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The Renminbi Equilibrium Exchange Rate: An Agnostic View*

Kurs równowagi dla waluty chińskiej: zdanie odrębne

*Antoine Bouveret**, Sana Mestiri*** Henri Sterdyniak*****

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Abstract

The alleged undervaluation of the renminbi has been the subject of intensive academic research over the past few years. Using equilibrium exchange rate models many authors have concluded that the renminbi is undervalued by 15 to 30% against the US dollar. Yet China has been experiencing strong economic growth for a decade and does not seem to suffer from the supposed misalignment of its exchange rate, with low inflation rate and current account surpluses. The estimations assume that the economy is at full-employment, a strong hypothesis for China, where unemployment amounts to 150 million people. This article claims that a low exchange rate is suited for the objectives of Chinese economic policy. The exchange rate can be undervalued according to traditional models and in equilibrium compared to the government's policy objectives as shown by a theoretical model.

Keywords: equilibrium exchange rate, developing country exchange rate, China economic strategy.

JEL: F31, F42, O24

Streszczenie

Rzekome niedowartościowanie waluty chińskiej (renminbi) od kilku lat jest przedmiotem ożywionej działalności badawczej. Posługując się modelami kursu równowagi, liczni autorzy twierdzili, że waluta ta jest niedowartościowana od 15% do 30% w stosunku do dolara. Niemniej w Chinach od 10 lat obserwujemy silny wzrost gospodarczy i kraj ten nie wydaje się cierpieć z powodu postulowanego niedostosowania kursu jego waluty. Inflacja pozostaje przy tym niska i odnotowujemy nadwyżki na rachunku obrotów bieżących. W przeprowadzanych dotąd szacunkach przyjmuje się założenie pełnego zatrudnienia w gospodarce chińskiej, co jest daleko idącym postulatem, zważywszy że liczba bezrobotnych w Chinach wynosi 150 mln. W niniejszym artykule sformułowano tezę, że niski kurs waluty jest korzystny dla celów polityki gospodarczej Chin. Kurs walutowy może być niedoszacowany z punktu widzenia tradycyjnych modeli i być w równowadze z punktu widzenia celów polityki gospodarczej rządu, co pokazujemy na modelu teoretycznym.

Słowa kluczowe: kurs równowagi, kurs walutowy kraju rozwijającego się, chińska strategia gospodarcza

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1. Introduction

The undervaluation of the renminbi-US dollar exchange rate has been a major issue in policy and academic circles (Figure 1). Many studies have estimated the equilibrium exchange rate of the renminbi using different theoretical frameworks[1]. Most of them conclude that the undervaluation of the renminbi falls between 15 and 30%. But China has been experiencing strong economic growth for a decade and does not seem to suffer from the supposed misalignment of its exchange rate, with a low inflation rate and current account surpluses.

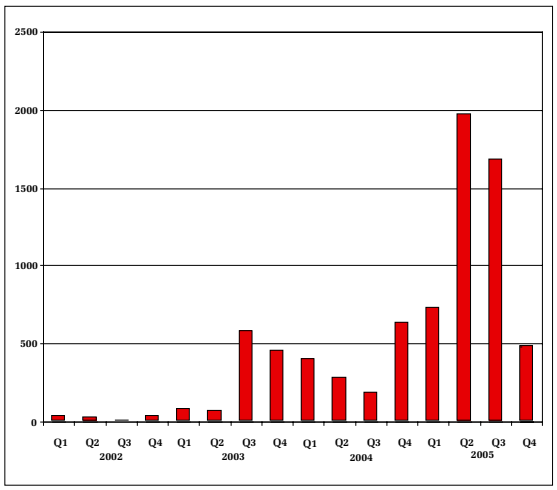
It appears, therefore, important to deepen the concept of undervaluation and to define accurately the equilibrium exchange rate norm. Some authors refer to the purchasing power parity, but this theory does not apply directly to economies with different development levels like the United States and China. Others claim that the growing American current account deficits or the persistence of massive unemployment in Western Europe are the result of an undervaluation of the renminbi. The global imbalances would be the consequence of the policy implemented by the People's Bank of China (PBC), which aims at stabilizing its exchange rate at a very low level. But in an International Monetary System without a code of good conduct, the exchange rate strategy of a country can only be judged with reference to its own interests. Who would say that the FED is taking Europe's interests into account while defining its exchange rate policy? The Chinese exchange rate strategy can only be assessed with reference to its growth strategy, and the Chinese growth strategy appears very successful, weakening the claim that China would be responsible for the global imbalances.

Some economists (in particular American economists from the Institute for International Economics: Goldstein 2004a; 2004b; 2005; Goldstein, Lardy 2003; 2005; Williamson 2004; Bergsten 2006; but also Frankel 2004) claim that China should revalue its exchange rate from 15 to 40% against the US dollar, which would make it possible to revalue all Asian currencies and decrease world imbalances. They agree with the American Congress which threatens China with commercial sanctions if it does not revalue its currency. On the contrary, other economists (McKinnon 2003; 2005a, 2005b; Bosworth 2004; Dooley et al. 2004; Aglietta 2005) argue that China should not yield to the American pressures. Revaluing the Renminbi would slow down its growth and lead to a crisis similar to Japan's after its *Endaka* (i.e. the revaluation of the Yen during the 80's).

This article aims at showing that the equilibrium exchange rate models commonly used are not relevant for a developing country such as China, whose objective is not to reach its equilibrium exchange rate but to reduce its unemployment. China faces massive unemployment: an undervalued exchange rate according to traditional standards allows it to induce a strong economic growth required to reduce unemployment. As a policy tool, the exchange rate is at an appropriate level with regard to Chinese economic growth. Broadly speaking, the optimal exchange rate for a developing country can only be defined according to a growth strategy: the more the country needs economic growth, the

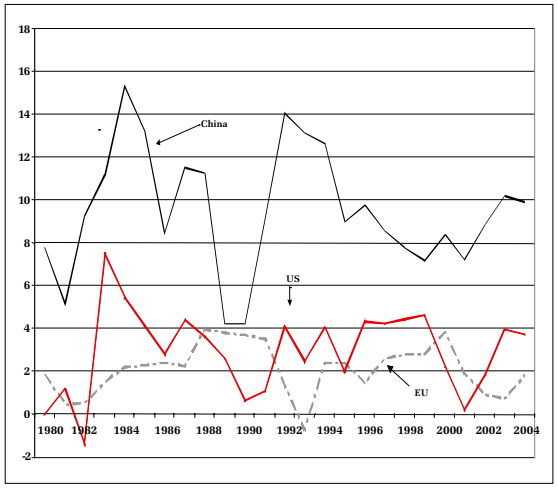
[1] See for instance: Jeong, Mazier (2003); Bénassy-Quéré et al. (2004); Wang (2004); Frunke, Rahn (2004); Coudert, Couharde (2005); Dunaway, Li (2005); Frankel (2004).

Figure 1. *Number of articles in "Banking and Finance" and "Business and Management" sections containing the words "China" and "undervaluation" or "revalue"*



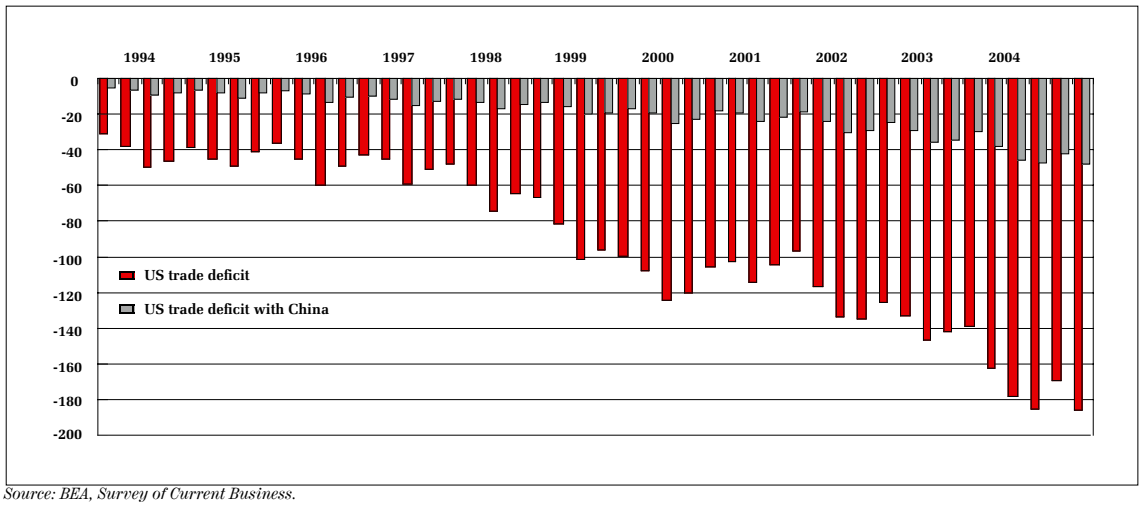
Source: Lexis-Nexis.

Figure 2. *Real GDP growth for the US, European Union and China*



Source: NBS, BEA, Eurostat.

Figure 3. *American trade deficit (quarterly data, in billions of US dollars)*



Source: BEA, Survey of Current Business.

more it has to increase savings, the lower the exchange rate has to be.

The remainder of the article is as follows: Part I describes the main facts concerning the Chinese economy from 1994, when the country decided to move to a *de jure* floating exchange rate regime, while moving to a *de facto* peg to US dollar. Part II analyzes equilibrium exchange rate estimations; Part III puts forward a model in which the exchange rate is willingly fixed at a low level to achieve strong economic growth. Part IV concludes.

2. A strong economic growth

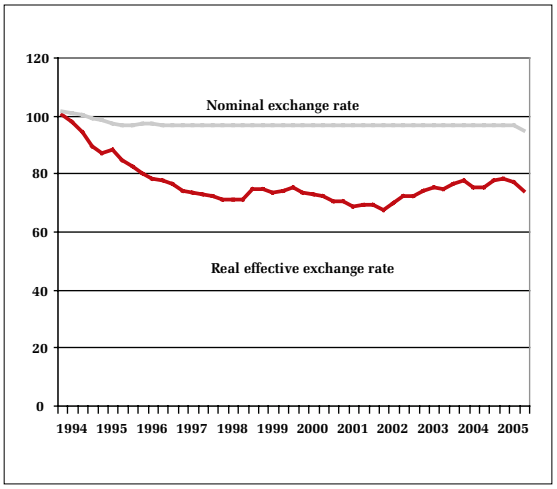
China has been experiencing a dramatic growth for a decade (Figure 2): from 1995 to 2004, its GDP growth has been 8.5% per year while 3.3% in the US and 2.2% in the Euro Area. Only a few Asian countries have experienced such growth: Vietnam and Myanmar (7.2% each) and India (6.1%).

Since 2003, the worsening of the US current account (6.5% of GDP in 2005, 5 points more than in 1993–1997) has lead to violent disputes against China, along the lines that the Chinese exchange rate regime could be held responsible for the deindustrialization of the American economy. The American current account deficit would be a consequence of the trade deficit with China (Figure 3). But the American deficit with China stands for a small part of American global deficit (approximately 20%) and therefore cannot be on its own a proof of the renminbi undervaluation. The renminbi exchange rate ought to be assessed according to a Chinese point of view: does it promote growth or does it lead to unsustainable imbalances?

2.1. The Renminbi exchange rate: a tool to promote development

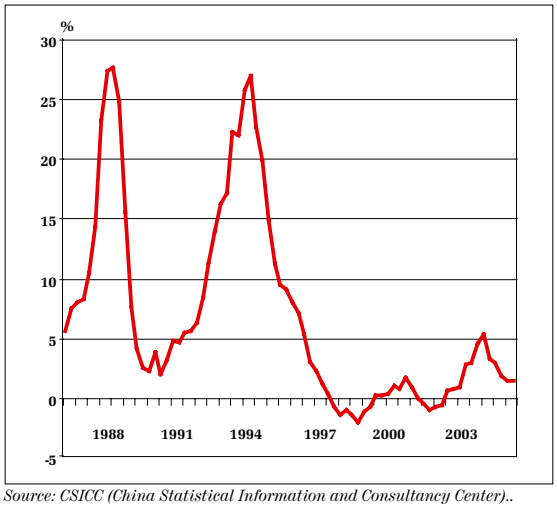
From 1994 to July 2005, the renminbi-US dollar nominal exchange rate has been fixed at 8.277 Yuan for a US dollar (Figure 4). Despite official speeches claiming that China moved to a floating exchange rate regime, Chinese authorities stabilized the exchange rate at this level from the 1st of January 1994 to the 21st of July 2005 with a very narrow margin (+/-0.18%). On the 21st of July 2005, the PBC revalued the Renminbi by 2.1% to 8.11 Yuan for a US dollar (with a band of +/-0.3%). The PBC

Figure 4. *Chinese real effective exchange rate* (1994=100) and nominal exchange rate against the US dollar***



** Based on nominal exchange rates and consumer prices, trade weights are taken from the period 1988-1990, see Zanello, Desruelle (1997).*
*** An increase is a depreciation of the Renminbi.*
Source: Global Insight.

Figure 5. *Inflation rate (consumer prices) in China 1987-2006 (quarterly data)*



Source: CSICC (China Statistical Information and Consultancy Center)..

also announced that the Chinese currency would be anchored to a currency basket (dollar, euro, won and yen), without defining the weights attached to each currency. Since then, the Renminbi has been slowly appreciating to 7.70 Yuan for a US dollar in May 2007. Its total rise is 6.8%, while the US demanded a significant appreciation (around 20%) and threatened China with protectionist measures. The PBC announcement lowered the pressure and showed its commitment in modifying its strategy, while underlining it would keep its freedom of choice.

The Chinese effective exchange rate had been appreciating from 1994 to 1997 due to inflation, which peaked to 24% in 1994. After 1994, the peg to the US dollar has been a nominal anchor, leading to a fall in inflation to 3% as soon as 1997 (Figure 5) which stabilized the effective exchange rate. The latter has followed the fluctuations of the US dollar: appreciation until 2001, depreciation from 2001 to 2004. A developing country with an undervalued currency would have experienced a substantial inflation, increasing its effective exchange rate, which is not the case for China. Exchange rate fixity, price control and absence of tensions on goods and labour markets have enabled China to stabilize its inflation at a low level.

Table 1. *The extent of Chinese urban unemployment (in %)*

Source	2001
Official sources (ADB)	3.6
The Economist	9.3
CIA World Factbook	9.8
Wang (2003)	12–15
Giles et al. (2005)	12.7
NBS survey (2001)	13.2

Source: Authors' compilation.

From 1994 to July 2006, the PBC chose to maintain a hard peg to the US dollar to promote substantial growth by an export-led strategy. China aims at incorporating its workers into the modern economic system because it is facing massive under-unemployment and unemployment, especially in rural areas (Box 1). A low exchange rate improves its external competitiveness. Its central role explains that the PBC does not want to allow speculation on its currency. In order to strengthen its economic and technological catching-up process, China needs Foreign Direct Investment and joint-ventures agreements; this pleads for a low exchange rate so as to maintain a high return on foreign investment. The value of the renminbi must be assessed with reference to this strategy.

The main criteria of undervaluation would be that a low level of the exchange rate leads to a too strong competitiveness, which would induce huge foreign demand and production larger than the capacity, raising the inflation rate. Yet the flaws of the argument are that growth requires some disequilibrium so that supply would be driven by demand; secondly, inflation rate has not risen over the past few years (Figure 5). As a consequence, most articles refer to the excessive accumulation of foreign exchange reserves, linked with current account surplus and FDI, as proofs of undervaluation.

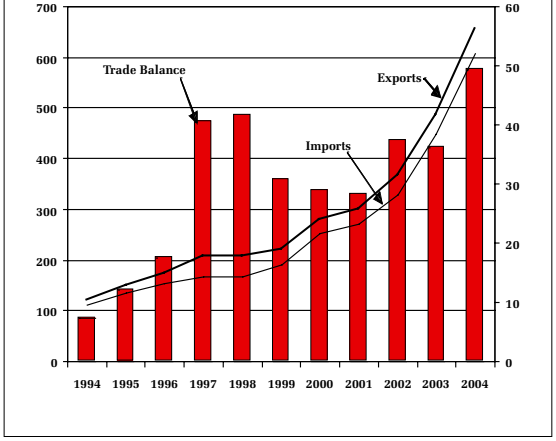
Box 1. Unemployment in China

In spite of the dynamism of the growth, the question of unemployment is crucial in China. From 1995 to 2002, the public firms were restructured and saw their employment decreasing from 113 to 72 million. At the same time, in spite of the system of licence of residence (hokou), the differences in income have attracted the rural people towards the cities. Official Chinese figures of unemployment are questionable: the urban unemployment rate would be 3.1% in 2002 (7.7 million of unemployed). According to Brooks (2004), it amounts to 5.3% (13.9 million). A study pursued by the Chinese Academy of Social Science in five cities assesses the urban unemployment at 12.7% (Giles et al. 2005). The Chinese Prime Minister acknowledged that urban unemployment was above 7% in a speech in 2002. (OECD 2005). The CIA World Factbook assesses it at 9.8%. Official unemployment does not take disguised unemployment, embodied by xiagang (people officially employed but who do not work for their firms and earn unemployment benefit), and rural unemployment into account, otherwise the number of unemployed would be close to 100-150 millions.

2.2. The Chinese competitiveness and the level of the renminbi

Chinese exports are very dynamic: they increased by 15.5% per year from 1990 to 2004 and more than 30% in 2003 and 2004. Chinese market share steadily increased from an index of 100 in 1994, to 130 in 2000, and will be over 250 in 2007. Yet import growth has also been dynamic, close to exports': 15.9% from 1990 to 2006 (Figure 6). Chinese trade surplus is hence huge (60 billion US dollars in 2004) but steady since 2000, around 2.5% of GDP. In 2005 it surged to 128 US dollar. The Chinese external balance amounted to 148 billion US dollars in 2005 (7.7% of the Chinese GDP), the second of the world, below Japan's (158 billion US dollars) and above

Figure 6. *Chinese exports, imports (in billions of US dollars, left axis) and trade balance (right axis)*



Source: NBS

Germany's (114 billion US dollars): it cannot therefore be blamed for global imbalances.

The US and Europe have been recording large trade deficits with China, but those deficits have to be corrected for two factors. The huge Chinese surplus with the US and Europe is counterbalanced by a rising deficit with Asian countries. During 2002-2004, more than 20% of imports or exports by mainland China were freighted through Hong Kong. When Hong Kong is added to mainland China (Table 2), the overall trade surplus slightly decreases.

China is a huge assembly plant where lots of products are transiting to be transformed by a cheap, low-skilled labour force. Chinese exports are relatively weak in Chinese value added[2] since they incorporate, in addition to low wages, imported intermediate consumptions, but also the profits carried out mainly by foreign companies, re-exported or reinvested in China[3].

[2] See Daudin et al. (2006)

[3] The prices of Chinese exports can be overestimated in the case of inter-firm transactions since firms can prefer, for taxation reasons, to declare their profits in China rather than in their country of origin.

Table 2. *Chinese trade balance in 2003 (in billions of US dollars)*

	Mainland China	Mainland China and Hong Kong
US	58	88
UE	18	29
Japan	-14	-31
South Korea	-21	-27
Hong Kong	65	
ASEAN	-15	-30
Other	-65	-12
Total	26	17

Source: NBS, BEA, Eurostat and Asian Development Bank.

Chinese competitiveness depends on structural factors: wages are low and stable because of a massive underemployed labour force. Half of Chinese exports are done by foreign firms located in China. They produce and export goods with high import content and are therefore relatively less affected by the exchange rate. Many Chinese export prices are determined in US dollar by foreign importers/producers and are less affected by the exchange rate. The dramatic increase in Chinese exports is deeply due to foreign firms' behaviour, looking for cheap labour force. The fast growth of exports can also be linked with China's accession to the WTO and the removal of customs tariffs (textile especially), which had been anticipated by Western retailers, which had strongly increased their orders. The progression of the Chinese imports could decrease insofar as multinational firms have begun to produce in China some goods they imported before (Zhou 2006).

If some American firms complain about competition from Chinese products, other firms or retailers benefit from low production costs in China. The low prices of Chinese exports mean that, for a given value, they represent a large volume and thus have a strong negative impact on employment in Western countries; but they also reduce the price level in the latter and increase the standard of living.

2.3. Is Chinese foreign exchange reserves accumulation sustainable?

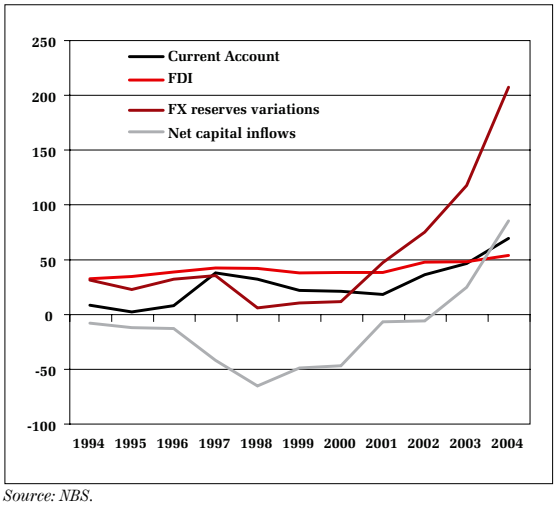
The second argument used to prove the undervaluation of the Renminbi would be the growth of PBC's foreign exchange reserves (Figure 7). They reached 846 billion US dollars in January 2006 (609 billion US dollars at the end of 2004), amounting to 6.8 % of US GDP, 45% of Chinese GDP and 13 months of Chinese imports. China has the world's largest foreign exchange reserves (Table 3). They are useful as a tool to deter speculation. This accounts for the building of foreign exchange reserves in Asian countries after the crisis of 1997–1998. Yet an excess of reserves can lead to a crisis, if the speculators consider that the exchange rate is undervalued and put pressure towards an appreciation of the currency.

Table 3. *Foreign exchange reserves in January 2006 (in billions of US dollars)*

China	845
Japan	832
Taiwan	258
South Korea	217
Eurozone	207
Russia	182
India	134
Hong Kong	128
Singapore	118

Source: IMF.

Figure 7. *The factors of Chinese foreign exchange reserve accumulation (in billions of US dollars)*



Source: NBS.

The accumulation of foreign exchange reserves stems from three channels (Figure 7 and Table 4): current account surplus, FDI and net capital inflows (excluding FDI). Chinese current account surplus reached 134 billion US dollars in 2005, mainly from trade balance but also from the "Other Transfers" account. Between 1994 and 2005, the current account surplus grew steadily.

Foreign Direct Investment (FDI)

Massive FDI has been flowing to China over the last decade. China's policy objective has been to attract foreign firms to impulse its modernization. FDI allows China to acquire new management and production techniques. FDI has been flowing to China since the 80's, because of its economic growth, its liberalization process and the opening of its markets. Foreign firms produce goods to export, thanks to low wages, but also for the domestic market, expecting a high level of development. There are also tax incentives (no taxes for foreign firms during the first two years then the tax is 15% against 33% for others businesses). In 2004, FDI amounted to 53 billion US dollars. From 1990 to 2002, the cumulated amount of FDI reached 424 billion US dollars, making China the third most attractive country behind the US and UK. China received 5% of FDI in the world and near 25% of FDI flowing to developing countries.

Net capital inflows

China's financial account has not been fully liberalized yet, despite partial measures for capital flows in 2003 and 2006. Some capital operations are still submitted to regulation and agreement. Those regulations prevented China from being widely affected by the Asian crisis of 1997-1998. Over the past few years, China has moved from a balanced capital inflow position in 2002 to a positive capital inflow position, around 110 billion US dollars, in 2004.[4]

Until 2000, current account surpluses and FDI were counterbalanced by net capital outflows. As a result, the foreign exchange reserves remained stable. But the net capital inflows became large in 2003–2004, leading to a rise in foreign exchange reserves accumulation. This evolution stems from two main factors. First, the rise of financial returns and their safety have inverted the flows from the Chinese Diaspora. Then Chinese residents save and get loans in US dollars through Chinese financial institutions. Since 2003, Chinese firms and households, expecting an appreciation of the currency, have increased their holdings in renminbi against

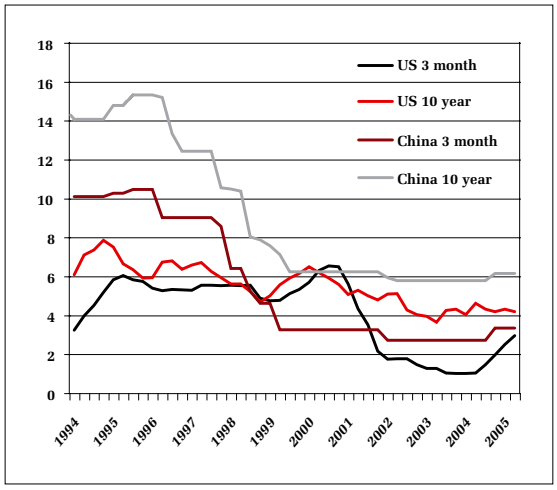
[4] Including "errors and omissions".

Table 4. *China's balance of payments (in billions of US dollars)*

	2000	2002	2004	2005
Trade balance	29	37	49	134
Income	-15	-15	-5	1.2
Other Transfers	6	13	23	25
Current account	**21**	**35**	**69**	**160**
FDI	38	47	53	67
Portfolio Investment Assets	-11	-10	20	-4.9
Other Investments	-24	-5	37	-4
Net errors and omissions	-12	8	27	-16
Reserves	-11	-75	-206	-207

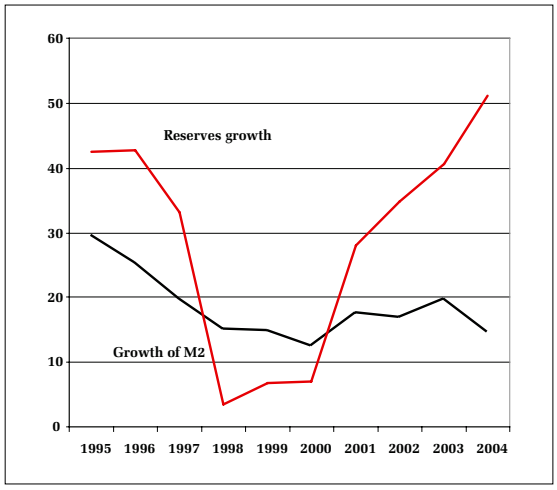
Source: NBS.

Figure 8. *Short and long-term interest rates in China an in the US*



Source: NBS.

Figure 9. *Monetary base and foreign exchange reserves growth*



Source: NBS.

US dollars. Firms' debts have been financed through loans in US dollars. So as to meet the demand for US dollars, despite a decline in US dollar deposits, Chinese banks have decreased their foreign assets and increased their debts in foreign currencies. The exporting companies converted their US dollars into renminbi, while the importers delayed their payments. The main part of foreign exchange reserves accumulation since 2003 is therefore attributable to speculation and cannot lead to consider that foreign exchange reserve accumulation is a proof of the renminbi undervaluation.

For a country it is easier to withstand net capital inflows than outflows because it does not have to face any liquidity constraint and does not have to borrow abroad. On the contrary, it may be harder to decrease the interest rate. China has not been willing to struggle against an appreciation of its currency through a fall in the interest rate (Figure 8): China short-term rate is slightly higher than the US and China long-term interest rate (10 years) is significantly higher. Considering Mundell's incompatibility triangle, the PBC has maintained an autonomous monetary policy and a fixed exchange rate, giving up liberalisation of capital flows. Chinese interest rates are nonetheless very low (2% for short term, 4% for long term) compared to real GDP growth. Credit regulation is mainly achieved through quantitative control and rationing. The viability of such a system is an increasing concern (Prasad et al. 2005): the exchange control is difficult to maintain in a country open to foreign trade since firms can delay their payments and adjust their prices to speculate.

The inflows of liquidity into the banking system may increase credits and loans, inducing a rise in inflation and an appreciation of the real exchange rate, despite the peg to the US dollar. This can be avoided if the central Bank sterilizes the surplus of liquidities by imposing obligatory reserves on the banks or by making them buy Treasury bills. In the case of China, the two types of operations have been jointly carried out and supplemented by the control of the credits. The sterilization has a cost which depends on the differential of interest rate between the assets in US dollars which constitute the reserves (to which the rate of appreciation of the Renminbi must eventually be added) and Chinese Treasury bills. The cost of the operation was important from 2001 to 2004 insofar as the American bonds offered a very low interest rate. The Central Bank has to play against the speculators to maintain the fixity of the exchange rate; so it runs an important exchange rate risk; a strong revaluation of the Renminbi would induce an important loss in capital for the PBC: 5% of the Chinese GDP for a revaluation of 10%. However, sterilization had been able to maintain the fixity of the Renminbi-US dollar exchange rate, until the revaluation of 2.1% in July 2005. In 2005, the Chinese authorities bought from 15 to 20 billion US dollars per month.

The growth of monetary aggregates in China does not come mainly from reserves accumulation (Figure 9): their evolution is quite different, especially after 2000, when reserves have been growing around 40% per year against 20% for monetary aggregates. The increase in money stems from a strengthening of Chinese households' savings and firms' deposits, reflecting the strengthening of speculative capital inflows. The inflation rate has remained fairly stable, taking into consideration the strength of GDP growth.

Table 5. *GDP components (in % of GDP)*

	1987	1995	2000	2004
Private consumption	49.8	46.1	47.2	43.3
Public consumption	12.5	11.4	13.1	12.0
Investment	36.1	40.8	36.3	45.3
Trade balance	0.1	1.7	2.5	2.6

Source: NBS.

Another look on the current account

The current account is also the difference between domestic savings and domestic investments. It is linked with the strong Chinese exports but it could also be linked with the weakness of imports in a country where public and private consumption are relatively low, savings high and where growth comes from the investment boom (Table 5).

China savings rate is very high: 42.5 % of GDP in 2003 (Table 6), 20 points higher than the average of the five large countries chosen by Kuijs (2005). This comes from two factors: the part of the national income which is owned by firms and household savings is particularly high (20% of GDP). The savings of the administrations is higher by 5 points of GDP than the average of other countries; this excess saving is transferred to the firms: the administrations finance large public firms to the amount of 6 points of GDP. Firms' savings are higher by 7 points of GDP. Lastly, household savings are higher by 9 points of GDP: the share of the income of households in the GDP is lower by 4 points; but the strong rate of saving of the Chinese households (25% of their income) induced a supplement of savings of 13 points of GDP.

Table 6. *Saving and investment in % of GDP in China*

	China (2003)	United States (2002)	France (2002)	Japan (2002)	Korea (2002)	Mexico (2001)
National Savings	42.5	14.3	20.7	25.5	31.0	20.8
Gap China/others countries:	–	28.2	21.8	17.0	11.5	21.7
Household savinsg	–	11.8	5.8	8.4	12.1	8.6
Firms' savings	–	8.6	9.4	– 0.5	4.1	8.3
Administration savings	–	7.9	6.7	9.2	–4.7	4.8

Source: Kuijs (2005).

Table 7. *Sources of investment in 2004 (in % of total investment)*

State	4.2
Domestic loans	20.4
Bonds	0.3
FDIs	4.3
Self-finance	51.3
Other*	19.5

* Grey banks' loans (informal banking loans).

Source: NBS.

Modigliani and Cao (2004) explain the high level of household savings by the life cycle hypothesis and reject explanations based on cultural or ethnical grounds. Strong economic growth and limiting demographic measures would have caused the rise of savings. The part of people under the age of 15 has fell dramatically, which, with the single child policy, has limited the role of the family and children in taking care of the older, being an incentive to save more. On the other hand, the enrichment has also improved the savings rate compared to the previous levels (5% during the 70's). This fact is reinforced by the weakness of the pension system, introduced in 1997 (see OECD 2005, p. 187). In addition, household savings are undoubtedly reinforced by constraints on consumption: foreign products are very expensive because of the low exchange rate; the access to the products is not always possible, especially in rural areas; regulations limit the purchase of some goods (cars for example); although its accession to the WTO will force China to change its regulations.

Investment is the main determinant of Chinese dramatic growth: the Investment/GDP ratio in 2004 was around 45%. This level is explained by the strength of growth as well as by its industrial orientation. Investment is mainly self-financed (Table 7), the other part stemming from household savings, and to a lesser extent from FDI and the public sector. Most of savings are channelled through the banking sector because agents cannot freely access to financial markets.

A deceleration of growth would have ambiguous effects on the savings and investment balance since both would drop. A rise in consumption would require a rise on the part of the households' income in the GDP (by a rise in wages and a more generous social policy) and a fall of the saving rate (through an improvement of the Social Security system).

Table 8. *Non performing loans (in % of total loans)*

	2000	2001	2002	2003	2004
Argentina	16	19.1	38.6	33.6	18.6
Hungary	3	2.7	2.9	2.6	2.7
France	5	5	5	4.8	n.a.
China	22.4	29.8	26	20.4	15.6
Hong Kong	7.3	6.5	5	3.9	2.2
Japan	5.5	8.4	7.2	5.2	2.9
US	1.1	1.3	1.4	1.1	0.8

Source: FMI, Global Financial stability report. September 2005.

The weakness of the banking sector: the role of non performing loans (NPL)

NPLs are important in Chinese banks' balance sheets (Table 8) despite the strengthening of the banking regulation committee and the participation of foreign banks in several large Chinese banks. The NPL decreased from 191 billion US dollars in late 2004 to 155 billion (9.5% of GDP) in June 2005. Yet it should be noted that over the period, the PBC injected over 40 billion US dollars into the banking sector. The banks do not have the capacity to assess the quality of the projects; many financings are still granted to large public firms for political reasons. Most economists consider that the recapitalisation, the reorganization and the liberalization of the banking structure are preconditions to the opening of China to capital flows and to the floating of the renminbi. In their absence, the Chinese banks could hardly intervene on international financial markets and could not develop hedge instruments which would make the Chinese companies able to support the floating of the currency. It remains to know if this float must be an objective of the PBC.

3. The Renminbi equilibrium exchange rate

Estimating the scope of China's undervaluation requires a theory of equilibrium exchange rate. Three main models have been used to estimate China's equilibrium exchange rate: the purchasing power parity (modified by the Balassa-Samuelson effect), the Fundamental Equilibrium Exchange Rate (FEER) and the Behavioural Equilibrium Exchange Rate (BEER). Those theories will be further investigated in this section.

3.1. From PPP to the Balassa-Samuelson effect (B-S)

According to the absolute version of PPP, the prices of two similar products, measured in a common currency, must be equal, warranting that no arbitrage can be made. Therefore the prices of the same product in Beijing or in NYC must, after conversion, be equal. The real exchange rate is stationary, constant and equals 1. According to a softer version, the relative PPP, exchange rate variations offset price variations and the real exchange rate is stationary. Yet neither absolute PPP nor relative PPP have sound theoretical grounds as an exchange rate model. For absolute PPP, does it concern every pro-

Table 9. *Country rating according to GDP per capita (in thousands of US dollars) and relative price index (2004)*

	GDP per capita	Relative price level
US	34,1	1
Japan	26,5	1,79
France	24,2	1,29
Germany	24,1	1,38
South Korea	19,5	0,84
Argentina	10,8	0,68
Poland	9,7	0,52
South Africa	9,5	0,45
Mexico	8,6	0,44
Turkey	7,2	0,48
Thailand	7,0	0,46
Iran	6,8	0,31
Myanmar	5,7	0,04
Ukraine	5,2	0,25
China	5,1	0,22
Philippines	4,1	0,30
Morocco	3,6	0,40
India	2,7	0,21
VietNam	2,4	0,19
Pakistan	1,9	0,28

Source: Chelem.

duct or just tradable goods? For non-tradable goods, like services, no mechanism allows for a direct arbitrage between a haircut in New York and in Beijing. If PPP is designed for tradable products (such as copper), PPP can at best determine the international division of labour: the exchange rate between Poland and France does not move to adjust copper production costs in Poland and France..

In order to compare standards of living, it is useful to estimate PPP (Table 9), but those estimates cannot be turned into equilibrium exchange rates. They are fragile because they do not use the same basket of goods to define the price level, those differences being huge for countries with different development levels like the US and China. For China, heterogeneity between areas is also a major issue, weakening the use of a global index.

The Balassa-Samuelson effect (Balassa 1964; Samuelson 1964) reconsiders the PPP and the stationarity of the real exchange rate, dividing the economy into a tradable sector, open to world competition, and a non-tradable sector. The real exchange rate is the weighted average of the two sector prices and may not be stationary. It is represented by the equation:

$$e = (s + p_T^* - p_T) - ((1-\alpha)(p_{NT} - p_T) - (1-\alpha^*)(p_{NT}^* - p_T^*))$$

The first term $(s + p_T^* - p_T)$ stands for the real exchange rate in the tradable sector (from the PPP), the second $(1-\alpha)(p_{NT} - p_T)$ and third terms $(1-\alpha^*)(p_{NT}^* - p_T^*)$ stand for the internal exchange rate (the ratio of tradable goods prices, p_T, to non-tradable goods prices, p_{NT}). The last two terms represent the relative price ratio of domestic and foreign non-tradable goods. Even if PPP were to hold for tradable goods, which is arguable, it would not hold globally if the relative price ratio is not similar in the two countries. Developing countries are less productive in industrial tradable goods, while the productivity gap is lower for services, which account for a major part of non-tradable goods (*e.g.*: hair-dressers and waiters have approximately the same productivity around the world). Given that productivity in developing countries is lower for tradable goods, and assuming that wages in the non-tradable sector equal tradable-sector wages, then both tradable and non-tradable sector wages in developing countries will be lower that those in the developed world. During the catching-up process, productivity gains in the tradable sector will lead to a rise in wages in all sectors, bringing about an appreciation of the real exchange rate. The B-S effect can explain why the lower the price level in a country, the less productive that country appears (Table 9).

As a result, China's low price level cannot account for the renminbi's undervaluation. China's price level can only be compared with other developing countries. Compared with Ukraine, Vietnam or other Asian countries, the Chinese case is not that odd. The Asian currencies are, *ceteris paribus*, lower than most African currencies, but those countries cannot be taken as references in terms of growth strategy.

Frankel (2004) estimates a regression linking the relative price level to GDP per capita. For the year 2000, his results are (t-ratio in brackets):

$$\log(PR) = -4{,}15 + \underset{(12{,}3)}{0{,}38}\ \log(Y/N)$$

According to that regression, the "equilibrium" relative price level between China and the US would be 36.2% (instead of 23.1%), indicating a need for a 57% Renminbi appreciation.[5] Yet the regression is not very accurate, with a root mean squared error of 39%. The results could be improved when other determinants, such as the need for growth, are taken into account. Those estimates show that the Renminbi is undervalued compared to other developing countries, but they do not show that this undervaluation could be detrimental to development.

Coudert and Couharde (2005) show that there was no Balassa-Samuelson effect in China between 1998 and 2002: the real exchange rate did not appreciate in accordance with the relative gap between consumer and producer prices. This result can be explained by a statistical bias (the data used partially reflects the price gap between tradable and non-tradable sectors: during the catching-up process, Chinese products evolve, and Chinese industrial products do not have the same price as their American counterparts), or by the theoretical reasons put forward by the authors: there is no wage equalization between the tradable and non tradable sectors in China and many prices are still managed. Finally, Chinese growth per capita may be a consequence of a massive transfer of workers from agriculture to industry leading to higher productivity of the labour force.

3.2. The Fundamental Equilibrium Exchange Rate (FEER)

Williamson (1983; 1994) defines the FEER as the exchange rate that allows internal (output at its potential) and external equilibrium (sustainable current account position). More precisely, the FEER is "[the real exchange rate] which is expected to generate a current account surplus or deficit equal to the underlying capital flow over the cycle, given that the country is pursuing" internal balance "as best as it can and not restricting trade for balance of payments reasons". The FEER is therefore a medium run concept. If the FEER approach can be criticized because of its theoretical inconsistencies (see Bouveret, Sterdyniak 2005), it raises the issue of defining the exchange rate in a multinational framework, taking the full employment and the current account targets into account. Here we focus on its application to emerging economies such as China.

[5] Using a similar method, Coudert and Couharde (2005) find a 43 to 50% undervaluation for the Renminbi-dollar exchange rate in 2003.

Three problems are to be solved. On the one hand, the target current account needs to be defined. The prevalent method is to choose a level at which the basic balance (including FDI) is at its equilibrium. In the Chinese case, Williamson and Mahar (1998) define a target of -2.8% of GDP while Williamson (2004) estimates it at -1% and Coudert and Couharde (2005) at -1.5%. Yet the choice is relatively arbitrary. A country may want to have a significant external surplus to avoid exchange rate fluctuations.

On the other hand, the FEER implies external equilibrium at full employment, which is debatable for developed countries, even if full employment is measured by the natural rate of unemployment. This point is even more arguable for developing economies. Emerging economies are catching-up. They face massive unemployment, and in China's case, a massive underemployed labour force. They face a supply constraint: they need to accumulate capital so as to increase employment. This implies a high return for national and foreign capital and a strong demand to pull growth. By definition, growth is not an equilibrium process. The full employment of the labour force is not currently reachable due to lack of capital. But China cannot resign itself to the level of production corresponding to the full employment of the current capital.

Lastly, it should be supposed that the authorities have sufficient instruments to maintain full employment with external balance equilibrated, which poses a problem for China. The authorities chose a development impelled by foreign trade, which also tends to develop investment. A development impelled by consumption would quickly be stopped by external deficit and capital lack.

Using an econometric framework, Jeong and Mazier (2003) estimate current account targets, distinguishing developed and emerging countries. The current account target is supposed to be an increasing function of fiscal surplus, GDP per capita, net foreign assets (in contradiction with the theory) and a decreasing function of net FDI inflows. For China, their equation amounts to a -1.5% norm (mainly because of FDI inflows). The gap between realized and potential output is measured by HP filter on industrial output; the need for growth is not taken into account. The Renminbi appears to have been undervalued by 60% against the US dollar in 2000. Coudert and Couharde (2005) apply the same method and use a target of -2.8% (from Williamson and Mahar (1998)) or -1.5% (from Jeong and Mazier (2003)); they estimate an undervaluation of the Renminbi between 44 and 54% in 2003.

3.3. The Behavioural Equilibrium Exchange Rate, an empirical method

Several articles estimate China's equilibrium exchange rate using the BEER method, put forward by Clark and MacDonald (1997). They assess a long-run relationship between the real exchange rate and its fundamentals (mainly net foreign assets and productivity), then estimate econometrically the exchange rate adjustment using an error-correction model (see Bouveret, Sterdyniak 2005). The fundamentals commonly used are (Table 10):

- The change in relative productivity, which implies a real exchange rate appreciation according to the B-S effect. Empirically, relative productivity is often proxied by the consumer to producer prices ratio, the for-

Table 10. *Some estimations of the Renminbi equilibrium exchange rate*

Article	Model	Fundamentals	Period	Undervaluation against US dollar	Method
Frankel (2004)	PPP with B-S effect	Relative GDP	1990 and 2000	-35% (2000)	Panel
Coudert, Couharde (2005)	PPP with B-S effect	Relative GDP	2003	-50% /-41 % (2003)	Panel
Jeong, Mazier (2003)	FEER	Current account target of -1.5% of GDP	2000	60%	By country
Goldstein (2004)	FEER	Current account target of -1% of GDP	2003	-15-30% (2003)	By country
Coudert, Couharde (2005)	FEER	Current account target of -1.5% of GDP and -2.8% of GDP	2002–2003	-54%/-44 % (2003)	By country
Funke, Rahn (2004)	BEER	NFA, productivity	1985–2002	-11% (2002)	By country
Wang (2004)	BEER	NFA, productivity	1980–2003	0% (2003)	By country
Bénassy-Quéré et al. (2004)	BEER	NFA, productivity	1980–2001	-47% (2003)	Panel

Source: Authors' compilation.

mer standing for all goods and the latter standing for tradable goods only. This approximation is highly debatable for China.

- Net Foreign Assets (NFA). A country with a positive net foreign assets position gets income flows. It can therefore have a trade deficit, hence a higher real exchange rate.
- Openness of the economy. It may lead to exchange rate depreciation.

Unfortunately, the econometric method used assumes the equilibrium real exchange rate to be equal to the real exchange rate on average over the period studied. This is an inaccurate assumption: there is no evidence that the means over the sample period stands for equilibrium. Using this method, Wang (2004) concludes that there is no Renminbi undervaluation. This result does not stem from the fundamentals, but from the fact that the author used annual data from the 1980–2003 period. The author estimates an equation with 8 independent variables (productivity, NFA, openness, a constant and 4 dummies) and 24 observations. Because of the small size of the sample compared with the number of regressors, the point estimates are close to the observations, while the residuals centred around zero are supposed to represent the degree of misalignment. The more precise the equation, the smaller the misalignment is denied. Funke and Rahn (2004) use a similar method over the period 1994–2002, and reach the conclusion of a null undervaluation on average over the sample, and of an 11% undervaluation in 2002.

Panel estimations are no more legitimate. Bénassy-Quéré et al. (2004) carry out regression on a panel with fixed effects for each country. Once again, this amounts to an assumption that the equilibrium exchange rate has been equal to the observations on average over the sample for each country. A unique equation for all countries is estimated, implying that the same behaviour applies to every country, *i.e.* from China to the US. In 2003, the Renminbi would be undervalued by 47% against the US dollar, this result counterbalancing a very strong overvaluation from 1980 to 1987.

Equilibrium exchange rate estimations vary widely, depending on the sample, the model and the norm used. In the articles referenced above, undervaluation falls between 0 and 45%. The uncertainty of empirical results underlines the care with which those results must be interpreted. The main flaws are in the theoretical basis of these methods: the concept of equilibrium is barely discussed. The studies concluding that the Renminbi was undervalued against the US dollar claim that the fixed exchange regime chosen by China is detrimental to the global economy, arguing that it increases global imbalances. According to traditional standards (PPP, FEER and BEER), undervaluation would be the cause of a global economic imbalance. On the contrary, we argue that this undervaluation is a consequence of an existing economic disequilibrium in China that it helps to correct.

4. A Chinese growth model

The Renminbi undervaluation is questionable on theoretical and empirical grounds. In this section we will analyze a model showing the possibility of an undervaluation of the exchange rate according to the traditional standards (PPP, FEER, BEER), but compatible with a development strategy. In this framework, the exchange rate is a tool to reach an objective of full-employment. The model can be linked with the work of Dooley et al. (2004).

Dooley et al. (2004) analyze the level of the Renminbi as a choice of the Chinese authorities. Facing massive unemployment, the Chinese government has chosen an exchange rate-led strategy to incorporate the labour force into the modern economic system. China has huge savings (household and firms savings) but, as the NPL shows, its banking system is plagued and is not able to play its role of financial intermediation. A low exchange rate can raise the foreign demand for Chinese goods and FDI so as to improve China's technological and managerial catching-up process. Low real wages and exchange rate allows high and stable returns on foreign capital in US dollars. The Chinese government accumulates foreign exchange reserves to stabilize the exchange rate and these reserves can serve as collateral for foreign investors. This thesis is disputed by Goldstein and Lardy (2005) who claim that the FDI plays only a minor role in Chinese growth, and the system is very expensive for the PBC (which runs the risk of seeing its foreign exchange reserves undergo a strong depreciation). They estimate that China could give up the current aspects of its strategy without losing much in growth and that the present system cannot last because the PBC will not agree to constantly accumulate risky stocks of foreign assets.

4.1. The model

Contrary to Dooley et al. (2004), our model is explicitly defined (Box 2). FDI plays no role because China is not facing a financing problem: self-financing and households savings are high (despite NPL), and FDI, despite its importance in value, accounts for barely 5% of total investments.

The idea is the following: China has a huge unemployed labour force and seeks to integrate it into the modern economic system. Without trade, investment would be low because domestic demand is low. China is facing a demand problem and not a financing problem. Lowering the exchange rate raises Chinese external competitiveness. An increase in demand leads to a rise in investment, and a fall in unemployment. Then Chinese wages and prices increase as a consequence of rising costs. In the long run, the real exchange rate would appreciate, allowing trade balance equilibrium, when the optimal capital level is reached.

Box 2. The Model

$$Y_t = K_t / a \quad (1) \quad a = 0.5$$

$$L_t = bY_t \quad (2) \quad b = 1$$

$$U_t = Pop - L_t \quad (3)$$

$$I_t = \lambda a(Dpot^a_{t+1} - Y^a_{t+1}) \quad (4) \quad \lambda = 0.25$$

$$K_t = K_{t-1} + I_{t-1} \quad (5)$$

$$C_t = cY_t + \tau(W_t - W^d_t) - cn(s_t p^*_t / p_t) \quad (6) \quad c = 0.5, \tau = 0.15, n = 0.2$$

$$W_t = (1+r)W_{t-1} + Y_t - C_t \quad (7)$$

$$W^d_t = \phi Y_t \quad (8) \quad \phi = 2$$

$$Dpot_t = C_t + D^*(s_t p^*_t / p_t) \quad (9) \quad D^* = 15$$

$$TB_t = C_t + I_t - Y_t \quad (10)$$

$$cu_t = \chi w_t + (1-\chi)pk_t \quad (11) \quad \chi = 0.7$$

$$pk_t = tpro((s_t p^*_t)^m p_t^{1-m}) \quad (12) \quad m = 0.5 \ ; \ tpro = 0.15$$

$$w_t = p_t^{\alpha} + \nu L_t \quad (13) \quad \alpha = 1, \upsilon = 0.05$$

$$p_t = (1+\beta)cu_t \quad (14) \quad \beta = 0.34$$

with: Y – output, K – physical capital stock, L – Employment, Pop – potential population, U – Unemployed, I – Investment, $Dpot$ – Potential Demand, s – nominal exchange rate (a rise is a Renminbi depreciation), cu – unit costs, w – nominal wages, pk – capital price, p – Chinese producer prices, C – Consumption, W – household wealth.

Comments

The production function is a Leontief (fixed proportions technology) function; output is limited by capital stock (1 and 2). Investment adjusts to the gap between potential demand and expected output for the next period (4). Consumption depends on income and the gap between current and desired wealth, which also depends on income[1] (6 and 8). Consumption is linked with the exchange rate because a real depreciation raises the domestic price of foreign products (hypothesis of a weak substitutability between foreign and domestic products). Potential demand is linked with domestic consumption, foreign demand and Chinese competitiveness (9). Domestic production that is not consumed in the country is exported (10). Unit costs depend on wages and capital price (11). The price of capital depends on the profit rate, the equipment goods prices, of which m% are imported (12). Wages are linked with prices and output (13). Firms apply a mark-up on their costs (14).

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[1] Concerning the parameters of the model, we take standard values for the consumption function, as for the price of capital and the unit costs. The parameters for the production function and the equation for potential demand are less usual. Given that the model is developed for illustrative purposes, other values may have been chosen but would not have altered qualitatively the results.

4.2. Equilibrium exchange rate and exchange rate dynamics

From a Chinese point of view, the equilibrium exchange rate is the exchange rate that sufficiently stimulates demand in order to raise investment and decrease unemployment. Investment increases the physical capital in the economy, which, through a complementary factors production function, raises employment. Formally, the sum of investments must increase output, physical capital and employment so that the whole active population could be employed. Investment must therefore allow the economy to reach its potential. As a consequence, the authorities must fix the nominal exchange rate at a level which allows a significant increase in potential demand and in investment. The model is solved in a rational expectations framework: the path chosen is the only one that converges to the equilibrium. If the authorities could modify their policy during the trajectory, several exchange rate values would be possible. This point is not discussed in this article.

It is therefore possible to define a minimal value of the exchange rate, $S_{\min}$, that allows the economy to reach full employment. Formally, $S_{\min}$ is the value that allows the capital stock to reach its optimal level, hence given the investment equation, $S_{\min}$ is the solution of the following equation,

$$s_{\min} = s \mid \sum_{k=1}^{T} I_k = \bar{K} \Leftrightarrow \sum_{k=1}^{T} \lambda a (C^a_{k+1} + D^* (\frac{sp^{a*}_{k+1}}{p^a_{k+1}}) \cdot$$

$$s_{\min} = \frac{\bar{K} - \sum_{k=1}^{T} \lambda a (C^a_{k+1} + D^* (\frac{p^{a*}_{k+1}}{p^a_{k+1}}) - Y^a_{k+1}))}{a \lambda D^* (T-1)}$$

In the steady state, all variables are stable. In order to reach its natural rate of unemployment, the economy must reach its optimal capital stock (which is exogenous). Given the production function, the capital stock depends on investment and hence on potential demand. The shock has to be large enough to reach this capital stock, if it is not the case, the economy will reach a steady state with unemployment. The shock is absorbed through an increase in prices and if the shock is not large enough, the increase in investment will be too weak to lead to a dramatic decrease in unemployment.

In the long run, the trade balance gets back to equilibrium because of real exchange rate variations (employment increases, and so do wages and prices), potential demand is equal to observed demand and investment is null. $S_{\min}$ can thus be analyzed as an equilibrium exchange rate, as in the FEER framework, but in this case it does have an impact on internal equilibrium, and this equilibrium cannot be reached immediately. For an exchange rate value lower than $S_{\min}$, (i.e. when the exchange rate is revalued), the rise in investment is not enough for absorbing the unemployed; in the long run the trade balance is in equilibrium, and investment is null, but unemployment still exists. Such an exchange rate can be undervalued with reference to traditional standards (PPP for instance), but because of unemployment it appears to be overvalued in our framework.

In our model, the exchange rate, through its effect on potential demand, is used as an impulse tool of the economy. Its effect is strong in the short run and decreases over time, when domestic consumption overcomes/replaces trade balance as the source of economic growth.

Figures 10 and 11 show the impulse response functions after an exchange rate shock (a depreciation).

Figure 10 shows the model dynamics when the government fixes the exchange rate at its equilibrium level. The low exchange rate raises competitiveness and potential demand. China has trade surpluses, and an investment boom which raises physical capital and employment. Then unemployment falls and wages rise, leading to a cost rise and finally to inflation. The real exchange rate appreciates because of price dynamics and stabilizes demand. Household consumption increases and becomes the main source of growth. In the long run, the optimal level of capital is reached, wages are stable and the trade balance is at equilibrium because of the real exchange rate.

Figure 11 shows a variant where the exchange rate is overvalued. This can be the case if the Chinese government decides to appreciate its currency because of American pressure. In this case, the initial exchange rate depreciation is not strong enough for unemployment to disappear. Employment increases but the rise in demand is not strong enough to dramatically raise investment and employment. The simulations of the model show that the exchange rate can be undervalued with reference to the PPP or FEER criterion, and be in equilibrium in a more realistic framework.

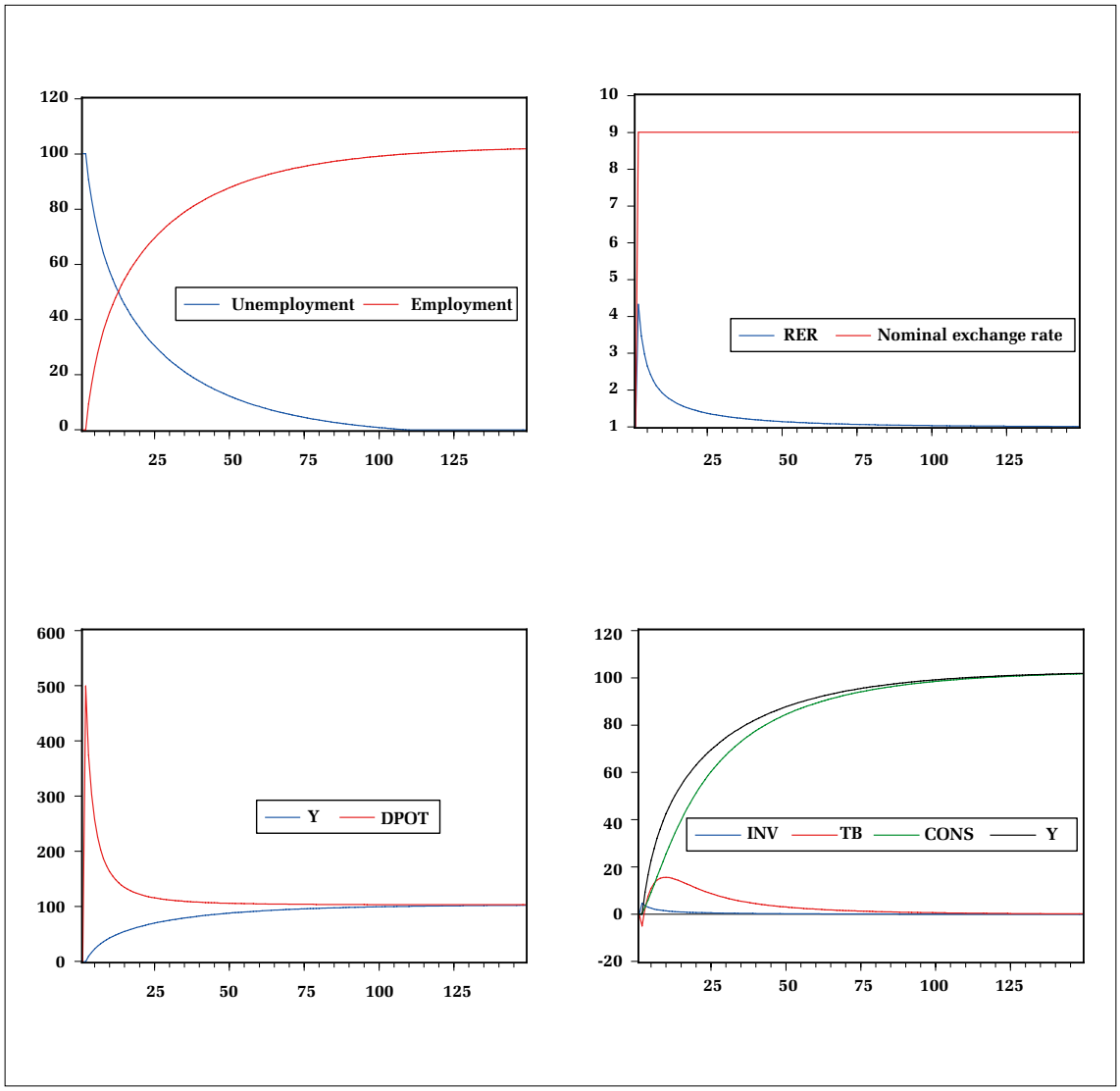
5. Conclusion

China has to choose an exchange strategy, which is particularly delicate. The exchange rate fixity with the US dollar may lead to American retaliatory measures and will become more and more difficult as capital flows to China. A floating exchange rate system would bring about a strong appreciation and a great instability, which would weaken the catching-up process. According to us, China must continue to control its exchange rate by allowing a slow and regular appreciation of the Renminbi and by avoiding a fast liberalization of capital flows. In addition, China will have to take a turning of economic policy. It requires a higher wage growth rate, a more generous and more extended social safety net, which would induce a fall of households' saving rate and a growth relying more on domestic consumption than on export. But the crisis of growth, which a strong appreciation of

the renminbi would be likely to cause, would prevent China from going in this direction.

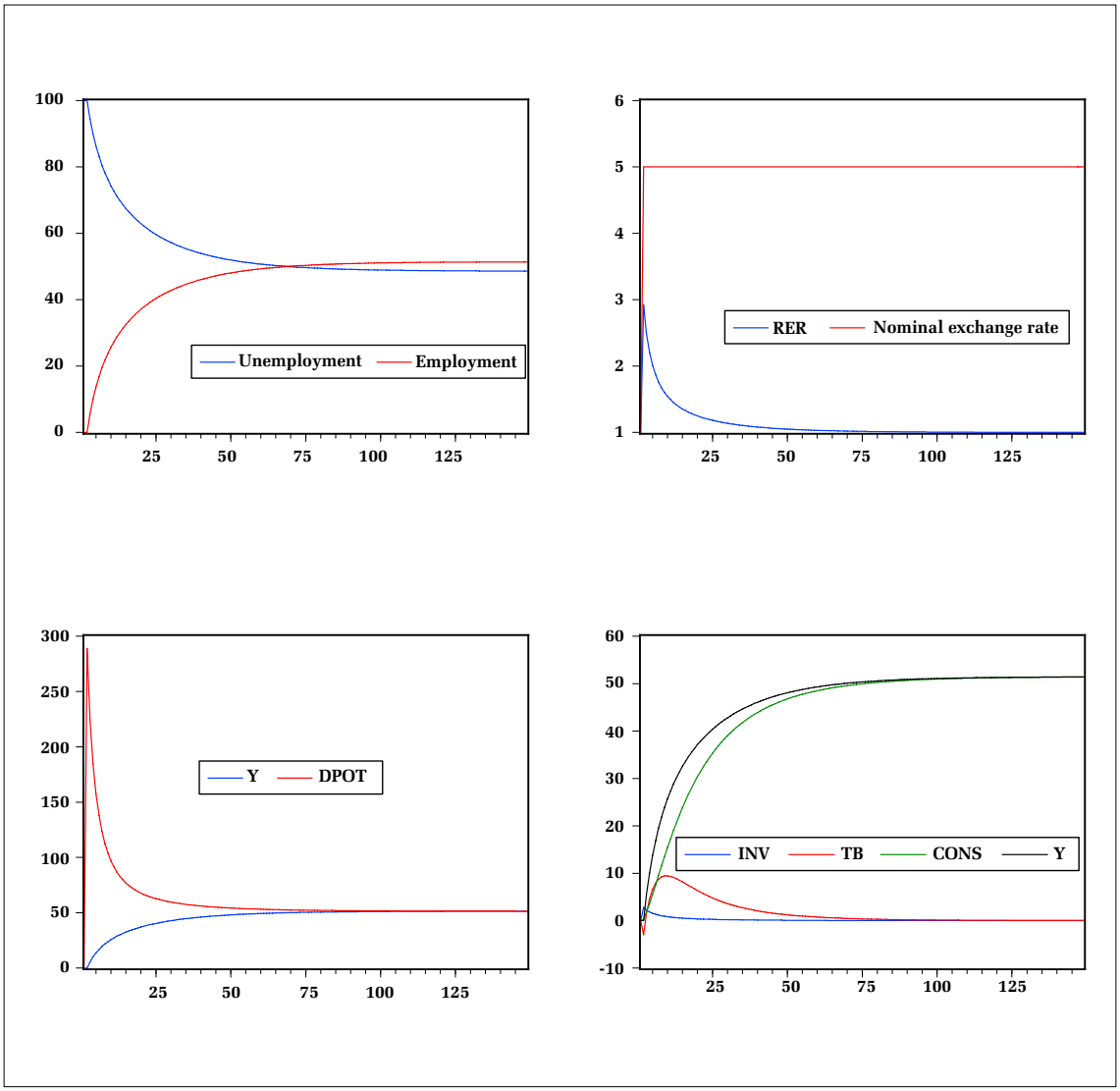
There are as many equilibrium exchange rates as economic policy strategies. In our model the equilibrium exchange rate must allow enough growth to absorb unemployment in China. The equilibrium exchange rate cannot be obtained immediately, because it would diminish incentives to invest in China. From this point of view, this model defines explicitly the link between the exchange rate and economic policy strategy. The model is relatively *ad hoc*. Of course it is just suited for China, but its goal is to show that there is an equilibrium concept for each country's objective. The multiplicity of equilibrium exchange rates weakens the relevance of equilibrium exchange rates estimations, in line with Joan Robinson's claims (1937) when she asserts that "The notion of the equilibrium exchange rate is a chimera". Our paper is a criticism of an improper use of the concept of equilibrium exchange rate. Two points will have to be deepened in the future: to determine explicitly the exchange rate strategy associated with a given growthstrategy; to analyze the conflicts which appear on a worldwide scale when each country chooses its optimal exchange rate strategy and to study if these conflicts can be addressed by cooperative processes.

Figure 10. *The exchange rate is at its equilibrium level*



Source: Author's calculations.

Figure 11. *The exchange rate is overvalued*



Source: Author's calculations.

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