

Currency appreciation and currency attack - Imperfect common knowledge

Dr. Nguyen Anh Thu*

*Faculty of International Business and Economics, VNU University of Economics and Business,
144 Xuan Thuy, Hanoi, Vietnam*

Received 12 September 2011

Abstract. This paper analyzed a model of currency attack, in which the domestic currency is pegged below its value and the real value of the currency increases gradually. The speculators, who know that the peg which might be abandoned in the future when foreign reserves reach a certain threshold can attack the currency so that the peg will collapse and the revaluation takes place immediately after the attack. The model is based on the fact that China had continuously to revalue its currency from 2005 to 2008, then in 2010, and will likely to revalue the Yuan in the near future under the pressure of its major trading partners. With the assumption of imperfect common knowledge among agents, there is a unique equilibrium in which the currency attack will occur.

Keywords: Currency appreciation, currency attack, imperfect common knowledge.

1. Introduction

In the last two decades, we have observed a number of currency crises all over the world. There are three distinct regional waves of currency crises: Europe in 1992-1993, Latin America in 1994-1995, Asian crises in 1997; and world financial crises beginning from 2008. The consequence of recent currency crises is the instability of the currency market and the depreciation of the domestic currency (Reinhart and Rogoff, 2009). Therefore, the problem during any currency crises is typically the depreciation of the currency (Pastine, 2002).

However, most recently, we also observed the problem of an appreciation of the currency in the case of China (and Japan in 1970s). In these cases, the domestic currency had been

pegged below its value and had been forced by other countries (the United States in particular) to be revalued. For example, the Chinese currency (the yuan) was pegged at 8.28 to the dollar and under the pressure from the US, has been revalued 2.1% in July 2005 (Japan Research Institute, 2005). Following this, the yuan has been continuously revalued from 2005 to 2008, then in 2010 and will likely be revalued in the near future under the pressure of Chinese big trading partners (International Monetary Fund, 2011). In reality, China benefits from the undervalued of its domestic currency by exporting great amount of its domestic products and thus can raise its trade surplus as well as its foreign reserves (Morris, 2004). Therefore, they do not want to lose these benefits - by allowing the domestic currency to appreciate. Thus a controversy arises between the desire to maintain the peg and the pressure to revalue the currency.

* Tel.: 84-4-37548547(407)
E-mail: thuna@vnu.edu.vn

The pressure will arise only if the domestic currency has reached a certain low undervalued point, or the foreign reserves of that country have reached a certain high amount. However, in the case when these points have not been reached, the speculators, who know that the domestic currency might be forced to appreciate in the future, can attack the currency so that the peg will collapse and appreciation soon follows. The objective of this paper is to investigate whether such an attack will happen, and if it happens, which equilibrium might prevail.

The paper is organized as follows: The next section briefly reviews the literature on some models of currency attack and currency crises. Section 3 presents the model and relevant information structure. Section 4 discusses the equilibrium of the model and Section 5 concludes the paper.

2. Literature review

Currency crises have been the subject of extensive economic studies, both theoretical and empirical. Up to now, there are two types of the models describing currency crises: First generation models and Second generation models. The First generation models originally developed by Krugman (1979) and further developed by other economists such as Flood and Garber (1984), Daniel (2001), Kocherlakota and Phelan (1999) argue that currency crises occur as a result of the worsening of the fundamentals, typically the inconsistency of economic policies. The Second generation models, first developed by Obstfeld (1986a) followed by Morris and Shin (1998), Heinemann and Illing (2002) and other economists argue that without the worsening of the fundamentals, currency crises are the result of the attack of speculators, who expect that the currency will depreciate. These models are also called self-fulfilling currency crises models.

Mínguez-Afonso (2007) developed the First-generation model with imperfect common knowledge. The model based on the standard

First-generation model (developed by Krugman, 1979), in which domestic currency is pegged above its real value and the government runs a budget deficit, whereby the shadow exchange rate increases and foreign exchange reserves decrease gradually⁽¹⁾. Next, the information structure of Abreu and Brunnermeier (2003) is incorporated to introduce uncertainty about the willingness of the Central Bank to defend the peg. In this information structure, agents notice the mispricing of the exchange rate sequentially and in random order so that they do not know if other agents are also aware of it. Agents do not know when the foreign reserves of the Government will be exhausted, either. Mínguez-Afonso (2007) proved that before the foreign reserve is exhausted, there exists a unique equilibrium in which the peg is abandoned. At that time, enough number of agents sell out their domestic currency where the selling pressure (of the domestic currency) is reached and the government is forced to abandon the fixed exchange rate regime.

3. The model

This paper analyzes a situation wherein the domestic currency is pegged below its real value. This paper assumes that the foreign exchange rate is pegged and from time t_0 the government runs a budget surplus, therefore foreign exchange reserves increase and the shadow exchange rate decreases gradually from time t_0 (opposite to that of Mínguez-Afonso, 2007). The peg will be abandoned in two cases. First, when the cumulative selling pressure (of the foreign currency) reaches a threshold κ , and second, when the shadow exchange rate reaches its lower bound and the government has to abandon the peg under pressure from other countries. The information structure is similar to that of Mínguez-Afonso (2007); agents notice the

⁽¹⁾ See also Obstfeld (1986b).

decrease of the shadow exchange rate sequentially and in random order. However, the difference is that agents know the lower bound of the shadow exchange rate at which other countries will force the government to abandon the peg. Agents do not know the exact time at which the shadow exchange rate begins to decrease, therefore they do not know the exact time when the lower bound will be reached. Under these assumptions this study will try to derive the equilibrium and the timing of the speculative attack.

In a model illustrated in the figures below, the exchange rate is the value of one unit of foreign currency represented in domestic currency. The government fixes the exchange rate at a certain level \bar{S} . We define the shadow exchange rate at time t as the exchange rate that would prevail at time t if the government takes no action to intervene in the exchange market, thus allowing the currency to float. We define the exchange rates in logarithmic form. We denote the logarithm of the shadow exchange rate by s_t .

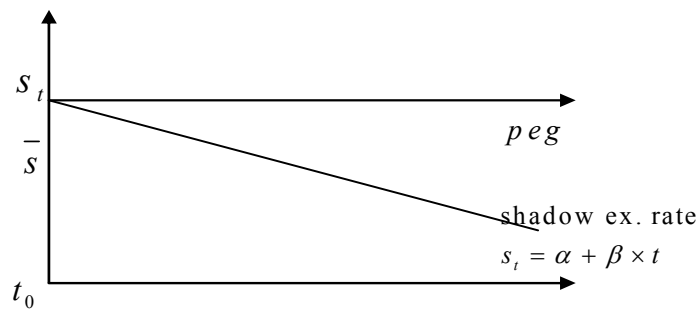


Figure 1: Fixed exchange rate and shadow exchange rate.

From time t_0 the government gains budget surplus (see appendix A where s_t is a linear decreasing function of time (figure 1)). We assume that t_0 is exponentially distributed on $(0, \infty)$ with cumulative distribution function $F(t_0) = 1 - e^{-\lambda t_0}$ ($\lambda > 0, t_0 > 0$).

Information structure

In this study, we assume a continuum of agents, with a mass of agents equal to one. At a

random time $t = t_0$ the agents begin to notice the decrease of the shadow exchange rate (t_0 is exponentially distributed). From there on, at each instant (between t_0 and $t_0 + \eta$) a new mass of agents $1/\eta$ of agents notice the decrease of the shadow, however, they do not know if they are the first or last to know and if they noticed it earlier or later compared to other agents.

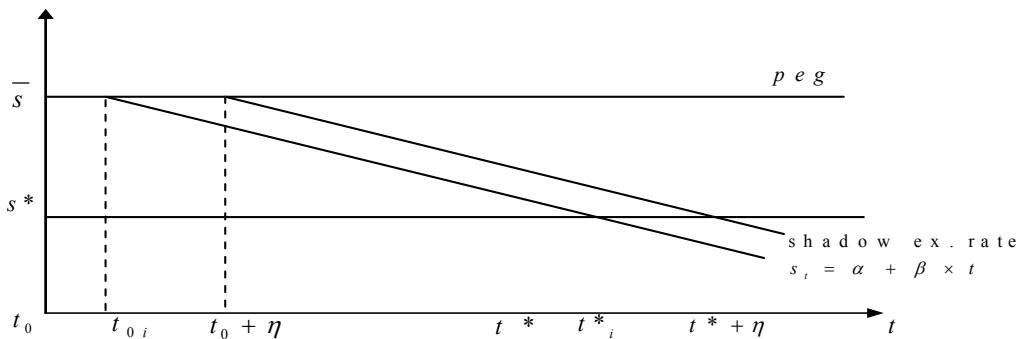


Figure 2: Information structure.

Until time t_0 , the exchange rate is \bar{s} , from time t_0 , although the exchange rate is pegged at \bar{s} , but the shadow exchange rate begins to decrease. If the pegged exchange rate is too high compared to the shadow exchange rate, the exported goods from this country will become extremely cheap and there will be large trade surpluses with other countries. Other countries, therefore, will put pressure on this country in order to float the exchange rate. We assume that when the shadow exchange rate decreases to s^* , such action will take place. We also assume that agents know this fact and know the level s^* . However, agents notice the decrease of the shadow exchange rate (time t_0) differently, therefore, they will estimate the time when the shadow exchange rate reaches s^* differently. If we denote t^* to be the time when the shadow exchange rate reaches s^* , then t^* will be exponentially distributed (because t_0 is exponentially distributed and shadow exchange rate is linear function - see Figure 2).

Assumptions

Firstly, we assume that $r^* > r$, so that agents will initially hold foreign currency denominated bonds because they offer higher interest rates (r^*) than domestic currency denominated bonds (with interest rate r).

Secondly, we assume that an agent holds either maximum long position or maximum short position in foreign currency. This assumption means that an agent initially invests his entire fund on foreign currency (maximum long position) to gain a higher profit, but when he fears

$$D_r^i(t - t_i) = \left| E \left[\frac{S_t - \bar{S}}{S} \middle| t_i \right] \right| = 1 - E \left[\frac{S_t}{S} \middle| t_i \right] \tag{E1}$$

The hazard rate is the probability that the peg will collapse, which is presented by $h(t/t_i^*)$. The Greed to Fear ratio is presented by $(r^* - r)/D_f^i(t - t_i)$, in which $(r^* - r)$ is the excess of return derived from investing in foreign

that the peg will be abandoned he will sell out all of his foreign currency (maximize short position).

Collapse of the peg

The pegged exchange rate will collapse in one of the following two cases. First, when the shadow exchange rate reaches its lower bound and under pressure of other countries, the government has to abandon the peg, or second, when the cumulative selling pressure (of the foreign currency) reaches threshold κ . This means that if the proportion of agents who sell out their foreign currency reaches κ , the fixed foreign exchange rate cannot be maintained.

Agents and actions

Because of the assumption $r^* > r$, each agent initially invests his entire fund in foreign currency and he will try to hold on to the foreign currency as long as possible because the longer he holds it the higher the profit he gains. However, the agent also knows that the fixed exchange rate will eventually be abandoned at some point in the future. If he keeps the foreign currency until that time, he will lose due to the devaluation of the foreign currency. Thus he would like to sell out just before the exchange rate is abandoned and the foreign currency suffers devaluation. However, the time of the collapse is not common knowledge. Therefore the problem of an agent is to find out the optimal time to sell out the foreign currency.

Optimal time means the time when an agent's payoff of selling out is at a maximum. In Appendix B, we prove that the payoff will be biggest when the agent's hazard rate equals his Greed to Fear ratio.

currency and $D_f^i(t - t_i)$ is the size of the expected depreciation of the foreign currency perceived by agent i (Mínguez-Afonso, 2007).

Agent i will sell out his foreign currency when his hazard rate equals his Greed to Fear ratio, i.e. if:

$$h(t/t_i^*) = \frac{r^* - r}{D_f^i(t - t_i^*)} \tag{E2}$$

4. Equilibrium

The fixed exchange rate will collapse when the cumulative selling pressure (of the foreign currency) reaches threshold κ or when the

shadow exchange rate reaches its lower bound s^* . Figure 3 shows the collapse of the peg when the selling pressure reaches κ .

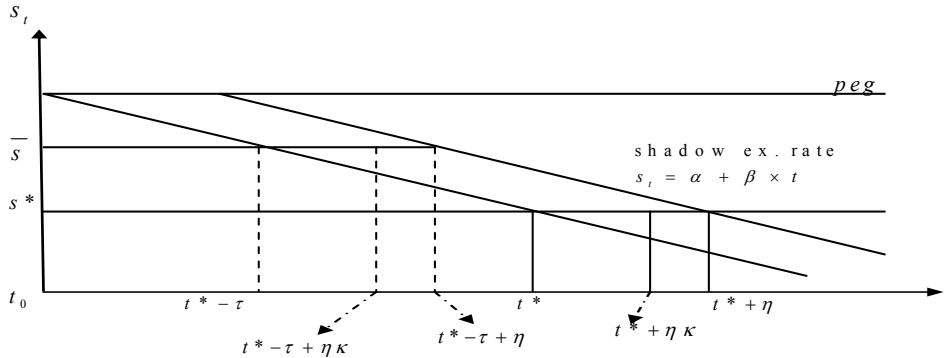


Figure 3: Collapse of the peg.
(At $t^* - \tau + \eta\kappa$, κ agents sell out, the peg collapses)

We assumed that all agents know that at s^* the government has to abandon the peg, but they estimate the time differently. Agent i , who estimates that s^* will be reached at t_i^* , will try to sell out before t_i^* , say at $t_i^* - \tau$, in order to avoid the loss incurred by the devaluation of the foreign currency. We will prove that agent i 's hazard rate will equal his Greed to Fear ratio only at $t_i^* - \tau$ and that the optimum τ is constant for every agent.

Thus the most informed agent will sell out his foreign currency at $t^* - \tau$, and the latest agent will sell out at $t^* - \tau + \eta$. At $t^* - \tau + \eta\kappa$, κ agents will sell out the foreign currency, the selling pressure is reached. Therefore there exists a unique equilibrium at which each agent sells out at $t_i^* - \tau$, and the peg will collapse at $t^* - \tau + \eta\kappa$ (Figure 3).

In order to prove the above equilibrium, firstly we will prove that for every agent, the hazard rate is constant in time, the Greed to Fear ratio is decreasing in time (so the equation hazard rate equals Greed to Fear ratio has a unique solution). Then we will derive the expression for τ from the time when the hazard rate equals the Greed to Fear ratio and prove that τ is constant for every agent.

The hazard rate is constant in time

We have assumed that t^* (the time when the shadow exchange rate decreases to s^*) is exponentially distributed, so we will have:

$F(t/t_i^*)$ is the conditional cumulative distribution function of t^* when t_i^* has occurred. That means when agent i estimates that s^* will be reached at t_i^* , then he will estimate t^* according to $F(t/t_i^*)$.

$$\begin{aligned} Prob(t^* \leq t) &= F(t) = 1 - e^{-\lambda t} \\ Prob(t^* \leq t/t_i^*) &= F(t/t_i^*) = \frac{1 - e^{-\lambda(t - (t_i^* - \eta))}}{1 - e^{-\lambda\eta}} \end{aligned} \tag{E3}$$

However, the problem of every agent is to estimate the time when the collapse will happen,

and this time is determined as $\hat{t} = t^* - \tau + \eta\kappa$. Agents will estimate this time according to:

$$\begin{aligned} \text{Pr ob}(\hat{t} \leq t / t_i^*) &= \text{Pr ob}(t^* - \tau + \eta\kappa \leq t / t_i^*) \\ &= \text{Pr ob}(t^* \leq t - \eta\kappa + \tau / t_i^*) = G(t / t_i^*) = F(t - \eta\kappa + \tau / t_i^*) \\ &= \frac{1 - e^{-\lambda(t - \eta\kappa + \tau - (t_i^* - \eta))}}{1 - e^{-\lambda\eta}} \quad \text{with support } [t_i^* + \eta\kappa - \tau - \eta, t_i^* + \eta\kappa - \tau] \end{aligned}$$

and

$$g(t / t_i^*) = \frac{\lambda e^{-\lambda(t - (t_i^* - \eta) - \eta\kappa + \tau)}}{1 - e^{-\lambda\eta}} \tag{E4}$$

Thus $G(t/t_i^*)$ is the conditional cumulative distribution function and $g(t/t_i^*)$ is the conditional density function of the time when

the peg collapses. The hazard rate represents, at each time, the probability that the peg collapses, given that it has survived until that time.

$$h(t / t_i^*) = \frac{g(t / t_i^*)}{1 - G(t / t_i^*)} = \frac{\lambda}{1 - e^{-\lambda(t - t_i^* - \eta\kappa + \tau)}} \tag{E5}$$

Agent i will sell out at $t_i^* - \tau$, so the hazard rate at that time will be:

$$h(t_i^* - \tau / t_i^*) = \frac{\lambda}{1 - e^{-\lambda\eta\kappa}} = \text{constant} = h \tag{E6}$$

The Greed to Fear ratio decreases in time

As defined earlier in the paper, the Greed to Fear ratio is:

$$\frac{r^* - r}{D_f^i(t - t_i)}$$

where $r^* - r$ is the excess of return from investing in foreign currency and $D_f^i(t - t_i)$ is the

size of the expected devaluation of the foreign currency feared by agent i .

$$D_f^i(t - t_i) = \left| E \left[\frac{S_t - \bar{S}}{\bar{S}} \right] \right| = 1 - E \left[\frac{S_t}{\bar{S}} \middle| t_i \right] \tag{E7}$$

and

$$\begin{aligned} E \left[\frac{S_t}{\bar{S}} \middle| t_i \right] &= \int_{t_i - \eta}^{t_i} e^{-\beta(t_o - t)} f(t_o / t_i) dt_o \\ &= \frac{\lambda}{\lambda + \beta} \frac{e^{(\lambda + \beta)\eta} - 1}{e^{\lambda\eta} - 1} e^{-\beta(t_i - t)} = ke^{-\beta(t_i - t)} \end{aligned} \tag{E8}$$

$k > 0$, so $D_i^j(t-t_i)$ is an increasing function of the time elapsed since agent i notices that the shadow exchange rate decreases. Since r^*-r is constant in time, the Greed to Fear ratio will decrease over time. It means that, the further the time elapses, the larger the possible depreciation of the foreign currency if the peg collapses, and thus the smaller the gain of an agent from holding foreign currency.

We have proved that for every agent, the hazard rate is constant in time and the Greed to Fear ratio decreases in time. In the next section, we will derive the expression for optimal τ and prove that τ is constant for every agent.

The Optimal τ

We have proved that agent i will hold foreign currency until $t = t_i^* - \tau$, when his hazard rate equals his Greed to Fear ratio. So we can derive τ from the following equation:

$$\begin{aligned} \frac{r^* - r}{D_i^f(t-t_i)} \Big|_{t=t_i^*-\tau} &= \frac{\lambda}{1 - e^{-\lambda\eta\kappa}} \Rightarrow \frac{r^* - r}{1 - ke^{-\beta(t_i - (t_i^* - \tau))}} = h \\ \Rightarrow \tau &= \frac{1}{\beta} \ln \left[\left(1 - \frac{r^* - r}{h} \right)^{-1} \frac{\bar{S}}{S^*} \right] + \frac{1}{\beta} \ln k \\ \Rightarrow \tau &= \frac{1}{\beta} \ln \left[\left(\frac{h}{h - (r^* - r)} \right) \frac{\bar{S}}{S^*} \right] + \frac{1}{\beta} \ln k \end{aligned} \quad (E9)$$

The first part of τ is the tradeoff between the excess of return derived from investing in foreign currency and the capital loss suffered by agent i if the peg is abandoned before he sells out. The second part is because of the information structure, which represents the period of time elapsed between the date $t = t_i^*$ at which agent i estimates that the shadow

reaches s^* and the time he believes that the shadow rate really reaches s^* (because agents know that his estimation may not be correct). However, we can assume that the agent acts purely according to his estimation, i.e. he believes that s^* be reached at $t = t_i^*$, so the second part of τ equals 0, and the agent will sell out at $t = t_i^* - \tau$, in

$$\tau = \frac{1}{\beta} \ln \left[\left(1 - \frac{r^* - r}{h} \right)^{-1} \frac{\bar{S}}{S^*} \right] \quad (E10)$$

Figure 4 illustrates the timing of the selling out of agent i , when the hazard rate equals the Greed to Fear ratio. We can see that, if the hazard rate is bigger than the excess of return ($h > r^* - r$), agent i will sell out at a certain time $t_i^* - \tau$, and therefore the peg will collapse at $t^* - \tau + \eta\kappa$. However, if the hazard rate equal to or

smaller than the excess of return ($h \leq r^* - r$), then the agent will never sell out because he has no fear of the devaluation of the foreign currency. In this case, the peg will be abandoned under pressure from other countries when the shadow rate reaches s^* .

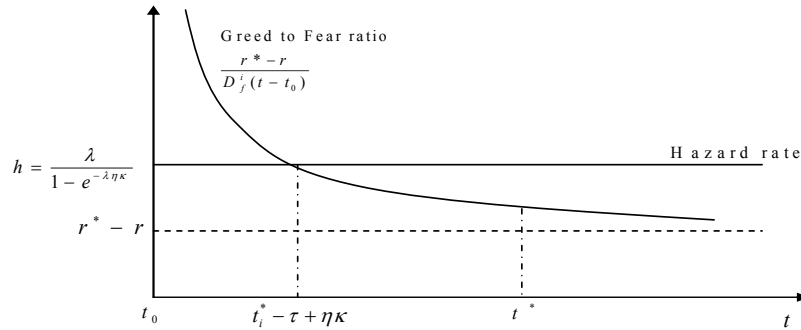


Figure 4: Timing of the attack.
 Agent *i* sell out when his hazard rate equals his Greed to Fear ratio
 At $t_i^* - \tau + \eta\kappa$, κ agents sell out and the peg collapses

Determinants of τ

(i) *Excess of return ($r^* - r$)*

The higher the excess of return, the longer the agent holds the foreign currency. This is because it

$$\frac{\partial \tau}{\partial (r^* - r)} = \frac{1}{\beta} \frac{1}{h - (r^* - r)} < 0 \quad \text{for } h > r^* - r \quad (E11)$$

We can see that the rising of excess of return will have small impact on τ if the hazard rate is high and the slope of the shadow exchange rate is small ($|\beta|$ is small, meaning β is high).

$$\frac{\partial \tau}{\partial h} = -\frac{1}{\beta} \frac{r^* - r}{h - (r^* - r)} > 0 \quad \text{for } h > r^* - r \quad (E12)$$

We have h which is defined by:

$$h = \frac{\lambda}{1 - e^{-\lambda\eta\kappa}} \quad (E13)$$

Therefore, the smaller dispersion among the agent (η) and the lower threshold level of the cumulative selling pressure (κ) causes a higher hazard rate, therefore τ will be larger, leading to an earlier attack.

(iii) *Slope of the shadow exchange rate ($|\beta|$)*

If β is smaller (the slope of the shadow exchange rate is bigger), τ will be larger, and

$$\frac{\partial \tau}{\partial \left(\frac{\bar{S}}{S^*}\right)} = \frac{1}{\beta} \left(\frac{\bar{S}}{S^*}\right)^{-1} < 0 \quad (E14)$$

can offer higher profit, so that $t^* - \tau$ longer, implying that τ is smaller. We have the change of τ

(ii) *The hazard rate (h)*

The higher the hazard rate, the sooner the agent sells out his foreign currency ($t^* - \tau$ is shorter, so τ is larger):

therefore the time of the attack will be sooner. $|\beta|$ is the growth rate of the government's surplus. The higher growth will cause the shadow exchange rate reach s^* faster, so that the attack will occur earlier.

(iv) *The comparison between \bar{S} and S^**

If \bar{S} is high and S^* is low (meaning the spread between \bar{S} and S^* is large) then τ will be small and thus the time of the attack will be postponed.

5. Conclusions

In this paper, we have analyzed a currency attack in the situation when the domestic currency is undervalued. We built a model based on Mínguez-Afonso (2007), and then analyzed the state when the domestic currency is pegged below its actual value and the shadow exchange rate decreases gradually (opposite to that of Mínguez-Afonso, 2007). We also incorporate the information structure of Abreu and Brunnermeier (2003) to introduce imperfect common knowledge among agents. The peg may collapse under two cases: first, when the cumulative selling pressure (of the foreign currency) reaches threshold κ , and second, when the shadow exchange rate reaches its lower bound and the government has to abandon the peg under pressure from other countries.

Under these assumptions, we have proved that for certain values of the hazard rate and interest rates ($h > r^*-r$), agents will sell out foreign currency τ time before they anticipate that S^* will be reached. Therefore, currency crises will occur in a unique equilibrium before the the shadow exchange rate reaches its lower bound (S^*), and thus the exchange rate will fall to a level higher than S^* .

$$\beta = \frac{\dot{D}_t}{D_t} = \frac{1}{D_t} \frac{d(D_t)}{dt} = \dot{d}_t \Rightarrow \dot{d}_t = \beta \quad (\beta < 0) \quad (1)$$

and $d_t = \ln(D_t)$ is the logarithm of the domestic credit.

The Central Bank's balance sheet will be

$$M_t^s = D_t + R_t \quad (2)$$

in which M_t^s is the money supply, and R_t are the foreign reserves at time t .

In reality, under pressure from other powerful countries and international community, China had to revalue its domestic currency since 2005. Before that, the time of the pressure as well as the level of the lower bound of the shadow exchange rate (S^*) in reality were not common knowledge among agents, therefore no currency attack had occurred before the pressure took place. However, if other cases similar to that of China happen in the future, agents then can estimate S^* , and thus a currency attack might take place as in our model.

In the model, we have assumed that the government runs a budget surplus resulting in stronger domestic currency. The assumption can be changed in the way that the domestic currency is stronger because of the growth of the economy (increase in output, for instance). The shadow exchange rate then will not be a linear function of time as in our model. Accordingly, this idea might create a quite different model with different results and therefore could be the subject of further studies.

Appendix A

The shadow exchange rate

In this section we use upper case letters to represent variables in levels and lower case letters to express them in logarithms.

We assume that in this country, the government runs a budget surplus from time t_0 on. If this growth rate is $|\beta|$ and D_t is the domestic credit at time t , we will have:

The exchange rate is S_t ($s_t = \ln S_t$), and the purchasing parity holds, so we have:

$$S_t = \frac{P_t}{P_t^*} \Rightarrow s_t = p_t - p_t^*$$

We assume that $P_t^* = 1$, thus $p_t^* = 0$

$$S_t = p_t \quad (3)$$

The monetary equilibrium is represented by the Cagan equation (Cagan, 1956):

$$m_t^s - p_t = -\delta \times \mathcal{E}_t$$

We can use equation (3) to rewrite the Cagan equation as:

$$m_t^s - s_t = -\delta \times \mathcal{E}_t \tag{4}$$

We define the shadow exchange rate as the exchange rate when the government does not use foreign reserves to interfere in the foreign exchange market, using equation (1) we will have:

$$m_t^s = \mathcal{E}_t \Rightarrow m_t^s = m_0^s + \beta \times t \tag{5}$$

Substituting equation (5) into (4), we have:

$$m_0^s + \beta \times t - s_t = -\delta \times \mathcal{E}_t \Rightarrow m_0^s + \beta \times t - s_t + \delta \times \mathcal{E}_t = 0$$

Then we try a linear equation $s_t = constant + \beta t$, so we have

$$m_0^s + \beta \times t - constant - \beta \times t + \delta \times \beta = 0 \Rightarrow constant = m_0^s + \delta \times \beta$$

Therefore we can derive a linear function of the shadow exchange rate

$$s_t = m_0^s + \delta \times \beta + \beta \times t = \alpha + \beta \times t$$

in which, α and β is constant and $|\beta|$ is the growth rate of the budget surplus.

Appendix B

Selling out condition

Assume agent i initially holds foreign currency, but he is aware that the fixed exchange rate will be abandoned and the foreign currency will devalue sometime in the future. He has to find out when to sell out his foreign currency and at the sametime maximizes the payoff in selling out.

Assume that agent i sells the foreign currency at time t . If the peg still holds at that time, the price of foreign currency (in terms of domestic currency) will be $e^{r^*t} \bar{S}$, (e^{r^*t} is the price in foreign currency at time t of an asset which yields constant interest rate r^* ; \bar{S} is the fixed exchange rate). In the event that the peg collapsed, the price of the foreign currency will be $E[e^{r^*t} S_t | t_i]$. Thus the payoff of agent i

$$\int_{t_i}^t e^{-rx} e^{r^*x} E [S_x | t_i] g (x | t_i) dx + e^{-rt} e^{r^*t} (\bar{S})(1 - G (t | t_i))$$

when he sells out at time t is:

in which

$$g (x | t_i) = \frac{\lambda e^{-\lambda (x - (t_i^* - \eta) - \eta \kappa + \tau)}}{1 - e^{-\lambda \eta}}$$

$$G (t | t_i) = \frac{1 - e^{-\lambda (t - \eta \kappa + \tau - (t_i^* - \eta))}}{1 - e^{-\lambda \eta}}$$

$G(t/t_i^*)$ is agent i 's conditional cumulative distribution function and $g(t/t_i^*)$ is the conditional density function of the time when the peg collapses.

$$\frac{g(t | t_i)}{1 - G(t | t_i)} = \frac{r^* - r}{1 - E \left[\frac{S_t}{S} | t_i \right]}$$

$$\Rightarrow h(t | t_i) = \frac{r^* - r}{D_f^i(t - t_i)}$$

Therefore we can conclude that agent i 's payoff in selling out will be greatest when his hazard rate equals his Greed to Fear ratio, and he will sell out the foreign currency at that time.

References

- [1] Abreu, D. and Brunnermeier, M.K. (2003), "Bubbles and Crashes", *Econometrica*, Vol. 71, No. 1, pp. 173-204.
- [2] Cagan, P. (1956), "The Monetary Dynamics of Hyperinflation", in Friedman, Milton (ed.), *Studies in the Quantity Theory of Money*, Chicago: University of Chicago Press, ISBN 0-226-26406-8.
- [3] Daniel, B. C (2001), "The Fiscal Theory of Currency Crises", *International Economic Review*, Vol. 42, pp. 970-88.
- [4] Flood, R. P. and Garber, P. M. (1984), "Collapsing Exchange Rate Regimes: Some Linear Examples", *Journal of International Economics*, Vol. 17, pp. 1-13.
- [5] Heinemann, F. and Illing, G. (2002), "Speculative Attack: Unique Equilibrium and Transparency", *Journal of International Economics*, Vol. 58, pp. 429-450.
- [6] International Monetary Fund (2011), "World Economic Outlook 2011", available at: <http://www.imf.org/external/pubs/ft/weo/2011/01/pdf/text.pdf>
- [7] Japan Research Institute (Asia Monthly, September 2005), "Revaluation of the Renminbi and Future Outlook", available at: <http://www.jri.co.jp/english/asia/2005/09/country.pdf>.
- [8] Kocherlakota, N. and Phelan, C. (1999), "Explaining the Fiscal Theory of the Price Level", *Federal Reserve Bank of Minneapolis Quarterly Review*, Vol. 23, pp. 14-23.
- [9] Krugman, P. (1979), "A Model of Balance of Payment Crises", *Journal of Money Credit and Banking*, Vol. 11, pp. 311-325.
- [10] Minguez-Afonso, G. (2007), "Imperfect Common Knowledge in First Generation Models of Currency Crises", *International Journal of Central Banking*, Vol. 3, No. 1, pp. 88-112.
- [11] Morris, G. S. (2004), "Adjusting China's Exchange Rate Policies", paper presented at IMF seminar on China's Exchange system, Dalian, China, May 26-27, 2004.
- [12] Morris, S. and Shin, H.S (1998), "Unique Equilibrium in a Model of Self-Fulfilling Currency Attacks", *The American Economic Review*, Vol. 88, No. 3, pp. 587-597.
- [13] Obstfeld, M. (1986a), "Speculative Attack and the External Constraint in a Maximizing Model of the Balance of Payments", *Canadian Journal of Economics*, Vol. 19, No. 1, pp. 1-22.
- [14] Obstfeld, M. (1986b), "Rational and Self-Fulfilling Balance of Payment Crises", *American Economic Review*, Vol. 76, pp. 72-81.
- [15] Pastine, I. (2002), "Panic, Boom and Bust: Excess demand, Devaluations and the Real Effects of Speculative Attacks", *Department of Economics*, Bilkent University.
- [16] Reinhart, C. M. and Rogoff, K. S. (2009), "The Aftermath of Financial Crises", *American Economic Review*, American Economic Association, Vol. 99, No. 2, pp. 466-72.

The problem of agent i is to maximize the above payoff. Differentiating the payoff function with respect to t and setting it equal 0, we have:

Sự tăng giá đồng tiền và tấn công tiền tệ: Trường hợp thông tin không hoàn hảo

TS. Nguyễn Anh Thu

*Khoa Kinh tế và Kinh doanh Quốc tế, Trường Đại học Kinh tế, Đại học Quốc gia Hà Nội,
144 Xuân Thủy, Hà Nội, Việt Nam*

Tóm tắt. Bài viết này phân tích một mô hình tiền tệ khi một đồng tiền được định giá dưới mức giá trị thực của nó trong khi mức giá trị thực này vẫn tiếp tục tăng lên. Những nhà đầu cơ biết rằng mức giá cố định trên có thể bị xóa bỏ trong tương lai khi dự trữ ngoại hối đạt tới một ngưỡng nào đó. Mô hình này dựa trên một thực tế là Trung Quốc đã liên tục phải tăng giá đồng Nhân dân tệ vào các năm 2005, 2008, 2010 và có thể còn phải tiếp tục nâng giá đồng Nhân dân tệ do áp lực từ cộng đồng quốc tế. Do đó họ có thể tấn công đồng tiền này và làm cho mức định giá sụp đổ và đồng tiền sẽ ngay lập tức tăng giá. Với giả thiết thông tin không hoàn hảo giữa các bên tham gia, mô hình sẽ đạt được trạng thái cân bằng duy nhất khi tấn công tiền tệ xảy ra.