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Uncanny Partnership in Global Imbalances: China's Continual Accumulation of US Treasuries[1]

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Uncanny Partnership in Global Imbalances: China's Continual Accumulation of US Treasuries

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Abstract

The combination of American consumption excess and China's financial extravaganza in accumulating US treasuries has widely been perceived as a major contributor to the global imbalances. The current research examines whether this uncanny partnership can last long by concentrates on the Chinese side of the story, i.e. to what extent China may continue to accumulate the US treasuries. Evidence from our model simulation and analysis suggests that the inertia effect is the most powerful influence driving the continuation of the stockpiling. China's holdings of the American Treasury are so large that the management of this colossal wealth has become a process that has its own life and dynamics due to influences of behavioural factors and the internal governance elements of Chinese funds. As a result, at least in the short run there shall be no sudden stop to China's continual accumulation of American assets. In the longer run, the interest rates and productivity improvement in China and around the world play a lasting role. It is unlikely that changes in the US consumer behaviour are able to fundamentally change China's hoarding. Neither there is evidence that the renminbi exchange rate changes will impact on China's willingness to hold its stock of American assets. These findings mean that even if controlling the inertia effect, transformation of the uncanny partnership would require China to keep a very low interest rate for a fairly long period and the US to adopt a substantially high interest rate. Moreover, there shall have sustainable and large improvements in productivity in both China and the US. We do not have reason to expect the forthcoming of these changes and so the party will go on. The uncanny partnership between China and America will be a lasting feature of the world economy.

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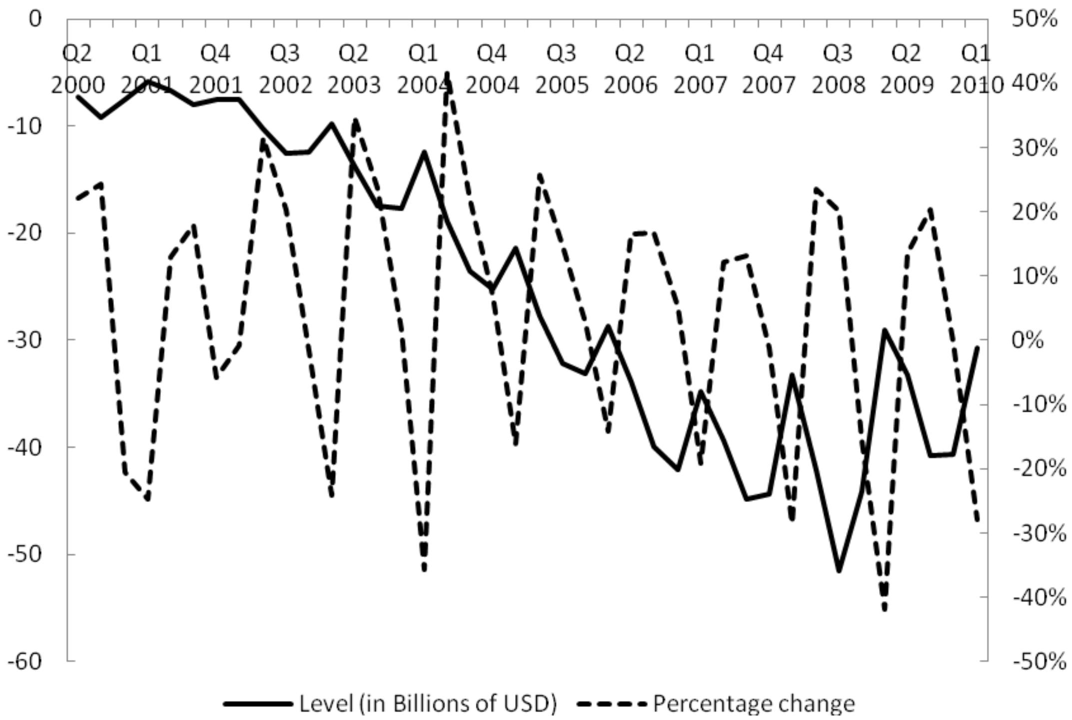
1 Introduction

As a mirror image of the global imbalances, external wealth held by emerging economies, China in particular, has been on the dramatic increase for the past decade (Lane and Milesi-Frretti, 2007; Eichengreen, 2009). A good part of this investment is in the form of international portfolio capital, with China being a prominent investor in US treasuries (Shen and Ng, 2008; Song, 2008). By September 2008, China became the largest holder of US treasury securities with a position of US$ 894.8 billion. In the meantime, US trade deficit with China reached US$ 51.53 billion (Figure 1), a reflection of excessive American consumption. The peculiar partnership of the American excess consumption and Chinese financial extravaganza raises the question of how long this company would last. Concerns have been raised in international research about the potential consequences if there is sudden stop to China's holdings

Figure 1 US Trade Balance with China (Q2 2000 – Q1 2010)



Source: Data extracted from the Table of Exports and Imports to the US reported by China, IMF Direction of Trade

of US treasuries (Dobbs, etc., 2010). Within China, doubts have also arisen by an increasingly agitating audience challenging the wisdom of this investment policy.

For one thing, over-concentration on the dollar instruments exposes China to the erratic movements in the dollar exchange rate in the era of global imbalances (Chen, 2009; Yu, 2009; Li, 2010). For the other, the continual hoarding of wealth abroad contrasts badly with the demand conditions in China. The Chinese domestic demand has been chronically weak and this is a chief reason why the country has to rely overly on investment as a main engine of growth (Tang and Feng, 2007). Pervasive overcapacity has ensued as a result and misallocation has been massive (Xia, 2009). Many domestic commentators claim that the weak domestic demand could have been helped with the resources that are now tied to the position in American treasuries (Dong, 2009; Zhang, 2009, Huang, 2010; Shen and Shao, 2010; Shi, 2010). Given all the adversities in this partnership, why China would continue to stockpile the American Treasury? Will this partnership in absurdity last long?

To explain this myth calls for a comprehensive study of the rationale behind China's policy choice, for which to the best of our knowledge no commonly accepted model currently exists. In this study, we develop a theoretical model with which we contribute to the understanding of the apparent incongruity in the Chinese policy. We seek to gain insights into the forces driving China's accumulation of the American Treasury that nurtures the unusual partnership. By taking the model to data and through analyzing impulse response functions and variance decomposition, useful policy advice may be generated.

A general equilibrium model is developed to capture the effects of different shocks on China's accumulation of American assets. We model a 'two-country' world where the home country is a small open economy facing the rest of the world. The model builds on the common settings of New Open Economy Macroeconomic (NOEM) models. In addition, we evoke the incomplete financial market assumption for the home economy and assume it incurs quadratic adjustment costs when changing investment levels. The incomplete market assumption is realistic in the Chinese context and is very useful to explicitly express changes in international asset balance, hence facilitating the empirical investigation. The quadratic cost function ensures stationarity in our system, making it possible the desirable analysis of impulse responses and variance decomposition. We include productivity shocks, own shocks of Chinese holdings of US treasuries and stocks to the exchange rate, interest rates and preferences in the model. A Bayesian approach is adopted to parameterize the model for the two countries, which provides the foundation to estimate the effects of the shocks. The sample period under examination is from 2000 Q2 to 2010 Q1 with quarterly data from China and the US. This period covers the beginning of the uncanny partnership and its subsequent developments.

We deploy the NOEM as our workhorse model for theoretical and empirical investigation. Relatively few works have examined external account within NOEM. Bergin (2006) empirically tests a NOEM model using G7 data and find that the model performs reasonably well for capturing dynamics of exchange rates and current account. In a general equilibrium approach with three trading partners, Obstfeld and Rogoff (2005) attribute a prominent role to the terms of trade effect in the adjustment of international imbalances. They assume that each of the three trading blocs (countries), namely the US, Europe and Asia, does not have identical preferences, but has a home bias in the consumption of tradables, such that each country has a relative preference for tradables that it produces and exports. Building on Obstfeld and Rogoff's (2005) model, Ferrero et al. (2008) develop a simple Dynamic Stochastic General Equilibrium (DSGE) model incorporating production and nominal price rigidities with a critical extension that endogenizes the dynamic adjustment path. Recently, the IMF has launched a series of research into the causes of the global imbalances. These research attempts are in the general spirit of the NOEM approach. The work by Batini et al. (2009) marks a beginning example of this development. Their research uses a flexible-price version of the dynamics general equilibrium model of the world economy developed at the Bank of Italy. In many aspects, this model shares features with the IMF's Global Economy Model (GEM) which is built on the NOEM as its theoretical foundation.

We concentrate on a critical aspect of the global imbalances, i.e. the extraordinary and continuing accumulation of the American Treasury by China. Our focus is not placed on the determination of the level of Chinese holdings of international assets per se, nor would we examine Chinese holdings of American assets as an investment choice and compare and contrast it to other investment outlets. We explore what drives China to continuously accumulate the position in the American Treasury.

Base on a DSGE model with incomplete financial markets, we unearth the evidence that in all probabilities China will continue to accumulate the US Treasury, so the unusual partnership will go on in the foreseeable future despite the absurdities existed in the Sino-American partnership have helped sponsor the global imbalances. The high volume of the Chinese holdings of the American Treasury has led to these holdings having their own lives and dynamics. The inertia effects dominate all other effects and will act as a dominant force keeping China to continue her accumulation of the US Treasury. Changes in the American consumer behaviour will have little effect on altering the trend. With or without these changes, China will continue to hold US treasuries. Once controlled for the inertia effect, transformation of the uncanny partnership would require China to maintain a very low interest rate for a fairly long period of time while the US adopts a substantially high interest rate. Meanwhile, there shall have sustainable and large improvements in productivity in both countries. We do not expect changes of these sorts and magnitudes are plausible. As such, the uncanny partnership between China and the US is likely be a lasting feature of the world economy.

The remainder of the paper is structured as follows. In Section Two, we construct the workhorse model and add portfolio adjustment costs to the basic settings. This model then is linearized to make it testable. Section Three develops our Bayesian methodology followed by simulation of the model using the Bayesian estimates. Then we carry out the analysis of impulse response functions and variance decomposition. The findings should be discussed in Section Three and Section Four concludes the paper.

2 The Model

In this section, we develop a general equilibrium model in the spirit of NOEM. The model is mainly based upon Gali and Monacelli (2005) who provides a small open economy framework. We also combine elements from but not limited to Obstfeld and Rogoff (1995) and Schmitt-Grohe and Uribe (2003) . An incomplete market setting is assumed for the financial sector and portfolio adjustment costs take the quadratic form. For a country that is capable of obtaining finance from the domestic financial market that is complete, the current account effect will be shut down. With incompleteness of financial markets, however, we can explicitly express the current account and international financial flows, providing a building block for subsequent theoretical and empirical exposition of the global imbalances. Another feature of our model is the incorporation of consumption habit subject to preference shocks, which enriches the features of the economy from the demand side.

2.1 Consumption and Preference

To make a presentation of the critical importance of interaction between China and America in the global imbalances, our model characterizes the world as consisting of two countries, i.e. a small open economy as the home country and the rest of the world that is a large open economy. In both economies, there is a representative household, respectively. Households maximize utility by choosing the level of consumption, work efforts and end of period holdings of assets or borrowing. The optimization problem of the household in the home country is given by:

$$\max_{C_\tau, N_\tau, B_\tau} E_0 \sum_{t=0}^{\infty} \beta^t V_t U_t \tag{1}$$

subject to

$$P_t C_t + \mathcal{E}_t B_t - \mathcal{E}_t \frac{\psi}{2}[B_t - (1+r^*_{t-1})B_{t-1}]^2 = W_t N_t + \mathcal{E}_t(1+r^*_{t-1})B_{t-1} + T_t \tag{2}$$

where β is the intertemporal discount factor. In expression (1), V_t denotes the process of possible changes in preference that affects the intertemporal choice of consumption and U_t is the utility function. In the budget constraints given by Equation (2), C_t is the consumption bundle, P_t the price index, and $\mathcal{E}_t$ the exchange rate. B_t represents the bond that is traded internationally. N_t refers to the work efforts which generate negative utility and W_t is the wage rate. T_t includes any transfer received or tax paid. Household has habit towards consumption and h indicates the persistency of consumption.

The utility function takes the form:

$$U_t = \frac{1}{1-\sigma}\left(\frac{C_t - \gamma h C_{t-1}}{A^*_t}\right)^{1-\sigma} - N_t \tag{3}$$

where A^*_t is the world technology process and γ is its steady state growth rate. Household has habit towards consumption and h indicates the persistency of consumption.

Apart from a standard assumption of contingent bonds, we assume that home household can have access to only a world traded bond B_t, through which we introduce incompleteness of the financial market. r_t^* is the interest rate of the bond denominated in foreign currency. The exchange rate of $\mathcal{E}_t$ is the price of per unit of foreign currency in terms of home currency. Given the non-stationarity of small open economy models, Schmitt-Grohe and Uribe (2003) introduce portfolio adjustment costs to induce stationarity. Instead of following their settings that the adjustment costs come from the differential between the prevailing level of bonds at each point of time and the long-run bond level:

$$\frac{\psi}{2}(B_t - \bar{B})^2 \tag{4}$$

we assume costs incurred when changing the level of bonds from that of the previous period:

$$\frac{\psi}{2}[B_t - (1 + r_{t-1}^*)B_{t-1}]^2 \tag{5}$$

Thus in the long run, the level of bonds will grow along a steady path:

$$\bar{B}_t = (1 + \bar{r}^*)\bar{B}_{t-1} \tag{6}$$

We assume away the possibility of financing or investing through a domestic financial market for simplicity. By our model construction, the difference between output and consumption is reflected in the net export, which is the source for financing international investment. This coincides with the fact that export proceeds by many small open economies are denominated in foreign currency. Converting earnings from foreign trade and then investing them in the domestic market incur costs including the transaction cost and exchange rate changes. These costs hold back future exports. While the home economy is a price taker on the international goods market, it could have some market powers in financial markets and affect the price of international assets when transacting them. These effects are captured by our assumption and could be reflected by a higher value for the coefficient on the adjustment costs ψ in the model.

Further assuming the uncovered interest rate parity, first-order conditions lead to the Euler equation of the consumption:

$$\frac{\beta P_t Z_{t+1}}{P_{t+1} Z_t}(1+r_t) = \frac{1-\psi[B_t-(1+r^*_{t-1})B_{t-1}]}{1-\psi[B_{t+1}-(1+r^*_t)B_t]} \tag{7}$$

where Z_t is the marginal utility of consumption:

$$Z_t = \frac{V_t}{A^*_t}\left(\frac{C_t-\gamma h C_{t-1}}{A^*_t}\right)^{-\sigma} - \frac{\beta\gamma h V_{t+1}}{A^*_{t+1}}\left(\frac{C_{t+1}-\gamma h C_t}{A^*_{t+1}}\right)^{-\sigma} \tag{8}$$

We linearize the equation around the initial steady path:

$$\begin{aligned} z_t =& \frac{\sigma\beta h}{(1-\beta h)(1-h)}c_{t+1} - \frac{\sigma+\sigma\beta h^2}{(1-\beta h)(1-h)}c_t + \frac{\sigma h}{(1-\beta h)(1-h)}c_{t-1} \\ & - \frac{\beta h}{1-\beta h}v_{t+1} + \frac{1}{1-\beta h}v_t + \frac{(1-\sigma)\beta h}{1-\beta h}a^*_{t+1} - \frac{1-\sigma}{1-\beta h}a^*_t \end{aligned} \tag{9}$$

Differences between the current and previous consumption levels and the current and expected future consumption levels affect the marginal utility of the household. The habit coefficient h controls the degree of persistence of the process. The higher is the persistence of consumption, the more reluctant is the household for changing consumption levels in the face of shocks to the economy. Also, high persistence degree of preference affects the changes in consumption as well. The preference process v_t also affects the utility from extra consumption. Linearization of the Euler equation leads to:

$$z_t = E_t\{z_{t+1}\} - E_t\{\pi_{t+1}\} + r_t - \frac{\psi}{\beta}E_t\{b_{t+1}\} + \psi b_t + \psi r_t^* - \beta\psi r_{t-1}^* \tag{10}$$

where z_t is $\log Z_t$ and π_t is the growth rate of Consumer Price Index (CPI) $d\log P_t$. b_t denotes the change rate of holdings of bonds $d\log B_t$. The Euler equation is different from a standard one since the adjustment costs for the current and next periods enter the equation.

While incompleteness of the financial market is assumed for the small open economy, we set the rest of the world to have a complete financial market. Furthermore, no costs are assumed for the rest of the world to incur when adjusting its financial positions. The world's Euler equation is given by:

$$\frac{\beta P_t^* Z_{t+1}^*}{P_{t+1}^* Z_t^*}(1 + r_t^*) = 1 \tag{11}$$

where Z_t^* is the marginal utility:

$$Z_t^* = \frac{V_t^*}{A_t^*}\left(\frac{C_t^* - \gamma h^* C_{t-1}^*}{A_t^*}\right)^{-\sigma} - \frac{\beta\gamma h^* V_{t+1}^*}{A_{t+1}^*}\left(\frac{C_{t+1}^* - \gamma h^* C_t^*}{A_{t+1}^*}\right)^{-\sigma} \tag{12}$$

Linearizing the world Euler equation and combining it with equation (10), we get the international risk sharing between the home and the rest of the world:

$$z_t = z_t^* - q_t + \psi b_t - \beta\psi r_{t-1}^* \tag{13}$$

where q_t is the real exchange rate of the home country. International risk sharing in our model deviates from the standard form of NOEM because of the adjustment costs of holdings of international bonds. Given that the home country does not change its external financial position:

$$b_t - \beta r_{t-1}^* = 0 \tag{14}$$

Equation (14) will reduce to the standard form $z_t = z_t^* - q_t$.

The consumption composite of the home household consists of home and foreign goods:

$$C_t = [(1-\alpha)^{\frac{1}{\eta}} C_{H,t}^{\frac{\eta-1}{\eta}} + \alpha^{\frac{1}{\eta}} C_{F,t}^{\frac{\eta-1}{\eta}}]^{\frac{\eta}{\eta-1}} \tag{15}$$

$C_{H,t}$ and $C_{F,t}$ are the consumption of home and foreign goods, respectively. η is the elasticity of substitution. α is the degree of openness, which is the share of foreign goods in total consumption, and is equal to the ratio of imports to GDP given initial zero trade balance. The corresponding price index for the home economy is:

$$P_t = [(1-\alpha)P_{H,t}^{1-\eta} + \alpha P_{F,t}^{1-\eta}]^{\frac{1}{1-\eta}} \tag{16}$$

Linearizing the above price index, we obtain the equation of the consumer price index in terms of producer price index (PPI) and changes in the terms of trade for the home economy:

$$\pi_t = \pi_{H,t} + \alpha s_t - \alpha s_{t-1} \tag{17}$$

where π_t is CPI and $\pi_{H,t}$ is PPI. s_t is the terms of trade defined as the ratio of price of imported to domestic goods, i.e. $s_t = p_{F,t} - p_{H,t}$. The relation between the real exchange rate and the terms of trade is defined as:

$$q_t = (1-\alpha)s_t \tag{18}$$

We further assume that both home and the rest of the world have a continuum of goods and consumption of the one differentiated goods has constant elasticity of substitution:

$$C_{H,t}(i) = \left(\frac{P_{H,t}(i)}{P_{H,t}}\right)^{-\epsilon} C_{H,t} \tag{19}$$

where ϵ is the elasticity of substitution between different brands of goods.

2.2 Market Equilibrium and Shocks

We follow standard assumption of production and do not consider changes in the capital labour ratio. The production function for the company producing brand i goods is linear in work efforts:

$$Y_t(i) = A_t N_t(i) \tag{20}$$

where $Y_t(i)$ is the real output and A_t is the specific productivity of the home country. Firms choose the price for both home and foreign demands and we also assume that the law of one price always holds. Moreover, we incorporate nominal rigidities in the production sector. Following the Calvo type stickiness, we allow a fraction $1-\theta$ firms to change price in each period. Firms that can adjust price $\bar{P}_{H,t}$ in the current period maximize their discounted expected profits:

$$\max_{\bar{P}_{H,t}} E_t \sum_{t=0}^{\infty} \theta^k Q_{t,t+k}[Y_{t+k}(i)(\bar{P}_{H,t}(i) - MC_{t+k}^N)] \tag{21}$$

where MC_t^N is the nominal marginal cost of production. The optimal price set at time t satisfies the following equation:

$$E_t \sum_{k=0}^{\infty} (\theta\beta)^k Q_{t,t+k} Y_{t+k} \left(\bar{P}_{H,t} - \frac{\epsilon}{\epsilon - 1} MC_{t+k}^N \right) = 0 \tag{22}$$

Aggregating the new price for $1-\theta$ firms that newly set their prices and the θ firms that keep their previous price, the price for home goods is given by:

$$P_{H,t} = [\theta P_{H,t}^{1-\epsilon} + (1-\theta)\bar{P}_{H,t}^{1-\epsilon}]^{\frac{1}{1-\epsilon}} \tag{23}$$

We linearize equation (22) and (23) around the perfect foresight, zero inflation steady state to get:

$$\pi_{H,t} = \beta\pi_{H,t+1} + \frac{(1-\theta)(1-\beta\theta)}{\theta} mc_t \tag{24}$$

where mc_t is the log real marginal cost:

$$mc_t = -z_t - a_t + \alpha s_t \tag{25}$$

s_t is the terms of trade of the home country. Home productivity improvement reduces the marginal cost of the home production. Foreign production and prices have similar setup and we do not display foreign counterpart equations for the economy of space.

Under our small open economy assumption, home household is a price taker of international goods. The imports of international goods by the home household assume only a negligible fraction of the total output of the world. Therefore total consumption of the rest of the world equals its total output in our model (in approximation):

$$c_t^* \approx y_t^* \tag{26}$$

However, the world demand for home goods consists of a non-negligible fraction of home outputs. Given zero initial trade balance, world demand affects home production proportionally, and is also subjects to changes in the terms of trade and in the real exchange rate:

$$y_t = (1-\alpha)c_t + \alpha c_t^* - \eta\alpha s_t - \eta\alpha q_t \tag{27}$$

Our assumption of one internationally traded financial asset allows us to explicitly express changes in international asset balance. Together with quadratic portfolio adjustment cost, this also introduces stationarity to the model, which proves useful for later empirical analysis. Given the budget constraint of the home economy, we further assume that all profits from the production sector are transferred to the home household in the same period, thereby the resource constraint becomes:

$$P_tC_t + \mathcal{E}_tB_t - \mathcal{E}_t\frac{\psi}{2}[B_t - (1+r^*_{t-1})B_{t-1}]^2 = Y_tP_{H,t} + \mathcal{E}_t(1+r^*_{t-1})B_{t-1} \quad (28)$$

We linearize this equation around a zero initial trade balance $P_0C_0 = Y_0P_{H,0}$:

$$b_t = \frac{1}{\phi}y_t - \frac{1}{\phi}c_t - \frac{\alpha}{\phi}s_t + \beta r^*_{t-1} \quad (29)$$

where ϕ is the initial ratio of the level of bonds to the output $\mathcal{E}_0B_0/P_0C_0$. If the relative price of the small economy to the rest of the world remains unchanged and the home country does not adjust its positions in bonds, the trade balance continues to hold, i.e. we have $c_t = y_t$. Adjustment costs are not present in this equation since they are of negligible magnitude relative to the level of bonds after linearization, while they show up in the Euler equation and international risk sharing that we demonstrated previously. Depreciation of the exchange rate, through the terms of trade effect, leads to higher level of output for the home economy. Home productivity growth should lead to a decrease in the level of foreign assets. Consumption increases after a positive productivity shock, since higher output increases the expectation of future consumption and affects current consumption according to the Euler equation. Though consumption does not go into the long-run level immediately; nevertheless the consumption increase could still be larger than that of production, which is restricted by sticky prices. The gap between consumption and income then is financed by a decrease in international assets.

Five categories of exogenous shocks are present in our model, including shocks to productivity, the own stock of holdings of US treasuries by the home country, and shocks to the exchange rate, interest rates and preferences. Productivity of both home and world households follows an AR(1) process:

$$a_t = \rho_a a_{t-1} + \epsilon_{a,t} \tag{30}$$

$$a_t^* = \rho_a^* a_{t-1}^* + \epsilon_{a,t}^* \tag{31}$$

We introduce shocks to the level of bonds held by the home economy:

$$b_t = \frac{1}{\phi} y_t - \frac{1}{\phi} c_t - \frac{\alpha}{\phi} s_t + \beta r_{t-1}^* + \epsilon_{b,t} \tag{32}$$

Given our focus on explaining Chinese accumulation of US treasury securities, we use data published by the US Treasury International Capital System, $\epsilon_{b,t}$ serves as the measurement error for our treasury securities data. Also, $\epsilon_{b,t}$ can indicate the magnitude of unexplained investment position changes.

Lubik and Schorfheide (2005) examine the NOEM model in explaining high volatility of the exchange rate. They document large unexplained exchange rate fluctuations, which we define as exchange rate shocks. This eases our analysis of exchange rate shocks as a possible force driving changes in international asset position. The exchange rate affects the dynamics of the terms of trade:

$$s_t = s_{t-1} + e_t + \pi_t^* - \pi_{H,t} + \epsilon_{e,t} \tag{33}$$

Assuming monetary policies of the two economies both follow the Taylor rule, we examine the relations among the monetary policies, inflation and productivity growth:

$$r_t = \rho_r r_{t-1} + (1-\rho_r)[\psi_1 \pi_t + \psi_2(y_t - y_{t-1})] + \epsilon_{r,t} \tag{34}$$

$$r_t^* = \rho_r^* r_{t-1}^* + (1-\rho_r^*)[\psi_1^* \pi_t^* + \psi_2^*(y_t^* - y_{t-1}^*)] + \epsilon_{r,t}^* \tag{35}$$

Preference shocks serve as shocks from the demand side in our model. Differing from Rabanal and Tuesta (2006), we do not assign other shocks to the demand functions:

$$v_t = \rho_v v_{t-1} + \epsilon_{v,t} \tag{36}$$

$$v_t^* = \rho_v^* vt - 1^* + \epsilon_{v,t}^* \tag{37}$$

Our model is closed by equations of the marginal utility (9), Euler equations (10), optimal pricing (24), real marginal cost (25), goods market clearing condition (26), monetary policy (34), and their foreign counterparts. We further need equations of international risk sharing (13), price index (17), the real exchange rate (18), asset positions (29), and productivity (30) (31) and preference (36) (37) process. By now we provide an explicit testable general equilibrium model for the analysis of the economies of question.

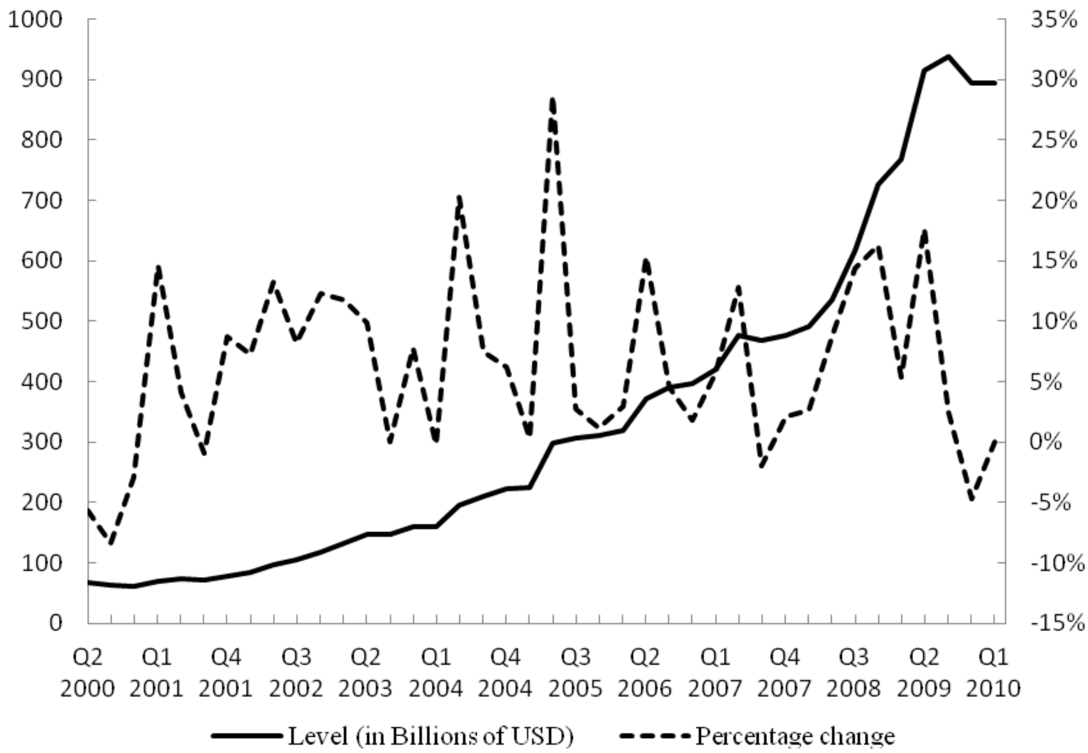
3 China's Continual Accumulation of US Treasuries

Our theoretical underpinning provides a testable model for investigating into the dynamics of the economy facing different types of shocks. We estimate our model using the Bayesian method using data from China and the US. The estimates enable us to infer the behaviour of the two economies. Impulse response functions and variance decomposition then are analyzed to explore what may happen to China's purchase of US assets, given the parameter values obtained from the estimation.

3.1 Data Description and Selection of Priors

Information of holdings of US securities by foreign country was first published by US Department of the Treasury through the Treasury International Capital System in 2000. The statistical data include those on U.S. financial accounts with foreigners excluding direct investment. Our sample period for estimation is thus chosen to cover 2000 Q2 to 2010 Q1. Figure 2 plots the level of and percentage changes in the holdings of the US Treasury by China. The level has steadily increased since 2000, and is almost doubled after 2008. During the sample period, the average growth rate before 2008 was 6.13 percent and 6.98 percent afterwards. Although after the second quarter of 2009 the growth seems to be stationary, there is no tendency of a reversal.

Figure 2 Holdings of US Treasury Securities (China, mainland Q2 2000 – Q1 2010)

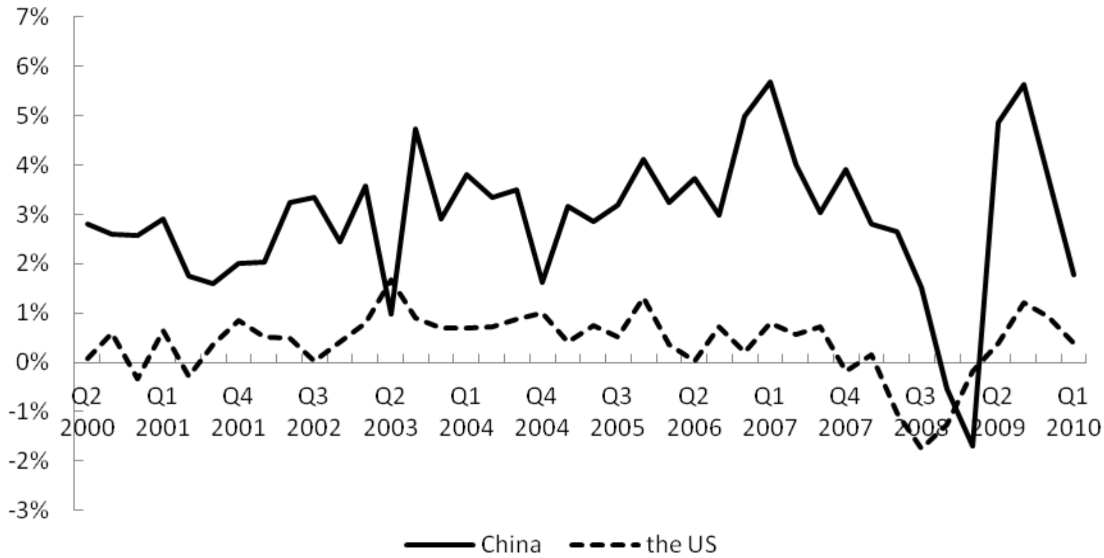


Source: Data extracted from the table on major foreign holders of treasury securities, Treasury International Capital System, accessed 16 November, 2010

In addition to the growth rate of Chinese holdings of US treasuries, we also use variables such as growth rates of real Gross Domestic Product (GDP), CPI and the exchange rate, and the interest rate for our empirical exposition. The real GDP growth rate of the US is sourced from the series GDPC96 of Federal Reserve Economic Data (FRED). For China, we use the nominal GDP and deflate it by GDP deflator, both obtained from IMF International Financial Statistics (IFS). The US real GDP are adjusted seasonally. To be consistent with the US, we also seasonally adjust the Chinese real GDP data by using the X-12 ARIMA.

Figure 3 shows the percentage growth of real GDP of both countries. China's real

Figure 3 Percentage Changes in Real GDP (Q2 2000 – Q1 2010)



Sources: For US: GDPC96, FRED; For China: GDP deflated by CPI, IMF IFS.

growth is considerably higher than that of the US. But China's growth shows greater volatility, which is likely caused by more volatile productivity improvements, among other things. Effects of productivity improvements on changes in China's holdings of international assets will be tested later.

The US CPI growth rate is from FRED‘s Consumer Price Index for All Urban Consumers (CPIAUCSL) and that of China uses data published by IMF‘s IFS. The dataset is seasonally adjusted using the method mentioned above. The US interest rate is the effective Federal Funds Rate or FEDFUNDS. For the interest rate of China, we collect the 3-month treasury securities rate. Both interest rates and the RMB-USD exchange rate are from IMF's IFS. Table 1 displays the descriptive statistics of the variables. The mean quarterly real GDP growth of China is 2.9 percent while the US

Table 1 Descriptive Statistics of Data Series (in percentage)

	Real GDP growth		CPI rates		Interest rates		Changes in RMB/USD exchange rate	Growth of US Treasuries held by China
	China	US	China	US	China	US		
Mean	2.9358	0.3961	1.9035	0.6037	0.6421	0.6702	-0.4820	6.3219
Standard deviation	1.4199	0.6517	2.3892	0.7379	0.1912	0.4850	0.8592	7.5785
Skewness	-0.8113	-1.2677	0.9403	-1.2728	0.7430	0.3601	-2.0546	0.5596
Excess Kurtosis	1.8587	2.2118	0.2687	4.8295	0.2857	-1.1952	3.9001	0.3399

Sources: Database of FRED, and IMF International Financial Statistics.

scored 0.4 percent during the period under examination. Standard deviations of real GDP growth for China and the US are 0.0144 and 0.0066, respectively. China growth is more volatile than the America's since China's standard deviations more than double that of the US.

We estimate our two country general equilibrium model using the Bayesian method (see Fernández-Villaverde, 2009 for the empirical estimation of DSGE models). Since Bayesian updates posterior distribution of parameters of the data based on prior settings, choice of priors is critical to the posteriors (Del Negroa and Schorfheideb, 2008). We follow Rabanal and Tuesta (2006) to set the intertemporal discount factor β to be 0.995, with the rest parameters unrestricted. Generally, priors for other parameters are similar as the settings in Lubik and Schorfheide (2005). In Table 2, we

Table 2 Prior and Posterior Distributions

	Prior means	Posterior means	Posterior confidence intervals		Distribution	Standard deviations
			Parameters			
α	0.06	0.1580	0.1473	0.1733	beta	0.05
ρ_a	0.60	0.6622	0.6137	0.7032	beta	0.10
ρ_a^*	0.60	0.8598	0.8435	0.8772	beta	0.10
σ	2.00	3.1163	2.9767	3.2648	gamma	0.50
h	0.30	0.6576	0.6291	0.6813	beta	0.10
h^*	0.30	0.8944	0.8901	0.8975	beta	0.10
θ	0.50	0.9511	0.9491	0.9529	beta	0.10
θ^*	0.50	0.8919	0.8845	0.8992	beta	0.10
η	1.00	1.1926	1.0685	1.3358	gamma	0.50
ρ_r	0.50	0.4604	0.4026	0.5404	beta	0.20
ψ_1	1.50	2.1951	2.1223	2.2706	gamma	0.20
ψ_2	0.50	0.3158	0.2747	0.3705	gamma	0.20
ρ_r^*	0.50	0.3521	0.3089	0.3924	beta	0.20
ψ_1^*	1.50	1.2679	1.2106	1.3140	gamma	0.20
ψ_2^*	0.50	0.7761	0.7289	0.8163	gamma	0.20
ρ_v	0.60	0.8715	0.8263	0.9069	beta	0.10
ρ_v^*	0.60	0.5791	0.5624	0.5998	beta	0.10
ψ	4.00	4.1706	4.0919	4.2392	gamma	0.20
ϕ	0.18	0.9570	0.862	1.0530	gamma	0.10
			Standard deviations of shocks			
ϵ_a	1.00	2.8793	2.5387	3.2040	inverse gamma	0.50
ϵ_a^*	0.50	2.3754	2.1825	2.5703	inverse gamma	0.50
ϵ_r	0.40	0.0752	0.0611	0.0873	inverse gamma	0.50
ϵ_r^*	0.40	0.0655	0.0577	0.0759	inverse gamma	0.50
ϵ_v	0.50	0.5907	0.4636	0.7622	inverse gamma	0.50
ϵ_v^*	0.50	0.2875	0.2552	0.3189	inverse gamma	0.50
ϵ_e	1.00	0.2590	0.2265	0.3005	inverse gamma	0.50
ϵ_b	1.00	0.2941	0.2372	0.3499	inverse gamma	0.50

display our assumptions of mean, standard deviation and type of probability distribution of priors. Both home and foreign economies have the same risk aversion coefficient σ and the intratemporal elasticity of substitution η. The degree of openness α is the ratio of imports to GDP of China by the end of 2009. ϕ is the steady state ratio of foreign asset balance to GDP and we use the ratio of Chinese holdings of the US Treasury to China's GDP in 2009. We assume large standard deviations for the exchange rate and the measurement error of shocks to international investment positions. The type of the distribution function is set according to the range of domain of parameters.

3.2 Posteriors and Simulation

The estimates of the parameters and standard deviations of the shocks reported in Table 2 enable us to empirically test the model using real-life data. Using these parameter values and standard deviations, we carry out stochastic simulations and to generate impulse response functions. The outcome reflects the effects of different shocks on the economies in the system under examination. Variance decomposition is also performed after the simulation to find out that to what extent individual shocks have contributed to the volatility of the variables.

It is claimed that the Bayesian estimator sometimes would suffer from the problem that only a few coefficients remain un-updated and the posteriors found are too close to the priors. In our estimation, however, most coefficients are updated and they are considerably different from the priors, suggesting that the model behaves well. The habit coefficient of consumption h for China and the US are 0.6576 and 0.8944, respectively. In the face of the shocks, the higher is the value of the habit coefficient, the more reluctant household is to change the consumption level since changing the current consumption level would lead to less utility in the next period. Given this, we expect more persistent consumption dynamics for the US than for China. The estimated coefficient value of ψ is 4.1706, which means that the adjustment costs incurred for changing foreign positions are considerable. The largest shock to the two economies comes from productivity, which is 2.893 for China and 2.3754 for the US. Productivity shocks to China are more volatile than that to the US. From the estimation, the standard deviation of the changes in the American assets held by China b is 0.2941.

Based on the estimates of parameters and standard deviations of the shocks, we then simulate our model and calculate impulse responses to a unit change in different shocks, measure as changes in one standard deviation. Figures 4 to 11 plot the impulse response functions (IRFs) to different shocks of the Chinese holdings in the US Treasury b, home and foreign consumptions c and c^*, CPI inflation π and π^*, the exchange rate e, and the output y and y^* for 40 quarters. Most variables return to the steady state after 40 periods and therefore we report IRFs corresponding to these periods.

It can be seen from Figure 4 that the strongest influence driving the changes in Chinese accumulation of the American Treasury is from the own shock of China's asset position itself. Changes by one standard deviation of the own shock of ϵ_b would

Figure 4 Impulse Response Functions of b

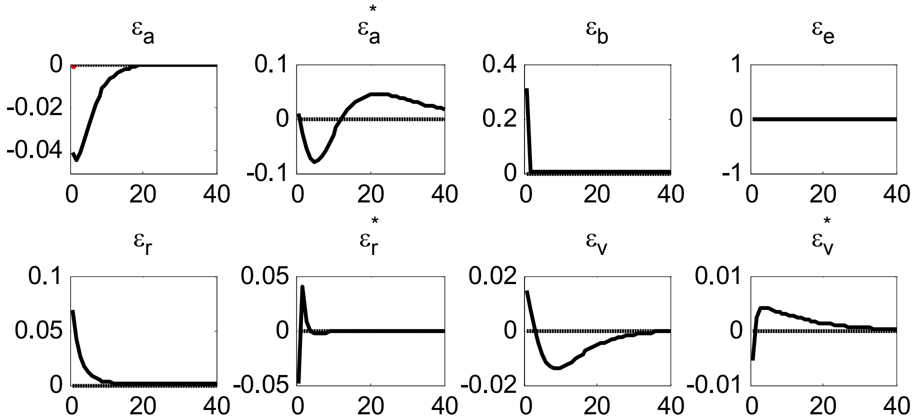


Figure 5 Impulse Response Functions of c

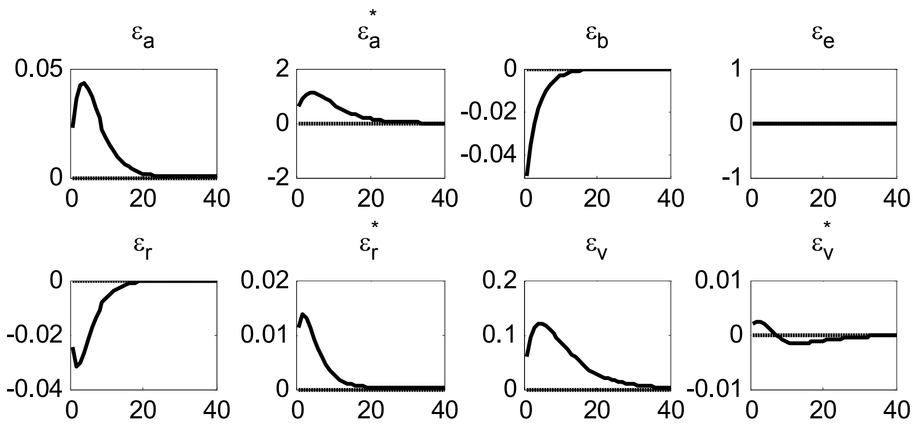


Figure 6 Impulse Response Functions of c^*

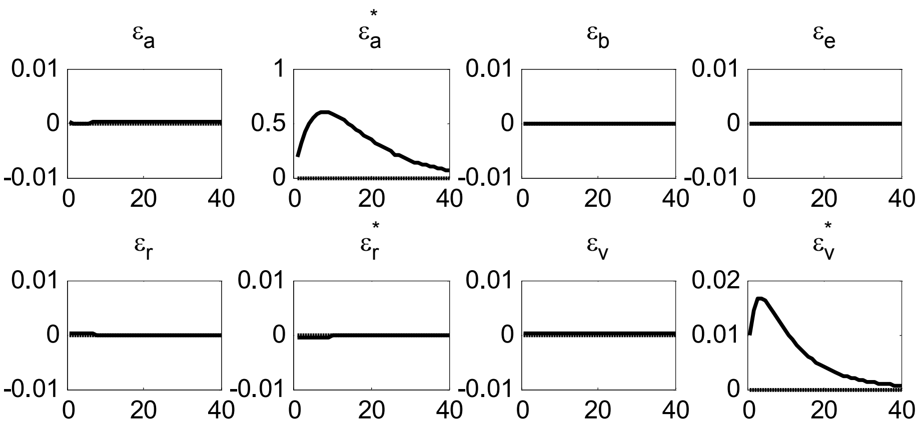


Figure 7 Impulse Response Functions of π

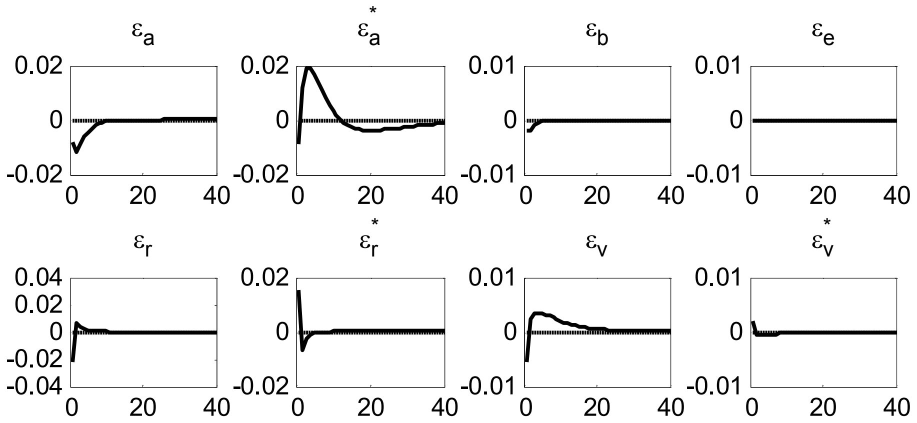


Figure 8 Impulse Response Functions of π^*

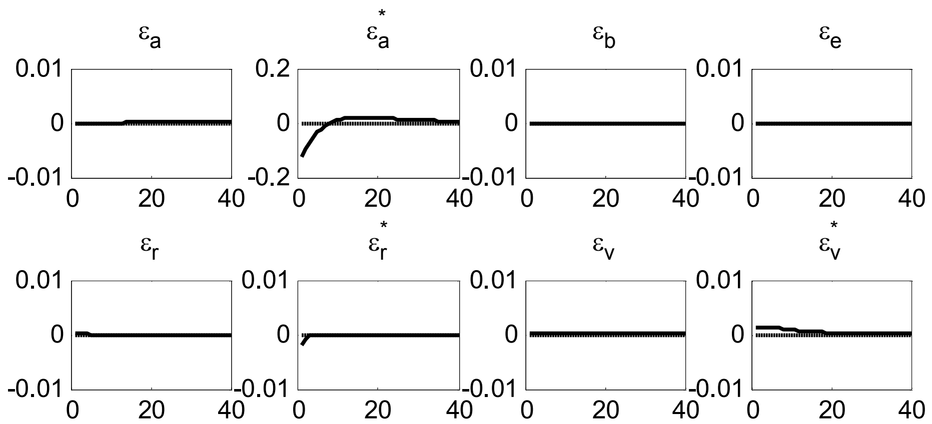


Figure 9 Impulse Response Functions of e

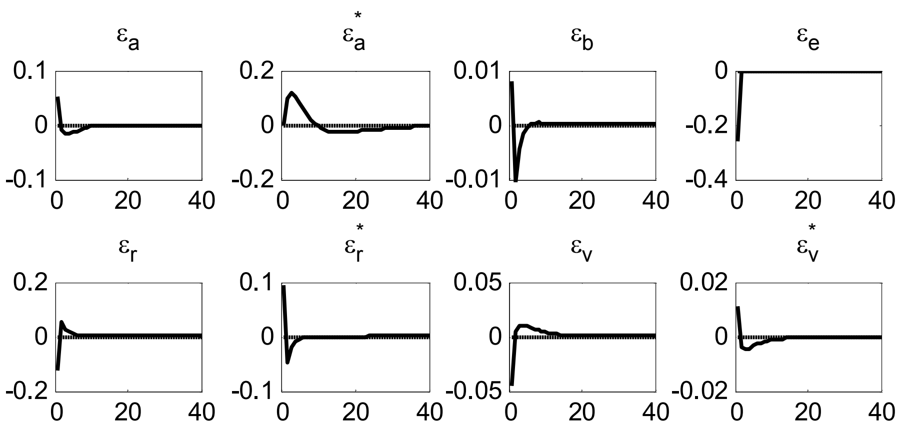


Figure 10 Impulse Response Functions of y

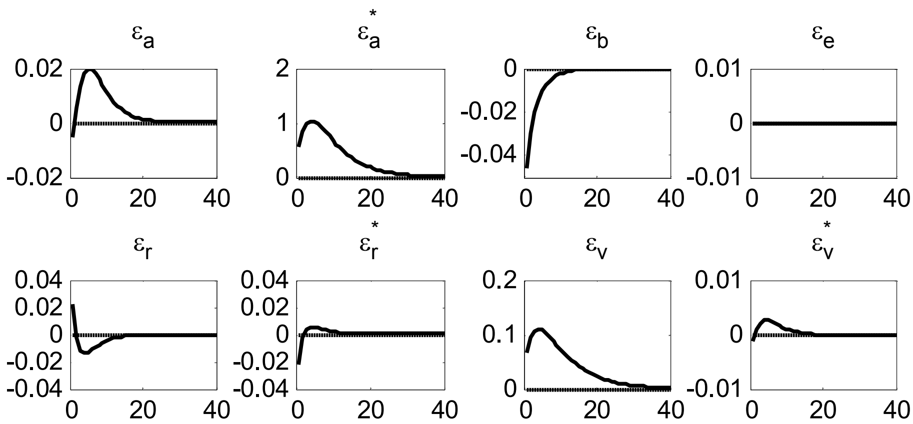
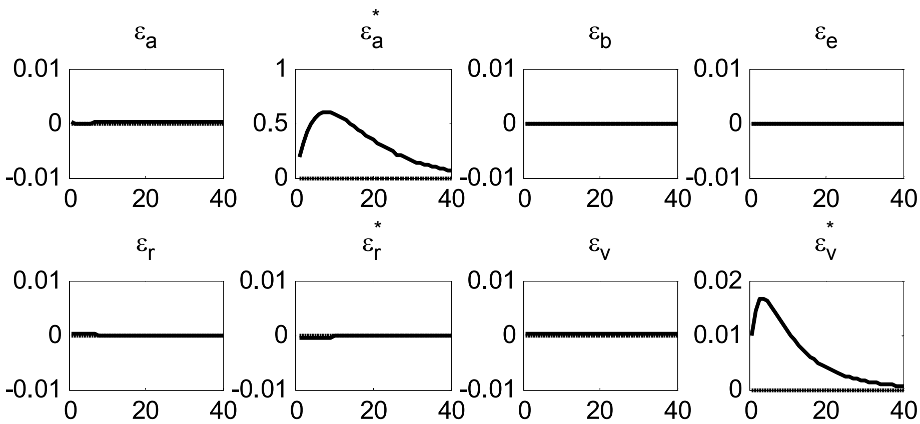


Figure 11 Impulse Response Functions of y^*



induce a 30.92% contemporaneous change in the position in the current period, which is the largest in magnitude of all responses to shocks. So it is the dominant influence in the system. But the effects do not last long since it quickly diminishes into zero after just one period. This is very much like the clustering of financial time series in the short run and seems statically related to the auto-correlation of the time series. From a finance perspective, this effect is likely related to the management inertia by fund managers of Chinese external wealth. It is plausible that these fund managers have adopted a passive investment strategy that “follows the trend” to just add up more American treasuries when new foreign exchange proceeds are acquired by China. This practice is not uncommon among designated fund managers of government assets around the world. It is also likely that an internal governance factor is at work here. The US treasuries are fixed income instruments. Adoption of a passive investment strategy means that Chinese official fund managers will not frequently buy and sell these instruments, but hold them to maturity in general cases. Given the fixed income nature of these instruments, Chinese fund managers tend to be assessed by the size of the assets under their management rather than the returns. This may lead to these managers piling up the US Treasury if possible. Given these reasons, we may call the effect of this sort as the inertial effect. This effect comes from the decision of the policy maker and cannot be explained by the behaviour of household.

The second strongest influence is from the shocks of the interest rates, home and abroad. With a change of one standard deviation in the shocks to the home interest rate ϵ_r, China’s holdings of American assets will shot up by more than 6.88 percent immediately in the current period, and keep on a positive note of greater than 1 percent thereafter, though with a declining acceleration, until after 5 time periods. This is to be expected since higher interest rates induce a reduction in consumption as shown in Figure 5, which encourages household savings. Some of the savings incremental will translate into additional holdings of the American Treasury. The effects of a positive change in the world interest rate are a different story. After a very brief dip, China's accumulation would climb to the new high. For China, a higher American interest rate means lower opportunity cost and higher returns on its portfolio investment. Adding more US treasuries to its stocks is therefore a sensible thing to do. Other things being constant, the addition in the short run has to come mainly from portfolio rebalancing. As such, the accumulation of this type could not keep going for long. The growth then quickly falls back to its steady state as shown in Figure 5.

Responses of the Chinese accumulation to productivity shocks are negative initially, but bounce back to the steady state later on. The decrease in b due to productivity shocks is 4.44 percent in the current period. The decrease diminishes with the passage of time, and returns back to the steady path about 9 periods after the shock. It is conceivable that with improved productivity, households will choose a higher level of consumption is predicted by our theoretical model and is also shown in the impulse response functions in Figure 5. Other things being equal, this will make fewer resources available to the home household for financing the purchase of US assets. Responses to a productivity shock originated from the US are of a similar pattern.

It is interesting to see how American consumption interacts with China's stockpiling of US assets. Our results suggest that, as a demand side shock, the preference shocks of home and the word households have only mild effects. From Figure 4 we observe that, for a positive one unit change in the preference of home consumer the Chinese accumulation of American assets registers a contemporaneous increase of 1.47 percent and then quickly drops to negative after 3 periods, with the subsequent decrease being 1.41 percent.

To gain insights into how the uncanny partnership may evolve, it is perhaps more important to examine the behaviour of American consumers given a unit change in the American consumption preference. It is hard to imagine that there will be any fundamental change to American consumers' habit and propensity any time soon. But even if they do, from Figure 6 we see that a unit negative change in the American consumption preference is associated with a negative change by 1.68 percent. On the production front, from Figure 11, the American output will also decline by 1.68 percent as well for a unit reduction in the consumption preference. For China's build-up of US treasuries, its responses to foreign preference change are even milder. Contemporarily, there is an immediate drop of 0.5 percent in response to one unit change in the US consumption preference, but this is reversed fairly quickly as the accumulation moves back to its steady state path in only 1 period. On the whole, changes in the US consumption preference will hardly affect China's hoarding of US treasuries.

For consumption and output, their responses to productivity shocks are collected in Figures 5, 10 and 11, respectively. Figure 5 shows that consumption increases by 4.34 percent with a unit change in home productivity shocks ϵ_a, which die out after 12 periods. From Figure 10 we observe an increase of about 1.98 percent in output in response to one standard deviation change in the productivity shocks and then the production growth moves back to the steady path in about 10 periods.

We note, however, the responses of consumption and output to ϵ_b are in the negative territory. A unit increase in the inertia shocks of ϵ_b would immediately suppress both consumption and output by 4.99 and 4.63 percent, respectively. Finally, we find no effect of the Renminbi exchange rate on China's accumulation of American treasuries. It is probable that the performance of Chinese official investment in the US Treasury is evaluated in dollar, rather than the Renminbi. So the Renminbi returns on the investment are immaterial to Chinese official fund managers. We conjecture that if the Renminbi is instead used as the numeraire, things could be interestingly different.

Table 3 shows contributions of different shocks to volatilities of the relevant variables through the variance decomposition analysis. Evidence from the decomposition gives further support to our previous finding that changes in the position b are mostly explained by changes in its own shocks. This is shown in the evidence that ϵ_b accounts for about 52% of the variance of b. So, the own shock of the position in American assets are also a dominant factor contributing to the changes in Chinese holdings of the American Treasury. Changes in the world productivity ϵ_a^* are the second largest influence that contributes to the volatility of China's position in the US Treasury, given its share is 36%. But from the graph of impulse response function of

Table 3 Variance Decomposition of Variables by Shocks (in percentage)

	ϵ_a	ϵ_a^*	ϵ_r	ϵ_r^*	ϵ_v	ϵ_v^*	ϵ_e	ϵ_b
b	4.79	35.58	4.21	2.24	1.25	0.10	0.00	51.83
e	2.26	35.25	12.04	7.20	1.56	0.14	41.44	0.12
c	0.12	98.43	0.04	0.01	1.35	0.00	0.00	0.05
c^*	0.00	99.95	0.00	0.00	0.00	0.05	0.00	0.00
y	0.03	98.74	0.01	0.01	1.17	0.00	0.00	0.04
y^*	0.00	99.95	0.00	0.00	0.00	0.05	0.00	0.00
π	10.64	58.49	17.23	9.41	3.74	0.19	0.00	0.30
π^*	0.00	99.95	0.00	0.01	0.00	0.04	0.00	0.00

b (Figure 4), we already know that its effects tend to induce the position to fluctuate upwards and downwards. In the first few periods, its effects on China's holdings of the American Treasure are negative and then become positive after 12 periods. So the effects of this type of shocks are mixed.

Effects of the home interest rate policy on the position reflect, to some extent, the optimal choice of the home household. Changes sourced from this shock account for 4.21 percent of the total volatility of China's foreign asset position. Similar are the effects of productivity changes in the home country, which are 4.79 percent of the total, and so are relatively moderate as well. On the whole, the total contribution of these two variables to the volatility of China's stocks of American assets is mild.

4. Conclusion

The combination of American spending excess and China's extraordinary accumulation of US treasuries represents a strange partnership between the two nations that has widely been perceived as a major promoter of the global imbalances. To facilitate rebalancing the world economy, it is critical to understand the dynamics of this uncanny partnership. The current study concentrates on the Chinese side of the story by developing a general equilibrium model to explore, despite its apparent futility, to what extent China would continue to hoard US treasury securities,. Evidence from our model simulation and analysis of the impulse response functions and variance decomposition suggests that the inertia effect is the most powerful influence driving the continuation of the stockpiling. China's holdings of the American Treasury are so large that the management of this colossal wealth has its own life and dynamics. Behavioural factors of the Chinese fund manager and the internal governance elements have played a credible role in developing the inertia. Given this, at least in the short run there shall be no sudden stop for China's continual accumulation of American assets.

In the longer run, however, the interest rates and productivity improvement in China and around the world play a lasting role. A positive change in the Chinese interest rate will induce an increase in China's accumulation of US treasuries, plausibly through its squeeze effect on consumption. In response to a positive change in the world interest rate, the accumulation will briefly drop but soon a reversal will occur to take the response to the balance. Responses of the Chinese accumulation to productivity shocks are negative initially since the home household will choose to consume more given the improvement in productivity, hence fewer resources would become available for buying US assets. The effects of consumption preference shocks are meek in general. There is hardly evidence that changes in the US consumer behaviour will fundamentally change China's continual hoarding of US treasuries. Given that the returns of Chinese investment in US treasuries are evaluated in dollars, we find no effect of the Renminbi exchange rate. In future research, shifting the numeraire currency when assessing China's investment performance may bring on interesting differences in the outcome.

Putting these effects together, China's accumulation of US treasuries is likely to continue despite all the absurdity of the Sino-American partnership that has helped sponsor the global imbalances. The largeness of the Chinese holdings of the American Treasury has led to the management of these holdings establishing its own life and dynamics. The inertia effects dominate all the other effects and will as a dominant force keep China continuing the accumulation of US treasuries. It is unrealistic to expect that there will be significant changes in the American consumer behaviour and our evidence show that, even these changes can occur, they will have little effects on altering the trend. Controlled for the inertia effect in the long run, transformation of the uncanny partnership would require China to keep a very low interest rate for a fairly long period and the US to adopt a substantially high interest rate. Moreover, there shall have sustainable and large improvements in productivity in both countries. We do not expect that changes of these types and magnitudes are forthcoming any soon. As such, the uncanny partnership between China and the US could be a lasting feature of the world economy.

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