A Provincial View of Global Imbalances: Regional External Adjustment in China

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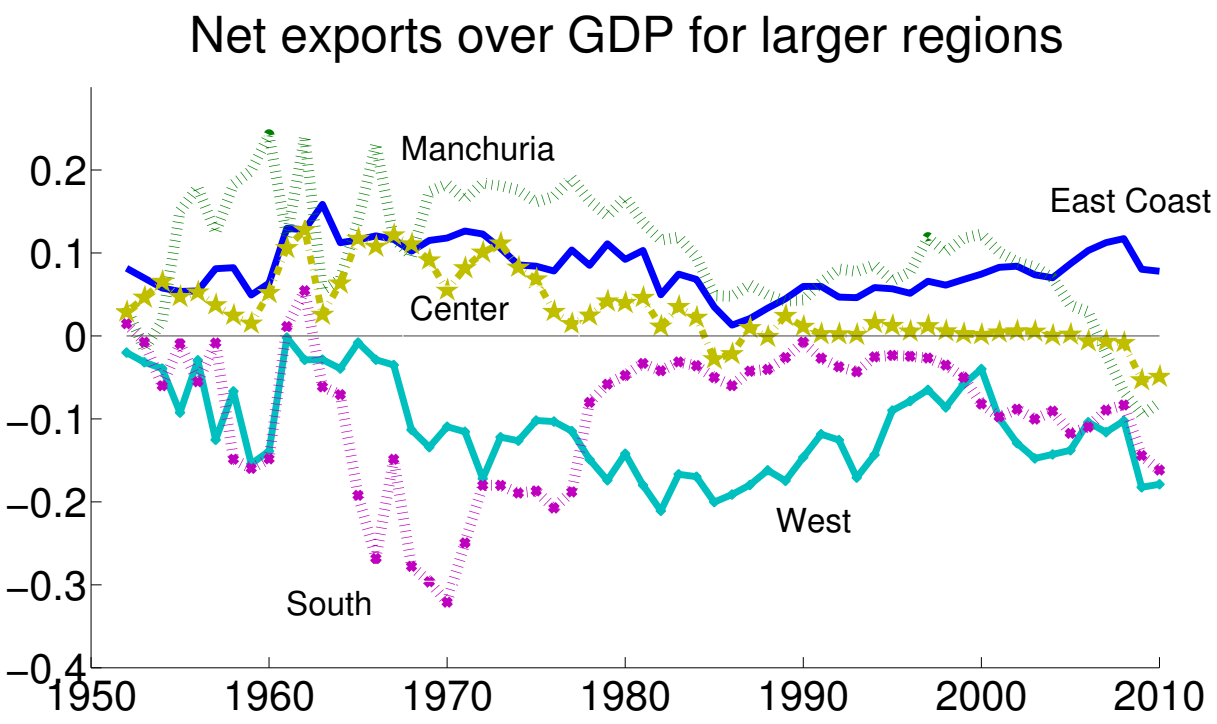
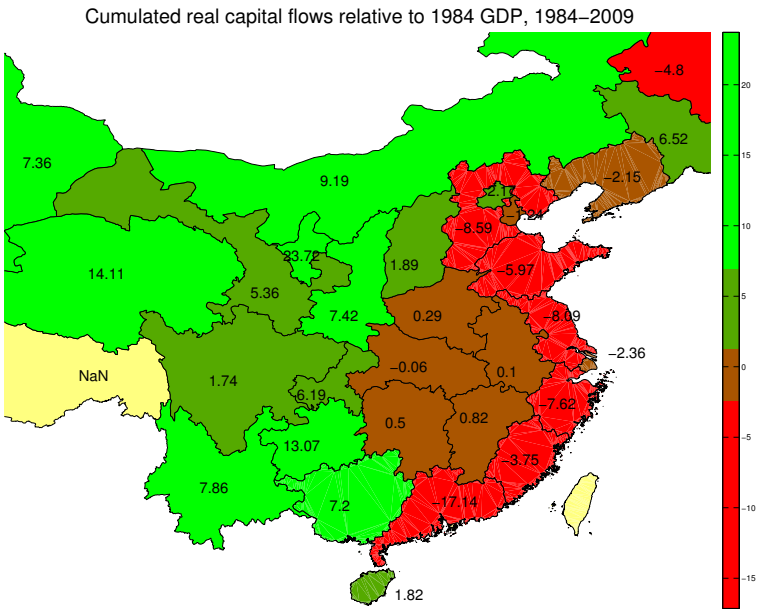
Motivation I

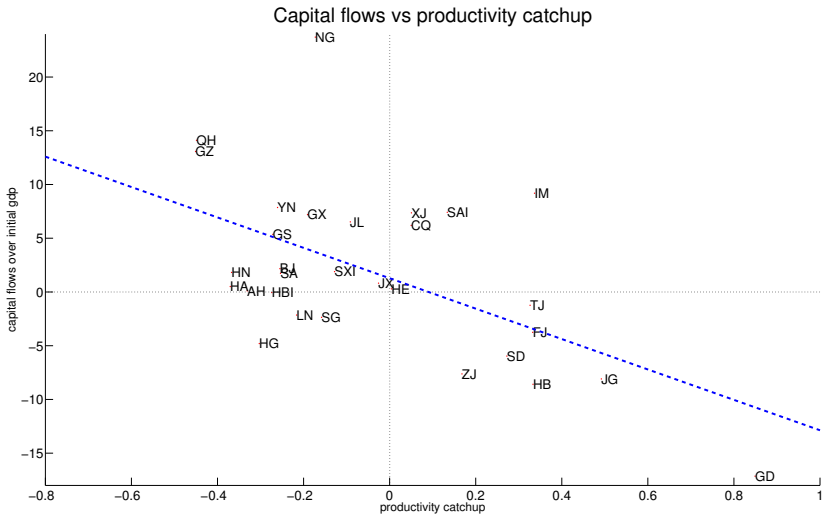
- Large variation in external balances (net exports) across Chinese provinces
- Exploit this variation to identify factors matter for dynamics of capital flows within China



Motivation II

China: an intra-national allocation puzzle (Cudré 2011)





What we do

- Model dynamics of provincial external balances using a simple theory-based framework
- Use framework to identify patterns of province-level external adjustment
- Correlate province-level patterns of external adjustment with regional characteristics

Methodology: Present value model of the current account developed in Kano (2008, JIMF), Hoffmann (2013, JIMF) and Hoffmann and Woitek (2011).

What we contribute

- Contribute to a growing body of literature on macroeconomic analysis using Chinese province-level data (e.g. Brandt et al. (RED, forthcoming)).
- One of the first papers to look at the dynamics of intra-national capital flows (net exports) in China
- Taxonomy of channels of external adjustment informative w.r.t. particular mechanisms that drive NX-dynamics
- Shed light on drivers of capital flows at both regional and global level $\rightarrow$ link between internal & global imbalances.

China's role in Global imbalances: previous literature

Large body of theoretical and empirical studies on global imbalances:

- Financial development: *Caballero et al. (2008)*, *Mendoza et al., (2009)*, *Song et al., (2011)*
- Financial repression: *Johansson (2012)*
- Data issues: *Zhang (2008)*, *Alfaro et al. (2011)*
- Political economy: *Aguiar and Amador (2011)*
- Industrial structure: *Jin (2011)*
- Policies: *Prasad and Wei (2007)*, *Yongding (2007)*, *Aizenman and Lee (2007 and 2008)*, *Aizenman and Lee (2010)*, *Anderson (2007)*
- HH vs Firms vs Gov savings: *Ma and Yi (2011), Kujis (2005)*
- Micro studies using HH data: *Chamon et al. (2008 and 2010)*, *Horioka and Wan (2007) and Modigliani*, *Cao (2004)*, *Banerjee et al.*, *2010*, *Du and Wei (2010)*, *China Household Finance Survey (2012)*
- Housing: *Chen, Funke, Mehrotra (2011), Chao et al. (2011)*
- Natural resources and heavy industry: *Anderson (2007)*
- HERE: theory-based but descriptive decomposition of X-section of provincial net exports, consistent with many existing models. This allows to correlate patterns of adjustment with province characteristics and (hopefully) to distinguish between competing explanations.

Model: Bergin and Sheffrin (EJ 2000), Hoffmann (JIMF 2013)

Each province k representative agent has lifetime CRRA utility over a consumption bundle X composed of tradeable and non-tradeable goods:

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

$$X_t^k = X\left(C_{Nt}^k, C_{Tt}^k\right) = C_{Tt}^{k\alpha} \times C_{Nt}^{k1-\alpha}$$

The law of motion of a province's claims on the rest of the world (including other provinces and other countries):

$$\begin{aligned} B_t^k &= (1+r_t^{kT})B_{t-1}^k + Y_t^k - I_t^k - G_t^k - C_t^k \\ \Delta B_t^k = CA_t^k &= NO_t^k - C_t^k + r_t^{kT} B_{t-1}^k \\ NX_t^k = CA_t^k - r_t^{kT} B_{t-1}^k &= NO_t^k - C_t^k \end{aligned}$$

The tradeable good is the numéraire ($P_t^k = P_N^k / P_T^k$)
Allow for a (province-specific) saving wedge to capture frictions in capital flows in the spirit of *Gourinchas and Jeanne, (2011)*:

$$1 + r_t^{kT} = (1 + r_t^W)(1 - \tau_t^{ks})$$

More

Log-linearization: Kano (2008), Hoffmann (2013)

Kano (2008) log linearization of the ex-ante intertemporal budget constraint delivers:

$$\widetilde{\frac{NX_t}{NO_t}}^k = \frac{\overline{C}}{NO}\sum_{l=1}^{\infty}\kappa^l E_t\left\{\Delta\widetilde{c}^k_{t+l} - \widetilde{r}^{T,k}_{t+l}\right\} + \sum_{l=1}^{\infty}\kappa^l E_t\left\{\widetilde{r}^{T,k}_{t+l} - \Delta\widetilde{no}^k_{t+l}\right\}$$

Defining $\eta = 1/\gamma$ (intertemporal elasticity of substitution), approximate Euler-equation:

$$\begin{aligned} E_t(\Delta c^k_{t+1}) &= \eta E_t\left[r^{T,k}_{t+1} + \frac{1-\eta}{\eta}(1-\alpha)\Delta p^k_{t+1}\right] + const \\ &= \frac{1}{\gamma}E_t\left(r^k_{t+1}\right) + const \end{aligned}$$

Plugging in and defining $(1-\alpha)E_t\Delta\tilde{p}_{t+1} = E_t\Delta\tilde{q}_{t+1}$:

$$\begin{aligned} \widetilde{\frac{NX_t}{NO_t}}^k &= [1 - \frac{\overline{C}}{NO}(1-\frac{1}{\gamma})]\sum_{l=1}^{\infty}\kappa^l E_t\widetilde{r^W}_{t+l} + [\frac{\overline{C}}{NO}(1-\frac{1}{\gamma})]\sum_{l=1}^{\infty}\kappa^l E_t\widetilde{\Delta q}^k_{t+l} \\ &\quad - \sum_{l=1}^{\infty}\kappa^l E_t\widetilde{\Delta no}^k_{t+l} - \left[[1 - \frac{\overline{C}}{NO}(1-\frac{1}{\gamma})]\sum_{l=1}^{\infty}\kappa^l E_t\widetilde{\tau}^{ks}_{t+l}\right] \end{aligned}$$

with

$$\kappa = exp\left[E(\Delta no^k_t) - E(r^w_t) + E(\tau^s_t)\right]$$

Note: κ is a function of the province-level savings wedge!

Model

Rewrite

$$\frac{\widetilde{NX_t}^k}{NO_t} = [1-\phi]\sum_{l=1}^{\infty}\kappa^l E_t \widetilde{r^W}_{t+l} + \phi\sum_{l=1}^{\infty}\kappa^l E_t \widetilde{\Delta q}^k_{t+l} - \sum_{l=1}^{\infty}\kappa^l E_t \Delta\widetilde{no}^k_{t+l} - (1-\phi)\sum_{l=1}^{\infty}\kappa^l E_t \widetilde{\tau}^{ks}_{t+l}$$

where

$$\phi = \frac{\overline{C}}{NO}\left[1-\frac{1}{\gamma}\right]$$

Abbreviate expected present values with $PV_t(.)$):

$$\frac{\widetilde{NX_t}^k}{NO_t} = (1-\phi)\times PV_t(\widetilde{r^w};\kappa) + \phi\times PV_t(\widetilde{\Delta q}^k;\kappa) - PV_t(\widetilde{\Delta no}^k;\kappa) - PV_t(\widetilde{\tau}^k;\kappa)$$

Four channels:

- Global tilting: consumption-tilting due to expected variation in world/national real rate of interest (high expected interest rate, save more)
- Domestic tilting: effect on intertemporal substitution of expected real exchange rate changes (price of domestic consumption bundle expected to rise, save more)
- Consumption smoothing: classical channel, if output below trend, expected changes positive, run NX deficit
- Tilting due to expected variation in savings wedge (We treat this residually for now)

Empirical implementation

Proxy the expectations with VAR endogenous variables in the spirit of *Campbell and Shiller (1987)* and *Gourinchas and Rey (2007):*

$$X_t = \left[\begin{array}{cccc} \Delta no_t^k & \Delta q_t^k & r_t^W & (NX/NO)_t^k \end{array} \right]$$

Use companion form $Z_t^k = \boldsymbol{A_{\{k\}}} Z_{t-1}^k + U_t^k$ to back out expectations as

$$\sum_{l=1}^{\infty} \kappa^l \boldsymbol{E}_t X_{t+l}^k = \boldsymbol{e}_x' \kappa \boldsymbol{A}_{\{k\}} \left[\boldsymbol{I} - \kappa \boldsymbol{A}_{\{k\}} \right]^{-1} Z_t^k$$

The predicted equation with selection vector e is:

$$\widehat{\frac{NX_t}{NO_t}}^k = \left[(1 - \overline{\frac{C}{NO}} \left(1 - \frac{1}{\gamma}\right)) e_r' + \overline{\frac{C}{NO}} \left[1 - \frac{1}{\gamma}\right] e_{\Delta q}' - e_{\Delta no}' \right] \kappa \boldsymbol{A_{\{k\}}} \left[\boldsymbol{I} - \kappa \boldsymbol{A_{\{k\}}} \right]^{-1} Z_t^k$$

- Calibrate $\overline{\frac{C}{NO}}$ from average ratio in the data
- Grid search for γ and κ to minimize:

$$\sum_{t=1}^{T} \left[\left(\frac{NX}{NO}\right)_t^k - \left(\widehat{\frac{NX}{NO}}\right)_t^k \right]^2$$

VAR variables

Net output per capita ($NO = Y - G - I$): ▸ More

- 2011 regional Statistical Yearbooks from the National Bureau of Statistic (revised)
- China Data Center (CDC) data from earlier Yearbooks to fill the gaps (non-revised)
- No proper GDP deflator, use general regional CPI (1984-2010) instead
- Population data issue

External balance of region: ▸ More

- Use GDP by expenditure approach on the regional level
- NX dynamics quite different from international trade, contains interprovincial flows as well
- Aggregation properties and data quality issues

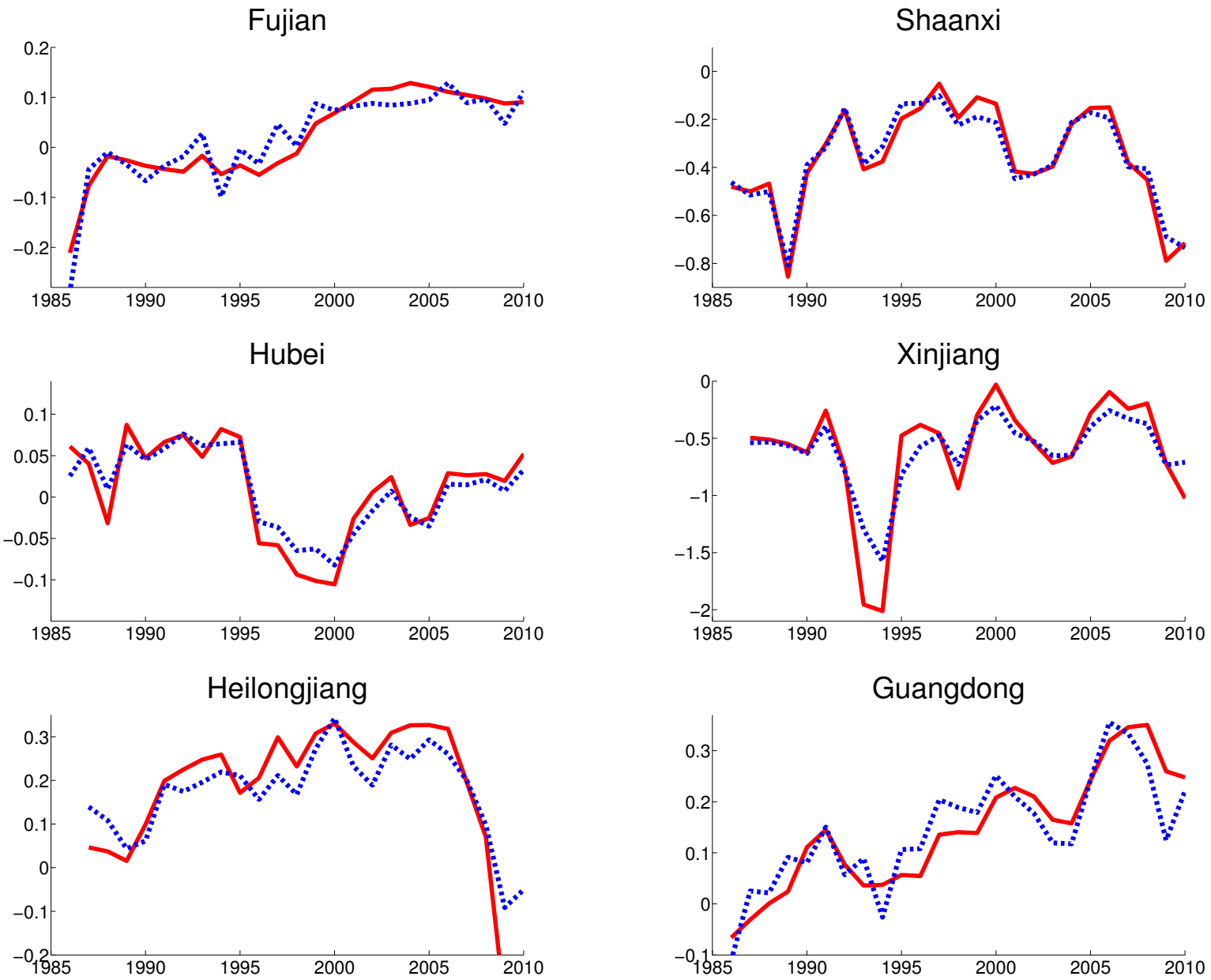
Reference interest rate as a linear combination of world and national interest rate: ▸ More

- World interest rate proxied with 3 months T-bill rate (Federal Reserve Board) less US urban ex-ante CPI (Bureau of Labor Statistics) to correct for inflation
- National interest rate proxied with official lending rate of PBoC corrected for ex-ante local CPI inflation
- Extent to which regions are sensitive to world interest rate depends on integration with world economy (absolute int trade balance)

Real exchange rate: ▸ More

- Combine IMF real effective exchange rate with share of NT in HH expenditures (urban and rural HH survey) and various indicators of prices of tradeables and non-tradeables (services price index, general CPI, CPI categories, price of housing)
- Integrated prices of housing for the 2000s

Real (solid) vs estimated (dashed) NX/NO



Specification and basic fit

Table: Specification, grid search results and basic fit measures

	γ	κ	$\rho(\hat{x}, x)$	$\sigma(\hat{x})/\sigma(x)$		γ	κ	$\rho(\hat{x}, x)$	$\sigma(\hat{x})/\sigma(x)$
Beijing	0.3	0.995	0.93	0.98	Hunan	1.6	0.900	0.49	0.92
Tianjin	1.0	0.833	0.99	0.83	Guangd.	4.0	0.995	0.89	0.94
Hebei	4.0	0.995	0.72	1.00	Guanxi	0.8	0.995	0.93	1.04
Shanxi	4.0	0.900	0.97	0.98	Hainan	3.0	0.995	0.95	0.81
Inner Mong.	1.0	0.995	0.98	0.84	Chongq.	1.8	0.995	1.00	1.00
Liaon	2.7	0.900	0.97	1.06	Sichuan	1.8	0.900	0.87	1.42
Jilin	2.4	0.905	0.98	0.94	Guizhou	0.8	0.995	1.00	0.91
Heilongj.	4.0	0.995	0.94	0.59	Yunnan	1.0	0.926	0.97	0.93
Shan	0.9	0.925	0.95	0.96	Tibet				
Jiangsu	2.6	0.900	0.96	1.33	Shaanxi	1.5	0.995	0.98	0.91
Zhej	4.0	0.900	0.92	1.12	Gansu	1.8	0.995	0.90	0.98
Anhui	1.5	0.900	0.80	0.99	Qinghai				
Fujian	3.2	0.995	0.92	1.05	Ningxia				
Jiangxi	1.5	0.900	0.91	1.38	Xinjiang	0.7	0.995	0.96	0.62
Shandong	2.3	0.995	0.54	1.22					
Henan	1.0	0.900	0.88	1.39	Median	1.7	0.995	0.95	1.00
Hubei	1.1	0.995	0.95	0.80	Mean	2.0	0.950	0.90	0.98

Results obtained from a two dimensional grid search by minimizing the square distance between the real and estimated NX/NO.
$\gamma = [0.20 - 4]$ and $\kappa = [0.900 - 0.995]$
Tibet, Qinghai and Ningxia are excluded because of data issues.
One or two lags.
Sample: 1985-2010.
Shorter sample: 2009 for Tianjin, Yunnan and Gansu, 2008 for Inner Mongolia, Anhui, Henan and Guanxi and 2007 for Jilin

Variance Decomposition

Decompose the variance of each province's net exports as:

$$1 = \beta_r^k + \beta_{\Delta q}^k + \beta_{\Delta no}^k + \beta_{res}^k$$

with

$$\beta_r^k = \frac{cov\left((1-\phi) \times PV_t(\widetilde{r^w}), NX^k/NO^k\right)}{var(NX^k/NO^k)}$$

$$\beta_{\Delta q}^k = \frac{cov\left(\phi \times PV_t(\widetilde{\Delta q}^k), NX^k/NO^k\right)}{var(NX^k/NO^k)}$$

$$\beta_{\Delta no}^k = \frac{cov\left(-PV_t(\widetilde{\Delta no}^k), NX^k/NO^k\right)}{var(NX^k/NO^k)}$$

$$\beta_{res}^k = \frac{cov(res^k, CA^k/NO^k)}{var(NX^k/NO^k)}$$

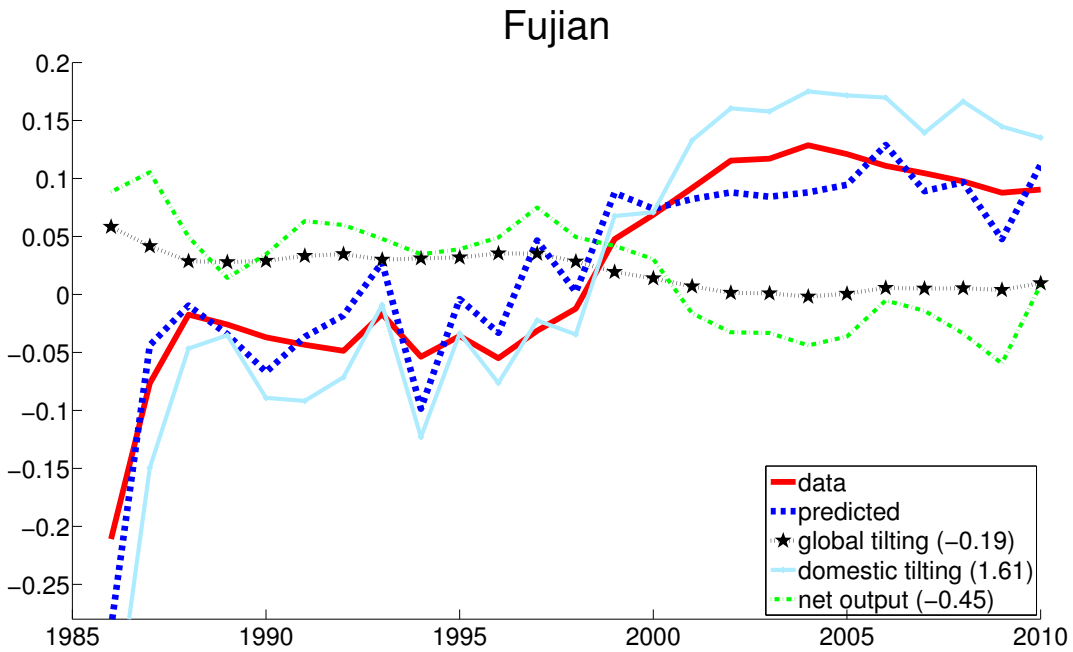
Note that the βs can be estimated with OLS by regressing channel on NX^k/NO^k.

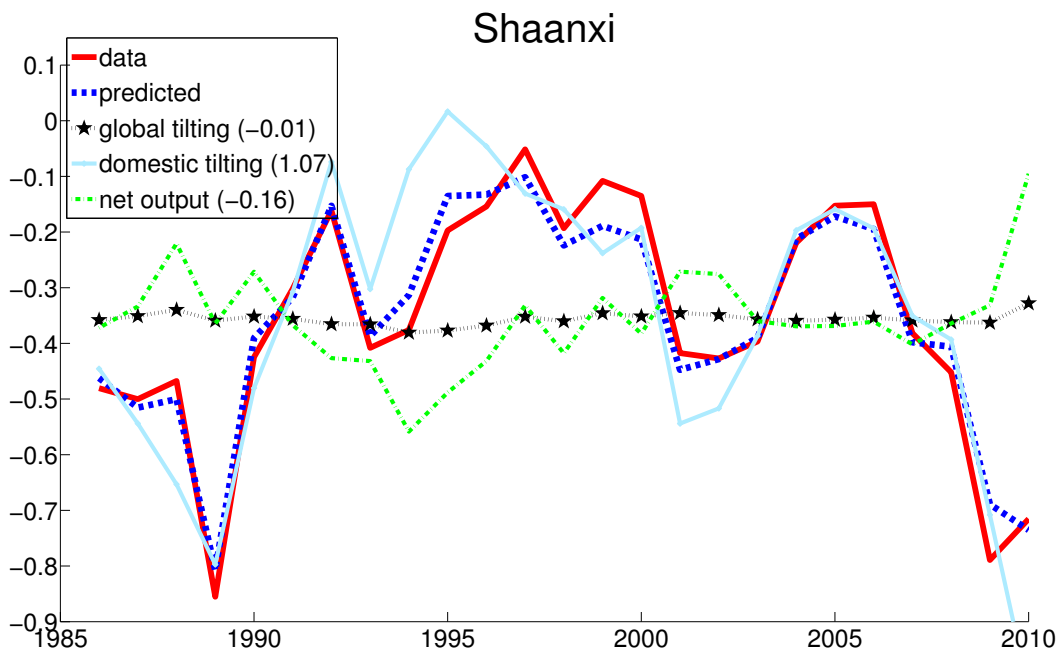
Channels of adjustment

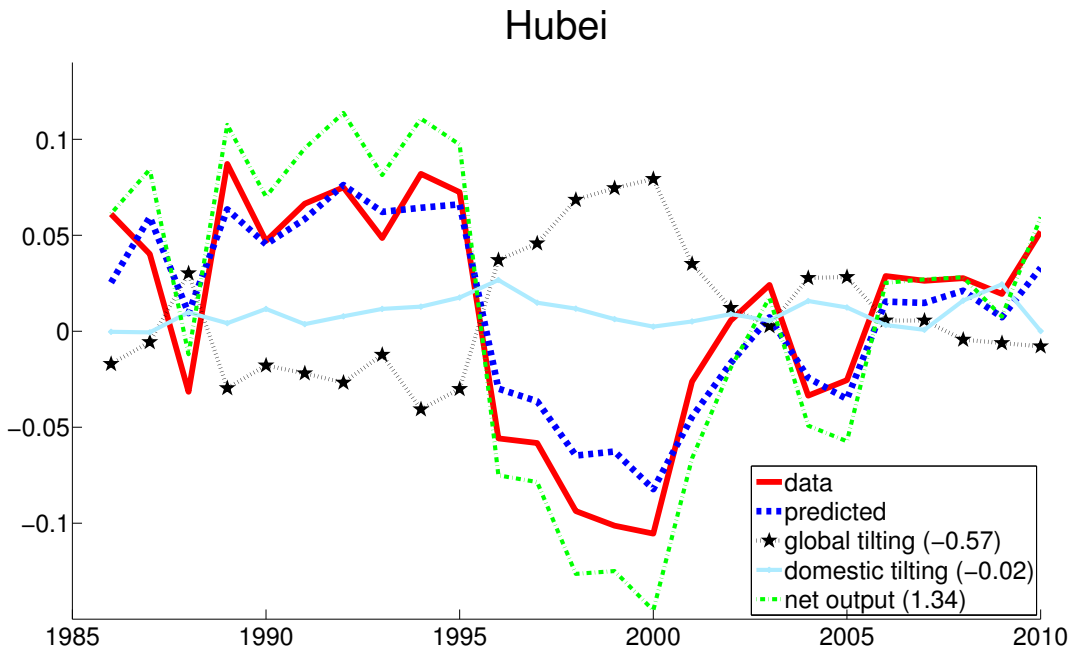
Table: Channels of external adjustment

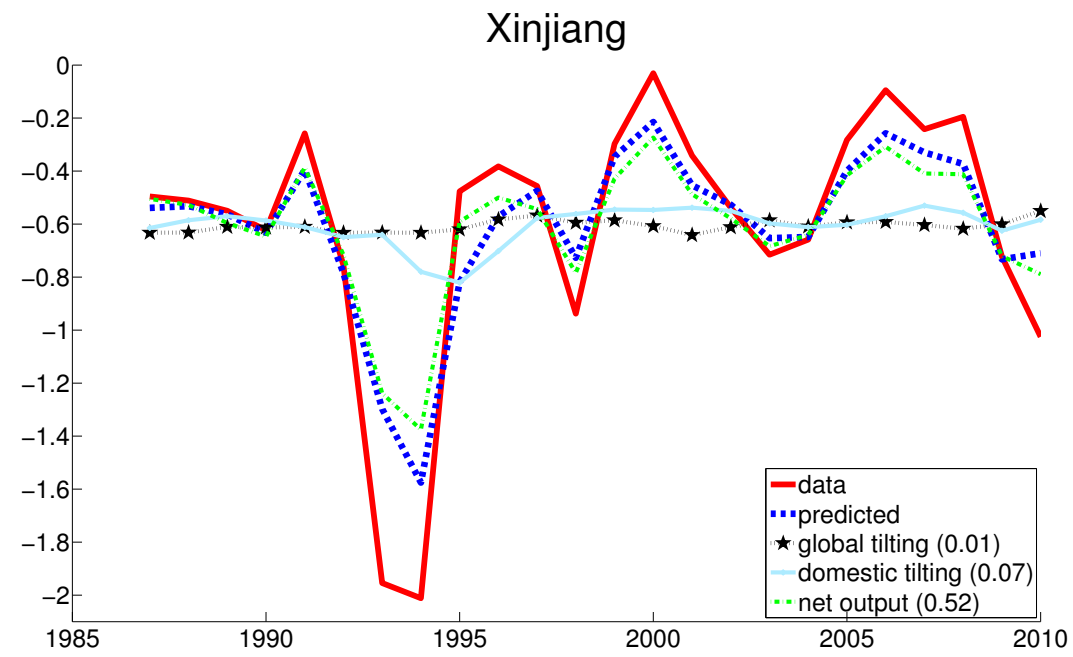
	glob β_r	*dom* $\beta_{\Delta q}$	*no* $\beta_{\Delta no}$	*un* β_{res}		*glob* β_r	*dom* $\beta_{\Delta q}$	*no* $\beta_{\Delta no}$	*un* β_{res}
Beijing	-0.33	0.85	0.39	0.09					
Tianjin	-0.01	-0.10	0.94	0.17	Henan	1.43	0.00	-0.21	-0.22
Hebei	-0.02	1.23	-0.48	0.27	Hubei	-0.57	-0.02	1.34	0.25
Shanxi	0.00	0.79	0.16	0.05	Hunan	-0.14	-0.85	1.45	0.55
Inner Mong.	0.02	0.00	0.80	0.18	Guangd.	-0.10	0.52	0.42	0.16
Liaoning	0.06	-0.74	1.71	-0.03	Guanxi	0.10	0.28	0.59	0.03
Jilin	0.00	0.35	0.57	0.08	Hainan	0.01	-0.03	0.79	0.23
Heilong.	-0.02	0.42	0.16	0.44	Chongq.	0.04	-0.24	1.19	0.00
Shanghai	-0.05	0.11	0.85	0.09	Guizhou	-0.03	0.09	0.84	0.10
Jiangsu	-0.03	0.73	0.58	-0.28	Yunnan	0.06	-2.56	3.40	0.10
Zhejiang	-0.04	1.20	-0.13	-0.03	Shaanxi	-0.01	1.07	-0.16	0.11
Anhui	-0.26	-0.50	1.56	0.20	Xinjiang	0.01	0.07	0.52	0.40
Fujian	-0.19	1.61	-0.45	0.03					
Jiangxi	0.20	1.23	-0.17	-0.26	Median	-0.02	0.10	0.58	0.10
Shandong	-0.02	-0.11	0.79	0.34	Mean	0.00	0.21	0.67	0.12

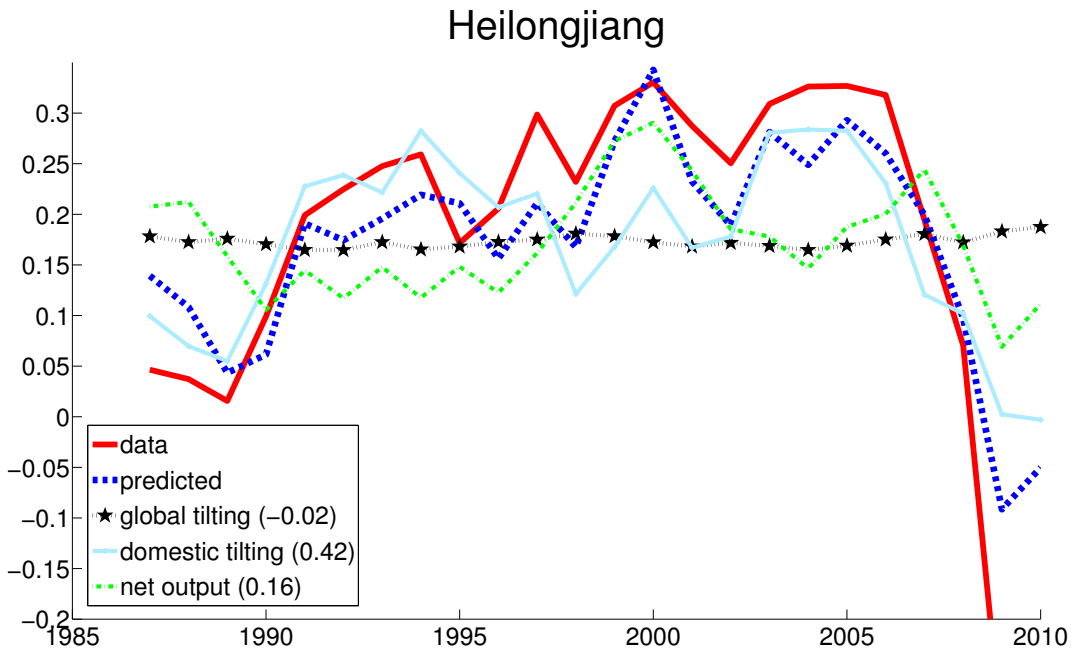
The table presents estimates of the variance decomposition coefficients β_r, $\beta_{\Delta q}$, $\beta_{\Delta no}$ and β_{res}.

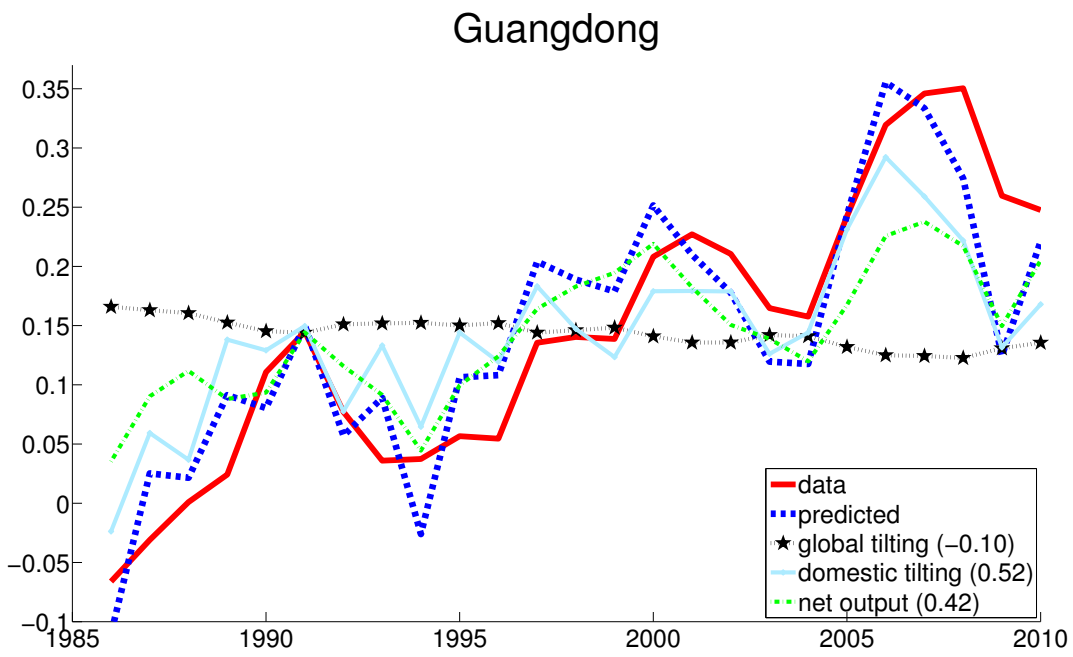

Fujian
0.2
0.15
0.1
0.05
0
−0.05
−0.1
−0.15
−0.2
−0.25
1985
1990
1995
2000
2005
2010
data
predicted
global tilting (−0.19)
domestic tilting (1.61)
net output (−0.45)


Shaanxi
data
predicted
global tilting (−0.01)
domestic tilting (1.07)
net output (−0.16)
0.1
0
−0.1
−0.2
−0.3
−0.4
−0.5
−0.6
−0.7
−0.8
−0.9
1985
1990
1995
2000
2005
2010


Hubei
0.1
0.05
0
−0.05
−0.1
1985
1990
1995
2000
2005
2010
data
predicted
global tilting (−0.57)
domestic tilting (−0.02)
net output (1.34)


Xinjiang
0
−0.2
−0.4
−0.6
−0.8
−1
−1.2
−1.4
−1.6
−1.8
−2
1985
1990
1995
2000
2005
2010
data
predicted
global tilting (0.01)
domestic tilting (0.07)
net output (0.52)


Heilongjiang
0.3
0.25
0.2
0.15
0.1
0.05
0
−0.05
−0.1
−0.15
−0.2
1985
1990
1995
2000
2005
2010
data
predicted
global tilting (−0.02)
domestic tilting (0.42)
net output (0.16)


Guangdong
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
−0.05
−0.1
1985
1990
1995
2000
2005
2010
data
predicted
global tilting (−0.10)
domestic tilting (0.52)
net output (0.42)

Panel: linking channels to regional characteristics

Want to link patterns of external adjustment to province-level characteristics:

$$\beta_x^k(t) = \beta_x + \boldsymbol{\gamma}_x' \boldsymbol{z}_t^k$$

with β_x being the average importance over regions and $\boldsymbol{\gamma}_x$ the sensitivity of respective channel to variation in characteristics.

Estimate $\beta_x^k(t)$ from:

$$x_t^k = \alpha + \tau_t + \mu_k + \beta_x^k(t) \times \left[\frac{NX}{NO}\right]_t^k + \boldsymbol{z}_t^{k\prime}\,\boldsymbol{\delta} + \nu_t^k$$

where x denotes the different channels.

Using the assumed functional form for $\beta_x^k(t)$, we get:

$$x_t^k = \alpha + \tau_t + \mu_k + \beta_x \times \left[\frac{NX}{NO}\right]_t^k + \boldsymbol{\gamma}_x' \boldsymbol{z}_t^k \times \left[\frac{NX}{NO}\right]_t^k + \boldsymbol{z}_t^{k\prime}\,\boldsymbol{\delta} + \nu_t^k$$

Structural Panel

Table: External adjustment patterns – panel evidence

Channel (X)	*coeff* β_X	*t-stat*
glob tilting	-0.04	(-1.31)
dom tilting	0.23	(2.46)
net output	0.64	(9.22)
unexpl	0.18	(3.63)

Panel estimates of the respective channels from the regression

$$x_t^k = \alpha + \tau_t + \mu_k + \beta \times \left(\frac{NX}{NO}\right)_t^k + \varepsilon_t^k,$$

where x_t^k stands for the VAR-implied expectations of the global tilting, domestic tilting and consumption smoothing channel respectively. T-statistics based on Arellano's heteroskedasticity's and autocorrelation-consistent standard errors.

Table: Channels of external adjustment and province-level characteristics

	glob	*dom*	*cons*	*un*	*glob*	*dom*	*cons*	*un*
NX / NO	− 0.053	0.120	0.779	0.153				
	(−1.55)	(1.18)	(8.55)	(3.15)				
NX / NO × Mining	0.037	0.475	−0.623	0.111				
	(0.65)	(1.81)	(−2.64)	(0.71)				
Mining	0.056	−0.056	−0.063	0.062				
	(1.29)	(−0.39)	(−0.68)	(1.42)				
NX / NO					0.064	−0.047	0.692	0.290
					(2.60)	(−0.54)	(7.46)	(4.15)
NX / NO × Deposits					−0.080	0.203	−0.034	−0.088
					(−3.11)	(2.54)	(−0.53)	(−3.03)
Deposits					−0.044	0.097	−0.046	−0.007
					(−2.33)	(2.54)	(−1.98)	(−0.44)
NX / NO	0.020	0.103	0.658	0.219				
	(1.29)	(1.79)	(7.83)	(3.32)				
NX / NO × ForeignInvest	−0.887	1.634	−0.177	−0.570				
	(−3.20)	(2.47)	(−0.31)	(−1.64)				
ForeignInvest	0.093	−0.491	0.380	0.018				
	(1.32)	(−1.56)	(1.36)	(0.12)				
NX / NO					0.072	−0.195	0.890	0.234
					(1.91)	(−1.06)	(4.84)	(1.76)
NX / NO × Secondary					−0.256	0.942	−0.564	−0.122
					(−2.64)	(2.34)	(−1.36)	(−0.51)
Secondary					0.124	−0.278	0.070	0.084
					(1.03)	(−1.13)	(0.55)	(0.71)

The table reports the results of panel regressions of the form $x_t^k = \alpha + \tau_t + \mu_k + \beta_X \times \left(\frac{NX}{NO}\right)_t^k + \gamma_X \times \left(\frac{NX}{NO}\right)_t^k \times Z_t^k + \delta_X \times Z_t^k + \varepsilon_t^k$, where x_t^k stands in turn for the VAR-implied expectations of the global tilting, domestic tilting and consumption smoothing channel. The variable Z_t^k stands for the different potential explaining variables.

Table: Channels of external adjustment and province-level characteristics

	glob	dom	cons	un	glob	dom	cons	un
NX/NO	−0.038	0.259	0.665	0.113				
	(−1.19)	(2.21)	(7.47)	(2.74)				
NX/NO × StateEnterprise	−0.014	−0.073	−0.053	0.140				
	(−0.30)	(−0.64)	(−0.52)	(2.64)				
StateEnterprise	−0.005	−0.021	−0.026	0.052				
	(−0.25)	(−0.33)	(−0.40)	(1.78)				
NX/NO					−0.009	0.158	0.652	0.200
					(−0.43)	(2.20)	(7.90)	(3.44)
NX/NO × Openness					−0.148	0.286	−0.050	−0.088
					(−2.61)	(1.22)	(−0.31)	(−1.42)
Openness					0.028	−0.027	0.003	−0.004
					(2.29)	(−0.54)	(0.08)	(−0.18)
NX/NO	−0.046	0.226	0.638	0.182				
	(−1.24)	(2.30)	(8.86)	(3.49)				
NX/NO × EastCoast	0.023	−0.008	0.043	−0.057				
	(0.45)	(−0.03)	(0.22)	(−0.77)				
EastCoast	0.043	−0.049	0.067	−0.005				
	(4.31)	(−1.93)	(3.97)	(−0.29)				
NX/NO					−0.059	0.230	0.626	0.203
					(−1.16)	(1.99)	(8.95)	(3.70)
NX/NO × PostWTO					0.029	−0.009	0.029	−0.049
					(0.78)	(−0.12)	(0.60)	(−1.89)
PostWTO					−0.401	−0.302	−0.086	0.032
					(−16.69)	(−4.20)	(−2.04)	(1.46)

The table reports the results of panel regressions of the form $x_t^k = \alpha + \tau_t + \mu_k + \beta_X \times \left(\frac{NX}{NO}\right)_t^k + \gamma_X \times \left(\frac{NX}{NO}\right)_t^k \times z_t^k + \delta_X \times z_t^k + \varepsilon_t^k$, where x_t^k stands in turn for the VAR-implied expectations of the different channels

Conclusion

- A simple intertemporal model does a surprsingly good job in replicating X-section of China's province-level net exports
- Domestic tilting and consumption-smoothing explain 80% of the variation in NX-dynamics for the average prefecture. This lines up with what is found from aggregate data (Hoffmann, 2012 forthcoming)
- But this hides considerable X-sectional variation in importance of channels
  - Expected variation in real exchange rates (domestic tilting) is relatively more important if province is ...
    - rich in mineral resources
    - more financially developed
    - attracts more foreign direct investment
    - has a bigger secondary sector
  - Unexplained / savings-wedge component of model correlates with SOE-importance (see Song et al. (2011))
  - WTO accession no discernible impact on pattern of external djustment but improves fit of the model overall

Moving ahead

- control for more province-level covariates (demography, urbanization, financial repression & frictions...) – in progress
- restrict behavioral parameters (γ) in the X-section – DONE
- parametrize time-variation in the savings wedge – in progress

Global imbalances through China's lens

Data issues

- Hidden capital inflows via underestimated returns on foreign investment and misreporting of EX and IM, real CA lower since mid 2000s *(Zhang, 2008)*
- World exports to Mars *(IMF, 2011)*
- CA not informative enough, importance of public debt, aid and reserve accumulation *(Alfaro et al., 2011)*

Financial dvpt

- Heterogeneity of countries in capacity to provide financial assets *(Caballero et al. 2008)*
- Diff in enforceability of financial contracts *(Mendoza et al., 2009)*
- Limited access to credit of high productivity private firms force them to rely on self-financing from retained earnings *(Song et al., 2011)*
- Financial integration low, investment by private firms respond to MPC, gov investment allocates capital to less productive regions *(Boyreau-Debray and Wei, 2004)*
- Bulk of financial system dominated by state-owned banks, small stock market, bond market dominated by gov assets *(Bai, 2006)*

Financial repression:

- FR systematic in China. Partly responsible for external imbalances, structural imbalances and increase in inequality *(Johansson, 2012)*
- Savings of HH trapped, flow to real estate sector bubble

Global imbalances through China's lens

Policies:

- Low intern.debt, high FDI, accumulation of reserves to prevent sudden stops, defend peg, bail out banking sector *(Prasad and Wei, 2007)*
- Evidence for financial (Fin Repr, visible hand) rather than monetary (RER) mercantilism *(Aizenman and Lee, 2008)*
- Exposure to potential financial crisis and sudden stops more decisive than exch.rate manipulation in the explanation of reserve accumulation *(Aizenman and Lee, 2007)*

Political economy:

- Surpluses and asset accumulation as political economy outcome of limited commitment towards non expropriation of international investment position and competition for power *(Aguiar and Amador, 2011)*

Industrial structure:

- Real capital intensity of CN exports low, no need of massive investment in capital, savings invested abroad in more capital-intensive economies, composition effect (capital flows towards economy becoming more specialized in capital-intensive goods) vs convergence effect *(Jin, 2011)*

Export-led growth:

- Model of export-led growth policy supported by mercantilist hoarding of reserves. Learning by doing externality in exports *(Aizenman and Lee, 2010)*
- Practitioners find importance exaggerated for China as a whole *(Anderson, 2007)*, investment and TFP are the driving factor

Global imbalances through China's lens

Households vs firms vs government savings:

- Corporate and gov savings high and contribute to imbalances, not only HH *(Ma and Yi, 2011)*
- High gov savings, partly transmitted to SOE which accumulate benefits (nearly no dividends), HH savings high but corporate and gov savings drive the trend *(Kujis, 2005)*
- Smalll central government budget deficits, huge regional government debts

Micro studies using household data

- Breaking of the iron rice bowl: educ, housing, health more expensive after SOE reforms, increase in uncertainty, financial underdvpt *(Chamon et al., 2008 and 2010)*
- Change in demographic policies and life-cycle behavior of HH explain part of increase in savings *(Horioka and Wan, 2007 and Modigliani, Cao, 2004)*
- Urban HH having daughter (provide less support) increased savings after one child policy *(Banerjee et al., 2010)*, *Du and Wei (2010)*: gender gap causes rise in savings and CA (competition on marriage market)
- Strong effect of property price on consumption spendings *(Chen, Funke, Mehrotra, 2011)*N
- Need to include investment in housing *(Chao et al., 2011)* to explain high HH saving
- 55% of Chinese have little or no savings *(China Household Finance Survey)*, rather rich urban upperclass

Model: Bergin and Sheffrin (2000)

Solve standard problem using BC expressed in tradeable goods using $C_t^k = C_{Tt}^k + P_t^k C_{Nt}^k$ gives:

$$P_t = \frac{P_{Nt}}{P_{Tt}} = \frac{1-\alpha}{\alpha} \frac{C_{Tt}}{C_{Nt}}$$

Compute demand functions and use them in the consumption bundle X^k.

Obstfeld and Rogoff (1996) trick: define P_t^{k*} as the price index of aggregate consumption ($P_t^{k*} X_t^k = C_{Tt}^k + P^k C_{Nt}^k = C_t^k$). Rewrite the maximization problem using the consumption bundle X^k instead of C_T^k, C_N^k and replacing C^k with $P^{k*} X^k$, one gets (aggregate terms):

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

and in disaggregated terms:

$$E_t \left[\beta \left(1 + r_{t+1}^{T,k}\right) \left(\frac{P_t^k}{P_{t+1}^k} \right)^{(1-\alpha)(1-\gamma)} \left(\frac{C_t^k}{C_{t+1}^k} \right)^{\gamma} \right] = 1$$

Back

VAR: net output per capita

Net output $NO = Y - G - I$:

- 2011 regional Statistical Yearbooks from the National Bureau of Statistic (revised)
- China Data Center (CDC) data from earlier Yearbooks to fill the gaps (non-revised)
- Exclude two Western provinces as Qinghai and Ningxia have low or even negative NO (very high investment) and Tibet (data availability)
- No proper GDP deflator, use general regional CPI (1984-2010) instead

Population:

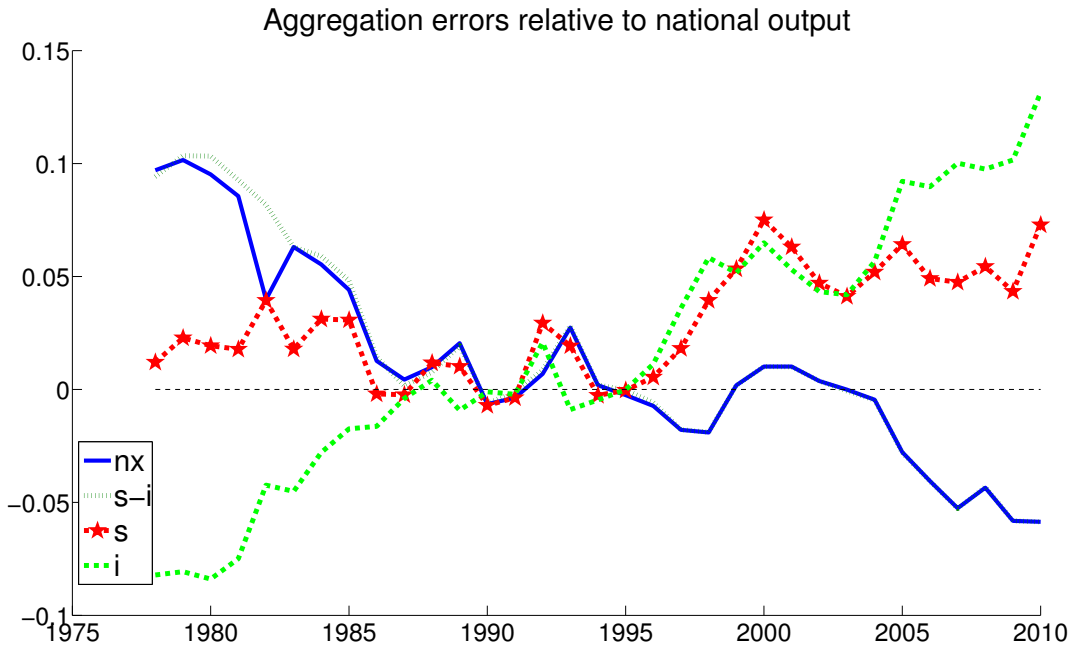
- Population data: problem of huge migration flows since the 1990s and different recording systems make it a challenge to disentangle. Often lack of information on the source of data. CDC data mixed.
- Public Security Authorities report persons possessing a local permanent resident hukou (political and property rights, access to education, healthcare, insurances...)
- Surveys (1% of pop) and Censuses (1982,1990,2000,2010) better at capturing nb of persons living in an area but definitions of resident vary over regions and over time
- Took a mix of all sources and of the existing literature, tried to avoid sudden jumps caused by change of source

Back

VAR: net exports

External balance of region:

- Use GDP by expenditure approach on the regional level
- *NX* dynamics quite different from international trade, contains interprovincial flows as well
- Aggregation properties and data quality issues



Expenditure components of regional GDP noisy:

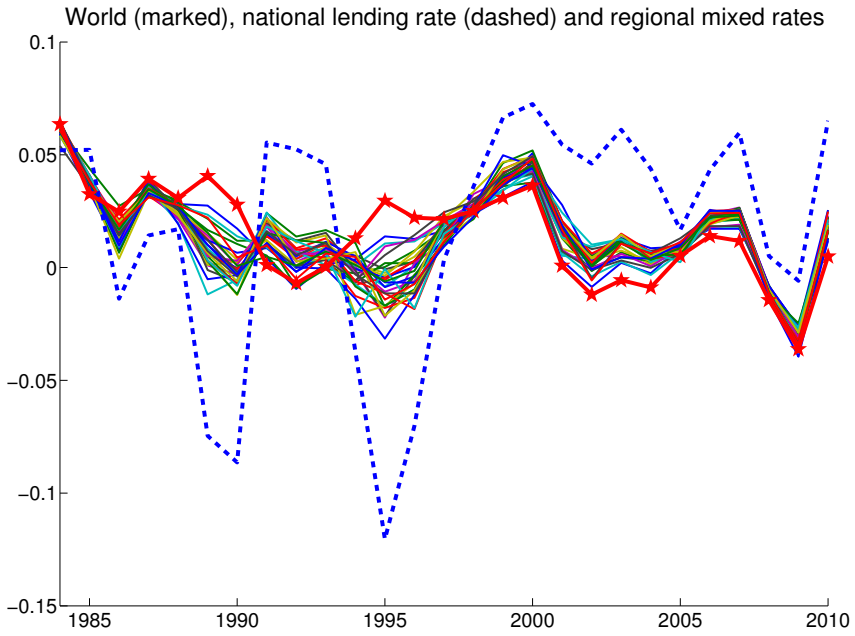
- Provincial savings higher than national values
- Provincial investment errors rising since the reforms started
- Rising discrepancies between aggregated NX and national NX driven by investment errors

Back

VAR: reference Interest rate

Reference interest rate as a linear combination of world and national interest rate:

- World interest rate proxied with 3 months T-bill rate (Federal Reserve Board) less US urban ex-ante CPI (Bureau of Labor Statistics) to correct for inflation
- National interest rate proxied with official lending rate of PBoC corrected for ex-ante local CPI inflation
- Extent to which regions are sensitive to world interest rate depends on integration with world economy
- Weight of world rate between 0.7 and 0.9 depending on mean of absolute international trade balance over GDP for 84-10



Back

VAR: real exchange rate

Combine different concepts due to changing data availability. Correct for differences in prices if tradeables and non-tradeables.
Real effective exchange rate (*REER*) from IMF as starting point:

$$\lambda^{84} = REER$$

Use HH surveys to get share of non-tradeables in consumption expenditures $(1-\alpha)$, service price index *SPI* and general *CPI*:

$$\lambda^{85-93} = REER \times (1-\alpha)\frac{SPI^{reg}}{CPI^{reg}}$$

Use *CPI* of tradeables as soon as available (food and clothes), respective weight corresponds to expenditure weight of rural and urban HH survey (combined using urbanization rate):

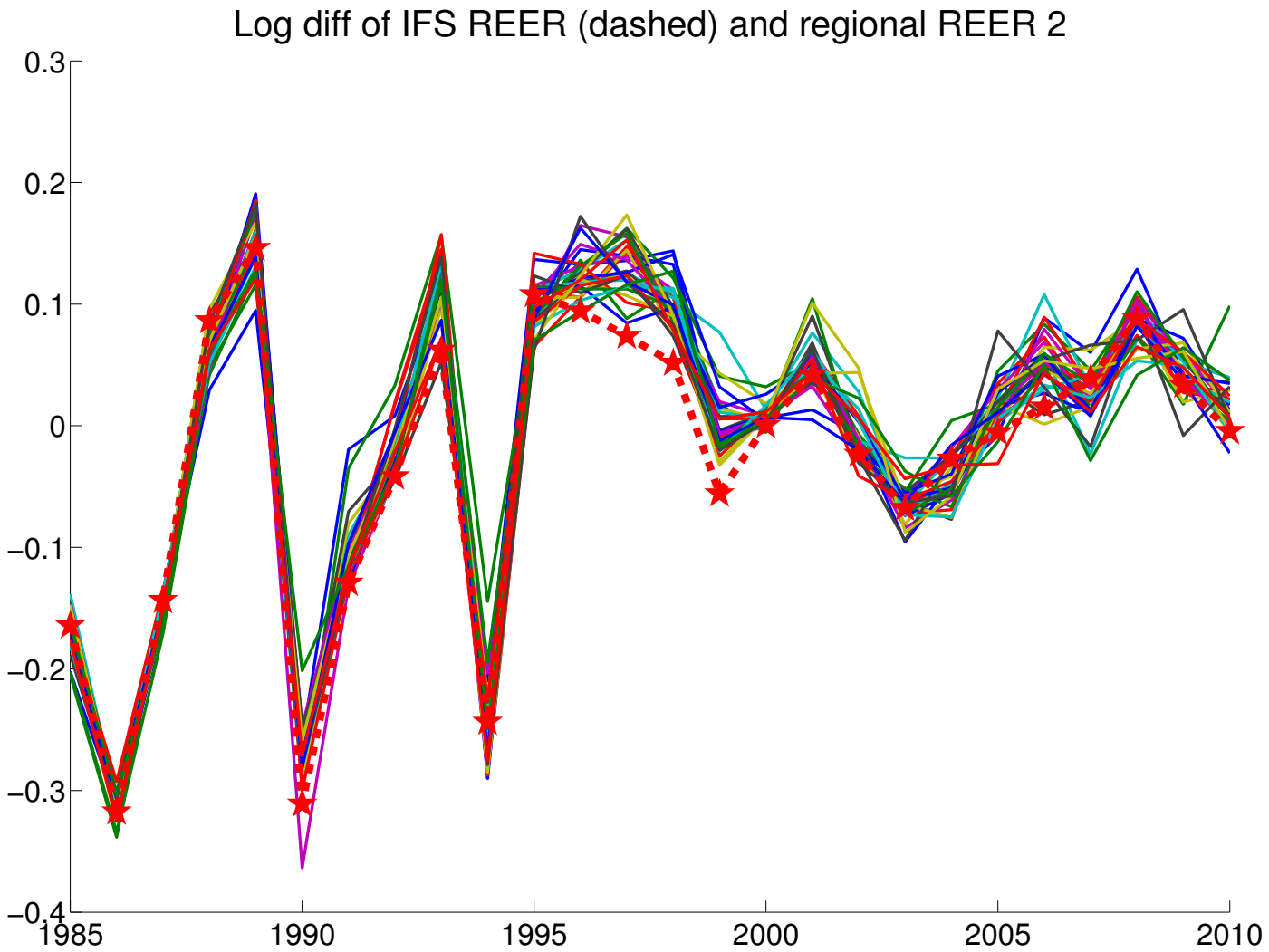
$$\lambda^{94-98} = REER \times (1-\alpha)\frac{SPI^{reg}}{CPI_T^{reg}}$$

Use *CPI* of non-tradeables (healthcare, transport & communication, education and culture, housing).
Trick: use average selling price of housing instead of official CPI figures for housing. Weights are from rural and urban HH surveys combined using urbanization rate. Non-housing weight only half official one, rest attributed to housing.

$$\lambda^{99-10} = REER \times (1-\alpha)\frac{HCPI_{NT}^{reg}}{CPI_T^{reg}}$$

Back

VAR: real exchange rate



Back