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Does the Marshall-Lerner Condition hold in China?*

---Empirical Analysis Based on China's SAM of 2000

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Abstract: This paper made empirical analysis from the angle of general equilibrium to the applicability of the Marshall-Lerner Condition to China. Firstly, beginning with the summary, this paper put forward new angles of the real effective exchange rate of RMB and of SAM to make positive research to the applicability of the Marshall-Lerner Condition to China. Secondly, this paper compiled China's SAM of 2000. Thirdly, this paper computed the practical effective exchange rate of RMB and the elasticity of China's import and export in the metaphase and long term in accordance with the CPI and EPI respectively. Finally, having the SAM of 2000 as the shocked base, this paper studied the influence of China's economy on the whole society and made comparison with the real value of 2001. The main conclusions of this paper are as follows: firstly, in accordance with the computation of the real effective exchange rate of RMB from the angle of either CPI or EPI, the RMB has long been underestimated since 1995 and in present there really exists pressure to appreciate. Secondly, in accordance with the computation, the sum (in absolute value) of China's elasticity of import and export is 1.93531, which is bigger than one and fits the Marshall-Lerner Condition, namely, if the sum (in absolute value) of elasticity of import and export is bigger than one, the depreciation of the home currency will improve the trade balance of this country. While as shown in the results of SAM shock analysis of 2000, we cannot draw the conclusion that the depreciation of RMB computed by the real effective exchange rate will do favor to the improvement of China's trade balance, in other words, the Marshall-Lerner Condition may not be suitable to China and can not be proved in China. Thirdly, the depreciation of RMB from the angle of real effective exchange rate has the most significant influence on the tariff, foreign exchange deposit, net capital inflow and outflow, which are directly connected with the exchange rate. On the one hand, it will be favorable to the tariff, foreign exchange deposit, net capital inflow and outflow computed by the home currency. On the other hand, we cannot draw the conclusion that the depreciation of RMB will do favor to the improvement of foreign exchange deposit if we compute it according to the foreign exchange. Because the practical scale of depreciation of the real effective exchange rate computed in accordance with the CPI and EPI is between 4.42% and 8.39%, while the change scale shocked of foreign exchange deposit we

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computed is between 1.63% and 5.59%, the scale of net capital inflow and outflow is between 2.66% and 7.37%, 0.17% and 1.58%. Obviously, the foreign exchange deposit, net capital inflow and outflow shocked by the depreciation of RMB and computed according to the foreign exchange decreased. Fourthly, the depreciation of RMB computed in accordance with the real effective exchange rate will do favor to the increase of capital formation, personal income tax, the transfer payment from government to enterprises, especially the increase of the transfer payment from government to enterprises will provide proof to our understanding to the abolish from the January 1st 2004 of the policy of Export Drawback that had long been implemented. Fifthly, the depreciation of RMB from the angle of real effective exchange rate will induce the decrease of household investment such as the farmer building houses.

Keywords: Marshall-Lerner Condition; Elasticity; Real effective exchange rate; Social Accounting Matrix (SAM); Shock Analysis.

JEL Classification NO.: F32; P45.

1.INTRODUCTION

The influential theoretical viewpoints of the relationship between exchange rate fluctuation and trade balance researching from the angle of elasticity are as follows: first, Marshall-Lerner condition; second, Lausen-Metzler effect; third, “J” curve effect. The common theoretical contribution lies in illustrating the inner mechanism that under a certain condition the depreciation of domestic currency can improve the trade balance of one country. The theoretical points can be precisely summarized as follows: if without taking account of the changes of national income, the currency depreciation will improve the trade balance under the condition that the sum (in absolute value) of elasticity of demand for import and export of one country is bigger than one, which is called Marshall-Lerner condition; with taking account of the changes of national income the currency depreciation will improve the trade balance under the condition that the improvement of one country’s initiative trade balance induced by the currency depreciation exceeds the improvement scale of import induced by the increase of national income, which is called Lausen-Metzler effect; with taking account of the time lag of the effect of the currency depreciation, owing to the changes of financial capital price induced by the changes of the exchange rate can be completed in a short period time and the changes of global trade of international income induced by the same factor is relatively retarded, thus the currency depreciation may induce that the trade balance will deteriorate in the short term and improve later. The trade time extension of trade balance takes on “J” shape, namely the called “J” curve effect.

In fact, no matter Marshall-Lerner condition, Lausen-Metzler effect or “J” curve effect, they all rest on the assumption of partial equilibrium; therefore, the applicability and effectiveness have been widely emphasized by the scholars and researched at home and abroad. Especially, from the problem that whether the RMB should depreciate or not in middle 1990s when the Southeast Financial Crisis broke out to the argument that whether the RMB should appreciate in the very beginning of 2003 and even at present, those problems made the shock analysis and scenario analysis of the influence of RMB exchange rate changes on the Chinese economy and society endowed with political color. This paper will be based on the Social Accounting Matrix (SAM) and through the shock analysis of the influence of real effective exchange rate changes of RMB on the import and export of China, researched the applicability and effectiveness of Marshall-Lerner Condition to Chinese economy and made literature summary in the second part. In the third part,

this paper shows the analyzing frame. In the fourth part, this paper will research the applicability and effectiveness of Marshall-Lerner Condition to Chinese economy through the results of comparatively static and dynamic analysis on the China's SAM of 2000. Finally, we draw the conclusion.

2. LITERATURE SUMMARY

The approach of elasticity, which is called "imperfect substitute" model, has always been the commonly used method in the analysis of trade balance (Goldstein and Khan, 1985). On this problem, the key is to test the influence range of the trade flow on the relative price, or rather, whether the depreciation of currency will improve the trade balance (Caves et al, 2002). In other words, whether the Marshall-Lerner Condition can be held? The assumption of Marshall-Lerner Condition are as follows: firstly, with other condition unchanged, we take the influence of exchange rate changes on the trade goods; secondly, without considering the capital flow, international balance is equal to the trade balance; thirdly, the supply of trade goods are of full elasticity; fourthly, initially, the trade balance is balanced. Resting on the above assumption, we assume that e_x and e_m denote the elasticity of export and import respectively and then we achieve the following conclusion:

a. if $e_x + e_m > 1$, the depreciation of home currency will improve the trade balance; b. if $e_x + e_m = 1$, the depreciation of home currency will make no difference to the trade balance; c. if $e_x + e_m < 1$, the depreciation of home currency will deteriorate the trade balance.

The earlier elasticity computation of testing the Marshall-Lerner Condition, no matter Marshall-Lerner condition, Lausen-Metzler effect or "J" curve effect, they all based on the assumption of partial equilibrium, therefore; on the positive analysis, to build the econometric models has been naturally the main approach of researchers at home and abroad to research and compute the similar problems (Kanamori, 1977; Jacques et al, 1984; Dai, 1997; Sinha, 2001). In respect of the data acquisition, researcher generally selected relative price indexes (namely, consider the comparison between export price and abroad market price, import price and home market price). As regard to import volume, generally they compute according to the total sum of import and export, and seldom involve sector computation and analysis. In order to realize the dimensionless calculation, most researchers apply relative price and volume and stabilize the initial data through logarithm. Aiming to obtain the constant price elasticity of import and export, researchers generally apply logarithm.[1] Despite that almost all the researchers considered that whether the results met the Marshall-Lerner condition, in the process of building models, comparatively ideal models took income factor. As a matter of fact, the models rest on the assumption of Lausen-Metzler effect. In aspect of the data selection, researchers usually apply yearly or quarterly data, and some time lag for one period to calculate the time lag effect, for instance, Dai (1997), Xu and Shi (2002). And the model of Zhong (2001) estimated the time lag of "J" curve effect.

[1] **If return to the original form, they are Cobb-Douglas form, which is widely accepted and used during the course of theoretical research and positive analysis by modern western economists.**

In respect of computing elasticity value abroad, the existed literatures dealt with most of the long or short term income elasticity of Western Developed countries' imports and exports. In order to make positive analysis to Marshall-Lerner condition, Kanamori (1977) computed the price elasticity and income elasticity of import and export of Belgium, Canada, France, Italy, Japan, Nether land, Sweden, UK and USA, the results of which show that the price elasticity of import is between -0.2 and -1.98, the export between -0.03 and -2.27, the corresponding income price elasticity is between 0.99 and 2.05, 0.61 and 3.55. Hooper et al (2000) computed the price elasticity of import and export in the long term and short term of G7 (including Canada, France, Germany, Italy, Japan, UK and USA). The price elasticity of import in the short term of G7 is between -0[2] and -6, the export between -0.1 and -0.5; the price elasticity of demand for imports in the long term of G7 is -0.06 and -0.9, the export between -0.2 and -1.6. Jacques et al (1984) computed the elasticity of demand for imports and exports of manufactured goods in the short and long term, including, Austria, Belgium, UK, Canada, Denmark, France, Germany, Italy, Japan, Nether land, Norway, Sweden, Switzerland and USA. The price elasticity of demand for imports in the short term is between -0.01 and -1.22, the export between -0.4 and -1.13, the price elasticity of demand for imports in the long term is between -0.25 and -1.22, the export between -0.31 and -1.67.The above researches indicate that almost all the Western Developed countries, with several countries in the short term dissatisfying the Marshall-Lerner condition of "the sum of elasticity of import and export is bigger than one", satisfy the Marshall-Lerner condition in the long term.

In the present years, the approach of applying cointegration method to estimate the elasticity of import and export in the long term and testing whether the Marshall-Lerner Condition is met has been emphasized by researchers (Bahmani-Oskooee, 1998; Bahmani-Oskooee and Niroomand, 1998; Caporale and Chui, 1999; Boyd, D. et al, 2001). The main approach all these papers applied is to estimate the equation of demand for import and export firstly, and then to test whether the sum (in absolute value) of the elasticity of import and export is bigger than one or not. Those models mainly applied the co-integration of Engle and Granger (1987) or the Max-likelihood Analyzing frame and Co-integration Testing frame of Johansen (1991).

In respect of computing the value of elasticity in China, Li (1991) concluded, after analyzing the data of 1970~1983, that the elasticity of imports and exports is -0.6871 and -0.0506 respectively. Chen (1992), after making the regression analysis to the price index and trade volume of China's imports and exports with the data from 1980 to 1990, deduced that the price elasticity of demand for imports is -0.3007, the exports -0.7241. Dai (1997), applying the time series data of export price index, abroad income index, export value index, export volume index, computed that the price elasticity of demand for export of 1981~1995 and 1985~1995 is -1.0331 and -1.1234 respectively, the income price elasticity is 0.6379 and 2.2761 (the statistical test insignificant) respectively. In the light of the non-acquirable statistical data, Dai (1997) quoted the result of China's elasticity of demand for import in the long term that the IMF (1994) computed: -0.3. Zhong (2001) made research on the quarterly data of the volume of import and export, the relative price of import to the home price, the relative price of export to the abroad price, GNP, effective exchange rate of China between 1993 and 1998. The main conclusions stayed as follows: the price elasticity of import in the short term is -0.420, income elasticity is 0.172, price elasticity of export is 0.582 (symbol abnormal), the elasticity of exchange rate is -2.031. There existed

2 zero indicates that the value is very small, near to one, almost inelastic.

obvious time lag of exchange rate changes of home currency affecting to the export and balance of payments: in the first tow quarters, trade balance manifested improved trend, in the fourth and fifth ones, the improvement was more notable. Yu (2000), applying arc elasticity and the data of China's main trade countries and regions, computed China's price elasticity of demand for imports and exports in the short term from 1996 to 1998, including USA, UK, Germany, Hong Kong, Japan, Malaysia, Singapore, Thailand and the whole world. While the conclusions are relatively rough. The maximum of export elasticity is 102.662, the minimum is -79.189, the minimum (in absolute value) is 0.505; the maximum of import elasticity is 32.283, the minimum is-23.133, the minimum (in absolute value) is 0.084. Zhang (2001), applying the time series data from 1985 to 1988, made research on the elasticity of import and export. As the results, firstly, the arc elasticity of imports and exports fluctuate shrewdly. The value of export elasticity shares half positive and negative respectively, the maximum is positive infinite, and the minimum (in absolute value) is 0.13. Secondly, the import elasticities are all positive except for two years, the maximum is 24.37 and the minimum 0.33. Finally, Zhang, in his paper, built linear regression function based on the data. And he substituted abroad rate of income changes with USA counterpart, abroad rate of price level changes with USA rate of produce price index changes, and concluded the China's elasticity of import and export is -0.0566 and -0.0057 respectively.

Because the modern explanation of the traditional elasticity analysis theory introduced macro economic policy and thereafter made effect on the "absorption" of macro-economy, the absorption analysis theory presented by S. Alexandler begin with the definition that the trade balance of one country is the difference between the output and absorption of one country and hence has been the significant instrument to make general analysis on this problem (Salvatore, 1996). However, in the practical performance, there exist the following problems: ① the absorption theory repose the hope of making up the international income and expense deficit in the increase of tax and decrease of national income, which equals to the implementation of tight policy at home and is inconsistent with the full employment; ② the international balance in the absorption theory still refers to the trade balance and ignore the influence of capital flow on the international income and expense; ③ like the elasticity theory, the absorption theory ignore the influence of home money supply and credit creation on the international income and expense (Salvatore, 1996).

Since the general equilibrium theory eases the assumption that "other conditions keep constant" and take several markets meanwhile and discuss all the goods markets and the influence of one another by means of mutual connection but not has a single market as the aim of research. Therefore, the general equilibrium theory has always been seriously emphasized and richly interested by economists (Starr, 1997). Zhang (2003) divided the research of general equilibrium into three main orientations: one is the non-linear general equilibrium theory built by Marshall and Walras, the other is the static and dynamic input-output model built by Leontief, the other is the orientation of macro economic research, which is based on the theory by Debreu (1959). In order to develop the general equilibrium theory from the existence, uniqueness, stability, effectiveness and bargaining to the computable and numerable positive analysis. Economists made every endeavor to do basic work, amongst which the Social Accounting Matrix (SAM) is one of the effective tools to do general analysis. Since 1960s when the first SAM, as one part of the Cambridge Growth Object, has been built under the leadership of Prof. R. Stone, the SAM theory has been fully researched and extended, such as the theoretical basis, frame structure, multiplier decomposition, conjunction analysis, data process, dynamic analysis, liability test (Pyatt, 1988,

1991a,1991b, 2001; Defourny and Thorbecke, 1984; Pyatt and Round, 1979; Round, 1991,2003; Robinson et al, 2001; Golan and Vogel, 2000; Adelman et al, 1991; Stone, 1981; Roland-Holst and Sancho,1995; Byron, 1996; Kim, 2002; Arndt et al, 2000). Meanwhile, with the impel of World Bank, more than 50 nations have built their own SAM, and they have been widely used in the economy development strategy research, income distribution and redistribution research, national o regional fiscal policy making, tax analysis, economic structure analysis, regional development analysis, calamity analysis, national welfare level comparison (Pyatt and Round, 1985; Robinson, 1988; Santos, 2003; Pyatt and Roe, 1977; Adelman and Robinson, 1978; Roland-Holst and Sancho, 1992; Whalley and St.Hillaire, 1983, 1987; Zhang and Mei, 1999; King, 1985; Thorbecke, 1985; Iqubal and Siddiqui, 1996; Kilkenny, 1999). Since SAM can not only satisfy the numeric relationship of “commodity” and “activity” in the inner of social economy but also give attention to the balance of horizontal and vertical. Meanwhile, the system reflected is non-linear and therefore, Keuning (1991) even proposed that SAM be the base of new national account system. The SESAME accounting system presented by Keuning and Verbruggen (2003) based on SAM has been implemented in Europe. Robinson et al (2001) presented that we could use cross-entropy technology to balance and innovate the SAM. As a matter of fact, from the angle of informationism, cross-entropy technology should be applied to make shock analysis.

In China, some textbooks such as *National Economy Statistics* or *National Economy Accounting Principle* introduced some knowledge about SAM, such as Qian (2000). Li et al(1996) compiled the first national SAM on the basis of the National Input-Output Table of 1987 and made comparably detailed introduction of the compilation. Later, Zhai et al(1998) compiled the SAM of 1995. Fan and Zheng (2003a) compiled the Financial SAM of China’s Region. In the present years, with the good endeavor of the economists at home and abroad, the CGE model of China has been the commonly used instrument of researchers to make research on the China’s economy and made some achievements (Zheng and Fan 1999; Li et al, 2000; Zhai et al, 1997; Wang and Zhou 2000; Feng et al, 1996; Zhou and Deng, 1998; Li, 2001; Garbaccio, 1994; Fisher-Vanden and Jorgenson, 2001; Zhang, 1996). The above models all achieved good depict and policy simulation on the analysis of the influence of the policies and measures such as China’s accession to the WTO, environment, tax, finance, endowment insurance, enterprise reform, trade liberty and the “three linkages” across the Taiwan strait. While those models did not study the China’s economy and Social problem from the angle of shock and renovation, then there exists gigantic space in researching the Chinese economic problems from the angel of SAM.

As for the research of the real effective exchange rate of RMB, there includes mainly effective and equilibrium exchange rate. The Effective Exchange Rate (EER) refers to the weighed average exchange rate of the home currency to a pack of foreign exchange. The Real Effective Exchange Rate (REER) eliminates the factor of price on the basis of EER. Seeing from the literature of foreign researchers, the computation of REER can be usually divided into two phases: firstly, the computation of EER and secondly, the elimination of price factor on the basis of EER and work out the REER. At present, there are two main methods to compute EER: first, the method of weighed average, namely, having the trade value of the main trade partners as the weight and achieve the exchange rate after averaging the related sub ones; second, the relatively complicated geometric method (Chinn, 2002). To work out the REER, we must eliminate the price factor, which need to choose the price index, of which they usually refer to Consumption Price Index (CPI), Production Price Index (PPI), and Retail Price Index (RPI), Export Price Index (EPI).

In accordance with the empirical research (Chinn, 2002) any of these four price indexes has defects and merits. Amongst the four indexes, CPI is the most attainable one, but the main defect is that CPI cannot distinguish the tradable goods from the non- tradable. As is known, foreign trade is mainly constituted of tradable goods, therefore, there will exist some error if we compute the REER with CPI, especially to those countries in which the proportion of non-tradable goods is big in CPI, the reliability of REER computed according to CPI. Though the PPI and RPI can tackle the above defects to a certain degree, there still exist defects in PPI and RPI. If one country import and export a big sum of semi-manufactured goods, the REER computed according to PPI and RPI may not reflect well the real competing capability of the goods. Compared with the above three indexes, the EPI should be the most ideal one, but it still has some bugs that if it is different in the structure of export between one country and the trade partner distinctly, the REER computed according to EPI may bear some variance.

The traditional definition of Equilibrium Exchange Rate is the exchange rate when the foreign exchange market cleared and refers to the exchange rate determined by the market power. The related theories analyzed the forming mechanism of exchange rate from the angle of foreign exchange supply and demand. Some researchers studied the forming mechanism of RMB exchange rate with this definition. Lu and Zhang (2000) analyzed the forming mechanism of RMB exchange rate under the Double-Rail System and built the RMB supply and demand model. Through the positive analysis, they maintained that there exist unilateral Granger cause and effect relationship between the adjusted exchange rate and the official exchange rate of RMB. The adjusting market introduced market power in the course of exchange rate determination of RMB, which is the choice of transition stage when the government eases the direct administration. And furthermore, the relatively low adjusted exchange rate compared with the official exchange rate improved the unfavorable influence of the official overestimated exchange rate on the export (Export Tax) and made the exchange rate mechanism play active role in the effective distribution of resources. Xiao (1992) also built a similar model under some assumptions and he pointed out that compared with the market equilibrium with the single exchange rate system, the double exchange rate system has a higher market exchange rate but a small treat value (the sum of foreign exchange transacted according to the market price and official price, namely the total sum of import and export) of foreign exchange when the markets reached the condition of equilibrium in the double exchange rate system, the difference was inverse ratio to the proportion of foreign exchange saving and the official price of exchange rate. The distribution of foreign exchange at the official price can also influence the equilibrium of the parallel markets and the less the exchange rate at the official price got by those importers who had been willing to buy the foreign exchange at a higher price, the higher the exchange rate of the parallel market and the more the total treat value (sum of import and export) in the double exchange rate system. Chen and Wang (2002) made analysis to the market equilibrium of foreign exchange after the RMB nailed the US dollar and researched the equilibrium state if RMB exchange rate beginning with the analysis of the micro-economic behavior of the main bodies in the foreign exchange market. They deduced the supply and demand curves of China's foreign exchange on the basis of China's foreign exchange administration system and the running and supervision of foreign exchange market and even the micro arrangement of system. In the light of the results, they made analysis to the non-equilibrium state of the foreign exchange market and pointed out that governmental restriction to the treat main bodies' owning foreign exchange cash and the fluctuation level of

exchange rate of RMB made a non-equilibrium (non-equilibrium induced by restriction to the fluctuation level and total disequilibrium) foreign exchange market a current phenomenon.

The research on the equilibrium exchange rate of RMB has always been a hotspot. Some scholars maintained that it made no meaning to discuss on which absolute level the nominal exchange rate of RMB should be appropriate exchange rate and the key of the problem is to judge whether the real value of RMB had been over-estimated and the influence on the domestic economic activity through analyzing the change trend of real exchange rate and further to determine the adjusting orientation and scale of exchange rate policy. Qiao (1998) defined that the real exchange rate of RMB was the ratio of the price of foreign commodities in terms of foreign currency transferring to home currency to the domestic price (the 1st form). He believed that since 1993, the real exchange rate of RMB to the main international currency such as the US dollar had been over-estimated about 30% and proposed that the real exchange rate of RMB recover to the level in the very beginning of 1994. While Chen (1999), taking use of the relative purchasing power par value, computed the real exchange rate of RMB to the main international currency such as US dollar and draw the conclusion that since 1990 the real exchange rate of RMB to the US dollar had not been overestimated but underestimated; to stabilize the exchange rate of RMB was neither “policy of rights and transition” nor “political connotation enormously exceed the economic demand”; the exchange rate of RMB to other currency may be overestimated to some degree, but that is because of the depreciation of those currency and they had and would rebound continuously. Therefore, the problem that exchange rate of RMB to those currency had been overestimated needn’t to be solved by means of RMB depreciation. Chen (2000) made comments on viewpoints in the above two papers and maintained that the latter mixed the definition of real exchange rate and nominal exchange rate, furthermore, the overestimation or underestimation of exchange rate had always referring to the nominal one. And he believed it inappropriate to have the real exchange rate as the bases of adjusting exchange rate of RMB, and the cost of exchanging was a better criterion. Zhang and Tang (2001), through the international comparison and analysis of exchange rate of RMB, believed that several economic bodies that were used to make comparison shared an obvious common characteristic that their real exchange rate had potential trend to depreciate in the normal period of development (especially eliminate the influence of twice petroleum crisis) when they stayed in the same stage of development as China. Their main purposes were to boost the foreign trade and they made effect on the current item and would put pressure on the nominal exchange rate.

Chou and Shih (1998) made analysis on the equilibrium of exchange rate of RMB from the angle of purchasing power par value and shadow exchange rate. Fan (1999) computed the REER of RMB and she believed that since 1980 the RMB had always been overestimated to some different degrees. Ma (2000) applied Edwards’s single equation regression and in accordance with the real trade value and relative price level of China’s trade partner computed the index of REER and then he took use of the following variables such as government payment, domestic bank loan value, trade condition, net export, interest rate difference between home and abroad. The estimated value of regression is the equilibrium real exchange rate, by which means he noticed that the exchange rate of RMB had been overestimated since 1995. Whereas at present, the fact that the price decrease induced by the domestic scant demand lessens the pressure of RMB being overestimated, the expansionary fiscal and monetary policy will prick up the degree of RMB being overestimated.

Zhang (1999), on the basis of research for the newly rising theories of equilibrium exchange rate since 1990s, put forward the theoretical frame of equilibrium exchange rate of RMB, and subsequently he computed the exchange rate level of RMB with positive research and estimated the unbalanced degree and policy of exchange rate of RMB. On the following step, he, in a paper of 2000, combined the methods of Edwards (1989) and Elbadawi (1994) and computed the equilibrium real exchange rate of RMB and presented the defects of related analyzing methods for equilibrium exchange rate. Hussain and Radelet (2000) achieved the real equilibrium exchange rate of China by applying ratio of the terminal price of China's trade partners to the CPI of China. They noticed that the real exchange rate was apt to appreciate and this trend was enhanced in the Asian Financial Crisis. Zhang (2001), in the theoretical frame on the basis of Montiel (1999), made computation and analysis on the real equilibrium exchange rate of China between 1955 and 1999. He maintained that before China's reform and opening up, the real exchange rate of RMB were basically overestimated except for years after the Bretton Woods System collapsed while after the reform and opening up the reform of exchange rate system improved the unbalanced state of RMB to a large degree. Lin (2002), applying multiple econometric positive methods, analyzed the equilibrium real exchange rate of RMB from the middle of 1950s to 2000 and computed the equilibrium level and inversion of real exchange rate of RMB. The results indicated that in the period of planned economy, the real exchange rate of RMB had long been overestimated, while after the reform and opening up the real exchange rate had long been underestimated because the equilibrium real exchange rate had been staying in the depreciating state.

Bu and Tyers (2001) applied some other approaches to analyze the equilibrium exchange rate of RMB. They defined the equilibrium exchange rate as an exchange rate level that can maintain the capital net inflow of the capital account in a "sustainable" range. Thereafter they combined the theory of equilibrium exchange rate with the model of the general equilibrium of Devarajan-Lewis-Robinson (DLR for short) and had the domestic price level as the middle variable and then made computation on the equilibrium real exchange rate of RMB from 1987 to 1998.They draw the conclusion that the equilibrium real exchange rate of RMB before 1996 took on a quite flat trend, while in 1996 it obviously ascend, and computing in accordance with the directly marking price, the exchange rate of RMB four years before the Asian Financial Crisis had been overestimated. Bu and Qin (2002) "in order to research the influence of measures such as China's accession to the WTO, decreasing tariff on the equilibrium exchange rate of RMB, they extended the Bi-Commodity Capital Accumulation Model presented by Turnovsky and introduced the currency into the production function and utility function of consumer and then they did comparative static analysis making use of parameter calibration method; they found that decreasing the import tariff had the RMB confronted with the pressure of depreciation, while the government increasing the tax and decreasing the consumption of tradable goods would do favor to the stabilization and addition of RMB; and the results of the positive research indicated that the decrease of abroad real exchange rate or of the growth rate of real money supply would induced the depreciation of the equilibrium exchange rate of RMB. "

All the above positive documents on the equilibrium exchange rate of RMB draw different results because of different approaches, whereas they shared some common points as follows: firstly, in the period of planned economy, the exchange rate of RMB had been overestimated because at that time exchange rate was only looked as the accounting tool to compile the inner accountant plan; secondly, in the period of Asian Financial Crisis, because the RMB insisted on

non-depreciation and continuing nailing the US dollar which was relatively appreciating, the real exchange rate of RMB had been overestimated relative to the equilibrium level; finally, different paper chose different substitute variable on some basic economic facets, but they commonly believed that trade condition and government payment were two of the determinant factors.

In the aspect of the exchange rate of RMB and international balance, Chen (1992), through the results of computation of China's elasticity of import and export, believed that the depreciation or appreciation of RMB made small meaning to improving the trade balance. Dai (1997), through the computation of China's elasticity of import and export, maintained that the depreciation policy implemented from 1981 to 1995 to improve the international balance was successful. Zhong's (2001) research showed as follows: firstly, the exchange rate elasticity of import was basically negative in the long run, which indicated that the depreciation of the RMB may restrain the import in the long run and implied that the "J"-curve effect was not significant in the long term in China; secondly, the influence of exchange rate on the trade balance item suffered a time lag for about one quarter and the trade balance item was improved in the second quarter. The above research all rest on the assumption that the Marshall-Lerner Condition was met and through econometric approaches, they first computed the price elasticity of China's import and export and then added the absolute value of the two elasticity to see whether the sum was bigger or smaller than one. Obviously, the above approach couldn't be used to test whether the Marshall-Lerner Condition was met or not. Furthermore, Fu (1997), Wang (1997), Li and Wang (1999) made modification and interrogation on the premises condition of Marshall-Lerner Condition, the approach to compute the elasticity and the value of application. Fu (1997) extended the partial equilibrium of Marshall-Lerner Condition to the general equilibrium frame and draw the conclusion that if the depreciation of one currency is to improve the trade balance, except for the satisfaction of Marshall-Lerner Condition, there still another two conditions: there existing one policy (for instance the fiscal policy) to keep the nominal price of non-tradable goods constant; the marginal propensity to consume of non-tradable goods equaling to one. None of the above researches has been supported by the positive analysis.

3. ANALYSIS FRAME AND MODEL

3.1 Social Accounting Matrix

SAM applies the form of matrix with row and column crossed, there are eight sectors in the row and as well as in the column: commodity, activity, factor, enterprise, family, government, capital and the rest of world (ROW), at last there is a summation. In the matrix, it is demanded that the purchase, expenditure or money flow from every account must have the corresponding sale, revenue or money flow in the other account. Every non-zero factor in the matrix shares a double meaning, which means income in the row and expenditure in the column. In light of the basic principle that any income or revenue should have a corresponding payment or cost, the income expressed in the row in the matrix should equal to the payment in the column.

SAM can be expressed with a matrix:

$$X = \{x_{ij}\} \tag{1}$$

where x_{ij} denotes the income that the account i got from the account j, correspondingly means the expenditure of j

The treat of commodity and service flows from the row to the column, while the capital from the column to the row. The value in the row must equal to the column, namely:

$$\sum_j x_{kj} = \sum_i x_{ik} \tag{2}$$

Eq.2 indicates SAM satisfies the Walras Law: if all the accounts except one are balanced, the last account is balanced too. The relationship among accounts in SAM can be expressed with one economic Income Circulation Table (as shown in Table 1).

Commodity denotes the combination of all kinds of products, and the income of it comes from the intermediate demand of manufacture sector, family's terminal consumption, governmental terminal consumption, investment and export; the expenditure is used for national output, tariff collected by the government and the import from abroad.

Activity refers to the production activity and the main bodies are manufacture sectors. The income comes from the domestic output of the product, and the expenditure is used for the intermediate demand of the manufacture process, the rewards paid to the manufacture factors and the indirect tax.

Factor mainly refers to the manufacture factors usually including capital and labor. The income is the rewards of factors and the expenditure includes the capital income of enterprise and the labor income of the family.

Income of enterprise refers to the capital income enterprises got in the process of manufacture and transfer payment from the government, the expenditure of enterprise includes the transfer payment of enterprise to the families, enterprise tax and deposit.

Income of family comes from the labor income, transfer payment from the government and from the enterprise and the remittance from the abroad; the expenditure is used for the consumption of family, direct tax, deposit and purchase from abroad.

Income of government mainly includes all kinds of tax, including tariff, indirect tax from manufacture sector, enterprise tax and direct tax; the expenditure of government is used for the terminal consummation of government, transfer payment to enterprises and families and the deposit of government.

Income of capital comes from the enterprise deposit, family deposit, government deposit and the net capital inflow; the expenditure of capital is used for investment.

Income of the ROW comes from import, abroad purchase of family; the expenditure of the ROW is used for export, abroad remittance and net capital inflow. All the above factors can be expressed as Table 1.

Table 1 Structure of Social Accounting Matrix

	Commodity	**Activity**	**Added Value**	**Enterprise**	**Family**	**Government**	**Finance**	**Capital Formation**	**ROW**	**Total**
Commodity		Intermediate Input			Family Consumption	Government Consumption		Capital Formation	Export	Total Demand
Activity	Total Output									Total Output
Added Value		Added Value								Added Value
Enterprise			Capital Income			Transfer Payment 1	Enterprise Loan			Enterprise Revenue
Family			Labor Income	Transfer Payment 2		Transfer Payment 3	Family Loan			Family Income
Government	Tariff	Indirect Tax		Enterprise Income Tax	Personal Income Tax		Government Loan			Government Income
Finance				Enterprise Saving	Family Saving	Government Saving			Foreign Exchange Saving	Financial Debt
Capital Formation				Enterprise Investment	Family Investment	Government Investment	Domestic Loan		Net Capital Inflow	Total Investment
ROW	Import						Net Capital Outflow			Foreign Exchange Payment
Total	Total Supply	Total Output	Added Value	Enterprise Payment	Family Payment	Government Payment	Financial Asset	Total Sum of Capital Formation	Foreign Exchange Income	

3.2 The Innovation Principle of Social Accounting

Any system is dynamic and developing, therefore the innovation of SAM must made innovation to the former SAM with the acquisition of basic knowledge so as to get the latest, instantaneous and all-round information of national economic account. Robinson et al. (2001) presented the following innovation cross-entropy optimizing equation:

Object function:

$$\min_{\{A,W1,W2\}}\left[\sum_i\sum_j A_{i,j}\ln A_{ij}-\sum_i\sum_j A_{ij}\ln\overline{A}\right]$$
$$+\left[\sum_i\sum_j W1_{i,j}\ln A_{i,j}-\sum_i\sum_j W1_{i,j}\ln\overline{W1}_{i,jwt}\right] \quad (3)$$
$$+\left[\sum_i\sum_j W2_{i,j}\ln A_{i,j}-\sum_i\sum_j W2_{i,j}\ln\overline{W2}_{i,jwt}\right]$$

Restriction condition:

Firstly, SAM function.

$$T_{i,j}=A_{i,j}\bullet(\overline{X}_i+e1_i) \quad (4)$$

where $\overline{X}$ is the prophase value of the column sum of SAM; $e1_i$ is the error value of the column sum of SAM.

Secondly, the consistency of row sum of SAM, namely according to the eq.1, to consider error item.

$$Y_i=\overline{X}_i+e1_i \quad (5)$$

Thirdly, the definition of row sum error.

$$e1_i=\sum_{jwt}W1_{i,jwt}\bullet\overline{v1}_{i,jwt} \quad (6)$$

Fourthly, definition of sum of weight of error of row sum.

$$\sum_{jwt}W1_{jwt}=1 \quad (7)$$

Fifthly, row sum.

$$\sum_j T_{i,j}=Y_i \quad (8)$$

Sixthly, column sum.

$$\sum_i T_{i,j}=\overline{X}_i+e1_i \quad (9)$$

Seventhly, accessional information.

$$\sum_i\sum_j G_{i,j}^{(k)}T_{i,j}=\gamma^{(k)}+e2_k \quad (10)$$

Eighthly, definition of error of macro economic gross.

$$e2_i=\sum_{jwt}W2_{i,jwt}\bullet\overline{v2}_{i,jwt} \quad (11)$$

Ninthly, definition of sum of weight of error of macro economic gross.

$$\sum_{jwt} W2_{jwt} = 1 \tag{12}$$

where e_i means the error of gross control, $w_{i,jwt}$ means the weight of error computed in the course of cross-entropy ($\sum_{jwt} w_{i,jwt} = 1$), $\overline{v}_{i,jwt}$ means the error brace set, jwt is defined the range, weight of brace set of error distribution must be used to measure every error, $\overline{w}_{i,jwt}$ is the prophase weight of the error brace set, $\sum_{jwt} \overline{w}_{i,jwt} = 1$; $\overline{X}$ is the prophase value of column sum, $e1_i$ is the error value of column sum of SAM, $\overline{W1}$ is the error distribution of the initial row sum, $\overline{W2}$ is the error distribution of macro economic gross, k denotes the number of accessional macro economic gross information, γ is the gross value of macro economy, G is an $n \times n$ gross matrix, and the corresponding factor with macro economic gross value is one, others are zero, $e2$ is the error value of the corresponding macro economic gross.

3.3 Shock Analysis of Exchange Rate Change on the SAM

The initiate shock of exchange rate change on the macro SAM is processed following two steps:

Firstly, the exchange rate change will influence the import, export, FDI, abroad remittance and tariff, all together five accounts in the SAM shown in Table 1. While the direct shock on FDI and abroad remittance is shown that the amount in terms of home currency will change by the same ratio as the exchange rate, and can be expressed as follows:

We assume λ is the exchange rate of foreign currency to home currency, then the changing ratios of them after the RMB appreciated are $-\frac{\lambda}{d\lambda}$, $-\frac{\lambda}{d\lambda}, \frac{\lambda}{d\lambda}$;

Secondly, in the aspect of import, export and tariff, in accordance with the purchasing power par value theory, the exchange rate is the ratio of the prices between two countries, namely,

$$P = \frac{p_w}{\lambda} \tag{13}$$

where P is the home price, p_w is the abroad price, hence $\frac{dp}{p} = \frac{p_w}{\lambda^2}$, through which, we can deduce:

$$\frac{dp/p}{d\lambda/\lambda} = -1 \tag{14}$$

The above equation shows that the ratio of price change is the same as that of exchange rate change, but in the opposite direction and the gist of exchange rate change is one kind of price changes. The appreciation of RMB will deduce the price of exporting goods increasing, and that of importing goods decreasing, and with the effect of elasticity of demand for import and export, the above two changes will determine the changes of the total value of import and export. Assuming that TR is the total value of import and export, Q is the total volume of import and export, ε is

the price elasticity of demand, and then, $\frac{dTR}{dp} = Q + p * \frac{dQ}{dp} = Q(1 + \frac{p}{Q} * \frac{dQ}{dp}) = Q(1 - |\varepsilon|)$,

hence, $\frac{dTR}{dp} = \frac{dp * Q(1 - |\varepsilon|)}{p * Q} = \frac{dp}{p}(1 - |\varepsilon|) = -\frac{d\lambda}{\lambda}(1 - |\varepsilon|)$, and for further, we can achieve the determinate formula of exchange rate change and demand elasticity to the import and export value change. Therefore, the change rate of total export value η_E and import value η_I after the RMB appreciation are

$$\eta_E = -\frac{d\lambda}{\lambda}(1 - |\varepsilon_E|) \tag{15}$$

$$\eta_I = -\frac{d\lambda}{\lambda}(1 - |\varepsilon_I|) \tag{16}$$

respectively.

By virtue of the shock of exchange rate change to the macro SAM, this will deduce that the income and expense of the related sector are unequal, and for the time lag effect of "J-curve" effect, the macro SAM cannot but experience a course from non-equilibrium to equilibrium. Therefore, if we apply cross-entropy technology, having the initial change of the above five accounts as newly supplying information, the equilibrium solve of the equilibrium state can be achieved.

4. EMPIRICAL ANALYSIS

4.1 Evaluation of China's Real Effective Exchange Rate[3]

4.1.1 Selection of Formula

The computation of effective exchange rate in this paper applied the first approach mentioned in the literature summary, namely, formula of weighed average[4].

$$EER = \sum_{i=1}^{n} E_i W_i \tag{17}$$

where n refers to the amount of a pack of foreign currency, E_i is the exchange rate of the home currency to the currency i, W_i is the weight of foreign currency i, which is determined by the total trade value between the home and the country i. The common explanation is the ratio of the trade value of the home with the country i to the total trade value of this country.

Since what we intend to achieve is the effective exchange rate by weight of trade and mainly the ratio of the RMB appreciation and depreciation, here we express them in terms of index. The definition of nominal effective exchange rate index by weight of trade is as follows:

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[3] This part is built up supported by Mr.Jihua Dong of Beihang University.

[4] From the viewpoint of theory, the approach of geometric average should be more precise for reason that it takes account of the influence of both the import value and export value of one country on the effective exchange rate respectively. However, for the following two reasons we abandon the approach of geometric average: firstly, on the "third market weight" which is the key variable to compute the effective exchange rate using this approach, Chinn (2002), the first presenter of this approach, didn't offer detailed explanation; secondly, on the β in this formula which is also key variable to compute the effective exchange rate using this approach, Chinn didn't offer precise explanation.

$$EER_{index} = \sum_{i=1}^{n} \left(\frac{Trade_i}{Trade_c} \right) \times \left(\frac{E_i}{E_{bi}} \right) \times 100 \quad (18)$$

where EER_{index} means the nominal effective exchange rate index, $Trade_c$ means the total foreign trade value of China in that year, $Trade_i$ means in those selected countries, in that year, the total trade value of country *i* with China. E_i is the exchange rate of currency *i* to the home currency.[5] E_{bi} refers to the basic stage exchange rate of the currency *i* to the home currency. $\left(\frac{E_i}{E_{bi}} \right) \times 100$ is the exchange rate index. Assuming a criterion for the basic stage and the EER_{index} is 100, then, if the EER_{index} in one certain year is bigger than 100, it manifests that the home currency depreciates related to the basic stage; and less than 100, it appreciates.

What we want to achieve is the real effective exchange rate of RMB, therefore, in the process of computation, we should filtrate the factor of price. We use purchasing power par value formula, namely, $e = \frac{E\overline{P}}{P}$, amongst which *E* is the nominal exchange rate , $\overline{P}$ is the abroad price level, *P* is the home price level.

4.1.2 Selection of Typical Countries

We select the period from 1994 to 2002[6] as the time sample, and USA, Canada, Japan, Korea, Hong Kong, Malaysia, Thailand, Indonesia, Singapore, Australia, Germany, France, UK, as the country sample that includes the four most significant trade partners, namely, USA, Japan, Hong Kong and Germany and the five newly developed industrial countries which is greatly elastic in the trade with China: Indonesia, Thailand, Malaysia, Singapore and Korea. In the past eight years, China's trade with these thirteen countries maintain steady trend of increasing and seeing from the average weight, the ratio of the trade value between China and these thirteen countries to the trade value between China to the rest of the world exceeds 70%. In accordance with the Big Sample Law, we believe these countries are typical in the course of computation of real effective exchange rate of the RMB.

4.1.3 Selection of Data

In this paper, we firstly compute the real exchange rate of the RMB and then the real

[5] In this paper, the exchange rate we applied is expressed by direct price marking, namely, how much domestic currency equals to one unit of foreign currency.

[6] As to the reason for selection of the period between 1994 and 2002 but not between 1982 to 2002, we consider like this: in accordance with the formula $e = \frac{E\overline{P}}{P}$, without consideration of the foreign price level $\overline{p}$, the factors that will make effect on the real exchange rate of this country are the nominal exchange rate *E* and the home price level of it. During the period of 1982-1994, the price level of China had been keeping a trend of increasing and in this period, the price level fluctuated shrewdly, so the price level *P* is the main factor that influences the real exchange rate of china. During the period of 1994-2002, the price level in China had been taking on a trend of steady deflation, and by virtue of the exchange rate of the RMB nailing to that of the US dollar and the US dollar, in this period, taking on an obvious trend of appreciation, the exchange rate of the RMB to other countries manifested an obvious trend of appreciation though the nominal exchange rate to the US dollar *E* was relatively steady. In this paper, since we consider mainly the relationship between the nominal exchange rate and the real exchange rate of the RMB, we selected the period of 1994-2002.

effective exchange rate index. In other words, we firstly solve:

$$e = \frac{E\overline{P}}{P} \tag{19}$$

and then

$$EER_{index} = \sum_{i=1}^{n}\left(\frac{Trade_i}{Trade_c}\right)\times\left(\frac{e_i}{e_{bi}}\right)\times 100 \tag{20}$$

The above eq.20, relative to eq.18, substitutes the nominal exchange rate E with the real exchange rate e.

Firstly, as to the selection of nominal exchange rate E, in light of "International Financial Statistics" of IMF, we listed the exchange rate of the currency of those fourteen countries including China to the Special Drawing Right (SDR) of IMF. Then we deduce the nominal exchange rate of the RMB to that of those thirteen countries by the same means. What is required to illustrate is since 1999, the EURO has been circulate formally and in order to make the currency in the EURO region out of circulation eventually till Jan. 1st 2002, the EU prescribed that one EURO equals to 1.95558 Deutsche Mark and 6.55957 FRANC. Therefore, the exchange rate of DM and FRANC to the SDR are achieved through the change ratio of the exchange rate of EURO in that year to SDR and to Deutsche Mark and to FRANC.

Secondly, as to the price index P and $\overline{P}$, here we applied two price systems. The first one is Consumption Price Index (CPI) system which is also the most commonly used price index to make research on the effect exchange rate of the RMB. Since the data revealed by the IMF are all having the year of 1995 as the basic stage, we here computed the real effective exchange rate index of the RMB by CPI are having the year of 1995 as the basic year.

However, we believed that the CPI bears an inner restriction, which is that in this index non tradable goods occupy a relatively large proportion. While in the foreign trade, most of the transaction is between tradable goods, the real effective exchange rate in terms of CPI will bear some variance. If we substitute the CPI with Export Price Index (EPI), the variance will be narrower. Therefore, the second system we are to introduce is EPI system. Because the EPI data of China is quite scant, we substitute it with the relatively similar Industrial and Agricultural Goods Comprehensive Price Index[7]. In this paper, the EPI of other thirteen sample countries comes from "International Financial Statistics", and by the same token, we still have the year of 1995 as the basic stage.

Finally, as to the trade weight, the trade value of China with those thirteen countries and the foreign trade value in that year are from "International Financial Statistics" of IMF and China's Statistical Year Book of the corresponding stage.

4.1.4 Computation Results and Concise Analysis

Eventually, we achieve the real effective exchange rate (REER) by CPI and by EPI are shown in the following Table 2 and Table 3.

[7] Data source: the Industrial and Agricultural Goods Comprehensive Price Index of 1994-2000 is from the National Statistic Bureau of P.R. China 2001 Yearly Data Chapter 9 9-1, and we suppose that the Industrial and Agricultural Goods Comprehensive Price Index of 2001 and 2002 is the sane as that of 2000 (Fan Yang, 2003). Table 4 in the appendix

Table 2 China's Real Effective Exchange Rate by CPI

Time	CPI	Sino-American Nominal ER	REER
1994	87.11	861.87	116.78
1995	100	853.07	100.00
1996	106.09	831.42	89.48
1997	106.94	828.98	78.65
1998	104.16	827.91	84.91
1999	101.04	827.83	87.55
2000	99.52	827.84	83.68
2001	99.82	827.70	79.90
2002	98.02	827.70	85.17

Table 3 China's Real Effective Exchange Rate by EPI

Time	EPI	Sino-American Nominal ER	REER
1994	104.6	861.87	91.67
1995	100	853.07	100
1996	101.9	831.42	92.77
1997	107.9	828.98	74.46
1998	114.8	827.91	68.53
1999	127.1	827.83	61.6
2000	130.4	827.84	56.43
2001	130.4	827.70	52.76
2002	130.4	827.70	54.92

Firstly, the real effective exchange rate indexes of 2000 and 1999 by CPI are 83.68 and 87.55 respectively, then as to 2000, compared with 1999, the RMB depreciated by 4.42% [(83.68-87.55)/87.55].

Secondly, the real effective exchange rate indexes of 2000 and 1999 by EPI are 56.43 and 61.60 respectively, then as to 2000, compared with 1999, the RMB depreciated by 8.39% [(56.43-61.60)/61.60].

We can find from the above analysis since 1995, including the period of Southeast Financial Crisis, the RMB have always been appreciating, in other words, the RMB has been underestimated. The range of underestimation in 2000, compared with 1999, is different achieved by different price indexes and the scope is between 4.42% and 8.39%.

4.2 Estimation of China's Elasticity of Import and Export

4.2.1 Selection of Model

In accordance with the demand theory, the export volume of one country depends on the abroad income level and the prices of exporting goods, namely,

$$E = f(Y, P_e / P_w) \tag{21}$$

where E denotes the export volume of this country, Y the real income level of other country in the

world, P_e the export price index, P_w the total price index of the world market. The bigger Y is, the more the demand for abroad doubtlessly. Therefore, $\partial E/\partial Y > 0$. If the export price of this country Pe is comparatively higher than the world market price, owing to the existence of competition, it will be difficult to export, thus $\partial Y/\partial(P_e/P_w) < 0$. To be simple, generally we express the eq.21 as the following form:

$$\ln(E) = \beta_0 + \beta_1 \ln(P_e / P_w) + \beta_2 \ln(Y / P_w) \tag{22}$$

where the coefficients β_1 and β_2 denote the price elasticity and income elasticity of export respectively $\beta_1<0$， $\beta_2>0$。

In the same way, the import of one country M depends on the income level of this country X and the relative price between prices of importing goods P_m and prices of home market P_d. If we express this with logarithm form, then we get:

$$\ln(M) = \gamma_0 + \gamma_1 \ln(P_m / P_d) + \gamma_2 \ln(X / P_d) \tag{23}$$

where P_d denotes the home price index, the coefficients γ_1 and $\gamma_2$denote the price elasticity and income elasticity of import, $\gamma_1<0$， $\gamma_2>0$。

Dai (1997) put forwarded that the volume of export cannot be observed directly. Therefore, so as to utilize the observable data to make regression analysis, we assume that the changes of export demand follow the assumption of stock adjustment, namely, we take into consideration one phase of time lag when compute the volume of export. Hence, the equation (22) can be changed to:

$$\ln(E) = \beta_0 + \beta_1 \ln(P_e / P_w) + \beta_2 \ln(Y / P_w) + \beta_3 \ln(E(-1)) \tag{24}$$

where E(-1) denotes the export volume for one-phase time lag, β_3 denote the adjusting coefficient of export demand, $\beta_3>0$. The bigger $\beta_3$is, the more complete the export adjustment, the more the export volume reflects the export demand.

In the same way, we can also maintain that the changes of import demand follow the assumption of stock adjustment. Considering that we have long been affected by the nation's Foreign Trade Policy. Therefore, we improve the model by importing another index of Sum of Tariff to reflect the influence of Foreign Trade Policy (for instance, Tariff Barrier, Non-Tariff Barrier)[8], then the eq.23 can be changed to:

$$\ln(M) = \gamma_0 + \gamma_1 \ln(P_m / P_d) + \gamma_2 \ln(X / P_d) + \gamma_3 \ln(M(-1)) + \gamma_4 \ln(TAR) \tag{25}$$

where M(-1) means the import volume for one-phase time lag, TAR means the total tariff value, coefficient γ_3 is the adjusting coefficient of import demand, $\gamma_3>0$, the bigger γ_3 is, the more complete the import adjustment is and the more the import value can reflect the import demand, coefficient γ_4 is the tariff elasticity, which shows the sensitivity of import value to tariff, $\gamma_4>0$.

4.2.2 Model of China's Export Elasticity

Table 4 lists the related statistical data of variable needed in this paper. We use for reference

[8] **As far as the total sum of tariff is concerned, it itself convey the information of both the tariff and import volume, then we can illustrate this variable as the comprehensive reflection of the Import Policy of one country (including, Tariff Barrier, Non-Tariff Barrier)**

the modeling experiences of the above summary at home and abroad and all the data in this paper is used in terms of indexes and choose the year of 1990 as the basic stage. The indexes of export value X is obtained from the statistical data from Chinese Customs and we refer to Dai's (1997) experiences in collecting data: the index of export price is obtained in the way that home retailing price index times exchange rates and then expressed into index. Index of export volume $E = R/(P_e / P_w)$ is obtained in the way that we average the sum of abroad price index and abroad income index (selecting data of USA and Japan, the most two trade partners of China)

Table 4 Basic Data for Price Elasticity Model of China's Export

Year	Index of Export Value	Index of Export Price	Index of Export Volume	Index of Abroad Price	Index of Abroad Income
1981	35.44	185.35	24.65	77.59	74.13
1982	35.95	167.07	26.6	80.9	74.24
1983	35.8	145.34	29.7	82.92	76.66
1984	42.1	143.92	34.18	85.58	80.74
1985	44.05	130.4	38.42	87.93	83.81
1986	49.83	112.39	49.83	88.99	87.07
1987	63.51	117.2	59.83	90.57	90.22
1988	76.53	125.24	65.94	92.67	94.48
1989	84.61	129.7	68.01	95.93	97.27
1990	100	100	100	100	100
1991	115.71	89.12	125.14	103.75	101.17
1992	136.8	88.57	145.36	106.25	102.64
1993	147.75	93.95	144.95	108.5	103.52
1994	194.88	75.21	235.04	110.25	107.05
1995	239.62	87.86	243.95	111.8	109.32
1996	315.39	81.39	346.62	110.2	113.59
1997	380.2	86.19	394.58	110.85	116.26
1998	381.77	91.7	372.40	111.06	118.94
1999	405.25	101.53	357.03	111.61	121.62
2000	517.46	104.16	444.38	110.59	124.30
2001	552.32	104.16	474.32	110.4	126.98
2002	675.79	104.16	580.35	110.87	129.66

Sources: data of 1981-1995 are from Zuxiang Dai (1997), PP.60 Table 2, the rest are from past years Chinese Statistics Year Book (1981-2002), Chinese Customs Year Book (1981-2002) World Economy Year Book (1990-2001) and with calculation.

We bring the data from Table 4 to equation (24), and can get the price elasticity model of China's export eq.26.

$$\ln(E) = 1.617090 - 0.857932 \ln(P_e / P_w) + 2.070160 \ln(Y / P_w) + 0.702293 \ln(E(-1)) \quad (26)$$

(5.233082) (-4.821133) (2.931140) (10.85010)

$R^2 = 0.994809$， $\bar{R}^2 = 0.993893$， DW=1.761853

Judging from the statistical test results, the model is reliable. The model indicates that the price elasticity of demand for export in China is -0.857932, distinctly different from zero, and the absolute value is less than one. In other word, the exporting goods price in terms of foreign currency increase by 1%, the demand for export will decrease by 0.857932% correspondingly, but the total revenue will increase.

4.2.3 Model of China's Import Elasticity

Table 5 lists the related statistical data of variable needed in this paper. As same as export model, all the data are applied in terms of indexes form, and choose the year of 1990 as the basic stage. The prices of import are deduced from the past years data revealed on the China's Statistical Year Book. The indexes of import volume are deduced in accordance with the data from the China's Statistical Year Book and have been divided by the exchange rate before expressed in terms of index form. The indexes of home price have been deduced from the indexes of home retailing price before expressed in terms of index. The indexes of tariff have been deduced from the past years total tariff before expressed in terms of index. The indexes of exchange rate have been deduced from the nominal exchange rate of RMB to US dollar before expressed in terms of index.

Table 5 Basic Data for Price Elasticity Model of China's Import

Year	Index of Import Volume	Index of Import Price	Index of Home Price	Index of Home Income	Index of Exchange Rate	Index of Tariff
1985	205.12775	38.61261	60.53	48.33	61.39405	129.0548
1986	166.36403	48.35099	64.47	55.00	72.18598	95.35249
1987	144.80113	55.9395	69.19	64.50	77.81611	89.53525
1988	155.89192	66.46181	82.20	80.49	77.81611	97.49072
1989	146.55593	75.64569	96.97	91.17	78.71509	114.1689
1990	100	100	100.00	100.00	100	100
1991	101.15114	118.2211	103.39	116.55	111.2916	117.7788
1992	115.48501	130.8082	109.99	143.62	115.291	133.7966
1993	114.98596	169.482	126.15	186.73	120.4633	161.2917
1994	71.547036	302.918	156.54	252.10	180.1869	171.4861
1995	73.426674	337.2117	183.29	315.28	174.5902	183.5293
1996	75.336789	345.4553	198.49	366.00	173.8209	189.8245
1997	77.729491	343.3515	204.06	401.46	173.3108	200.9245
1998	79.937526	328.8654	202.42	422.39	173.0871	196.8681
1999	96.799518	320.8876	199.58	442.46	173.0703	353.5815
2000	127.89499	329.9261	200.36	482.36	173.0724	471.9703
2001	140.21061	325.6259	201.76	524.67	173.0432	528.5957
2002	173.75883	318.4429	200.12	564.97	173.0432	442.9093

Sources: China's Statistical Year Book (1981-2003) China's Customs Year Book (2002) with calculation by ourselves.

We bring data from Table 5 to eq.23, and then can get the price elasticity model of China's export eq.25.

$$\ln(M) = 1.873882 - 1.077378\ln(P_m / P_d) + 0.508026\ln(X / P_d)$$
$$(2.331477) \quad (-5.093453) \qquad (3.516265)$$
$$+0.399601\ln(M(-1)) + 0.194608\ln(TAR) \qquad (25)$$
$$(2.964126) \qquad (1.149615)$$
$$R^2 = 0.925102, \quad \bar{R}^2 = 0.900137, \quad \text{DW}=1.657410$$

Judging from the statistical test results, the model is reliable except for the tariff elasticity. Seeing from the metaphase and long term, the price elasticity of demand for import is -1.077378, distinctly different from zero, and the absolute value is bigger than one to a small degree.

The results of the above econometric model shows that the elasticity of export and import in China are -0.857932 and -1.077378, and the sum 1.93531(in absolute value) is bigger than one and satisfy the Marshall-Lerner condition: a. if $e_x+e_m>1$ the depreciation of home currency will improve the trade balance of this country.

4.3 Shock Analysis and the Computation Results

4.3.1 Basic Data Base: compilation of 2000 SAM of China

Table 6 Social Account Matrix of China in 2000 (Blanced)

	Commodity	Activity	Added Value	Enterprise	Family	Government	Finance	Capital Formation	ROW	Total
Commodity		1649420000			443715500	117090900		335309700	231989500	2777526000
Activity	2574302000									2574302000
Added Value		789344500								789344500
Enterprise			290148600			8965841.34	34664750			333779200
Family			499195900	47122800		9214829.25	21052420			576586000
Government	6203408.225	135537100		17521160	9564313.95		0			168826000
Finance				85250100	84646130	12459950			4408450.51	186764600
Capital Formation				183885100	38660050	21094500	64720630		26949370	335309700
ROW	197020500						66326830			263347300
Total	2777526000	2574302000	789344500	333779200	576586000	168826000	186764600	335309700	263347300	

In light of the above definition, we apply the data of China's Input-Output Table of 2000 revealed in the China's Statistic Year Book (2003) and the Statistic Transaction of Labor and Social Security Development of 2001 from the National Labor and Security Bureau, Table of Condition of Tax Department , The Probe Statistic Year Book of China's Price and the Income and Expense of the Township Citizen, The Probe Statistic Year Book of China's Price and the Income and Expense of the Rural Citizen, Annals of The People's Bank of China 2000, The Table of RMB Credit Income and Expense in Financial Institution, Table of China's International Balance. In

accordance with the definition in Table 1, we acquire the initial table of 2000 SAM of China, and later by balancing this table by Cross-Entropy technology; we acquire the balanced table of 2000 SAM of China (as shown in Table 6). We apply the Wald test and Lagrange multiplier test and likelihood ratio difference Test presented by Byron (1996) and the results are significant.

4.3.2 Shock Computation Results

The above conclusion of computation shows that seeing from the real effective exchange rate of the RMB, compared with 1999, the RMB depreciated in 2000. However, different price index, different depreciation range, which is between 4.42% and 8.39%. In accordance with the conclusion of Zhong et al (2000, pp.41), "positive effect of the exchange rate change of home currency on the export and international balance of China has distinct time lag, around one or two quarters after the exchange rate changed, the trend of improvement in export and international balance will emerge and after four or five quarters this trend will be evident." In other words, the effect of the RMB depreciation on the international balance improvement will emerge in the next year. Therefore, the effect of the RMB depreciation in 2000 should be proved in 2001.

We bring the elasticity of import and export into eq.15 and the upper limit and floor level of the RMB depreciation by real effective exchange rate into the eq.16, and then we can acquire the import value, export value, FDI, abroad remittance and tariff of 2000 on the condition that the real effective exchange rate remains constant. Thereafter, we can acquire two initial table of 2000 SAM, and it is evident that this table will not be balance for addition of new information. And by the former Cross-Entropy technology, we balance it and get two balanced SAM, comparing with Table 6, we get Table 7 and Table 8.

4.3.3 Research Conclusions

Table 7 shows: we cannot draw the conclusion that the RMB depreciation by real effective exchange rate will improve the trade balance of China, in other words, the Marshall-Lerner Condition does not surely fit China since the Marshall-Lerner condition can not be proved in China. However, the depreciation of the RMB will make positive effect on both export and import, especially on import, which is consistent with the real value. Meanwhile, the fluctuation degree of the real value is larger than the simulated value for the reason that whether by CPI or by EPI, the solutions for the SAM shock analysis are equilibrium solutions and the random if the real value is larger and the fluctuation degree should be larger. The trend to change is consistent with the simulated conclusion and can be tested by positive research. In other words, the fluctuation degree of the real effect is magnified compared with the equilibrium value.

Table 8 shows: firstly, the related economic parameters fluctuate in the same orientation of that of the equilibrium value after the RMB depreciated, while the fluctuation degree of the real effect is magnified compared with the equilibrium value. Secondly, the depreciation of the RMB by real effective exchange rate affects the most the parameters directly-related with the exchange rate such as tariff, foreign exchange saving, net capital inflow and outflow. On the one hand, it will do favor to the increase of tariff, foreign exchange saving, net capital inflow and outflow in terms of the home currency. On the other hand, if they are expressed in terms of foreign currency, we cannot achieve that the depreciation of the RMB will be favorable to the foreign exchange saving for the reason that the real depreciation degree of the real effective exchange rate of 2000 is between 4.42% and 8.39% by CPI and EPI, while the change rate of foreign exchange saving by shock analysis is between 1.63% and 5.59% and that of net capital inflow and outflow are between 2.66% and 7.37% and between 0.17% and 1.58% respectively. Obviously, the foreign exchange

saving, net capital inflow and outflow in terms of foreign currency shocked by the depreciation of the RMB are decreasing. Thirdly, the depreciation of the RMB by the real effective exchange rate will be favorable to the increase of capital formation, personal income tax and the transfer payment of the government to the enterprises, especially the increase of the transfer payment of the government to the enterprises offers positive proofs for our understanding of the policy of canceling "Export Drawback" since January 1st 2004. Fourthly, the depreciation of the RMB by the real effective exchange rate will deduce the decrease of family investment such as the self-built houses. Fifthly, it will be hard to tell the influence of the depreciation of the RMB by the real effective exchange rate on the transfer payment of the government to the families, enterprise loan, domestic loan and the enterprise income tax.

Table 7 Change Rate of the Shock Influence of the Real Effective Exchange Rate on the International Balance (%)

Parameter	Result by CPI	Result by EPI	2001/2000 (in the real value)
Export	1.58	2.75	6.75
Import	2.21	3.83	8.18
Trade Balance	-0.63	-1.08	-1.43

Note: ① In order to make the analysis easy, we substitute the change rate of trade balance with the difference of export change rate minus import change rate; ② 2001/2000 (in the real value) comes from China's Statistic Year Book (2003), China Statistics Press.

Table 8 Change Rate of the Shock Influence of the Real Effective Exchange Rate on Other Main Economic Parameter (%)

Parameter	Result by CPI	Result by EPI	2001/2000 (in the real value)
Tariff	0.47	1.96	12.00
Foreign Exchange Saving	1.63	5.59	34.56
Net Capital Inflow	2.66	7.37	15.11
Net Capital Outflow	0.17	1.58	9.83
Capital Formation	0.19	0.35	14.37
Personal Income Tax	1.08	1.11	50.83
Transfer Payment 1	0.20	1.30	8.32
Transfer Payment 2	0.35	1.11	-28.86
Government Saving	0.33	-0.30	20.71
Family Investment	-0.18	-0.20	-53.09
Enterprise Loan	0	-0.34	154.42
Domestic Loan	0	-0.92	7.62
Enterprise Income Tax	0.10	-0.02	48.77

Note: same as the above

Therefore, we can draw one conclusion that the influence of exchange rate changes of RMB on the domestic economy will not be as strong as people expected. The domestic economic sectors are affected by the self structure and the social structure to a large degree. The depreciation of the RMB will not be favorable to the improvement of the trade balance of China.

5. CONCLUSIONS

This paper made empirical analysis on the applicability to China from the angle of the general equilibrium and drew the conclusion that the Marshall-Lerner Condition cannot be proved applicable in China. In other words, the depreciation of the RMB by the real effective exchange rate will not improve the trade balance in China, on the contrary, will deteriorate the trade balance. However, the depreciation of the RMB will drive the import and export of China to increase and the increasing degree of import will be larger than the export. The conclusions of research are as follows:

Firstly, in accordance with the computation, seeing from the real effective exchange rate of the RMB by CPI or EPI, the RMB has been underestimated since 1995 and at present RMB undertakes the pressure to appreciate.

Secondly, in accordance with the computation, the elasticity of export and import in China is -0.857932 and -1.077378 respectively, and the sum (in absolute value) is 1.93531 that is bigger than one which can satisfy the Marshall-Lerner Condition : namely, if $e_x+e_m>1$, the depreciation of home currency will improve the trade balance of this country. However, the results of the shock analysis on the 2000 SAM cannot supply us with enough reasons to believe that the depreciation of the RMB by the real effective exchange rate will improve the trade balance in China. In other words, the Marshall-Lerner Condition is not surely applicable in China.

Thirdly, the depreciation of the RMB by real effective exchange rate affects the most the parameters directly-related with the exchange rate such as tariff, foreign exchange saving, net capital inflow and outflow. On the one hand, it will do favor to the increase of tariff, foreign exchange saving, net capital inflow and outflow in terms of the home currency. On the other hand, if they are expressed in terms of foreign currency, we cannot achieve that the depreciation of the RMB will be favorable to the foreign exchange saving for the reason that the real depreciation degree of the real effective exchange rate of 2000 is between 4.42% and 8.39% by CPI and EPI, while the change rate of foreign exchange saving by shock analysis is between 1.63% and 5.59% and that of net capital inflow and outflow are between 2.66% and 7.37% and between 0.17% and 1.58% respectively. Obviously, the foreign exchange saving, net capital inflow and outflow in terms of foreign currency shocked by the depreciation of the RMB are decreasing.

Fourthly, the depreciation of the RMB by the real effective exchange rate will be favorable to the increase of capital formation, personal income tax and the transfer payment of the government to the enterprises, especially the increase of the transfer payment of the government to the enterprises offers positive proofs for our understanding of the policy of canceling “Export Drawback” since January 1st 2004.

Fifthly, the depreciation of the RMB by the real effective exchange rate will induce the decrease of family investment such as the self-built houses.

From the above conclusions, we can treat the situation the Chinese government confronted with the appreciation more logical from another viewpoint.

Firstly, at present, the RMB is faced with the pressure to appreciate and the range of appreciation is from 15% to 30%.

Secondly, we should treat this problem of appreciation seriously since the policy makers should pay enough attention to the magnifying effect on the economy and society fluctuation. Therefore, the mild and stable appreciation will make less effect on the society and economy.

Thirdly, on the opposition of the people’s general understanding, the appreciation of the RMB will

be favorable to the trade balance in China, namely, the growth speed of export is faster than that of the import.

Fourthly, the appreciation of the RMB will improve the increase of domestic family investment, which is the "wealth effect" after the RMB appreciated.

Finally, the appreciation of the RMB will induce the decrease of capital formation, personal income tax, and the transfer payment of the government to the enterprises, which should be induced by the domestic employment pressure after the RMB appreciated.

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