14. THE DOLLAR STANDARD AND STABILITY OF CHINA'S MACROECONOMY [1]

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Abstract

This paper studies how Dollar Standard influences the stability of macro-economy of China. Our conclusions are (1) the Dollar Standard influences the stability of macro-economy of China through risk sharing mechanism of international commodity market and international financial market, (2) the size of an economy and the type of shocks affect the stability of China's macro-economy. The Dollar Standard will increase the stability of macro-economy of China when the Chinese economic scale is small and internal shocks are weak. While the Dollar Standard will lead to the severe instability of China's macro-economy, especially to the price and exchange rate, when the Chinese economy scale increases and exogenous shocks play a lion's share.

Keyword: Dollar Standard, Stability of Macro-economy, New Keynesianism
JEL Classification: E11,E37

I. Introduction

U.S. dollar has kept its position in the international trading settlement since the breakup of the Bretton Woods system. Some scholars argue that the current international monetary system is similar to Bretton Woods system. Thus, it is respectively called the post-Bretton Woods system (Bayoumi, 1993), the Revived Bretton Woods system (Dooley, 2003), the Dollar Hegemony (Kindleberger, 1986) or the Dollar Standard(McKinnon, 2001). Among them, the Dollar Standard is the most widespread definition. Under Dollar Standard, the world economy remains unstable. Examples are the Latin American debt crisis in early 1980s, the Mexico currency crisis

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in 1994, the southeast Asian financial crisis in 1997, the financial disturbance of Brazil and Russia in 1998, the Argentine crisis in 2001, the financial crisis in Dubai in 2009, etc, we discover the basic reason for the crisis, scholars and policy makers from different countries have considered the stability of Dollar Standard and macro-economy as a significant study. The idea of tying Dollar Standard to the stability of macro-economy is not new. It has been proved that Dollar Standard has accelerated the world economic growth relying too much on expansionary economic policy of the US, while ameliorates the world economic growth when it makes world economy unbalanced (Zhang, 2008; Xiang and Liu, 2009). Dollar Standard is the origin of the world imbalance and the fundamental cause of the world financial disturbances and crisis (Peng and Liao, 2010). However, limited by deduction and local analysis method, these studies have not explained the effects of Dollar Standard on the macro-economic stabilities of periphery countries based on dynamic general equilibrium analysis.

It is a progress of introducing PCP-LCP pricing model into the new open macro-economy analysis framework and using the general equilibrium analysis to research the influences of the Dollar Standard on macroeconomic stabilities of the United States and periphery countries (Devereux, et.al, 2007). They argue that the instability of the US economy increases due to the lack of exchange rate adjustment mechanism, but peripheral countries' economies can maintain stable through the exchange rate adjustments and get positive welfare increment. In order to analyze the problem more closely to reality, Calvo pricing is introduced into the model, which leads to an opposite conclusion. Because of the Dollar Standard, exchange rate transmission is asymmetry, which means the US monetary policy has more influences on the import and export trade than the peripheral countries (Tervala, 2010), i.e, the United States' expansionary monetary policy will lead to a beggar-thy-neighbor effect, so the Dollar Standard increases macroeconomic volatilities of other countries. According to the existing researches, opinions are different as to there is little agreement on how the Dollar Standard influences the US and other countries' economies. Someone argues Dollar Standard adds US macroeconomic fluctuations, but enhances peripheral country residents' welfare (Devereux, et.al, 2007). The other holds an opposite view (Tervala, 2010). The main causes of the opposite views are different analysis methods and different Dollar Standard measurements. On the method, Devereux, et.al (2007) only uses the static analysis and ignores dynamic characteristics of economic activities. On the measurement, Tervala (2010) supposes all export goods to America from other countries are priced in dollars, which is not supported in real economy.

Compared to those studies cited above, this paper has three improvements, (1) we use Dynamic Stochastic General Equilibrium (DSGE) analysis method to replace Static Random General Equilibrium analysis method in Devereux, et.al (2007); (2) on the Dollar Standard measurement, we assume that only a part of goods exported to America are priced in the dollar; (3) on the basis of China's data, we analyze the impacts of internal and external shocks on China's economic stability under the Dollar Standard. The remainder of the paper is organized as follows. In Section Ⅱ, we explain the measurement method of the Dollar Standard. Section Ⅲ introduces Dollar Standard into the new Keynesian DSGE analysis framework. Section IV is the random numerical simulation. In Section IV, we analyze the welfare. The last Section summarizes the article and illuminates how China can avoid the negative impacts of shocks on China's macroeconomic stability.

II. The Measure of Dollar Standard and the Transmission Mechanism of Stability of Macro-economy

Though Mckinnon (2001, 2002) has done a systematic study on the Dollar Standard, he failed to give directly the Dollar Standard metrics. Devereux et.al (2007), who modeled the Dollar Standard for the first time, did not directly give specific equation for the Dollar Standard, but we can obtain the specific definition according to the derivations in his paper. The Dollar Standard under the domestic price index is given by

$$P_t = \left[\int_0^n p_t(j)^{1-\theta} dj + \int_n^1 (e q_t^*(j))^{1-\theta} dj \right]^{\frac{1}{1-\theta}}$$

$$P_t^* = \left[\int_0^n p_t^*(j)^{1-\theta} dj + \int_n^1 q_t^*(j)^{1-\theta} dj \right]^{\frac{1}{1-\theta}}$$

Above is the measure of the Dollar Standard by Devereux et al(2007). Where n represents the share of a country; P^* represents foreign price index; $p(j)$ is the domestic currency price of domestic goods; $q^*(j)$ is the foreign currency price of foreign goods; $p^*(j)$ is the foreign currency price of domestic goods; and e represents the nominal exchange rate. The most direct manifestation of PCP-LCP is the set of bilateral price indexes. Because foreign export manufacturers only use PCP pricing method, the domestic price index includes only domestic commodity price in local currency and export commodity price in foreign currency. The main contribution by Devereux et al(2007) is that the Dollar Standard is defined by international commodity price as for export manufacturers, which gives Dollar Standard study a fully microscopic vision. However, the rough definition cannot represent the dynamic characteristics of the Dollar Standard. Tervala(2010) has made improvements.

$$P_t = \left[\int_0^n p_t(z)^{1-\theta} dz + \int_n^{n+(1-n)b^*} p_t^*(z)^{1-\theta} dz + \int_{n+(1-n)b^*}^1 S_t q_t^*(z)^{1-\theta} dz \right]^{\frac{1}{1-\theta}}$$

$$P_t^* = \left[\int_0^{n(1-b)} (p_t(z)/S_t)^{1-\theta} dz + \int_{n(1-b)}^n q_t^*(z)^{1-\theta} dz + \int_n^1 q_t^*(z)^{1-\theta} dz \right]^{\frac{1}{1-\theta}}$$

Above is the definition of the Dollar Standard by Tervala (2007). The commodity price index is denoted by P; The European commodity price index is denoted by P^*; z is goods; p is dollar price; q is price in EUR, and S is the exchange rate. The goods without an asterisk is American produced, while the goods with an asterisk is

European produced. That is, $p_t(z)$ is the dollar price of American goods, and $p_t^*(z)$ is the dollar price of European goods. The ratios that local currency price used by U.S. and European export manufacturers are denoted by b and b^* respectively. Both of the export goods in the United States and Europe are priced in U.S. dollar. When b=0 and b^*=1, it has a greater influence under Dollar Standard. When b and b^* change, the influence of Dollar Standard changes. Tervala (2010) has successfully described the dynamic characteristics of Dollar Standard. However, in the process of analysis, he was unable to consider the impact of macroeconomic stability and welfare distribution when the degree of the Dollar Standard changes assuming b=0 and b^*=1 under the Dollar Standard.

So how should we clarify the transmission mechanism that Dollar Standard has impacts on the stability of macro-economy? Both the definition of the Devereux et al (2007) and Tervala (2010) indicate that the characterization of Dollar Standard is implicit in the set of price indexes. First, the Dollar Standard affects the choices of price currency of each country's export manufacturers. Affected by the Dollar Standard, the United States and the outside countries export manufacturers tend to use the Dollar Standard, thus the U.S. export manufacturers adopt the PCP pricing model while the periphery countries use LCP pricing model. Second, different pricing models adopted by the export manufactures lead to a different composition of the national price index. Price Index for the United States includes the domestic goods and imported goods priced in U.S. dollars, while the price index of the outside countries includes domestic goods priced in periphery countries' currency and imported goods priced in U.S. dollars. Third, the composition of the price index affects directly the pass-through effect of the exchange rate. If the exchange rate of dollar to outside countries 'currency changes, the price of goods exported to outside countries adjusts accordingly, so the exchange rate risk of U.S. export manufacturers will be distributed to the outside countries through changing commodity prices. However, the outside countries exporting goods to the United States will not make timely adjustments when the exchange rate changes, so the risk of fluctuations in exchange rates can only be dispersed by the domestic market. PCP pricing means that the full exchange rate pass-through effect and LCP pricing means incomplete exchange rate pass-through effect. Fourth, when the exchange rate risk cannot be shared effectively by the international market, domestic macroeconomic variables will be over-adjusted so as to achieve a new equilibrium, which has a great effect on the stability of macro-economy.

This part summarizes the Dollar Standard transmission mechanism of the stability of macro-economy as follow, Dollar Standard→ price currency options of exporting firms→ price index→ pass-through effect of the exchange rate→ the stability of macro-economy. Since there are complicated and dynamic links between macroeconomic variables, it is difficult to describe the relation simplistically. The next part will take advantage of the new Keynesian DSGE model for in-depth analysis of this issue.

III. Dollar Standard DSGE model

In the 1990s, the economic behavior of the individual was introduced into the framework of macroeconomic analysis, and a new Keynesian analysis framework was formed which became the micro-foundation. The analytical framework has been widely recognized by the academic community.

1. Household

Assuming that the resident's utility consists of three parts, consumption, real money balances and labor, $U_{\mathrm{t}} = U(C_t, M_t / P_t, L_t)$ .Consumption, real money balances and utility are positively correlated, while labor and utility is negatively correlated. Each resident has the same utility function,

$$U_{\mathrm{t}}^{\ i} = \sum_{s=t}^{\infty} \beta^{s-t} \left[\frac{(C_s^i)^{1-\rho}}{1-\rho} + \frac{\chi}{1-\nu} (\frac{M_s^{\ i}}{P_s})^{1-\nu} - \frac{1}{1+\eta} \left(L_s(j) \right)^{1+\eta} \right] \qquad (1)$$

Where the total utility is denoted by $U_{\mathrm{t}}^{\ i}$; t represents time; The subjective discount rate is denoted by β; Real money balances is denoted by M/P; Consumption elasticity of money demand is denoted by $1/\nu$; Labor supply elasticity is denoted by $1/\eta$, and labor input is denoted by L. Foreign residents' utility function can be represented accordingly.

The consumer price index C_t [4]is defined as,

$$C_t = \left[(1-\varphi)^{\frac{1}{\delta}} C_{H,t}^{\frac{\delta-1}{\delta}} + \varphi^{\frac{1}{\delta}} C_{F,t}^{\frac{\delta-1}{\delta}} \right]^{\frac{\delta}{\delta-1}} \qquad (2)$$

Where domestic and foreign consumer products are denoted by $C_{H,t}$ and $C_{F,t}$, respectively; Weight of foreign consumer goods in the country's consumer price index is denoted by φ , which can be seen as the country's degree of trade openness; Elasticity of substitution of domestic and foreign goods is denoted by δ .

Initial wealth hold by residents is in the form of bonds, the prices of which variable. Residents earn through labor work, and use their income to buy goods, which means the inflow of funds equal to the outflow of funds. The constraints are as follows,

$$E_t Q_{t,t+1} B_{t+1}^i + M_t^{\ i} = B_t^i + M_{t-1}^{\ i} + TR_t^i + W_t^{\ i} L_t^i - P_t C_t^i \qquad (3)$$

Where stochastic discount factor is denoted by $Q_{t,t+1}$, the amount of holding bonds is denoted by B_t^i , Transfer payments are denoted by TR_t^i , and wages are represented by W_t^i . To simplify the analysis, assuming that government spending is zero, the government adopt a balanced budget policy, and all of its money income is used to

[4] *The consumer price index is a constant elasticity of substitution consumption index, and we often adopt this form when modeling because of its appropriate meaning.*

transfer payments, so the government's budget achieves balance under equilibrium conditions, and the equation $M_t - M_{t-1} = TR_t$ holds. Under the constraint condition (3), the maximized utility in the formula (1) can be achieved by the following first order conditions,

$$\beta R_t E_t \left[\left(\frac{C_{t+1}}{C_t}\right)^{-\rho} \left(\frac{P_t}{P_{t+1}}\right) \right] = 1 \qquad (4)$$

$$C_t^{\rho} L_t^{\eta} = \frac{W_t}{P_t} \qquad (5)$$

Equation (4) is Euler equation for consumption, a vital condition for the commodity market's equilibrium. It implies the intertemporal allocation of consumption when consumers maximize their utilities, is determined by interest rate and risk aversion coefficient. Consumers tend to arrange more income for future consumption when the interest rate rises, and behave contrarily when the risk aversion coefficient falls.

Equation (5) is the supply function of labor, the vital condition for the labor market's equilibrium. In this model, labor is the only element of input in the production, the labor input and technology level determine the output directly. The increase of labor input adds consumers' income, and then increases consumption and utility, but also squeezes leisure time, having a negative effects on consumers' utility. Thus, to achieve the maximum of utility, consumers shall find the optimal equilibrium point to balance work and leisure. This equilibrium point is the implied solution of the second equation's optimal first order condition. From the log-linearization of the first order condition, we have

$$c_t = E_t c_{t+1} - (1/\rho)(i_t - E_t \pi_{t+1} - \chi)$$

$$\rho c_t + \eta l_t = w_t - p_t$$

Where C denotes the logarithm of domestic consumption index, i is the nominal interest rate, π indicates inflation rate, $\chi = (1-\beta)/\beta$, all small letters in this article are the logarithm form of corresponding variables, the asterisk means the corresponding variables oversea. $c_{H,t}$ denotes the demand of domestic residents for domestic goods, $c^*_{H,t}$ is the demand of foreign residents for domestic goods. Under the equilibrium condition, domestic output equals to the demand for domestic goods from home and oversea,

$$y_t = (1-\varphi) c_{H,t} + \varphi c^*_{H,t} \qquad (6)$$

Combine (2)、(6) and relations between price indexes, we thus obtain the IS curve,

$$x_t = E_t x_{t+1} - \omega_1 (i_t - E_t \pi_{t+1} - \chi) + \omega_2 \Delta E_t y^*_{t+1} + \omega_3 \Delta E_t a_{t+1} \qquad (7)$$

Where x represents the output gap, defined as $x = y_t - \bar{y}_t$, a is rate of technology advance, Δ is difference mark,

$\omega_1 = (1-\varphi)/\rho(1-2\varphi)$, $\omega_2 = \varphi/(1-2\varphi) - k_2/k_1\delta(1-\varphi)$, $\omega_3 = (1+\eta)k_1$,

$k_1 = [\eta\delta(1-\varphi) + \rho\delta - 2\varphi\rho\delta + \varphi] / \delta(1-\varphi)$, $k_2 = \rho\varphi\delta - \varphi$.

The output gap is affected not only by interest rate, but also by the output of later period, inflation anticipation and technology shock. Under the opening economy, the output gap is related to the output oversea as well. This provides a refinement of limited analysis in traditional theory and clears up relations among macroeconomic variables in context of the framework of general equilibrium. When financial opening index is less than 0.5, interest rate waves against the output gap, consistent with the traditional IS curve in which the output declines and interest rate rises.

2. Firm

To simplify our analysis, we assume that labor is the only input in the production function.

$$Y_t(j) = A_t L_t(j) \quad (8)$$

Where $Y(j)$ represents the quantity of goods j produced by manufacturers, A denotes technology shock. In traditional Keynes model, it is assumed that price sticks in one period but changes to a new level promptly in next period. However, Calvo (1983) improved the way price stickiness acts, as he assumes that in each period a fraction $1-\theta$ of producers change their prices to a new balanced level, the rest of them maintain their prices, i.e., the probability for producers to adjust their prices is $1-\theta$ in each period, then price changes smoothly.

$$P_{H,t} = [\theta P_{H,t-1}{}^{1-\xi} + (1-\theta)(P_{H,t}^{new})^{1-\xi}]^{\frac{1}{1-\xi}} \quad (9)$$

Where $P_{H,t}^{new}$ is the new price for domestic goods after adjustment, ξ means the substitution rate for home goods to that oversea. Since manufacturers have a certain monopoly power, they can set new market price aimed at maximizing their profits, which can be reached by maximizing the discounted value of future cash flows, according to different market price settings.

$$\max_{P_{H,t}^{new}} \sum_{k=0}^{\infty} \theta^k E_t[Q_{t,t+k} Y_{t+k} (P_{H,t}^{new} - MC_{t+k}^n)]$$

Where MC is the marginal cost, and basing on solution of optimization, the first order condition of producers is

$$\sum_{k=0}^{\infty} \theta^k E_t[Q_{t,t+k} Y_{t+k} (P_{H,t}^{new} - \frac{\zeta}{\zeta - 1} MC_{t+k}^n)] = 0 \quad (10)$$

From (8), (9), (10) we obtain the aggregate supply curve,

$$\pi_{H,t} = \beta E_t(\pi_{H,t+1}) + k_1 x_t \quad (11)$$

Equation (11) represents untraditional Phillips curve, and home inflation rate is not only affected by output gap, but also by expectation. The bigger the output gap is, the higher home inflation rate is, the higher the expectation, the higher home inflation rate.

3. Price Index

Measures of the Dollar Standard by Tervala (2010) which well depicted its dynamic characteristics, are consistent with our method to analysis dynamic stochastic general equilibrium (DSGE), therefore, we define domestic price index in the context of the Dollar Standard as follow:

$$P_t = \left[\int_0^{\varphi s} E_t P^*_{F,t}(j)^{1-\theta} dj + \int_{\varphi s}^{\varphi} P_{F,t}(j)^{1-\theta} dj + \int_{\varphi}^{1} P_{H,t}(j)^{1-\theta} dj \right]^{\frac{1}{1-\theta}} \quad (12)$$

A fraction s of homeland imported commodities adapt dollar price, while the rest adapt domestic current price. When s=1, all imported commodities should adapt dollar price, giving rise to a high degree of Dollar Standard; when s=0, on the contrary, imported commodities should be marked in domestic current entirely;, as a result, the degree of Dollar Standard is low.

Inflation is defined distinctly in IS curve and Phillips curve, thus a clarification of the relation between the two of them is needed. According to Log-linearize domestic consumption price index and we have,

$$p_t = \varphi s(e_t + p^*_{F,t}) + (\varphi - \varphi s) p_{F,t} + (1-\varphi) p_{H,t}$$

Through differentiation we establish the relevance of inflation index π_t based on CPI and inflation index $\pi_{H,t}$ based on domestic price index,

$$\pi_t = \varphi s \Delta \tau_t + (1 - \varphi + \varphi s)\pi_{H,t} \quad 13$$

Where τ is terms of trade, defined as the ratio of export price index to import price index. Based on the equilibrium condition that output equals consumption, we can derive the following expression,

$$\tau_t = (c_t - c^*_t + \varepsilon(1 - 2\varphi)) / \delta(1 - 2\varphi)$$

Substituting the expression into (13), we can derive as follow,

$$\pi_t = \frac{(\nu - \varphi s)(1 - \varphi + \varphi s)}{\nu} \pi_{H,t} + \frac{\varphi s}{\nu}(i_{t-1} - \chi) - \frac{\varphi s \rho}{\nu} \Delta y^*_t \quad (14)$$

Where $\nu = \rho\delta - 2\rho\delta\varphi + \varphi s$, $\varepsilon = \log[(1-\varphi)/\varphi]$. The formula shows that π_t is affected by $\pi_{H,t}$, previous interest rate i_{t-1} and foreign output fluctuation Δy^*_t, with effecting related value of parameters such as financial openness. Suppose the values of ρ and δ are both 1,in case $\varphi<1/3$, there is a positive relation between $\pi_{H,t}$, i_{t-1} and π_t, while Δy^*_t and π_t are negatively related ; in case $1/3<\varphi<1/2$, the relation between $\pi_{H,t}$, i_{t-1} and π_t turn out to be negative, while Δy^*_t and π_t are positively related ; in case $1/2<\varphi$, the relationship of $\pi_{H,t}$ and π_t turns into positive, while the relationship of the other two variables remains the same. As we can see, the effects that $\pi_{H,t}$ 、 i_{t-1} and Δy_t^* have on π_t will alter with the changes of financial openness degree.

4. Interest Rate Parity

The financial openness degree is firstly measured through uncovered interest rate parity（Edwards and Khan, 1985）. If capital could flow freely, arbitrage activities will happen between home and abroad, and then the degree of capital control could be measured by the deviation of interest rate parity. Edwards and Khan believe that except for financial openness, interest rate adjustment lag, which is significantly combined with interest rate parity, is another important factor that has impacts on transmission of economic shocks. In theory, financial openness evaluates the degree of openness in countries' financial markets and characterizes the maturity of international financial market. While interest rate adjustment lags reflect the defects of domestic financial market, especially the depth of interest rate liberalization regarding domestic financial market. In a perfect domestic financial market, interest rate will adjust rapidly answering new economic shocks, and the delay will be short. Otherwise, it will be very long.

$$i_t = \psi\alpha(i_t^* + E_t e_{t+1} - e_t) + \psi(1-\alpha)i_{t-1} + (1-\psi)(\bar{r} + \pi_t) \quad (15)$$

Where i^* denotes foreign nominal interest rate; e_t denotes the logarithm of nominal exchange rate; $\bar{r}$ governs real interest rate; ψ denotes degree of financial openness: the higher its value, the higher financial openness is; α is interest rate adjustment lag: the value of which is greater, the adjustment is shorter. In case $\psi = 0$, domestic financial market remains in fully closed state, and domestic nominal interest rate is totally determined by its inflation rate and real interest rate. In case $\psi = 1$, domestic financial market is completely open. When $\alpha = 0$, current interest rate is largely affected by previous interest rate and thus its adjustment speed is quite low. When $\alpha = 1$, interest rate will rapidly adjust to its new equilibrium.

5 Monetary Policy and Economic Shock

The empirical analyses have discovered that real interest rate is the only parameter consistently related to price stability and economic growth in the long run (Taylor, 1993). Therefore Taylor puts forward the corresponding interest rate rules, namely the Taylor rule. The Taylor rule refers to the monetary policy rule that interest rates should be adjusted on the basis of gap between output and price level as well as its settings. It is believed that interest rate rule is optimum for the central bank to maintain stability of output and price level. The Taylor rule is extensively noted and many scholars amend it afterwards. Under open economic conditions, to introduce interest rate smoothing factor and prospective variables at the same time, we can derive the Taylor rule in the following (16),

$$i_t = \omega i_{t-1} + (1-\omega)(\kappa_\pi E\pi_{t+1} + \kappa_x x_t + \kappa_e e_t) + \mu_t \quad (16)$$

The forward perspective is introduced to interest rate rules (Clarida, Gali and Gertler, 2000). There is a lag in transmission from monetary policy to economic variables. Therefore it is needed to predict the changes of economic variables in advance so as to make preparations and ensure the validity of monetary policy. They propose to introduce inflation and expected output into the Taylor rule, each phase of target nominal interest rate is a function of expected inflation rate and output gap. μ_t denotes domestic monetary policy shock.

$$i_t^* = \rho_1 i_{t-1}^* + eq \quad (17)$$

$$y_t^* = \rho_2 y_{t-1}^* + ed \quad (18)$$

$$\mu_t = \rho_3 \mu_{t-1} + em \quad (19)$$

$$a_t = \rho_4 a_{t-1} + es \quad (20)$$

In open economy, shocks can be divided into foreign economic shocks and domestic economic shocks. Referring to the experience of Parrado (2004), we can draw four exogenous economic shock variables from equations(17), (18), (19) and (20), they are foreign interest rate shock, foreign output shock, domestic monetary policy shock and domestic technology shock. (17) and (18) imply foreign economic shocks, while (19) and (20) stand for domestic economic shocks. Foreign interest rate shock can be illustrated as monetary policy shock. Where eq , ed , em and es are all independent and identically distributed random variables ,which have the same mean value as 0 and the same variance as 0.01.

IV. Numerical Simulation

There are several exogenous variables in our model, the assignment of which is not consolidated and mainly based on the operation rules of each country's internal economy. As for immeasurable parameters such as β and η, we refer to the existing researches and choose calibration values in line with the real situation in China. With regards to φ and ρ_4, we could-make estimations through China's real data.

In this article we measure the degree of financial openness through capital market openness and currency market openness by average. Capital market openness= (foreign investment + outward investment)/GDP, currency market openness= net foreign assets of financial institutions /total assets of financial institutions. As a result, the financial openness of China ψ is 0.22 in 2009.We measure trade openness through ratio of imports to consumptions and thus we evaluate China's average trade openness φ to be 0.44 based on data from China in1999-2010. We introduce ρ_4 as the total factor productivity of China during 1978-2008,which is estimated to be 0.83 (Liu and Chang, 2010). The elasticity of substitution for goods (δ) is 2 (Huang 2010). Since the Taylor rule has not been adopted in China, we cannot obtain the correlation of monetary policy through actual data. Therefore we refer to the existed work

(Parrado, 2004) and assign parameters of monetary policy rules. Parrado implies through empirical evidence for Chile that rate-smoothing factor ω approximates to 0.5, and it is followed in our study. He also indicates that the value of κ_e is 0 in the case of floating exchange rate, while turns out to be 3.34 if exchange rate regime is under management. Besides, the value of κ_x is 0 in the case of strict inflation targeting; otherwise, the value is 0.5. Since inflation target is of importance to monetary policy, the value of κ_π is 1.5. Considering economic environment in China and monetary authorities' policy orientation, neither managed floating exchange rate regime will be abandoned in the short run, nor strict inflation target regime will be adopted. Consequently, maintaining the steady growth of output is still an important monetary policy objective and the values of κ_π, κ_x, κ_e are 1.5, 0.5, 3.34, respectively. We assign values of α, ρ_1, ρ_3, β, $\bar{r}$ to be 0.5, 0.8, 0.8, 0.99, 0.04 (Parrado, 2004) and values of η, θ, ρ, ρ_2 to be 3, 0.75, 0.86 (Gali and Monacelli, 2005). Now that this paper focuses on the impact of Dollar Standard on volatility of macro-economy in China, we choose letter s to be the variable.

After the introduction of Calvo pricing mechanism, the solving process of DSGE model becomes complex and uncertain. Foreign scholars mainly use the random numerical simulation method to analyze the results of different economic impact on macroeconomic variables. We use the similar analytical method here. This text uses the Monte Carlo numerical simulation through MATLAB, the number of simulations is 2100 and the time period is 25. Under the Dollar Standard, at least more than half of the goods imported from the U.S. to China will be priced in U.S. dollars. Otherwise the U.S. Dollar Standard will not be maintained. Therefore, there are no practical values for the degree of U.S. Dollar Standard-s being less than 0.5. This passage will analyze the results of economic impacts on the trend and volatility of macroeconomic variables, when the s equals to 0.6, 0.8 and 1.

Figure. 1

The impact of Dollar Standard on the moving trend of macroeconomic variables

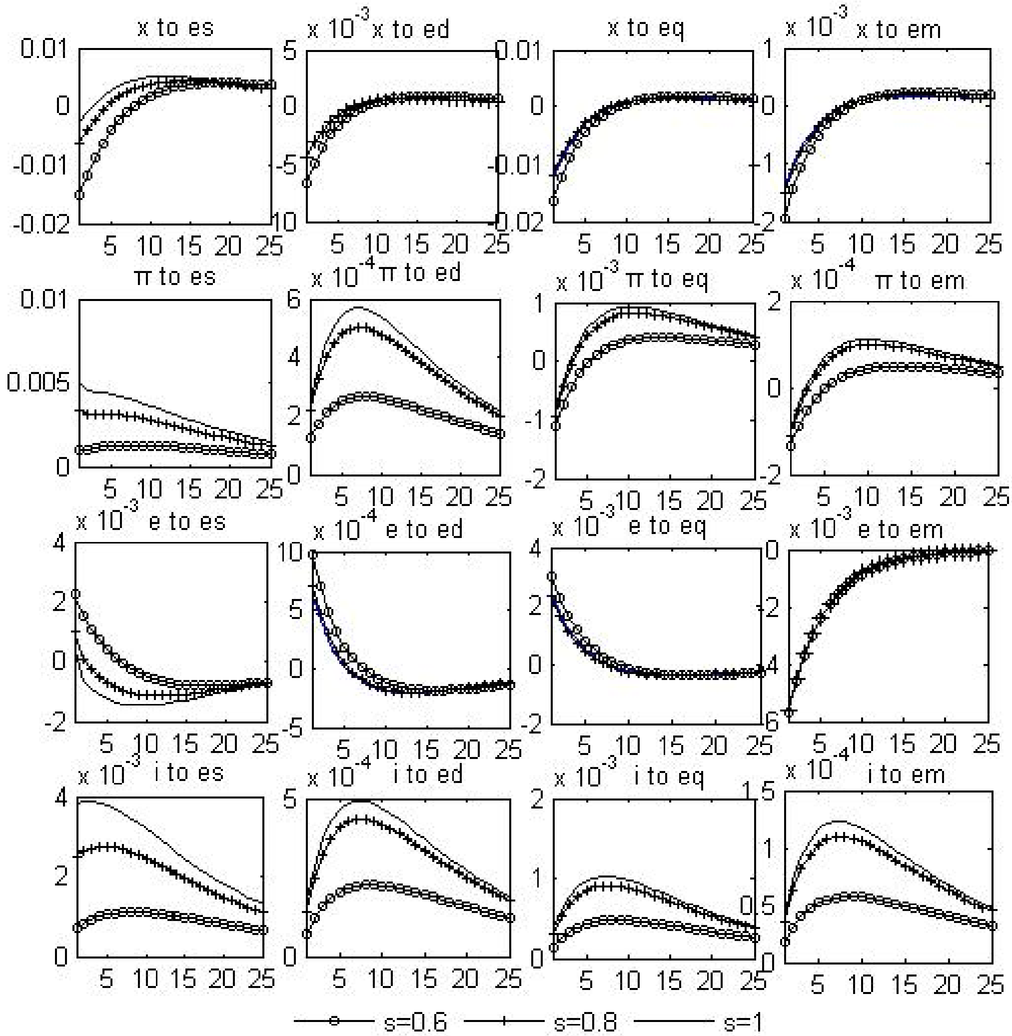
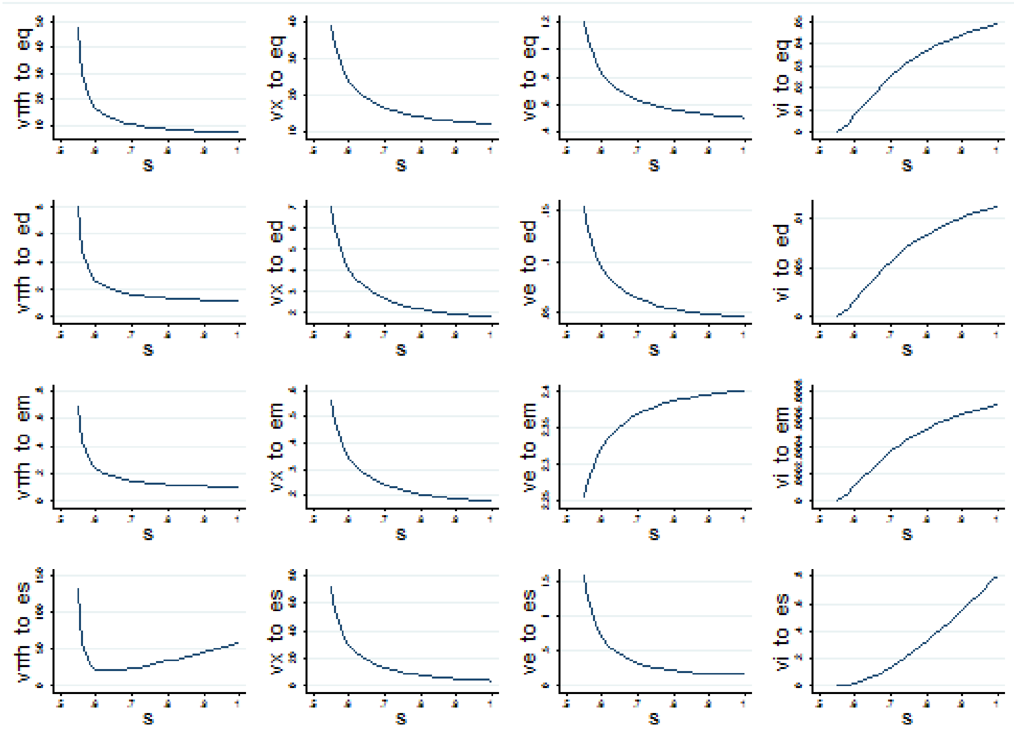


Figure 2

The impact of Dollar Standard on the volatility of macroeconomic variables



Proposition 1. Movements in macroeconomic variables depend on the economic impacts, rather than the degree of the U.S. Dollar Standard. When economic shocks occur, the output gap will be reduced first, and then converge to a new equilibrium level, the variation trend is unrelated with the degree of U.S. Dollar Standard. When domestic technology shocks occur, the change of CPI index seems to tilt to the right straight line; when the other three economic shocks occur, the change of CPI index is down to the opening of the parabola, the change in trend also has nothing to do with the level of U.S. Dollar Standard. Changes in exchange rates and interest rates also have similar characteristics. Therefore, The U.S. Dollar Standard will not affect the macroeconomic cycle of China.

This paper uses variance to measure the volatility of macroeconomic variables. The letter v represents the corresponding variables' variances. In figure 2, the horizontal axis is the degree of U.S. Dollar Standard, from 0.5 to 1. Vertical axis represents the corresponding variance of the macroeconomic variables. In order to be analyzed more conveniently, the variance is magnified a million times. This change will not affect the final conclusion.

Proposition 2. The level of the Dollar Standard will directly affect the volatility of the macroeconomic variables. When technology shock dominates, the continued rise of the Dollar Standard will lead to substantial price fluctuations. When currency impact dominates, the continued rise of the Dollar Standard will lead to exchange rate fluctuations.

There are two risk transmission channels between countries under open economy condition, International commodity markets and international financial markets. When there is no Dollar Standard, it is proved that commodity markets and international financial markets between two countries can disperse risks effectively, and the risk diversification is symmetric (Obstfeld and Rogoff, 1995). Domestic economic impact is dispersed through the international commodity markets and international financial markets to foreign countries. Foreign economic shocks also can be dispersed to domestic through the international commodity markets and international financial markets. Thus, the two countries can gain from the expansion of range of risk diversification. But the Dollar Standard leads to an asymmetric bilateral commodity market risk transformation. Foreign economic shocks can be effectively dispersed by commodity prices and exchange rate adjustments to domestic, while the international risk-sharing mechanism of domestic economic impact is hindered under the Dollar Standard. Under this condition, the impact of domestic technology can only be eliminated by the excessive adjustments of the domestic commodity prices. In the case of capital controls, the country's monetary shocks can only be eliminated by excessive exchange rate adjustment. This will inevitably lead to large fluctuations of the domestic price level and exchange rate. When price and exchange rates are both regulated, the government will suppress such negative effects. However, with the deepening of Chinese market-oriented reforms, commodity prices and exchange rate volatility will increase, the current high inflation and large fluctuations of the exchange rate is indicative of this.

When there are no national technology shocks and monetary shocks, with improvement in the level of the U.S. Dollar Standard, the fluctuations of output gap, domestic price index and exchange rate drop significantly, only interest rate have increased. At the beginning of reform and opening- up, productivity level in China was low, the government rarely used expansionary monetary policy to stimulate economic growth, i.e., and domestic technology shocks and monetary shocks are small, especially when there are strict controls on interest rates. With foreign output shocks and monetary shocks stimulating domestic economy, the gap between actual level of economic development and the potential level of economic development becomes narrower. In this case, the influence of Dollar Standard on key macroeconomic variable become smaller, it stimulates the economic growth while maintaining macroeconomic stable.

Overall, the Dollar Standard affects the macroeconomic stability through the risk-sharing mechanisms in international commodity markets and international financial markets. The Dollar Standard improves the macroeconomic stability while China's economy is small and internal economic shocks are weak. With the increasing scale of China's economy, domestic economy shocks become more and more influential and the U.S. Dollar Standard will cause instability in China's macroeconomic.

V. Welfare Analysis

Although the previous part compares the impacts of different shocks on the macro-economy under the US Dollar Standard, but we still cannot analyze the effect in a whole. Therefore, this part adopts welfare analysis to see effects that the degree of the Dollar Standard's changes have on macro-economic welfare. As the method of Gali and Monacelli (2005), this paper uses the expected loss function as the welfare judgment. Because the utility of real money balances is very little, we mainly analyze the utility of real variables. From the utility function, we obtain,

$$W_t = -\frac{1-\varphi}{2}\sum_{t=0}^{\infty}\beta^t[\frac{\theta\varepsilon}{(1-\theta)(1-\beta\theta)}\pi_{H,t}^2 + (1+\eta)x_t^2]$$

Taking unconditional expectation, the loss function is,

$$\Omega_t = -\frac{1-\varphi}{2}[\frac{\theta\varepsilon}{(1-\theta)(1-\beta\theta)}\operatorname{var}(\pi_{H,t}) + (1+\eta)\operatorname{var}(x_t)]$$

Where $Var(x_t)$ and $Var(\pi_{H,t})$ are unconditional variances of output gap and domestic inflation. ε is equal to 6 (Gali and Monacelli, 2005).

Table 1

Welfare Loss

s	eq	ed	em	es	Total
0.60	100.00	15.77	1.43	140.45	257.65
0.62	86.77	13.68	1.24	126.56	228.25
0.64	78.01	12.30	1.12	123.70	215.13
0.66	71.73	11.32	1.03	126.27	210.35
0.68	66.98	10.58	0.96	131.98	210.50
0.70	63.27	10.00	0.91	139.70	213.87
0.72	60.28	9.53	0.86	148.83	219.50
0.74	57.83	9.15	0.83	159.00	226.80
0.76	55.78	8.83	0.80	169.99	235.40
0.78	54.05	8.55	0.78	181.63	245.01
0.80	52.57	8.32	0.75	193.82	255.47
0.82	51.29	8.12	0.74	206.47	266.62
0.84	50.18	7.95	0.72	219.52	278.36
0.86	49.21	7.79	0.71	232.90	290.61
0.88	48.35	7.66	0.69	246.59	303.29
0.90	47.59	7.53	0.68	260.55	316.36
0.92	46.91	7.43	0.67	274.74	329.76
0.94	46.31	7.33	0.66	289.14	343.44
0.96	45.76	7.24	0.66	303.73	357.39
0.98	45.27	7.16	0.65	318.48	371.57
1.00	44.83	7.09	0.64	333.38	385.95

Table 1 gives the value of China's welfare loss as the degree of Dollar Standard changes. We take the welfare loss from foreign interest rate shock when the Dollar

Standard value is 0.6 as a benchmark, and the value is set at 100. The rest welfare loss can be calculated accordingly. The conclusions are as follows:

（1）In the absolute number of welfare loss, local currency shock will lead to the least welfare loss, while local technology shock will lead to the largest welfare loss.

（2）In the change tendency of the welfare loss, when foreign interest rate shock, foreign output shock or its monetary policy shock occurs, as the degree of the Dollar Standard rises, China's welfare loss has a diminishing tendency; And when domestic technology shock occurs, as the degree of the Dollar Standard also rises, China's welfare loss will firstly decrease and then increase.

（3）Finally, summing up four shocks' welfare loss, when the Dollar Standard degree is less than 0.66, with the Dollar Standard rising, the total welfare loss will reduce. When the Dollar Standard level is greater than 0.66, with the Dollar Standard rising, the total welfare loss will increase. Therefore, there is the optimal Dollar Standard that makes the total welfare loss minimum.

In short, China's welfare loss depends on the degree of the Dollar Standard and the type of the economic shocks. When the domestic technology shock is small, the increase of the Dollar Standard degree is good to the improve of Chinese residents' welfare level, when the domestic technology shock is predominant, the increase of the Dollar Standard degree goes against the improving Chinese residents' welfare level. The welfare analysis result and the simulation result are consistent.

How to offset the negative effect Dollar Standard has on Chinese economic stability? Firstly, it is necessary to speed up the internationalization of RMB and increase its proportion in the international pricing and settlements. The rising international status of the RMB can weaken dollar's control of Chinese import and export commodity price and trade settlements. Secondly, it will lessen the negative impacts of Dollar Standard if the bargain power of Chinese exporter improves. Since China's reform and opening-up, in order to develop overseas markets, the excessive competition among Chinese exporters has become more serious. For the long-term interests, Chinese exporters should avoid over competition and actively strengthen corporation so as to improve the overall bargain power, which is beneficial for domestic risk diversification. Thirdly, it is necessary to promote the reform of China's financial market and improve the risk sharing mechanism of the domestic financial market.

VI. Conclusions

Based on the relevant study (Gali, 2005; Tervala, 2010), we develop a New-Keynesian DSGE model under the open condition including the Dollar Standard. We analyze the effects of the fluctuation and the welfare loss of the macroeconomic variables caused by the variation of the Dollar Standard under different shocks. This paper uses the Monte Carlo simulation with MATLAB. The result shows that, (1) the variation of the Dollar Standard has no effect on China's macroeconomic fluctuation cycle but affects the fluctuation of its macroeconomic variables; (2) the changing of Dollar Standard has a direct effect on the macroeconomic variation. When the technology shock dominates, the strengthening of the Dollar Standard may cause a great fluctuation on the price level. When the monetary shock occupies, the strengthening of Dollar Standard will cause a great fluctuation on the exchange rate; (3) the loss of China's welfare is determined by Dollar Standard and the type of the economic shocks. Moreover, there is an optimum degree of Dollar Standard to minimize the China's welfare loss.

In general, the Dollar Standard affects the macroeconomic stability of the peripheral countries through the risk sharing mechanism of the global commodity market and the international financial market. Under the Dollar Standard, the risk in American commodity market and financial market can be efficiently transferred to Chinese market by the exchange rate transmission mechanism, while due to the limitation of the external dispersed mechanism, the risk in Chinese commodity market and financial market is controlled only through the expense of the domestic macroeconomic stability. In the early years of the reform and opening-up, because of the small economic scale and the strict controls on its internal macroeconomic variables, China had not suffered severe threat in its economic stability. The shocks caused by America stimulate the rapid growth of China's GDP However, with the expansion of Chinese economic scale and the acceleration of marketalization, the negative effect on the stability of Chinese economy grows larger, which is brought by Dollar Standard.

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Appendix

1. The full model

The IS curve：

$$x_t = E_t x_{t+1} - \omega_1 (i_t - E_t \pi_{t+1} - \chi) + \omega_2 \Delta E_t y^*_{t+1} + \omega_3 \Delta E_t a_{t+1}$$

Where $\omega_1 = \frac{1-\varphi}{\rho(1-2\varphi)}$, $\omega_2 = \frac{\varphi}{1-2\varphi} - \frac{k_2}{k_1\delta(1-\varphi)}$, $\omega_3 = \frac{(1+\eta)}{k_1}$,

$$k_1 = \frac{\eta\delta(1-\varphi)+\rho\delta-2\varphi\rho\delta+\varphi}{\delta(1-\varphi)}, \quad k_2 = \rho\varphi\delta - \varphi,$$

The Phillips curve：

$$\pi_{H,t} = \beta E_t(\pi_{H,t+1}) + \lambda k_1 x_t, \qquad \lambda = \frac{(1-\theta)(1-\beta\theta)}{\theta}$$

wThe interest rate parity：

$$i_t = \psi\alpha(i^*_t + E_t e_{t+1} - e_t) + \psi(1-\alpha) i_{t-1} + (1-\psi)(\bar{r} + \pi_t)$$

The price relationship：

$$\pi_t = v_1 \pi_{H,t} + v_2 (i_{t-1} - \chi) - v_3 \Delta y^*_t$$

$$v_1 = \frac{\rho\delta(1-2\varphi)}{\rho\delta - 2\rho\delta\varphi + \varphi}, v_2 = \frac{\varphi}{\rho\delta - 2\rho\delta\varphi + \varphi}, v_3 = \frac{\varphi\rho}{\rho\delta - 2\rho\delta\varphi + \varphi}$$

The monetary policy：

$$i_t = w i_{t-1} + (1-w)(\kappa_\pi E\pi_{t+1} + \kappa_x x_t + \kappa_e e_t)$$

The utter shocks：

$$i^*_t = \rho_1 i^*_{t-1} + eq$$
$$y^*_t = \rho_2 y^*_{t-1} + ed$$
$$\mu_t = \rho_3 \mu_{t-1} + em$$
$$a_t = \rho_4 a_{t-1} + es$$

2. The calibration values

Parameters	Value	Parameters	Value	Parameters	Value	Parameters	Value
ψ	0.22	α	0.5	κ_π	1.5	ρ	1
φ	0.44	θ	0.75	κ_x	0.5	ρ_1	0.8
β	0.99	η	3	κ_e	3.34	ρ_2	0.8
δ	2	$\bar{r}$	0.04	s	0-1	ρ_3	0.8
ω	0.5					ρ_4	0.83