Empirical Analyses of Chinese Exchange Rate Behavior from 1979-2007 [*]

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Abstract

This paper presents a single-equation econometric model approach to define the variables that determined the real exchange rate behavior in China during the 1979-2007 period as an indicator of the government`s de facto exchange rate policy. The empirical findings confirm that the Chinese economic policy mix has almost always led to some real exchange rate volatility, which is inconsistent with the exchange rate policy between 1979-2007, the impact of the reserves on the real exchange rate is analyzed to determine the degree of government intervention to limit its volatility. Therefore, it is believed that the most viable solution in short-medium term for China is the `managed bands` regime around a crawling real effective exchange rate-central parity, with no pre-announced management bands parameters. This choice will allow Chinese policy-makers to steer the economy out of the numerous regional and international political and economic shocks.

Key Words: Exchange Rate Policies, "Managed Bands"

1. Introduction

The empirical evidence shows that it is becoming more and more difficult to maintain a basket of currencies exchange rate regime with almost no width band in the long run for a country that is becoming integrated in the international trade and financial systems. Calvo and Reinhart (2000) demonstrated that most of the emerging market countries with exchange rates described as floating had more volatility than the fixed-rate ones. The emerging economies that describe themselves as having floating exchange rates content themselves with allowing their exchange rates to float as freely as do the USA, often use direct or indirect intervention to limit exchange rate fluctuations (Velasco,2000).

Therefore, this paper considers the main question for China since 21 July 2005 is how to adopt a kind of managed float exchange rate regime, namely a basket of currencies exchange rate regime. Managing the exchange rate means that the government imposes limits on its fluctuations, either explicitly in the form of announced bands, or as an undisclosed benchmark for intervention. These limits determine the band`s width within which the government leaves the exchange rate to fluctuate. For the convenience of this research, the managed float exchange rate, a basket of currencies exchange rate, shall be termed `managed bands`.

The paper is organized in six sections. The first is introduction. The second section describes the literature about monetary policies and real exchange rate. In the third section, is about real exchange rate model and exchange rate behavior and its determinants in China, 1979-2007.

Section four presents the econometric methodology for the identification of the determinants of the real exchange rate behavior in China from 1979 to 2007, and comments on the empirical results. Section five analyzes the policy implications of the results, namely the choice of `managed bands` as a most viable intermediary regime. The final section concludes the analysis.

2. Literature

2.1 The relationship between real exchange rate and monetary policy

Economic theory and practice have proved that exchange rate stability is incompatible with an activist monetary policy directed toward output stabilization. As the quantity theory of money puts it, the price level is related directly to the stock of money or monetary base (Fisher, 1911). Knowing that the real exchange rate is a relationship between national and international prices, this implies that any variation in the monetary base that induces a price level change different from the international price level change will provoke a variation in the real exchange rate(Bassem Kamar, Damyana Bakardzhieva, 2005).

The Mundell-Fleming model, also admitted that an increase in the money supply will lead to changes in both the real and currency markets, ending up with higher interest rates, higher national income and an exchange rate depreciation. However, current account in an open economy is seldom balanced, requiring liberalization of capital flows. The alternative of continuous central bank interventions can possibly hold in the case of net capital inflows, which will be compensated by the accumulation of international reserves, but can hardly hold in the case of massive net capital outflows since reserves will be drained out sooner or later. Therefore, a country adopting an open door policy is considered to be depending on its degree of openness (Bassem Kamar, Damyana Bakardzhieva, 2005).

Policy-makers are, in general, rather reluctant to abandon one of the major tools of economic adjustment to external and internal shocks, not to mention the threat of the domestic financial system in the absence of a lender of last resort. The problems that arise from the removal of the

nominal exchange rate as an adjustment instrument were illustrated by Argentina`s financial and economic turmoil(Bassem Kamar, Damyana Bakardzhieva, 2005).

Intermediate policies are actually situated, the idea of a `managed band` with different degrees and types of management restriction. The primary benefit of an intermediate regime is that it allows policy to be directed towards limiting misalignments. As defined in the economic literature, exchange rate overvaluations are damaging because they lower the competitive power of the tradable goods industry, whereas an undervalued currency can provoke stagflation (Williamson, 2000). Some economists(McKinnon,2000; Calvo and Reinhart ,2000), suggest that most emerging economies fear the perfectly free float and, even if they announce it officially to satisfy IMF recommendations, their real exchange rate policy is much closer to a heavily managed float. Therefore, when examining particular country cases, one needs to analyze in greater detail the exchange rate behavior and its determinants in order to establish the de facto exchange rate policy applied by the government (Bassem Kamar, Damyana Bakardzhieva, 2005).

2.2 Real effective exchange rate

(1) The meaning of HBS

The real exchange rate (regarding it as the price ratio between two countries) for us to use the same currency value according to PPP (purchasing power parity) should always be one. However, it has not been widely tested by empirical Research. A lot of literature has analyzed the differences between real exchange rate and PPP,   for example, Harrod (1939) pointed out that the different levels of productivity in the domestic and foreign country will introduce permanent deviation. The influential Balassa-Samuelson hypothesis emphasizes the role of the growth of productivity for real exchange rates. It considers that it is the difference of productivity between two countries that determines the relative price difference between them (the relative price difference of traded goods and non-traded goods). This hypothesis implies a well known conclusion: A country which has been experiencing fast economic growth will achieve the appreciation of real exchange rates at the same time (Haihong Gao, 2003)

(2) Empirical testing HBS

Balassa (1964) and Officer (1976) respectively estimated the productivity derivative model using the cross-data of full sectors. Marston (1990) estimated five double lateral exchange rates from 1973 to 1986 using the same methods. From the end of the 1990s to now Takatoshi Ito, Steven Symansky (1997) and Menzie David Chinn (1997) and others have tested the exchange rates of multiple countries by way of processing panel data in order to test the effectiveness of productivity models about real exchange rates (Wei Wang，2003).

Many Chinese scholars have concentrated on the relationship between RMB real exchange rate and economic growth. However, they ignored the two countries relationship of relative labor productivity and RMB real exchange rate. Wei Wang (2003) used a derivative model of real exchange rate proposed by other scholars to analyze the relationship between RMB real

exchange rate and relative productivity. After testing the historical data by way of integration, Wei Wang demonstrated that there were long periods of stationary relationship between the relative productivity of Sino-America and RMB real exchange rate versus the USD even though the assumptions were occasionally violated.

(3) Developing HBS

Progress of productivity is the main factor of economic development. But, there are different views when empirical testing is undertaken about. We consider that it is possible that the value of *HBS* is more theoretic than practical (Haihong Gao, 2003).

(4)The key of designing exchange rate regime

A small country will most put at risk its policy aims if it only considers a basket of currencies weighted according to trade (Naoyuki Yoshino, Sahoko Kaji and Ayako Suzuki, 2004). The theories how to choose the weights of a basket of currencies have been the subject of exploration until the present. The key of designing an exchange rate regime based on a basket of reference currencies is to the definition of the concrete weights for each currency in that basket (Hejie Zhang, 2005).

(5) Majority of RMB real effective exchange rates have been based on IMF or BIS

However, until now majority of RMB real effective exchange rates have been based on IMF (relative years of International Financial Statistics Yearbook, such as some scholars, Hui Li, Wei Xu etc., Liping He etc., Ya Liu etc., Wei Li etc., Wei Huang etc, 2008; Zhibin Li, 2009, or BIS (Bank for International Settlements)，such as some scholars, Jianhuai Shi etc., Liping He, Dongbo Tang, 2008； Wenbin Sha, Longjie Xiao, etc., 2009. Mouthful of them were different from IMF or BIS. But, they were estimated as the same traded weights based on current account (Guoxing Tang ect.，2003, Jinbin Wang etc.， Yizhong Wang，Xia Fang etc.，2009), or got results by way of putting relative exchange rate of IMF into its model (Maohui Sun，20060, or considered questions from the viewpoint of goods market equilibrium (Yongxiang Pu，Rod Tyers，2001) or service trade (Shusong Ba etc.，2007). Although some scholars (Liyan Han etc., 2008) consider *FDI* at the same time, it merely is a RMB indicator not RMB real effective exchange rate.

(6) What is the fatal flaw which IMF and BIS set up RMB real effective exchange rate?

The fatal flaw of IMF and BIS set up RMB real effective exchange rate is still based on the weight of trade. The principal precondition is still PPP, not considering new mechanism of exchange rate nowadays. What is the new mechanism of it?

(7) The new mechanism of forming exchange rate nowadays

Since the disappearing of Bretton Woods System of reflecting the feature of fixed exchange rate, and setting up Jamaican system which floating exchange rates are dominant, due to distribution of currencies far away of real economics, and financial derivative tools have been gradually created, and the growth of non-real capitals has been quicker than the real capitals.

Since 1970`s, the development of international funds flow has deeply impacted on the mechanics of forming exchange rate.

Nowadays, in the foreign exchange spot market, an average daily turnover is $182 billion in 2007(V. Foreign exchange markets, BIS 78th Annual Report, P4). Comparing with turnover in the foreign exchange market to an average daily level of $3.5 trillion between 2001 and 2007(V. Foreign exchange markets, BIS 78th Annual Report, P13), the turnover of the foreign exchange spot market is only small part of total turnover of the foreign exchange market, it is about 5.2%. As known, the turnover of the foreign exchange spot market mainly constitutes the current account. So, it is clear that the mechanism which forms exchange rate model used by IMF and BIS can not reflect the fact of exchange rate behavior. It should be modified by practice.

3. Setting up real exchange rate models

3.1 The determination of labor productivity and comparison with them

(1) The literature which analyzes the balassa-samuelson hypothesis often regards reflecting the relationship between real investment and product and labor numbers as overall labor productivity

It calculates the average product of what per labor force produces in unit time according to the value of product. It is an important indicator to test economic activities of enterprises. It is a synthetic expression of enterprise product technological level, managerial level, the extent of labor technological skill, and labor activities.   At present, the productivity of full employment in some country, such as China, is defined as below

$$\text{overall labor productivity} = \frac{\text{value-added in industry}}{\text{average number of full employee}} \qquad (1)$$

We may transform labor productivity per year into the price in base year, such as 2000, by way of CPI in order that we can compare the numbers involved in productivity of full employment per year.

(2) It is an appropriate measure for us to regard average income of employee as the productivity of full employment

In developed countries, if there are relative market demands, the majority of non-traded goods may be transformed into traded goods. Even if there are some sectors which traditionally belong to the services sectors, it can express service trade,   furthermore, it can become traded sectors by way of non- factors services. Thus, it corresponds to the demand of open economy researches as developed countries to put non traded sectors into the Balassa-Samuelson hypothesis referring researches. China has gradually changed into a country with a market economy. The hypothetical conditions of what open economy demands about capital mobility to refer the Balassa-Samuelson hypothesis have gradually been satisfied. It is appropriate   for us to regard average income of employee as the productivity of full labors （Kejian Gu，2000）.

(3) We consider that the modified fundamental principal of HBS is that relative productivity among different countries or regions could determine the real effective exchange rate.

It is our hypothesis that if a country or region productivity (overall labor productivity)is higher than sample countries or regions, its real effective exchange rate will be appreciation, and if a country or region productivity is lower than those, it will be depreciation. Thus, we could try on putting relative productivity into the weights of a basket currencies of RMB exchange rate regime. It is clear why the constructed real exchange rate is used rather than the standard real exchange rate. There are two reasons. The one is, if the hypothesis is true by test in future, we could deeply understand the relationship between real effective exchange rate and productivity. The other is, our new model can consider the exchange rate mechanism from the viewpoint of both commercial and capital market, that is Balance of Payments, by way of *GDP* based on modern exchange rate market.

3.2 Model

We define the weights of RMB exchange rate in the regime based on a basket of currencies

$$W_{it} = \frac{numerator}{denominator}, \quad numerator = \frac{GDP \ of \ China}{the \ employee \ in \ China},$$

$$denominator = \sum_{i=1}^{n} A_i \times B_i \tag{2}$$

In equation (2):   i is sample countries or regions,

$$A = \frac{GDP \ of \ sample \ countries \ or \ regions}{the \ employee \ in \ sample \ countries \ or \ regions},$$

$$B = \frac{the \ total \ exports \ and \ imports \ between \ China \ and \ the \ sample \ countries \ or \ regions}{the \ total \ exports \ and \ imports \ in \ China}$$

3.3 The calculation of the indicators of RMB effective exchange rate

What calculated the indicators of RMB effective exchange rate concludes the indicators of nominal effective exchange rate and the indicators of real effective exchange rate. The indicator It of RMB nominal effective exchange rate as follow based on the way of IMF.

$$I_t = I_0 \cdot \prod_i (\frac{s_{i,t}}{s_{i,0}})^{W_{i,t}} \tag{3}$$

In model (3), $S_{i,t}$ is the nominal exchange rate of RMB in *t* to *i* currency. $S_{i,0}$ is the nominal exchange rate of RMB in base term to *i* currency. I_0 is the nominal exchange rate indicator of RMB in base term, and defined as 100. $W_{i,t}$ is the weights of *i* currency in the nominal exchange rate indicators of RMB. It can be simply understood for us to show that the RMB nominal exchange rate indicator is RMB nominal exchange rate relative to the currency of foreign or region. If the RMB nominal exchange rate is higher than ever, it shows that RMB is appreciation than the currency of foreign or region. The foreign or region is particularly considered as a basket of currencies.

We can get RMB real effective exchange rate indicators RI_t, if putting the real exchange rates $q_{i,t}$ of RMB to the *i* currency into (3) instead of $S_{i,t}$ in (3).

$$RI_t = RI_0 \cdot \prod_i (\frac{q_{i,t}}{q_{i,0}})^{W_{i,t}}$$

(4)

In (4), $q_{i,t=}\, s_{i,t}p_t / p_{i,t}$, p_t is the Chinese *CPI* in *t* term, $p_{i,t}$ is the *CPI* in *i* country or region in *t* term. RI_0 is the RMB real effective exchange rate indicator in base term, and is considered as 100. Because $p_t=p_{i,t}$ in base term, so $q_{i,0=}\, s_{i,0}$. As the same as above, it can be simply understood for us to show that the RMB real exchange rate indicator is RMB real exchange rate relative to the currency of foreign or region. If the RMB real exchange rate is higher than ever, it shows that RMB is appreciation than the currency of foreign or region. It expresses that the competitive capacity of exports price is lower than ever.

3.4 The choice criteria of sample countries and regions

The ratios, which is the total sum of exports and imports in sample countries or regions over the total sum of exports and imports in Chinese mainland, is equal or more than 1% from 1979 to 2007. In addition, in view of great fluctuations of data in some countries or regions in some years, as long as the average ratios per three years is not less than 1%, such as Malaysia, the ratios are 1.2%, 1.1%, 0.7% from 1979 to 1981and Chinese Taiwan, the ratios are 6.5%, 0.6%, 6.3% from 1996 to 1998, these countries or regions can also be chosen in some years.

3.5 The choices of sample countries and regions

From 1979 to 2007, according to our calculation, the ratios, which are the sum of exports and imports among China and main countries and regions, are among 71.9%-89.2%. There are about 20 main sample countries and regions, such as, America, Japan, Korea, Singapore, Hong Kong, Taiwan in China, Australia, Canada, France, Germany, Italy, Netherland, England, Tailand, Malasia, Indonesia, Philippines, India, Russia, Brazil, which have been put into our model in relative years.

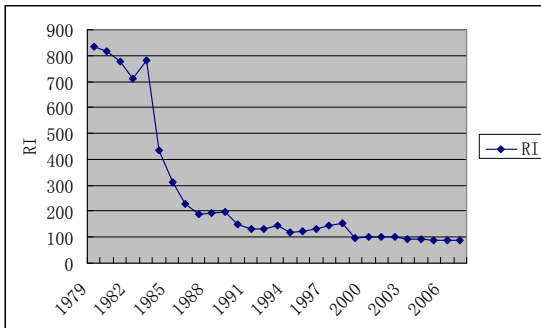**3.6 Chinese RI behavior and fluctuations from 1979 to 2007**

Figure 1 Chinese *RI* behavior, 1979–2007

In this case, a decrease in the value of the *RI* from 1979 to 1982 and from 1984 to 1991 and from 1993 to 1994 and from 1998 to 1999 and from 2001 to 2006(figure 1) is consistent with a

depreciation, or real undervaluation, which necessitates an automatic nominal depreciation in the absence of any governmental intervention. An increase in the value of the *RI* from 1982 to 1984 and from 1991 to 1993 and from 1994 to 1998 and from 1999 to 2001and from 2006 to 2007 is consistent with an appreciation, or real higher valuation, which necessitates an automatic nominal appreciation in the absence of any governmental intervention. Generally speaking, a depreciation in the value of the *RI* from 1979 to 2007 apart from some years, such as from 1982 to 1984 and from 1991 to 1993 and etc., maintaining an undervalued nominal exchange rate will help exporters, decrease imports and lead to current account surplus and balance of payment well. Maintaining a overvalued nominal exchange rate will hurt exporters, increase imports and lead to current account deficit and balance of payment crisis (figure 2).
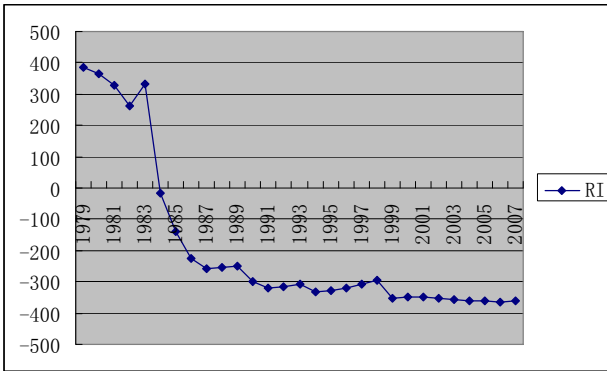

Figure 2. Chinese *RI* fluctuations, 1979–2007

3.7 The literature on the determinants of the real exchange rate

Before defining the variables that influence the exchange rate behavior, the measure of the real exchange rate must be defined first.

The literature on the determinants of the real exchange   rate behavior has become quite large in the last two decades and will not be   reviewed in detail in this paper. In summation, some economists (Edwards ,1987, 1989; Elbadawi,1994, 1997) have shown that the real exchange rate is   affected by the disequilibrium in either external or internal fundamentals, such   as government consumption (*GCON*), the terms of trade (*TOT*), the degree of   openness (*OPEN*) or the net capital flows (*NKF*). One more variable is added,   which influences the fluctuations of the *RI* and measures the monetary policy, expressed by the ratio of liquidity to *GDP*.

As noted, this analysis is not concerned especially with the exchange rate   equilibrium, but principally with the *RI* fluctuations. Notations and a detailed   description of the initial set of variables can be found in table A1 in the   Appendix. The theoretical formula defining the model is as follows:

RI =*f* (*LIQ*, *GCON*, *TOT*, *OPEN*, *NKF*)   (5)

The time span used is 1979-2007. The macroeconomic data that characterize the model confine us to using annual data frequency; the main sources are:

China Customs(http://www.customs.gov.cn/YWStaticPage/default.htm) ,

National Bureau Statistics of China(http://www.stats.gov.cn/) ,

Ministry of Commerce of the People`s Republic of China(http://www.mofcom.gov.cn/) ,

IMF(http://www.imfstatistics.org/imf/), http://www.stat.go.gp./english/data/chouki/index.htm,

kosis (korean statistical information system),

Groningen Growth and Development Centre and the Conference Board,

Total Economy Database, http://www.ggdc.net, and etc.

In the calculations of all variables, 2000 was chosen as the base-year.

The government consumption in China represents between 10.7% and 31.3% of the *GDP* during the studied period (1979-2007). Therefore, the *GCON* variable is used to represent an important part of the demand for both tradable and non-tradable goods. If that consumption was biased in favor of the non-tradable, an increase in *GCON* would lead to an increase in the prices of non-tradable goods and an appreciation of the *RI* (an increase in the value of *RI*) . If the government consumption is dominated by tradables, the effect of an increase in *GCON* on the *RI* is likely to be in the direction of depreciation(Bassem Kamar, Damyana Bakardzhieva, 2005).

In defining the liquidity to *GDP* ratio, the M_3 to *GDP* ratio is used as a proxy of the monetary policy. With the increase of Chinese exports, the foreign currency would be increase too. The foreign currency, such as USD, would be depreciation. The People's Bank of China has to buy more foreign currency in foreign exchange market and distribute relative RMB in order to keep RMB exchange rate stable. The result is that the money supply would be increased. It will lead to an increase in prices.   The interest would be increase in order to reduce inflation. Thus, it will be a depreciation of exchange rate according to relative international financial theories, such as uncovered interest parity, which deals with forward exchange markets, it is argued that spot exchange rates should move to just offset differences in nominal interest rates; countries with high nominal interest rates should experience depreciations, and vice versa(Robert M. Dunn Jr.&John H.Muttl, 2004). In a word, an increase in the liquidity ratio (*LIQ*) will lead to an increase in prices. It will be a depreciation of *RI*.

Next, indicators to determine capital flows are needed. Capital mobility and capital controls are hard to measure, as pointed out by many authors (Edwards, 1992; Obstfeld et al., 2003). First, take the terms of trade (*TOT*), which represent the relative price of exports to the price of imports. It can be used as an additional indicator of capital flows fluctuations, since an increase in the international price of a country`s exports, such as oil prices, will lead to an increase in capital inflows. Theoretically, the terms of trade influence on the *RI* cannot be given an a priori sign, because it will depend on whether income or substitution effects dominate. If the income effect is stronger, this will lead to an appreciation of the *RI*, and if the substitution effect is more robust, this will mean *RI* depreciation (Elbadawi, 1997).

As pointed out previously, the growing degree of openness is consistent with decreasing capital controls, which in return creates higher possibilities for capital flows` fluctuations. Therefore,

to measure the degree of the country`s trade openness the variable *OPEN* (total trade as a percentage of *GDP*) is used. Even though the degree of openness is not a direct indicator for capital flows, it is believed that the increase in openness will lead to higher capital flows` fluctuations, both for import, export and investment concerns, and that these fluctuations would have an impact on the exchange rate behavior. Yet, economic theory is rather ambiguous concerning the exact effect of a commercial liberalization, so there is not an a priori sign given to that variable (Edwards, 1992). Alternatively, a second measure of openness, and of capital flows, called *OPEN1*, which represents the imports to *GDP* ratio, is also calculated and tested.

The last indicator that is intended to measure the net capital flows (*NKF*) is calculated as absolute value of [(*Exports-Imports*)/*GDP*]/Change in gross international reserves (including gold, in current US dollars) / *GDP*. For the purpose of this study it is considered that central bank interventions through change in international reserves neutralize the impact of net capital flows fluctuations on the exchange rate behavior. Therefore, if the net capital inflow proxy is not significant, this will be due to central bank interventions and a situation closer capital controls. Then, the impact of the reserves on the real exchange rate is analyzed to determine the degree of government intervention to limit its volatility.

4. Econometric methodology and results

Like Bassem Kamar and Damyana Bakardzhieva   (2005), it is assumed that the long-run static relationship provided by theory is a linear coposition of the logarithmic transformations of the variables (*V*) chosen:

$$ln\ E_t = c + \beta_1\ lnV_t^1 + \beta_2\ lnV_t^2 + \ldots + \beta_N\ lnV_t^N + \varepsilon_t \tag{6}$$

where *E* is the real exchange rate, *β* are the coefficients to be estimated, *V* are the *N* independent variables chosen in equation (6), c is a constant, and *ε* is an i.i.d., mean-zero, stationary random variable. If the variables in equation (6) are replaced with the notations in Appendix table A1, one obtains:

$$logRI_t = C + \beta_1\ logGCON_t + \beta_2 log\ LIQ_t + \beta_3 logTOT_t + \beta_4\ logOPEN_t + RESIDUAL_t \tag{7}$$

Bearing in mind the small sample and the consequent insufficiency of degrees of freedom, several proxies of openness and capital flows are tested subsequently. The four columns of Appendix table A2 summarize the results from the OLS estimation on three alternative models, each one containing a different proxy (*OPEN* for Model 1, *OPEN1* for Model 2 and *NKF* for Model 3). Model 4 uses the ratio of central bank foreign reserves to *GDP* as a proxy, reflecting the degree of government intervention.

If merely considering open proxies, such as *OPEN*, *OPEN1*, *NKF*, only the *OPEN1* variable in Model 2 turns out to be statistically significant, with a coefficient statistically different from zero. As mentioned earlier, the effect of *OPEN1* on the real exchange rate behavior can be weakened. The net capital inflow proxy (*NKF*)is not significant, this will be due to central bank interventions and a situation closer capital controls in order to limit its volatility.

However, for the rest of the tests, attention shall be restricted to this first specification, using the *OPEN1* variable only. Having considered all of variables in Table A2, Model 4 is the relative convenient to both theories above and econometric test. All of them are significant at less than 5% significance level except 10% of *RES*. It is reason for us to choose Model 4 according to Chinese economic situation.

The coefficients have signs that do not contradict the basic theoretical analysis . The model fits the reality reasonably well, as determined by the appropriate values of the R^2 and the adjusted R^2 .

To finalize this first step of the cointegration test, the RESIDUAL from the equation (7) must be tested for stationarity. If the residual term is stationary, then it can be concluded that the variables are cointegrated. The unit root tests of the RESIDUAL term from equation (7) provided in Appendix table A2 imply that the real exchange rate and the variables from all of the Model are cointegrated.

Commentary on the results. Because the sign of *TOT* is the same as *RI*, it means that the income effect is stronger than the substitution effect in China during the studied term. The reserves *RES* appearing to have significant effect at 10% significance level means that THE PEOPLE`S BANK OF CHINA interventions did completely compensate the fluctuations of capital flows.

Such a position allows the conciliation between a somehow active and, to a certain extent, autonomous monetary policy, relatively liberalized trade and capital flows, and certain stability of the real exchange rate. The authors` believe that such a position is achievable and has been actually practiced by the Chinese authorities.

5. Policy implications

Most central banks in the world intervene in the currency market and thus manage their exchange rate, no matter if this is part of an explicit policy, or a disguised management of a presumed `free float`. Williamson`s logic (2000, 2001) is followed in suggesting that an intermediary regime is both a viable and suitable solution for developing countries that wish to reduce nominal and real exchange rate volatility.

The intermediary framework of exchange-rate management, known as the `basket, band, and crawl` regime, is favored here, and is specified further with the notion of `managed bands` The framework suggested by Williamson(1996) and given the acronym `BBC` by Dornbusch and Park (1999), consists of three elements, discussed here briefly.

The first element defines the center of the bands which should depend on *RI*-real effective exchange rate.

The second element is the crawl. It is generally used to neutralize the inflation differential and to reflect the real adjustment of the economy. It is the crawling, in fact, that is called in this research `management` of the bands. The central bank can manage the behavior and the

direction of its bands in order to achieve its complete economic strategy. The crawl should be used as an essential adjustment policy that would allow for dealing with internal and international imbalances.

The final element, on which more attention will be focused, is the band. Bands are needed to allow for the central parity to adjust in line with changes in the fundamentals without creating distortionary market expectations. The width of the band is a question to be decided by the authorities according to their particular policy program. A possible benchmark for this decision might be the calculation of the average misalignment of the real effective exchange rate.

6. Conclusions

The purpose of this paper was to analyze the behavior of the Chinese real effective exchange rate and its determinants. The results from the econometric tests confirmed the intuition that the Chinese authorities have always managed the exchange rate, whether under the label of `adjustable peg US dollar` or `adjustable reference to a basket of currencies`. They have also operated some capital flows liberalization, but have intervened frequently to counter the excess inflows or outflows. Finally, the Chinese policy-makers have not refrained from using the monetary policy tools for the management of the country`s internal economic balance. Even if this might appear to be inconsistent in the terms, the authors believe that this intermediary policy mix choice has allowed them to steer the Chinese economy through the overlapping series of regional and international political and economic shocks.

There are strong arguments in favor of the implementation of a `basket, band and crawl` regime in China, but one can go further towards the idea of soft bands, suggesting that the parameters of the exchange rate management should not be announced in order to curb all speculative expectations. It is the authors` belief that THE PEOPLE`S BANK OF CHINA has considerable experience in managing the exchange rate, and that it has both the potential and the vision to operate such a policy. The stability that is created by a BBC regime with no pre-announced parameters should counterpart its inherent lack of transparency. As long as the productive investments have a safety net against speculative distortions, and as long as they have confidence in the soundness of the government`s macroeconomic policy, a `managed bands` exchange rate regime will allow China to maintain its internal and external balances.

We put relative productivity into the weights of a basket currencies of RMB exchange rate regime based on the fundamental principal of *HBS*. The gaps, it is important for us to put balance of payments into the mechanism of RMB exchange rate, we wanted to fill. There are a number of possible extensions of our analysis. First of all, the important thing is whether or not the depreciated trends of RMB real effective exchange rate mean that Chinese productivities are lower than sample countries or regions? If it is true, then we may successfully modify the hypothesis of *HBS*. That is, the mechanism of forming real effective exchange rate would mainly base on all over productivity not differentiating traded sector or non traded sector.

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Appendix

Table A1. Notation and description of the initial set of variables

Variable	Definition
RI	Real effective exchange rate index
GCON	Government consumption=general government consumption/GDP
LIQ	Liquidity=M_3/GDP
TOT	Terms of trade=the relative price of exports to the price of imports. 2000=100 for the index.
OPEN	Degree of openness=(Imports+Exports)/GDP
OPEN1	Degree of openness and capital flows indicator (proxy 1)=Imports/GDP
NKF	Net capital flows=absolute value of [(Exports-Imports)/GDP]/Change in gross international reserves(including gold, in current US dollars)/GDP
RES	(Total foreign reserves+Gold)/GDP

Table A2. OLS estimations of the short-medium-run determinants of the Chinese real exchange rate behavior

		Model 1	Model 2	Model 3	Model 4
LGCON	*c*	0.628675	0.607121	0.622665	0.437211
	t	3.730556	3.845932	3.364735	2.10236
	p	0.001	0.0008	0.0026	0.0462
LLIQ	*c*	-0.61089	-0.58646	-1.05441	-1.34384
	t	-2.55104	-3.16196	-9.46985	-6.58299
	p	0.0175	0.0042	0	0
LTOT	*c*	0.793613	0.348359	1.250744	1.295935
	t	1.562927	0.655715	2.571013	2.929214
	p	0.1312	0.5182	0.0168	0.0073
LOPEN	*c*	-0.54864			

	t	-1.95751			
	p	0.062			
LOPEN1	*c*		-0.69688		
	t		-2.80193		
	p		0.0099		
LNKF	*c*			-0.01235	
	t			-0.40565	
	p			0.6886	
LRES	*c*				0.197843
	t				1.708408
	p				0.1005
R^2		0.951963	0.958024	0.944673	0.950334
Adjusted R^2		0.943957	0.951029	0.935452	0.942056
DW		0.836843	0.959784	1.075157	1.418747
ADF		-2.30783*	-2.30102*	-2.66512**	-3.12885*

The dependent variable in static Models 1, 2 and 3 is LRI. C means coefficient of relative variable.

Variables with coefficients that are not statistically significant are given in italics. ADF refers to the unit root tests of the residual

**Significance at 1% level; *significance at 5% level; + denotes significance at 10% level.