X+M)/GDP.(China Statistical Bureau)
- Chinese manufacturing export participation from Chinese Annual Survey of Enterprises (China Statistical Bureau)
- China's net foreign assets - 1990 - 2011 from Lane and Milesi-Ferretti (2007)
- US Export Participation to China - US Exporters from US Exporter Profile (1992, 1996 to 2014) scaled by US firms with 20+ employees from Small Business Administration (1988 - 2011). Share of exporters interpolated for 1993 to 1995 period. Number of firms from 2012-2014 is assumed to grow at a constant rate.

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Table 1: Parameters

Fixed Parameters

β	ζ_b	γ	a_1	θ
0.96	0.0001	0.30	0.16	5

Estimated Parameters

	prior mean	posterior mean	posterior mode	90% HPD - interval	prior	prior std.dev.
ρ_{z_d}	0.95	0.9961	0.9993	0.9905 - 1	unif	0.5
ρ_{z_c}	0.7	0.7474	0.7313	0.5586 - 0.954	unif	0.5
ρ_{ξ_c}	0.79	0.9173	0.9619	0.8099 - 0.9981	unif	0.5
ρ_{ξ_d}	0.95	0.9781	0.9917	0.9578 - 0.9998	unif	0.5
ρ_b	0.945	0.9476	0.9525	0.9158 - 0.98	norm	0.025
ρ_{ξ_g}	0.8	0.895	0.9745	0.7423 - 0.9978	unif	0.5
ρ_f	0.9	0.8202	0.8529	0.666 - 0.9939	unif	0.5
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
$\bar{q}$	1.431	1.4254	1.4312	1.2579 - 1.5874	norm	0.1
$\bar{Y}_w$	-1.335	-1.2873	-1.289	-1.3342 - -1.2481	norm	0.1
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.

Table 2: Variance Decomposition (in percent)

	ezc	ezd	exic	exid	eb	exig	econt
xic	0	0	21.98	0	0	78.02	0
xih,xif	0	0	11.17	49.19	0	39.65	0
beth	0	0	0	0	100	0	0
YYSL	0	94.11	0.2	3.12	2.31	0.25	0.01
ChCf	0	95.03	0.28	2.26	1.76	0.67	0.01
EXMNL	0	47.03	1.79	28.09	20.75	2.27	0.07
XMYL	0	18.04	8.54	27.45	16	29.85	0.12
RER	0	25.94	1.09	60.82	9.98	2.13	0.05
Yw	12.58	40.63	1.58	24.71	18.38	2.05	0.06
YRh	0.08	96.59	0.11	1.76	1.3	0.14	0
Ch	0.06	95.93	0.36	1.43	1.11	1.1	0
Cf	11.4	24.15	5.7	23.12	17.84	17.69	0.1
Nhl	0	46.8	3.2	20.8	15.73	11.14	2.32
Nfl	0	48.83	3.51	20.78	14.7	12.13	0.05
tshare	0	18.69	15.94	4.86	0.11	60.36	0.03
tsharef	0	35.01	10.78	11.92	2.6	39.62	0.06
tsharew	0.08	6.63	8.93	45.5	5.67	33.16	0.02
By	0	47.32	1.77	28.16	20.45	2.24	0.07

Table 3: Conditional Variance Decomposition (in percent, 25 periods)

	ezc	ezd	exic	exid	eb	exig	econt
xic	0	0	54.08	0	0	45.92	0
xih,xif	0	0	27.75	48.69	0	23.56	0
beth	0	0	0	0	100	0	0
YYSL	0	99.34	0.02	0.05	0.53	0.04	0.01
ChCf	0	89.57	3.75	2.42	0.6	3.65	0
EXMNL	0	0.16	4.82	5.39	81.74	6.85	1.04
XMYL	0	5.98	43.92	5.36	0.99	43.22	0.53
RER	0	11.93	1.78	83.67	0.91	1.62	0.08
Yw	97.99	0.01	0.19	0.16	1.42	0.21	0.02
YRh	2.04	97.59	0.01	0.03	0.31	0.03	0.01
Ch	1.98	83.09	6.99	1.1	0.32	6.52	0.01
Cf	56.92	1.09	19.39	5.06	0.8	16.56	0.19
Nhl	0.02	0.55	27.81	0.95	1.34	32.73	36.6
Nfl	0.01	1.66	42.31	0.38	1.2	54.31	0.13
tshare	0	1.91	48.68	5.32	0.02	43.97	0.1
tsharef	0	2.63	45.38	10.54	0.13	41.04	0.29
tsharew	0.34	1.3	29.85	41.32	0.36	26.84	0.01
By	0	0.2	5.36	7.1	83.56	3.09	0.69

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

	Benchmark	Benchmark - No PTM	Static
ezc	0.0%	0.0%	0.0%
ezd	8.4%	9.2%	5.5%
exic	10.7%	7.4%	7.1%
exid	43.6%	41.0%	33.3%
eb	-18.2%	-14.6%	-9.5%
exig	-17.8%	-25.1%	-33.3%
enter	0.0%	0.0%	-
econt	-0.9%	-1.1%	2.8%
initial	7.7%	7.1%	4.7%
Total	33.5%	24.0%	10.6%

Notes: Each entry measures the change in China's foreign assets in 2014 from that shock alone.

Table 5: Source of Change in Trade-GDP (1990 to 2014)

	China Trade share Real	China Trade share Nominal	ROW Trade Share Nominal
ezc	0.0%	0.0%	0.0%
ezd	-26.5%	-10.7%	4.1%
exic	22.1%	16.7%	5.3%
exid	13.2%	-9.2%	4.3%
eb	0.5%	-0.1%	0.0%
exig	25.0%	18.3%	5.9%
e_enter	0.0%	0.0%	0.0%
e_cont	-1.5%	-0.5%	-0.3%
initial	15.0%	9.2%	3.4%
Total	47.9%	23.8%	22.8%

Notes: Each entry measures the change in the trade shock from 1990 to 2014 from that shock alone.

Change in the Source of the Change in Trade-GDP (2011-2014 vs 1997 to 2007)

	China Trade share Real	China Trade share Nominal	ROW Trade Share Nominal
ezc	-0.02%	0.00%	0.00%
ezd	-0.79%	-0.32%	0.13%
exic	-2.59%	-2.42%	-0.77%
exid	-0.28%	0.28%	-0.12%
eb	-0.41%	0.07%	-0.05%
exig	-0.30%	-0.13%	-0.06%
e_enter	0.00%	0.00%	0.00%
e_cont	0.15%	0.07%	0.04%
initial	-0.29%	-0.18%	-0.06%
Total	-4.51%	-2.64%	-0.89%

Notes: Each entry measures the difference in the average annual contribution from 2011 to 2014 minus that from 1997 to 2007.

Table 6: Posterior Mode of Paremeters

	Benchmark	No PTM	Static
ρ_{z_d}	0.9993	0.9993	0.9996
ρ_{z_c}	0.7313	0.7382	0.6633
ρ_{ξ_c}	0.9619	0.9566	0.9788
ρ_{ξ_d}	0.9917	0.9927	0.9936
ρ_b	0.9525	0.9519	0.9562
ρ_{ξ_g}	0.9745	0.9793	0.9703
ρ_f	0.8529	0.8714	0.9948
σ_{z_d}	0.0678	0.0676	0.0697
σ_{z_c}	0.0333	0.0333	0.0332
σ_{ξ_c}	0.1549	0.1439	0.1479
σ_{ξ_d}	0.1531	0.1325	0.1253
σ_{ξ_g}	0.0118	0.0141	0.0141
σ_{f_0}	0.0047	0.0047	
σ_{f_1}	0.2193	0.2197	0.2201
σ_b	0.0044	0.0044	0.0035
$\bar{q}$	1.4312	1.4401	1.4225
$\bar{Y}_w$	-1.289	-1.2887	-1.3924
ρ	1.7364	1.7645	1.8388
σ	4.3826	4.432	4.969
$\bar{z}$	2.368	2.363	2.3819
$\bar{\xi}_c$	0.5026	0.5	0.5
$\bar{\xi}_d$	0.1	0.1	0.1
ς_q	-0.2923		
ς_y	-0.1633		
f_0	0.3728	0.3666	
f_1	0.0407	0.0403	0.1207
σ_η	0.1824	0.1929	0.0289

Figure 1: Aggregate Dynamics in China

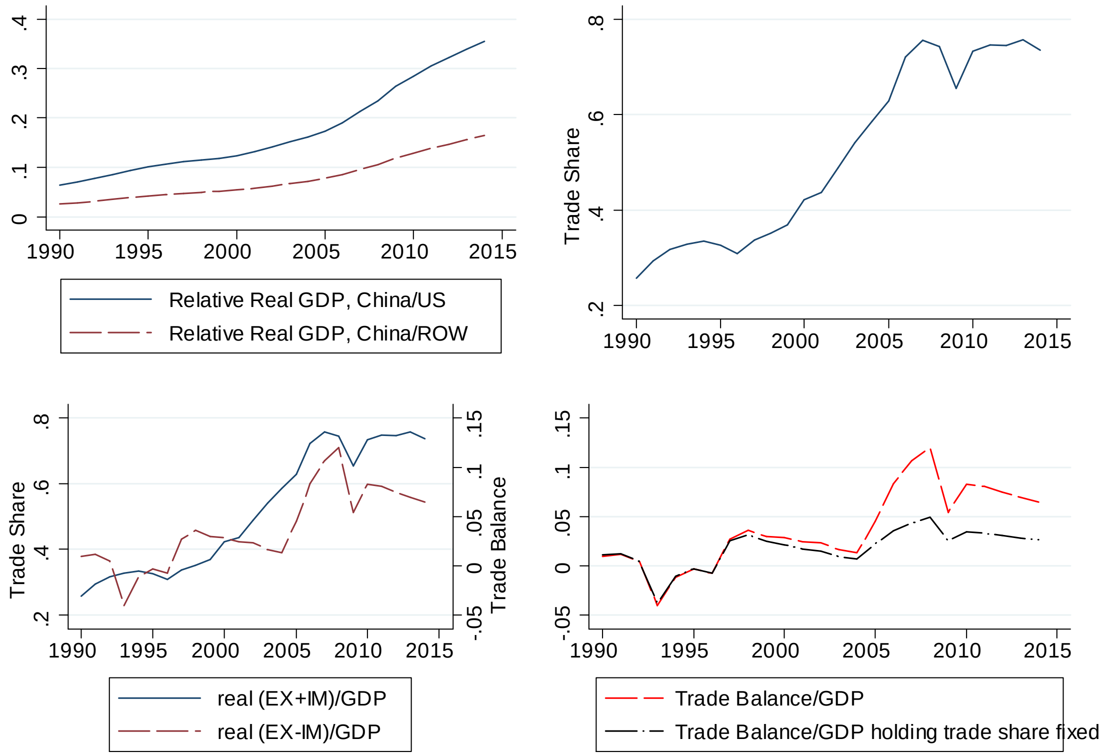

Figure 2: Disaggregate Trade Dynamics in China

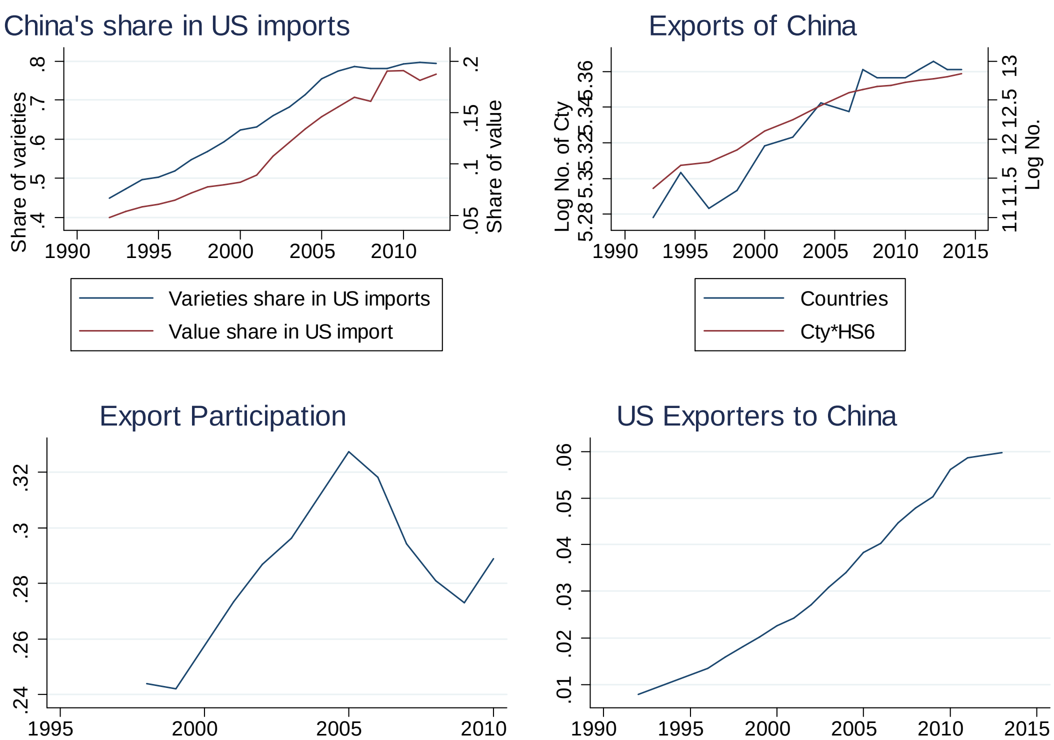

Figure 3: Historical and Smoothed Series

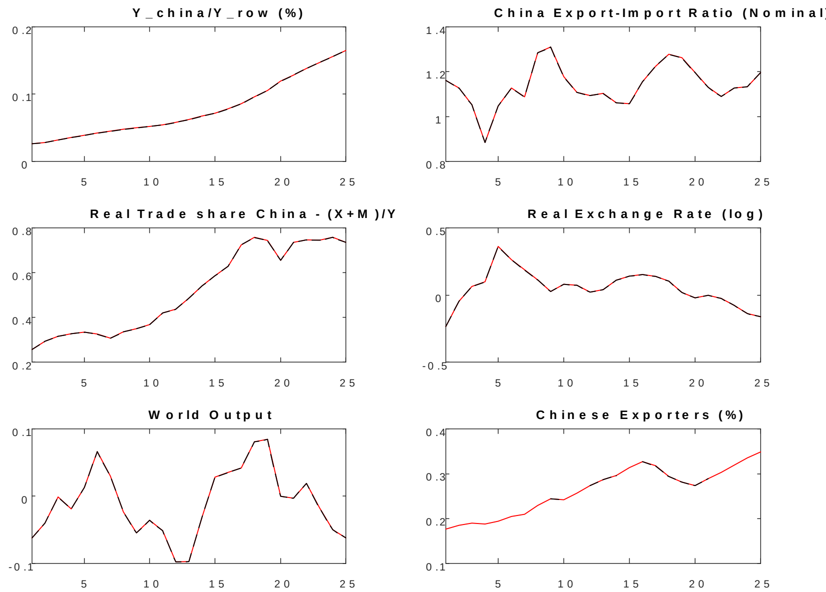

Figure 4: Estimated Shocks

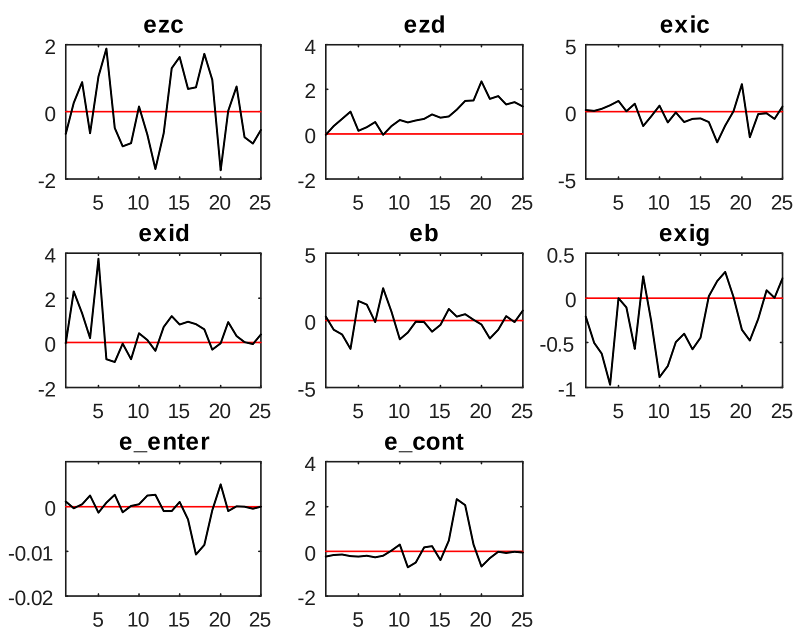

Figure 5: Deviations from Steady State of State Variables

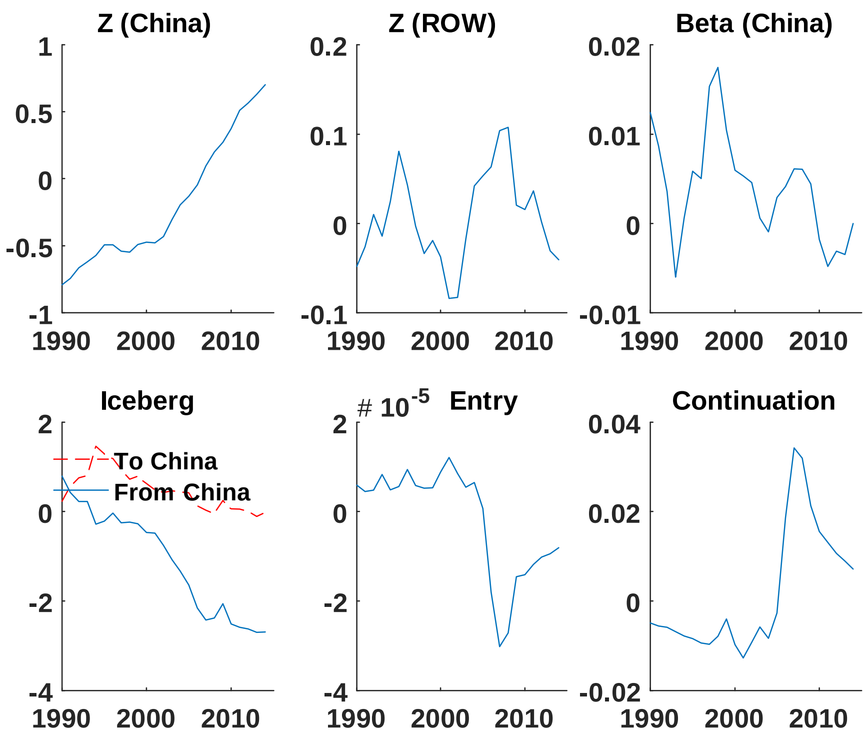

Figure 6: Decomposition of Aggregate Dynamics

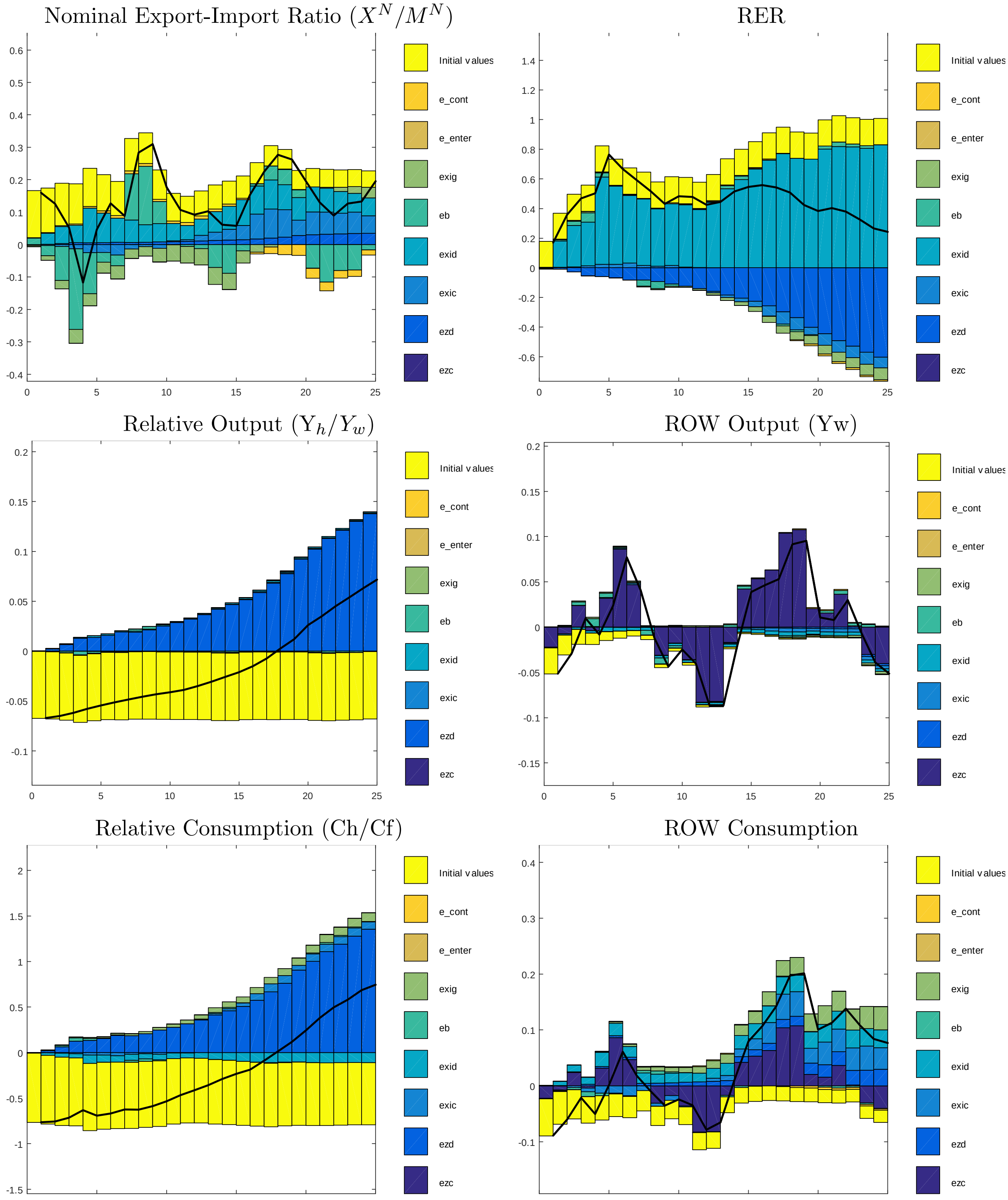

Figure 7: Decomposition of China Net Foreign Assets (Model)

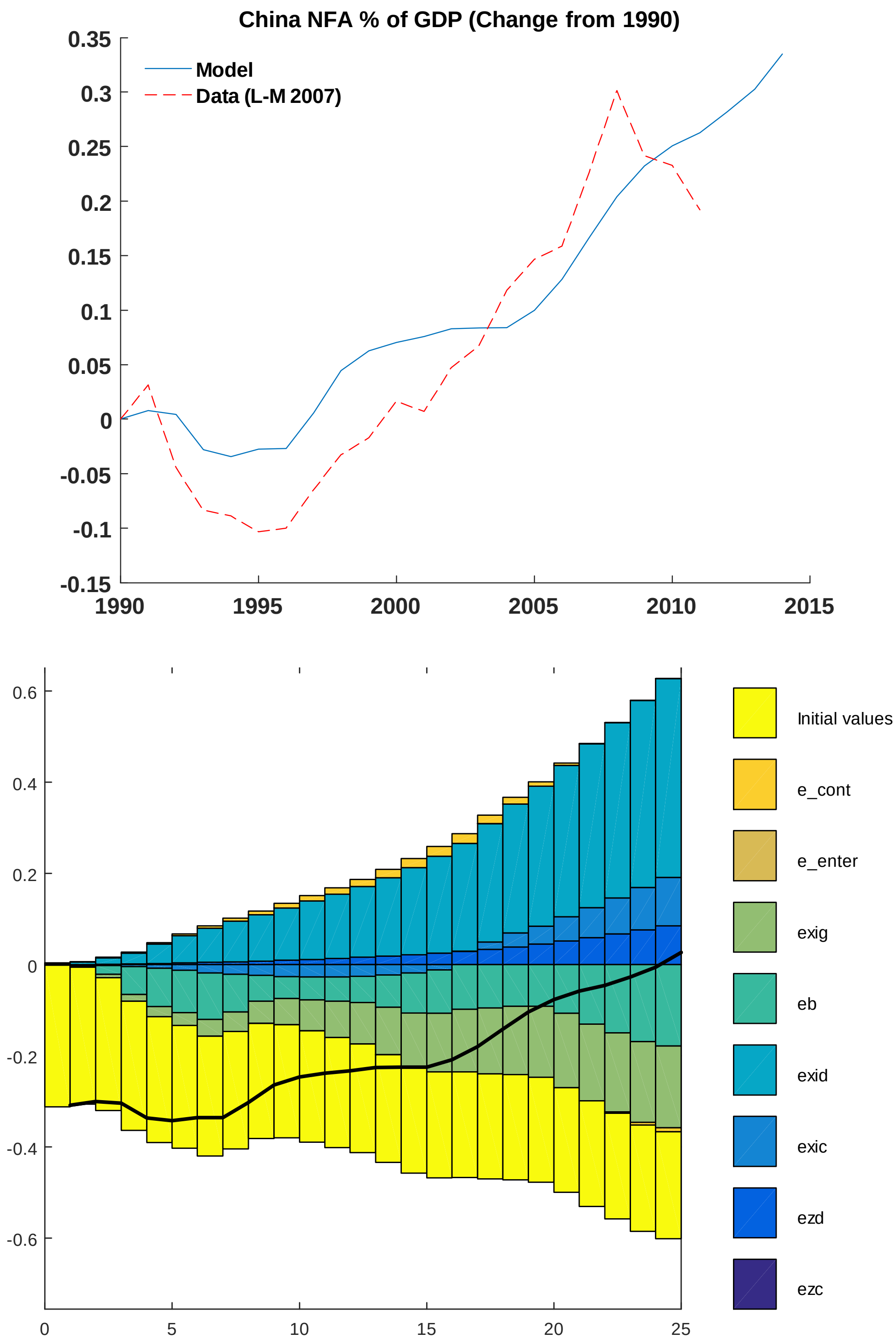

Figure 8: Decomposition of Trade Dynamics

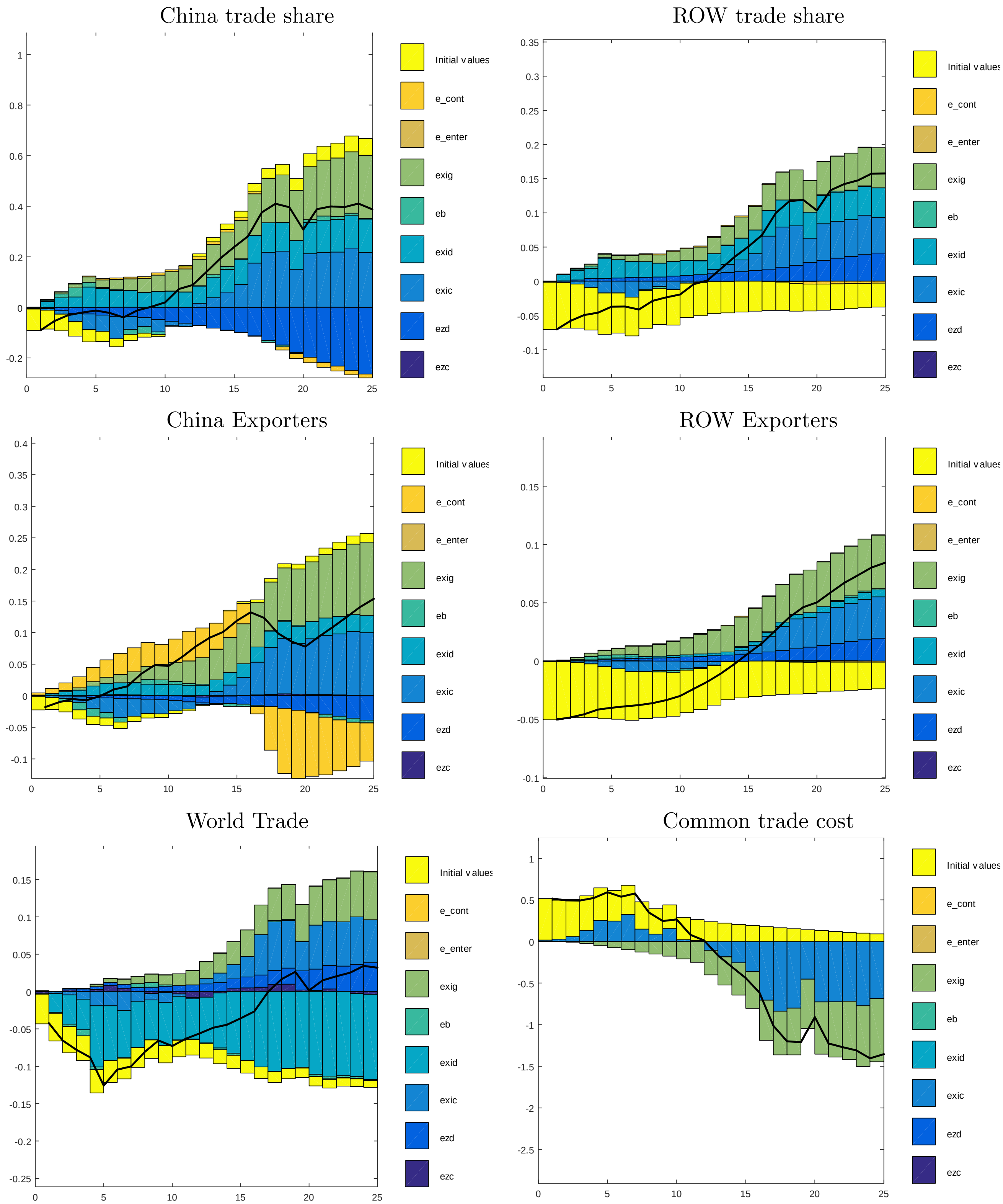

Figure 9. Trend Trade Cost

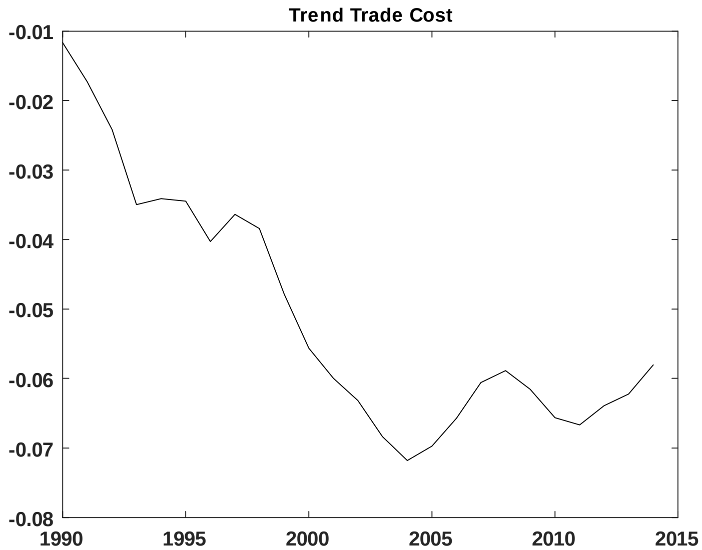

Figure 10. Impulse Response of Assets-GDP (By)
to one standard deviation shock

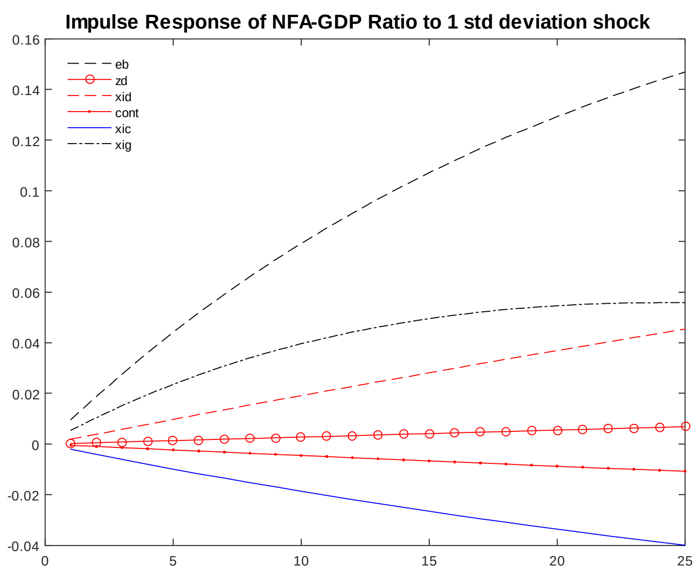

Figure 11. Impulse Response to shocks