

Chinese Protectionism, International Reserves and the Sustainability of Global Imbalances

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Abstract

The Chinese economy is modelled with a variety model of growth which takes in account the fixed exchange rate policy and positive spillovers from attracted FDI. The main theoretical result is the market overvaluation of the current international reserves hold by the People's Bank of China (PBC). As a consequence, the Chinese growth is quite balanced and the global imbalances due to China is sustainable. This result is consistent with the "no commercial" investment strategy of Chinese Sovereign Fund. Futhermore, the model replicates several stylized facts: a small consumption growth, the use of the exchange rate as both a trade and monetary tool, the will for a small but steady appreciation of the Renminbi. Several unexpected policy implications arise from the model. Firstly, appreciation of the Renminbi is linked to the Chinese technological catching-up. Secondly the sustainability of global imbalances is provided by both limited financial integration and limited inflows of "hot money". Finally, it is quite costless for China to prevent a global crisis by written off a part of the increasing public debt in advanced economies.

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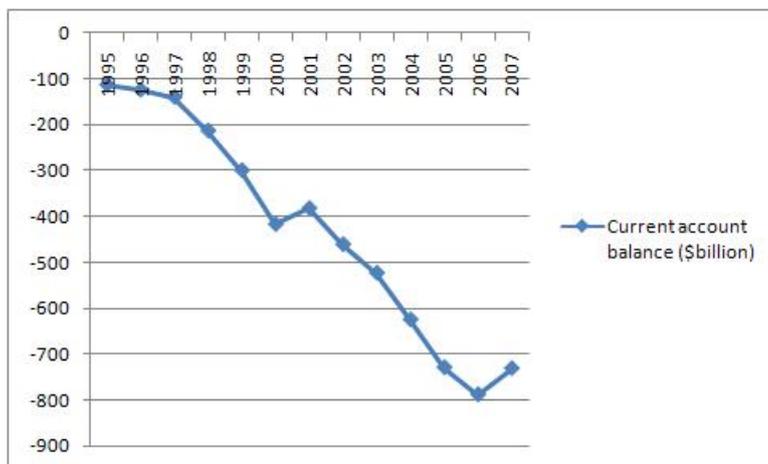
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1 Introduction

The People's Bank of China (PBC) has become the largest buyer of American Treasury Bonds and the Chinese government proposed to fund the increased American public expenditures to cope with the financial crisis aftermaths. Bernake named the Asian demand of american liabilities the "Global Saving Glut", [3]. The path of the american debt notably towards China keeps on rising very fast, delaying expected repaiements. The value of the american current account relative to GDP is over 6%, more than the back to equilibrium threshold computed by the IMF [26].

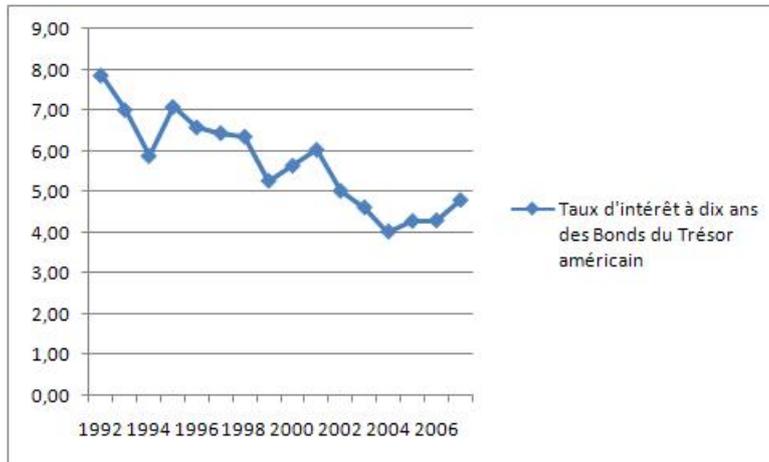
Figure 1: American current account between 1995 and 2007



Source FMI

The american growing indebtness towards the rest of the world is called "Global Imbalances". American treasury bonds becomes riskier and riskier, whereas the return on liabilities have decreased since the early 1990's,[32], as pinpointed by the Greenspan conundrum . Therefore, saving money by funding the american economy could not be the main purpose for China.

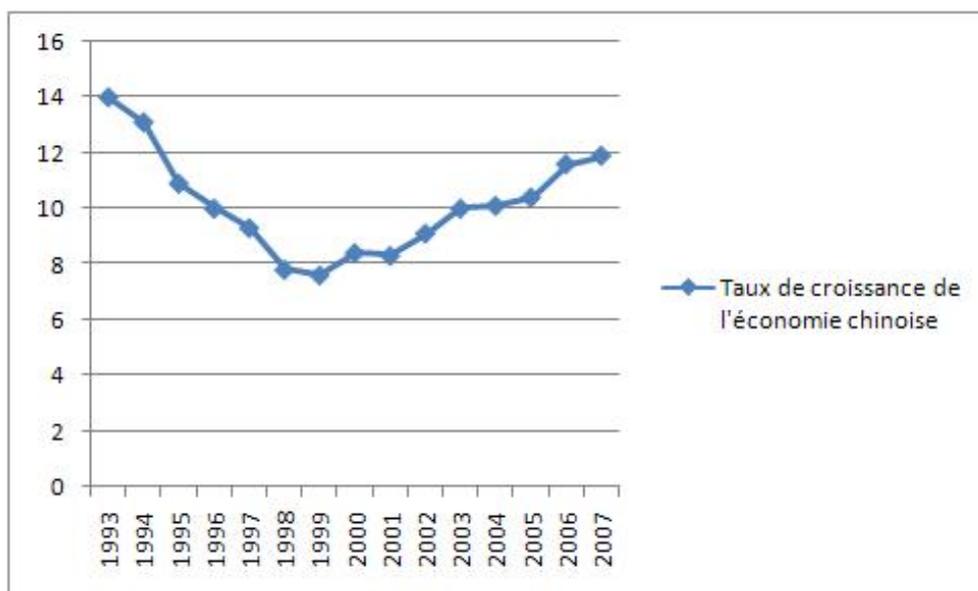
Figure 2: 10 years interest rate on US Treasury bonds between 1992 and 2006



Source FMI

But the Chinese government launched the "Market for Technology" policy at the end of the 1970's to accelerate the growth of its economy by attracting foreign technology to offset the Chinese low technological level. The Chinese growth strategy is funded on three main pillars: a big rise in exports driven by Foreign Direct Investment (FDI) attracted by a devalued currency, huge saving rate (about 40% of the GDP) and a strong capital accumulation. The growth of foreign firms is a major factor of the whole Chinese growth, about 40% between 2003 and 2004, thanks to a total factor productivity nine times higher than in Chinese firms,[34] . This strategy is quite a success because the average growth is 9% with no evidence of overheating was found until 2005,[9].

Figure 3: Evolution de la croissance chinoise entre 1993 et 2007



Source FMI

Unfortunately, the growth strategy is not perfect. To prevent the State-owned Firms and the domestic banking system from crowding out the market, the Chinese government has imposed some protectionism measures. The inefficient banking system leads to bad allocated public investment. Inequalities increase between Provinces and both skilled and unskilled labor. A capital overaccumulation in the exports sector threatens the development of the service sector, [9]. Advice for a more balanced growth are recommended like the appreciation of the Renminbi in order to smooth the current account surplus and to drive the capital towards the services sector. On 21st of July 2005, the peg of the Renminbi to the Dollar was slightly modified with unexpected effects, [11]: both the current account surplus and then American indebtedness has increased. Nevertheless the Chinese government doesn't want to change its growth strategy, despite more and more warnings about global instability and pressures from increased inflows of "hot money".

The aim of the paper is to provide a theoretical framework consistent with stylized facts which could explain the behaviour of the Chinese Government. By using a variety model of growth which takes in account the fixed exchange rate policy and positive externalities from attracted FDI, it is shown that the market value of international reserves held by PBC is significantly overvalued by the market. Inflows of unaccounted "Dark matter" inside FDI makes the Chi-

nese native industry protectionism policy ([15]) sustainable as much as the global imbalances due to China. American overindebttness becomes a begnin issue for the Chinese economy, because the unpaid share of the debt can be assumed as an indirect cost in the short term that enables a long-lasting accelerated growth of the domestic sector. Finally we demonstrate that the devalued Renminbi, i.e "‘Global Imbalances’’ due to China, will end with the technological catch-up of the domestic sector.

The next section explains the place of the paper in the current theoretical Literature on Global imbalances. The third section deals with the assumptions of the model. The fourth section exposes the computed results. Finally, the last section presents policy implications of the theoretical results.

2 Related Litterature

There is a need for explaining the place this paper in the current Literature. Firstly we will show that current models which aim at explaining the "‘Global Imbalances’’ can’t fit patterns of the Chinese economy. The key point of the paper is to link "‘Global imbalances’’ with FDI externalities. A review of the main results in this research field is then necessary.

2.1 Chinese characteristics ignored by the main "‘Global Imbalances’’ theories

Here are presented several well-known theories which aim at explaining whether the american debt towards China is sustainable.

The american external debt growth can be qualified as sustainable if the expected share of the american GDP in the expected OECD GDP is taken in account,[22]. But Asian economies record fast growth. China has become the third economy on national GDP scale. The expected american GDP share in the expected world GDP becomes smaller and smaller. The american debt sustainability is then not ensured.

By taking in account cross-country financial ownerships, "‘Global imbalances’’ are sustainable in the long run thanks to valuation effets,[25]. The expected Dollar depreciation is slower, lower the substituability of american and foreign assets. This model is highly interesting but not relevant for the Chinese case. The amount of American assets in China are insignificant

relative to amount of Chinese assets in the US economy.

The lack of confidence in the Chinese public services could be compensated by safe American securities. Liquidity supply would be ensured for Chinese firms to avoid a public congestion, as highlighted in [28]. Moreover, households would accumulate American securities to ensure the value of their saving, [10]. Both theories, which ignore the interventionist government, are not relevant for the Chinese economy because PBC owns the American Treasury Bonds, neither the Chinese firms nor the Chinese households do.

The protection against a huge capital outflow and outcomes close to the 1990's Asian crisis features, [12], is another limited explanation. Actually, the Chinese indebtedness in foreign currency is null and free capital movement is quite limited to protect the inefficient banking system from bankruptcy, [4].

We shall expect a relevant link between "Global Imbalances" and FDI whose China has been the more important recipient during the last two decades according to [29].

2.2 Multinationals and FDI Literature

Competition has increased for OECD firms in the industrial and manufacturing sectors during the Globalization. In order to remain competitive, firms have improved their productivity by developing R&D, ICT and marketing. Furthermore, cost optimization through outsourcing in low wage economies has become a strategic feature, which the "Market for technology" policy took into account very soon. In 1986, the Chinese government allowed the settlement of foreign-owned firms in "Special Economic Zones", if one uses advanced technologies or if one produces to export and then respects OECD production standards. Special economic zones, preferential policies, high economic growth, market size, rich labor endowment, exchange rates, geographic proximity and culture links are identified as major determinants for attracting FDI, [35].

The Chinese growth is definitively affected by FDI, [21] and [35], even if the total factor productivity growth remains hard to estimate, [9]. One third of the Chinese growth would be generated by FDI, [33].

FDI generates spillovers and technology transfers if the human capital in the host economy is high enough, [13]. Actually, foreign firms use new management schemes. They train the local operatives and managers to develop higher skills. They increase production standards towards domestic suppliers of intermediate goods. Domestic firms can invest in absorbing and adapting foreign technology.

The high labor turn-over in China spread foreign know-how to the whole economy. To slow down the leak, foreign firms raise wage of the skill labor, (Q3/2008, Hudson Report). Moreover, copying is established in the Chinese culture as a traditional habit,[19]. Chinese fast improvement in ICT (Telecoms), aerospace science, and so on, assess the huge stock of human capital in China.

Actually the devalued exchange rate is a key factor in attracting FDI.[14]. Japanese FDI were attracted by the devaluation of the Renminbi since 1995, [31] . Moreover a high echange rate volatility makes Japanese and American IDE run away [30].

The "Global Imabalances" and FDI spillovers are not often linked in the Literature. [7], [8] links both issues and generates quite good predictions, but the model is based on political fondations. Finally [27] deals with "Dark Matter". According to the authors, US external imbalances comes from the mismeasurement of official statistics: US current account is balanced if they include the export of US "Dark Matter". The first source of "Dark Matter" is the mismeasure of FDI based on book value. The blueprint, the product and business know-how are not well accounted, whereas both defenitively increase FDI market value.

In this article, dark matter export point of view is left towards the dark matter imports through FDI in China along with technology and productivity transfers to the domestic sector. The simple variety model of growth developped here explains why a substantial part of the chinese current account can be considered as an indirect cost of a domestic growth accelerator. As a consequence high returns on external assets become little concerns. Chinese government, which seeks to develop its domestic sector, are not willing to follow foreign economical recommandations.

3 The model

The model is composed of two economies, the Chinese economy and the Rest Of the World (ROW), which are not totally identical. The main difference is that the Chinese economy is divided in two sectors, the domestic and the foreign ones. The Rest of the World has no subdivision.

First of all, the Chinese consumption function is depicted, whereas the ROW consumption is not. ROW consumption function is actually identical but less complex, because there is no subdivision. Then the regular state growth rate is computed for the worlwide economy. Next,

consequences of FDI settlement and positive spillovers on the domestic sector are modelled. Finally we will focus on the balance of payments, the banking system and the monetary policy.

3.1 Households consumption

Chinese households can consume chinese and foreign goods produced in China. They can also import, i.e consume foreign goods produced in the Rest Of the World. The consumption function is then depicted as:

$$c(t) = \left[(1 - \chi_{row})^{\frac{1}{\xi_{row}}} c_c(t)^{\frac{\xi_{row}-1}{\xi_{row}}} + \chi_{row}^{\frac{1}{\xi_{row}}} im(t)^{\frac{\xi_{row}-1}{\xi_{row}}} \right]^{\frac{\xi_{row}}{\xi_{row}-1}}$$

and

$$c_c(t) = \left[(1 - \chi)^{\frac{1}{\xi}} c_d(t)^{\frac{\xi-1}{\xi}} + \chi^{\frac{1}{\xi}} c_f(t)^{\frac{\xi-1}{\xi}} \right]^{\frac{\xi}{\xi-1}}$$

$c_c(t)$ is the consumption of goods produced in China. $im(t)$ is the amount of imports. $c_d(t)$ the consumption of domestic goods and $c_f(t)$ the consumption of foreign goods produced by FDI. The demand in both sector, $i = d, f$, can be written as:

$$c_{i,t} = (1 - \chi_{row}) (1 - \chi) \left(\frac{P_{c,t}}{P_t} \right)^{-\xi_{rom}} \left(\frac{P_{i,t}}{P_{c,t}} \right)^{-\xi} c_t$$

where $P_t = \left[(1 - \chi_{row}) P_c(t)^{1-\xi_{row}} + \chi_{row} P_{row}(t)^{1-\xi_{row}} \right]^{\frac{1}{1-\xi_{row}}}$ is the consumption price index in China. $P_c(t) = \left[(1 - \chi) P_d(t)^{1-\xi} + \chi P_f(t)^{1-\xi} \right]^{\frac{1}{1-\xi}}$ is the consumption price index of goods produced in China.

Imports depend on the exchange rate:

$$im(t) = \chi_{row} \left(\frac{P_{row,t} (1 + \Delta E(t))}{P_t} \right)^{-\xi_{rom}} c(t)$$

All along the paper, $P_f(t) = P_{row}(t)$ for a sake of simplicity.

The exchange rate E fits the following consitions:

$$1\$ = EYuan$$

and

$$\Delta E_t = E_t - E_{eq}$$

$\Delta E(t)$ is the gap between the nominal exchange rate E_t and the equilibrium exchange rate E_{eq} . When $E_t = E_{eq}$, the balance of payments is totally balanced and then is equal to zero.

It is assumed that the Chinese government can protect domestic firms with subsidy written as follows:

$$P_d(t) = \frac{MC_d(t)}{S(t)} = P_f(t)$$

where MC_d is the marginal cost of domestic firms and $S(t)$ a variable which represents public resources allocated to protectionism. Hence, $P_d(t) = P_f(t) = P_{row}(t)$, then the Chinese real consumer price index is always equal to one.

3.2 A two country variety model of endogeneous growth

For a sake of simplicity, the Chinese labor offered by the population is constant in time in both sector and equal to one. Consumption per capita is then equal to the entire chinese consumption:

$$L = L_d + L_f = 1$$

L is the total supply of labor in the Chinese economy. L_d is the supply of labor in the domestic sector. L_f is the supply of labor in the foreign sector.

3.2.1 The optimal consumption

Infinitely lived households seek to maximise their intertemporal utility function:

$$U = \int_0^{\infty} u(c_{op}(t)) e^{-\rho t} dt$$

ρ is the discount rate and $u(c(t))$ fits the inada conditions:

$$u(c(t)) = \frac{c_{op}(t)^{(1-\theta)} - 1}{1-\theta}$$

$\theta = \frac{1}{\sigma}$ is the inverse of the intertemporal substitution elasticity.

In both sector, $i = d, f, row$, the standard budget constraint remains:

$$\eta_i(t) \dot{N}_i(t) = w_i(t) + r_i \eta_i(t) N_i(t) - c_{op,i}(t)$$

and by the initial condition on assets:

$$\eta_i(0) N_i(0) = \eta_{i,0} N_{i,0}$$

To avoid Ponzi scheme, this constraint is added:

$$\lim_{t \rightarrow \infty} \left\{ \eta_i(t) N_i(t) \exp \left[- \int_0^t [r(v)] dv \right] \right\} \geq 0$$

$\eta_i(t) \dot{N}_i(t)$ represents the growth in assets over time in sector i , $\eta_i(t) N_i(t)$. $\eta_i(t)$ is the price of R&D and $N_i(t)$ the number of varieties which can be produced thanks to the R&D activity. $c_i(t)$ is the consumption of goods from the sector i . $w_i(t)$ is the total wage earned by Chinese households in domestic firms.

To find the optimal growth rate of consumption we use an Hamiltonian:

$$H(t) = u(c_{op,i}(t)) e^{-\rho t} + \mu(t) [w_i(t) + r \eta_i(t) N_i(t) - c_{op,i}(t)]$$

where $\mu(t)$ is the discount value of the assets (variety) stock.

The three first order conditions are derived:

$$\frac{\partial H}{\partial c_{op,i}(t)} = 0 \Leftrightarrow \mu(t) = u'(c_{op,i}(t)) e^{-\rho t}$$

$$\frac{\partial H}{\partial \mu(t)} = \eta_i(t) \dot{N}_i(t)$$

and

$$\frac{\partial H}{\partial \eta_i(t) N_i(t)} = -\dot{\mu} \Leftrightarrow \dot{\mu}(t) = -r\mu(t)$$

The transversality condition imposed by the no Ponzi scheme condition is:

$$\lim_{t \rightarrow \infty} \{\mu(t) \eta_i(t) N_i(t)\} = 0$$

the growth of the optimal consumption is:

$$\gamma_{c_{op,i}} = \frac{c_{op,i}}{c_{op,i} = \xi(r-\rho)}$$

Parameter ρ is relatively small, so that a positive growth of consumption is always expected. ξ is the elasticity of substitution between domestic and foreign goods produced in China: higher is ξ , greater the competition and stronger the growth. It is assumed that ξ is high enough to make the mark-up close to unity.

3.2.2 The final output function

According to [18],[5], [6], [23] and [24], we follow this output function for the domestic representative firm:

$$Y_i(t) = A_i L_i^{1-\alpha} \sum_{j=1}^{N_i(t)} (X_{i,j}(t))^\alpha$$

with $0 < \alpha < 1$. At the regular state growth $Y_i(t) = Y_i$ the output of the domestic firms, $A_i(t) = A_i$ its parameter of productivity. L_i is the labor employed in domestic firms assumed as constant. $X_{i,j}(t) = X_{i,j}$ the quantity of intermediate products j used in domestic firms. To study the effect of N, we assume that the quantity of intermediate good $X_{i,j}$ is the same for all j then $X_{i,j}(t) = X_i$ on the optimal path. The domestic output function becomes:

$$Y_i = A_i L_i^{1-\alpha} X_i^\alpha N_i$$

The return to scale of the technology, ie the number of variety N_i , is constant. Hence, there is no transition path to a limited accumulation per capita, [2]. The regular state growth rate is

directly computed.

The profit of the final domestic firm is:

$$\Pi_d = Y_i - w_i L_i - P N_i X_i$$

Where w_i and P are respectively the cost of labor and intermediate outputs paid by domestic firms to chinese employees and the domestic firm of intermediate output. Maximising the profit gives:

$$L_i = (1 - \alpha) \frac{Y_i}{w_i} \frac{1}{\mu}$$

and

$$X_i = L_i \left(\frac{A_i \alpha}{P \mu} \right)^{\frac{1}{1-\alpha}}$$

X_i is the demand of intermediate goods from the final firm to the intermediate firm. μ is the mark-up equal to $\frac{\xi}{\xi-1}$.

The marginal cost of both sector is equal to:

$$P_i(t) = \mu MC_i(t) = \mu \frac{w_i(t) P}{A_i} \left[\frac{1}{N_i(t)} \left(\frac{1-\alpha}{\alpha} \right)^\alpha + \left(\frac{\alpha}{1-\alpha} \right)^{1-\alpha} \right]$$

3.2.3 The intermediate sector

The R&D sector keeps its monopoly indefinitely on the output contrived by its own. The intermediate firm idea is protected by secret or patent, which generates revenues that steadily decreases with time because new and more profitable patents arise. This assumption makes the regular state growth be not pareto-optimal. Our analysis is then based on a second best. The cost of $X_{i,j} = X_i$ is identically equal to unity. The discount value of intermediate firm profit can be written as:

$$V_i(t) = \int_t^\infty (P - 1) X_i e^{-\bar{r}(v,t)(v-t)} dv$$

Where v is the period when the patent is too obsolete to generate revenue. The average interest rate between t and v , $\bar{r}(v,t) = \left[\frac{1}{v-t} \right] \int_t^v r(\omega) d\omega = r$, is constant at the regular state.

The discount factor indeed becomes $e^{-r(v-t)}$. To obtain an equilibrium with R&D activities we must add this constraint:

$$V_i(t) = \eta_i$$

η_i represents the cost of R&D in the domestic sector. If $V_i(t) > \eta_i$, resources to R&D activities would be unlimited, no equilibrium would exist. If $V_i(t) < \eta_i$, no R&D activities would exist.

At each period the intermediate firm maximises its profit by choosing the optimal P . As shown in the Appendix:

$$P = \frac{1}{\alpha} > 1$$

P is not affected by the level of final output. A decrease in the demand of intermediate good would drop the profit of the monopoly and then stop R&D activity.

3.2.4 The regular state growth rate of the Chinese economy

As we know P , we can include the value in the intermediate good demand equation. The Appendix shows that the growth of varieties, optimal consumption and output is the same:

$$\gamma_i = \xi \left[\frac{L_i}{\eta_i} \left(\frac{1-\alpha}{\alpha} \right) \left(\frac{A_i}{\mu} \right)^{\frac{1}{1-\alpha}} \alpha^{\frac{2}{1-\alpha}} - \rho \right]$$

For a sake of simplicity we assume that the growth rate of the worldwide economy is equal to the growth rate in the domestic and foreign sectors as in the rest of the world

$$\gamma_d = \gamma_f = \gamma_{row}$$

To keep this assumptions, all parameters are identical and this condition is added:

$$\frac{L_d}{\eta_d} = \frac{L_f}{\eta_f} = \frac{L_{row}}{\eta_{row}}$$

The unit subsidy given by state to the domestic sector is equal to:

$$S(t) = \left(\frac{1}{N_d(t)} - \frac{1}{N_f(t)} \right) \left(\frac{1-\alpha}{\alpha} \right) \frac{W(t)}{\alpha}$$

As we assume $A = 1$, $P_d(t) = P_f(t)$, $\frac{Y_f(t)}{L_f} = \frac{Y_d(t)}{L_d}$, the wage rate is always the same across domestic and foreign sectors.

3.3 The Chinese growth affected by positive spillovers and technology transfers

Technology transfers and positive spillovers are the main channel to increase Chinese total productivity factor, [35], and then the domestic growth sector is positively affected. Before the Chinese economy is opened to FDI, the growth rate is γ_d . Afterwards, $t = T \dots \infty$, it becomes:

$$\gamma_d(t) = \gamma_d + \vartheta^{1 - \frac{N_d(t)}{N_f(t)}} - 1$$

$N_f(t)$ is the number of varieties (technology level) of foreign firms in China. $N_d(t)$ is the number of variety produced by the domestic sector. ϑ is a constant parameter for setting up positive spillovers and technology transfers from the foreign sector to the domestic sector. We assume that the additive domestic sector growth decreases with the Chinese catch-up: there are less and less spillovers to absorb and technology to transfer. To keep the shares of foreign and domestic output equal to the regular state shares, the whole economy is supposed to grow at $\gamma_d(t)$. The bigger marginal cost of the domestic sector is offset by public subsidies.

We assume free technology transfer from foreign firms abroad to their affiliates in China (FDI). The cost of R&D is then less important for FDI in China. η_f will decrease to ensure that $\gamma_{ROW} = \gamma_f$ and $N_{ROW}(t) = N_f(t)$

Technology transfers and positive spillovers generated by FDI is called "Dark Matter". Its value can be considered as public saving of subsidies necessary to decrease the cost of R&D, η_d , in order to get $\gamma_d(t)$. The "Dark Matter" value can be computed as:

$$dm(t) = N_d(t-1) \gamma_d(t) (\eta_d - \eta_d(t))$$

where $\eta_d(t)$ is the discount cost of R&D due to positive externalities imported inside FDI.

3.4 The official and the unofficial trade balance

Following [27], there is an official trade balance and an unofficial one that takes in account the import of "Dark Matter". To write the trade balance, exports must be taken in account. Both domestic and foreign sectors export. As exports is foreign consumption, it is assumed that:

$$c_{op,i}(t) = c_i(t) + ex_i(t) + d_i(t)$$

$c_i(t)$ is the chinese households consumption of good i funded by the domestic banking system. $ex_i(t)$ represents exports of output i . $d_i(t)$ is a surplus of demand which comes from the private sector, like consumption funded by foreign banks, or the public sector as public expenditures. Because of asymmetric economies, China and the ROW, this condition is imposed:

$$ex_{ROW}(t) = im(t)$$

$$ex_d(t) + ex_f(t) = im_{ROW}(t)$$

where $im_{ROW}(t)$ is the imports of ROW from China. As domestic consumption and imports, exports fits Dixit-Slignitz basic conditions. Then

$$ex_d(t) = (1 - \chi)(1 - \chi_{row}) \left(\frac{1}{1 + \Delta E(t)} \right)^{-\xi_{row}} c_{row}$$

and

$$ex_f(t) = \chi(1 - \chi_{row}) \left(\frac{1}{1 + \Delta E(t)} \right)^{-\xi_{row}} c_{row}$$

$c_{row}(t)$ is the exogenous consumption of the rest of the world which grows initially at $\gamma_{row} = \gamma$. $\xi_{i,row}$ is the elasticity of substitution between goods produced in both sectors and goods produced in the rest of the world.

The accumulation of foreign currency reserves is due to the excess of the trade balance and large inflows of foreign capital. The balance of payments is restricted to the trade balance:

$$TB_{of}(t) = \Delta NIR_{of}(t)$$

$TB_{of}(t)$ is the official trade balance. $\Delta NIR_{of}(t)$ is the accumulation of Net International Reserves (NIR) necessary to keep a fixed and undervalued peg of the Renminbi. To simplify the model, interest rate on NIR is equal to zero.

The unofficial trade balance takes in account takes in account the imported "Dark Matter" inside FDI.

$$TB_{un}(t) = TB_{of}(t) - dm(t)$$

where $NIR_{un}(t)$ is the accumulation of international reserves necessary to keep the Renminbi peg undervalued and constant if the trade balance took in account "Dark Matter".

3.5 The banking and monetary policies

The Chinese economy suffers from a inefficient banking system, [11], which is unable to fund the whole domestic sector, [20]: chinese private firms are credit constraint whereas State firms are not. But the former enjoy financial support from the central and the local governments. Few connexions between foreign firms and the Chinese banking system exist, [20]. Liberalizing the banking sector is impossible because it would threaten the modernization of the State firms. Hence, a limited supply of credit leads to a limited supply of money. The monetary policy is then affected by the inefficient but necessary protected banking system.

3.5.1 The exchange rate policy

As explain above, a decrease in the demand of intermediate goods would drop the profit of the intermediate sector. R&D expenditures would end and crowd the domestic sector out the market. The level of the devalued exchange rate is choosen by the Monetary Authority to fit this condition:

$$\Delta E(t) = \left[\frac{C_{op,d}(t) - c_d(t) - d_d(t)}{\chi(1 - \chi_{row})c_{row}} \right]^{\frac{1}{\xi_{row}}} - 1$$

3.5.2 The monetary policy

[36] supports the fact that the income velocity of money is decreasing in China. For a sake of simplicity, the income velocity of money is assumed to be constant. The growth rate of money must then equal the growth rate output: if the Chinese economy produces 10% more of cars

each year, the supply of money must equally increase to enable selling. Then

$$\gamma_M(t) = \gamma(t)$$

with $\gamma_M(t)$ the growth rate of the stock of money and $\gamma(t)$ the growth rate of the Chinese economy.

On the one hand, following [1], the Chine Central Bank balance sheet can be simplified as follows:

Central Bank Balance Sheet	
Assets	Liabilities
Credit to the Banking System (NDA)	Foreign Liabilities (-NIR _{of})
Foreign Exchange Reserves (NIR _{of})	Currency in circulation (M)
Other Domestic Assets (NDA)	Reserves Of hte banking system (M)
	Bonds (-NDA)

The stock of money is equal to the Net Domestic Assets (NDA) plus the Net International Reserves (NIR). Thus we can write:

$$\gamma_M(t) = \frac{NDA}{M} \gamma_{NDA}(t) + \frac{NIR_{of}}{M} \gamma_{NIR_{of}}(t)$$

where $\gamma_{NDA}(t)$ is the growth rate of NDA and $\gamma_{NIR_{of}}(t)$ is the growth rate of NIR_{of}.

On the other hand, the growth rate of the Chine economy is proportionnaly linked to the growth in the domestic sector and the foreign sector:

$$\gamma(t) = (1 - \chi) \gamma_d(t) + \chi \gamma_f(t)$$

The domestic banking system supply money just for a limited part of the economy. The fixed exchange rate policy generates money through NIR. At each period the share of the NIR

accumulation that must be prevented from sterilization:

$$\gamma_s(t) = \frac{M}{NIR_{of}}\gamma_d(t) - \frac{NDA}{NIR_{of}}\gamma_{NDA}(t)$$

3.5.3 The inefficient domestic banking sector

We suppose that the domestic banking system funds consumption and investment for modernization in the domestic despite a large amount of bad debts. A proportional relationship is assumed between the total amount of loans and the National Domestic Assets:

$$\gamma_{NDA}(t) = \gamma_L(t)$$

where $\gamma_L(t)$ is growth rate of the total supply of loans from the domestic banking system. The latter is written as follows:

$$L(t) = L_c(t) + L_{\eta N}(t) + s(t)$$

$L(t)$ is the total amount of loans supplied by the domestic banking system. $L_c(t)$ is the amount of loans for consumption and $L_{\eta N}(t)$ the amount of loans for investment. Loans growth is supposed to be correlated with both consumption and investment growth. $s(t)$ represents the sterilization due to the accumulation of international reserves.

Let's assume that the amount of loans used for investing is proportionally linked to the investment. The Chinese government's main purpose is to ensure investment, so that the growth rate of investment supply is equal to the domestic growth rate.

$$\gamma_{L_{\eta N}}(t) = \gamma_d(t)$$

$\gamma_{L_{\eta N}}(t)$ represents the growth rate of loans for investment that follows the domestic growth. The growth rate of consumption is assumed to be proportionally linked to the growth rate of loans for consumption too. But sterilization must be taken into account and then lowers the level of consumption loans. Because the supply of consumption credit is not a government priority,

the consumption growth rate can seriously differ from the domestic sector growth rate.

$$\gamma_c(t) = \frac{L_c}{C} \gamma_{L_c}(t) - \frac{s}{C} \gamma_s(t)$$

$\gamma_c(t)$ is the growth rate of consumption, $\gamma_{L_c}(t)$ stands for the growth rate of consumption loans which is dampened by sterilization due to the exchange rate policy, $\frac{s}{C} \gamma_s(t)$. s is a positive and relatively small parameter which enable the share of the growth rate of NIR accumulation to sterilize, $\gamma_s(t)$, to come into the last equation. A solvability constraint is imposed for all the banking system:

$$\frac{DP(t)}{L(t) * R(t)} = \zeta$$

with $0 < \zeta < 1$ and $DP(t)$ the amount of deposits proportionally linked to the growth domestic sector:

$$\gamma_d(t) = \gamma_{DP}(t)$$

FDI and private Chinese firms using advanced technology tend to crowd State Firms which enjoy credit supply out the market. The risk incurred in the banking system increases with the amount of State Firms' bad debts.

$$\gamma_R(t) = \vartheta_R^{1 - \frac{N_d(t)}{N_f(t)}} - 1$$

With ϑ_R , $\gamma_R(t)$ differs from the positive externalities on the domestic sector growth rate. The increase in risk fall with the technological catch-up too.

4 Equilibrium of the domestic sector in a globalized economy

There is a constant and permanent shock at period $t = T$: the quantity of labor in the rest of the world increases to $L_{row}(T)$. This is called the Globalisation: foreign companies supply a

worldwide market. As for a consequence:

$$\gamma_{ROW}(T) > \gamma_{ROW}(T-1)$$

That is to say:

$$N_{ROW}(T) > N_d(T)$$

At $t = T$ the Chinese Government supports the both sectors to avoid collapse. This protectionism policy is not sustainable, that's why the Chinese government launches the "Market for technology" strategy at $t = T + z$ in order to make the domestic sector competitive. The exchange rate is one of the main factor to attract FDI. During the 1980's, the Renminbi is pegged to the Dollar and steadily devalued: both the capital and the trade balances become positive, NIR stock rises.

4.1 Consequences on consumption

According to the model, the consumption growth The growth rate of consumption for $t = T$ becomes:

$$\gamma_c(t) = \gamma_d(t) - \frac{L(T)}{L_c(T)} \left[\vartheta_R^{1 - \frac{N_d(t)}{N_f(t)}} - 1 \right] - \frac{s}{c} \gamma_s(t)$$

Thus the share of consumption in the Chinese GDP is:

$$\omega(t) = \frac{c(T)}{c_{op}(T)} \prod_{z=T}^t \left(\frac{1 + \gamma_d(z) - \frac{L(T)}{L_c(T)} \left[\vartheta_R^{1 - \frac{N_d(z)}{N_f(z)}} - 1 \right] - \frac{s}{C} \gamma_s(z)}{1 + \gamma_d(t)} \right)$$

The share of consumption funded by the traditional banking system decreases all along the Chinese technological catch-up.

4.2 Consequences the exchange rate policy

Using the last result, the path of the devalued exchange rate can be computed:

$$\Delta E(t) = \left[\frac{\left(1 - \omega \left(\frac{N_d(t)}{N_f(t)}\right)\right) c_{op,d}(t) - d_d(t)}{\chi (1 - \chi_{row}) c_{row}(t)} \right]^{\frac{1}{\xi_{row}}} - 1$$

Every things equal, the exchange rate must be devalued all along the technological catch-up. But assuming a that the devaluing the Renminbi is bounded is reasonable: $\Delta E(t) = \Delta E$. The consequence is that:

$$d_d(t) = \left(1 - \omega \left(\frac{N_d(t)}{N_f(t)}\right)\right) c_{op,d}(t) - (1 + \Delta E)^{\varepsilon_{row}} \chi (1 - \chi_{row}) c_{row}(t)$$

In order to avoid a steady devaluation of Renminbi and to keep the peg of the Renminbi constant, the surplus of demand must increase with the technological catch-up. The surplus of demand can be funded by the private sector thanks to the slowly but steady modernisation of the banking system. Public expenditures can compensate for the lake of private consumption. In a context of global economic crisis (a decrease in c_{row}), the equilibrium of the domestic sector, i.e the domestic growth sector strategy, can be ensured thanks to a rise public expenditures.

4.3 Consequences on sterilization

According to the native industry protectionism policy, the banking system which is inefficient must be protected to ensure the modernization of State Firms. Hence, NDA is not sufficient to fund the growth of the chinese economy.

$$\gamma_{NDA}(t) = \gamma_d(t) - \left(\vartheta_R^{1 - \frac{N_d(t)}{N_f(t)}} - 1 \right)$$

and thus a partial sterilization is necessary according to this rule:

$$\gamma_s(t) = \gamma_d(t) - \frac{NDA}{NIR_{of}} \left(\vartheta_R^{1 - \frac{N_d(t)}{N_f(t)}} - 1 \right)$$

When $N_f(t) > N_d(t)$, there is positive relationship between NIR and the stock of money. The exchange rate policy is not only a trade tool but a monetary tool too, as pinpointed by [17].

Empirical observations on reserve accumulation and sterilization in ([1], graph 8), is consistent with this theoretical results.

4.4 Consequences on the value of NIR stock

By attracting FDI, The domestic sector enjoy positive spillovers and technology transfers. Then the value of the "Dark Matter" is:

$$dm(t) = N_d(t-1) \left(\gamma_d + \vartheta^{1-\frac{N_d(t)}{N_f(t)}} - 1 \right) \left(\eta_d - \frac{L_d \left(\frac{A}{\mu} \right)^{\frac{1}{1-\alpha}} \left(\frac{1-\alpha}{\alpha} \right) \alpha^{\frac{2}{1-\alpha}}}{\theta \left(\left(\gamma_d + \vartheta^{1-\frac{N_d(t)}{N_f(t)}} - 1 \right) + \frac{\rho}{\theta} \right)} \right)$$

More the Chinese technological backwardness is important, more the value of imported "Dark Matter" is important. As this import is not accounted in the trade balance, the real value of NIR stock is:

$$V_{NIR}(t) = NIR_{of}(\Delta E(t)) - \sum_{s=T}^t dm(s)$$

According to the model, the unofficial value of NIR stock is much more smaller than the official value. Two results arise. Firstly, the value of the expected american repaiment is relatively small even if a great part of the official NIR is invested in American Public Bonds. This result explains why the Chinese government has never been reluctant to fund an over-indebted economy.

Secondly, a sudden increase in the NIR, with a rise in "hot money" inflows or a rise in Chinese exports, improve Chinese intensives for finding new sources of positive externalities. This explains why the Chinese Sovereign Fund was set up after 2004, when the current account reached more than 4% of the GDP, even if the amount of foreign reserves was already huge. [16] shows that the Chinese Soveriegn Fund strategy is not oriented towards return on invesment maximisation. The core investment is oriented to the domestic banking system, commodities and high technological foreign firms, what fuels positive externalites.

4.5 Is the growth strategy sustainable?

The Chinese government supports the domestic sector by allocating public resources to domestic protectionism:

$$S(t) = \left(\frac{N_f(t)}{N_d(t)} \right)^{1-\alpha}$$

If

$$\gamma_{ROW}(t) \geq \gamma_d(t)$$

The consequence is that

$$\lim_{t \rightarrow \infty} S(t) \rightarrow \infty$$

In this case the growth strategy of the domestic sector is unsustainable. The condition for sustainability is:

$$\gamma_d(t) > \gamma_{ROW}(t)$$

then

$$\eta(t) < \frac{L_d}{L_{ROW}(T)} \eta_{ROW}$$

The Chinese discount cost of R&D is bounded. Therefore, the Chinese growth strategy is sustainable if and only if the discount cost of R&D is small enough. The intellectual property rights are not respected despite the WTO agreements. According to the model, a though implementation of those agreements could seriously threaten the success of the Chinese domestic sector growth strategy.

4.6 Back to the initial regular state?

At $t = T_{fi}$, $N_d(T_{fi}) = N_f(T_{fi})$, the domestic sector is as much competitive as the foreign sector and the ROW. There is no more positive spillovers. The domestic sector doesn't need

public subsidy anymore if and only if:

$$\eta_d(t) \leq \frac{L_d}{L_{ROW}(T)} \eta_{ROW} < \eta_d(T)$$

The discount cost of R&D in the domestic sector can't go back to its initial value $\eta_d(T)$. During the technological catch-up the domestic intermediate sector must learn and become more efficient than the initial regular state.

With the technological catch-up, the value of the imported "Dark Matter" steadily decreases, whereas the real value of the NIR stock rises. Accumulation of NIR is expected to decrease: the Renminbi must be steadily appreciated.

$$\frac{\partial \Delta E(t)}{\partial \frac{N_d(t)}{N_f(t)}} < 0$$

Then surplus of demand becomes:

$$d_d(t) = \left(1 - \omega \left(\frac{N_d(t)}{N_f(t)}\right)\right) C_{op,d}(t) - \left(\frac{1}{1 + \Delta E \left(\frac{N_d(t)}{N_f(t)}\right)}\right)^{-\varepsilon_{row}} \chi (1 - \chi_{row}) c_{row}(t)$$

According to the model, the domestic private and public consumption must steadily increase with the technological catch-up. Therefore, modernization of the banking system becomes a public priority. This explains why the Chinese government has recently allowed foreign private banks to settle in "Special Zones".

5 Policy implications

The model explains that the growth in China is more balanced than expected. Global Imbalances from China are just a mirror of an unofficial native industry protectionism that is not infinitely long lasting. If the Chinese growth strategy is sustainable, as it seems to be, global imbalances are sustainable too. As a consequence, any threat technology transfer and positive spillovers absorbed by the Chinese domestic sector is threat on the sustainability of the Global Imbalances.

International statistics must be revised as agreements about the respect of intellectual property rights. The latter can't be respected because the breach of the WTO agreements is an

important pillar of the Chinese growth strategy.

Financial markets believe in an extrem imbalanced current account because "Dark Matter" imports is not taken in account. A high reevaluation of the Renminbi is expected which leads to large inflows of "hot money" made easier by alleviated capital controls. The growth in China could be threaten, then central banks must cooperate to impose a small but steady expected reevaluation of the Renminbi. To ease this reevaluation, banks from advanced economies must cooperate with the Chinese banking system to modrnize consumption credit supply without leave credit invesment to firms of the domestic sector.

In order to prevent any global crisis, overvalued international reserves can be used in a "win win" cooperation between PBC and Monetary authorities in advanced economies. A cancellation of a significant share of the american debt would restore confidence in the global stability. PBC could help to slow down the european public debt. Preventing a global crisis makes the Chinese technological catch-up still feasible. Finally, thanks to overvalued international reserves, a cooperation with PBC can prevent any global crisis before the setting up of a new international monetary system.

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.1 The marginal cost

Both domestic and foreign sectors are similarly parametered at the regular state. Both consumer prices index are then identical and can be computed by using the maximising profit function conditions of the final firms:

$$L_i = (1 - \alpha) \frac{Y_i}{W_i}$$

$$X_{t,i} = N_i X_i = \alpha \frac{Y_i}{P_i}$$

where $X_{t,i}$ is the sum of all identical intermediate goods used in the final sector. The marginal rate of substitution is:

$$L_i = \frac{(1 - \alpha) P_i}{\alpha W_i} X_{t,i}$$

By replacing values of labor and the total intermediate input in the production function we find:

$$L_i = \frac{Y_i}{AN_i^{1-\alpha}} \left(\frac{1 - \alpha P_i}{\alpha W_i} \right)^\alpha$$

$$X_{t,i} = \frac{Y_i}{AN_i^{1-\alpha}} \left(\frac{\alpha W_i}{1 - \alpha P_i} \right)^{1-\alpha}$$

The total cost for the final firm is written as:

$$CT_i = W_i L_i + P_i X_{t,i}$$

which becomes

$$CT_i = W_i \frac{Y_i}{AN_i^{1-\alpha}} \left(\frac{1 - \alpha P_i}{\alpha W_i} \right)^\alpha + P_i \frac{Y_i}{AN_i^{1-\alpha}} \left(\frac{\alpha W_i}{1 - \alpha P_i} \right)^{1-\alpha}$$

Hence, the marginal cost is:

$$\frac{\partial CT_i}{\partial Y_i} = MC_i = W_i \frac{1}{AN_i^{1-\alpha}} \left(\frac{1 - \alpha P_i}{\alpha W_i} \right)^\alpha + P_i \frac{1}{AN_i^{1-\alpha}} \left(\frac{\alpha W_i}{1 - \alpha P_i} \right)^{1-\alpha}$$

There is perfect competition background for the final firms, then:

$$P_i(t) = MC_i(t) = \frac{W_i(t) P_i(t)}{A_i} \frac{1}{N_i^{1-\alpha}} \left[\left(\frac{1-\alpha}{\alpha} \right)^\alpha + \left(\frac{\alpha}{1-\alpha} \right)^{1-\alpha} \right]$$

There is an inverse relationship between the level of technology, N_i , and the consumer price, $P_{f,i}$.