

What drives China's Current Account?*

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Abstract

The paper offers an empirical taxonomy of the factors driving China's current account. A simple present-value model with non-tradeable goods explains more than 70 percent of current account variability over the period 1982-2007, including the persistent surpluses since 2001. Expected increases in the prices of non-tradeables (e.g. housing and medical care) and expected declines in net output (GDP less investment and government spending) are the main channels of external adjustment. Much of China's current account surplus seems driven by shocks that have global effects by persistently depressing the world real interest rate. This is consistent with recent theoretical models that suggest that factors related to China's domestic financial development are key in understanding global imbalances.

JEL CLASSIFICATION: F32, F30, F40

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1 Introduction

China's persistent current account surplus has attracted considerable academic and public attention in the last years. It is often regarded as one of the main sources of a perceived imbalance in global capital flows and as the mirror image of the persistent U.S. trade deficit.

While a range of explanations have been discussed for China's surplus, surprisingly few attempts have been made to assess the relative merit of different mechanisms of China's external adjustment in a simple, unified theoretical framework.¹ This is what I seek to do in this paper. As the base of my empirical analysis, I use a simple intertemporal model of the current account with non-tradeable goods in the mould of Bergin and Sheffrin (2000). The model nests four basic channels of external adjustment: i) consumption smoothing, ii) net factor income payments, iii) consumption tilting due to expected changes in the world real interest rate and iv) consumption-tilting due to expected changes in the real exchange rate.

The main results can be summarized as follows: first, the simple model can explain more than 70 percent of the variation in China's current account over the period since 1982. It also explains most of the run-up in the Chinese current account surplus since the beginning of the decade. This result may in itself be surprising since it is probably fair to summarize the tenor of the recent debate as implying that the textbook model (see e.g. Obstfeld and Rogoff (1995), ch. 2) would not fit China's recent experience. Turning to the channels of external adjustment, I identify consumption tilting due to expected rises in the relative price of non-tradeable goods and consumption smoothing (expected declines in net output growth) as the key factors. Net factor income plays only a negligible role whereas expected changes in the world interest rate are negatively correlated with China's

¹ See e.g. Gruber and Kamin (2007) for a panel study of Asian surpluses.

current account.

I assess the robustness of my conclusions to various changes in the definition of China's external surplus and the definition of the real exchange rate. Some recent analyses have emphasized the role of trade mis-invoicing and measurement error in China's current account balance (see Lane and Milesi-Ferretti (2007), Zhang (2008)). To assess the importance of these issues for my conclusions, I also present results based on alternative calculations of China's external balance based on Zhang (2008). These changes do not affect the main result though: the model still replicates most of the variability in China's current account patterns, including the run-up of surpluses in the last couple of years.

How can these findings be interpreted? First, at a general level, it is surprising that a simple intertemporal model without frictions seems to fit some key aspects of the data so well. This would seem to be at odds with the bulk of the literature that has emphasized the importance of various frictions for the explanation of why capital tends to flow uphill, i.e. from major emerging markets to developed economies, primarily the US (see e.g. Caballero, Farhi and Gourinchas (2008), Mendoza, Quadrini and Rios-Rull (2009) and Song, Storesletten and Zilibotti (2011)). I make the following remarks: first, the frictionless model here is used as a vehicle to collect and structure a set of stylized facts, not as a definite theoretical description of the underlying mechanisms. This follows the approach taken in a series of recent papers on emerging market macroeconomics that have argued that simple, almost stylized models fit the data for these economies quite well provided the moments of some key shocks are changed vis-à-vis the typical specification chosen for already developed economies.² Secondly, much of my empirical analysis rests on the log-linearization of an intertemporal budget constraint which itself is based on a relatively limited set of theoretical assumptions. As I go along, I discuss in detail in which way the

²For example, Aguiar and Gopinath (2007) argue that a higher variance of trend shocks to total factor productivity can explain why net exports are more anticyclical in emerging than in developed markets. For a similar setup see also Neumeyer and Perri (2005). None of these papers denies the importance of frictions in explaining business cycles in emerging markets—quite to the contrary. But they argue that these frictions manifest themselves rather in changes in the structure of shocks, and not so much in the structure of the basic model. This insight allows the basic model to be used as a vehicle to collect and discuss stylized facts.

potential presence of financial frictions affects the interpretation of my results.

To my knowledge, this paper provides the first taxonomy of the broad macroeconomic mechanisms – adjustment in (intertemporal) prices vs adjustment in quantities (output, investment government spending) – through which China’s external adjustment can be expected to occur. It is not my aim to pin down a single mechanism that can explain China’s high savings rate, which according to Yang, Zhang and Zhu (2010) has many causes and remains a ‘puzzle’. However, I discuss at a more specific level how certain mechanisms that have been proposed in the literature could plausibly map in to the broad channels of adjustment that I identify in my analysis.

To start, there are a number of possible interpretations of my finding that expected changes in the price of non-tradeable goods drive China’s current account: the declining provision of public services (medical care, education) and housing in China and the ensuing rise in the price of these non-tradeable goods and services present a strong incentive for private households to save. This ‘breaking-of-the-iron-rice-bowl’ interpretation is in line with micro-data evidence as reported in e.g. Chamon and Prasad (2010) who identify exactly these factors as the drivers of the secular increase in the savings rate of Chinese private households during the 1980s and 1990s.³ China’s changing demographics also likely plays an important role. As recently noted by Wei and Zhang (2009), a rising sex ratio provides a strong competitive savings incentive, especially for parents with a son, since wealth accumulation may help increase a son’s chances in the marriage market. This excess saving could spill over into prices for housing and education.

A second robust fact that I document is the quite remarkable showing of intertemporal variation in national cash flow – output less investment and government spending – as a factor driving current account dynamics. In fact, China’s current account predicts *declines*

³The fixed exchange rate regime may have facilitated this transition: the ensuing accumulation of foreign reserves provides a centralized way to back up the public banking sector and to increase its credibility. This in turn puts private households – most of which do not otherwise have access to financial markets – in a position to hold international assets indirectly by channeling their savings through the public banking. This interpretation is supported by the findings in Caballero, Farhi and Gourinchas (2008) who argue that official reserve accumulation is indirectly held by the private sector through low-return sterilization bonds.

of national cash flow relative to its long-term trend.⁴ That would seem to be at odds with the increasing output growth rates of the recent past. However, as shown in Panel B in Figure 1 which presents the main data, China's investment has grown much faster than output over much of the last decade. One explanation of this pattern is that firms outside the state sector may have to finance future investment from retained earnings if they cannot access private capital markets (see e.g. Song, Storesletten and Zilibotti (2011)). As the share of these firms in value added has increased, so may have the aggregate (corporate) savings rate. Increases in (firm) saving then predict subsequent increases in investment.

Encouraged by the empirical performance of the simple present-value model of the current account on Chinese data, in the second part of the paper I ask whether the model also holds conditional on a set of broadly specified structural shocks. To my knowledge, such a conditional test of a present-value model is new to the literature and constitutes a methodical innovation of the paper. The specific structure of my empirical model allows me to identify permanent and transitory shocks with only minimal theoretical restrictions. I then build on Kano (2008) to distinguish between a country-specific and a global variety of both permanent and transitory shocks: country-specific shocks should not affect the world interest rate whereas global shocks do. From a theoretical point of view, these two categories of shocks should be crucially important from the point of view of current account dynamics.⁵ My results suggest the following: first, the estimated response of China's current account is generally in line with the predicted response of the channels of external adjustment to both transitory and permanent shocks (be they global or country-specific). Secondly, I find that permanent global shocks are an important driver of China's current account. They are associated with a marked increase in the current account balance and

⁴ This finding has an interesting correspondence in the Engel and Rogers (2006) result that US output growth projections are consistent with the size of the US deficit.

⁵For the importance of permanent vs. transitory shocks see Aguiar and Gopinath (2007) and Hoffmann (2001*b*). For country-specific vs. global shocks see Glick and Rogoff (1995), Hoffmann (2001*b*), Engel and Rogers (2006) and Kano (2008).

a prolonged decline in the world real interest rate. This pattern is consistent with the predictions of recent theoretical models in which factors related to China's domestic financial development are driving the surplus and lead to declines in global interest rates.⁶

The paper is now structured as follows. Section two outlines the theoretical framework and explains the econometrics used to test it. Section three presents the data and section four the main results. Section five offers further discussion and concludes.

2 The framework

The empirical analysis in this paper is based on a simple intertemporal model of the current account in which the representative consumer maximizes

$$\sum_{t=0}^{\infty} \beta^t E_0 \left[\frac{X(C_{Nt}, C_{Tt})^{1-\gamma}}{1-\gamma} \right]$$

where C_N is non-tradeables consumption, C_T is tradeables consumption and $X(\cdot)$ defines a consumption bundle to be defined below. We denote the value of consumption in terms of tradeable goods with

$$C_t = C_{Tt} + PC_{Nt}$$

where P is the relative price of the non-tradeable good. Then we write the budget constraint (expressed in tradeable goods) as

$$B_t = (1 + r_t^W)B_{t-1} + Y_t - I_t - G_t - C_t$$

where B_t is the stock of foreign assets, r_t^W the world real interest rate and Y_t , I_t , G_t and C_t denote the value of real output, investment, government consumption and private con-

⁶See Caballero, Farhi and Gourinchas (2008) and Mendoza, Quadrini and Rios-Rull (2009).

sumption respectively. In this model, the current account balance is given by

$$CA_t = \Delta B_t = r_t^W B_{t-1} + NO_t - C_t$$

where I introduce the notation $NO_t = Y_t - I_t - G_t$ to denote net output, i.e. the national cash flow available for consumption .

Following Bergin and Sheffrin (2000) the consumption bundle X is a CES aggregate of tradeable and non-tradeable goods with unit elasticity of substitution, so that

$$X_t = C_{Tt}^\alpha \times C_{Nt}^{1-\alpha}$$

In this setting, it is well known that the intertemporal consumption allocation can be solved for independently from the intratemporal allocation between tradeable and non-tradeable goods. Specifically, we can define the price index of aggregate consumption by recognizing that for any such index P_t^* it must be true that $P_t^* X_t = C_{Tt} + P C_{Nt} = C_t$ for all P_t . Then replacing C_t with $P_t^* X_t$ in the budget constraint, one obtains the Euler equation

$$E_t \left(\beta \frac{P_t^*}{P_{t+1}^*} \left(\frac{X_t}{X_{t+1}} \right)^\gamma (1 + r_{t+1}^W) \right) = 1$$

which can be rewritten in terms of aggregate consumption expenditure as

$$E_t \left(\beta \left(\frac{C_t}{C_{t+1}} \right)^\gamma \left(\frac{P_t^*}{P_{t+1}^*} \right)^{1-\gamma} (1 + r_{t+1}^W) \right) = 1 \quad (1)$$

As shown in Obstfeld and Rogoff (1995), the aggregate price index for consumption is an expenditure-weighted CES aggregate of the tradeable and non-tradeable goods prices so that $P_{t+1}^*/P_t^* = (P_{t+1}/P_t)^{1-\alpha}$. Hence, (1) links aggregate consumption expenditure growth to the consumption-based real interest rate, which is the world-real interest rate corrected for real exchange rate changes (defined as the change in the relative price of non-traded

goods). Assuming that consumption growth, the real exchange rate, and the real interest rate are jointly log-normal, Sheffrin and Bergin (2000) show that this condition can be log-linearized to obtain

$$E_t(\Delta c_{t+1}) = \frac{1}{\gamma} E_t(r_{t+1}) + \text{constant} \quad (2)$$

where $r_{t+1} = r_{t+1}^W + (1 - \alpha)(\gamma - 1)\Delta p_{t+1}$ is the consumption-based real interest rate.

The model here does not feature explicit financial frictions. However, such frictions could easily be incorporated as a 'savings wedge' following Gourinchas and Jeanne (2009). These authors have argued very convincingly that such a 'savings wedge', i.e. a friction in intertemporal allocation of consumption – rather than frictions in the accumulation of capital – is important in explaining persistent surpluses in emerging markets such as China. Including a time-invariant or independently identically distributed 'savings-wedge' into the model, however, would not alter the generally form of equation (2) but only the size of the constant.⁷ Hence, in the log-linearization of the budget constraint that I use below, the savings wedge will have an impact on the mean of the current account but not on the fluctuations around that mean that are the focus in this paper.

We are now interested in obtaining a representation for the current account. As is well known, this model does not have a closed-form solution, but Bergin and Sheffrin (2000) and Kano (2008) have suggested different log-linearizations of the intertemporal budget constraint. Here, I follow Kano and consider a log-linearization of the current account / net output ratio which can be represented as

$$\frac{\widetilde{CA}_t}{NO_t} = b\widetilde{r}_t^W + c \sum_{k=1}^{\infty} \kappa^k E_t \left\{ \Delta \widetilde{c}_{t+k} - \widetilde{r}_{t+k}^W \right\} + \sum_{k=1}^{\infty} \kappa^k E_t \left\{ \widetilde{r}_{t+k}^W - \Delta \widetilde{n}o_{t+k} \right\}$$

⁷To see this note that a savings wedge would affect the law of motion for the stock of foreign bonds, so that $B_t = (1 + r_t^W)(1 - \tau_s)B_{t-1} + Y_t - I_t - G_t - C_t$ where $\tau_s > 0$ measures the savings wedge. The consumption-based Euler equation then becomes $E_t \left(\beta \left(\frac{C_t}{C_{t+1}} \right)^\gamma \left(\frac{P_t^*}{P_{t+1}^*} \right)^{1-\gamma} (1 + r_{t+1}^W) (1 - \tau_s) \right) = 1$ which with τ_s fixed or i.i.d. means that the stochastic part of (2) remains unchanged.

where Δno is the growth rate of net output and the tilde denotes deviations from the unconditional mean of the respective variable. The parameters b , c , are the long-term means of B/NO , C/NO respectively and $\kappa = \exp [E(\Delta no_t) - E(r_t^W)]$. Note that the above approximation follows directly from the intertemporal budget constraint. The condition is therefore consistent with arbitrary processes for investment and output. In particular it is worth emphasizing that this identity will also hold in a much richer model than the one I discuss here, e.g. in a production economy in which both output and investment are endogenous. As discussed before, since it measures deviations from long-run means, it will also be robust with respect to the presence of savings frictions, as long as these frictions are constant over time.

The analysis here goes beyond Kano's in that we now substitute for consumption growth and the real interest rate term on the right hand side of the expression using the fact that $r_{t+1} = r_{t+1}^W + (1 - \alpha)(\gamma - 1)\Delta p_{t+1}$. In Kano's model, there are no non-tradeable goods, so the consumption based real interest rate directly coincides with the world real interest rate. In the model here, there is an additional channel of intertemporal adjustment, which is given by expected real exchange rate changes.⁸ Plugging in for $r_{t+1}/\gamma = E(\Delta c_{t+1})$, I obtain the equation which is the focus of my empirical analysis:

$$\frac{\widetilde{CA}_t}{NO_t} = b\widetilde{r}_t^W + \left[1 - c \left(1 - \frac{1}{\gamma}\right)\right] \sum_{k=1}^{\infty} \kappa^k E_t \widetilde{r}_{t+k}^W + c \left[1 - \frac{1}{\gamma}\right] \sum_{k=1}^{\infty} \kappa^k E_t \widetilde{\Delta q}_{t+k} - \sum_{k=1}^{\infty} \kappa^k E_t \widetilde{\Delta n\tilde{o}}_{t+k} \quad (3)$$

where I have introduced additional notation so that $\Delta q_{t+1} = (1 - \alpha)\Delta p_{t+1}$ is the real exchange rate.

This equation suggests four channels of current account adjustment. The first term measures the role of net factor income flows. The second term is consumption-tilting due to expected variation in the world real rate of interest: if interest rates are temporarily

⁸The analytics of this follows Bergin and Sheffrin (2000). However, these authors do not disentangle the role of real exchange rate changes and variation in the world real rate of interest in external adjustment, as I will do below.

high, so that the sum of future interest-rate deviations from the long-term mean interest rate is positive, consumers will want to defer consumption and save more. I call this the global tilting term since it is determined by global variation in interest rates. Clearly, this global tilting effect becomes stronger as the intertemporal elasticity of substitution, $1/\gamma$, increases. The third term is the effect on intertemporal substitution of expected real exchange rate changes. If the price of the domestic consumption bundle relative to tradeable goods is expected to rise in the future, there is an incentive to save more. I refer to this channel as 'domestic tilting' since it is driven by relative variation in expected prices of only domestically (non-tradeable) to internationally consumed goods. Finally, the last term reflects the classical consumption smoothing channel: if output is below (above) trend, so that the sum of expected changes is positive (negative), the country should run a deficit (surplus) *ceteris paribus*.

To test this model, I proxy the expectation terms on the right hand side of (3) using a vector autoregressive model (VAR):

$$X_t = \sum_{l=1}^p \mathbf{A}_l X_{t-l} + \varepsilon_t$$

where $X_t = \left[\Delta no_t \quad \Delta q_t \quad r_t^W \quad CA_t/NO_t \right]'$ is the vector of endogenous variables, the \mathbf{A}_l are 4×4 coefficient matrices of the p -th order VAR and ε_t is the vector of reduced-form residuals. Stacking $Z_t = \left[X_t, X_{t-1}, \dots, X_{t-p+1} \right]'$, write the VAR companion form as VAR(1) so that

$$Z_t = \mathbf{A} Z_{t-1} + U_t \tag{4}$$

where \mathbf{A} is the companion matrix and $U_t = \left[\varepsilon_t, 0, \dots, 0 \right]$ the vector of shocks. Then, once the VAR-parameters has been estimated, the expectation terms are easily backed out as

$$\sum_{k=1}^{\infty} \kappa^k \mathbf{E}_t x_{t+k} = \mathbf{e}'_x \kappa \mathbf{A} [\mathbf{I} - \kappa \mathbf{A}]^{-1} Z_t$$

where x_t stands, in turn, for Δno_t , Δq_t , r_t^W , $\frac{CA_t}{NO_t}$ and e_x is the unit vector associated with the position of x in the vector Z_t (i.e. the first unit vector for Δno , the second for Δq_t etc.). Plugging this representation of the expectation terms into (3) above, one gets the CA/NO ratio predicted by the model

$$\frac{\widehat{CA}_t}{NO_t} = b\tilde{r}_t^W + [(1 - \phi)e'_r + \phi e'_{\Delta q} - e'_{\Delta no}] \kappa G [I - \kappa G]^{-1} Z_t \quad (5)$$

where $\phi = \left(1 - \frac{1}{\gamma}\right) c$ and where $\widehat{\cdot}$ denote the predicted value from the model with a hat.

For any known set of parameter values b , $1/\gamma$, and c the predicted current account can now be compared to the actual current account. The steady-state share of foreign assets, b , and c (the long-term consumption / net output ratio) could in principle be calibrated from the data, while the elasticity of intertemporal substitution, $1/\gamma$, is unobservable. Here, I only fix c from the data and estimate both $1/\gamma$ and b using a GMM-procedure in which I perform a grid search to minimize the in-sample sum of squared deviations between the actual and predicted CA/NO . The reason for not imputing b from the data directly is that the long-term net foreign asset position may actually be very imperfectly proxied through reported net foreign asset positions or through cumulated current accounts (see Lane and Milesi-Ferretti (2007)). This is particularly true for China, for which some authors have argued that current account data may understate actual foreign liabilities and overstate foreign assets (see Zhang (2008)).

Based on the representation (5), I now decompose the variance of the current account as follows. Write the component that is unexplained by the model as $res = CA/NO - \widehat{CA}/NO$, take the variance on both sides and plug in for \widehat{CA}/NO from (5). Then, dividing by $var(CA/NO)$, one gets

$$1 = \beta_b + \beta_r + \beta_{\Delta q} + \beta_{\Delta no} + \beta_{res} \quad (6)$$

where

$$\begin{aligned}\beta_b &= \frac{\text{cov}(b(\mathbf{e}'_r Z_t, CA/NO))}{\text{var}(CA/NO)} \\ \beta_r &= \frac{\text{cov}\left((1-\phi)\mathbf{e}'_r \kappa \mathbf{A} [\mathbf{I} - \kappa \mathbf{A}]^{-1} Z_t, CA/NO\right)}{\text{var}(CA/NO)} \\ \beta_{\Delta q} &= \frac{\text{cov}\left(\phi \mathbf{e}'_{\Delta q} \kappa \mathbf{A} [\mathbf{I} - \kappa \mathbf{A}]^{-1} Z_t, CA/NO\right)}{\text{var}(CA/NO)} \\ \beta_{\Delta no} &= \frac{\text{cov}\left(-\mathbf{e}'_{\Delta no} \kappa \mathbf{A} [\mathbf{I} - \kappa \mathbf{A}]^{-1} Z_t, CA/NO\right)}{\text{var}(CA/NO)} \\ \beta_{res} &= \frac{\text{cov}(res, CA/NO)}{\text{var}(CA/NO)}\end{aligned}$$

where again $\phi = \left(1 - \frac{1}{\gamma}\right) c$. Here, β_b is the contribution of net factor income to the variance of the current account, β_r the contribution of (expected) variation in the world real rate of interest (the global tilting factor), $\beta_{\Delta q}$ the contribution of expected changes in the real exchange rate (the domestic tilting factor), and $\beta_{\Delta no}$ the contribution of output variation (consumption smoothing). The coefficient β_{res} is the fraction of the variance of the current account that remains unexplained by the model.

This decomposition is similar in spirit to the one suggested by Gourinchas and Rey (2007), but it is more tightly constrained by economic theory: equation (3) is derived under the assumption of intertemporal optimality in consumption (i.e. that the Euler-equation (1) holds). The decomposition here therefore also allows to identify the role of global and domestic tilting factors in external adjustment.⁹

⁹The setup here abstracts from the role of valuation effects on the stock of foreign assets. For China this is justifiable on a number of grounds: first, using quarterly data for the U.S., Gourinchas and Rey (2007) find these effects to matter mainly at short to medium horizons. The focus here is on medium- to longer term patterns of external adjustment. Specifically, since quarterly data for China do not exist over long time periods, my data here is necessarily annual. In addition, reliable data for non-reserve foreign assets seem hard to obtain. Finally, we may expect valuation effects to play a limited role simply because most of China's recent foreign assets accumulation is held in the form of foreign reserves which have been used to stabilize

I now use this framework to identify the drivers of China's current account adjustment. The next section first describes the data set. Section four presents empirical results.

3 Data and Estimation

The main data used in this study are from the International Monetary Fund's International Financial Statistics and were taken from the June 2009 CD. The data are annual and range from 1982 to 2007. China's economic reform started in 1979 but transformation to a market economy was gradual in the beginning. I therefore report most results based on a somewhat shorter baseline sample starting in 1987.

Investment is constructed as the sum of gross fixed capital formation (line xxx93E) and inventory investment (line xxx93I). GDP is taken from line xxx99B, government consumption expenditure is from line xxx91F. Net output, GDP less investment and government consumption, is then turned into real quantities by deflating with the GDP deflator (92499BIPZF...). Further, I turn this variable into per capita terms using the population data from the IFS.

I use two measures of the current account balance. The baseline measure is the official series from the IFS (series code 92478ALDZF...). The second measure is obtained from Zhang (2008). This series is identical to the IFS until 2003 but makes some important adjustments for the last years of the sample. Specifically, Zhang (2008) argues that current account surpluses since 2003 are considerably overstated in official statistics. He identifies two main sources of measurement error: first, a large part of China's foreign trade is actually accounted for by foreign firms. According to the IMF's Balance of Payments (BoP) manual, returns on foreign direct investment should figure in a country's current account as a negative item, irrespective of whether these returns are repatriated or not. For China, the rate of return on foreign firms investment are likely to be under-reported. Based on

the nominal exchange rate.

BoP data, they amount to around 5 percent in 2007, whereas a number of studies that estimate the return on capital directly reach estimates of an average rate of return of 14 percent. This discrepancy could lead to a considerably overstatement of China's current account surplus.

A second channel identified by Zhang (2008) is the incentive for mis-invoicing of imports and exports by foreign firms which could be presented by China's fixed exchange rate in conjunction with its capital control regime. Revaluation expectations for the Renminbi (RMB) will provide an incentive for capital inflows which, however, are officially restricted. One way for foreign firms to circumvent these capital controls is to under-invoice purchases from the foreign mother companies and to over-invoice their exports which would lead to an upward bias in the current account balance. Zhang provides empirical evidence for the quantitative importance of this channel. I therefore report many of my results based on Zhang's adjusted data and refer to these data as the valuation-adjusted current account. Doing so serves as a robustness check as to how strongly the results obtained from official data are affected by measurement error and, in particular, revaluation expectations.

I also employ two measures of the relative price of non-tradeable goods. The first is again taken from the IFS, the real effective exchange rate based on consumer prices (series code 924..RECZF...). As a more direct measure of the relative price of non-tradeable goods, I use a breakdown of the CPI into various expenditure categories (food, tobacco, clothing, household facilities, medical care, traffic and communications, recreation and residence) and construct the non-tradeable component as the ratio of the CPI for housing, medical care and residence relative to the aggregate CPI. These data are, however, only available from 1994 onwards.¹⁰ Finally, I use the annual average of the 3-months US T-bill rate less CPI inflation to proxy for the real world interest rate. For reference in the discussion of my results below, Figure 1 plots the main data used in the analysis.

The VAR in the four variables $X_t = \left[\Delta no_t \quad \Delta q_t \quad r_t^W \quad CA_t/NO_t \right]'$ is estimated with

¹⁰I thank the Hong Kong Monetary Authority for kindly providing these data.

two lags. To obtain the estimates of b and $1/\gamma$, I use the GMM- procedure outlined above: based on a grid search, I choose the values of b and $1/\gamma$ so as to minimize the sum of squared deviations $\sum_{t=1}^T (\widehat{CA_t/NO_t} - CA_t/NO_t)^2$. In so doing, I fix c to the long-run mean of the consumption-net output ratio (0.97) and choose the discount factor $\kappa = 0.93$.¹¹ To initialize the grid search, I obtain averages for China's net foreign asset position (which is also available from the IFS but only for the last couple of years). I then let the grid search procedure choose b in the interval of plus / minus one hundred percent of net output around this initial value. The grid search for $1/\gamma$ is constrained to the positive unit interval, which is the range that is typically considered as plausible in the macroeconomic literature. Allowing values greater than one for $1/\gamma$ in the grid search does not change the estimates, though. The results reported below are also robust to fixing $1/\gamma$ (instead of estimating it) to a range of values in the unit interval.

4 Results

Figure 2, Panel A plots the predicted against the actual current account for the baseline period 1987-2007. Panel B plots the same figure for the full sample, 1982-2007. In both cases, the correlation between the actual and the predicted time series appears visually very high across the whole sample period. The actual and the predicted current account also match in terms of relative variability. However, while the specification estimated from the shorter period explains a considerable part of the increase in the current account surplus since the beginning of the 2000s, the model estimated from the full sample seems to do less well on that account. The first two columns of Table 1 report more formal evidence, first on correlations and relative variability, second on the estimated parameter values. Correlations exceed 0.8 in both the full and the baseline samples and in both

¹¹ Alternative choices of c and κ between 0.9 and 1.00 have virtually no effects on the results.

samples the relative volatilities of the actual and the predicted current account are close to unity.¹² The estimate of the intertemporal elasticity of substitution ($1/\gamma$) is somewhat higher for the baseline specification. The estimate of the long-run mean of the share of foreign assets, b , is virtually zero in both cases.

The lower two panels of Figure 2 plot the actual against the estimated current account that I obtain based on Zhang's (2008) valuation-adjusted current account data. Measures of fit and estimated parameter values are in the last two columns of Table 2. Again, the correlation is visually striking. Interestingly, the model now mimics virtually all of the pick-up in the Chinese surplus after 2001, irrespective of whether the full or the baseline sample are used. When the model is estimated on the long sample, it seems that the overall fit is comparable to the model estimated on official data for the same period overall, but – at least visually – the model based on valuation adjusted data seems to perform better on the last couple of years (i.e. exactly those years for which current account data are subject to the adjustment). The estimate of the intertemporal elasticity of substitution changes very little vis-à-vis the specification based on official data nor does the long-run share of foreign assets which is still estimated to be close to zero.¹³

Figure 3 provides a graphical representation of the individual expectation components in the predicted current account. Panel A is based on the IFS data set and it is apparent that the real exchange rate channel plays a key role. Turning to the formal variance decomposition (6), this impression is confirmed: as shown in the first column of Table 2, the exchange rate channel accounts for virtually all of the variability of the current account

¹²In particular, getting relative volatilities to be of the same order of magnitude often proves difficult in empirical implementations of present-value models (see e.g. Kano (2008), Campbell and Shiller (1987)).

¹³That the estimate of b is so close to zero seems at odds with the almost explosive path of China's net foreign asset position over the last years. Two remarks are in order: first, the number reported here is an estimated (in-sample) long-run average value. Very little information about China's foreign asset position exists for most of the sample period considered here. As a matter of fact, however, it is likely that China's net foreign asset position has only turned positive shortly after the turn of the millennium (see Dollar and Kraay (2006)). This may makes a sample average close to zero appear quite plausible. Secondly, some theoretical papers have attempted to calibrate the long-run value of China's external position, projecting current demographic and financial development patterns into the future. For example, Dollar and Kraay (2006) find a slightly negative long-term average asset position, again reasonably close to the numbers estimated here.

over the sample period when the IFS current account data are used. The global tilting factor and consumption smoothing seem to offset each other: the real interest rate channel seems to be positively correlated with current account fluctuations over the sample period, expected net output fluctuations appear negatively correlated with the overall effect netting out. The net factor income channel is virtually mute.

Turning to the longer sample period (2nd column of Table 2), the model still explains 70 percent of the variability in the actual current account, with the real exchange rate channel still accounting for virtually all of this. Expected net output changes do not seem to explain much nor do, again, net factor income flows. Expected variation in world interest rates is significantly negatively correlated with the current account, in contrast with the results for the shorter sample period. This fact seems to be at odds with the model, since the predicted current account from (3) should be positively correlated with the world real rate of interest—provided that $1 - \phi = 1 - c \left(1 - \frac{1}{\gamma}\right)$ is positive, which it is for the value of the intertemporal elasticity of substitution that we have estimated here. I explore this result in somewhat more detail below.

The third column provides the beta-decomposition for the period after 2001 (but with the expectations calculated from the VAR estimated from the long sample 1982-2007). This shows that the model estimated on the long sample cannot explain the IFS current account data after 2001: the share of the variance explained by the model drops to around 30 percent (i.e. β_u rises to 0.68) for this subperiod.

As argued before, China's surplus in recent years may be subject to considerable measurement error due to revaluation expectations in the fixed exchange rate regime. The results so far may therefore tend to overstate the role of expected real exchange rate variation for external adjustment. I therefore provide results based on the Zhang (2008) valuation-adjusted current account in Figure 3B and the last three columns of Table 2. Based on the shorter period, the model still explains almost 80 percent of the variance of CA/NO . Based on the long sample it still explains roundabout 70 percent, practically unchanged

vis-à-vis the model estimated from official data. However, based on the valuation-adjusted data, the model now also does well on the post-2001 period: the share of the explained variance in CA remains stable at around 70 percent, in line with the estimate for the whole period 1982-2007.

Digging deeper into the relative contribution of the various channels, it is also apparent from Table 2 that the role of the exchange rate expectations channel is more subdued when the valuation-adjusted instead of the IFS current account data are used. For the post-2001 period, price expectations now do not seem to play a role in this specification, a pattern that is also apparent from the graphs in Figure 2B. This is consistent with Zhang's interpretation that the difference between the valuation adjusted and the baseline current account represents mis-invoicing that is in turn driven by appreciation expectations. While, taken over the whole sample, expected changes in the real exchange rate are an important driver of current account fluctuations, the result here also suggests that expected variation in real exchange rates alone can only partially account for the run-up in China's surplus after the turn of the millennium.

Based on the valuation-adjusted current account, Figure 3B and the decomposition in Table 2 document a stronger effect of the consumption smoothing channel (i.e. variation in expected net output growth). This is interesting because the consumption smoothing channel is center stage in even the most simplified version of the intertemporal model that do not allow for time variation in interest rates. It is the insights from this baseline textbook model (see Obstfeld and Rogoff (1996), ch. 2) that make surpluses in emerging markets – and in China in particular – appear puzzling in the first place: in an economy that is expected to grow fast over a protracted period of time we would expect to see persistent current account deficits. It is therefore surprising that this channel contributes so much to the explanation of China's recent surplus: the channel is significant over the whole sample and it contributes even more strongly after 2001, the period of rising surpluses. In looking for a possible explanation of this finding, it is important to note that the

model does not make a claim about future GDP growth. Rather, what figures on the right hand side of the current-account equation (3) is national cash flow actually available for consumption, i.e. output less investment and government spending. A shock that leads to a persistent increase in output growth could lead the sum of growth rates in investment and government spending (weighted by their weights in aggregate GDP) to temporarily exceed that of output. This, in turn, could mean that long-term expected growth rates in net output turns negative, which would justify a current account surplus. It is apparent from the data plot in Figure 1 that this indeed what happened: in the first years of the new millennium investment grows much stronger than output.

Figure 4A further illustrates the role of expected net out variation for the run-up in China's current account. The figure plots demeaned net output growth rates at different horizons (1, 2, 3 and 5 years) against the long-term net output growth forecast from the VAR. First, note that the correlation between forecast and actual realization increases with the differencing horizon, reaching 0.58 at the 5-year horizon. This is what the model would imply – the current account predicts long-term changes in net output. Second, medium- to long-term (3-5 years) net output growth rates tend to fall below their long-run mean (i.e. turn negative in the graphs) soon after the turn of the millennium and the VAR forecasts reflect this pattern. It is therefore consistent with simple theory that this period of net output falling below its long-term trend also marks the onset of China's big current account surpluses.¹⁴

Figure 4B provides similar plots for real exchange rate changes, again at the 1, 2, 3, and 5-year horizons. Again, the correlation between the long-run VAR forecast and actual changes increases with the forecast horizon. The magnitude of the VAR forecast also lines

¹⁴These results mirror Engel and Rogers (2006) who show that projected US output growth rates are consistent with the US deficit. However, I stress that this pattern could itself be the result of the presence of financial frictions: given GDP growth, it implies that today's savings predict future increases in investment, which should not happen in a frictionless economy. One possible interpretation is that this reflects corporate savings of the many, quickly expanding small firms that do not have access to bank credit and that have to finance future investment from today's earnings (see e.g. Song, Storesletten and Zilibotti (2011) for a model in which financing frictions for small firms lead to high investment-savings correlations and for empirical evidence on this mechanism).

up nicely with actual exchange rate changes between one and two years ahead. At 3- and 5 years, the VAR forecast would seem too volatile relative to the data. This may not be surprising, though, given the difficulties of predicting exchange rates at long-horizons in general and given the repeated changes in the renminbi's exchange rate regime over the sample period (in 1994 and 2005) in particular. Still, the long-term VAR predictions contain significant information about the direction of exchange rate changes. The correlation between the long-term VAR forecast and the data at the 5-year horizon is 0.72.

To explore the important role of the real exchange rate in external adjustment further, I repeat the exercise reported in Table 2 but now based on an alternative measure of non-tradeables prices. I construct an index of the relative price of non-tradeables goods using a weighted average of the CPI for medical care and housing. This data is available monthly from 1994 onwards. To obtain an annual series, I take the end-of-year observations as stand-ins. Since estimating the model for the period after 1994 would make the sample very short, I splice this series together with the real exchange rate index used so far and report estimates for the period 1987-2007. The actual cumulated weight of housing and medical care in the CPI is around 0.25. But I assume it is not known *a priori* and extend the grid search procedure described above to also iterate over α , the share of tradeables in the CPI. The results are in Table 3 and show that the flavor of all previous results is preserved also under this specification: the model still fits the current account data in terms of correlations and relative variability. The estimate of the elasticity of intertemporal substitution is 0.31, the share of foreign assets is still estimated to be virtually zero. The share of non-tradeable goods, $(1 - \alpha) = 0.1$, is estimated to be somewhat lower than the actual weight in the data (0.25). The decomposition into the channels of external adjustment reveals a picture that is largely unchanged vis-à-vis the specifications in Table 2. Note that the results presented in Table 3 are based on the valuation-adjusted current account, which—as we have seen in Table 2—tends to lead to relatively low estimates of

the contribution of real exchange rate changes to external adjustment.¹⁵ Still, roundabout 30 percent of the variation of the current account remain explained through adjustment in relative prices over the whole sample period and the model remains stable after 2001. This, once again, suggests that expected increases in the price of non-tradeables (rather than, say, expectations of nominal exchange rate appreciation alone) are a very important driver of China's current account. However, they also suggest that the 'conventional' channel of intertemporal variation in national cash flow (net output) still has an important role to play: Figure 4B and the results in Table 3 show that expected price changes alone are not able to explain the increase in the surplus during the early 2000s if valuation-adjusted data is used.

4.1 Dynamic analysis

From the results reported so far, it seems that two channels of external adjustment can explain the bulk of the variation in the Chinese current account: *i*) variation in expected national cash flows and *ii*) consumption tilting driven by expected increases in the relative price of non-tradeable goods. In this section, I examine whether the model response to a broad set of structural shocks is equally consistent with theoretical predictions and which of these shocks are responsible for this pattern.

I identify two groups of structural shocks: permanent and transitory and country-specific and global. While this fundamental distinction is of considerable importance in the theoretical and empirical literature,¹⁶ it is clearly also of independent interest to know to what extent *a*) fluctuations in China's current account are driven by trend and cyclical factors and *b*) to which extent they they interact with global developments.

¹⁵Indeed, using the official current account statistics would also lead to similar results to those in Table 2. These are not reported.

¹⁶On the importance of these two categories of shocks (permanent vs transitory and country-specific vs. global) see e.g. Glick and Rogoff (1995), Hoffmann (2003, 2001b), Aguiar and Gopinath (2007) Conversely, and Kano (2008). Nason and Rogers (2002) examine various identification schemes inspired by the theory in an SVAR-context.

One important methodical innovation I offer in this section is that I combine the impulse responses of net output, the interest rate and exchange rates based on the fundamental equation (3) to back out a model-implied response of the current account which can then be compared with the response of the actual current account from the VAR. This allows to test to which extent the simple theoretical model from the first part of the paper holds *conditional* on a particular type of shock and also to identify dimensions along which the model may fail. For example, one interesting pattern that arises from the earlier analysis is that expected variation in the world interest rate (the 'global' tilting channel) tends to be negatively correlated with current account, which seems inconsistent with the frictionless model above. The analysis here sheds light on this finding.

Identification of shocks

The structure of my empirical model allows to separate permanent and transitory components without further identifying restrictions. To see this, note first that the VAR model is essentially a cointegrated system: collect $\Delta \mathbf{x}_t = \begin{bmatrix} \Delta q_t & \Delta no_t \end{bmatrix}'$ and $\mathbf{z}_t = \begin{bmatrix} r_t^W & \frac{CA}{NO_t} \end{bmatrix}'$. Then $X_t = \begin{bmatrix} \Delta \mathbf{x}_t & \mathbf{z}_t \end{bmatrix}'$ and the VAR-model from (4) above can be represented as

$$\begin{bmatrix} \Delta \mathbf{x}_t \\ \mathbf{z}_t \end{bmatrix} = \begin{bmatrix} B_1(L) & D_1(L) \\ B_2(L) & D_2(L) \end{bmatrix} \begin{bmatrix} \Delta \mathbf{x}_{t-1} \\ \mathbf{z}_{t-1} \end{bmatrix} + \boldsymbol{\varepsilon}_t$$

with appropriately partitioned matrix polynomials $B_1(L)$, $B_2(L)$, $D_1(L)$, and $D_2(L)$. It is then easily verified that this system can then be rewritten as a vector error correction model with

$$\Delta X_t = \Gamma(L)\Delta X_{t-1} + \boldsymbol{\alpha}\boldsymbol{\beta}'X_{t-1} + \boldsymbol{\varepsilon}_t$$

where

$$\Gamma(L) = \begin{bmatrix} \mathbf{B}_1(L) & \frac{D_1(L)-D_1(1)}{1-L} \\ \mathbf{B}_2(L) & \frac{D_2(L)-D_2(1)}{1-L} \end{bmatrix} \quad \text{and} \quad \alpha = \begin{bmatrix} D_1(1) \\ D_2(1) - \mathbf{I} \end{bmatrix},$$

and where $z_t = \beta' X_t$ is the error-correction term. The matrix β stacks the cointegrating vectors, which here are 'trivial' in the sense that they are just the third and fourth unit vectors.¹⁷

It is well-known that in such a system, the space of permanent and transitory shocks can be directly identified from the adjustment loadings α : in the four-dimensional system here, there are two cointegrating relations, implying that there are two common trends (permanent shocks) and two transitory shocks. As shown by Johansen (1995) and as discussed in Hoffmann (2001a,b), the vector of permanent shocks, π_t , is then identified from

$$\pi_t = \mathbf{S}'_p \alpha'_\perp \varepsilon_t \tag{7}$$

where α_\perp is the orthogonal complement of α . Let Ω denote the covariance matrix of the reduced-form, residuals ε_t . Then $\mathbf{S}_p = (\alpha'_\perp \Omega \alpha_\perp)^{-1/2}$ is a normalization matrix that ensures that the permanent shocks are mutually orthogonal and have unit variance: $\text{var}(\pi_t) = \mathbf{I}_2$. I will discuss the choice of this matrix shortly. Requiring that transitory shocks are orthogonal to π_t , one obtains

$$\tau_t = \mathbf{S}'_\tau \alpha' \Omega^{-1} \varepsilon_t$$

where $\mathbf{S}_\tau = (\alpha' \Omega^{-1} \alpha)^{1/2}$ is again a normalization matrix. The matrices \mathbf{S}_π and \mathbf{S}_τ are not uniquely identified. The orthogonality restrictions $\text{var}(\pi_t) = \mathbf{I}_2$ and $\text{var}(\tau_t) = \mathbf{I}_2$ impose three non-redundant restrictions on each of them. Therefore, to achieve just-identification, one additional restriction is required for each pair of shocks. I obtain these restrictions by

¹⁷We keep the standard notation in much of the literature on cointegrated models (see e.g. Johansen (1995)) but note that the matrices α and β in this subsection are not to be confounded with the scalars α and β in the theoretical model above or with the coefficients of the variance decomposition (6).

distinguishing between global and a country-specific shock of each type (permanent and transitory). In so doing, I build on Kano (2008) in arguing that only global shocks should have a bearing on the world real rate of interest. To see how this restricts the choice of S_p and S_τ , note that the relation between the reduced-form residuals and the permanent and transitory shocks can be inverted to obtain

$$\varepsilon_t = \mathbf{P} \begin{bmatrix} \tau_t^g \\ \tau_t^c \\ \pi_t^g \\ \pi_t \end{bmatrix}.$$

Here, the superscripts g and c now denote the global and country-specific shocks respectively and where the matrix \mathbf{P} can be shown to be of the form (see Hoffmann (2001a)):

$$\mathbf{P} = \begin{bmatrix} \alpha \mathbf{S}_\tau^{-1} & \Omega \alpha'_\perp \mathbf{S}_p^{-1} \end{bmatrix}$$

The first two columns of \mathbf{P} give the period-zero impulse response to the transitory shocks and the last two columns to the permanent shocks. Then recalling the ordering of the variables in our system (the world real interest rate is ordered third) , the restrictions on \mathbf{S}_τ and \mathbf{S}_p are given by

$$\alpha \mathbf{S}_\tau^{-1} = \begin{bmatrix} * & * \\ * & * \\ * & 0 \\ * & * \end{bmatrix} \quad \text{and} \quad \Omega \alpha'_\perp \mathbf{S}_p^{-1} = \begin{bmatrix} * & * \\ * & * \\ * & 0 \\ * & * \end{bmatrix}$$

This completes the identification of the shocks.

Impulse responses

As mentioned above, I propose a novel approach to study the dynamic properties of the model that to my knowledge has not been explored in the literature on present-value models: this approach recognizes that the set of VAR cross-equation restrictions that are imposed by the fundamental current account equation (3) should not only hold unconditionally but also conditionally, for any of the four structural shocks that I have identified above. Given the parameters b , $1/\gamma$, and α , the current account response to any given shock should equal the sum of the responses on the right hand side of (3). By plotting the predicted and actual current account responses against each other, I therefore obtain an impression to what extent the fundamental current account equation¹⁸ (3) holds along the dynamic adjustment path of the VAR-model *conditional* on a shock of a particular type. Figure 5A provides the results of this exercise, based on the IFS data for the period 1982-2007.¹⁹ Interestingly, for all four shocks, the actual current account response lines up with the restrictions imposed by theory: the bootstrapped confidence intervals suggest that the actual response of the current account and the one predicted by the right hand side of (3) are statistically almost indistinguishable. This result lines up with the unconditional findings from the previous sections: there is no single shock with respect to which there would a clear gap between theoretical prediction and actual current account response – the model has considerable fit.

Figure 5B provides more detail on the adjustment channels in response to the different shocks. Here, I decompose the predicted current account response into the individual responses of the two tilting and the smoothing terms. In particular it is worth zooming in on the role of the permanent global shock, which in small-open economy setting, theoretically, should not have a big impact on current account. For China, however, this shock leads to

¹⁸This term was coined by Obstfeld and Rogoff (1995)

¹⁹In presenting my results, I abstract from the role of the net factor income channel since b is estimated to be so close to zero that multiplying it with the interest rate response is negligible. Note also that results based on the valuation-adjusted current account are very similar.

a considerable current account surplus by driving up expected future increases in the real exchange rate. At the same time, the shock is associated with a persistent (though ultimately temporary) decline in the world real interest rate.²⁰ The real interest rate response to the permanent global shock therefore contributes to the negative (unconditional) correlation between the global tilting channel and the current account as it appeared in Table 2 while also replicating the general pattern of external adjustment established there, with important roles for expected variation in real exchange rates and national cash flows.²¹

Table 4 presents variance decompositions of the four variables in the system. First, it is noteworthy that both the permanent and the transitory global shocks together explain most of the variance of the world (US) interest rate at all horizons. This suggests that the identification of global factors works quite well. Note also that the country-specific shock explains most of the transitory variation in the current account. However, permanent shocks—and here in particular the global breed—seem to explain a considerable share of the variation in the current account as well. This suggests that China's current account is to a large extent driven by permanent shocks that are global in the sense that they are also associated with marked swings in the world interest rate. These shocks also seem to account for the patterns of external adjustment that I have established in the first part of the paper. While a more detailed structural interpretation of the global permanent shock is beyond the scope of the analysis here, the responses to it are consistent with the predictions of recent theoretical models that have pointed at the role of China's low

²⁰Based on the valuation-adjusted current account, the permanent global shock also leads to a more sizable expected decrease in net output (results not shown here but available on request). This is consistent with the previous finding that net output variation plays a more important role for current account dynamics once the valuation-adjusted data are used. Interestingly, the interest rate response remains strongly negative also in this setting.

²¹It is important to emphasize at this point that the analysis here does not allow me to identify whether the global interest rate variation is not in itself the repercussion of the movement in China's current account, which by itself could be a function of shocks to future domestic non-tradeable prices and national cash flows. What it implies, however, is that large share of the variation in China's current account is associated with global interest rate variation. In fact, this reading would be consistent with the point made by Aizenman and Sun (2010) who argue that, unlike a small open economy, China's size matters for global rebalancing. This is consistent with my results here in that it implies that China will not be able to pursue recent surpluses for a very long period to come.

domestic financial development for its high savings rate and low global interest rates and that I have previously discussed in this paper.²²

5 Discussion and Conclusion

A simple present-value model of the current account explains more than 70 percent of the variation in China's current account over the period 1982-2007 and most of the recent run-up in surpluses. The model nests four channels of external adjustment: net factor income flows, the standard consumption smoothing motive and two forms of consumption tilting: i) tilting due to variation in the world real rate of interest—the global component of tilting—and ii) tilting due to expected changes in the relative price of non-tradeables (i.e. the real exchange rate)—the domestic component of tilting. My results reveal an important role for the domestic component of tilting and for consumption smoothing. These results hold even once I control for revaluation expectations and measurement error in China's current account. They suggest that expected increases in the price of non-tradeable goods and services such as housing and medical care provide a strong incentive for Chinese households to defer tradeable consumption. My interpretation of the strong showing of the expected variation in national cash flow as a driver of China's current account is that low financial development, capital controls or physical adjustment costs may force firms to finance future investment from retained earnings. In this way, an ultimately positive TFP shock could lead to a persistent (though ultimately temporary) decline in the cash flow available for consumption because investment may be deferred for some while but will then temporarily grow more quickly than output itself.

My taxonomy of the channels of China's external adjustment also reveals a negative correlation between the global tilting component (expected variation in the world interest

²²See Bernanke (2005), Caballero, Farhi and Gourinchas (2008), Mendoza, Quadrini and Rios-Rull (2009), Chamon and Prasad (2010) and Song, Storesletten and Zilibotti (2011) for prominent examples.

rate) and the current account. To shed light on this correlation and on external adjustment more generally, I explore the conditional dynamics of the model by distinguishing between country-specific and global as well as between permanent and transitory shocks.

As a key driver of China's current account (and of the negative correlation with world real interest rates) I identify the permanent global shock: while associated with a decline in the world interest rate, it also leads to a persistent increase in China's current account. At the same time, it also contributes to the strong positive association between the current account and expected price changes for non-tradeables. This pattern is consistent with recent theoretical models in which China's low domestic financial development is a key driver of its surplus and of globally low interest rates.

At a general level, the results in this paper have two major implications: first, China's current account is amenable to modeling using standard econometric tools and does not seem to defy the rules of intertemporal budget balance. To my knowledge, this is the first paper to bring to bear a small —deliberately stylized— model of current account dynamics on the Chinese economy. My analysis suggests that a real appreciation of the currency should be a major factor in external adjustment, a prediction that is vindicated by the recent acceleration in domestic inflation. Also, my model implies that high savings rates predict rising investment rates, consistent with the view that a combination of low financial development and high growth expectations forces private firms to finance future investment from retained earnings.. As China's domestic financial markets develop and as investment rates normalize (which is even more likely in a quickly aging society), there is also likely to be a rebalancing over the medium term (see also Aizenman and Sengupta (2011) for a similar prediction). Secondly the structural analysis shows that rebalancing of China's current account is likely to be associated with global repercussions: much of the variation in China's current account is related to shocks to the world interest rate, which reflects China's increasing weight in the world economy. This again, suggests that China's export-led growth strategy — that a small economy might be able to pursue over very

long horizons — will eventually have to come to an end in the medium term (a point emphasized by Aizenman and Sun (2010)).

References

- Aguiar, Marc, and Gita Gopinath.** 2007. “Emerging Market Business Cycles: The Cycle is the Trend.” *Journal of Political Economy*, 115: 69–102. 3, 5, 21
- Aizenman, Joshua, and Rajeswari Sengupta.** 2011. “Global Imbalances: Is Germany the New China? A Skeptical View.” *Open Economies Review*, 22(3): 387–400. 28
- Aizenman, Joshua, and Yi Sun.** 2010. “Globalization and the sustainability of large current account imbalances: Size matters.” *Journal of Macroeconomics*, 32(1): 35–44. 26, 29
- Bergin, Paul R, and Steven M Sheffrin.** 2000. “Interest Rates, Exchange Rates and Present Value Models of the Current Account.” *Economic Journal*, 110(463): 535–58. 2, 7, 8, 9
- Bernanke, Ben S.** 2005. “The Global Saving Glut and the U.S. Current Account Deficit.” *Remarks at the Sandridge Lecture, Virginia Association of Economics, Richmond, Virginia.* 27
- Caballero, Ricardo J., Emmanuel Farhi, and Pierre-Olivier Gourinchas.** 2008. “An Equilibrium Model of Global Imbalances and Low Interest Rates.” *American Economic Review*, 98(1): 358 – 393. 3, 4, 6, 27
- Campbell, John Y., and Robert J. Shiller.** 1987. “Cointegration and Present-Value Models.” *Journal of Political Economy.* 16
- Chamon, Marcos, and Eswar Prasad.** 2010. “Why are Saving Rates of Urban Households in China Rising?” National Bureau of Economic Research 1. 4, 27
- Dollar, David, and Aart Kraay.** 2006. “Neither a borrower nor a lender: Does China’s zero net foreign asset position make economic sense?” *Journal of Monetary Economics*, 53(5): 943–971. 16
- Engel, Charles, and John H. Rogers.** 2006. “The U.S. current account deficit and the expected share of world output.” *Journal of Monetary Economics*, 53(5): 1063–1093. 5, 19
- Glick, Reuven, and Kenneth Rogoff.** 1995. “Global versus country-specific productivity shocks and the current account.” *Journal of Monetary Economics*, 35(1): 159–192. 5, 21
- Gourinchas, Pierre-Olivier, and Hélène Rey.** 2007. “International Financial Adjustment.” *Journal of Political Economy*, 115(4): 665–703. 12

- Gourinchas, Pierre-Olivier, and Olivier Jeanne.** 2009. "Capital Flows to Developing Countries: The Allocation Puzzle." Peterson Institute for International Economics Peterson Institute Working Paper Series WP09-12. 8
- Gruber, Joseph W., and Steven B. Kamin.** 2007. "Explaining the global pattern of current account imbalances." *Journal of International Money and Finance*, 26(4): 500 – 522. 2
- Hoffmann, Mathias.** 2001a. "Long run recursive VAR models and QR decompositions." *Economics Letters*, 73(1): 15 – 20. 23, 24
- Hoffmann, Mathias.** 2001b. "The Relative Dynamics of Investment and the Current Account in the G7-Economies." *Economic Journal*, 111: C148–163. 5, 21, 23
- Hoffmann, Mathias.** 2003. "International Macroeconomic Fluctuations and the Current Account." *Canadian Journal of Economics*, 36(2): 401–420. 21
- Johansen, Søren.** 1995. *Likelihood-based inference in cointegrated vector autoregressive models*. Oxford:Oxford University Press. ISBN 0-19-877449-4. 23
- Kano, Takashi.** 2008. "A structural VAR approach to the intertemporal model of the current account." *Journal of International Money and Finance*, 27(5): 757–779. 5, 8, 16, 21
- Lane, Philip R., and Gian Maria Milesi-Ferretti.** 2007. "The External Wealth of Nations Mark II." *Journal of International Economics*, , (73): 223–250. 3, 11
- Mendoza, Enrique G., Vincenzo Quadrini, and Jose-Victor Rios-Rull.** 2009. "Financial Integration, Financial Development, and Global Imbalances." *Journal of Political Economy*, 117(3): 371 – 416. 3, 6, 27
- Nason, James M, and John H Rogers.** 2002. "Investment and the Current Account in the Short Run and the Long Run." *Journal of Money, Credit and Banking*, 34(4): 967–86. 21
- Neumeyer, Pablo A., and Fabrizio Perri.** 2005. "Business cycles in emerging economies: the role of interest rates." *Journal of Monetary Economics*, 52(2): 345 – 380. 3
- Obstfeld, Maurice, and Kenneth Rogoff.** 1995. *Foundations of International Macroeconomics*. Princeton University Press. 2, 7, 25
- Song, Zheng, Kjetil Storesletten, and Fabrizio Zilibotti.** 2011. "Growing like China." *American Economic Review*, 101: 202–241. 3, 5, 19, 27
- Wei, Shang-Jin, and Xiaobo Zhang.** 2009. "The Competitive Saving Motive: Evidence from Rising Sex Ratios and Savings Rates in China." National Bureau of Economic Research Working Paper 15093. 4
- Yang, Dennis Tao, Junsen Zhang, and Shaojie Zhu.** 2010. "Why are Savings Rates so high in China?" Hong Kong Institute for Monetary Research Working Paper 31/2010. 4
- Zhang, Zhiwei.** 2008. "Dark Matter in China's Current Account." Unpublished manuscript, International Monetary Fund. 3, 11, 13, 14, 17

Table 1: Fit of the intertemporal model and parameter estimates

		IFS data		Valuation-adj. CA	
		1987-2007	1982-2007	1987-2007	1982-2007
Correlation	$(\rho(\widehat{CA}/\widehat{NO}, CA/NO))$	0.96	0.82	0.85	0.82
Rel. Std. Dev.	$(\frac{\sigma(\widehat{CA}/\widehat{NO})}{\sigma(CA/NO)})$	1.16	0.80	0.89	0.83
Subst. Elasticity	$(1/\gamma)$	0.71	0.61	0.91	0.71
Net Foreign Assets	(b)	0.11	0.01	0.01	0.01

The Table presents correlations of the predicted and the actual current account and their relative standard deviations along with the parameter estimates (substitution elasticity $(1/\gamma)$ and long-term net foreign asset position (b)) obtained from the GMM procedure described in the main text. The predicted current account is given by equation (3) as

$$\frac{\widehat{CA}_t}{\widehat{NO}_t} = b\widetilde{r}_t^W + \left[\left(\frac{1}{\gamma} - 1 \right) c + 1 \right] \sum_{k=1}^{\infty} \kappa^k E_t \widetilde{r}_{t+k}^W + c \left[1 - \frac{1}{\gamma} \right] \sum_{k=1}^{\infty} \kappa^k E_t \widetilde{\Delta} q_{t+k} - \sum_{k=1}^{\infty} \kappa^k E_t \widetilde{\Delta} \widetilde{n} o_{t+k}.$$

Table 2: Channels of external adjustment

Channel	IFS data		Valuation adjusted CA			
	1987-2007	1982-2007	2001-2007	1987-2007	1982-2007	2001-07
Net factor income	-0.01 (-0.97)	-0.01 (-2.59)	0.00 (1.41)	-0.00 (-0.15)	-0.01 (-2.16)	0.00 (1.36)
World interest rate	0.11 (2.56)	-0.12 (-3.02)	0.29 (2.22)	-0.04 (-0.47)	-0.24 (-3.62)	0.29 (1.56)
Real exchange rate changes	1.14 (11.02)	0.75 (6.15)	-0.30 (-1.95)	0.19 (4.72)	0.60 (4.94)	-0.16 (-1.05)
Net output changes	-0.13 (-2.01)	0.03 (0.54)	0.33 (2.62)	0.61 (6.24)	0.31 (4.08)	0.55 (4.76)
Unexplained	-0.11 (-1.35)	0.34 (3.49)	0.67 (1.63)	0.23 (2.04)	0.32 (3.07)	0.32 (0.71)

The table presents estimates of the coefficients β_x from the variance decomposition (6), where $x = b, r, \Delta q, \Delta mo$ in turn. Numbers in parentheses are t-statistics. Boldface indicates significance at the five-percent level.

Table 3: Model fit and channels, based on price index of housing and medical care

		Val. adjusted CA, 1987-2007		
Fit of the model & parameter estimates		Channels of external adjustment		
			1987-2007	2001-2007
Correlation		Net factor income	-0.00	0.00
$(\rho(\widehat{CA/NO}, CA/NO))$	0.90		(-0.15)	(1.36)
Rel. Std. Dev.		World interest rate	-0.04	0.05
$(\frac{\sigma(\widehat{CA/NO})}{\sigma(CA/NO)})$	0.94		(-1.34)	(1.24)
Subst. Elasticity		Real exchange rate	0.31	0.26
$(1/\gamma)$	0.31		(5.65)	(2.11)
Net Foreign Assets		Consumption Smoothing	0.57	0.74
(b)	0.01		(6.14)	(24.01)
Share of tradeables in CPI		Unexplained	0.15	-0.05
(α)	0.90		(1.48)	(-0.25)

The left panel of the Table presents correlations and relative standard deviations for predicted and actual current account and the estimated parameters $(1/\gamma, b$ and $\alpha)$ when the relative price of non-tradeables is measured using an aggregate of prices for housing and medical care. The right panel gives the relative importance of external adjustment channels for this model, based on the decomposition (6). See notes on Tables 1 and 2 for further details.

Table 4: Forecast Error Variance Decompositions 1982-2007

Horizon/yrs	$r_{t+k} - E_t(r_{t+k})$	$\frac{CA_{t+k}}{NO_{t+k}} - E_t\left(\frac{CA_{t+k}}{NO_{t+k}}\right)$	$q_{t+k} - E_t(q_{t+k})$	$no_{t+k} - E_t(no_{t+k})$
<hr/>				
global, transitory				
1	0.64	0.09	0.16	0.10
3	0.56	0.05	0.15	0.07
5	0.42	0.04	0.07	0.03
	[0.14–0.56]	[0.02–0.22]	[0.02–0.14]	[0.02–0.14]
<hr/>				
country-spec., trans.				
1	0.00	0.40	0.22	0.01
3	0.00	0.53	0.15	0.01
5	0.01	0.30	0.04	0.01
	[0.01–0.14]	[0.07–0.39]	[0.01–0.14]	[0.01–0.08]
<hr/>				
global permanent				
1	0.36	0.02	0.52	0.07
3	0.42	0.16	0.30	0.13
5	0.45	0.51	0.32	0.15
	[0.13–0.67]	[0.09–0.64]	[0.08–0.73]	[0.03–0.82]
<hr/>				
country-spec., permanent				
1	0.00	0.49	0.09	0.82
3	0.02	0.26	0.40	0.79
5	0.11	0.14	0.57	0.81
	[0.04–0.35]	[0.08–0.53]	[0.13–0.81]	[0.09–0.91]

Table presents forecast error variance decompositions based on IFS data for the 1982-2007 period. Numbers in rectangular brackets indicate 80 percent bootstrap confidence intervals at the 5-year horizon.

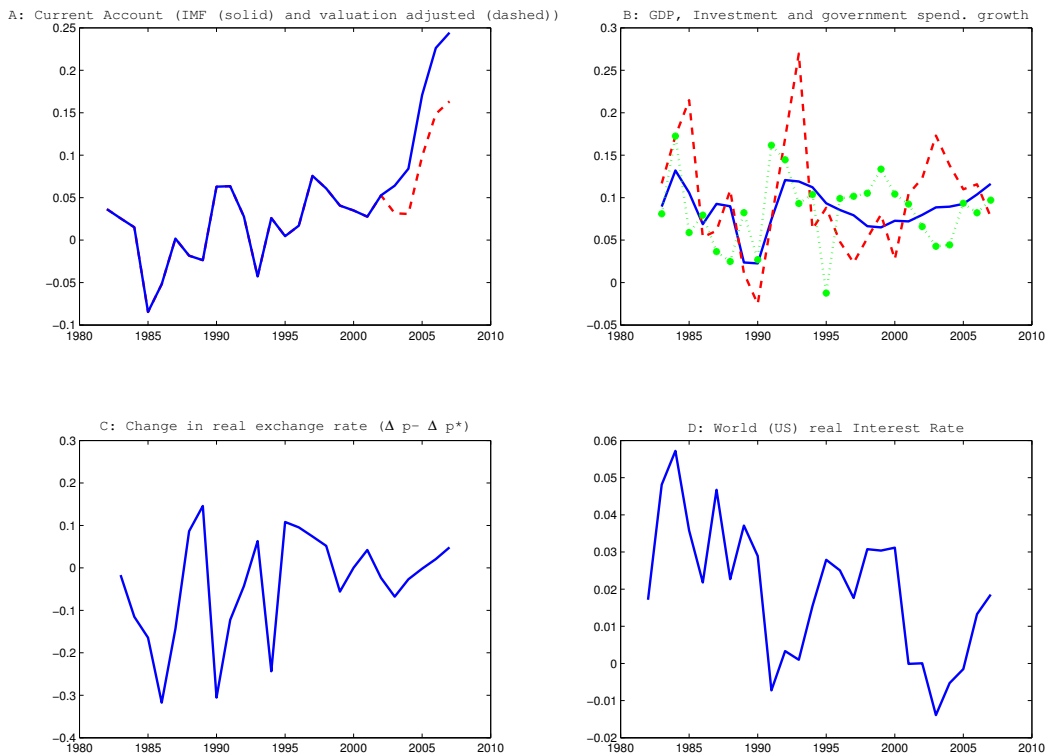
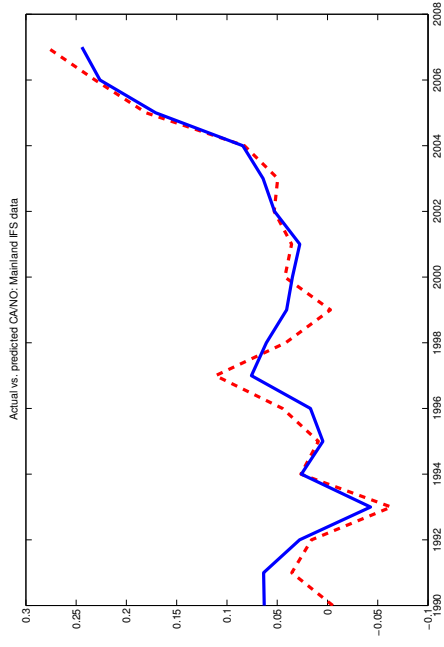
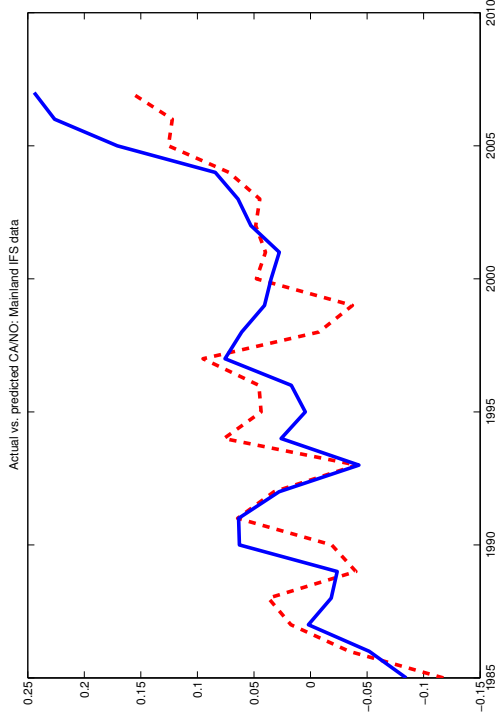


FIGURE 1: Plot of the main data used in the analysis. Panel A: current account over net output. The red-dashed line represents Zhangs (2008) valuation-adjusted current account data (after 2003). Panel B: output (solid line), investment (red dashed line) and government spending growth rates (green, dotted line). Panel C: the rate of change of the real exchange rate. Panel D: the world (US) real interest rate (lower left).

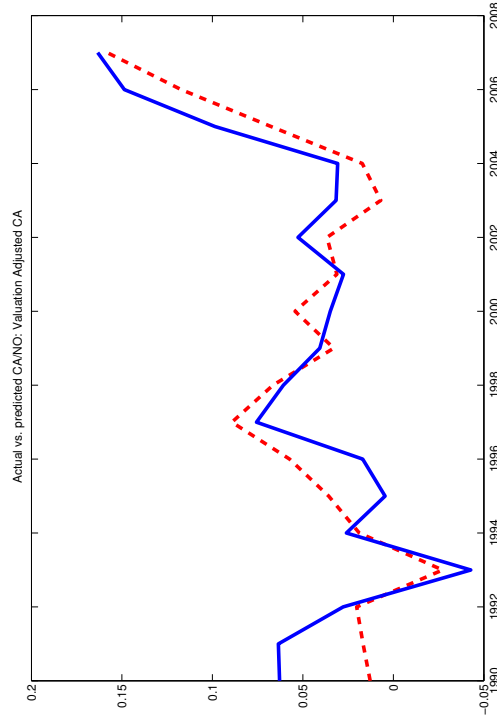
Panel A



Panel B



Panel C



Panel D

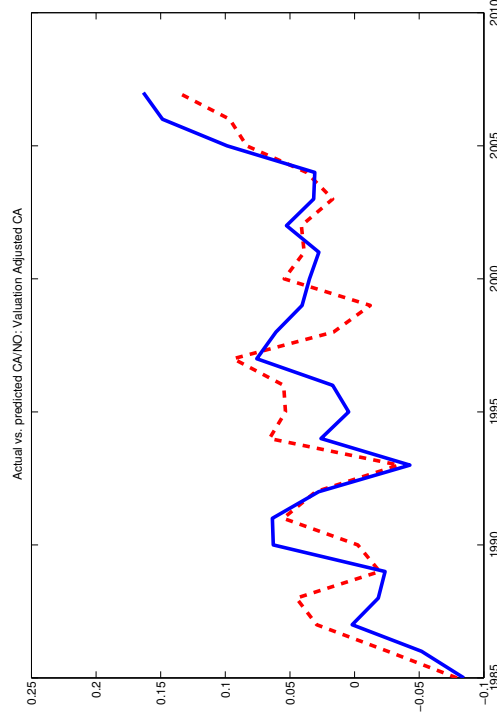


FIGURE 2: Actual Current account over net output ratio (CA/NO) (blue, solid line) vs. model prediction (red, dashed line). The left column (panel A and C) shows the results for the 1987-2007 period, the right column (panel B and D) for the 1982-2007 period. The results in panel A and B are obtained from the model estimated from the official IFS statistics, the ones on panels C and D from the valuation adjusted current account.

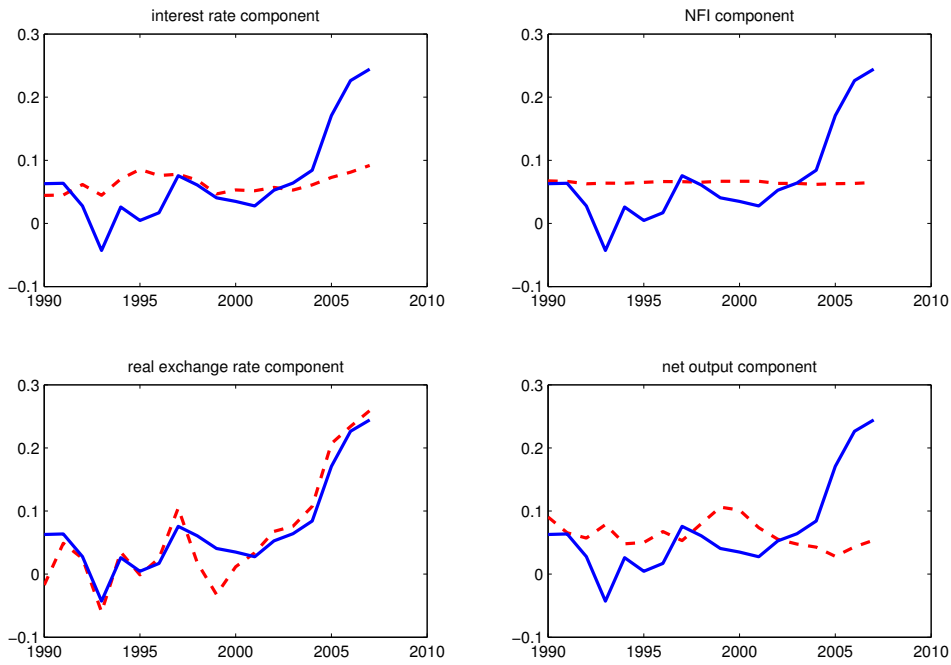


FIGURE 3A: Current Account / Net output ratio (IFS data) (blue, solid line) vs. individual channel components extracted from the model (red, dashed line).

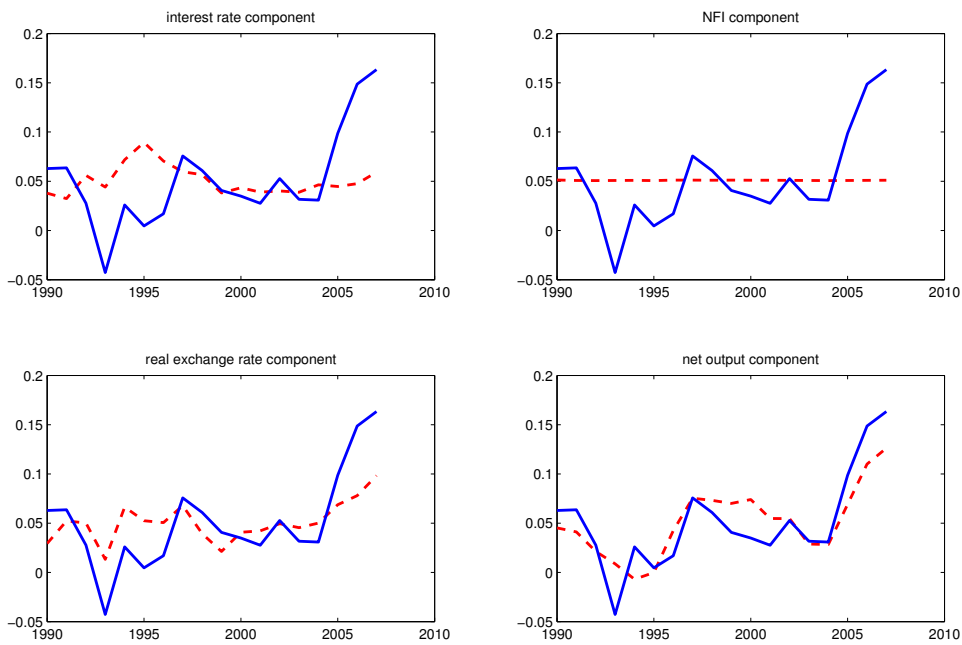


FIGURE 3B: Current Account / Net output ratio (valuation adjusted data) (blue, solid line) vs. individual channel components extracted from the model (red, dashed line).

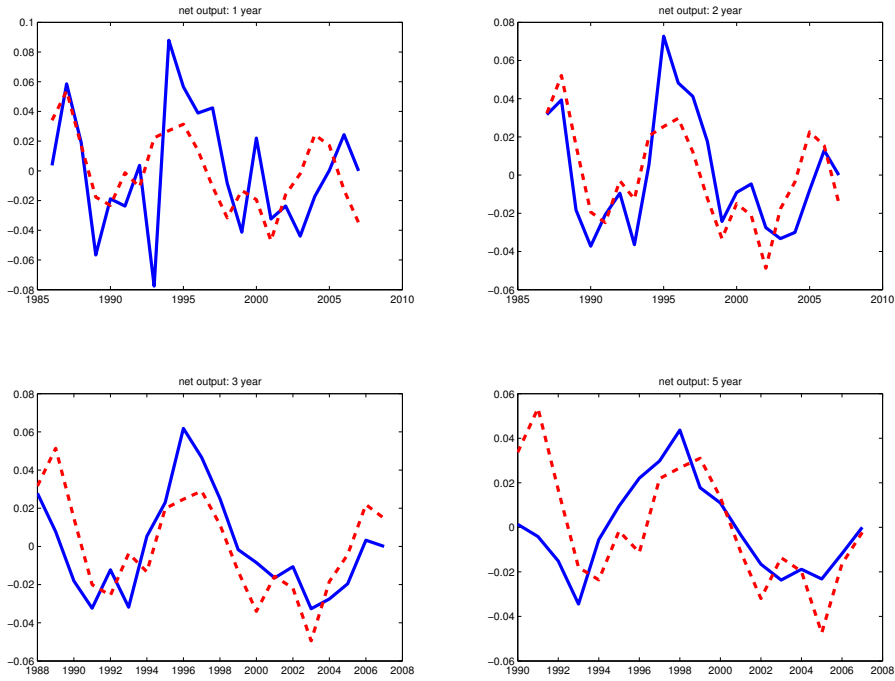


FIGURE 4A: Net output growth rates over 1,2,3,5 years (blue, solid line) vs. the VAR-implied long-run predictions (red, dashed) line. Valuation-adjusted data, 1982-2007.

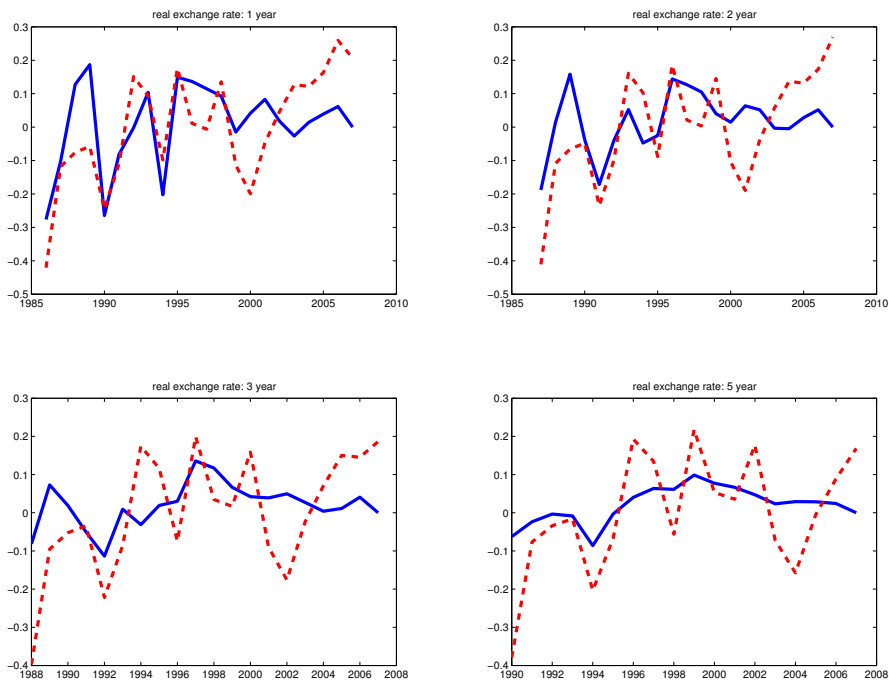


FIGURE 4B: Real exchange rate changes over 1,2,3,5 years (blue, solid line) vs. the VAR-implied long-run predictions (red, dashed lines). Valuation-adjusted data, 1982-2007.

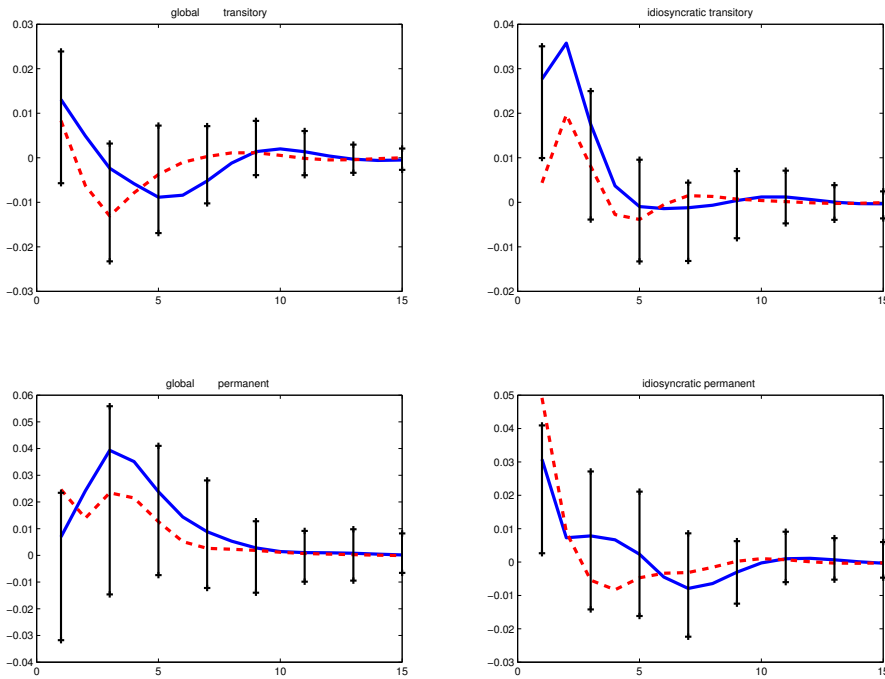


FIGURE 5A: Impulse response of the current account: actual (blue, solid line) vs. theoretically predicted (red, dashed) line. IFS data, 1982-2007. Vertical black lines indicate 80-percent bootstrapped confidence intervals of the actual response.

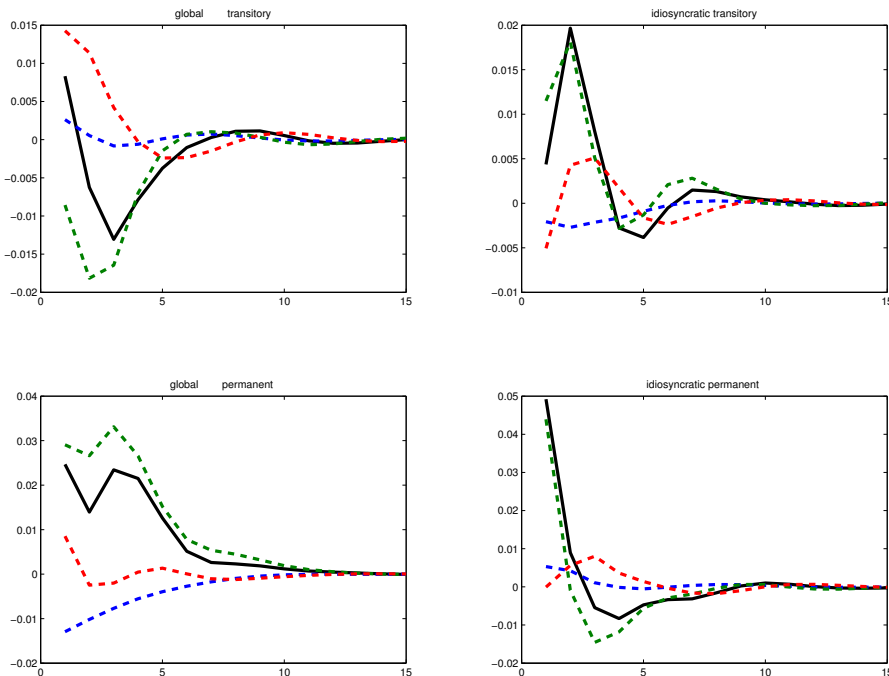


FIGURE 5B: Response of the theoretically predicted current account (black, solid line) and decomposition into the impulse response of the individual channels (dashed lines): consumption tilting due to world real interest rate (blue) and real exchange rate (olive) changes and consumption smoothing due to net output changes (red). IFS data, 1982-2007.