Financial Development and Capital Flows: An Application

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Abstract

Could China's Property Law Reform of 2007 have induced the housing market value drop that preluded the 2007-2008 subprime crisis? We show how a well-known stylized global model may suggest a positive answer.

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1 Introduction

In a particularly influential paper, Caballero, Farhi, and Gourinchas (2008), (henceforth CFG), incorporate country heterogeneity in an economy's ability to supply safe stores of value. In their non-Ricardian model, persistent current account imbalances between regions could be viewed as an equilibrium response to the dearth of safe assets and the comparative advantage of developed economies to provide them. In this note, we reinterpret the findings of CFG in light of an important reform undertaken by the People's Republic of China: The Chinese Law on Property, enacted on October 1st 2007, which extends legal property rights to both government and individual citizens for the first time, and extends the tenure period for residential housing. We view this case of particular importance given the more recent renewed interest in US China asset trades, the continued opening, the sheer size of Chinese markets, and the corresponding risks that they pose to the rest of the world, should these markets collapse.

Most notably, we show how, in CFG's stylized world model, such a key reform affecting the Chinese markets (particularly housing) could have been linked to developments in the housing markets in the United States on the eve of the financial crisis. What is more, the simple model is also able to replicate the salient features of China's asset boom over the last 10 years: rising asset values, high rates of return as noted in Chen and Wen (2017).

The next two sections briefly describe the motivating evidence and the simulation results of our variant of CFG, leaving the analytical details to the appendix.

2 A World Wealth Shock: The Chinese Law on Property of 2007

Capitalization of value in the economy requires functioning markets, subsumed by a secure system of property rights. Indeed, CFG argue that the capitalization parameter should reflect the overall level of financial development or secure system of property rights. In this light we explore the

impact of the financial reform process in China coupled with the gradual opening of its capital account. In particular, we focus on a major reform to property rights, which we argue to be of major importance in the ability of the Chinese economy to supply local assets: the Property Law of the People's Republic of China (henceforth, LP), which was passed on March 16, 2007 and took effect on October 1, 2007.

Prior to the reform, private property and ownership was not legally defined or protected in China. The LP clearly defines private property and protects public and private property equally.[1] The law is comprehensive and governs property rights over both real and financial assets, with the exception of land ownership. Private individuals and firms can own structures, but pay for usufructuary right, or usage rights. As part of the LP, these usage rights for residential property were extended to 70 years and are automatically renewed thereafter. Land used renewal of leases for business is not automatically renewed. This essentially extends the life of housing assets in the Chinese market.

Another essential element of the LP is to strengthen property rights for firms and creditors by strengthening property rights over tangible assets and allowing the seizure of secured assets. This would encourage external financing of funding profitable projects and increase firm value (Berkowitz et al., 2015).[2]

The property law is first made available for public comment on July 10, 2005 and eventually passed, after a lively public debate in March 16, 2007.[3] Despite, the passing in early 2007, the comment period signals initial public knowledge of the law in July 2005. Once, the law is entered into the agenda for spring 2007 in December 2006, passage was almost inevitable. We take the initial comment period in 2005 to be the first point at which strengthening of property rights would be, at least partially, reflected in asset values in China.

In the context of CFG's model, the LP is an increase in China's δ, a

[1] This is particularly relevant for urban and rural housing market, which were subject to a great extent to local government land-grabbing policies (Zhang, 2008).

[2] Berkowitz et al. (2015) find in a large sample of private firms, that the passage of the reform promoted investment, access to financial and increased firm value, with larger effects for constrained, politically unconnected firms.

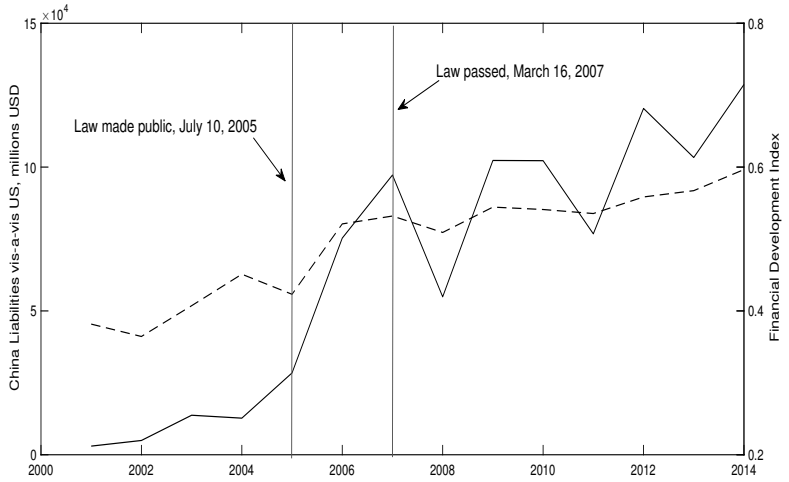
[3] There was a large response from the public during the comment period, with a recorded 11,543 responses from a broad geographical distribution Zhang (2008).

higher level of financial development, which would impact immediately the value of Chinese assets.

There has been some evidence that the LP impacted immediately firm value and access to external financing (Berkowitz et al., 2015). Do we also observe an impact on aggregate financial development and capital flows? Indeed we do.

Figure 1 shows the financial development index for China and Chinese liability flows vis-à-vis the US from 2000 to 2014.

Figure 1: Chinese Liabilities (solid line) vis-à-vis the United States and Financial Development (dashed line)



source: Chinese liability data from IMF's Coordinated Portolio Investment (CPIS) database and financial development index from Svirydzenka (2016)

Two things are evident. First, the liability flows in the Chinese economy are highly correlated with the measure of financial development.[4]

Second, from the comment period, to the passing of the LP, there is a four-time increase in Chinese liabilities vis-à-vis the US and an increase of about one fourth in the financial development index (from 0.42 to 0.53).[5]

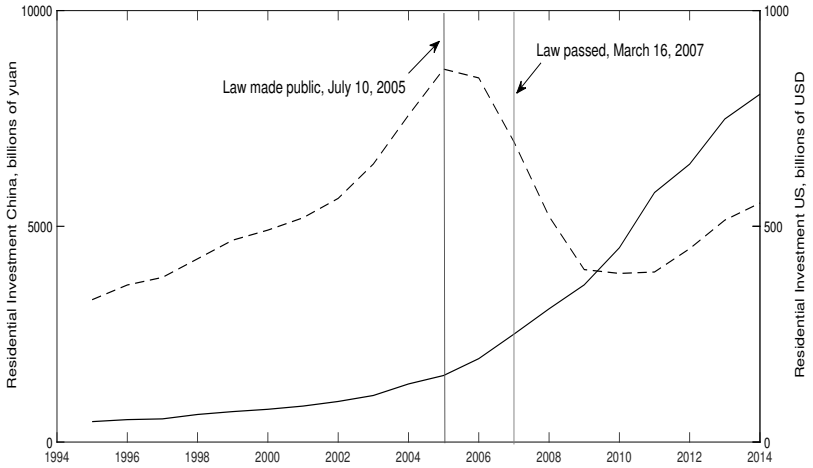
[4]Clearly, one measure of financial depth may be directly related to the liability, for example the US purchases of Chinese equities would be a component of market capitalization over GDP ratio for China. However, given other broad measures of financial market (and institutional) depth, we find this interesting.

[5]This is primarily driven by an increases in financial market depth, access and efficiency, but not solely from market depth measures such as market capitalization to GDP ratio, which could reflect the increase in market value.

The increase in Chinese liabilities could reflect a sale of US assets by Chinese or the purchase of Chinese assets by agents in the United States. Either, would reflect, together with asset positions, increasing relative demand for Chinese assets.

The US financial crisis has its origins in the housing market. Given the sheer size of the US and Chinese housing markets, and that agents in both countries tend to hold a large portion of wealth or demand for stores of value in real assets such as housing, we examine the evolution of residential investment in the US and China over time and in relation to the comment period and enactment of the LP.

Figure 2: Residential Investment in China (solid line) and the US (dashed line), annual billions of USD and yuan



source: Data for US residential investment Bureau of Economic Analysis and Data for Chinese residential investment from National Bureau of Statistics

Figure 2 depicts residential investment in millions USD or yuan from 1995 to 2015 for the US and China. What becomes evidently clear, is that sometime during 2005, residential investment in the US began to decline, preceding the drop in housing prices and precipitating the financial crisis. During the same time, residential investment picked up pace in the Chinese economy, almost doubling in a span of 3 years.

Thinking of the Chinese case in the context of CFG's model, allows us to consider how continued development in the Chinese markets could have major implications for the US economy. Indeed, if one considers the above

case and the size of Chinese markets, almost 84 percent of the decline in US residential investment from 2005 to 2007 is accounted for by the increase in Chinese residential investment from 2005 to 2007.

3 Model Simulation Results

We simulate a two region world representing the United States and fast growing, emerging economies, dominated in their asset trades with the United States by China. In doing so, we hope to draw a connection between our interpretation of CFG and the events of the mid-2000's leading up to the financial crisis. Where possible, we use the same parameters as CFG in order to draw comparison. In order to illustrate the potential impact of the reform in China, we calibrate the increase in the asset supply parameter that replicates the large correction in the US current account over GDP starting in 2006. The parameters used in the simulation exercise are shown in Table 1.

Table 1: Model Parameters

Chinese capitalizable share (pre-reform)	δ^{CN}	0.08
Chinese capitalizable share (post-reform)	δ^{CN}_{ss}	0.099
US capitalizable share	δ^{US}	0.12
Endowment growth rate	g	0.03
Share of wealth consumed	θ	0.25
Share of US output	x	0.70
AR parameter in reform process	ρ	0

We study the transition of the Chinese economy when, 15 years after initial financial opening, the reform of property rights takes place, which affects the supply of local assets.[6] We show two additional equivalent alternative scenarios in which the reform does not take place: one with financial opening and one in which there is a decline in the ability for the Chinese

[6]We simulate a full opening of the Chinese capital account in 1990. De jure measures of capital account openness increase starting in the 1990's for China, although such measures are generally low for China (Chinn and Ito, 2006). We note the increase in asset trades between the US and China starting in the 1990s as an indication of de facto opening of the capital account. We could alternatively assume opening begins upon WTO accession in 2001, without effecting the results of our model, aside from the transition prior to the LP.

economy to provide safe assets. In all exercises, the US economy remains fundamentally unchanged. The derivation of these models is shown in the Appendix.

The simulation shows the initial opening of Chinese economy in period 1, where a lower level of financial development in China is reflected by a lower δ of 0.08, relative to that of the US ($\delta^{US} = 0.12$).[7] Thereafter, 15 years after opening, a financial reform takes place that shifts δ^{CN} from 0.08 to 0.099 according to eq. (17). We assume that the reform is immediate and takes full effect, that is, we set $\rho = 0$. If the reform takes place slowly over time, this will have an effect on the levels of all variables due to the slow adjustment of the interest rate. The qualitative message that we provide holds in both cases. We calibrate the post-reform δ_+^{CN} to that which brings the model's prediction for the change in the US current account over GDP that occurs after the reform in line with the empirical counterpart of the large correction in the US current account over GDP starting in 2006 and shown in Figure 4. The calibration exercise is described in detail in the Appendix.

The US current account over GDP worsens over the sample period from around 0 percent in 1991 to 2005, slowing its decline around -6 percent in 2005 and rising in 2006 to 2009 to -3 percent. In the first year after enactment of the LP, the current account over GDP increased by about 1 percentage point. In order to highlight the mechanism of the model and the potential for the role of the LP on capital flows between the US and China, the calibration exercise that we carry out determines the magnitude of the policy change in China (reflected by increasing δ_+^{CN}) that rationalizes the full correction in the US current account occurring during the comment period and after passage of the LP (2005-2009) of around 3.2 percentage points. The calibration exercise results in a post-reform $\delta_+^{CN} = 0.099$: the observed correction in the US current account over GDP is fully rationalized in our model by the LP that essentially cuts the gap between the regions' abilities to supply safe assets in half.

The results of our simulation exercise is shown in Figure 3. The main simulation results are shown in the solid line. The dashed lines in the

[7] In order to keep the comparison straightforward with CFG, we assume identical parameters for their regions U and R used in the baseline of their model.

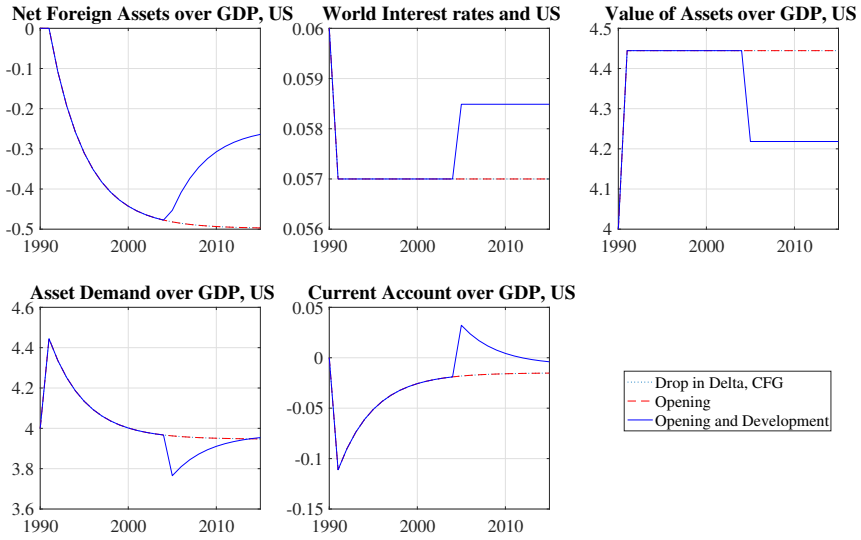
simulations show the observationally equivalent two alternative cases: initial opening with a lower level of development or an open economy with a sudden drop in provision of safe assets.

Upon opening, from a US perspective, there is an immediate drop in world interest rates, reflecting coming online of China, having a lower level of financial development. As a result, asset value in the US increases, while asset demand falls allowing them to absorb domestic demand for assets as well as the excess demand for safe assets created in the Chinese economy. From a Chinese perspective, the excess demand for assets stems from a higher demand for assets, and a lower supply of assets due to a higher return relative to autarky returns.

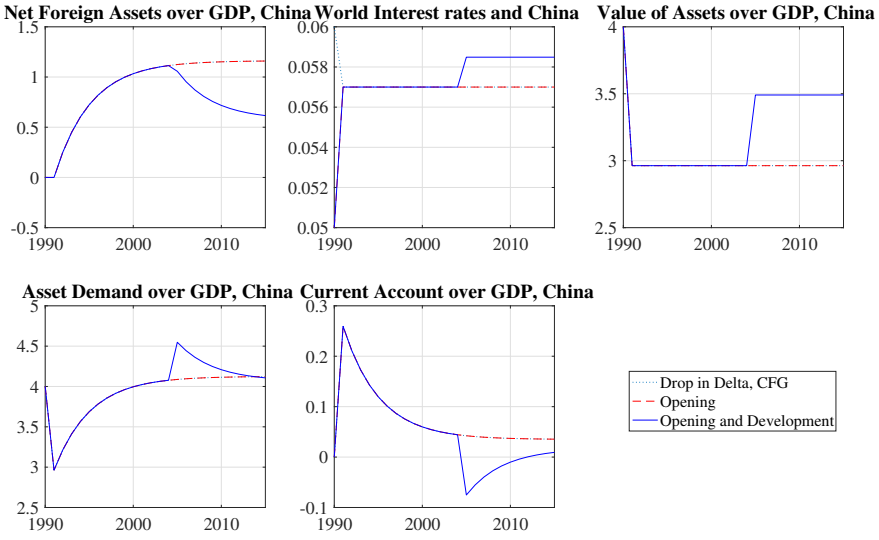
The higher relative demand for US assets is channeled into the US, reflected by persistent current account surpluses, and the resulting accumulation of large net foreign asset position in China. These persist until 15 years after opening, when there is an unexpected reform in China. At this point, there is an increase in the value of assets in China and a decline in asset value in the US. Asset demand in China increases initially due to valuation effects of local asset holdings, but returns to a value slightly lower than its initial position. Asset demand falls more than asset supply in the US as the result of the reform in China, resulting in a correction in the current account over GDP of around 3 percent, generating a current account surplus. The level of the current account upon impact of the reform depends on the initial levels of the current account, or the other parameters of the model. We could consider a different parameterization that would generate the large correction in the US current account, without current account surpluses, but prefer to be consistent with CFG for sake of comparison.

There is an initial correction in the current account surpluses for China, which return to slightly positive values over time, due to the slow pace of reform being reflected in the value of local assets. Net foreign asset positions do not fully disappear, but are largely reduced after the reform.

Figure 3: Simulation Results



(a) United States



(b) China

The simulation results for three models are shown in Panel (a) for the United States and in Panel (b) for China. The solid, blue line depicts the simulation results for our model with initial opening the early 1990s and the LP in 2005. The dashed, red line depicts the model for initial opening in the early 1990s and finally the dotted, blue line depicts the model with a drop in one region's asset supply in the early 1990s. Source: authors calculations.

4 Conclusion

We have shown that the findings of CFG are useful in understanding the coming online of a large, developing economy with a lower provision of supply safe assets from a stage of an initially closed capital account. Using our interpretation of CFG, we are able to understand the opening and subsequent financial reform in China that increased the value of local assets in China, and changed the relative demand for Chinese and US assets. According to our analysis, all of this has come at a time in which the US began to experience drop in asset prices that preceded the sub-prime crisis.

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Appendix

4.1 CFG: A reinterpretation

We start from the model of CFG with two regions, i=A,B, that differ solely in their ability to produce safe stores of value. Each region has an endowment, X_t^i that grows at rate g and supplies safe assets by capitalizing a share, δ^i, of its endowment. The total value of safe assets in economy i evolves according to

$$V_{t+1}^i = (1 + r_t)V_t^i - \delta X_t^i. \tag{1}$$

Total wealth in each economy is represented by the total savings of aggregate households, who consume a constant share of total wealth in each period, θW_t, earn interest rate on existing wealth and receive a non-financial income flow in each period. Total wealth in the economy evolves according to

$$W_{t+1}^i = (1 + r_t - \theta)W_t^i + (1 - \delta)X_t^i. \tag{2}$$

The return on saving in a single asset is found by the market clearing of asset demand (savings) and asset supply, and goods market clearing. This results in the following interest rate[8]

$$r_t^i = \delta^i\theta + g. \tag{3}$$

In a two region world, when countries are fully open to asset trade, total world supply of assets,$V_t = V_t^A + V_t^B$ must equal the world demand for assets, $W_t = W_t^A + W_t^B$. Using this market clearing condition, the world interest rate is:

$$r_t = \bar{\delta}\theta + g. \tag{4}$$

where, $\bar{\delta}$ represents a weighted average of the two regions' abilities to produce stores of value, $\bar{\delta} = x\delta^A + (1 - x)\delta^B$ and $x_t = X_t^A/(X_t^A + X_t^B)$ is

[8]The model is based on perpetual youth model of Blanchard (1985), where there is an equal probability of dying over the lifetime, rate θ. The micro-founded model can be represented in reduced form by assuming only the old consume just before death and therefore, the share of total wealth in the economy declines in each period by the rate of death, θ. This model is necessary to introduce non-Ricardian features so that the supply does not automatically adjust to demand, leaving interest rates unaffected by the share δ.

the share of region A's output in total world output. Differences in world interest rates and autarky rates spur excess demand for assets in the region with a lower δ and capital flows into the region with a comparative advantage in supplying assets.

We consider two identical cases: first, that of CFG in which the world is comprised of two regions, initially identical, but where one experiences a drop in financial development due to financial crisis; and a second, where one region is less-developed, but initially closed to international asset trade and subsequently opens.

4.2 CFG

The two regions are completely open and initially identical, which discourages international asset trade. During time t, denoting a shock occurring at $t+$, region B's safe asset stores are reduced, or $\delta^B_{t+} < \delta^A_t$. The excess demand in Region B is allocated to Region A's assets via capital flows. The current account surplus in region B remains as long as the regions differ in their ability to supply assets.

At the beginning of time t, prior to opening, the goods market clearing condition in each region, $\theta W^i_t = X^i_t$, holds. By Walras' law, asset markets also clear at the regional level. This results in the supply and demand for assets in each region, $\frac{V^i_t}{X^i_t} = \frac{W^i_t}{X^i_t} = \frac{1}{\theta}$.

During period t, region B experiences a drop in asset supply, reflected in a shock upon opening the world interest rate drops to:

$$r^*_+ = \bar{\delta}_+\theta + g \tag{5}$$

where, $\bar{\delta}_+ = x\delta^A + (1-x)\delta^B$ and $r^*_+ < r^*$. Note that we remove the subscript from the share As output, due to an assumption that the two regions outputs are growing at the same rate, g. As CFG show in *Proposition One*, with a constant interest rate, asset supply drops immediately in region B

and rises in region A to new steady state levels,

$$\frac{V_t^A}{X_t^A} = \frac{\delta^A}{r^* - g} \qquad \frac{V_{t+}^A}{X_{t+}^A} = \frac{\delta^A}{r_+^* - g} \tag{6}$$

$$\frac{V_t^B}{X_t^B} = \frac{\delta^B}{r^* - g} \qquad \frac{V_{t+}^B}{X_{t+}^B} = \frac{\delta_+^B}{r_+^* - g}. \tag{7}$$

where, $\delta_+^B < \delta^B$.

Equilibrium asset demand follows the transition equations given in eq. (2), until the new equilibria asset levels are reached,

$$\frac{W_t^A}{X_t^A} = \frac{(1 - \delta^A)}{\theta + g - r_+^*} \tag{8}$$

$$\frac{W_t^B}{X_t^B} = \frac{(1 - \delta_+^B)}{\theta + g - r_+^*}. \tag{9}$$

As emphasized by CFG, after a shock to region B's supply of assets, asset demand rises in region A and falls in region B. The excess demand created in region B as a result of the drop in δ^B is channeled to region A assets and imbalances persist in equilibrium.

4.3 Financial Opening

At time t, region B is closed to capital markets and autarky returns govern domestic asset supply and demand. In the rest of the world, interest rates reflect the level of financial development in region A.

By the same reasoning as before, with no asset trade at the beginning of time t, the goods market clears locally, i.e., $\theta W_t^i = X_t^i$ holds. By Walras' law, asset markets also clear. This results in the supply and demand for assets in each region, $\frac{V_t^i}{X_t^i} = \frac{W_t^i}{X_t^i} = \frac{1}{\theta}$.

During time t, denoted by $t+$, region B opens to international capital flows. Absent capital market imperfections, there is an immediate adjustment of interest rates in both regions to the world interest rate,

$$r^A = \delta^A \theta + g \qquad \rightarrow r_+^* = \bar{\delta}_+ \theta + g \tag{10}$$

$$r^B = \delta^B \theta + g \qquad \rightarrow r_+^* = \bar{\delta}_+ \theta + g. \tag{11}$$

where, $r_t^B < r_+^* < r^A$. After opening, with no frictions to asset trades the world interest rate is equal to that in CFG case after the shock to region B's financial asset supply.

The corresponding impact on asset supply and demand in each region is,

$$\frac{V_t^A}{X_t^A} = \frac{\delta^A}{r^* - g} \qquad \frac{V_{t+}^A}{X_{t+}^A} = \frac{\delta^A}{r_+^* - g} \tag{12}$$

$$\frac{V_t^B}{X_t^B} = \frac{\delta^B}{r^B - g} \qquad \frac{V_{t+}^B}{X_{t+}^B} = \frac{\delta^B}{r_+^* - g}. \tag{13}$$

Asset supply falls in Region B due to a higher world return and supply rises in region A due to a lower world interest rate relative to autarky rates. Asset demand follows the transition equations given in eq. (1) and eq. (2) for regions A and B, until the new equilibria below are reached,

$$\frac{W_t^A}{X_t^A} = \frac{(1-\delta^A)}{\theta + g - r_+^*} \tag{14}$$

$$\frac{W_t^B}{X_t^B} = \frac{(1-\delta^B)}{\theta + g - r_+^*}. \tag{15}$$

As apparent equilibrium asset supply and demand are equal to CFG.

Current accounts are defined as the differences in the change in asset demand minus the change in asset supply.

$$CA_t^i = \Delta W_t^i - \Delta V_t^i \tag{16}$$

In the two cases above, asset supply and demand in both regions are equal to $\frac{1}{\theta}$. Asset supply in each region immediately adjusts to the new steady state value. Thus in order for the two cases to be identical, it is sufficient to show that asset demand along the transition is the same in both regions.

Asset demand in region i at time t is taken from the difference eq. (2). With asset demand in time t equal in both cases, interest rates are the same in each case and the stream of non-financial income is the same in both cases (i.e., $(1-\delta^i)X_t$).

Thus, the two cases above are observationally equivalent, apart from the initial autarky rate of return being equal to the effectual rate of return

for region B assets at time t in the case of opening.

4.4 Opening with Financial Development

We examine the predictions of CFG on capital flows in an environment that reflects the coming online of developing economies that are simultaneously developing their financial markets. Financial development is experienced in region B as slow increase in its δ parameter after opening. Thus, while the impact of initial opening is being felt by region A in terms of increased demand for its assets, we also recognize a growing ability of own assets to be supplied to agents in region B. We represent this reform process as a simple auto-regressive process, with parameter, ρ,

$$\delta_t^B = \rho\delta_{t-1} + (1-\rho)\delta^* \tag{17}$$

where δ^* in region B reflects the greater ability of economy B to produce safe assets in the long run and may be less than or equal to the δ in region A. For sake of illustration, we assume that region B's financial development catches up fully to that of region A or, $\delta^* = \delta^A$.

Our formulation for the reform process in region B deserves some further discussion. The reduced form process for δ may reflect several, more realistic features of financial reform in a developing economy. First, the reform process is often incremental, where immediate effects are seen in forward looking variables, but where real effects are slow to take affect. Second, this form may also reflect a diffusion of policy over time, or throughout the economy.

As a result of the reform process, the world equilibrium interest rates also changes over time,

$$r_t^* = \bar{\delta}_t\theta + g, \tag{18}$$

where, $\bar{\delta} = (1-x)\delta_t^B + x\delta^A$.

The arbitrage equation for value of domestic assets, eq. (1) can be solved forward, to reflect that asset value immediately reflects future changes in δ and the world interest rates. Substituting in the process in eq. (17)

into the aggregate arbitrage equation,

$$\frac{V_t^B}{X_t^B} = \sum_{j=1}^{\infty} \frac{(1+g)^{j-1}\delta_{t+j}}{\mathcal{R}_{t+j}}, \tag{19}$$

where, $\mathcal{R}_{t+j} = \prod_{i=1}^{j}(1+r_{t+i})$. Thus, an increase in δ in region B will be reflected in gradually rising interest rates and rising δ, the combined effect is that value of local assets over GDP in region B rises. As shown in CFG, in the case of an immediate reform, the value of assets simply jumps to its steady state value.[9]

4.5 Calibration of Asset Supply Parameter

Our interpretation of CFG assumes a reform process that begins 15 years after capital account represented for China (region B) in eq. (17). For simplicity, we assume that the reform takes place immediately and accordingly, set $\rho = 0$. We calibrate the change in δ^{CN} at the start of the reform to that which brings the model's prediction for the increase in US current account over GDP at the start of the reform in China in line with the large correction in the US current account over GDP starting in 2006. The US current account over GDP is shown in Figure 4 below. From 2005 to 2009 there is a correction in the US current account over GDP of around 3.2 percentage points. This correction begins between 2005 and 2006 with a constant current account, which stands in contrast with the average annual change of -0.05 percentage points from years 2000 to 2005.

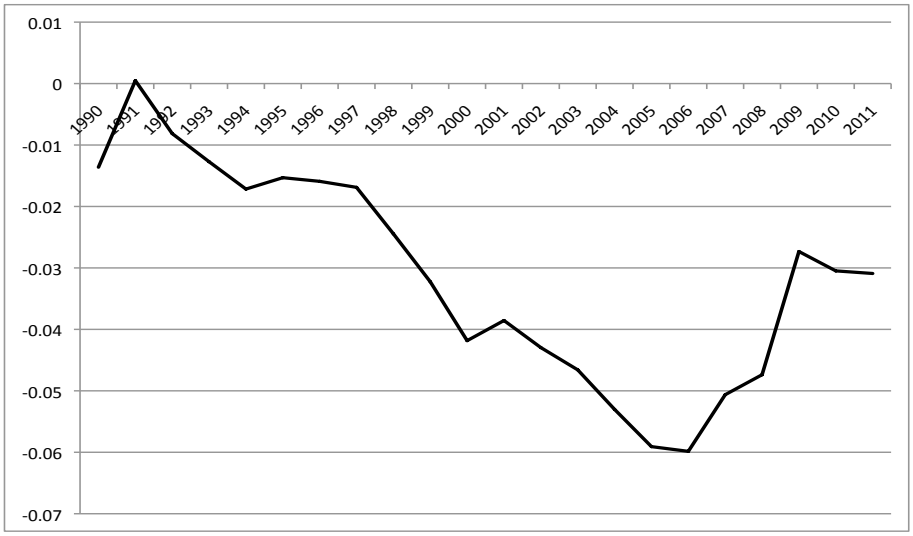
The expression for the US current account ($i = US$) that results in period t, after the reform takes place is derived in what follows. From eq. (16), the current account can be represented:

$$CA_t^{US} = r_+^*(W_{t+}^{US} - V_{t+}^{US}) + X_t - \theta W_{t+}^{US}. \tag{20}$$

At the time the reform occurs, the value of assets in both economies

[9] This is *Lemma 1* in Caballero et al. (2008).

Figure 4: Current Account over GDP, United States



The figure depicts in the solid black line the current account from International Monetary Funds, International Financial Statistics as reported by External Wealth of Nations, Mark II (Lane and Milesi-Ferretti, 2007), divided by GDP.

adjust to new steady state values:

$$\frac{V_{t+}^{CN}}{X_t^{CN}} = \frac{\delta_+^{CN}}{r_+^* - g} \tag{21}$$

$$\frac{V_{t+}^{US}}{X_t^{US}} = \frac{\delta^{US}}{r_+^* - g}. \tag{22}$$

If the reform takes place at when there are cross-border holding of assets, there will be valuations changes that are proportional to the share of existing wealth held in each economy's assets. We show this for the US case, but an analogous condition holds for the Chinese case. We define the degree of home bias as the share of US assets held at home as $\mu_t^{uu} = \min(1, W_t^{US}/V_t^{US})$ and the share of Chinese trees held at home as $\mu_t^{cc} = \min(1, W_t^{CN}/V_t^{CN})$.

Then value of existing wealth in the economy at time $t+$ when the reform takes place is:

$$W_{t+}^{US} = \mu_t^{uu} V_{t+}^{US} + (1 - \mu_t^{cc}) V_{t+}^{CN}. \tag{23}$$

Inserting this into eq. (20) and the post-reform world interest rate,

$r^*_+ = \bar{\delta_+}\theta + g$, and rearranging gives the expression:

$$CA^{US}_t = (\bar{\delta_+}\theta + g)\left((1-\mu^{cc}_t)V^{CN}_{t+} - (1-\mu^{uu}_t)V^{US}_{t+}\right) + X_t - \theta(\mu^{uu}_t V^{US}_{t+} + (1-\mu^{cc}_t)V^{CN}_{t+}). \tag{24}$$

This is precisely the definition of the current account as being equal to the trade balance plus the interest payments on net cross-border asset holdings.

Accounting for the valuation changes given in eq. (21) and dividing both sides by X^{US}_t the current account over GDP in the US is:

$$\begin{aligned}\frac{CA^{US}_t}{X^{US}_t} =&(\bar{\delta_+}\theta + g)\left((1-\mu^{cc}_t)\frac{\delta^{CN}_+}{r^*_+ - g}\frac{(1-x)}{x} - (1-\mu^{uu}_t)\frac{\delta^{US}}{r^*_+ - g}\right)\\ &+1-\theta\left(\mu^{uu}_t\frac{\delta^{US}}{r^*_+ - g} + (1-\mu^{cc}_t)\frac{\delta^{CN}_+}{r^*_+ - g}\frac{(1-x)}{x}\right).\end{aligned} \tag{25}$$

We calibrate the δ^{CN}_+ to bring model predictions for the change in the capital account over GDP from period $t-1$ to t, that is pre- and post-reform, to the correction in capital flows over GDP observed starting in 2006 in the US. The change in the current account over GDP generated by the model is:

$$\begin{aligned}\Delta CAX^{US}_{t-1} \equiv&\frac{CA^{US}_t}{X^{US}_t} - \frac{CA^{US}_{t-1}}{X^{US}_{t-1}} = (1-\mu^{cc})\frac{(1-x)}{x}(r^*_+ - \theta)\frac{\delta^{CN}_+}{r^*_+ - g} - \left(r^*_+\frac{\delta^{US}}{r^*_+ - g} - r^*\frac{\delta^{US}}{r^* - g}\right)\\ &+\mu^{uu}\left((r^*_+ - \theta)\frac{\delta^{US}}{r^*_+ - g} - (r^* - \theta)\frac{\delta^{US}}{r^* - g}\right).\end{aligned}$$

From eq. (25) and using the definition for r^*_+ and that $\bar{\delta_+} = x\delta^{US} + (1-x)\delta^{CN}_+$, the change in the current account over GDP is a function of the parameters of the model and the policy change parameter, δ^{CN}_+, that we wish to calibrate.

Using data for the current account over GDP from Lane and Milesi-Ferretti (2007), we carry out a numerical root finding exercise to find the δ^{CN}_+ as the solution to the following equation:

$$F(\delta^{CN}_+) = \Delta CAX^{US}_{t-1} - \widehat{\Delta CAX}^{US} = 0, \tag{26}$$

where $\widehat{\Delta CAX}^{US}$ is calculated as the change in the US current account over

GDP from 2006 to 2009, or 3.2 percentage points.