On the current account imbalances of the United States and China

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Preface

With this thesis, my study as a master student in the University of Oslo ends, but what I've learned will become a treasure in my life. In this moment, I want to thank all those who have helped me during my campus life, special thanks to my supervisor, Asbjørn Rødseth. Under his guide, I learn more than how to write an interesting thesis. I am grateful that he has spent those time and great help throughout the work of this thesis on the supervision. His kindness in giving feedbacks and warming supports makes this paper a possible.

Thanks to all lecturers who make economics an exciting world. Particularly thanks to Erik Biørn and Harald Erik Goldstein, who teach me how to use the Econometric models to analyze and deal with the economic data. Øistein Røisland and Steinar Holden also instruct me to know about business fluctuations and how the monetary policies operate in the real world. Thanks all the friends here that make my life interesting.

Finally, I am also grateful to my parents' support and encouragement from China and also thank for my grandparents' unconditional love.

University of Oslo, December 2010

Xiaozhi Guo

Summary

In the past decade, the large deficit current account in the U.S. and the huge surplus current account in China have been a main feature in the world economy. This situation has generated concern among analysts and policy makers. Obstfeld (2010) states that "the connection between the much-debated global current account imbalances of the past decade and the U.S. financial collapse is an intimate one, although nothing as simple as cause and effect. Instead, the imbalances were a primary symptom of forces that led to the financial crash." Many economists have argued that this deficit and surplus in the U.S. and in China are unsustainable and that, at some point, situations would reverse. Just as Feldstein (2008) said that "the large trade and current account deficit of the U.S. cannot continue indefinitely because doing so would constitute a permanent gift to the U.S. economy."

The improvement of the U.S. current account implies the sum of current accounts in other countries would be deteriorated. In the thesis, within the intertemporal model, just by the market power the current accounts in the U.S. and in China would reverse in the future and reach sustainable levels in the end, respectively. So as to avoid some shortcomings of the intertemporal model, the Mundell-Fleming-Tobin model and the Specie-flow mechanism are applied, which are much closer to the reality, to analyze current accounts' changes just by the market power and under effects of the exchange rate changes in the U.S. and in China, respectively.

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1. Introduction

A striking feature of the current global economy is the emergence of significant global imbalances over the past decade, which is reflected by the massive current account deficit in the U.S. and the huge current account surplus in China, respectively. The sustainability and adjustment of current account imbalances is a hot topic that attracts much attention and generates concerns among policy makers and economists.

Even if the U.S. current account deficit started to shrink in 2007, it remained at 5% of GDP. Hence, some economists claim that this economic situation would last for several years or decades. However, others maintain that this imbalance is unsustainable and that, at a certain future point, it would go down and would reach the sustainable level. Edwards (2002, 2004) pointed out that countries will tend to experience the short-term deviation from their long sustainable current account levels, which implies that large current account imbalances would not persist forever. This statement was also mentioned by Kraay and Ventutra (2000, 2002). Meanwhile, plenty of economists put forward a series of ways, such as the monetary policy and the fiscal policy, to deal with current account imbalances. Obstfeld and Rogoff (2005) held that regardless of origins of the recent U.S. current account deficit, a correction of this imbalance will require a real depreciation of the U.S. dollar on the order of thirty percent. Mussa (2004) stated that with respect to the necessary correction of the U.S. current account deficit, the depreciation of U.S. dollar from 2001 could help to bring an end to the further increase in the U.S. imbalance.

Besides, the global economy is as a whole and the enforcement of the cooperation is more and more important. Facing large imbalances, both deficit and surplus nations should share the burden of adjustment. Edwards (2007) mentioned that the reduction of Chinese large current account surplus is necessary, if global imbalances are to be resolved. Some economists also

claim that China would be a key player in the adjustment of global imbalances and the appreciation of RMB could improve some countries' current account imbalances. From 2005 Chinese government began to appreciate the RMB and the net export growth rate in China started decreasing from 2008, when it was accompanied by the falling current account. Aizenman and Jinjarak (2008) also estimated that the current account surplus in China would fall over the next six years and the huge surplus current account would not last forever.

Based on the intertemporal model and the Specie-flow mechanism and the Mundell-Fleming-Tobin model, I mainly discuss how current accounts could be improved and deteriorated in the U.S. and in China, respectively. Would the current account imbalance be solved in the future just by the market power in the U.S.? Does the revaluation of RMB/USD deteriorate the current account in China and relieve global imbalances? Does the depreciation of U.S. dollar improve the current account? How do the current accounts move from short run equilibrium to the long run equilibrium? To understand these uncertainties, current account backgrounds would be introduced in the section 2. In the next section, I illustrate logic relationships among net export, savings and the current account. In the section 4, within the intertemporal model, which factors causing the current account imbalances in these two nations would be found and how savings and investment changes affect current accounts in the U.S., in China and in the rest of the world. Although explaining the current account change well, this model has some shortcomings, as it ignores some elements. These disadvantages would have impacts on its power to explain the real economic situation.

To avoid the intertemporal model's demerits, the Specie-flow mechanism and the Mundell-Fleming-Tobin model would be applied in the section 5, which are much closer to the reality. Within the Mundell-Fleming-Tobin model and the Specie-flow mechanism, current accounts' change would be analyzed just under the market power and under effects of nominal exchange rate changes in the U.S. and in China, respectively.

2. The current account backgrounds in the U.S and in China.

2.1 The definitions of the balance of payment and the current account

The balance of payment (BOP) is an item in which countries record their monetary transactions with other countries in the world. These transactions include payments for countries' export and import of goods and services and financial capitals, as well as financial transfers. Meanwhile, the BOP could be separated into two parts, the current account and the capital account. The current account is the sum of the balance of trade (export minus import of goods and services), the net factor income (such as interest and dividends) and net transfer payment (such as foreign aid). When all components of the BOP sheet are included, it should balance and there exists no overall surplus or deficit. Nevertheless it is possible that imbalances exist on individual elements of the BOP, such as the current account. This surplus/deficit current account would lead to imbalances among countries. In the Washington Consensus period several economists referred that there is no need to worry about imbalances; while opinions swung back in the opposite direction in the wake of the financial crisis in 2008 and many economists claim that global imbalances do matter and countries need to take some actions to correct imbalances. To understand why the U.S. deficit current account could not go on, it makes sense to review the evolution.

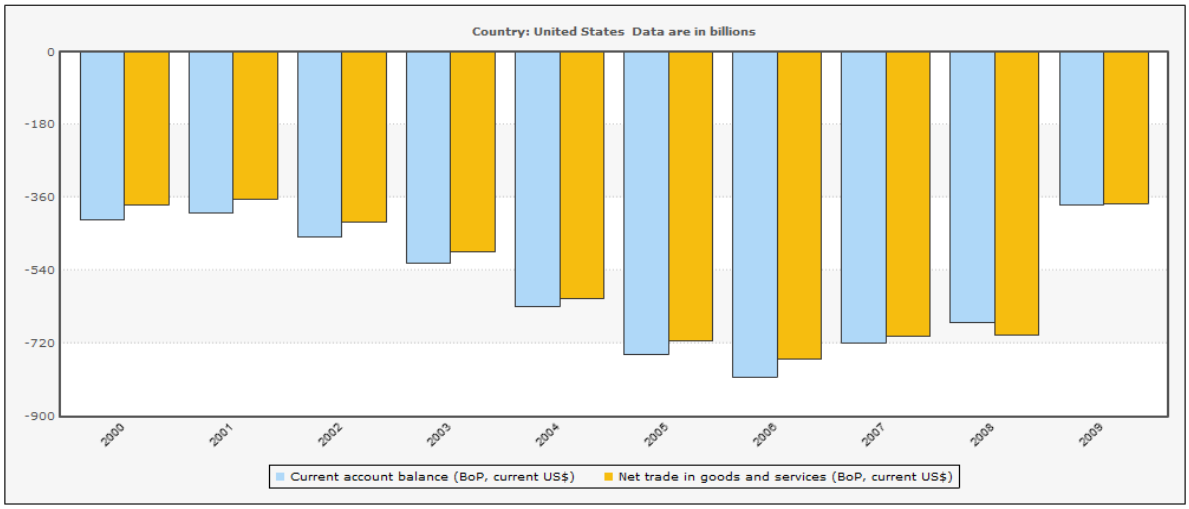
2.2 The current account from 2000 to 2009 in the U.S.

Even though fluctuating in some years, the deficit current account in the U.S. grew from 2000 to 2006. In 2000, deficit current account in the U.S. was about $416[1] billion. Two years later, the deficit current account was up to $458 billion. Then in the following four years, it increased approximately $100 billion each year. It peaked at $803 billion in 2006, which was

[1] The data is from the World Bank, December 24, 2010

approximately two times as large as it in 2000. Partly due to the adjusted exchange rate and the financial crisis, the current account deficit was $669 billion in 2008, about 12% down, and reduced $378 billion in 2009, which is similar level as it in 2001, see figure 1.

Figure 1: The U.S. current account and net export in goods and services



Source: The data is from the World Bank, 24 December 2010

In addition, it could be seen from the figure 1 that the net export plays an essential role in the current account. Based on the data from 2000 to 2009, the deficit net export on average (the arithmetic mean) accounted for more or less 93% of the current account in the U.S.

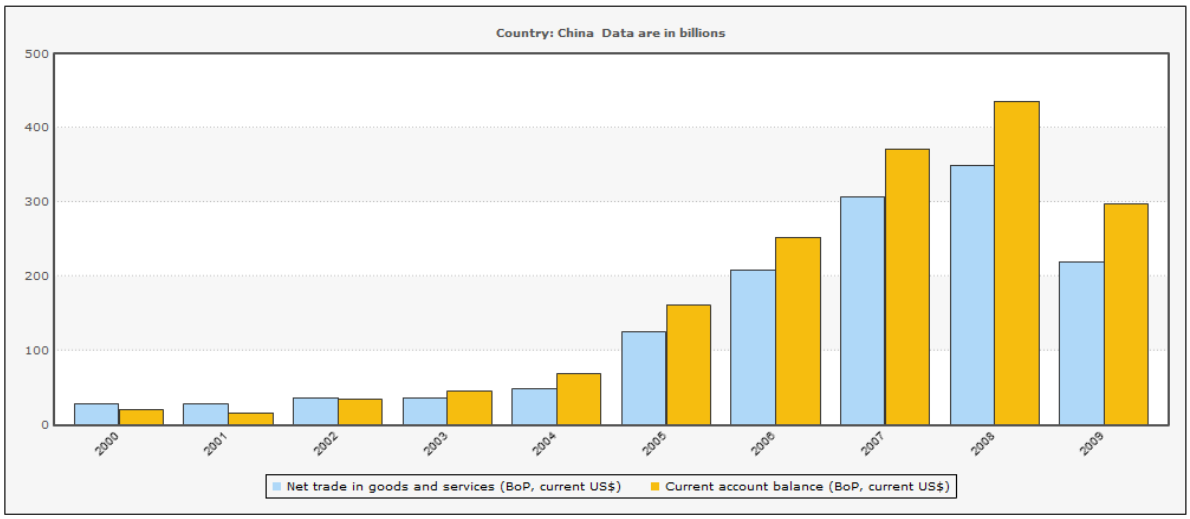
2.3 The current account from 2000 to 2009 in China

A fundamental accounting principle in open economy macroeconomics is that the sum of all current account balances across all countries in a given year should add up to zero, which implies that one country's deficit must be another country's or countries' surplus. China, as one of major trade partners of the U.S., had the increasing current account surplus from 2000 to 2008, even though it fluctuated in some years. In 2000, it was $21[2] billion and was up to

[2] The data is from the World Bank, December 24, 2010

$35 billion in 2002. Then it jumped to $69 billion in 2004, which was followed by an $100 billion increase each year in the next four years. In 2008, the current account in China peaked at $436 billion, which was approximately 21 times as large as it in 2000. However, because of the revaluation of the RMB from 2005, the growth rate of net export begun to lower. Furthermore, the financial crisis in 2008 also severely affected the growth rate of Chinese net export in 2009, which were accompanied by the decline current account surplus in China, see figure 2.

Figure 2: The current account and net export in goods and services in China



Source: The data is from the World Bank, 25, December 2010.

In addition, the net export in goods and services in China also has an important role in the current account. In 2000, the net export was $29 billion in China, which was more or less 141% of the current account, and increased to $37 billion in 2003, which accounted for about 78%. Though the ratio between net export and the current account was decline, the magnitude of net export grew significantly. However, owing to the revaluation of RMB and the financial occurring 2008, the growth rate of net export from 2008 slid down obviously, which was coupled with the decline surplus current account rate (%GDP). Based on the data from 2000 to 2009, net export on average (the arithmetic mean) accounted for approximately 83% of the current account in China.

2.4 The U.S. current account deficit will end

Feldstein (2008) states that "The current trade imbalance has been a very favorable arrangement for the U.S., owing to receiving goods and services from the rest of the world and paying them back IOUs (I owe you) in the form of government and corporate debts. However, even though foreign governments are willing to do these trades to obtain export surplus with the U.S., no rational nations are volunteers to continuously provide goods and services and get only IOUs rather than the real fortune. In addition, when these IOUs or interest are due, it only gives new IOUs in exchange". In reality, it is implausible that this situation could last forever, since the world cannot continuously send large "gifts" to U.S. year by year. Thereafter, in the future the U.S. current account deficit will end. Just as the reality, policy makers in the U.S. have implemented the depreciation of the U.S. dollar and the current account deficit has been decline from 2007. The current account would reach sustainable level at some future time, even if there is a long way to go.

2.5 Chinese current account surplus will fall further

Among recent years, main reasons why China achieved an enormous and growing net export surplus are the relatively high RMB exchange rate and the relatively cheap labor, which not only stimulate aggregate demand and increase net export, but also create plenty of jobs and shift labor from the agriculture to the industry. So as to stable the global economy, in December 2005 the G-7[3]called for the RMB flexibility and appreciating the RMB exchange rate. Then, China has agreed to move to a more flexible exchange rate and has widened the daily limit in the movement of the currency. Since 2005 the RMB official exchange rate[4] has been gradually adjusted and it was down from 8.19[5] RMB/USD in 2005 to 6.83 RMB/USD in

[3] In 2005, G-7 consisted of a group of high-income countries including Canada, France, Germany, Italy, Japan, United Kingdom and the United States)

[4] official exchange rate (LCU US$ period average)

[5] The data is from World Bank, 25,December, 2010

2009. Under the effect of the RMB/USD revaluation, the growth rate of net export has begun to decline since 2005. In 2009, the current account deteriorated remarkably. Of course, it can't deny the financial crisis impact on the whole global economy. Furthermore, many developing countries, such as India and Turkey, have become big processing factories, not only due to the high tech process, but the cheap labor and the low exchange rate. In addition, this financial crisis also has severely affected economy situations in the U.S., England and European Union and in the rest of the world, which have a great impact on their import volumes from China. Based on these factors above, it is impossible that this huge net export surplus in China could last forever and the surplus current account would slide down in the coming years.

3 The logic relationships among the current account, savings and net export

From the definition, the current account is the difference between savings and the investment in one country. Meanwhile, the accumulative current account in one country equals to funds that it borrow from /lend to other countries in the corresponding year.

In the U.S. relatively small gross domestic savings and the relatively large investment resulted in the current account deficit in the past decade. As Joseph Stiglitz (06, October, 2010) said "the basic problem in our macro-economy is that the United States saves too little" and "our household saving rate went down to zero, now our household savings is increasing, but our government, national saving rate did not change because of the increasing deficit".[6] So the critical way of dealing with this imbalance in the U.S. is to appropriately adjust savings and investment in order to reduce debts. The detail way is to increase gross domestic savings and cut down the investment. In addition, from analysis above the net export is an essential role in the current account. What is the relationship between savings and the net export? Obviously decreasing import in goods and services from foreign counties and lifting export to overseas are the wise way, which could increase net export and, as a result, increase GDPs and gross domestic savings.

By the same logic analysis, enormous large gross domestic savings and the relatively small investment in China resulted in current account surplus in the past ten years. To solve this imbalance, it is nature to reduce savings and raise the investment. From above, it is known that the net export plays an essential role in the current account. How does China decrease gross domestic savings and net export simultaneously? Increasing import volume from

[6] The source is from http://www.China.org.cn/opinion/2010-10/06/content_21068782.htm.

overseas and cutting export to foreign countries could reduce net export and, as a result, decreasing GDPs and gross domestic savings. Accordingly, the decreasing net export and increasing investment are key elements that deteriorate Chinese surplus current account. In the following sections, I will discuss, within the intertemporal model, which factors caused the current account deficit in the U.S. and the current account surplus in China in the past ten years; and why tendencies in the U.S. and in China would reverse in the coming years.

4 Application of two periods' intertemporal model

4.1 The introduction of two periods' intertemporal model

A country's current account balance over a period equals to national savings less the domestic investment or is equal to the change in its net foreign debts. This two periods' intertemporal model is adapted from Obstfeldt and Rogoff (1996).It describes when is the country foreign borrower, when does it lends abroad, what role do government policies play, how a country could gain from rearranging the timing of its consumption through international borrowing and lending and how current accounts reverse from the surplus/deficit situation to the deficit/surplus case. By analyzing changes of key factors, including the productivity, consumption patience, the capital stock and the investment rate, we could get which elements impact current accounts in the U.S and China in the corresponding year, respectively.

The model used here has only two periods and there exists no capital stock at the end of period two in the whole world. Provided one country owns surplus current account in the period one, it may resulted from relatively high consumption patience and/or the relatively high capital stock and/or the high growth rate of productivity and/or the relatively low investment rate. Meanwhile, if the national savings is so large, it could cover the domestic investment and the lending to foreign countries, then, in the second period, owing to the previous domestic investment and foreign debts and interest, the final consumption expenditure would be high, which would lead to negative savings and its magnitude equals to the second period's capital stock plus foreign debts and interest. In addition, due to no capital stock in the end, the national investment would also be negative, whose magnitude equals to the second period's capital stock. Hence, the current account in the period two would be deficit and its magnitude equals to foreign debts and interest. In the end the current account would reach sustainable level. If the country holds the deficit current account in the period one, the process is opposite.

4.2 Assumptions

Within the model, the world is divided into two parts, including the home country and the other countries in the world.

The population size is normalized to one in each area and all individuals are identical.

There exit no monetary policy and fiscal policy that have impacts on savings and investment decisions.

The goods and services are perfect substitutes in the whole world.

People can perfectly foresee the future and there is no uncertainty in the future.

It's presumed that each country exits only two periods t=1 and t=2.

The economy in the whole world ends in period 2, holding no uncollected claims on foreigners.

The foreign debt is zero, $B_1=0$, in the initial state in the whole world.

4.3 The optimal conditions

C_t represents the household consumption in the period t and the U is the consumer's utility function, which depends on the household consumption expenditure C_t, and is strictly increasing and strictly concave, $U'(C) >0$ and $U''(C) <0$,

$$U_t=u(C_1) +v(G_2) +ßu(C_2) + ßv(G_2)$$

, where ß is the subjective discount factor.

Let Y_t denote the output in the period t, which is a concave function of the capital K_t. K_t is the capital stock at the beginning of period t, r is the world real interest rate for borrowing and lending in the world capital market,

$$Y_t = A_t F(K_t)$$

, where $K_t = I_{t-1} + K_{t-1}$. A_t is the productivity and I_t is the investment in the period t. K_1 is given by past history. $I_2 = -K_2$. Since people do not hold any capital at the end of period two, $K_3 = 0$.

The budget constraint of first period is $C_1 + B_2 + K_2 + G_1 = Y_1 + K_1$ and the constraint of the second period is $C_2 + K_3 + B_3 + G_2 = Y_2 + K_2 + B_2(1+r)$, where B_t is the net lending to abroad in the beginning of period t and G_t is the general final government consumption. Assume that $B_1 = 0$ and since there are only two periods in the model, $K_3 = 0$ and $B_3 = 0$, the second period's budget constraint is $C_2 + G_2 = Y_2 + K_2 + B_2(1+r)$.

In the model, the consumption C_t, investment I_t, savings S_t and output Y_t are endogenous variables; r, K_t, A_t and G_t are the exogenous variables.

Current account equation: $CA_t = S_t - I_t$

$$= Y_t - C_t - G_t - I_t + rB_t$$

$$= A_t F(K_t) - C_t - G_t - I_t + rB_t$$

$$= A_t F(K_t) - C_t - G_t - (K_{t+1} - K_t) + rB_t$$, where K_t, t=2 and t=3.

Under assumptions, people maximize their utility with respect to C_1 and C_2, subject to budget constraints

$$\text{Max } U_t = u(C_1) + v(G_1) + ßu(C_2) + ßv(G_2), \quad (1)$$

$$\text{Subject to } \quad G_1 + C_1 + B_2 + K_2 = Y_1 + K_1 \quad (2)$$

$$G_2+C_2 =Y_2+ (1+r) B_2 +K_2 \quad (3)$$

, where the K_1 is given by history, K_3=0 and t=2 and t=3.

4.3.1 The optimal consumption

Differentiating (1) with respect to the consumption C_1 and C_2, we get the first order condition:

$$ßu' (C_2)/u' (C_1) =1/ (1+r) \quad (4)$$

, which is the Euler consumption equation. It indicates that when the utility is maximum with respect to the consumption C_1 and C_2, it is not possible that consumers could increase their utility by transferring consumption among these two periods.

4.3.2 The optimal investment

The country maximizes their profit with respect to K_2

$$\text{Max } Y_2-rK_2 = A_2F (K_2)-rK_2 \quad (5)$$

Differentiating (6) with respect to K_2, we get the first order condition:

$$A_2F' (K_2) = r \quad (6)$$

$$A_2F' (I_1+K_1) = r \quad (7)$$

It indicates that, under optimal conditions, the rate of return on investment at home equals to the interest rate for borrowing and lending in the world capital market r and it also implies the investment I_1.

4.4 The general analysis of the intertemporal model

4.4.1 The impact of the exogenous variable change

① The effect of productivity on current account

If the productivity A_1 increases, the current account CA_1 would improve when other factors keep constant in the first period and investment demand is not affected. If the productivity A_2 increases, it has two effects that lead to the deterioration of the current account: 1) for a given capital stock K_2, the production Y_2 would increase. As in the endowment economy, the increasing productivity A_2 would contribute to the high interest rate, high consumption C_1 and high investment I_1 in the period one, which would deteriorate the current account CA_1. 2) from the equation $A_2F'(K_2)=r$ (6), if the real interest rate are unchanged, the increase of production A_2 would increase the capital stock K_2 and, accordingly, investment I_1 would rise, which is accompanied by the deteriorated current account CA_1. Hence the country with a high productivity A_2 will tend to cause the deterioration of the current account CA_1, if other elements are constant.

② the effect of the capital stock on the current account

If the capital stock K_1 increases, it has two opposite effects: 1) it increases the total wealth, which is spent on the consumption C_1. So the current account CA_1 deteriorates, but less than the increase in capital stock K_1; 2) since the capital stock K_2 is unaffected, the increase in capital stock K_1 reduces the investment I_1 and improves the current account CA_1. In this case the second effect obviously dominates the first one. Hence, the countries with a high initial capital stock will ceteris paribus tend to have the current account surplus CA_1.

③ The effect of general government final consumption on current account

Suppose that the first period general final government consumption $G_1 > G_2$. Now the private sector will borrow against relatively high second period after tax income to shift part of the burden of temporary taxes to the future, when other elements are equal. The high general final government consumption, G_1, in the period one lowers the household final consumption, but by an amount smaller than G_1. The reason is that government consumption is temporary and drops in the period two. Hence, the current account would be deteriorated in the period one and then be improved in the period two. On the other hand, when general final government consumption $G_1 < G_2$, it's the naturally opposite process.

4.4.2 The analysis of the endogenous variables change

From the Euler consumption condition, $ßu'(C_2)/u'(C_1) = 1/(1+r)$ (4), it indicates that when the utility is maximum, it is not possible that consumers can increase their utility by transferring consumption between these two periods and the marginal rate of substitution is equal to the price of consumption in period two in terms of consumption in period one, $1/(1+r)$.

More patient citizens have patience would move consumption forward so as to obtain higher utility in future; less patient citizens would consume most of life-time wealth in the current period. If citizens in one country have low patience on consumption, high consumption C_1 is coupled by low gross domestic savings. Meanwhile when gross domestic savings could not cover investment, it would borrow from abroad. So the current account would be deficit. Then in the next period, owing to the Euler consumption condition, the consumption C_2 would lower relative to the gross domestic product Y_2 since citizens have to repay debts and interest; at the same time the gross domestic product Y_2 would raise because of previous productive

investment and the capital stock. In addition, due to the initial limited endowment and no capital stock in the end, the investment I_2 in the period two would be negative. Consequently, combined increasing savings and the negative investment, the current account in the second period would be surplus. In the end the surplus current account would be equal to the change of foreign debts that was borrowed from overseas in the period one.

On the other hand, citizens who have high patience consume low, which is accompanied by high gross domestic savings. It implies that high savings could cover the investment and the lending to foreign counties. Hence, the current account is surplus now. Then, in future citizens obtain more wealth owing to the interest repayment and, as a result, their consumption growth rate would be naturally high; simultaneously although previous investment contributes to the growth of output, increasing consumption exceeds the gross domestic product, which is accompanied by negative savings in the second period. In addition, the investment in the period two would be negative resulting from the limit endowment and no capital stock in the end. Hence, the deficit current account in the end would be deficit, whose absolute value equals to the first period's lending add interest.

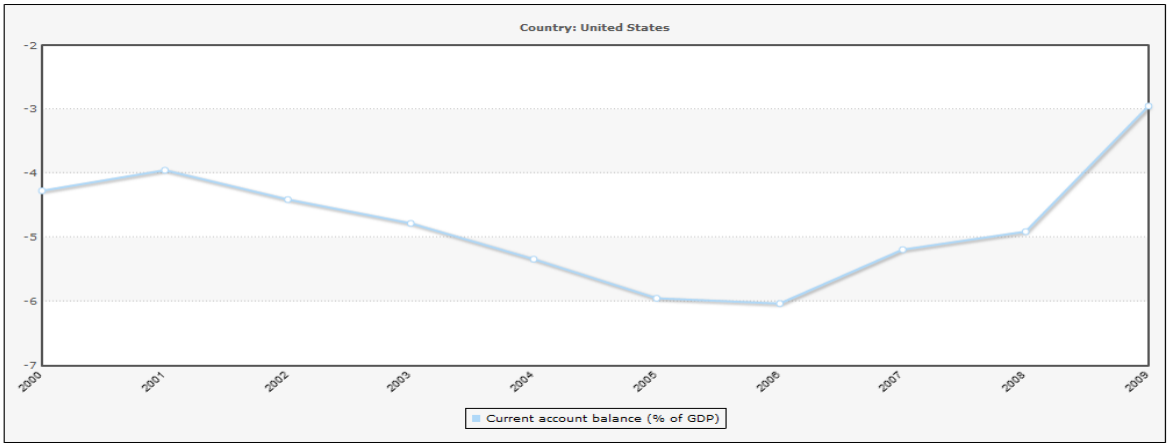
4.5 The current accounts in the U.S. and in the rest of the world

From the figure 3, the deficit current account in 2000 was $416 billion and accounted for 4.2% of the GDP. In the following several years (except 2001) the current account deficit increased, particularly from 2004 to 2006. Then from 2007, it began to fall. In 2009, it was down to $378 billion and made up 2.7% of the GDP.

In theory, the sum of current accounts in the whole world should be zero. However, from the table 1 the sum of current accounts in the whole world is nonzero. It may result from the measurement errors or statistical errors or other errors. In this thesis it is ignored. Based on

the data from the World Bank, the current account in the U.S. was still deficit from 2000 to 2009, which means that the sum of current accounts in the rest of the world was positive.

Figure 3: The U.S. current account rate (% GDP)



Source: Data is from the World Bank, 25.December.2010

Table 1: The U.S., other countries and world current accounts (unit: current U.S. billion$)

	the U.S.	the U.S.	World	other countries	other countries
year	current account(1)	current account rate (% of GDP)	current account (2)[7]	current account (3)=(2)-(1)	current account rate (% of GDP)
2000	-416	-4.21	-226	190	0.85
2001	-397	-3.88	-220	177	0.81
2002	-458	-4.33	-163	295	1.30
2003	-521	-4.70	-105	416	1.58
2004	-630	-5.34	-27	603	1.98
2005	-748	-5.94	-33	715	2.16
2006	-803	-6.02	66	869	2.40
2007	-718	-5.11	162	880	2.11
2008	-669	-4.65	88	757	1.61
2009	-378	-2.68	241	619	1.41

Source: The data is from the World Bank, 29.December.2010.

[7] Here it is ignored that the world current account is zero in theory. The sum of rest countries current account equals to the world current account minus the American current account in the relative year.

4.5.1 Why the current account was deficit in the U.S.

The deficit current account in the U.S. resulted from the magnitude of savings was less than the investment in the corresponding year. Within this model, by analyzing some factors, including the investment, productivity, citizens' patience and the capital stock, we could explain why the current account was deficit and why deficit was increasing in the U.S. in the last decade.

① The low consumption patience in the U.S.

From the table 2, the gross domestic saving rate (% GDP) was smaller in the U.S. than in the rest of the world and kept the decreasing trend from 2000 to 2009; while it increased in other countries. In the U.S., the domestic business saving rate took on the increasing trend from 2000 to 2006; while the household and institutions saving rates increased from 2000 to 2004, but in 2005 it bottomed at the 3%, then rebounded to 3.8% that was the same as it in 2000; and the gross government saving rate was decline from 2000 to 2005, nevertheless in 2006 it went up to 0.9%, see table 3. Hence, a main reason why the gross domestic saving rate fell from 2000 to 2006 in the U.S. was the decrease of gross government savings. Then in the following three years, both the domestic saving rate and household and institutions saving rate presented increasing trends, however, the gross government saving rate was continuous decline and the gross government saving rate in 2009 was down to 6.7%. Accordingly, the further decline of the gross domestic saving rate between 2007 and 2009 was also mainly because of the falling government saving rates.

The low domestic saving rate could be seemed as American has low consumption patience, ß, and, as a result, has high final consumption expenditure. So it could be seen as a reason to cause the deficit current account in the U.S.

From the equation, $CA_t=A_tF\ (K_t)-(C_t+G_t)-I_t+rB_t$, the increasing final consumption expenditure would ceteris paribus deteriorate the current account as other elements are constant. As the table 1 and table 4 shown, the final consumption expenditure rate increased about 5%, which was coupled by the approximately 1.8% deficit current account rate expansion. Here, final consumption expenditure (formerly total consumption) can be split two components, household final consumption expenditure, C_t, and general government final consumption expenditure, G_t. Changes of household final consumption and general government final consumption impacted the current account in the U.S.

- Impact of the household final consumption expenditure on current account

From the equation, $CA_t=A_tF\ (K_t)-C_t-G_t-I_t+rB_t$, the increasing household final consumption would ceteris paribus deteriorate the current account. As table 4 and table 5 are shown, household final consumption in the U.S. was larger than in other countries. So it could be seen as the factor causing deficit current account in the past some years. Furthermore, the household final consumption rate increased only 0.9% from 2000 to 2006, which were accompanied by the current account deficit rate (%GDP) climbing from 4.2% to 6.0%; while the household final consumption rate (%GDP) in the rest of the world slid down from 57.85% to 55.41%, which were coupled by the current account surplus rate (%GDP) enlargement from 0.85% to 2.4%. Hence, it can be concluded that slightly increasing household final consumption expenditure contributed to the increasing deficit current account in the U.S.

- The impact of general final government consumption G_t (t=1and t=2) on current account.

Suppose when other elements keep constant, an economy with disproportionately high government consumption in period one will have the deficit current account in that period. The general final government consumption lowers the household final consumption C_1, but

with an amount smaller than G_1. Since the government consumption is temporary and drops in the period two, private sector will want to borrow against relatively high after tax income in the second period to shift part of the burden of temporary taxes to the future. Combined with relatively slight decreasing consumption C_1 and high general government final consumption G_1, the current account was deteriorated in the period one. As government consumption is expected to occur in the period two, the current account would be in surplus. From the table 4 and 5, the general government final consumption rate in the U.S. took on raising trend and increased from 14.28% in 2000 to 15.75% in 2006 and the household final consumption rate rose only 0.9%; while in other countries the general government final consumption expenditure increased about 0.5%, but the household final consumption rate was down approximately 0.9%. Hence, it can be concluded that the increasing general government consumption expenditure in the U.S. was a factor to deteriorate the U.S. current account; while the relatively large decline household rate and the relatively low increase in general government final consumption rate contributed to the increase of the sum of current accounts in other countries.

Consequently, provided other factors are unchanged, the low consumption patience, ß, leads to higher final consumption expenditure in the U.S. than in the rest of the world, which caused the current account deficit in the U.S., and increasing final consumption expenditure contributed to the current account deteriorating in the past ten years.

Table 2: The U.S. and other countries gross domestic savings and gross domestic saving rates (unit: current US billon$)

	the U.S.	the U.S.	rest countries	rest countries
year	gross domestic savings[8]	the gross domestic saving rate (% of GDP)[9]	gross domestic savings	the gross domestic saving rate (% of GDP)[10]
2000	1,654	16.7	5,556	24.9
2001	1,572	15.4	5,252	24.1
2002	1,517	14.3	5,482	24.2
2003	1,530	13.8	6,452	24.5
2004	1,664	14.1	7,723	25.4
2005	1,779	14.1	8,590	26.0
2006	1,913	14.3	9,815	27.2
2007	1,962	14.0	11,632	27.8
2008	1,793	12.5	13,188	28.1
2009	1,612	11.4	11,421	25.9

Source: The data is from the World Bank, 31, December, 2010.

[8] Gross domestic savings are calculated as GDP less final consumption expenditure (total consumption). Data are in current U.S. dollars

[9] Gross domestic saving rate in the U.S. is the gross domestic savings is divided by the U.S. GDP in the corresponding year.

[10] Gross domestic savings rate (current US billion$) in the rest countries is equal to the sum of gross domestic savings over the sum of GDPs (current US billion$) in the rest countries.

Table 3: The U.S. domestic business savings, household and institutions' savings, and government savings and the relative saving rates (%GDP) (unit: current US billion$)

year	domestic business savings	domestic business rate (%GDP)	households and institutions savings	households and institutions saving rate (%GDP)	gross government savings	gross government saving rate (%GDP)
2000	1000.6	10.1	375.6	3.8	424	4.2
2001	1086.5	10.6	380	3.7	229.2	2.2
2002	1189.1	11.2	467.7	4.4	-95.9	0.9
2003	1244.6	11.2	505.3	4.6	-197.1	-1.8
2004	1369.2	11.6	510.9	4.3	-155.9	-1.2
2005	1532.1	12.2	377.8	3	-6.5	-0.1
2006	1553.6	11.6	504.3	3.8	116.5	0.9
2007	1461.4	10.4	493.9	3.5	58.3	0.4
2008	1401.2	9.8	735.3	5.1	-351.3	-2.4
2009	1529.4	10.8	950.9	6.7	-946.6	-6.7

Source: The data is from the Bureau of Economic Analysis, 22, December, 2010

Table 4: The U.S. household and general government final consumption expenditure and relative rates (unit: current US billion $)

year	household final consumption expenditure[11]	household final consumption expenditure rate(% of GDP)	general government final consumption[12]	general government Final consumption rate (% of GDP)
2000	6830	69.00	1414	14.28
2001	7149	69.86	1513	14.78
2002	7439	70.25	1633	15.42
2003	7804	70.38	1755	15.82
2004	8285	70.14	1862	15.76
2005	8819	70.10	1981	15.75
2006	9323	69.90	2100	15.75
2007	9806	69.73	2226	15.83
2008	10104	70.32	2399	16.70
2009	10001	70.83	2430	17.21

Source: The data is from the World Bank, 31.Dec, 2010.

[11] Household final consumption expenditure (formerly private consumption) is the market value of all goods and services, including durable products, purchased by households. It excludes purchases of dwellings but includes imputed rent for owner-occupied dwellings. It also includes payments and fees to governments to obtain permits and licenses. Here, household consumption expenditure includes the expenditures of nonprofit institutions serving households, even when reported separately by the country. Data are in current U.S. dollars.

[12] General government final consumption expenditure (formerly general government consumption) includes all government current expenditures for purchases of goods and services. It also includes most expenditure on national defense and security, but excludes government military expenditures that are part of government capital formation. Data are in current U.S. dollars.

Table 5: Other countries household and general government final consumption expenditure and rates (%GDP) (unit: current US billion$)

year	Household final consumption expenditure	Household final consumption expenditure rate(% of GDP)	General government final consumption expenditure	General government final consumption expenditure rate (% of GDP)
2000	12907	57.85	3825	17.14
2001	12678	58.22	3817	17.53
2002	13143	57.9	4047	17.83
2003	15155	57.5	4736	17.97
2004	17254	56.79	5388	17.74
2005	18605	56.29	5828	17.63
2006	20014	55.41	6294	17.43
2007	22865	54.73	7172	17.17
2008	25406	54.08	8121	17.29
2009	24473	55.59	8108	18.42

Source: The data is from the World Bank, 31.Dec, 2010.

② The productivity in the U.S.

For a given capital stock K_2, an increase productivity A_2 would elevate the production Y_2, would lead to the high consumption C_1 and the high investment I_1, which would deteriorate the period one current account CA_1. And the slow growth rate of the productivity should imply that more gross domestic savings and less investment in the home country as remaining factors keep constant, which would improve the current account CA_1 to some extent. From the table 6, it can be seen the GDP per labor force (current international $) in the whole world increase, but the growth rate of productivity was much higher in the U.S. than in the rest countries in the past decade. The GDP per labor force (constant 2000 US$) increased from $66.9 thousand in 2000 to $73.9 thousand in 2006 in the U.S., which expanded 10.5%; while it enlarged 9.3% in the rest countries. The relatively high growth rate of productivity implies

less gross domestic savings and the more investment, which contributed to the current account deterioration. So it can be concluded that the relatively high productivity was the factor causing the increase of the current account deficit in the U.S. Nevertheless, the difference on growth rates of productivity between the U.S. and other countries is smaller, so this relatively high growth rate of productivity in the U.S wasn't the most important factor causing the increase of the deficit current account in the past several years.

Table 6: The U.S. and other countries GDP per labor force

	the U.S.	the U.S.	other countries	other countries
year	GDP per labor force(constant2000 US thousand $)[13]	GDP per labor force (current US thousand $)[14]	GDP per labor force (constant 2000 US thousand $)	GDP per labor force(current US thousand $)
2000	66.9	66.9	8.56	8.6
2001	67.2	68.7	8.57	8.2
2002	67.9	70.6	8.60	8.4
2003	69.6	73.9	8.69	9.6
2004	71.7	78.2	8.91	10.9
2005	72.9	82.2	9.10	11.7
2006	73.9	86.0	9.36	12.5
2007	74.3	89.6	9.66	14.3
2008	73.9	90.9	9.71	15.8
2009	..	..	..	..

Source: Data is from the World Bank, 25, December, 2010.

③ The capital stock in the U.S.

From the equation, $K_{t+1}=I_{t+1}+K_t$, the capital stock K_{t+1} would increase, as long as the net domestic investment I_{t+1} is positive. From the table 7, it can be seen that the net domestic

[13] GDP per labor (constant 2000 US$) equals to the GDP(constant 2000 US$) divided by the labor force in the relative year

[14] GDP per labor (current US$) equals to the GDP (current US$) divided by the force labor in the corresponding year.

investment was positive in the past decade which leaded to the increasing capital stock in the U.S. However, the net domestic investment rate (%GDP) presented the decline trend and fell from 9% in 2000 to 1.6% in 2009, even though fluctuating in 2005 and 2006. As a result, it can be concluded that the capital stock went up but with the decreasing growth rate from 2000 to 2009. Then, from the equation, $CA_t=A_tF\ (K_t)-C_t-G_t-I_t+rB_t$, the increasing gross domestic investment should improve the current account as other factors were constant. Hence, it can be concluded that the slightly increasing capital stock wasn't the factor to trigger the increase of current account deficit in the U.S.

Table 7: The U.S. net domestic investment and net domestic investment rates (%GDP)

(unit: current US billion$)

year	the net domestic investment	the net domestic investment rate(%GDP)
2000	892	9.0
2001	728	7.1
2002	685	6.5
2003	731	6.6
2004	908	7.7
2005	1023	8.1
2006	1092	8.2
2007	984	7.0
2008	743	5.2
2009	232	1.6

Source: Bureau of Economic Analysis, 14, January, 2011

④ The gross fixed capital formation[15] in the U.S.

Based on the data from the World Bank database, the investment[16] (constant 2000 US$)

[15] Gross fixed capital formation (formerly gross domestic fixed investment) includes land improvements; plant, machinery, and equipment purchases; and the construction of roads, railways, and the like, including schools, offices, hospitals, private residential dwellings, and commercial and industrial buildings. Data are in constant 2000 U.S. dollars.

[16] The investment here is equivalent to the gross fixed capital formation in the World Bank.

increased from $1982 billion in 2000 and grew to $2239 billion in 2006, but the investment rate (% of GDP) slid down 0.6%, while rest countries' investment rate increased from 22.4% in 2000 to 23.4% in 2006, see table 8. In the model, I_t represents the investment and from the equation, $CA_t=A_tF(K_t)-C_t-G_t-I_t+rB_t$, the decline investment rate in the U.S. should improve the current account in the corresponding years, provided other factors keep constant. Hence, it can be concluded that the U.S. current account deficit is not caused by the low U.S. investment rate than the world average and the increasing deficit from 2000 to 2006 wasn't caused by the decline investment rate in the U.S. Combined with the decline saving rate from 2007 to 2009, the significantly decline investment rate was the main reason why the current account was improved in the U.S.

Table 8: The U.S. and other countries' investments and relative investment rates (%GDP)
(unit: constant 2000 US billion $)

	the U.S.	the U.S.	the other countries	the other countries
year	investment	investment rate[17](% GDP(constant 2000 US$))	investment	investment rate (%GDP (constant 2000 US$))
2000	1,982	20.02	5,005	22.4
2001	1,961	19.60	5,023	22.1
2002	1,902	18.67	5,043	21.8
2003	1,958	18.75	5,235	22.0
2004	2,078	19.21	5,552	22.4
2005	2,189	19.63	5,894	22.9
2006	2,239	19.56	6,309	23.4
2007	2,207	18.91	6,738	23.8
2008	2,095	17.95	6,881	23.8
2009	1,769	15.57	6,557	23.1

Source: Data is from the World Bank, 26, December, 2010

From the analysis above, within the model the low consumption patience could be seen as element bringing deficit current account and the relative slightly high growth rate of

[17] The investment rate is equal to the investment (constant 2000 US$) is divided the GDP(constant 2000 US$)

productivity and the increasing final consumption, particular the general government final consumption, caused the increase of the deficits on current account in the U.S.

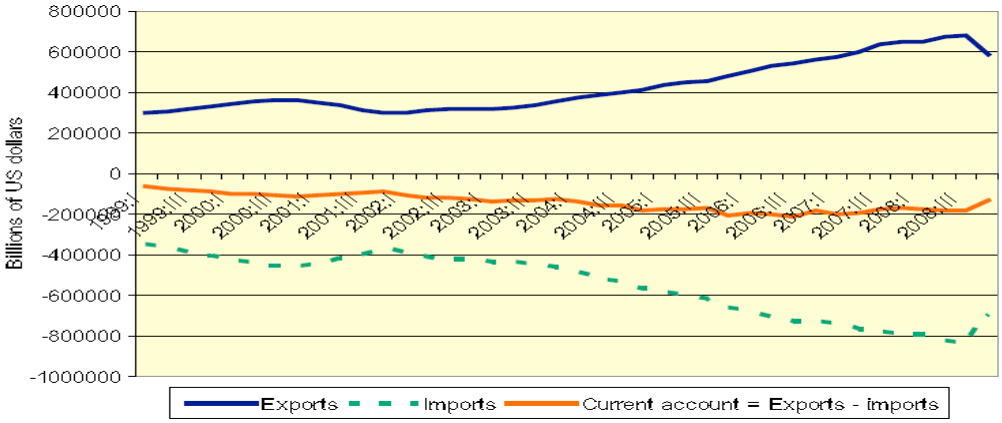
4.6 The tendencies of current accounts in the U.S. and in the rest of the world would reverse in the future

4.6.1 The current account would improve in the U.S.

① The reducing final household consumption expenditure C_2 or/and general final government consumption G_2 would improve the U.S. current account

Based on the Euler consumption equation, $ßu'(C_2)/u'(C_1) = 1/(1+r)$ (4), the consumption C_2 would fall because American citizens have to repay the interest and debts that were borrowed from rest nations. From the budget constraint, $C_2=Y_2+ (1+r) B_2+K_2-G_2$, $B_2<0$, the consumption C_2 would be less than $Y_2+K_2-G_2$. Meanwhile, the falling general final government consumption would also improve the current account. Provided other factors equal, from the equation, $CA_2=A_tF(K_t)-C_t-G_t-I_t+rB_t$, the falling final household consumption would improve the current account CA_2. In 2009, the final consumption expenditure significantly went down to $9961 billion, while deficit current account rate was down to 2.68%. It's a good illustration that the decreasing final consumption does improve the current account in the U.S. Just as Obstfeld (2010) state, "the compressed U.S. deficit results from falling levels of exports and imports, with imports falling more", see figure 2. The improved U.S. current account makes a sign that it moves in the direction of sustainability, even though it is hard to know if the trend will continue in the coming years.

Figure 2 The U. S. export, import and current account[18]



Resource: Obstfeld (2010), Journal of International Money and Finance 29(2010)

② previous investment and the capital stock would improve the U.S. current account

The investment in the first period leads to the increasing production, $Y_2=A_2F(I_1+K_1)$. Compared with other nations, the relative increasing production should improve the current account, as other factors are constant. Being together with the relative increasing Y_2 and falling final consumption G_2+C_2, the gross domestic savings would go up in the second period. In addition, owing to the initial limit endowment and no capital stock in the end, the investment in the second period would be negative,$I_2=-K_2$. So the difference between the savings and investment would be positive, $Y_2-G_2-C_2-I_2>0$, which implies that current accounts CA_2 would be improved in the U.S. From the equation $Y_2-G_2-C_2-I_2=-(1+r)\ B_2$, $B_2<0$, the surplus current account CA_2 would equal to its debts and corresponding interest.

[18] In this figure, the current account equals to the export value minus the import value and ignores other component of current account.

4.6.2 The sum of current accounts in the rest of the world would deteriorate

Based on the definition, the sum of the current account should be zero in the whole world. The deficit current account CA_1 in the U.S. captured that the sum of current accounts in the rest nations were surplus. As the analysis above, compared with American, the citizens in other countries have relatively high patience on consumption. So their gross domestic savings were relative high, which could be used as domestic investments or lending to the U.S. Hence, the sum of surplus current accounts CA_1 in the rest countries equals to the lending and interest that U.S. would return in the second period.

① **The increasing final household consumption expenditure C_2 or/and general final government consumption G_2 would deteriorate the sum of current accounts in other countries**

Based on the Euler consumption equation (4), $0<ß<1$, the consumption C_2 in the rest countries would be high since they would receive the claim in the second period. From the budget constraint, $C_2=Y_2+ (1+r) B2+K_2-G_2$, $B_2>0$, the household final consumption C_2 would be larger than $Y_2+K_2-G_2$. Provided other factors being constant, from the equation, $CA_t = A_tF(K_t)-C_t-G_t-I_t+rB_t$, the raising final consumption, C_t+G_t, would deteriorate the current account CA_2. In the table 3, overall final consumption in the rest of the world took on the increasing trend, particular from 2007 to 2008, which were accompanied by the 0.5% decrease on the surplus. In 2009, even though the final consumption rate and investment rate went down, the saving rates significantly slide down, which was the reason why the sum of surplus current accounts deteriorated in other nations.

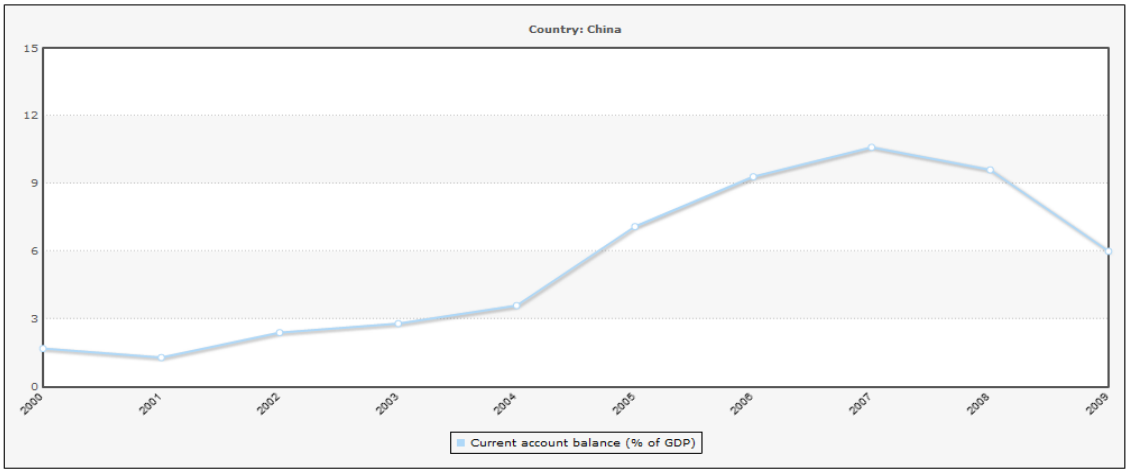
② **previous investment and the capital stock would not guarantee the current account surplus in the second period**

The first period investment would lead to the increasing production, $Y_2=A_2F\ (I_1+K_1)$. Provided other factors keep constant, the increasing production relative to the rest countries should improve the current account. However, the Y_2 couldn't cover the final consumption G_2+C_2, so gross domestic savings would be negative in the period two. In addition, owing to the initial limit endowment and no capital stock in the end, the investment in the second period would be negative, $I_2=-K_2$. From the equation $Y_2-G_2-C_2-I_2=-(1+r)B_2$, $B_2>0$, the difference between savings and the investment would be negative, which implies that current account CA_2 would be deteriorated and the magnitude of CA_2 would equal to debts plus corresponding interest. From the table 1, it documents that from 2007 the sum of current accounts in other countries deteriorated, which makes a sign that the sum of current accounts in the rest of the world couldn't be surplus forever and would reach the sustainable level in future.

4.7 The current accounts in China and other nations in the world

Among these years, the GDPs and final consumption growth rates took place large changes in China, which is seen as an accelerating realignment of the global economy and has growing repercussions on the global economy. From the figure 4, the current account rate from 2000 to 2007 represented the increasing trend, particular in the last three years. After 2007 the current account in China has begun to slide down and was down to $297 billion in 2009. Meanwhile, the sum of current accounts in other area was deficit among these years and had the opposite trend.

Figure 4: China current account rate (%GDP)



Source: The data is from the World Bank, 31, December, 2010

4.7.1 Why current account in China is surplus

In the past decade, the current account in China was surplus and the surplus on current account increased from 2000 to 2008. Which factors brought current account surplus and why surplus on current account was increasing in China? Within this model, by analyzing some factors including citizens' patience, the productivity, the capital stock and the gross fixed capital formation, we obtain factors causing the surplus current account and increasing surplus

on current account.

Table 9: China and other countries' current account and relative current account rates (%GDP) (unit: current US billion$)

	China	China	other countries	other countries
year	current account balance	current account balance (% of GDP)	current account balance	current account balance (% of GDP)
2000	21	1.7	-247	0.80
2001	17	1.3	-237	0.77
2002	35	2.4	-198	0.62
2003	46	2.8	-151	0.42
2004	69	3.6	-96	0.24
2005	161	7.1	-194	0.45
2006	253	9.3	-187	0.40
2007	372	10.6	-210	0.40
2008	436	9.6	-348	0.61
2009	297	6.0	-56	0.11

Source: The data is from the World Bank, 31, December, 2010

① high consumption patience in China

From the table 10, the gross domestic saving rate was larger in China than in the rest of the world in the last decade and kept the increasing situation from 2000 to 2009. It can be seen from the table 11 that the increasing gross domestic saving rate from 2000 to 2006 was because of increasing domestic business savings, household and institutions savings and gross government savings. Then in the following three years, even though the domestic business saving rate was unchanged, household and institution saving rate and government saving rate still increased, which leaded to the further increase of the gross domestic saving rate in China. Consequently, one reason why China held the increasing gross domestic saving rate was because of the increase of household and institutions saving rates and government saving rates

among these ten years. Within the model, high gross domestic saving rates could be seen as that Chinese has high consumption patience, ß, and, accordingly, has low final consumption expenditure, which contributed to the surplus current account in China in the last decade. From the table 10, the gross domestic saving rate in China increased from 37.5% in 2000 to 50.7% in 2006, which contributed to the 7.6% expansion of the surplus current account rate (%GDP); while it increased from about 21.8% to 22.2% in other countries, which was also coupled by the 0.4% improvement of the current account rate. Although the gross domestic saving rates went up from 50.5% in 2007 to 52.1% in 2009, the current account rate in China deteriorated from 10.6% to 6%, which was mainly due to the relatively sustainable increase of investment rate among these three years.

Table 10: China and other countries' gross domestic savings and relative rates (%GDP)

(unit: current US billion$)

	China	China	other countries	other countries
year	gross domestic savings	gross domestic saving rate (% of GDP)	gross domestic savings	gross domestic saving rate (% of GDP)
2000	450	37.5	6761	21.8
2001	509	38.4	6316	20.6
2002	588	40.4	6412	20.1
2003	712	43.4	7272	20.3
2004	885	45.8	8503	21.1
2005	1,075	47.6	9,295	21.4
2006	1,375	50.7	10,354	22.2
2007	1,766	50.5	11,829	22.6
2008	2,341	51.8	12,641	22.2
2009	2,596	52.1	10,438	19.6

Source: The data is from the World Bank, 31, December, 2010.

Table 11: China domestic business saving rate (%GDP), household and institutions saving rate (%GDP) and gross government saving rate (%GDP)

year	the domestic business saving rate(%GDP)	household and institution saving rate (%GDP)	gross government saving rate (%GDP)
2000	16.5	17.5	3.3
2001	17.4	16.6	4.2
2002	18	17.2	5.1
2003	18.3	18.3	7.0
2004	23.5	18.5	4.6
2005	20.4	21.5	6.4
2006	18.8	21.7	8.9
2007	18.8	22.2	0.8
2008	18.8	23.4	11.0

Source: The data is from Ma and Yi (2010), China's high saving rate: myth and reality

The final consumption can be split into two parts, household final consumption expenditure and general government consumption. Changes of general final government consumption, G_2, and final household consumption, C_2, would affect the current account.

- Impact of the household final consumption expenditure on current account

From the equation, $CA_t=A_tF\ (K_t)-C_t-G_t-I_t+rB_t$, the decreasing household final consumption would improve the current account, as other elements are equal. As table 12 and table 13 are shown, the household final consumption rate in China was much smaller than in the rest of the world, which contributed to the surplus on current account in China. Moreover, household final consumption rate fell 46.2% in 2000 to 38% in 2006, which were accompanied by with the surplus current account rate climbed from 1.7% to 9.3%. So it can be concluded that relatively large decline household consumption rate in China significantly improved the current account. Even though it can be seen from the table 13 the final household consumption rate in other countries went down and the current account also improved, in

reality the sum of current accounts in the rest of the world should deteriorate when the current account in China improved, since the sum of current accounts in the whole world equals to zero. So it's assumed that the data about other countries isn't exact.

- The impact of general final government consumption G_t (t=1and t=2) on current account.

From the table 12 and 13, the general government final consumption rate in China was slightly lower than other nations, which was a component to contribute to the surplus on current account. Furthermore, it took on decline trend and was from 15.8% in 2000 to 14.1% in 2006, which was accompanied by the 8.2% decrease on household final consumption rate and by the 7.6% increase on surplus current account rate; while the general government final consumption rate in the rest countries increased about 0.9%, which was coupled by the 2.3% decrease on final consumption rate. Hence, it can be concluded that the decreasing general government consumption expenditure improved the current account in China. In addition, the relative falling household final consumption rate and falling government consumption contributed to the increasing current account surplus in China.

Consequently, provided other factors are constant, high consumption patience, ß, leaded to low final consumption expenditure, particular low household final consumption, and caused the current account surplus in the past decade. And the decreasing final consumption rate contributed to the increase of the current account surplus in China.

Table 12: China household and general government final consumption expenditure and relative rates (%GDP) (unit: current US billion$)

year	household final consumption expenditure	the household consumption expenditure rate (%of GDP)	general government final consumption expenditure	the general final expenditure rate (% of GDP)
2000	554	46.2	189	15.8
2001	597	45.1	211	16.0
2002	641	44.1	227	15.6
2003	697	42.5	242	14.8
2004	788	40.8	270	14.0
2005	887	39.3	322	14.3
2006	1030	38.0	383	14.1
2007	1257	36.0	472	13.5
2008	1592	35.2	601	13.3
2009	1782	35.7	650	13.0

Source: The data is from the World Bank, 31, Dec, 2010.

Table 13: Other countries' household and general government final consumption expenditure and relative rates (%GDP) (unit: current US billion$)

year	household final consumption expenditure	the household final consumption expenditure rate	general government final consumption expenditure	the general government final consumption expenditure rate
2000	19183	62.86	5050	16.28
2001	19230	62.67	5119	16.68
2002	19941	62.64	5454	17.13
2003	22263	62.18	6249	17.45
2004	24752	61.48	6980	17.33
2005	26538	61.18	7488	17.26
2006	28308	60.56	8011	17.14
2007	31414	60.02	8926	17.05
2008	33919	59.69	9920	17.46
2009	32693	61.5	9888	18.6

Source: The data is from the World Bank, 31, December, 2010

② the productivity in China

The productivity is increasing in China and rest countries, as time goes, see table 14. Even though the productivity GDP per labor (current account US$) in China was still lower than in rest nations, the growth rate of productivity level in China was also much higher than in the rest countries. Referring to the GDP per labor force (constant 2000 international US$), it grew from $1.7 thousand in 2000 to $3.5 thousand in 2008 in China, which increased 105.9%; while it increased 5.2% in the rest countries. The relatively high growth productivity implies that fewer saving and more investment as other factors keep constant, which would deteriorate the current account. So it can be concluded that the relatively high growth productivity in China wasn't the factor causing the increase of the current account surplus in the past several years.

Table 14: China and other countries GDP per labor force

	China	China	other countries	other countries
year	GDP per labor (constant 2000 US$)	GDP per labor (current account US$)	GDP per labor (constant 2000 US$)	GDP per labor (current account US$)
2000	1.7	1.7	15.28	15.27
2001	1.8	1.8	15.20	14.85
2002	1.9	2.0	15.19	15.13
2003	2.1	2.2	15.26	16.71
2004	2.3	2.6	15.56	18.45
2005	2.5	3.0	15.73	19.49
2006	2.8	3.5	15.97	20.58
2007	3.2	4.5	16.21	22.64
2008	3.5	5.8	16.07	24.13
2009	..	..	..	..

Source: The data is from the World Bank, 31, December, 2010

③ the capital stock in China

From 2000 to 2009 the capital stock in China was increasing quickly. From the equation, $CA_t=A_tF(K_t)-C_t-G_t-I_t+rB_t$, the increase of capital stock should improve the current account in the relative year, as other factors keep constant. Consequently, the growing capital stock in China caused the increasing surplus on the current account among these ten years.

④ the gross fixed capital formation in China

Referring to the investment rate, the investment rate was still higher in China than in the rest of the world, see table 15. From equation, $CA_t=A_tF(K_t)-C_t-G_t-I_t+rB_t$, the relative large investment rate should deteriorate the current account. So it can be concluded that the relative large investment rate in China was not the reason to cause surplus on current account. Furthermore, from the data, the investment (constant 2000 US$) in China was $409 billion in 2000 and up to $1252 billion in 2009, the investment rate increased about 8.47%; while it fluctuated around 21% in other countries. Provided other factors being constant, the going up investment rate should deteriorate current account in corresponding years. But in reality the current account presented the opposite case. As a result, it can be concluded that the increasing investment rate couldn't be seen as one factor causing increasing surplus on current account in China in the past some years.

Table 15: China and other countries investments and investment rates (%GDP)

(unit: constant 2000 US billion$)

year	China investment	China the investment rate (%GDP(constant 2000 US$))	the other countries investment	the other countries the investment rate (%GDP(constant 2000 US$)
2000	409	34.14	6578	21.21
2001	446	34.36	6538	20.80
2002	505	35.66	6440	20.16
2003	588	37.74	6605	20.20
2004	656	38.25	6974	20.55
2005	732	38.34	7351	20.99
2006	823	38.26	7725	21.30
2007	931	37.89	8014	21.39
2008	1,021	37.91	7,955	21.02
2009	1,252	42.61	7,074	19.22

Source: The data is from the World Bank, 12, December, 2010

Just as the analysis above, high consumption patience caused the current account surplus in China and the growing capital stock and the falling final consumption rate contributed to the raising current account surplus in China.

4.8 Tendencies of current accounts in China and other countries would reverse

4.8.1 The current account would deteriorate in China

① The increasing final household consumption expenditure or/and general final government consumption would deteriorate current account in China

Based on the Euler consumption equation, (4), $0<ß<1$, the consumption C_2 in China would be high since they would receive the claim in the second period. From the budget constraint, $C_2=Y_2+ (1+r) B_2-G_2+K_2$, $B_2>0$, the consumption C_2 is larger than $Y_2+K_2-G_2$. Provided other factors being constant, from the equation, $CA_t=A_tF (K_t)-C_t-G_t-I_t+rB_t$, the raising final

consumption would deteriorate the current account CA_2. Meanwhile, increasing government consumption also would deteriorate the current account in China.

② the previous investment and the capital stock would not guarantee the current account surplus in the second period

The first period investment lead to the increasing production, $Y_2=A_2F(I_1+K_1)$. Provided other factors are constant, the increasing production should improve the current account. However, the production Y_2 couldn't cover the final consumption G_2+C_2, so gross domestic savings would be negative in the second period. In addition, owing to the initial limited endowment and no capital stock in the end, the investment in the second period would be negative, $I_2=-K_2$. From the equation $Y_2-C_2-G_2-I_2=-(1+r)B_2$, $B_2>0$, the current account CA_2 would be negative and the magnitude of CA_2 equal to its debts plus corresponding interest. In 2010, the current account was deterioration. "One was in the terms of trade, which remained below 2009 levels in the third quarter, as a result of higher price for primary products, notably for metals and minerals. The other was the low growth of the investment income, which was held back by the low global interest rate and a slowdown in the growth of China's foreign exchange reserves, which nonetheless reached $2.65 trillion by September 2010."(OECD Economic Outlook, 2010 issue 2). It make a sign the huge surplus current account in China wouldn't last forever and would slide down and reach the sustainable level in the future.

4.8.2 The sum of current accounts in other countries would improve

As the reference above, the citizens in the rest of the world have relative low patience on consumption and resulted in low gross domestic saving which could not cover the investment. Hence, the sum of deficit current accounts in the remaining countries equals to the loan and interest that was loaned from China in the period one.

① **The falling final household consumption expenditure or/and general final government consumption would improve current account in rest countries**

Based on the Euler consumption equation (4), $0<ß<1$, the final consumption C_2 in other countries would be low since they have to repay relative debts and interest to China. From the equation, From the constraint, $C_2=Y_2+(1+r)B_2-G_t+K_2$, $B_2<0$, the consumption C_2 is smaller than life wealth $Y_2+K_2-G_2$. Provided other factors being constant, from the equation, $CA_t = A_tF(K_t)-C_t-G_t-I_t+rB_t$, the falling final consumption, C_t+G_t, would improve the current account CA_2.

② **the previous investment and capital stock would contribute to the improved current account in other countries**

The previous investment leaded to the increasing production in the second period. Ceteris paribus, the increasing capital stock, K_2, would bring the rising GDP and lifting gross domestic savings, and as a result, the current account would be improved. As the analysis above, the investment in the second period would be negative, $I_2=-K_1$. Combined the increasing gross domestic savings and negative investment would lead to the surplus current account CA_2, $CA_2=Y_2-C_2-I_2-G_2 =-(1+r)B_2$, $B_2<0$ and the magnitude of currents account CA_2 would equal to debts and corresponding interest that should repay to China. In the future, the sum of current accounts in other countries would reach the sustainable level.

4.9 Shortcomings of the intertemporal model

Within the model, the change of current accounts could be well explained, but it ignores some factors affecting savings and investment behaviors. Under this model, high consumption patience in China caused high domestic savings and, as a result, the current account surplus. Nevertheless, there exit many elements triggering the high saving rate in China in reality. Based on the life-cycle hypothesis, consumption and savings depend mainly upon the lifetime resources and the demographic structure of the population. The expected high growth of income would reduce current savings; an increase in the ratio of working to nonworking population could increase the savings rate, given the higher average income resulting from a greater proportion of population being employed. Converse to the life-cycle hypothesis, higher income and expenditure risks may increase savings, as households increase savings to solve the adverse shocks, i.e. the precautionary savings. Baldacci et al (2010) claimed that "the government spending on health care, education, and pensions are associated with lower household savings." First, "social expenditures will increase the aggregate level of household lifetime resources and, hence, current consumption". When making decisions as to the current consumption level, households are assumed to consider current income and the expected income in future. An expansion of government social expenditures to cover a greater share of expenditures borne by households will, therefore, increase household lifetime resources and household current consumption and lower savings. Secondly, "social expenditures can generate an additional impact on current consumption through decreasing precautionary savings." As social expenditures elevated, households faced the lower future health and education cost and higher retirement income and, accordingly, may save less to cover these expenses. They also claimed that the low consumption rate in China partly reflect the high level of precautionary savings. It may be largely due to inadequate social protection programs relating to health and old age, and the elevated private cost of higher education, demographic trends and inadequate access to credit for a significant share of the population and so on.

Chamon and Prasad (2010) point out that in the absence of a strong social safety net and an underdeveloped financial system, this could lead households to self-insure by increasing their savings. So Households hold substantial precautionary savings to ensure future uncertainty environment. Chamon et al (2010) documented that in China strong average income growth has been accompanied by a substantial increase in income uncertainty. Partly since households with younger heads have a lower buffer stock of savings, an increase in transitory income variance causes them to save more in order to adjust their buffer stock to the riskier environment. Barnett and Brooks (2010) mention that spending on health has an impact on household savings. Increasing one RMB in government health spending is associated with increasing two RMB in urban household consumption. Gruber and Yelowitz (1999) found that, among the population eligible for Medicaid in 1993, each US$1,000 of added coverage increased household consumption by US$538 These suggest a positive relationship between the extension of social services and households' consumption rate.

Furthermore, in reality it is implausible that the time could be divided into two periods and ends in the second period, since the real life would refer to countless periods and economic activities would last countless periods.

To be much closer to the reality, the specie-flow mechanism and the Mundell-Fleming-Tobin model would be applied in the following section.

5. Application of the specie-flow mechanism and the Mundell-Fleming-Tobin model

5.1 Introduction

The specie flow theory originally states that if home country has a surplus in its net export with other countries, then the specie would flow into the home country. As stocks of specie accumulate, wealth of citizens in this country would increase. Then they would raise their expenditure not only in the domestic market but also in foreign markets. This increasing consumption demand in the home market causes the relative price level to rise, which implies that the competition of domestic goods and services would fall and net export would go down in the home country. Meanwhile, foreign countries would increase their net export and, as a result, would improve their current accounts. Finally expenditure in the home country would increase until net export in the whole world reaches sustainable states. Naturally, if another country has a deficit on its net export with foreign countries, the process is reversing with the above one. Nowadays the deficit current account is settled by the interest bearing debt.

The Mundell-Fleming-Tobin model combines the Mundell-Fleming model and the portfolio model. The Mundell-Fleming model mainly portrays responses of outputs, the interest rate and the exchange rate when policy makers implement the fiscal policy or/and the monetary policy under the perfect capital mobility, the imperfect capital mobility and the capital immobility. By applying the specie-flow mechanism and the Mundell-Fleming-Tobin model, I will discuss changes of net export and current accounts in the U.S. and in China as the nominal exchange rates change, respectively.

5.2 Assumptions

The world is divided into two parts, consisting of home country and other countries in the world. It is assumed that the nominal wage is rigid in the short run and there is no inflation and deflation in the initial situation in the whole world. In addition, the sum of the absolute value of the elasticity of demand for export and import is greater than one, which is sufficient for an increase in real exchange rate to improve the trade balance measured in home goods.

Let P and P_* denote price levels of home goods' and foreign goods', respectively, which are constant markup on wage and behave as if they are rigid in the short run.

Let E denote the nominal exchange rate, and R is the real exchange rate, $R=EP_*/P$.

Let r and r_* be the real domestic interest rate and the foreign countries' interest rate, respectively. It is supposed that the real domestic interest rate and real foreign countries' interest rate are equal, $r=r_*$.

Let Y and Y_* denote domestic production and foreign countries' production, respectively.

Net export is $X=X(R, Y, Y_*)$, which depends on the real exchange rate, home production and foreign countries' production and it's assumed that $X_R>0$, $X_Y<0$, $X_{Y*}>0$.

C is aggregate domestic consumption, which depends on domestic production and wealth. It's assumed that $0< C_Y <1$, $C_W>0$.

F_* is the foreign debt, which is measured by the foreign currency.

The government consumption is balanced by the tax income, so it is also ignored here.

There is no investment, since national savings plays more important role in the model.

5.3 The general analysis of the Mundell-Fleming-Tobin Model

The Model is adapted from Asbjørn Rødseth (2000).

$Y=C(Y, W, r, r_*) + X(R,Y,Y_*)$ (8)

$W=-EF_*/P$ (9)

$CA=S=Y-C-rEF_*/P= X(R, Y, Y_*)-rEF_*/P$ (10)

$R=EP_*/P$ (11)

$\dot{P}=P\gamma(Y-\bar{Y})$ (12)

$\dot{F}_*= r_*F_*-(P/E)\,X\,(EP_*/P, Y, Y_*)$ (13)

$\dot{W}=S$ (14)

Equation (8) portrays the *IS* curve, the production is the sum of aggregate consumption, C, and net export, X, where $0<C_Y<1$, $C_W>0$, $X_{Y*}>0$, $X_Y<0$ and $X_R>0$. Equation (9) describes wealth measured by home goods and Equation (10) is the current account function. Equation (11) is the real exchange rate. Equation (12) is the Philips Curve function, inflation $\dot{P}/P$ is proportional to the gap between actual and equilibrium, where is $\gamma>0$. Equation (13) is the dynamic function of the foreign debt. Equation (14) illustrates dynamic wealth that is a function of gross domestic savings.

In this model, exogenous variables are E, Y_*, P_*, r_* and predetermined variables are W_0, P_0, and F_{*0}, which are initial states of corresponding variables. Endogenous variables are Y, P, S and F_*.

5.3.1 The short-run effects of exogenous variable change

① The impact of the nominal exchange rate on production

Differentiating (8) with respect to the nominal exchange rate, E, gives

$$\partial Y/\partial E= \{(-F_*/P)\, C_2+ (P_*/P)\, X_1\}/ (1-C_1-X_2)>0 \quad (15)$$

The revaluation of the home currency relative to the U.S. dollar would reduce aggregate demand on domestic goods and services, since people become poorer and the raising relative price level would shift the demand shift towards foreign countries, which would ceteris paribus result in low home production. Combined with assumptions, $0<C_1<1$, $C_2>0$ and $X_2<0$, the denominator is positive. If the home country is a net borrower, $F_*>0$, the first term, $(-F_*/P)\, C_2$, is negative and if it's a net lender, $F_*<0$, the first term is positive. The decrease of the nominal exchange rate, E, would reduce the real exchange rate, R, and, as a result, would have a negative impact on net export and output, so the second term, $(P_*/P)\, X_1$, is positive. It's assumed that the second term dominates the first one in the numerator. Consequently, the revaluation of the home currency would reduce home production.

② The impact of the nominal exchange rate on wealth

Differentiating (9) with respect to the nominal exchange rate, E, gives

$$\partial W/\partial E=-F_*/P \quad (16)$$

It indicates that the country wealth would change the foreign debt over the price level when the nominal exchange rate is revaluated. If the country is a net lender, $F_*<0$, this country wealth would increase $-F_*/P$ when the nominal exchange rate increases one unit. If the country is a net borrower, $F_*>0$, the wealth would reduce F_*/P when the nominal exchange rate increases one unit.

③ The impact of the nominal exchange rate on the current account

Differentiating (10) with respect to the nominal exchange rate, E, gets

$$\partial CA/\partial E = X_1 P_* /P + X_2 \partial Y/\partial E - rF_*/P$$

$$= X_1 P_* /P + X_2 \{(F_*/P)\, C_2 + (P_*/P)\, X_1\}/ (1-C_1-X_2) - rF_*/P > 0 \quad (17)$$

From assumptions $X_1>0$, $X_2<0$, and conclusion $\partial Y/\partial E>0$ (15), the first term is positive and second one is negative. The sign of the third item depends upon whether the home country is a net borrower, $F_*>0$, or a net lender $F_*<0$. It's assumed that the first item always dominates the second and third ones, so the effect of the nominal exchange rate on the current account is positive. In other words, the increase in the home nominal exchange rate relative to the U.S. dollar would improve the home current account.

5.3.2 The short-run effects of endogenous variable change

① the impact of the home price level change on production

Differentiating (8) with respect the price level, P, we get

$$\partial Y/\partial P = \{ -C_2\, EF_* /P^2 - X_1 EP_* / P^2 \} / \{ 1-C_1-X_2 \} < 0 \quad (18)$$

The elevation of the home price level would reduce the domestic production as remaining factors are unchanged. From assumptions, $0<C_1<1$, $C_2>0$, $X_1>0$, $X_2<0$ and $X_3>0$, the denominator is positive. The increasing home price level would reduce the real value of the foreign debt, F_*. It would raise the aggregate demand if the foreign debt F_* is negative; it would lower the aggregate demand if the foreign debt F_* is positive. Meanwhile, the increasing domestic price level would lower the international competition capability and result in the falling export value. If the foreign debt is large enough, the first term would dominate the expression. However, it's assumed that the real exchange rate effect dominates the numerator and, as a result, the aggregate demand would fall when the domestic price level

goes up.

② the impact of the home price level change on the current account

Differentiating (10) with respect to the price level, P, gets

$$\partial CA/\partial P= X_2\partial Y/\partial P-X_1EP_*/P^2+r_*EF_*/P^2$$

$$= \{ -C_2 EF_* /P^2-X_1EP_*/ P^2 \} / \{ 1-C_1-X_2 \} -X_1EP_*/P^2+r_*EF_*/P^2< 0 \quad (19)$$

The falling home price level would improve the domestic current account, as remaining elements are constant. The combination of assumptions, $X_1>0$ and $X_2<0$, and the conclusion $\partial Y/\partial P<0$, the first term is positive and second one is negative and third item depends on whether home country is a net lender, $F_*<0$, or a net borrower, $F_*>0$. If it's a net lender, $F_*<0$, the second one is negative and the third one is positive; vice versa. In the short run, it's assumed that the first term dominates the whole expression, so the decrease of the price level would improve the home current account.

③ the impact of foreign debts change on the production

The effect of increasing foreign debt on production is negative. Differentiating (8) with respect to the foreign debt, F_*, we gets

$$\partial Y/\partial F_*= \{ -C_2 E/P \} / \{ 1-X_2-C_1 \} <0 \quad (20)$$

From consumptions, $0<C_1<1$, $X_2<0$ and $C_2>0$, the denominator is positive and numerator is negative. It implies that as other factors are unchanged, the higher foreign debt is, the lower domestic wealth and lower home output would be, since home consumers would reduce their consumption demand through the wealth effect C_2.

④ **the impact of the foreign debt change on the current account**

Differentiating the equation (10) with respect to the foreign debt, F_*, we gets

$$\partial CA/\partial F_* = X_2 \partial Y/\partial F_* - r_* E/P$$

$$= X_2 \{ -C_2 E/P \} / \{ 1-X_2-C_1 \} - r_* E/P > 0 \quad (21)$$

From the assumption $X_2<0$ and the conclusion $\partial Y/\partial F_*<0$, the first term is positive, and the second one is negative. Within the model, it's assumed that the first item dominates the second one, which implies that the increase of foreign debt would ceteris paribus improve the home current account.

5.3.3 The stationary equilibrium

$\bar{Y} = C(\bar{Y}, W, r, r_*) - r_* W \quad (18)$

$C(\bar{Y}, W, r, r_*) = \bar{Y} + r_* W = \bar{Y} - r_* E F_*/P \quad (19)$

$X = X(R, \bar{Y}, Y_*) = r_* E F_*/P = -r_* W \quad (20)$

Equation (18) is the condition for the internal balance and production would keep the sustainable level in the long run, which implies that output in the long run is determined by the supply and independent on the nominal exchange rate, E, and the price level, P.

Equation (19) is the long run final consumption function. Combined with the long run production, $\bar{Y}$, and the final consumption C, the wealth, W, and the foreign debt, F_*, could be determined by this function. In other words, the savings behavior determines wealth.

Equation (20) is the condition for the external balance, which implies that in the long run the net export value is used to pay interest on the foreign debt. Based on wealth W, the real exchange rate, R, could be determined in this function. Meanwhile, from the definition,

$R=EP_*/P$, the home price level could be determined by the given real exchange rate R.

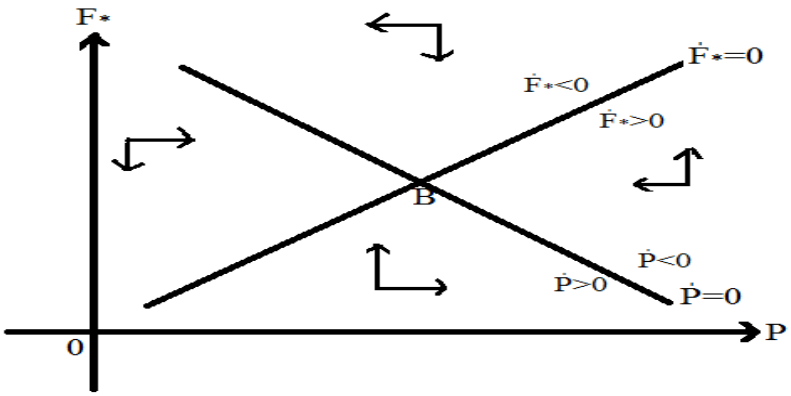
From the analysis above, in the long run the production, $\bar{Y}$, wealth, W, foreign debts, F_* and the real exchange rate, R, are independent of the nominal exchange rate, E.

5.3.4 The movement from the short-run to the stationary equilibrium

The movement from the short-run to the long-run equilibrium can be illustrated by a diagram. The internal balance line and the external balance line divide the plane into four regions. If the economy case is in one of regions, the equilibrium would move in a direction which is the intermediate between two marked arrows in the corresponding region. The internal balance line slopes downwards, since the high price level, P, is coupled by the aggregate demand, $\bar{Y}$, only if the foreign debt is low. In the right of the locus for the internal balance, the home price level is high, which means that the aggregate demand is low and the price level would fall. In the left hand side of the internal balance line, the domestic is relatively low, so the aggregate demand would be high and the price level would slide down. The movement direction for the home price level is drawn by the marked horizontal arrows.

The large foreign debt tends to accompany with the surplus current account, since consumers would increase gross domestic savings so as to reduce the foreign debt. And a high price tends to cause the current account deficit. Hence, the high foreign debt, F*, is associated with the high home price, P, and the external balance line slopes upwards, see figure 5. If the economy situation is above the external balance, it means that the foreign debt is high, and then the domestic demand is low, gross domestic savings would be high and foreign debt would fall. The movement direction for the foreign debt, F_*, is figured by the marked vertical arrows, see figure 5.

Figure 5: The transition from the short-run to the long-run equilibrium.



5.4 The current account in the U.S.

The whole world is divided into two parts, the U.S. and foreign countries. Within the model, I discuss the change of the U.S. current account just by the market power and under the impact of the exchange rate change, respectively.

5.4.1 Why the current account was deficit in the U.S.

Within the model, from the equation, $CA=S=X(R, Y, Y_*)-rEF_*/P$ (10), the increasing deficit current account in the U.S. mainly depended upon the decreasing gross domestic saving rate, which was coupled by the decreasing net export rate and the increasing foreign debt. Among 2002 and 2006, the depreciation of the U.S. dollar increased the market competitiveness, but deficit net export went up from $379 billion in 2000 to $759 billion in 2006, see table 16. Even though the depreciation of the U.S. dollar reduced the initial real value of the origin foreign debt, large deficit net export accounted for the large share of the current account. Hence as the deficit net export increased, the current account deficit raised from 2002 to 2006. Then in the following three years, deficit net export started to decrease and was down to $375 billion in 2009, which was accompanied by the current account improvement in the U.S.

In addition, from the equation (17), $\partial CA/\partial E>0$, the U.S. dollar depreciation should improve American current account, as remaining factors are constant. But it took place until 2007, which indicated in reality the impact of exchange rate changes on current account would experience a relatively long time. It could be illustrated by the J-curve theory. As the U.S. dollar was depreciation, in the short term the volume of import and export kept the same level partly because of pre-existing contracts. Moreover, in the short run consumption demand for import is price inelastic, which results from time lags in the consumers' search for relatively cheaper alternatives. Therefore, the quantity demanded for import remained unchanged, although consumers paid a higher price than previous. Nevertheless, the depreciation of the U.S. dollar caused the import price to be up and the export price to go down. Therefore, net

export has begun to increase until 2007, which was coupled by the improvement of the current account. But net export still kept the deficit case; hence, the current account was deficit in 2009 mainly because net export made up of the large share of it.

Table 16: The U.S. net export, net export rate (%GDP) and the net export rate (% current account)

	the U.S.	the U.S.	the U.S.
year	the net export (current US billion$)[19]	the net export rate (%GDP)	the net export rate (%current account)
2002	-421	-3.98	91.9
2003	-494	-4.45	94.8
2004	-609	-5.16	96.7
2005	-714	-5.68	95.5
2006	-759	-5.69	94.5
2007	-702	-4.99	97.8
2008	-699	-4.86	104.5
2009	-375	-2.66	99.2

Source: The data is from the World Bank, 31, December, 2010.

5.4.2 The movement from the short-run to the long-run equilibrium about the U.S.

① The movement from the short-run to the long-run equilibrium just by the market power about the U.S.

Within the model, assume that the initial point of the U.S. is the point A in the region I with the current account deficit. The point A represents the combination of the foreign debt and the price level in 2002, when the U.S. was the net borrower. To increase net export and reduce the current account deficit, American would reduce their expenditure not only in the domestic

[19] The net export here is net trade in goods and services in the World Bank database. Net trade in goods and services is derived by offsetting imports of goods and services against exports of goods and services. Exports and imports of goods and services comprise all transactions involving a change of ownership of goods and services between residents of one country and the rest of the world. Data are in current U.S. dollars.

market but also in the foreign market. The falling consumption demand would reduce the domestic price, which implies that the home market competition capability would elevate and net export would go up. But the export income still could not cover interest payment, so the foreign debt would increase. After some years, the path would hit the external balance, where the foreign debt would keep stationary and the price level would be decline. Then the path would enter in the region II.

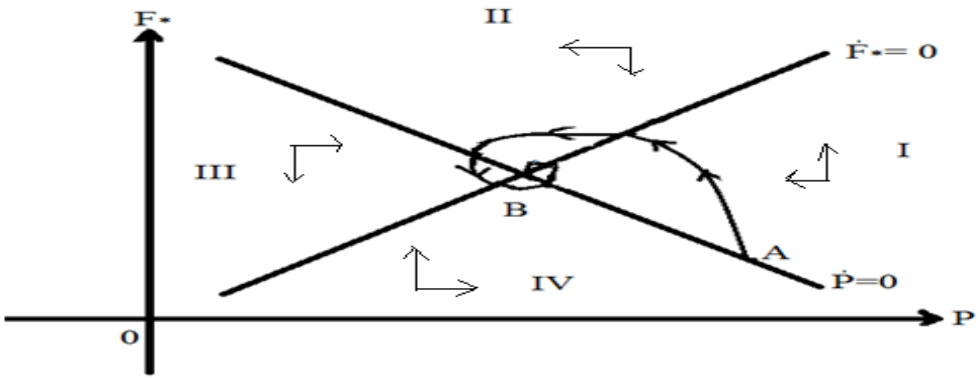
In the region II, due to the high foreign debt, American would shorten consumption expenditure, which would be coupled by the decline home price level. The falling relative price level would lift the market competiveness and net export would rise. It would lead to the current account surplus and the gradual decline in the foreign debt. Then the path would hit the internal balance, where the price level would stay in a stationary state and the foreign debt would be down and then would enter in the region III.

Owing to the relatively low price level, the net export value would increase. The surplus net export contributed the American wealth increase and the foreign debt decrease, which was coupled by the current account surplus. Then American demand would continue to increase, owing to the steady decline of the foreign debt, which implies that the current account would deteriorate. The path would hit the external balance, where the foreign debt would keep constant and the price level would still increase. Then the path would enter in the region IV.

In the region IV, the price level increase would reduce the competitiveness, so the net export value would slide down, which would be coupled by the increasing current account deficit. The real appreciation and the accumulation of foreign debt both would reduce American demand for home goods, which would be coupled by the falling inflation. Some years later, the path would hit the internal balance, which implies the inflation would stop and the competitiveness would begin to improve. Then the path would enter in the region I, where is

the original area. However, the path would be closer to the long run equilibrium B. In the future, it might repeat this course several times before reaching the stationary equilibrium, but the curve would be closer and closer to the long run equilibrium B, if there exit no shocks. When the net export income is counteracted by import expenditure in the U.S., the current account deficit would be down to zero and the path would hit the stationary equilibrium B. The combination of the foreign debt and the price level would move as shown arrows, see figure 6. Of course, it's not necessary that the movement of the foreign debt and the price level could be directly towards the stationary equilibrium instead of the spiral curve.

Figure 6 : The movement[20] from the short-run to the stationary equilibrium about the U.S.



② The movement from the short-run to the long-run under the impact of the exchange rate change about the U.S.

Within the model, assume that initial point of the U.S. is the point A with the deficit current account. The point A represents the combination of the foreign debt and the price level in 2002, when the U.S. was the net borrower. From 2002 to 2005, the U.S. dollar was depreciated to all currencies of the whole world in several times. Even the exchange rate

[20] The path should cross the external balance line horizontally and should cross the internal balance line vertically. In the figure 5, the path movement is not drawn exactly.

slightly rebounded in 2006 and 2007; the following subprime crisis and financial crisis have seriously affected economy recovery in the U.S. As the U.S. dollar depreciation, the relative price level was much cheaper than before, which lifted the market competiveness and the current account. Since in the short run the consumption demand for imports is price inelastic, net export couldn't immediately significantly increase and the current account could not immediately be improved, which leaded to the interest-bearing claims increase. As a result, the deficit current account was increasing from 2002 to 2006. Until 2007 the net export began to increasing, which was coupled by the improved current account. In the coming years, to increase net export and reduce huge foreign debt, American would reduce their expenditure not only in the domestic market but also in the foreign market. The falling consumption demand would cause relative price to fall, which implies that the American market competition capability would elevate and net export would go up. But the export income still could not cover the interest payment, so the foreign debt would increase. After some years, the path would hit the external balance, where the foreign debt would keep stationary and the price level would be decline. Then the path would enter in the region II.

In the region II, due to the high foreign debt, American would shorten the consumption expenditure, which would be coupled by the decline home price level. The reducing price level would lift the market competiveness and net export would rise. It would improve the current account and the foreign debt would be gradual decline. Then the path would hit the internal balance, where the price would stay in a stationary state and the foreign debt would be down and then would enter in the region III.

Owing to the relatively low price level, the net export value would increase. The surplus net export contributed the American wealth increase and the foreign debt decrease, which was coupled by the current account surplus. Then the American demand would continue to increase owing to the steady decline in foreign debt, which implies that current account would

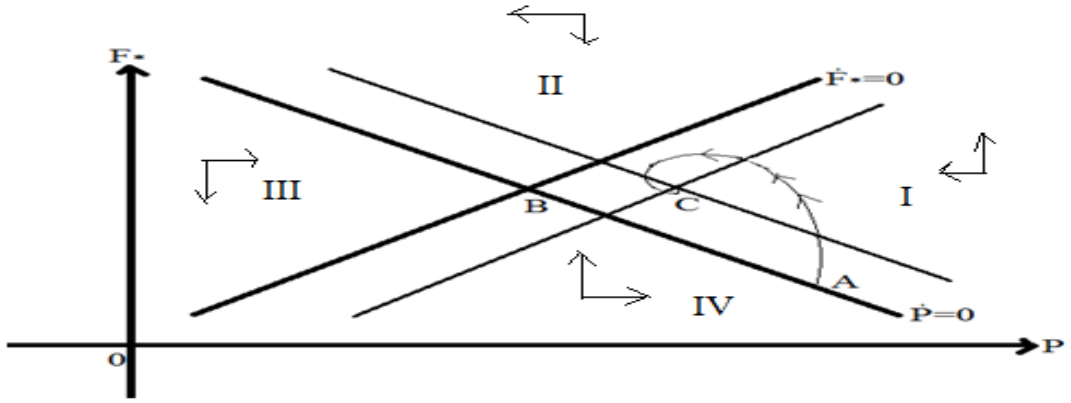
deteriorate. The path would hit the external balance, where the foreign debt would keep constant and price level would still increase. Then the part would enter in the region IV.

In the region IV, the price level increase would reduce the competitiveness, so the net export value would slide down, which would be coupled by the increasing deficit current account. The real appreciation and the accumulation of the foreign debt would reduce the American demand for home goods, which would be coupled by the falling inflation. Some years later, the path would hit the internal balance, which implies the inflation would stop and competitiveness would begin to improve. Then the path would enter in the region I, where is the original area.

The combination of the foreign debt and the price level would move as the marked arrows from region I to region II and then to region III and region IV, and/or would repeat this process several times before reaching the new stationary equilibrium C. It may take several years or several decades until the net export value equals to interest payment and the current account would equal to zero. It is drawn in the figure 7. In addition, it's not necessary that the movement of the combination of the foreign debt and the price level is spiral curve. The path can be directly towards to the stationary equilibrium.

In the long run, whatever the movement is under the market power or under the exchange rate change effect, the foreign debt would be unchanged, since the foreign debt is independent of the nominal exchange rate. But since the devaluation of the US dollar, the new equilibrium price level under the nominal exchange rate change is higher than the original equilibrium price level, because of the high nominal exchange rate.

Figure 7: The movement[21] from the short-run to the stationary equilibrium about the U.S.



[21] The path should cross the external balance line horizontally and should cross the internal balance line vertically. In the figure 6, the path movement is not drawn exactly.

5.5 The current account in China

Within the model, the whole world is divided into two area, China and foreign countries. Compared with the model about the U.S. model above, it postulated that the Chinese exchange rate is fixed and the capital mobility is imperfect.

5.5.1 Why the current account was surplus in China

Within the model, from the equation, $CA=S=X(R, Y, Y_*) - rEF_*/P$ (10), the increasing current account mainly depended on raising gross domestic savings, which resulted from elevating net export and raising net foreign asset in the past several years. From the equation (8), $Y=C(Y, EF_*/P, r, r_*) + X(EP_*/P, Y, Y_*)$, the lifting net export would increase the production in corresponding years, as other elements keep constant. The relative low exchange rate lowers the Chinese relative price level, which attracts large consumption demand from overseas, and naturally the net export is high. Just as table 18 shows, the net export rapidly grew and was from $125 billion in 2005 to $349 billion in 2009, which was accompanied by the increase of 121% of GDP (current US $) in China. Therefore, the net export increase contributed to the increase in production and savings. Many economists put forward many ideas about why consumption expenditure rate took on decrease trend as the growth rate of the income is relatively high, see the section 4.9. From the equation, $\dot{W}=S$, as gross domestic savings went up, the accumulated wealth increased, which covered not only the interest payment but also some debts. Based on the equation, $CA=X(R, Y, Y_*)-rEF_*/P$ (10), the increasing net export and the decline foreign debt leaded to the increase in the current account surplus. However, the accumulated wealth per capita was lower than the world level. Hence, Chinese would continuously increase wealth until it reaches the optimal level, which implies that gross domestic savings may be high in the next several years or several decades.

In addition, from the equation (17), $\partial CA/\partial E>0$, the revaluation should deteriorate Chinese current account. But from 2005 to 2009 current account kept the increasing situation. It indicated that in reality the change of the exchange rate does impact the current account, but the process is slow. It could be illustrated by the J-curve theory. As the RMB was revelation, in the short term, the volume of net exports kept the same level partly because of pre-existing contracts. Moreover, in the short run, consumption demand for import is price inelastic, which results from the time lags in the consumers' search for relative cheaper alternatives. As a result, the quantity demanded for imports remain the same, although consumers are now paying a higher price than before. However, the revaluation caused the price of imports to be down and the price of exports to go up. In the long run, demand for imports would pick up and domestic consumers would switch their expenditure to foreign products and the export volume would go down. Ceteris paribus, the deterioration of the current account is to be expected in the long run. Of course, it's no doubt that the global financial crisis in 2008 has impacted net export and current accounts in China and in the rest of the world. It is also one reason to explain why the current account started to deteriorate in China in 2009.

5.5.2 The movement from the short-run equilibrium to the stationary equilibrium about China

① the movement from the short-run to the stationary under the only market power about the China

Among these years sustainable exports of the raw material and the OEM [22] (the original

[22] An original equipment manufacturer (OEM) manufactures products or components that are purchased by a company and retailed under the purchasing company's brand name. OEM refers to the company that originally manufactured the product.

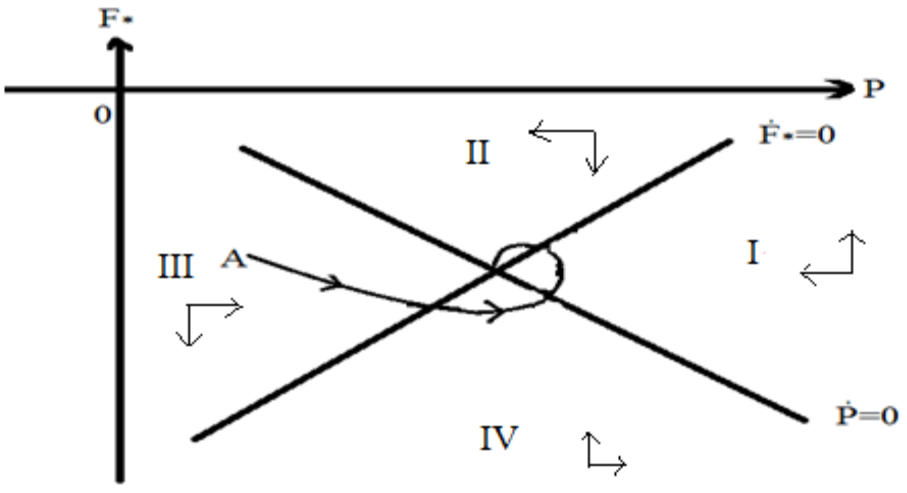
equipment manufacturer) contributed to the net export increase. Within the model, assume that the initial point is the point A in the region III with the current account surplus. The point A represents the combination of the price level and the foreign debt in China in 2005, when it was a net lender and the net export rate (%GDP) was 5.5%. Owing to the relatively low price level, the net export value exceeded the import value. The surplus net export contributed the increase in Chinese wealth and the decrease in the foreign debt, which was coupled by the current account surplus. Then the Chinese demand would continue to increase owing to the steady decline in the foreign debt, which implies that current account would deteriorate. The path would hit the external balance, where the foreign debt would keep constant and the price level would still increase and the real exchange rate would still appreciate. Then the part would enter in the region IV.

In the region IV, the increase of the price level and the falling real exchange rate would reduce the competitiveness, so the net export value would slide down, which would be coupled by the increasing current account deficit. The real appreciation and the accumulation of foreign debts both would reduce Chinese demand for home goods, which would be coupled by the falling inflation. Some years later, the path would hit the internal balance, which implies the inflation would stop and the competitiveness would begin to improve. Then the path would enter in the region I.

In the region I, to increase net export and reduce the current account deficit, Chinese would reduce their expenditure not only in the domestic market but also in the foreign market. The falling consumption demand would cause the price level down, which implies that the home market competition capability would elevate and net export would go up. But the export income still could not cover the interest payment, so the foreign debt would increase. After some years, the path would hit the external balance, where the foreign debt would keep the stationary and the price level would be decline. Then the path would enter in the region II.

In the region II, due to the high foreign debt, Chinese would shorten the consumption expenditure, which would be followed by the decline home price level. The reducing price level would lift the market competiveness and net export would rise. It would lead to the current account surplus and the gradual decline in the foreign debt. Then the path would hit the internal balance, where the price would stay in a stationary state and the foreign debt would be down and would enter in the region III, where is the starting point. After going a full circle, the economy would repeat this process several times before reaching the stationary equilibrium. It may experience several years or several decades until the net export value equals to interest and current account equals to zero. When the income of net export is counteracted import expenditure in China, the current account surplus would be down to zero, the path would directly hit the stationary equilibrium B, see the figure 8. Of course, it's not necessary that the path of the combination of the foreign debt and the price level moves spirally. It may move directly to the stationary equilibrium B.

Figure 8: The movement[23] from the short-run to the stationary equilibrium about China



[23] The path should cross the external balance line horizontally and should cross the internal balance line vertically. In the figure 7, the path movement is not drawn exactly.

② The movement from the short-run to the stationary equilibrium under the nominal exchange rate change in China

Assume that the initial point is the point A in the region III with the current account. surplus The point A represents the combination of the price level and the foreign debt in China in 2005, when it was a net lender and the nominal exchange rate was 8.28RMB/USD and net export rate (%GDP) was 5.5%, see table 17. In 2005, the nominal exchange rate went down to 8.19 RMB/USD, which raised Chinese relative price level (PPP conversion factor (GDP) to market exchange rate ratio) and reduced the market competitiveness. But, compared with foreign countries, relative price level in China was low and meanwhile in the short run the consumption demand for the imports was price inelastic. Hence, net export continuously increased and was up to $125 billion in 2005, which was 2.6 times as large as it in 2004 and was also coupled by the 3.5% increase in the surplus current account rate. Meanwhile, the raising current account contributed to the increase in wealth. The combination of the foreign debt and the price level would move as drawn arrows. In 2006 the nominal exchange rate slid down to 7.97 RMB/USD, which further lowered the market competitiveness. The net export went on growing but with the low growth rate of net export, which was accompanied by the 2.1% increase in current account surplus and the increase in the net foreign asset and wealth. In 2007, the nominal exchange rate was continuous revaluation and was down to 7.61RMB/USD. The net export went up with the 47% growth rate and the 1.3% increase in current account rate in China, which was coupled with the increase of wealth. In 2008, the nominal exchange rate was revaluated again and reduced to 6.95RMB/USD, which has affected the net export volume. At the same time the financial crisis occurring in 2008 has severely affected Chinese net export. The growth rate of net export was only 13.6%, which was accompanied by the 1% increase in current account surplus in China. So the increase of wealth was smaller in 2008 than in 2007. In 2009, the nominal exchange rate was revaluated once again and down to 6.83RMB/USD. The net export significantly fell and was 63% of previous year's net export, mainly resulting from the severe financial crisis and the

revaluation RMB/USD. Since net export accounts for more than the 80% current account in China, the current account surplus in 2009 slid down to $297 billion. Even though the current account surplus lowered in 2009, the wealth remained increase, which contributed to the wealth enlargement. Then Chinese demand would continue to increase owing to the steady decline in the foreign debt, which implies that the current account would deteriorate. The path would hit the external balance, where the foreign debt would keep constant and the price level would still increase and the real exchange rate would still appreciate. Then the part would enter in the region IV.

In the region IV, the increase of the price level and the real exchange rate revaluation would reduce the market competitiveness, so the net export value would slide down, which would be coupled by the increasing current account deficit. The real appreciation and the accumulation of foreign debts both would reduce Chinese demand for home goods, which would be coupled by the falling inflation. Some years later, the path would hit the internal balance, which implies the inflation would stop and competitiveness would begin to improve. Then the path would enter in the region I.

In the region I, to increase net export and reduce current account deficit, Chinese would reduce their expenditure not only in the domestic market but also in the foreign market. The falling consumption demand would cause the relative price level to fall, which implies that the home market competition capability would elevate and net export would go up and would be coupled by the current account improvement. But the export income still could not cover interest payment, so foreign debt would increase and the current account would be still deficit. After few years, the path would hit the external balance, where the foreign debt would keep stationary and the price level would be decline. Then the path would enter in the region II.

In the region II, due to the high foreign debt, Chinese would shorten consumption expenditure,

which would be followed by the decline home price level. The reducing relative price level would lift the market competiveness and net export would rise. It would lead to the current account surplus and the gradual decrease in the foreign debt. Then the path would hit the internal balance, where the price level would stay in a stationary state and the foreign debt would be down and would enter in the region III, where is the starting point. After going a full circle, the economy would start on another and the yet another, and in this way the path would spiral towards the stationary equilibrium in the future. When the income of net export is counteracted by import expenditure in China, the surplus current account would be down to zero, the path could directly hit the new stationary equilibrium C, see figure 9. Of course, the path is not necessary to be a cyclic and may directly move to the new long run equilibrium C.

In the long run, whatever the movement is under the market power or under effect of the exchange rate change, the foreign debt would be unchanged because the foreign debt is independent of the nominal exchange rate. But since the revaluation of the RMB/USD, the new equilibrium price level under the nominal exchange rate change is lower than the original equilibrium price level, due to the low nominal exchange rate.

Table 17: China nominal exchange rate (%GDP) and relative price (PPP conversion factor (GDP) to market exchange rate ratio)

year	the nominal exchange rate(RMB/US$)	PPP conversion factor (GDP) to market exchange rate ratio[24]
2005	8.19	0.42
2006	7.97	0.44
2007	7.61	0.47
2008	6.95	0.55
2009	6.83	0.55

Source: The data is from the World Bank, 28, December, 2010

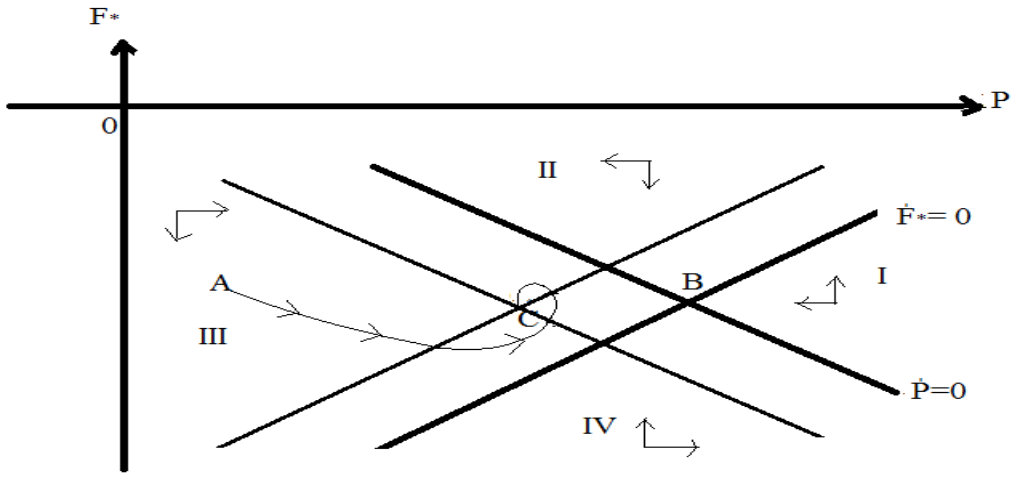
Table 18: China net export and the net export rate (%GDP)

year	net export current US billion$	net export rate (%GDP)
2005	125	5.5
2006	209	7.7
2007	307	8.8
2008	349	7.7
2009	220	4.4

Source: The data is from the World Bank, 28, December, 2010.

[24] The ratio of PPP conversion factor to market exchange rate is the result obtained by dividing the PPP conversion factor by the market exchange rate. The ratio makes it possible to compare the cost of the bundle of goods that make up gross domestic product (GDP) across countries. It tells how many dollars are needed to buy a dollar's worth of goods in the country as compared to the United States

Figure 9: The movement[25] from the short-run to the stationary equilibrium about China



[25] The path should cross the external balance line horizontally and cross the internal balance line vertically. In the figure 8, the path movement is not drawn exactly.

5.6 Shortcomings of the applied Specie-flow mechanism and Mundell-Fleming-Tobin model

Within the the Specie-flow mechanism and the Mundell-Fleming-Tobin model, changes of net export and current accounts in the U.S., China and rest countries are well explained. However, it is hard to explain explicitly to explain why the current accounts in the U.S. and in China were deficit and surplus in the past several years, since it ignores some important factors, such as the investment, productivity, the capital stock, which have influences on the current accounts to some extent. Just as the two periods' intertemporal model analysis, these factors affect the current account changes in these years. Moreover, the movement of the combination between the home price level and the foreign debt in the figures is only under the market power and exchange rate changes. It's not realistic since it does not consider the impact of the random events, such as this financial crisis and business fluctuation, so the real path is not necessary along the curves in the figures.

6. Conclusion

Within two periods' intertemporal model and combining the data from the World Bank and other sources, we find reasons why current accounts are imbalance in the U.S. and in China, respectively. And under assumptions and optimal conditions, current accounts in these two countries would reverse and would reach sustainable levels in the future. Nevertheless, it's hard to use this model to explicitly explain the real world, since there are some shortcomings in the model, such as the reason of high gross domestic savings, the arbitrary timing division and so on.

The specie-flow mechanism and Mundell-Fleming-Tobin model are much closer to the reality, which avoid some disadvantages of the intertemporal model. As the analysis, just by the market power or under the effect of exchange rate changes, the current accounts in the U.S. and in China would reach sustainable levels, i.e. zero in future. However, the application of the specie-flow mechanism and the Mundell-Fleming-Tobin model also has some demerits, as it ignores some important factors, such as investment, the productivity, the capital stock and some random factors in the real life, which have influences on the current account to some extent.

About when current accounts in the U.S. and in China will reach their sustainable levels, I think only history could tell us the truth.

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