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**Jiawen Yang**

Associate Professor of International Business and International Affairs

**Isabelle Bajeux-Besnainou**

Professor of Finance

School of Business and Public Management  
The George Washington University

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**Jiawen Yang\***

Associate Professor of International Business and International Affairs

Email: [jwyang@gwu.edu](mailto:jwyang@gwu.edu)

**Isabelle Bajeux-Besnainou**

Professor of Finance

Email: [bajeux@gwu.edu](mailto:bajeux@gwu.edu)

School of Business and Public Management  
The George Washington University

## **Abstract:**

Recently, some U.S. policy makers and business executives have claimed that the Chinese currency, the Renminbi (RMB), is undervalued at the current exchange rate of 8.28 yuan to the dollar. The alleged low value of the RMB has been blamed for the loss of manufacturing jobs in the United States and deflation in industrial countries. So the RMB has been under increasing pressure to revalue or to float. Is the RMB really undervalued at its current level? This paper addresses this question through basic analyses in terms of purchasing power parity (PPP), balance of payments flows, and portfolio balance. We found no convincing support for this claim. Including both tradable and non-tradable components in prices indices, PPP tends to overestimate the value of the RMB. China's surpluses in trade and current accounts are relatively small, showing no indication of currency misalignment. While China's accumulation of international reserves appears higher than international norms, factors like preferential treatment for foreign investment and control on capital outflows have played a major role.

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Some claims have been made recently from U.S. policy makers and business executives that the Chinese currency, the Renminbi (RMB), has been undervalued at the current exchange rate of about 8.28 yuan to the U.S. dollar. The bases for such claims include valuation based on the Big Mac prices across countries, U.S. trade deficits with China, and China's accumulation of international reserves. It is alleged that the undervalued Chinese currency has caused job losses in the U.S. manufacturing sector and deflation worldwide. Thus the Chinese currency faces intensifying pressure to revalue or to float.

While such claims have gained stronghold among policy makers and manufacturers in industrial countries, particularly in the United States, they do not appear to be built upon solid economic analysis. The purpose of this paper is to examine the bases of the claims through some fundamental economic analyses and determine whether the Chinese currency is indeed undervalued at its current level. Currency valuation has been one of the most challenging areas of economic research. While the literature of exchange rate determination is beamed with sophisticated economic models and empirical testing, there is no consensus on a best model that can be used practically to determine the value of a currency.<sup>1</sup> In practice, purchasing power parity (PPP), balance of payments flows, and international portfolio allocations are often being referred to in academic research and policy analysis. We would like to employ these fundamental economic analyses to investigate whether the RMB at its current level is properly valued.

The findings of this research contribute directly to the current debate on the valuation of the Chinese currency and to related policy formulations on international trade and capital flows. They are certainly important for the development of China's external positions (such as trade and current account balances, and international reserve accumulations) and for China's overall financial and economic stability. They should also prove to be crucial for the stability and tranquility of the international financial system, as China is now deeply woven in the fabrics of international trade and investment.

The rest of the paper is organized as follows. We first highlight the bases of claims that the RMB has been undervalued and provide the backdrop for our analyses. In the ensuing sections, we look into the valuation issue through purchasing power parity, balance of payments approach, and portfolio balance analysis respectively. We summarize our findings and offer policy recommendations in the concluding section.

### Claims That the RMB Is Undervalued

In 1986 the Economist magazine began publishing a survey of prices of Big Macs in a number of countries as "a rough-and-ready guide to whether a currency is under- or over-valued," in the hope of making economic theory more digestible (Economist 1991). The survey started to cover China in 1992 (with 1996 as an exception). As Table 1 shows, there have been sizable deviations from the Big Mac parity - the RMB has been under-valued by as much as more than 50% for most years during 1994-2003. That is, the Big Mac has been selling at less than half the price in China than in the United States. According to the Economist survey, the average price of a Big Mac in four American cities was \$2.71 in April 2003.<sup>2</sup> The cheapest burgers were in China (\$1.20) while the dearest were in Switzerland (\$4.52). Therefore, the survey claimed that the yuan was the most undervalued currency while the Swiss franc was the most overvalued.<sup>3</sup> Based on the Big Mac prices, the exchange rate between the RMB and the U.S. dollar should have been at 3.65 yuan to the dollar. The actual exchange rate was 8.28 yuan/dollar, implying that the Chinese currency was undervalued by 56% against the dollar (The Economist 2003)

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<sup>1</sup> See Taylor (1995) for a literature review of the economics of exchange rates.

<sup>2</sup> It is interesting to note that the reference for the Big Mac index - the price of a Big Mac in the United States - varies significantly even within the United States. The 1989 Economist survey found that the price of a Big Mac varied much more in America than within other countries. The price in Manhattan (\$2.48) was about 23% higher than the average price in four U.S. cities (\$2.02), or, using the Big MAC standard, the average dollar in the four U.S. cities was undervalued by about 18.5% against the dollar in Manhattan.

<sup>3</sup> "Yuan" is the basic unit of the Chinese currency and people often use it to refer to the Chinese currency, while the official name of the Chinese currency is Renminbi, or RMB.

**Table 1 Valuation of RMB Based on Big Mac Prices**

Year	Prices RMB (Yuan)	Prices in dollars	Actual exchange rate	PPP Implied exchange rate	RMB under (-) / over(+) valuation %
1992	6.3	2.19	5.44	2.88	-47
1993	8.5	1.50	5.68	3.73	-34
1994	9.0	1.03	8.70	3.91	-55
1995	9.0	1.05	8.54	3.88	-55
1997	9.7	1.16	8.33	4.01	-52
1998	9.9	1.20	8.28	3.87	-53
1999	9.9	1.20	8.28	4.07	-51
2000	9.9	1.20	8.28	3.94	-52
2001	9.9	1.20	8.28	3.90	-53
2002	10.5	1.27	8.28	4.22	-49
2003	9.9	1.20	8.28	3.65	-56

Sources: *The Economist*, various issues

There was no data for China for the 1996 survey.

While the Big Mac prices are not an appropriate guide for currency valuations, as proved in the next section, policy makers and business executives do use them to support their claims that the Chinese currency is undervalued.<sup>4</sup> In a testimony before the U.S. House of Representatives, Bender (2003), a U.S. business executive, cites the Big Mac index as proof of the RMB being undervalued.

Other claims of the undervaluation of the RMB are based on U.S. trade deficits with China and China's accumulation of international reserves. Judging from "rough orders of magnitude based on the gross figure in play" and China's "protracted and very large-scale official intervention of the past several years," Preeg (2002) asserts that the Chinese renimbi was "probably in the order of 40 percent weaker." Other economists have drawn similar conclusions, although the magnitudes of their estimates may not be as dramatic. Goldstein (2003) and Goldstein and Lardy (2003) believe that so long as China maintains controls on capital outflows, runs surpluses on both the overall current and capital accounts in its balance of payments, and accumulates international reserves in large amounts, there is a compelling case that the Chinese currency is significantly undervalued. Their preliminary estimates suggest that the undervaluation of the RMB is on the order of 15 to 25 percent. These estimates, according to Goldstein (2003), can be obtained either by "solving a trade model for the appreciation of the RMB that would produce equilibrium in China's overall balance of payments," or "by gauging the appreciation of the RMB that would make a fair contribution to the reduction in global payment imbalances, especially the reduction of the US current-account deficit to a more 'sustainable' level."

These estimates – the probable 40% by Preeg and the preliminary 15% to 25% by Goldstein and Lardy – have been widely quoted by U.S. policy makers and business executives as proofs of the Chinese currency being undervalued and used as the basis for U.S. trade policy formulations. In his testimony before the U.S. Congress on behalf of the U.S. National Association of Manufacturers (NAM), Vargo (2003) cites the 15% to 40% range and tends to believe that, given the price pressures expressed by many NAM member companies, "the market price would be toward the upper end of that range." U.S. Rep. Phil English (R-PA) (2003) states that "many economists estimate that the Chinese yuan is undervalued against the dollar by as much as 40 percent." He claims that that "Beijing's artificially debased currency" is allowing China to export to the U.S. market with a 40 percent price advantage over U.S. domestic producers. The "40 percent" estimate has thus become a frequent reference in the U.S. political arena. A bill introduced in the U.S. House of Representatives states that "the large and growing trade surplus of the People's Republic of China with the United States strongly suggests that the RMB is undervalued against the dollar."

<sup>4</sup> See Pakko and Pollard (1996) for discussions of Big Mac prices and deviations from purchasing power parity.

Recently, economists have estimated that the RMB is undervalued against the United States dollar by as much as 40 percent.”<sup>5</sup> A separate bill introduced in the U.S. Senate states that “the currency of the People's Republic of China, the yuan, is artificially pegged at a level significantly below its market value. Economists estimate the yuan to be undervalued by between 15 percent and 40 percent or an average of 27.5 percent.”<sup>6</sup> The bill then proposes that, unless a certification is made by the President to the Congress that China is no longer manipulating its currency, “a rate of duty of 27.5 percent ad valorem on any article that is the growth, product, or manufacture of the People's Republic of China, imported directly or indirectly into the United States shall be levied.”

### Purchasing Power Parity (PPP) and the Value of the RMB

The basic idea of PPP is that, under a frictionless trade situation (no transportation cost, no transaction cost, and no trade restrictions), prices of internationally traded commodities should be the same in every country, and hence the exchange rate between any two currencies should be the ratio of the prices in the two countries. In this section, we analyze the value of RMB using the three versions of the PPP<sup>7</sup>, starting with the law of one price (applied to the Big Mac) and then moving to the absolute and relative PPP.

### The Fallacy of the Big Mac Standard for the Valuation of the RMB

How good is the Big Mac index as a guide for currency valuation? In a study on how well the hamburger standard performed, Cumby (1996) found that deviations from Big Mac parity were temporary and convergence to relative Big Mac parity was quite rapid. The performance of the RMB exchange rate has appeared to be the contrary – deviation of the RMB from the Big Mac parity persisted and showed no signs of adjustment for over a decade. But the RMB is not alone. Sizable deviations are quite common and persistent for a few other currencies as well, such as the Australian dollar, the Hong Kong dollar, the Indonesian rupiah, and the Thai baht, to name just a few (see Economist 2001). How can this dramatic violation of the law of one price be explained? Pakko and Pollard (1996) give four explanations: the existence of barriers to trade, the inclusion of non-traded elements in the cost of a Big Mac, imperfect competition, and existence of current account imbalances. Krugman and Obstfeld (2003) also cite product differentiation and local production cost as the contributing factors. For many countries the Big Mac represents a taste that differentiates itself from local foods. This product differentiation renders McDonald's market power to tailor prices to the local market. Moreover, the price of a Big Mac must cover not only the cost of ground meat and buns, but also the wages of serving people, rent, electricity, and other local expenses. The prices of these nonfood inputs can differ sharply in different countries.

To determine whether the Big Mac index is a good measure of currency valuation, we focus our analysis on a decomposition of this price between tradable ingredients and non-tradable inputs (as labor) in the Big Mac prices. Without loss of generality, the price of a Big Mac in the United States is specified as follows:

$$P_{\$} = P_{T,\$} T_{US} + W_{\$} L_{US} \quad (1)$$

Where

- $T$ : Ingredients that can be traded across countries.
- $L$ : Labor and other local inputs required preparing and serving the Big Mac.
- $P_{T,\$}$ : Prices of traded ingredients in the United States.
- $W_{\$}$ : Wages rates and cost of local inputs in the United States.

Similarly, the price of a Big Mac in China is specified as

$$P_{RMB} = P_{T,RMB} T_{China} + W_{RMB} L_{China} \quad (2)$$

<sup>5</sup> H.R. 3058, The Currency Harmonization Initiative through Neutralizing Action (CHINA) Act of 2003.

<sup>6</sup> S 1586 IS. A bill to authorize appropriate action if the negotiations with the People's Republic of China regarding China's undervalued currency and currency manipulations are not successful.

<sup>7</sup> See Pakko and Pollard (1996) for discussions of the three versions of PPP.

The Big Mac is presumably a homogeneous product across countries and it is sensible to assume that the tradable ingredients,  $T_{US}$  and  $T_{China}$ , are the same. For simplicity, we normalize them at 1. Labor inputs should represent the main portion of the non-tradable ingredients,  $L_{US}$  and  $L_{China}$ .

Labor productivity in preparing and serving the Big Mac should not be much different in the United States and China. This assumption, while intuitively plausible, is also evidenced in Balassa (1964) and Samuelson (1964). In their reappraisal of the purchasing power parity framework, Balassa (1964) and Samuelson (1964) highlighted the importance of non-traded goods (services) in the relationship between prices and exchange rates. They assumed that the labor forces of poor countries are less productive than those of rich countries in the tradables sector but that international productivity differences in nontradeables are negligible. Given this assumption, we again normalize the non-tradable inputs for the Big Mac in both countries at 1. Thus equations (1) and (2) become

$$P_{\$} = P_{T, \$} + W_{\$} \quad (3)$$

$$P_{RMB} = P_{T, RMB} + W_{RMB} \quad (4)$$

The exchange rate (expressed as yuan to the dollar) based on Big Mac can be expressed as follows:

$$E_{Big\ Mac} = \frac{P_{RMB}}{P_{\$}} = \frac{P_{T, RMB} + W_{RMB}}{P_{T, \$} + W_{\$}} \quad (5)$$

The first part of equation (5) is exactly how the Economist magazine formulates its “implied PPP of the dollar.” Following Balassa (1964), we argue that, in the absence of trade restrictions, the market (or actual) exchange rate equates the prices of traded goods, with allowance made for transportation costs. Thus,

$$P_{T, RMB} = E_T P_{T, \$} \quad (6)$$

Where  $E_T$  is the exchange rate (yuan/\$) that prevails in the traded goods market. Then Equation (5) becomes

$$E_{Big\ Mac} = E_T \frac{P_{T, \$} + (W_{RMB}/E_T)}{P_{T, \$} + W_{\$}} \quad (7)$$

Equation (7) yields an important comparison between the Big Mac implied exchange rate and the exchange rate determined by the traded goods market. The conformity between the two exchange rates hinges crucially on (1) the proportion of the cost of traded ingredients in the total dollar cost of the Big Mac,  $P_{T, \$} / (P_{T, \$} + W_{\$})$ , and difference between the wages rates (costs of nontradable ingredients) as measured in dollars,  $(W_{RMB}/E_T)$  as compared with  $W_{\$}$ . As the proportion of cost of the tradable ingredients approaches 1 (That is, everything is tradable), the two exchange rates will converge. On the other hand, if all the ingredients are nontradable, the conformity of the two exchange rates depends entirely on the convergence of the wage rates (costs of the nontradable ingredients) in the two countries. When the wage rates are equal, so are the two exchange rates. But as long as  $(W_{RMB}/E_T) < W_{\$}$ , we have

$$\frac{P_{T, \$} + (W_{RMB}/E)}{P_{T, \$} + W_{\$}} < 1 \quad (8)$$

and

$$E_{Big\ Mac} < E_T \quad (9)$$

That is, as long as the wage rates in China are lower than that in the United States, the Big Mac based exchange rate is below the exchange rate based on traded goods; the RMB then appears undervalued.

It is common knowledge that China, despite its rapid economic growth in the past two decades, its per capita income is still among the lowest in the world. According to the World Bank, in 2002, United States per capita income was

\$35,060 while China's was \$940. That is, the U.S. per capita income was 37.3 times as much as that of China. Even based on the World Bank's estimate of China's PPP adjusted per capita income - \$4,390 in 2002, the U.S. per capita income was still about 8 times as high as that for China. Table 2 presents the quarterly and hourly wage rates for workers employed in different types of enterprises in China. The average hourly wage in the first quarter of 2003 was \$.77 for Chinese workers. Moreover, the rural workers (farmers) – the majority of China's population – could not even earn that rate on average. For comparison, the average hourly wage rate in the U.S. was \$15.46 in October 2003, about 20 times that for Chinese workers.<sup>8</sup>

**Table 2 Workers' Compensation in China: First Quarter 2003**

Type of Enterprises	Number of People Employed		Average Compensation		
			Quarterly		Hourly
	000	%	in Yuan	In USD	In USD
Total	108,343	100.00%	3,139.00	379.11	0.73
State-owned Enterprises	70,702	65.26%	3,243.00	391.67	0.75
Township Enterprises	10,884	10.05%	1,883.00	227.42	0.44
Other	26,757	24.70%	3,379.00	408.09	0.78

*Notes:*

*Other enterprises include joint ventures with foreign enterprises and large privately owned enterprises. Hourly compensation is based on 40 hour/week and 13 weeks in the quarter. The prevailing exchange rate of 8.28 yuan/USD is used for conversion.*

*Source:*

*National Bureau of Statistics of China, Compensation for Employees in Urban Areas, <http://www.stats.gov.cn/tjsj/jdsj/1200305070150.htm>. Accessed June 11, 2003.*

According to McDonald's 2002 financial report, tradable ingredients (food and paper) were about 25% of total sales.<sup>9</sup> That is, out of the average price of \$2.71 for a Big Mac in the United States in 2003, about \$0.69 represented tradable ingredients and \$2.02 for non-tradable ingredients. Assume that the tradable ingredients in China cost the same but the non-tradable ingredients were a quarter of the U.S. costs, not an unreasonable assumption as discussed above, then the Big Mac should have sold for \$1.19! This estimate is strikingly close to the Economist survey price - \$1.20 in China.

The conclusion that low per capita income countries' currencies tend to be undervalued based on PPP has been well documented in the academic literature. Balassa (1964) points out that, since services (non-tradable) enter the calculation of purchasing power parities but do not directly affect exchange rate, the purchasing power parity based exchange rate, measured as currency units for the low wage country per unit of the currency for high wage country, will be lower than the equilibrium rate of exchange. Balassa points out further that the greater the productivity differentials in the production of traded goods between two countries, the larger the differences in wages and in the prices of services and, correspondingly, the greater the gap between purchasing power parity and the traded goods market equilibrium exchange rates. Instead of relying on the differential productivity postulate, Bhagwati (1984) and Kravis and Lipsey (1983) resort to differences in endowments of capital and labor to explain the lower price levels of poor countries and the undervaluation of currencies for these countries.

<sup>8</sup> The average hourly wages for the private sector in the United States is obtained from the U.S. Department of Labor, The Employment Situation: October 2003, available at <http://www.bls.gov/news.release/empst.nr0.htm> (accessed November 9, 2003).

<sup>9</sup> McDonald's 2002 Financial Report, available at <http://www.mcdonalds.com/corporate/investor/financialinfo/investorpub/financial/page16/ada1/index.html>. Accessed November 21, 2003.

The relationship between wages/price levels and currency valuation is evident in the Big Mac prices and currency valuations based on these prices. Table 3 presents the Big Mac valuation data from the Economist survey for 2002 and data for per capita income.

**Table 3 Big Mac Valuation and Per Capita Income - 2002**

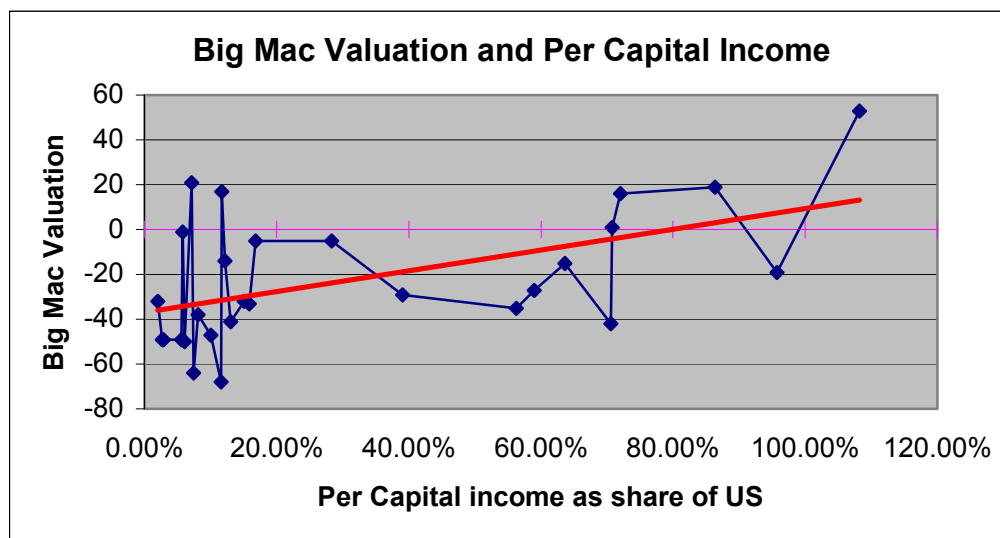
2002	Local currency units	Prices in local currency	Prices in dollars	Actual exchange rate 4/23/02	Implied PPP of the dollar	Local currency under (-) /over(+) valuation, %	GNP per Capita \$ (2002)	PPP GNP per Capita \$ (2002)	GNP per capita as compared with US	PPP GNP per capita as compared with US
United States	\$	2.49	2.49	-	-	-	35,060	35,060	1.00	1.00
Argentina	Peso	2.50	0.78	3.13	1.00	-68	4,060	9,930	0.12	0.28
South Africa	Rand	9.70	0.87	3.90	10.90	-64	2,600	9,870	0.07	0.28
Russia	Ruble	39.00	1.25	31.20	15.70	-50	2,140	7,820	0.06	0.22
<b>China</b>	<b>Yuan</b>	<b>10.50</b>	<b>1.27</b>	<b>8.28</b>	<b>4.22</b>	<b>-49</b>	<b>940</b>	<b>4,390</b>	<b>0.03</b>	<b>0.13</b>
Philippines	Peso	65.00	1.28	26.10	51.00	-49	1,020	4,280	0.03	0.12
Thailand	Baht	55.00	1.27	43.30	22.10	-49	1,980	6,680	0.06	0.19
Malaysia	M\$	5.04	1.33	2.02	3.80	-47	3,540	8,280	0.10	0.24
Hong Kong	HK\$	11.20	1.40	4.50	7.80	-42	24,750	26,810	0.71	0.76
Poland	Zloty	5.90	1.46	2.37	4.04	-41	4,570	10,130	0.13	0.29
Brazil	Real	3.60	1.55	1.45	2.34	-38	2,850	7,250	0.08	0.21
Australia	A\$	3.00	1.62	1.20	1.86	-35	19,740	26,960	0.56	0.77
Czech Rep	Koruna	56.28	1.66	22.60	34.00	-33	5,560	14,500	0.16	0.41
Hungary	Forint	459	1.69	184.00	272.00	-32	5,280	12,810	0.15	0.37
Indonesia	Rupiah	16,000	1.71	6426	9430	-32	710	2,990	0.02	0.09
New Zealand	NZ\$	3.95	1.77	1.59	2.24	-29	13,710	20,020	0.39	0.57
Singapore	S\$	3.30	1.81	1.33	1.82	-27	20,690	23,090	0.59	0.66
Japan	Yen	262.00	2.01	130.00	105.00	-19	33,550	26,070	0.96	0.74
Canada	C\$	3.33	2.12	1.34	1.57	-15	22,300	28,070	0.64	0.80
Chile	Peso	1,400	2.16	562.00	655.00	-14	4,260	9,180	0.12	0.26
Mexico	Peso	21.90	2.37	8.80	9.28	-5	5,910	8,540	0.17	0.24
S. Korea	Won	3,100	2.36	1304	1245	-5	9,930	16,480	0.28	0.47
Peru	New Sol	8.50	2.48	3.41	3.43	-1	2,050	4,800	0.06	0.14
Sweden	SKr	26.00	2.52	10.40	10.30	1	24,820	25,080	0.71	0.72
Britain	Pound	1.99	2.88	1.25	1.45	16	25,250	25,870	0.72	0.74
Venezuela	Bolivar	2,500	2.92	1004	857	17	4,090	5,080	0.12	0.14
Denmark	DKr	24.75	2.96	9.94	8.38	19	30,290	29,450	0.86	0.84
Turkey	Lira	4,000,000	3.06	1606426	1324500	21	2,500	6,120	0.07	0.17
Switzerland	SFr	6.30	3.81	2.53	1.66	53	37,930	31,250	1.08	0.89

Sources: Big Mac prices and valuation from *The Economist* (2002); Per capita GNP data from World Bank, *World Development Report*, 2003.



The correlation between the Big Mac valuation against the U.S. dollar and the normalized income level using the U.S. per capita income as the benchmark is positive (0.5248) and statistically significant.<sup>10</sup> This relationship is plotted in Figure 1.

**Figure 1 Correlation between Per Capita Income and Big Mac Valuation**



Based on our analysis of the Big Mac standard, we conclude that, given that labor cost is lower in China than in the United States, PPP implied value of the dollar as measured in the Chinese currency should be less than the exchange rate determined by the traded goods market. In other words, the PPP implied value of the RMB should be higher than the value of the RMB determined in the traded goods market. To generalize, the exchange rates for currencies of low-income countries tend to be undervalued based on PPP standards, or equivalently, PPP standards tend to overestimate the value of currencies of low-income countries.

Given that China's labor cost and rental are significantly lower than that of the United States, the relatively lower price of Big Mac in China and hence the derived under-valuation is not surprising. The under-valuation of the RMB or the overvaluation of the U.S. dollar, as judged by the Big Mac standard, is a natural result of the non-tradable nature of the product and the wages differences in the two countries. Samuelson (1964) pointed out about four decades ago that professors, "particularly cultured ones, are particularly prone to infer an overvaluation of the dollar by the cheapness abroad of personal services (maids, tenors, and Doctors of Philosophy)." By this reasoning, every prosperous region has a chronically overvalued currency. He illustrated the non-tradable nature of services by saying that, patently, he could not import cheap Italian haircuts, nor could Niagara-Falls honeymoons be exported. By the same token, American workers would not go to China in 2003 to buy Big Mac hamburgers for lunch, even though the Big Mac hamburger costs less than that of the United States in 2003.

Thus, currency valuations based on such measures should not be taken as the basis for exchange rate policy recommendations. However, the RMB should revalue if the gap in productivity and labor compensation between the two countries narrows over time.

#### **Other Measures of PPP and the Value of the RMB**

While the Big Mac index has been regarded as a "medium-rare guide to whether currencies are trading at the right exchange rates (Economist, 1986)," they are, after all, the prices of only one commodity and suffer from the lack of

<sup>10</sup> Based on the PPP GNP per capita, this correlation is 0.4031, still positive and statistically significant. This smaller correlation is expected when the income levels are adjusted with PPP.

representation of the vast range of commodities that exist in the real world. The **absolute version of PPP** generalizes the law of one price to include more commodities. The World Bank and the United Nations (UN) sponsored an international comparison program (ICP) in 1968 to provide statistics that allow cross-country comparisons of economic aggregates in real terms by using observed PPPs as conversion factors.<sup>11</sup> The following quote may provide a glimpse of the significance of this program:

Why has China's per capita GNP in US dollars remained more or less constant at just over 2 percent of that of the USA between 1985 and 1995 when in fact China grew five times faster than the USA during the same period? This apparently paradoxical outcome underscores the inherent problem associated with exchange rate-based cross-country comparisons. The need for alternative conversion factors has become increasingly evident in light of the recent currency meltdown in Asia.<sup>12</sup>

The data generated by International Comparison Program can be distributed in many ways, one of which is through Penn World Tables (PWT).<sup>13</sup> PWT includes PPP-based time series data of detailed national accounts items and foreign exchange rates, price levels etc. Table 4 lists the time series data for exchange rate of the Chinese currency RMB and the price level of gross domestic product of China. Based on these data, the RMB has been undervalued since 1980. For example, in 2000, the RMB was only 23.1% of its PPP implied value.

While the PWT measures may be appropriate for adjusting countries' GDP levels, they are not appropriate to judge the valuation of currency, as they are based on non-tradable goods as well as traded goods - the same problem as with the Big Mac standard. We can then expect, similarly with the Big Mac standard, that the RMB would be undervalued, due to low income in China.

Compared with the law of one price and the absolute version of PPP, the **relative PPP** is a more commonly used alternative measure for prices and exchange rates. Relative PPP is about price changes rather than absolute price levels as in the case of the Big Mac valuation. It states that the current exchange rate is adjusted from the previous level by the relative price changes of the corresponding currencies. More formally, relative PPP can be written as

$$E_t = E_{t-1} \frac{P_t / P_{t-1}}{P_t^* / P_{t-1}^*} = E_{t-1} \frac{1 + \pi}{1 + \pi^*} \quad (10)$$

where  $P$  and  $P^*$  are the price levels in domestic currency and in foreign currency respectively,  $E$  is the exchange rate, as defined before,  $\pi$  and  $\pi^*$  are the corresponding domestic and foreign inflation rates, and  $t$  and  $t-1$  are time indicators. Since relative PPP uses price changes over time, a base period has to be selected. The base year selection is critical in currency valuation. We choose two separate time periods for our analysis – 1985 and 1994 for our RMB valuation. 1985 was the year when the dual exchange rates for the RMB were first merged. 1994 was the year when China adopted a market-based and managed floating exchange rate system and the official exchange rate and the foreign exchange coordination rate were merged to produce a single exchange rate.<sup>14</sup> Consumer price indexes are used for data availability and their comprehensive coverage. We calculate the relative PPP implied exchange rate using a fixed base year and a rolling base year respectively. Our results show that the RMB has been undervalued for most years since 1985 if 1985 is used as a fixed base (see Table 5). The currency was undervalued by more than 20% since 1992 except for 1997. The results are less dramatic, though, when the rolling base is used. We have obtained sharply different results when 1994 is used as the base year (see Table 6). The currency has been overvalued for all years since 1995, and for some years by more than 20%, when 1994 is used as the fixed base.

<sup>11</sup> The program was first established in 1968 as a joint venture of the UN and the International Comparisons Unit of the University of Pennsylvania, with financial contributions from the Ford Foundation and the World Bank. Starting with a modest project to undertake comparisons in 10 countries in 1970. The program has since been expanded to the status of a truly global program. For more information, visit <http://www.worldbank.org/data/icp/abouticp.htm> (Accessed February 28, 2003).

<sup>12</sup> The World Bank, "The International Comparison Programme and Purchasing Power Parities," <http://www.worldbank.org/data/icp/abouticp.htm> (Accessed February 28, 2003).

<sup>13</sup> See Summers and Heston (1991) for description and analysis of the Penn World Table.

<sup>14</sup> See Yang (2004) and Yang and Yin (2003) for a background study of the RMB.

The rolling base results indicate that the currency has been slightly under-valued since 1998. The dramatically different results using separate years as the bases highlight the importance of base year selection in PPP valuations.

**Table 4 Valuation of RMB Based on Penn World Table Data**

Year	Exchange Rate Yuan/US Dollar	Price Level of GDP
1980	1.498	54.8
1981	1.705	44.8
1982	1.893	38.5
1983	1.976	36.4
1984	2.320	31.2
1985	2.937	27.6
1986	3.453	24.4
1987	3.722	23.8
1988	3.722	27.7
1989	3.765	30.6
1990	4.783	23.5
1991	5.323	21.1
1992	5.515	21.5
1993	5.762	23.8
1994	8.619	19.3
1995	8.351	22.8
1996	8.314	24.3
1997	8.290	24.5
1998	8.279	24.0
1999	8.278	23.5
2000	8.279	23.1

**Source: Penn World Table, [pwt.econ.upenn.edu](http://pwt.econ.upenn.edu), accessed January 11, 2003**

The exchange rate for RMB is expressed as yuan/US dollar. The price level of GDP (right column in Table 2) is measured by the percentage of the market exchange rate to the exchange rate implied by PPP, using the whole bundle of all goods and services that make up the gross domestic product as the benchmark. It measures the extent to which the market exchange rate deviates from the purchasing power parity. The price level is expressed as following:

$$\text{Price Level} = \frac{FX}{CF_{ppp}} * 100$$

Where

$FX$  : The exchange rate of a currency measured as US dollar/Domestic currency.

$CF_{ppp}$  : The conversion factor based on purchasing power parity, using the whole basket of goods in the economy as benchmark.

Based on the above expression, if the price level is less than 100, the value of this currency, measured by FX, is less than PPP implied rate, measured by  $CF_{PPP}$ , and the currency is undervalued at its current exchange rate.

**Table 5 Valuation of RMB Based on Purchasing Power Parity (1985 as Base Year)**

Year	Official Rate	China CPI	US CPI	1985 as Base Year		Rolling Base	
				PPP Rate	Valuation	PPP Rate	Valuation
1985	2.94	32.91	70.61	2.94	0.00%		
1986	3.45	35.15	71.92	3.08	-10.81%	3.08	-10.81%
1987	3.72	37.69	74.61	3.18	-14.49%	3.57	-4.12%
1988	3.72	44.75	77.61	3.63	-2.38%	4.25	14.16%
1989	3.77	52.96	81.35	4.10	8.94%	4.20	11.59%
1990	4.78	54.58	85.74	4.01	-16.15%	3.68	-23.03%
1991	5.32	56.51	89.37	3.98	-25.16%	4.75	-10.74%
1992	5.51	60.09	92.08	4.11	-25.43%	5.49	-0.36%
1993	5.76	68.86	94.80	4.58	-20.57%	6.14	6.52%
1994	8.62	85.55	97.27	5.54	-35.71%	6.98	-19.05%
1995	8.35	100.00	100.00	6.30	-24.55%	9.80	17.35%
1996	8.31	108.32	102.93	6.63	-20.24%	8.79	5.71%
1997	8.29	111.36	105.34	6.66	-19.64%	8.35	0.75%
1998	8.28	110.42	106.97	6.50	-21.44%	8.09	-2.23%
1999	8.28	108.87	109.31	6.28	-24.19%	7.99	-3.51%
2000	8.28	109.15	113.00	6.09	-26.49%	8.03	-3.02%
2001	8.28	109.91	116.20	5.96	-27.99%	8.11	-2.05%

Notes: Official Rate: Yuans per U.S. dollar; annual average – CPI: Consumer price index (1995 = 100)  
Data sources: IMF, International Financial Statistics, various issues.

**Table 6 Valuation of RMB Based on Purchasing Power Parity (1994 as Base Year)**

Year	Official Rate	China CPI	US CPI	1994 as Base Year		Rolling Base	
				PPP Rate	Valuation	PPP Rate	Valuation
1994	8.62	85.55	97.27	8.62	0.00%		
1995	8.35	100.00	100.00	9.80	17.35%	9.80	17.35%
1996	8.31	108.32	102.93	10.31	24.05%	8.79	5.71%
1997	8.29	111.36	105.34	10.36	24.98%	8.35	0.75%
1998	8.28	110.42	106.97	10.12	22.19%	8.09	-2.23%
1999	8.28	108.87	109.31	9.76	17.90%	7.99	-3.51%
2000	8.28	109.15	113.00	9.47	14.34%	8.03	-3.02%
2001	8.28	109.91	116.20	9.27	11.99%	8.11	-2.05%

Notes: Official Rate: Yuans per U.S. dollar; annual average – CPI: Consumer price index (1995 = 100)  
Data sources: IMF, International Financial Statistics, various issues.

### Valuation of the RMB Based on the Flow Model

As Holland (2003) points out, theoretical assessments of a currency's "true" value are always tricky and are of limited worth at the best of times. However, it has been argued that China's rapid accumulation of foreign reserves in recent years is evidence that the RMB is undervalued. Indeed, as described earlier, U.S. trade deficit with China and China's current account surplus as well as China's accumulation of international reserves have been cited as bases for the claim the RMB is undervalued. These arguments stem from what are often referred to as the flow approach to currency valuation.

The flow approach to exchange rate determination concentrates on the flows of currency passing through the foreign exchange market. An increase in the demand for a particular country's goods, services, and assets translates into an increase in demand for the country's currency and tends to raise the value of the currency, and vice versa. Under a pegged exchange rate system, the gap between supply and demand can be measured by the rate at which a central bank is depleting (or adding to) its stock of international reserves. This approach appears to be especially applicable to valuing the RMB since the currency is virtually pegged to the U.S. dollar even though the official regime is managed float. The sustainability of such a pegged rate can be assessed by comparing the central bank's stock of international reserves to their rate of depletion or increase.<sup>15</sup>

To investigate whether the RMB is undervalued according to the flow approach, we will examine successively China's trade, particularly China's trade with the United States, China's current account balance, China's capital flows, and China's international reserves. A rigorous analysis of the currency valuation based on the flow model would require an empirical examination of the elasticity of each flow to an exchange rate change and the validity of the Marshall-Lerner condition. As Preeg (2002) points out, econometric testing of the impact of "currency manipulation" on the U.S. trade deficit is still a challenge. We believe that China's trade and capital flows are to a large extent affected by government policies, both in China and abroad, and that it is not appropriate to use standard empirical analyses that require a setting in which market forces play the major role. Instead, we will highlight the factors that may render judgment of the validity of the claim that the RMB is undervalued.

#### U.S. TRADE DEFICITS WITH CHINA

The growing U.S. trade deficit with China has been one of the major factors that have motivated the claim that the RMB is undervalued. While the claim that the undervalued Chinese currency has contributed to the U.S. trade deficit with China is relatively new, discussions of the causes of the deficit are not (See Lardy 1997, Yang 1998, and Fung and Lau 2001 for an overview of the issue). We can identify six of them:

First, there have been disagreements on the size of the deficit between trade statistics reported by the United States and by China. As shown in Table 7, the U.S. trade deficit with China was \$42.7 billion according to China's report while that number amounts to \$103.1 billion as reported by the United States. The statistical treatment of Hong Kong's re-exports between the United States and China has been a major reason for this discrepancy (Lardy 1997 and Fung and Lau 2001).

Second, low labor cost has been the driving force for China's exports. As mentioned earlier, despite the high growth rate and the significant improvement in living standards, China's per capita income is still among the lowest in the world. Exports of labor-intensive goods are natural tendency in international trade that allows China the opportunity to converge, albeit slowly, to world standard in labor income.

Third, Chinese firms have been awarded a value-added tax rebate for exports – currently at 15% (Goldstein and Lardy, 2003). Although such export incentives are international norms, this tax rebate has spurred Chinese firms to seek ways to sell their products abroad. In the meantime, the rebate has become a heavy fiscal burden for the Chinese government.

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<sup>15</sup> See Levich (1985) for a discussion of the flow model and the role of international reserves in exchange rate determination.

Fourth, a large swarm of small and medium-sized enterprises competing against each other for the export market has been a unique characteristic of China's market structure. Such cutthroat competition has made China an ideal sourcing ground for U.S. companies. According to Wonacott (2003), China increasingly suffers from a production glut, and the big overseas retailers such as Wal-Mart Stores Inc. that soaks up China's exports have been quick to capitalize. They are demanding rock-bottom prices and forcing factory bosses to cut costs as much as possible in order to remain in contention for export orders.

**Table 7 Disagreements on U.S. – China Trade Balances**

Year	As Reported by China			As Reported by US		
	Export	Import	US	Export	Import	US
	To US	From US	Trade Balance	To China	From China	Trade Balance
1985	2,336.2	5,198.7	2,862.5	3,855.7	3,861.7	-6.0
1986	2,632.7	4,718.2	2,085.5	3,106.2	4,770.9	-1,664.7
1987	3,030.4	4,835.6	1,805.2	3,497.3	6,293.5	-2,796.2
1988	3,398.7	6,633.0	3,234.3	5,021.4	8,510.9	-3,489.5
1989	4,413.6	7,863.6	3,450.0	5,755.4	11,989.9	-6,234.5
1990	5,313.9	6,591.0	1,277.1	4,806.4	15,237.3	-10,430.9
1991	6,198.0	8,010.3	1,812.3	6,278.3	18,969.0	-12,690.7
1992	8,598.8	8,902.7	303.9	7,418.4	25,727.6	-18,309.2
1993	16,976.5	10,632.8	-6,343.7	8,762.8	31,539.9	-22,777.1
1994	21,421.4	13,976.7	-7,444.7	9,281.8	38,786.7	-29,504.9
1995	24,743.9	16,123.2	-8,620.7	11,753.6	45,543.2	-33,789.6
1996	26,730.6	16,178.9	-10,551.7	11,992.6	51,512.6	-39,520.0
1997	32,743.9	16,289.8	-16,454.1	12,862.3	62,557.6	-49,695.3
1998	38,000.6	16,997.3	-21,003.3	14,241.3	71,168.7	-56,927.4
1999	42,003.1	19,488.7	-22,514.4	13,111.0	81,788.2	-68,677.2
2000	52,161.7	22,374.6	-29,787.1	16,185.3	100,018.4	-83,833.1
2001	54,282.7	26,202.2	-28,080.5	19,234.8	102,280.5	-83,045.7
2002	69,950.5	27,230.1	-42,720.5	22,127.7	125,192.6	-103,064.9

*Sources:*

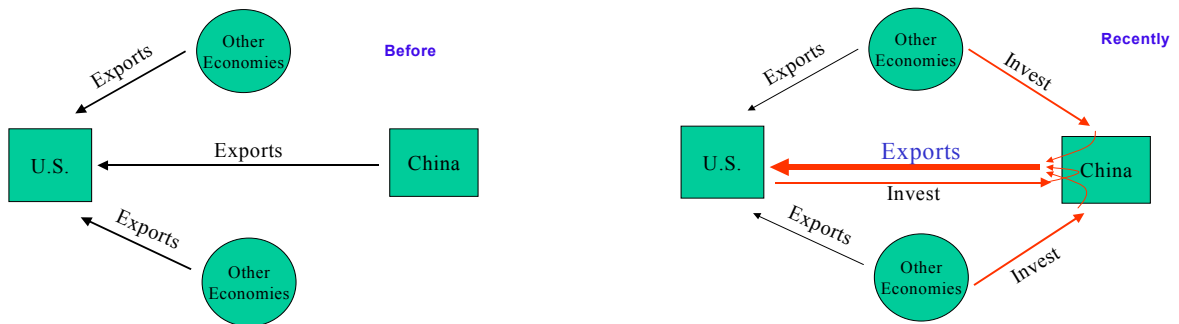
U.S. data are from U.S. Department of Commerce. <http://www.census.gov/foreign-trade/balance/c5700.html>. Accessed June 14, 2003. China data from 1985 to 2001 are from IMF, *Direction of Trade Statistics Yearbook*, various issues. China data for 2002 are from Commerce Ministry of China, <http://www.mofcom.gov.cn/tjzl.shtml>. Accessed October 20, 2003.

Fifth, China's exports to the United States have also been driven by foreign investment in China. Taking advantage of China's low labor cost and preferential policies toward foreign investment, many former exporting firms in Taiwan, South Korea and other economies in the area moved their production facilities to mainland China in the past 15 years and started to export from China to the United States. Many U.S. companies have production operations in China and sell their products from China to the United States. Figure 2 illustrates the transition of exports to the United States from other economies to China. In fact, as much as 60% of China's exports have been conducted by foreign-invested enterprises.

Finally, U.S. economic sanctions against China have been a major hindrance for U.S. exports to China (Askari et al 2003). While the diplomatic relations have long been normalized between the two countries, the United States maintains stringent restrictions of exports to China of products that can be used for both military and civil purposes. These products range from high-performance computers, high-precision machine tools, nuclear power generation technology, to communication satellites. U.S. policies toward China have also adversely affected trade financing and support for investment in China.

To summarize, the U.S. trade deficits with China have been attributed to technical factors (such as the statistical discrepancies) and policy factors by both governments (preferential treatment for foreign investment and export tax rebate on the part of China, export restrictions on the part of the United States) as well as economic factors (China's low labor cost). Given the existence of multiple non-economic factors that entangle trade between the two countries, it is difficult to judge whether the currency is properly valued at its currency level. Would a revaluation of the Chinese currency help mitigate the U.S. trade deficits with China? The answer depends on the exchange rate pass-through and demand elasticities of both countries' exports.<sup>16</sup> There are no China-specific data available for a formal empirical investigation. The experience of the U.S. trade with Japan may lend some insights. The Japanese yen has appreciated against the U.S. dollar since the collapse of the Bretton Woods system in the early 1970s, yet the U.S. trade deficits with Japan have persisted. Empirical studies (notably Marston 1990) have shown that the exchange rate changes have not fully passed through to prices for Japanese exports in the U.S. market.

**Figure 2 Transition of Exports to the United States**



<sup>16</sup> Exchange rate pas-through refers to the sensitivity of prices in the export market to changes in exchange rates. See Yang (1997, 2003) for discussions of exchange rate pass-through and experience of U.S. imports.

### CHINA'S OVERALL TRADE BALANCE

The U.S. trade deficits with China, after all, are a bilateral trade issue. China's trade with the rest of the world, including the United States, has been more balanced. As Table 8 shows, China's trade surplus has ranged between \$7 billion and \$47 billion in the last 10 ten years. Is this trade balance too high to warrant a revaluation of the Chinese currency? In 2002 its trade surplus was \$44.2 billion, about 3.65% of its gross national income. But this percentage could be reduced to merely 0.79% if the PPP-adjusted gross national income is used for the denominator.<sup>17</sup> China has been a net service importer and its combined balance on trade and services has been smaller than the trade balance. This combined balance on trade and services was \$37.4 billion in 2002, accounting for 3.09% of China's gross national income, or 0.66% of China's PPP-based gross national income. Viewing these statistics, here is a dilemma. If one accepts the PPP base, China's trade is more or less in equilibrium – trade balance close to zero, then no exchange rate adjustment is necessary to bring down the surplus in relative terms. On the other hand, it would be inconsistent to keep the gross national income at the level that is converted by current actual exchange rate and still claim that the currency is undervalued. Therefore, based on these statistics, it is difficult to reach a conclusion that China's trade is in disequilibrium and requires currency realignment.

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### CHINA'S CURRENT ACCOUNT BALANCE

While the trade balance may be an important indicator for currency valuation, it has to be considered in a more general context. As Goldstein (2003) points out, it is the overall current and capital-account positions that matter for judging the extent of exchange rate misalignment—not bilateral trade balances or components of the current and capital accounts. For countries that have to service their net liability position in international investment, a trade account surplus may be required to generate the necessary foreign exchange for its international financial obligations. It is well known that China has received large amounts of foreign investment in the past decades. Repatriation of investment proceeds by foreign investors from China eventually has to be met by trade surplus.

China is a net payer for investment income to foreign investors, so its current account balance is even smaller than its trade balance and its balance on trade and services. As Table 8 shows, China's current account balance was \$35.4 billion in 2002, 2.93% of its gross national income, or 0.63% of its PPP adjusted gross national income. The ratio of current account balance to gross national income was smaller from 1999 to 2001. China's current account balance in recent years does not look particularly abnormal if it is compared with a few other major industrial countries (See Table 9). The current account balances for Japan, France, and Canada were near or above 2% of their respective GDPs in 2001 and 2002. More importantly, as China's foreign investments gradually reach their payoff stage in future years, China's liability for investment income payment will, reduce China's current account balance. In sum, China's current account balance does not support the claim that the RMB is undervalued.

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<sup>17</sup> According to the *World Development Report 2004* by the World Bank, China's PPP gross national income was \$5625 billion while its gross national income converted at the actual exchange rate was \$1,209.5 billion.

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**Table 8 China's External Balances**

	Current Account Balance		Trade Balance		Balance on Goods and Services	
	\$ Million	% of GDP	\$ Million	% of GDP	\$ Million	% of GDP
1989	-4,317.00	-1.24%	-5,620.00	-1.61%	-4,927.00	-1.41%
1990	11,997.00	3.42%	9,165.00	2.61%	10,668.00	3.04%
1991	13,272.00	3.39%	8,743.00	2.23%	11,601.00	2.96%
1992	6,401.00	1.42%	5,183.00	1.15%	4,998.00	1.11%
1993	-11,609.00	-1.95%	-10,654.00	-1.79%	-11,497.00	-1.93%
1994	6,908.00	1.25%	7,290.00	1.32%	7,611.00	1.38%
1995	1,618.39	0.23%	18,050.10	2.57%	11,957.60	1.70%
1996	7,243.00	0.88%	19,535.00	2.37%	17,551.00	2.13%
1997	36,963.00	4.09%	46,222.00	5.11%	42,824.00	4.73%
1998	31,472.00	3.30%	46,614.00	4.88%	43,837.00	4.59%
1999	21,115.00	2.11%	35,982.00	3.60%	30,641.00	3.07%
2000	20,518.40	1.90%	34,473.70	3.19%	28,873.50	2.67%
2001	17,401.00	1.46%	34,017.00	2.85%	28,084.00	2.36%
2002	35,421.97	2.93%	44,166.57	3.65%	37,382.67	3.09%

Sources: IMF, *International Financial Statistics*, various issues. Data for 2002 are from China State Administration of Foreign Exchange, [http://www.safe.gov.cn/Statistics/BOP\\_2002.htm](http://www.safe.gov.cn/Statistics/BOP_2002.htm). Accessed October 20, 2003. China's GDP data for 2002 are from World Bank, *World Development Report 2003*. [http://econ.worldbank.org/files/30042\\_select.pdf](http://econ.worldbank.org/files/30042_select.pdf). Accessed October 20, 2003.

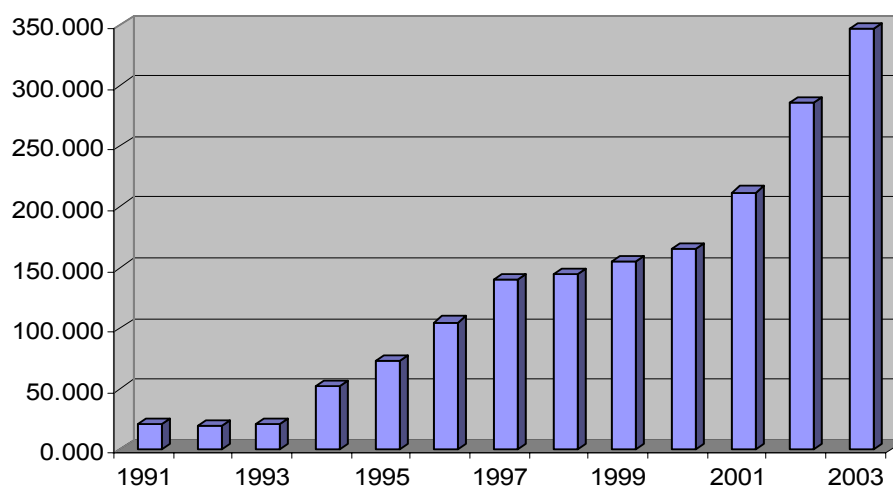
**Table 9 Current Account Balances for Selected Countries**

		2001	2002
Canada	\$ Billions	17.345	14.889
	Percent	2.4	2.0
France	\$ Billions	23.021	25.92
	Percent	1.7	1.8
Germany	\$ Billions	0.874	46.146
	Percent	0	2.3
Italy	\$ Billions	-0.652	-6.741
	Percent	-0.1	-0.6
Japan	\$ Billions	87.794	112.742
	Percent	2.1	2.8
United Kingdom	\$ Billions	-17.978	-14.448
	Percent	-1.3	-0.9
United States	\$ Billions	-393.744	-480.865
	Percent	-3.9	-4.6

Sources: IMF, *International Financial Statistics*, various issues.

#### CHINA'S CAPITAL FLOWS AND INTERNATIONAL RESERVES

China's accumulation of international reserves has been viewed as a clear indication that the RMB is undervalued. China's international reserves have grown rapidly in the past few years and reached a historical level of \$346.5 billion by June 2003 (Figure 3).

**Figure 3 China's International Reserves**

Sources: *China State Administration for Foreign Exchange. Data for 2003 was at end of June 2003.*

While China's current account surpluses have contributed to this accumulation, the main source of international reserves has come from capital inflows, particularly foreign direct investment (FDI) flows to China. As shown in Table 10, about \$50 billion flew to China as direct investment, contributing to about two-thirds of China's overall balance.

**Table 10 China's Capital Flows and Overall Balance**

Year	Financial Account	FDI Inflow	Overall Balance
1990	3,255	3,487	12,047
1991	8,032	4,366	14,537
1992	-250	11,156	-2,060
1993	23,474	27,515	1,769
1994	32,645	33,787	30,453
1995	38,674	35,849	22,469
1996	39,966	40,180	31,705
1997	21,037	44,237	35,857
1998	-6,275	43,751	6,248
1999	5,204	38,753	8,652
2000	1,958	38,399	10,693
2001	34,832	44,241	47,447
2002	32,340	49,308	75,507

Sources: *IMF, International Financial Statistics, 1990-2001. Data for 2002 were from China State Administration of Foreign Exchange, [http://www.safe.gov.cn/Statistics/BOP\\_2002.htm](http://www.safe.gov.cn/Statistics/BOP_2002.htm) (accessed October 20, 2003).*

There are multiple reasons for the large FDI flows to China. In general, foreign investment has been attracted by continuous improvement in China's business environment, a vast domestic market and a low cost but relatively highly productive labor force in China. China's preferential policies toward foreign investment have also been a major incentive for foreign investment. These preferential policies include tax exemptions and deference, favorable land allocations, and special administrative assistances. Such policies have even motivated Chinese firms to find foreign partners for their local production, or to move capital abroad and transfer it back as "foreign" investment to qualify for the preferential treatment.

In addition to foreign investment, other specific government policies have also resulted in the accumulation of reserves. China has adopted current account convertibility since 1994, but maintained relatively rigid control on capital outflows. Chinese enterprises are required to sell their foreign exchange earnings from exports to the government.

It is undeniable that the stability of the Chinese currency has provided assurance for foreign investors, particularly so in the aftermath of the Asian financial crisis. Yet, given the various non-market factors that have contributed to China's accumulation of international reserves, it is not convincing to argue that the RMB has been undervalued.

It appears ironical that China, with a very low per capita income and a thirst for foreign investment, accumulates large amount of costly international reserves. Much of the reserves are invested in U.S. Treasury securities. By the end of June 2003, China's holding of U.S. Treasury securities amounted to \$122.5 billion, more than one third of its international reserves (Table 11).

**Table 11 Major Foreign Holdings of U.S. Treasury Securities**  
(\$ Billions)  
Holding at End of Period

Economies	2003	2002	2001
	June	Dec	Dec
Japan	441.6	364.7	317.9
United Kingdom	122.8	108.5	45.0
<b>Mainland China</b>	<b>122.5</b>	<b>102.9</b>	<b>78.6</b>
Caribbean Banking Centers	71.6	62.0	33.6
Hong Kong	51.8	48.1	47.7
Germany	48.3	44.1	47.8
Korea	45.4	43.1	32.8
Taiwan	35.0	34.5	35.3
OPEC	31.1	42.2	46.8
International & Regional Orgs.	29.8	30.7	28.2
Mexico	24.8	22.9	19.3
Belgium-Luxembourg	24.7	24.6	22.4
Switzerland	20.6	18.9	18.7
Singapore	20.2	17.8	20.0
Italy	18.9	18.6	18.9
Spain	15.4	17.6	15.6
Thailand	14.1	16.3	15.7
Canada	13.8	11.2	15.4
France	11.8	17.0	20.6
Netherlands	*	*	5.2
All Other	183.0	158.0	154.6
<b>GRAND TOTAL</b>	<b>1347.2</b>	<b>1203.7</b>	<b>1040.1</b>

Note: \* Less than \$50 million. Sources: Department of the Treasury/Federal Reserve Board, 8/15/2003

The experiences of many developing countries suffering from financial/currency crises in the 1990s exemplify the dire consequences of chronic current account deficits and rapid depletion of international reserves following sudden capital flow reversals. The adequacy of international reserves has often been viewed as important to assure international investor confidence. Obviously, China has taken precautionary measure to build its international reserves since the Asian financial crises. It is important for China, a developing country with relatively large amount of foreign debt and foreign investment income payment liabilities, to keep a certain level of international reserves.

Yet, are China's international reserves too high at their current level? This appears to be a judgment call. Rajan (2002) offers discussions of the costs and benefits of holding international reserves. The costs of holding "excess" reserves can be quite high. Yet holding excess reserves by countries appear to be an age-old fact. In what became known as the "Mrs Machlup's Wardrobe Theory", Machlup (1966) suggested that the acquisitive characteristics of monetary authorities in terms of adding to their reserves resembled those of his wife in terms of clothes. He argued that monetary authorities essentially looked to maximize their reserves.

At the end of June 2003, China's international reserves were 190% of its foreign debt balance (\$182.569 billion) versus the international safety standard of more than 20%. At the same time, China's international reserves were 540% of China short-term debt versus the international safety standard of 100%.<sup>19</sup> China's international reserves have earned China high credit standing in the international financial market. China's international reserves played an important role in supporting the RMB. While several currencies collapsed and depreciated sharply in the recent Asian financial crises, the RMB stood firm and proved to be a pillar for stability in the international monetary system.

However, the accumulation of China's international reserves is very costly for different reasons. First, the preferential treatment of foreign investment entails a high cost of foreign capital. Second, the export tax rebate masks to some extent the high cost of foreign exchange earnings through exports. Third, investment in U.S. Treasury securities, while considered low risk, may not prove to be the most efficient allocation of the costly international reserves. Fourth, the accumulation of international reserves increases China's domestic money supply and exerts inflation pressure on the Chinese economy.

Whether or not China's reserve holding is excessive would deserve a separate and more specific study. As long as the answer to this question is inconclusive, it would be difficult to argue that the RMB is undervalued. Even if China's international reserves are deemed as excessive, the value of the RMB should not be the culprit, or the sole culprit, since many other policy-related factors (such as the export tax rebate, preferential treatment of foreign investment, and control on capital outflows) are in play.

### **Portfolio balance approach**

The portfolio balance approach to exchange rate determination focuses on the supply and demand for financial assets across countries. The basic assumption is that investors are free to allocate their wealth among domestic and foreign financial assets. In such a setting, the exchange rate establishes an equilibrium (a balance) in investor portfolios comprised of domestic and foreign assets (Levich 1985). Yet the model is not readily applicable to the Chinese currency because of some market frictions: investors in China do not have limited access to foreign assets because of capital controls on outflows. Despite the low average income, China's household savings rate is among the highest in the world. Yet, most individual households/individuals have limited choices in their investment portfolios since China's financial markets are still underdeveloped. Much of their savings are stored as savings deposits in major commercial banks. At the end of August 2003, China's household savings deposits in China's financial institutions amounted to \$1198.74 billion, more than three times of China's international reserves (Table 12). If Chinese investors were allowed to adjust their investment portfolio and diversify into international asset holdings, it would certainly create a significant downward pressure on the Chinese currency.

The downward pressure on the currency could be dramatic if one considers the scale of the non-performing loans (NPL) in China's banking system, which is estimated at around 40% of the total loans outstanding. The principal factors shaping China's NPL levels include extensive policy lending during the years of the command economy,

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<sup>19</sup> China Daily (Overseas Edition), November 5, 2003. Page 4.

weak financial performance of the state-owned enterprises (SOEs) and lax internal credit risk controls of the state-owned banks (Ma and Fung 2002). The four major state-owned commercial banks had assets of more than RMB 10,000bn (\$1,200bn) at the end of 2001, equivalent to 115 per cent of China's gross domestic product (Lardy 2002).<sup>20</sup> Some analysts argue that, based on China's huge bad loan problem, the currency should be weaker than it is now (Clifford 2002). If asset recovery by the banking industry does not pick up rapidly, credit crunch would be inevitable, which would restrain future economic growth and cause higher unemployment. Any resultant loss of confidence in the banking system might not only lead depositors to withdraw money from the banks but also jeopardize capital inflows, threatening the stability of RMB.

**Table 12 China's Deposits in Financial Institutions  
(End of August 2003)**

	In RMB Billion	In US\$ Billion
Total Deposits	19,772.56	2,387.99
Deposits by Enterprises	6,721.44	811.77
Fiscal Deposits	640.14	77.31
Deposits by Government Departments & Organizations	604.18	72.97
<b>Household Savings Deposits</b>	<b>9,925.56</b>	<b>1,198.74</b>
Demand deposits	3,275.81	395.63
Time Deposits	6,649.75	803.11
Rural Deposits	443.37	53.55
Trust Deposits	243.89	29.46
Other Deposits	1,193.98	144.20

Sources: People's Bank of China, <http://www.pbc.gov.cn/baogaoyutongjishuju/2003S1.htm>. Accessed October 22, 2003.

### Concluding Remarks

In this paper, we investigated the claim that the Chinese currency has been and is currently undervalued from multiple aspects of exchange rate determination: purchasing power parity, balance of payments flows, and portfolio balance. We found no convincing support evidence for this claim. Since price indices, including the Big Mac index, include non-tradable components, and China's wage rates are significantly lower than those of the United States, the valuation of RMB based on crude purchasing power parity measures is always higher than the rate determined in the traded goods market. The U.S. trade deficits with China have been affected by many other factors (such as China's low labor cost, market structure, and U.S. economic sanctions) rather than the exchange rate. China's surpluses in both its trade and current accounts are relatively small and do not indicate that the currency is in misalignment. China's rapid accumulation of international reserves has mainly built through increases in capital inflows, which are a result of a few key non-market driven factors (such as control on capital outflows and preferential treatment of foreign investment).

<sup>20</sup> The four major state-owned commercial banks are the Bank of China, Agriculture Bank of China, China Construction Bank, and Industrial and Commercial Bank of China.

Stability of the Chinese currency has played an important role in regional economic stability and the viability of the international monetary system as well as in China's economic growth. The value of the RMB certainly will depend on China's future economic performance. If China maintains its relatively higher economic growth than the rest of the world and gap in wage rates between China and industrial countries shrinks, the value of the Chinese currency should increase accordingly.

Yet, few, if any, emerging markets have had a successful story with capital account convertibility and currency stability. Although there are benefits of capital account liberalization – if it is well managed, international financial capital flows have contributed to the volatility of exchange rates for emerging markets.<sup>21</sup> For China, any abrupt and dramatic change in the value of RMB would have a grave impact on China's economic and financial stability.

While we do not recommend revaluation or full floating of the Chinese currency at the present stage, we do believe it is important that China take steps to prepare for a more market-based exchange rate and external balances. Specifically, the value-added tax rebate for exports and preferential treatment for foreign investment should be reduced and eventually eliminated. China should improve and rely more on its foreign exchange earning capacity rather than on the accumulation of international reserves in building international investor's confidence.

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<sup>21</sup> Financial capital flows include international portfolio investment (in stocks and bonds) and short-term bank deposits and loans. As compared with FDI capital flows, foreign financial capital flows are more liquid and volatile, and can reverse directions very quickly. See Yang (2002) for a discussion of the difference between foreign direct investment and foreign financial capital flows.

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