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What drives China's Current Account?

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Background

- China's persistent current account surpluses commonly identified as one of the main sources of *global imbalances*.
- Particularly important instance of the 'Capital Allocation Puzzle' (Gourinchas and Jeanne (2007))
- Theoretical models emphasize domestic financial frictions as the source of capital flowing uphill. (Mendoza et al. (JPE 2009), Caballero et al. (AER 2008), Song et al. (AER 2010, forthcoming)
- Virtually no formal econometric modelling of China's current account, though.

Contribution of this paper

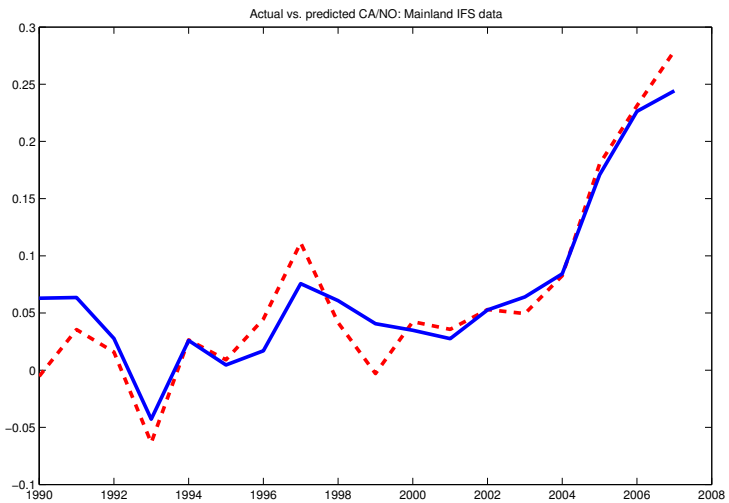
- Theory-based identification of broad macroeconomic factors driving China's current account.
- Offer a taxonomy of how much various channels contribute to China's external adjustment. Does CA...
  - predict variation in national cash flows (smoothing) ?
  - predict variation in (global) interest rates? ('global' tilting)
  - predict variation in real exchange rates? ('domestic' tilting)
- Pay attention to the role of measurement error and of revaluation expectations for China's growing surplus after 2003.

Main findings

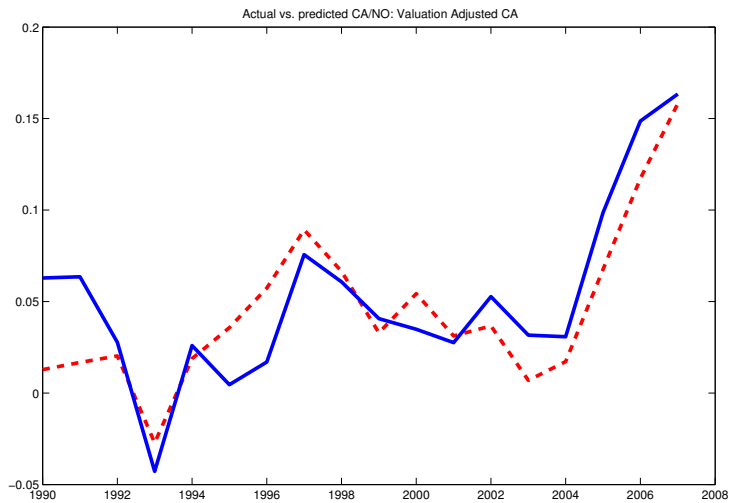
- Simple model of CA dynamics with non-tradeable goods explains 70 percent of the variance in China's current account
- Drivers of CA-dynamics:
  - expected price increases for non-tradeables (housing, education, medical care) are key. This finding is NOT primarily related to revaluation expectations in the fixed exchange rate regime.
  - Expected variation in national cash flow (net output) : China's surplus predicts declines in output less investment and gov spending!
  - Shocks that increase China's CA persistently depress global interest rates.

Fit of the model

Official (IFS) CA-data



Valuation-adj. CA



Actual (blue) and model-predicted (dashed) current account 1990-2007.

The setup

- Start from intertemporal budget constraint:

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

- Define net output $NO = Y_t - I_t - G_t$ and re-write IBC as

$$B_{t-1} = \sum_{k=0}^{\infty} E_t \left\{ R_{t+k} \left[C_{t+k} - NO_{t+k} \right] \right\}$$

- Log-linearization of the intertemporal budget constraint yields (Kano 2008)

$$\frac{\widetilde{CA_t}}{NO_t} = b\widetilde{r_t^W} + c\sum_{k=1}^{\infty} \kappa^k E_t \left\{ \Delta\widetilde{c}_{t+k} - \widetilde{r}_{t+k}^W \right\} + \sum_{k=1}^{\infty} \kappa^k E_t \left\{ \widetilde{r}_{t+k}^W - \Delta\widetilde{no}_{t+k} \right\} \tag{1}$$

  where $R_{t+k} = \left[\prod_{l=0}^{k} (1 + r_{t+l}^W) \right]^{-1}$, Δno: growth rate of net output, b and c: long-term means of B/NO and C/NO, $\kappa = exp\left[E(\Delta no_t) - E(r_t) \right]$
- So far no restrictions from theory used!

Theory model (Bergin and Sheffrin (EJ 2000))

- Representative household maximizes lifetime utility from a Cobb-Douglas consumption bundle composed of tradeable and non-tradeable goods:

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

  subject to above BC. Then $C_t = P^* X = C_{Tt} + P C_{Nt}$ is aggregate consumption expenditure (in terms of tradeable goods.
- The Euler equation in this model is

$$E_t \left(\beta \left(\frac{C_t}{C_{t+1}} \right)^{\gamma} \left(\frac{P_t^*}{P_{t+1}^*} \right)^{1-\gamma} \right) = \frac{1}{1 + r_{t+1}^W} \tag{2}$$

- Assuming that Δc, and Δp are jointly log-normal:

$$\begin{aligned} E_t(\Delta c_{t+1}) &= \frac{1}{\gamma} E_t \left\{ r_{t+1}^W + (1-\alpha)(\gamma - 1)\Delta p_{t+1} \right\} + constant \\ &= \frac{1}{\gamma} E_t \left(r_{t+1} \right) + constant \end{aligned}$$

  where r is the consumption-based interest rate and $\Delta q = (1-\alpha)\Delta p_{t+1}$ the real exchange rate.(See slide 25).

– Plug in for $E_t(\Delta c_{t+k})$ in (1) to obtain

$$\begin{aligned}\widetilde{\frac{CA_t}{NO_t}} &= b\widetilde{r_t^W} \\ &+ \left[1 - \left(1 - \frac{1}{\gamma}\right) c\right] \sum_{k=1}^{\infty} \kappa^k E_t \widetilde{r^W}_{t+k} \\ &+ c\left[1 - \frac{1}{\gamma}\right] \sum_{k=1}^{\infty} \kappa^k E_t \widetilde{\Delta q}_{t+k} \\ &- \sum_{k=1}^{\infty} \kappa^k E_t \Delta \widetilde{no}_{t+k}\end{aligned} \tag{3}$$

– $b\widetilde{r_t}$: income effect of change in r_t

– $\left[1 - (1 - \gamma^{-1})c\right] \sum_{k=1}^{\infty} \kappa^k E_t \widetilde{r}^W_{t+k}$: net impact of intertemporal substitution and of the wealth effect from variations in the world interest rate –> 'Global Tilting'

– $c\left[1 - \frac{1}{\gamma}\right] \sum_{k=1}^{\infty} \kappa^k E_t \widetilde{\Delta q}_{t+k}$: net impact of changes in relative prices — > 'Domestic tilting'

– $\sum_{k=1}^{\infty} \kappa^k E_t \Delta \widetilde{no}_{t+k}$: net impact of variation in national cash-flow (consumption smoothing)

The 'frictionless' setup: some reflections

- Model without financial frictions used here does not mean to imply that Chinese economy IS actually frictionless.
- But: proof of the pudding is in the eating.
- Build on a literature (Chari, Kehoe, McGrattan E'metrica 2007, Aguiar Gopinath (2007), Gourinchas & Jeanne (2009)) that models with frictions can be mapped into 'wedge-economies'
- —> Frictions show up in the structure of shocks! (e.g. more persistent 'efficiency wedges' or 'savings wedges'.)
- Here: assume savings wedge constant but efficiency wedge may well be present.

Bringing the model to the data

- Define $X_t = \left[\begin{array}{cccc} r_t & CA_t/NO_t & \Delta q_t & \Delta no_t \end{array} \right]'$ and stack $z_t = \left[\begin{array}{cc} X_t', & X_{t-1}' \ldots \end{array} \right]'$ to write the VECM in companion form:

$$z_t = \mathbf{G} z_{\mathbf{t-1}} + \mathbf{u_t}$$

- Use Hansen-Sargent prediction formula

$$E_t \{r_{t+i}\} = \mathbf{e}_r' \boldsymbol{G}^i Z_t, \; E_t \{\Delta q_{t+i}\} = \mathbf{e}_{\boldsymbol{\Delta q}}' \boldsymbol{G}^i Z_t \text{and } E_t \{\Delta no_{t+i}\} = \boldsymbol{e}_{\boldsymbol{\Delta no}}' \boldsymbol{G}^i Z_t$$

- to obtain predicted current account - net output ratio:

$$\widehat{\frac{CA_t}{NO_t}} = b\widetilde{r}_t^W + \left[\left(1 - \left(1 - \frac{1}{\gamma} \right) c + 1 \right) e_r' + c \left(1 - \frac{1}{\gamma} \right) e_{\Delta q} - e_{\Delta no}{}' \right] \boldsymbol{A} Z_t$$

where $\boldsymbol{A} = \kappa \boldsymbol{G} \left[\boldsymbol{I} - \kappa \boldsymbol{G} \right]^{-1}$.

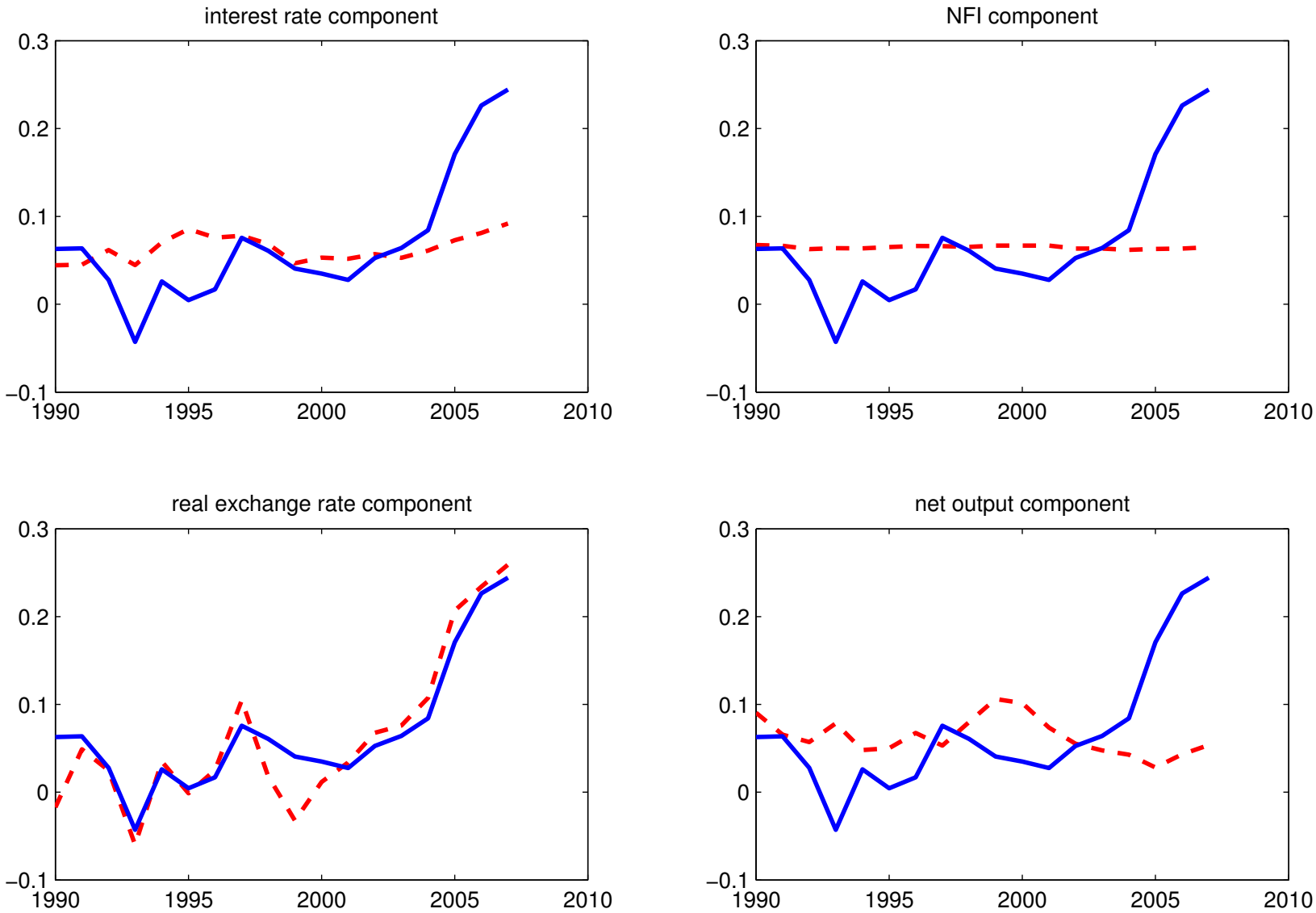
- Test: Compare $\widehat{CA_t/NO_t}$ with actual CA/NO!
- To do so: fix c from the data, estimate $1/\gamma, b$ using a GMM procedure.

Data

- *GDP*, *I*, *G* , real exchange rate data from official national sources and IMF International Financial statistics.
- Current Account Data – use from IFS, but these may be overstated for two reasons:
  - 60% of external trade is *de facto* intra-company trade of multinationals. The interaction between revaluation expectations in the fixed exchange rate regime and capital controls provides an incentive to over-invoice on exports and to under-invoice on imports.
  - return on FDI underestimated in official figures. (as compared to extant figures for other Emerging markets and microeconometric estimates). That leads to understatement outflows of capital income in official *CA*-figures.
- Zhang (2008) provides adjusted *CA*-figures for the period 2003- 2007. Use these alternatively.
- CPIs for housing, medical care and other non-tradeables from PBC and HKMA.

Table: **Fit of the intertemporal model and parameter estimates**

		IFS data		Valuation-adj. CA	
		1987-2007	1982-2007	1987-2007	1982-2007
Correlation	$(\rho(\widehat{CA/NO}, CA/NO))$	0.96	0.82	0.85	0.82
Rel. Std. Dev.	$(\frac{\sigma(\widehat{CA/NO})}{\sigma(CA/NO)})$	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



CA/NO(IFS data) (blue, solid line) vs. external adjustment factors extracted from the model (red, dashed line).

What are the drivers of China's CA?

- Recognize that $ca := CA_t/NO_t = \widehat{CA_t/NO_t} + res_t$ and recall that

$$\widehat{ca} := \frac{\widehat{CA_t}}{NO_t} = b\widetilde{r}_t^W + \left\{ \left(\left(\frac{1}{\gamma} - 1 \right) c + 1 \right) e_r' - c \left(\frac{1}{\gamma} - 1 \right) e_{\Delta q}' - e_{\Delta no}' \right\} \boldsymbol{A} Z_t$$

- Decompose the variance of the current account as follows:

$$\begin{aligned} 1 &= \frac{cov(ca, \widehat{ca} + res)}{var(ca)} \\ &= \underbrace{\frac{cov(ca, br)}{var(ca)}}_{\beta_b} + \underbrace{\frac{cov(ca, global\ tilt)}{var(ca)}}_{\beta_r} \\ &\quad + \underbrace{\frac{cov(ca, dom\ tilt)}{var(ca)}}_{\beta_{\Delta q}} + \underbrace{\frac{cov(ca, smooth)}{var(ca)}}_{\beta_{smooth}} + \underbrace{\frac{cov(ca, res)}{var(ca)}}_{\beta_{res}} \end{aligned}$$

Table: **Channels of external adjustment**

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

Table: **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)		
				β_x	t-stat
Correlation	$(\rho(\widehat{CA/NO}, CA/NO))$	0.90	Net factor income	-0.00	(-0.15)
Rel. Std. Dev.	$(\frac{\sigma(\widehat{CA/NO})}{\sigma(CA/NO)})$	0.94	World interest rate	-0.04	(-1.34)
Subst. Elasticity	$(1/\gamma)$	0.31	Real exchange rate	0.31	(5.65)
Net Foreign Assets	(b)	0.01	Consumption Smoothing	0.57	(6.14)
Share of tradeables in CPI	(α)	0.90	Unexplained	0.15	(1.48)

Does the CA predict the right things?

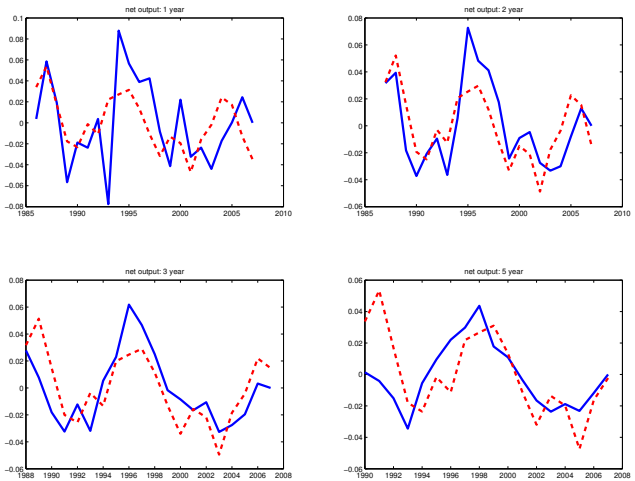


FIGURE 3A: Net output growth rates over 1,2,3,5 years (blue, solid line) vs. the VAR-implied long-run predictions (red, dashed) line. Valuation-adjusted data, 1982-2007.

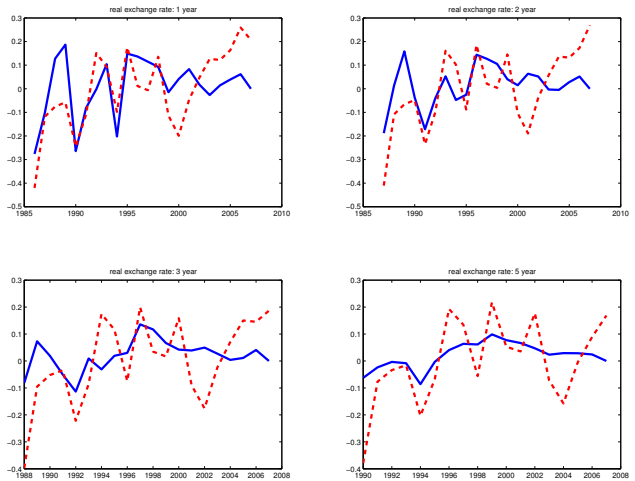


FIGURE 3B: Real exchange rate changes ober 1,2,3,5 years (blue, solid line) vs. the VAR-implied long-run predictions (red, dashed lines). Valuation-adjusted data, 1982-2007.

Taking stock

- Simple present value model (PVMCA) able to describe bulk of variation in Chinese CA-data.
- Key drivers of external adjustment: (i) expected changes in prices of non-tradeables , (ii) expected variation in national cash-flows
  - ad (i): Precautionary motives?
  - ad (ii): Financing frictions for firms could lead to deferred investment growth, temporary declines in $NO = GDP - I - G$
- Negative correlation between CA and expected variation in world interest rate!

Dynamic analysis

- PVMCA seems to fit China's current account well overall.
- But is the dynamics of the model consistent with responses to various groups of – broadly – 'structural' shocks?
- And which shocks can account for eventual difference between model and data? (notably: negative correlation between r^W and CA/NO)
- Here: broadly classify shocks into permanent / transitory and global / country-specific
- Then suggest novel way to explore the conditional fit of a present-value model, checking whether the response of CA/NO is consistent with the responses on the RHS of

$$\widehat{\frac{CA_t}{NO_t}} = b\widetilde{r}_t^W + \left[\left(1 - \left(1 - \frac{1}{\gamma}\right)c + 1\right)e_r' + c\left(1 - \frac{1}{\gamma}\right)e_{\Delta q} - e_{\Delta no}{}'\right]\boldsymbol{A}Z_t$$

Identification

With $\Delta \boldsymbol{x}_t = \begin{bmatrix} \Delta q_t & \Delta no_t \end{bmatrix}'$ and $\boldsymbol{z}_t = \begin{bmatrix} r_t^W & \frac{CA}{NO}_t \end{bmatrix}'$ re-write the mixed levels-differences VAR

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

as a VECM:

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

where

$$\boldsymbol{\Gamma}(L) = \begin{bmatrix} \boldsymbol{B_1}(L) & \frac{\boldsymbol{D_1(L) - D_1(1)}}{1-L} \\ \boldsymbol{B_2}(L) & \frac{\boldsymbol{D_2(L) - D_2(1)}}{1-L} \end{bmatrix} \quad \text{and} \quad \boldsymbol{\alpha} = \begin{bmatrix} \boldsymbol{D_1}(1) \\ \boldsymbol{D_2}(1) - \boldsymbol{I} \end{bmatrix}$$

This is a trivially cointegrated system with two cointegrating relationships – CA/NO and r^w.

– Then identify permanent shocks with the space orthogonal to error-correction behavior, i.e. spanned by $\boldsymbol{\alpha}_{\perp}$:

$$\boldsymbol{\pi}_t = \boldsymbol{S}_p^{'} \boldsymbol{\alpha}_{\perp}^{\prime} \boldsymbol{\varepsilon}_{\boldsymbol{t}} \tag{4}$$

– Transitory shocks orthogonal to $\boldsymbol{\pi}_t$:

$$\boldsymbol{\tau}_t = \boldsymbol{S}_{\tau}^{'} \boldsymbol{\alpha}^{\prime} \boldsymbol{\Omega}^{-1} \boldsymbol{\varepsilon}_t$$

– Need to identify normalization matrices $\boldsymbol{S}_p$ and $\boldsymbol{S}_{\tau}$. Requiring that $var(\pi) = I_2$ and $var(\tau) = I_2$imposes 3 retrictions on each S.

– 1 add'l restriction in each S comes form requring that only global shocks affect r^W in the short-run.

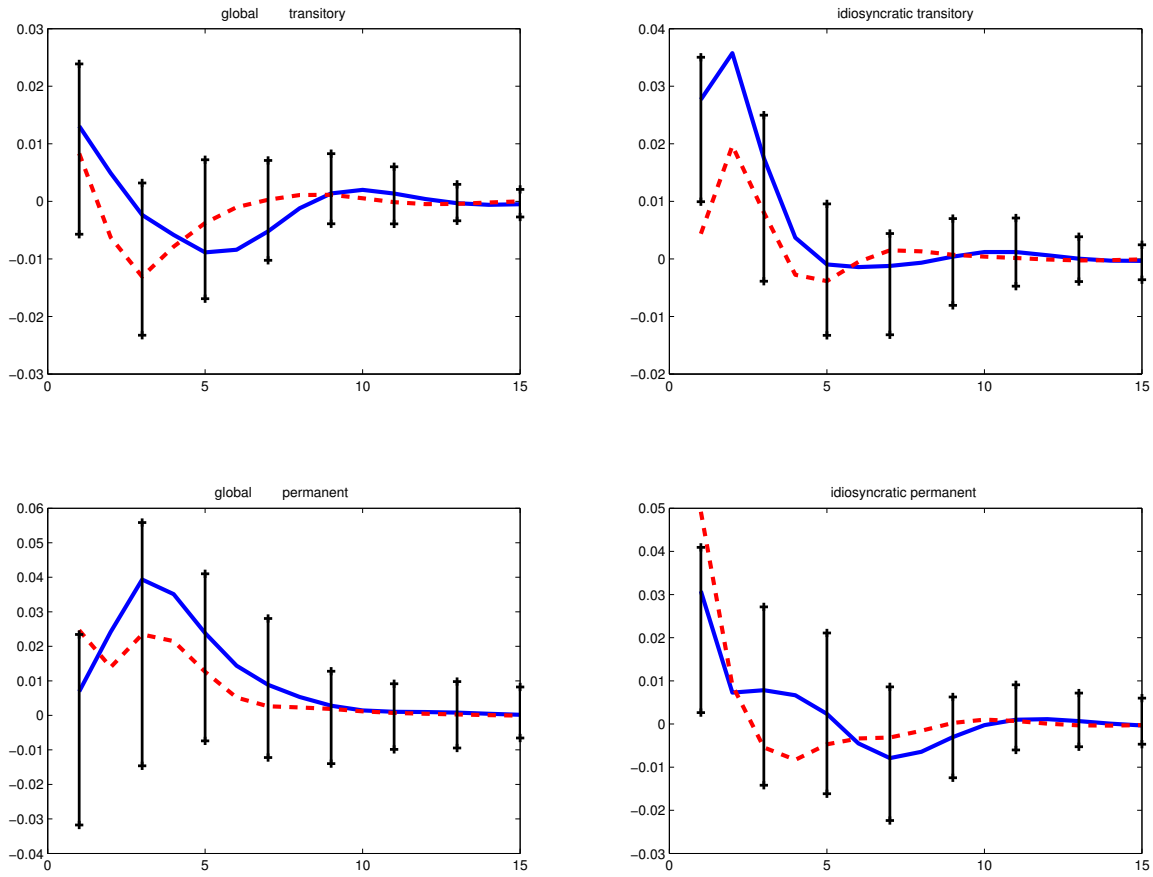


FIGURE 3A: Impulse response of the current account: actual (blue, solid line) vs. theoretically predicted (red, dashed) line. IFS data, 1982-2007. Vertical black lines indicate 80-percent bootstrapped confidence intervals of the actual response.

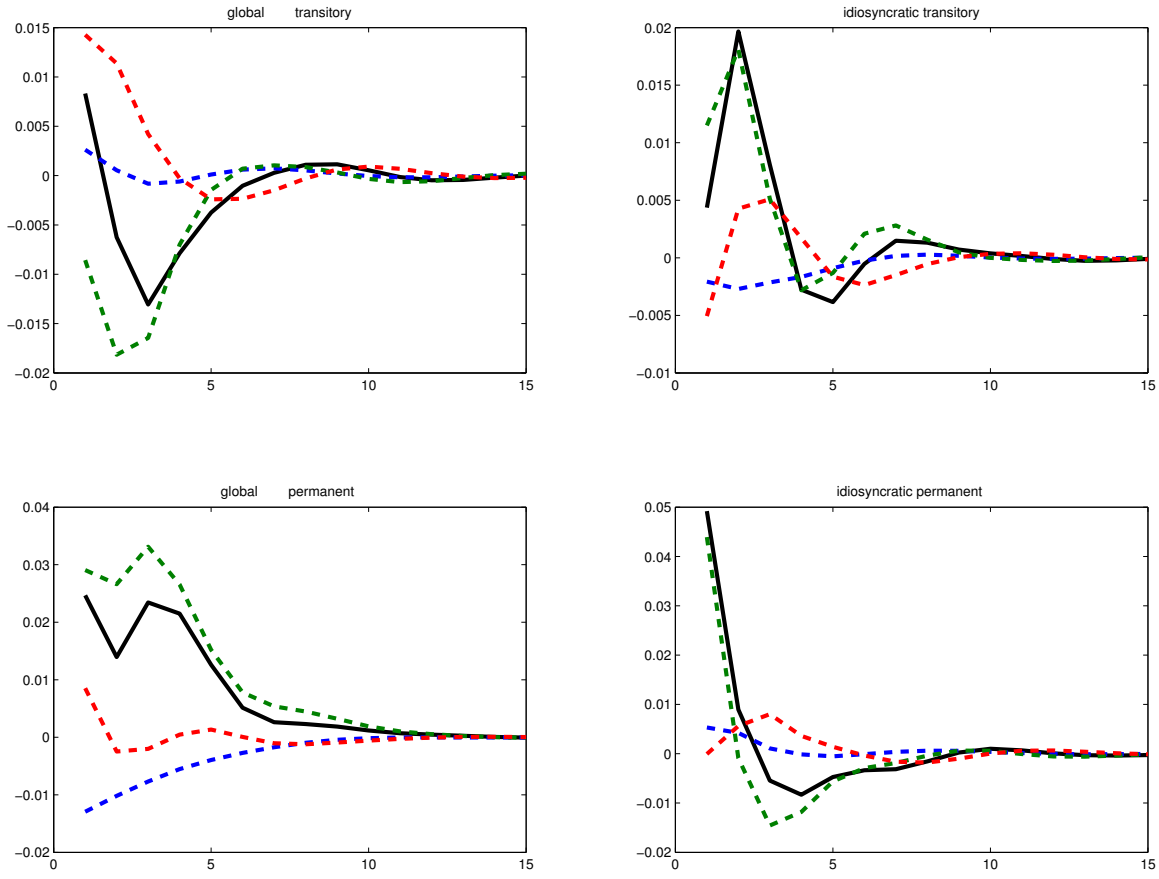


FIGURE 3B: Response of the theoretically predicted current account (black, solid line) and decomposition into the impulse response of the individual channels (dashed lines): consumption tilting due to world real interest rate (blue) and real exchange rate (olive) changes and consumption smoothing due to net output changes (red). IFS data, 1982-2007.

Wrapping up

- PVMCA able to describe bulk of variation in Chinese CA-data – unconditionally AND conditional on a number of broadly 'structural' shocks!
- Key drivers of external adjustment: (i) expected changes in non-tradeable goods , (ii) expected variation in national cash-flows
- Negative correlation between CA and expected variation in world interest rate!
- Global permanent shock has a persistent effect on both China's current account and the world real interest rate.

The savings wedge