Signaling versus Commitment Strengthening: Exchange Rate Insurance against Currency Attacks

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Abstract

A government which suffers from the time inconsistency problem may wish to adopt a commitment device to resolve or mitigate the problem. When the government's preferences are only private information, a strong type government (one more capable of refraining itself from the problem) may choose not to adopt such a device because of possible mimicking by a weaker type. Moreover, there does not exist a separating equilibrium where only the strong type uses the device. Although given the framework these implications seem straightforward, they are not necessarily recognized in policy discussions. I illustrate this by evaluating a novel policy proposal of exchange rate insurance advocated for Hong Kong and China during the Asia financial crisis by Merton Miller with endorsement from Gary Becker and Myron Scholes.

“If the Hong Kong Monetary Authority can provide insurance to the public against HK dollar’s devaluation and make it clear to the public that the Authority will suffer a great loss in case HK dollar is devalued afterwards, then the public will be convinced of the Authority’s determination ... I also gave a similar suggestion to the Chinese government. (p. 18)

“ I told (Chinese vice) Premier Zhu: ‘...Issuing this type of insurance is a sure win. If you know your currency will not devalue and still sell devaluation insurance, in the US you will be prosecuted for insider trading.’ I also told him: ‘You even do not need to actually issue the guarantee. Merely declaring such an intention will have a very palatable effect.’” (p. 21)

–Merton Miller (1998), in a speech delivered in Hong Kong, January 1998

1 Introduction

A government which suffers from the well known time inconsistency problem (see Kyland and Prescott, 1977, and Barro and Gordon 1983) may wish to resolve or mitigate the problem by adopting a commitment device. When the government’s preferences are only private information, as usually the case, a strong type government (one more capable of refraining itself from the problem) may choose not to adopt such a device because of possible mimicking by a weaker type. Therefore, a pooling equilibrium may result where the commitment device is not adopted despite its obvious benefits in a world of common information. Such a framework also leads to some not-so-nice results. For instance, a separating equilibrium may not exist where the commitment device is only adopted by the strong type. That is, any separating equilibrium may prescribe both strong and weak types to choose positive though different levels of commitment. This poses a difficulty to policy economists as to whether the commitment device shall be recommended.

Although the framework with both the time inconsistency and asymmetric information is realistic, its implications are not fully spelled out in the literature. This is so perhaps because the implications seem too straightforward, or perhaps because no important relevant real world problems have been identified. I argue that under close scrutiny both claims are arguable. Firstly, without clear documentation of the implications in the literature, policy debate participants are less likely to be aware of them. I demonstrate this by studying a policy debate during the Asia financial crisis about setting up a defense mechanism against currency attacks. The prevention of currency attacks also serves as an important real world example to illustrate the relevance of the framework. The paper thus contributes to better understanding of the defense against currency crisis in particular, and the difficulty of solving the dual problem of time inconsistency and asymmetric information in public decision making in general.

During the Asia financial crisis, Hong Kong, despite its better fundamentals relative to other crisis distressed economies, faced huge devaluation speculation on its dollar. To alleviate the pressure, Merton Miller and his local co-thinkers made a proposal—which is usually known as the Miller proposal—urging Hong Kong to sell exchange rate insurance (ERI). The key theoretical prediction put forward is the existence of separating equilibrium in which only the strong type government will adopt the insurance scheme. Allegedly supportive of the proposal were two other Nobel laureates Gary Becker and Myron Scholes (see Chan and Kwan, 1998, p. 130). In his meeting with the then Chinese Vice Premier Zhu Rongji in early 1998, Miller even made the same suggestion to China to boost the credibility of RMB. It appears that Miller saw the proposal not only useful for Hong Kong, but also generally suitable as a prescription for fixed exchange regimes with abundant reserves. Despite its wide coverage in the media in the region, nonetheless there has been little consensus as to whether the proposal would have worked for Hong Kong, or will work in general.

A framework featuring both time inconsistency and government preferences being private information is appropriate for assessing ERI. Both features are stated in Miller (1998) and his local co-thinkers' work (Chan and Chen, 1999). More importantly, the time inconsistency problem has been identified by Obstfeld (1994, 1996) and Ozkan and Sutherland (1995), among others, and is the key element of the popular second generation models of currency crisis. Information asymmetry presumably plays an important role in the study of currency crisis, as it does in the new political economy literature (see, e.g., Vickers 1986, Drazen and Masson 1994, and Drazen 2000a, b).¹

In this paper, I construct a theoretical model to study the desirability of ERI. It is well known that multiple equilibria² in currency crisis models render comparative static exercise infeasible. To resolve this difficulty one needs a convincing way for equilibrium selection. I find the recent breakthrough in Morris and Shin (MS, 1998) an ideal approach and hence build my theoretical model on it. The novelty of my work is that I allow the government to choose the amount of insurance prior to revelation of future fundamentals, as well as the preferences of the government to be private information—the government can be either strong or weak in its defense resolve and the type is private information. So far as I know, my work is the first along the line of MS to study the optimal strategy on the part of the government.

¹In the second generation currency crisis models à la Obstfeld (1994, 1996), the central role is given to the time inconsistency problem, while the asymmetric information on the part of government is assumed away. However, in our view, asymmetric information is not assumed not because it is unimportant, but because such a simplification helps single out that time consistency per se can lead to instability of the exchange rate that is not accounted for by the first generation crisis models.

²Note that there are two senses of multiple equilibria. After the update belief is formed, there may be multiple equilibria in the attack game. Given that there is no multiplicity in this attack game, there still may be multiple equilibria in the game where the government decides on D , as there are few restrictions on the out-of-equilibrium updated belief. Morris and Shin remove the first type of multiplicity, but not the second.

Some authors downplay the role of multiple equilibria in the attack game. For instance, Drazen (e.g., 2000a) rightly points out that a model of an optimizing government does not automatically imply multiple equilibria. His argument is based on models in which each trader's payoff is assumed in a way that eliminates payoff complementarity: each trader's payoff will be independent of others' actions. Using this modeling approach, one can greatly simplify the strategic interaction among speculators so as to allow a more tractable analysis of interaction between the government and a representative agent from the public. This is clearly in line with the modeling tradition of Kydland and Prescott and Barro and Gordon.

The study highlights a conflict for an instrument to be both a commitment device and a signaling device. Two main results emerge. First, every separating equilibrium generally involves both types using ERI, in sharp contrast with its advocates' claim that a separating equilibrium exists where only the strong type uses ERI. Second, simulation shows that when government type is commonly known the optimal level of ERI of the weak type exceeds that of the strong type.

The first result poses great difficulty as to whether ERI should be recommended. Even if the model builder is convinced of the model, she still needs to calibrate parameters for it. Difficulty in the calibration makes this separating equilibrium less powerful. The second result, albeit far from conclusive, suggests that adopting ERI might be a negative signal: there might exist a separating equilibrium where only the weak type adopts the insurance scheme. If it is the case, the strong type should avoid adopting it at all. If not, the simulation result still rationalizes public's pessimistic belief that whoever adopts it is identified as the weak type. This leads to a pooling equilibrium where neither type uses the insurance scheme.

I think that my theory is relevant to other public policy making problems as well. Central bank policy is one such example. A similar argument can be made to explain why greater commitment to not rescuing failed banks that is supposedly desirable for central banks might not be actually adopted. This thus provides an alternative understanding of notions such as "constructive ambiguity" and "too big to fail."

The rest of this paper is organized as follows. Section 2 highlights the basic insight of the paper. Section 3 describes a model of currency attacks preceded by government's decision to issue insurance. Section 4 solves the speculators' attack decisions after the insurance decision has been made. Section 5 studies the optimal choice of ERI given the speculative attack decisions studied in Section 4. Section 6 contains simulation results on optimal quantity of insurance when government type is commonly known. Section

7 reviews the debate of ERI in Hong Kong, proposes an alternative defense policy, and discusses other applications of the general framework. Section 8 concludes.

2 Basic Intuition

A reduced form model is used to convey the main arguments. There are two types of government: strong and weak. Relative to a weak type, a strong type is always more determined to defend the currency peg. Type i government is allowed to make a policy choice D_i , which is publicly observable, $i = s$ (strong), w (weak). The set of feasible choices is denoted by $\mathfrak{D}$ which, dependent on the context, equals either $[0, \infty)$ or $[0, \overline{D}]$, where $\overline{D}$ is a known upper bound. Although the policy choice I have in mind is the amount of ERI issued, it can be any other policy choice that affects the government's incentive to devalue. Denote type i government's expected utility function by $W_i(\pi_s^u, D)$, $i = s, w$, where D is the policy choice that the public observes and π_s^u the public's updated belief about the probability of the government being strong upon D is observed. The following assumption is made.

A1 $W_i(\pi_s^u, D)$ is strictly concave in $D \in \mathfrak{D}$, and hence, for every π_s^u , there exists a unique

$$D \in \mathfrak{D} \text{ that maximizes } W_i(\pi_s^u, D), i = s, w.$$

Proposition 1 *There exists a separating (semi-separating) equilibrium in which $D_s > 0$ is chosen with probability one and $D_w = 0$ with probability one (with positive probability) only if*

$$\text{for all } D \in \mathfrak{D}, \min_{\pi_s^u} W_w(\pi_s^u, D) \leq W_w(0, 0). \quad (1)$$

Equation (1) states that there is a profile of updated belief $\pi_s^u(D)$ such that the weak type of government finds it (at least weakly) optimal to choose $D_w = 0$ with the associated updated belief of $\pi_s^u(0) = 0$, instead of choosing any $D_w > 0$ with associated

updated belief $\pi_s^u(D_w)$. Note that (1) is only a necessary condition for the aforementioned separating or semi-separating equilibrium; to ensure equilibrium existence we also need to consider the incentive compatibility constraint on the part of the strong type. Yet (1) is not automatically guaranteed. There are two possible scenarios according to the characteristics of the weak type's expected utility function.

A2a It is not in the weak type of government's interest to choose any positive D when its type is commonly known, i.e., $W_w(0, D)$ is non-increasing in D when $D = 0$.

A2b It is still in the weak type of government's interest to choose a positive D when its type is commonly known, i.e., $W_w(0, D)$ is increasing in D when $D = 0$.

Figure 1

The two scenarios correspond to panels a and b in Figure 1. For panel a, (1) is easy to satisfy. For instance, $\pi_s^u(D) = 0$ for $D \notin \{0, D_s\}$ is one such profile of updated belief. This type of equilibrium is well studied in the signaling literature: the strong type of government chooses a sufficiently large signal, while the weak type chooses no signal at all.

For panel b, it is more difficult to find a belief profile to satisfy (1). Note that the profile that $\pi_s^u(D) = 0$ for $D \notin \{0, D_s\}$ will not work for this propose. Given that its type is fully revealed in a separating equilibrium, the weak type will prefer to choose a positive D . To prevent it from doing so, we need stringent beliefs. A *necessary* condition for (1) is that $W_w(\pi_s^u(D), D) < W_w(0, D)$ for all $D \in (0, D^*)$, where $D^* > 0$ is defined as the largest D such that $W_w(0, D) \geq W_w(0, 0)$. (Refer to Figure 1.) That is, *for each $D \in (0, D^*)$, there exists a strictly positive $\pi_s^u(D) > 0$ such that the weak type's payoff is lower than the one*

resulting from the case where its type is completely revealed ($\pi_s^u(D) = 0$). Although this condition is difficult to rule out, it is clearly rare. In any case, the condition as depicted in Panel b violates an essential assumption in standard signaling games where the signal is costly to use and directly unproductive.

Any policy that increases the government's cost of devaluation presumably hardens its defense commitment. Insurance against devaluation from the current peg is one such policy, as compensation to insurees is incurred only upon devaluation of the peg. As long as the government gets enough premia from selling the insurance ex ante to offset for the expected loss in compensation ex post, it will have the incentive to choose a positive D . This argument holds for the weak type of government as well. Therefore, scenario b might be plausible and deserves our attention. (This accords with Ozkan and Sutherland 1995, who argue that increasing the devaluation cost can increase the life expectancy of a fixed exchange rate.)

3 Framework

The framework follows closely that of Morris and Shin (1998). The players of the game are the government of a country and a continuum of speculators, whose size is normalized to unity; all players are risk neutral. The government can be either strong (s) or weak (w). (The exact utility representation will be discussed shortly.) There are three stages in the game.

In stage 1, while the government knows its own type, the public hold a belief π_s ($\pi_w \equiv 1 - \pi_s$) as the probability of the government being strong (weak). The country currency is pegged at e^* , which is the price of domestic currency in terms of foreign currency.³ The fundamentals are sound and there is no immediate risk of currency crisis

³The fundamentals considered include the business environment and exchange rates of other countries.

or devaluation. Nonetheless, the government cares about bad fundamentals and currency attacks that may occur in the future. The state of future fundamentals θ is a random variable distributed according to cumulative distribution function $G(\theta)$, where $0 < G(\theta) < 1$ for all $\theta \in (-\infty, +\infty)$. For each θ , the exchange rate that otherwise prevails in a freely floating market is $m(\theta)$. As a larger θ represents stronger fundamentals, $m(\theta)$ is a strictly increasing function of θ . The country's exchange rate is overvalued as long as $e^* > m(\theta)$. For the study to be economically interesting, assume that the chance of overvaluing is quite high, i.e., $G(m^{-1}(e^*))$ is close to unity. Thus for weaker fundamentals where $\theta < m^{-1}(e^*)$ devaluation is possible. For strong fundamentals where $\theta > m^{-1}(e^*)$, for simplicity, I assume that the government commits to no revaluation. In other words I will study a scenario in which there is devaluation risk but not revaluation risk.

While the government cannot change the distribution of future fundamentals, it can affect the likelihood of a currency attack by making speculators less aggressive. To do so, type i government issues insurance against devaluation of its domestic currency. In the absence of insurance, upon devaluation to m , the holder of one unit of domestic currency will experience a loss that amounts to $e^* - m$ of foreign currency. In the case of no devaluation, no loss is incurred. Assume that the insurance contract takes the following form: for each unit of domestic currency insured, the government is obligated to repay an amount of foreign currency, $\gamma \times (e^* - m)$, upon devaluation, and repay nothing otherwise.⁴ Whereas the proposal by Miller and Chan and Chen assumes a complete insurance, i.e., $\gamma = 1$, here I generalize it to allow for incomplete insurance where $0 < \gamma < 1$. Let D_i/e^* be the amount of domestic currency that type i government chooses to insure, $i = s, w$. Therefore, the total repayment in foreign currency upon a deviation is $D\gamma(e^* - m)$. The insurance contracts are sold via the market. Let $P(\pi_s^u(D_i), D_i)$ be the total premium (in

⁴The interest rate of the foreign currency is normalized to zero, while that of the domestic currency is endogenously determined; the interest rate differential thus represents the risk premium that is associated with the domestic currency's devaluation probability.

foreign currency) that type i government collects where D is the amount of ERI issued and $\pi_s^u(D_i)$ is public's updated beliefs of the probability of the government being strong. The government are assumed to make institutional arrangements to ensure proper delivery of its repayment obligations.⁵ Finally, I assume that speculators are not allowed to buy insurance.⁶

In stage 2, θ is revealed. While the government observes θ , the speculators each observe only an iid signal x distributed according to a cumulative function $H(x|\theta)$. Upon observing the iid signals, all speculators simultaneously and independently decide whether to short sell one unit of local currency. If the speculator does not short sell, his payoff is zero whatsoever happens in stage 3. If he short sells, his payoff is $R(\theta) - t$ for a successful attack (i.e., when the currency is let afloat), and $-t$ for an unsuccessful attack, where $R(\theta) \equiv e^* - m(\theta)$ and t is the transaction cost of short sales. We assume that neither the number of potential speculators nor the transaction cost is affected by the size of D .

In stage 3, upon seeing the magnitude of attack $\alpha \in [0, 1]$ (the proportion of speculators who have attacked), type i government chooses either to keep the peg or to float, $i = s, w$. In the latter case, its welfare will be $-D_i\gamma R(\theta)$, which is the loss of foreign reserves upon devaluation due to insurance repayment. In the former case, its welfare will be $v_i - c_i(\alpha, \theta, D_i)$, where v_i is the utility gained from having the exchange rate regime unchanged and $c_i(\alpha, \theta, D)$ the cost of maintaining the exchange rate. I assume that

⁵One method is to earmark enough foreign reserves and have them stored via a third party, such as an international organization. Another is to follow Chan and Chen, where the instrument takes the form of domestic currency put options: basically, the government loans out an amount of foreign currency of $D \times e^*$ to authorized institutions, which are allowed to repay the loans in foreign currency or in a corresponding amount of domestic currency at the rate (e^*) that was fixed when the contracts were signed. In this case, the concern about lack of commitment on the part of the government clearly does not exist, as money has already been in the borrowers' hands. Note that this proposal is analytically identical to the full insurance proposal in which $\gamma = 1$ (with a difference of a multiplying factor that is dependent on the interest rate differential).

⁶By holding insurance policies, speculators will be more aggressive in attacking because they also gain from receiving compensation from devaluation. Similarly, those who are not speculating in the absence of ERI scheme, upon holding ERI, will want to see the peg unpegged; therefore, the ERI proposal affects the number and composition of potential speculators. This concern is not serious when speculators are atomistic because they will have to compete with genuine insurees over whom they have no cost advantage. It deserves more thought, however, if some speculators have market power.

$c_i(\alpha, \theta, D_i)$ is decreasing in θ but increasing in α and D . Note that I also assume that $v_s \geq v_w$ and $c_s(\alpha, \theta, D) \leq c_w(\alpha, \theta, D)$ for all α, θ and D , and that one of the inequalities must be strict. This means that given the same θ and D , the maximum scale of attack that the strong type of government is able and willing to stand against is always greater than that of the weak type. This thus justifies the notion of strong and weak types that we have adopted.

Assuming a unity discount factor and a zero interest rate (for foreign currency), type i government's objective in stage 1 is to choose a D to maximize its expected overall utility

$$\begin{aligned} W_i(\pi_s^u(D), D) &= P(\pi_s^u(D), D) + \int_{A_i(\pi_s^u(D), D)} (-D\gamma R(\theta)) dG(\theta) \\ &\quad + \int_{(-\infty, +\infty) \setminus A_i(\pi_s^u(D), D)} (v_i - c_i(\alpha(\pi_s^u(D), D), \theta, D)) dG(\theta), \end{aligned} \quad (2)$$

where $A_i(D)$ is the set of fundamentals in which the peg is foreseen to be abandoned and $\alpha(D)$ is the scale of the attacks that are anticipated.

Define $\bar{\theta}$ such that $R(\bar{\theta}) = 0$; i.e., for $\theta \geq \bar{\theta}$, the fundamentals are so strong that speculators' gain from a successful attack is too slim to cover the transaction cost. For each D , define $\underline{\theta}_i(D)$ as the θ that satisfies $v_i - c_i(0, \theta, D) = -D\gamma R(\theta)$. That is, for $\theta \leq \underline{\theta}_i(D)$ the peg will be abandoned even in the absence of attacks. The following two assumptions are made.

B1 For all D , a finite $\underline{\theta}_i(D)$ exists and $G(\underline{\theta}_i(D)) > 0, i = s, w$.

This states that for all D devaluation in the absence of attacks is still a possible event. Put another way, for all D , we can imagine very bad fundamentals, even in the absence of any attacks, the government may prefer devaluing to maintaining the peg.⁷

⁷ An alternative assumption that serves the same purpose is that however independent the government is, political constraints still impose an upper bound to the choice of D . Consequently, even with the optimally chosen amount of ERI, the prospective of devaluation cannot be ruled out completely.

B2 A finite $\bar{\theta}$ exists and $G(\bar{\theta}) < 1$.

That is, attacking is not always beneficial. For $\bar{\theta} < \theta < m^{-1}(e^*)$, devaluation is possible upon a large enough attack, but the capital gain is too small to offset the transaction cost. For $\theta > \bar{\theta}$, devaluation is simply impossible and attacks can never be successful. The purpose of this assumption is to rule out the possibility that, back in stage 1, it is foreseen with certainty that the currency will be devaluated later.

I follow the tie-breaking rules that the government will give up the currency peg if it is indifferent between defending or abandoning the peg and that each speculator will not attack if he is indifferent between attacking and not attacking. The rules and payoff functions of the above game is commonly known. A time line of the game is depicted in Figure 2.

Figure 2

It is instructive to review the benchmark scenario where the ERI is unavailable and there is only one type of government. When θ is observed without errors, there exists a range of θ (i.e., $\underline{\theta} < \theta < \bar{\theta}$) where multiple equilibria prevail: maintenance of the peg preceded by no attack is one equilibrium outcome and collapse of the peg preceded by attack is another. When θ is observed with errors, however, Morris and Shin (1998, 2000) show that the equilibrium is unique: there exists a state θ^* such that the unique equilibrium outcome is to unpeg for $\theta \leq \theta^*$ and not to unpeg otherwise. Their approach not only enables us to conduct comparative statics in the study of currency crises, but also clarifies that the time inconsistency problem does not have to lead to multiple equilibria. Interestingly, the time inconsistency problem still causes the abandonment of the peg in

the otherwise sustainable region $[\underline{\theta}, \theta^*]$.⁸

4 The Attack Game

The game is solved by backward induction. Consider the government's decision at stage 3. Given D and upon observing α and θ , type i government's optimal strategy is to defend (i.e., maintain) the peg as long as defending gives a utility greater than not defending. (Note that given α , the updated $\pi_s^U(D)$ belief is irrelevant in government's defense decision.) Thus we can define a maximum scale of attack

$$a_i(\theta, D) \equiv \inf \{ \alpha | v_i - c_i(\alpha, \theta, D) \geq -D_i \gamma R(\theta) \}, \quad (3)$$

against which type i government chooses to defend.

A pair of representative $a_i(\theta, D)$ are depicted in Figure 3. Note the following. First, $a_i(\theta, D)$ is continuous in θ and D . Second, for all D , there is a $\underline{\theta}_i(D)$ such that $G(\underline{\theta}_i(D)) > 0$ and for all $\theta \leq \underline{\theta}_i(D)$, $a_i(\theta, D_i) = 0$. Hence, for low enough θ , devaluation will be chosen even in the absence of attacks. Third, for stronger fundamentals where $\theta > \underline{\theta}_i(D)$, it takes a positive attack size for the peg to be abandoned and $a_i(\theta, D_i)$ is assumed to increase with θ (which must be the case when D is small enough). Fourth, $a_s(\theta, D)$ is greater than $a_w(\theta, D)$; the strong type government is always less likely to give up its peg.

Figure 3

⁸Some authors argue that the multiple equilibrium issue still deserves further investigation. Models that exhibit multiple equilibria along the line of Morris and Shin have been constructed. The parameter space that allows for multiple equilibria, however, is narrower relative to that of Obstfeld. See Chan and Chiu (2002), Sbracia and Zaghini (2001), and Heinemann and Illing (2002) for details. Prati and Sbracia (2001) present empirical results that are supportive of the Morris-Shin approach.

4.1 Unique Equilibrium in the Attack Game

Back to stage 2, a strategy is said to be a cutoff strategy k if it prescribes the speculator to attack upon observing a signal strictly less than k and not to otherwise. If all speculators play the same cutoff strategy k , the attack scale will be $s(k, \theta) = H(k|\theta)$, where θ is the true state. Type i government will abandon the currency peg if and only if $s(k, \theta) \geq a_i(\theta, D)$, or θ is less than or equal to

$$\phi_i(k, D) \equiv \arg \max_{\theta} \{s(k, \theta) - a_i(\theta, D) \geq 0\}.^9 \quad (4)$$

A representative $s(k, \theta)$ as a function of θ is depicted in Figure 3.

Denote by $u_k(i, x)$ as a speculator's expected utility from attacking when he has a signal x , the government is of type i , and all other speculators adopt the cutoff strategy k . (Note that neither π_s^u nor D affects $u_k(i, x)$.) Since the government will still abandon the peg under states $\theta \leq \phi_i(k, D)$,

$$u_k(i, x) = \int_{-\infty}^{\phi_i(k, D)} R(\theta) dF(\theta|x) - t. \quad (5)$$

where $F(\theta|x)$ is the cumulative distribution function of θ given signal x . Taken into account that the government is of type s with probability π_s^u , the speculator's expected utility from attacking equals

$$E_i u_k(i, x) = \pi_s^u u_k(s, x) + (1 - \pi_s^u) u_k(w, x). \quad (6)$$

It is straightforward to show that $E_i u_k(i, x)$ is strictly decreasing in x ; i.e., other things being equal, the stronger the signal, the smaller the speculator's gain from attacking.

⁹Note that $s(k, \theta)$ is decreasing and $a_i(\theta, D)$ increasing in θ . Even if $a(\theta, D)$ is downward sloping, as long as $s(k, \theta)$ cuts $a(\theta, D)$ from above, which must be true for sufficiently precise signals, the definition of $\phi(k, D)$ below still holds true.

Then any k^* that satisfies $E_i u_{k^*}(i, k^*) = 0$ constitutes an equilibrium.

According to Morris and Shin (1998, 2000), provided that the signal is sufficiently precise, the function $u_k(i, k)$ is strictly decreasing in k . Hence, the solution k^* to $E_i u_k(i, k) = 0$ is unique and so is the equilibrium. (B1 and B2 together guarantee the existence of k^* , as well as the equilibrium.) Note that the cutoff strategy k^* constitutes a unique equilibrium not only among the class of symmetric equilibria, but also among the class of all equilibria (asymmetric equilibria included).¹⁰ Despite the paper's main concern with ERI, the extension of the uniqueness result in MS to an environment of incomplete information on the part of government is by itself a useful contribution.¹¹

Proposition 2 *Provided that signals are precise enough, given D and π_s^u there exists a unique equilibrium in which all speculators adopt cutoff strategy $k^*(\pi_s^u, D)$ and the type i government abandons the peg if and only if $\theta \leq \theta_i^*(\pi_s^u, D) = \phi_i(k^*(\pi_s^u, D), D)$, $i = s, w$. The values $k^*(\pi_s^u, D)$ and $\theta_i^*(\pi_s^u, D)$, $i = s, w$, are solved by (4) together with setting $E_i u_{k^*}(i, k^*)$ to zero.*

Two points are worth further discussion. Firstly, the earlier comparison between $a_s(\theta, D)$ and $a_w(\theta, D)$ tells us that it requires a larger attack for the strong type of government to abandon its peg. This must also be true in equilibrium when the speculators' actions are optimally chosen. Given D and π_s^u , we can partition the space of θ into three categories. For sufficiently weak fundamentals ($\theta \leq \theta_s^*$), both weak and strong types of government will abandon the peg; for moderate fundamentals ($\theta_s^* \leq \theta \leq \theta_w^*$), only weak

¹⁰Morris and Shin (1998, and 2000) show that in the game in which government type i is commonly known, the equilibrium uniqueness (among all possible types of equilibria) is guaranteed if $u_k(i, k)$ is decreasing in k . Exactly the same proof will show that for the game in which the government type is private information, the sufficient condition for equilibrium uniqueness is $E_i u_k(i, k)$ being decreasing in k . That condition is satisfied here.

¹¹I have assumed that the speculators are atomistic. Building on Morris and Shin (1998), Corsetti et al. (2002) assume that there are two types of speculators: a large player with market power and small atomistic players, and study a game in which these players need to move simultaneously and another game in which they are allowed to move in two stages. They still find a unique equilibrium. We can likewise model the speculators as Corsetti et al. do, and obtain a unique equilibrium in this study. In this case, the same comparative statics will prevail.

type will do so; for sufficiently strong fundamentals ($\theta > \theta_w^*$), neither type will devalue. (To simplify the notation, I omit the arguments in these $\theta_i^*(\cdot), i = s, w$.)

Secondly, Proposition 2 suggests a competing explanation vis-a-vis Obstfeld (1994, 1996) for episodes such as the EMS crisis where the fundamentals are basically sound. Given the same fundamentals, my analysis states that the attack scale is variable, depending on the public's beliefs about the government type $\pi_s^u(D)$. Hence multiple equilibria or self-fulfilling prophecies may be apparent only and can be fully explained by a difference in public's beliefs about government preferences or related private information. The self-fulfilling models maintain that these beliefs are self-fulfilling and hence face few restrictions. My theory, however, maintains that they come from an updating process following the Bayes rule.¹² Since these beliefs can be proxied by some measure of interest rate differentials, a detailed enough event study should enable us to distinguish which model has greater explanatory power.

4.2 The effect of D and updated belief π_s^u on speculators' behavior

Given the updated belief π_s^u , the same attack scale α and the same state θ , an increase in D raises both the government's cost of defense $c_i(\alpha, \theta, D)$ and its cost of devaluation $D\gamma R(\theta)$. Given θ , for one unit increase in D , the maximum scale that type i government can bear is increased by $\partial a_i(\theta, D)/\partial D = (\gamma R(\theta) - c_3)/c_1$. If the increase in devaluation cost exceeds the corresponding increase in defense cost—a case which we assume to be normal—then the government will be more determined in its defense. For the case in which $a_i(\theta, D)$ is increasing in D , it is easy to see that speculators will adopt a less aggressive cutoff strategy (i.e., a weaker cutoff signal k) when D is increased. It should be noted that even though an increase in D leads to less aggressive attack, it is not automatically

¹²For events that are out of the equilibrium path, the corresponding beliefs cannot be updated via Bayes' rule, and hence can be quite arbitrary. However, this does not matter in our discussion, as by definition, those events will not occur in practise; the beliefs in an event study should always be updated by Bayes rule.

true that ex ante the net gain of adopting ERI is worthwhile. This point is dealt with in the next Section.

Likewise, we can study, given D , how π_s^u affects speculators' attack decisions. It is straightforward to see that, *regardless of the sign of $\partial a_i / \partial D$* , an increase in π_s^u always makes speculators less aggressive, resulting in a lower cutoff state k^* . The results in this subsection are summarized in the following proposition.

Proposition 3 1. If $\partial a_i / \partial D > 0$ (i.e., $\gamma R(\theta) > \partial c_i / \partial D$), then $\partial k^*(\pi_s^u, D) / \partial D < 0$ and $\partial \theta^* / \partial D < 0$.

2. $\partial k^*(\pi_s^u, D) / \partial \pi_s^u < 0$ and $\partial \theta^*(.) / \partial \pi_s^u < 0$.

5 The optimal choice of D

After studying the problems in stages 2 and 3, we are ready to study the problem in stage 1, in which the government chooses an optimal D . Since the main concern of the analysis is whether a separating equilibrium exists, we only need to consider a simpler problem where the government's type is commonly known, from which much knowledge about the game with two types of government can be learned.

The government knows, for any given D , that all speculators in stage 2 will adopt a cutoff strategy $k^*(D)$ and the government itself in stage 3 will abandon the peg if and only if $\theta \leq \theta^*(D) = \phi(k^*(D), D)$. (As government type is commonly known, updated beliefs and government type are omitted in all notation.) Therefore, the government's welfare as a function of D is

$$\begin{aligned} W(D) &= \int_{\theta^*(D)}^{\infty} (v - c(s(k^*(D), \theta), \theta, D)) dG(\theta) \\ &\quad + \int_{-\infty}^{\theta^*(D)} (-D\gamma R(\theta)) dG(\theta) + P(D), \end{aligned} \tag{7}$$

where $P(D)$ is the premium it raises from selling insurance. Assuming insurees' risk neutrality, this premium—the amount that the insured are willing to pay to insured—just equals government's expected repayment, i.e., $P(D) = -\int_{\infty}^{\theta^*(D)} D\gamma R(\theta)dG(\theta)$. Hence, (7) is simplified to

$$W(D) = \int_{\theta^*(D)}^{\infty} (v - c(s(k^*(D), \theta), \theta, D))dG(\theta). \quad (8)$$

Differentiating $W(D)$ with respect to D , we have

$$\begin{aligned} \frac{dW(D)}{dD} &= \int_{\theta^*(D)}^{\infty} \left(-\frac{dc(s(k^*(D), \theta), \theta, D)}{dD} \right) dG(\theta) \\ &\quad - (v - c(s(k^*(D), \theta^*(D)), \theta^*(D), D))g(\theta) \frac{d\theta^*(D)}{dD}. \end{aligned}$$

Substituting $v - c(.) = -\gamma DR(\theta^*)$ in the second term of RHS of the above equation, we have

$$\frac{dW(D)}{dD} = \int_{\theta^*(D)}^{\infty} \left(-\frac{dc(s(k^*(D), \theta), \theta, D)}{dD} \right) dG(\theta) + \gamma DR(\theta^*)g(\theta) \frac{d\theta^*(D)}{dD}. \quad (9)$$

Focusing on the case where $d\theta^*(D)/dD < 0$ (an increase in D leading to less aggressive attacks), the above equation states that increasing D involves both a cost and a benefit. Note that in the critical state, the government is indifferent between keeping and abandoning the peg, i.e., $v - c(.) = -\gamma DR(\theta^*) < 0$, and the government's welfare is in fact negative. A reduction in $\theta^*(D)$ that arises from an increase in D enlarges this loss. The first term of the RHS of (9) is negative, representing this cost. The second term on the RHS—the expected reduction in $c(.)$ for $\theta > \theta^*(D)$ —is the benefit from an increase in D . If there is a downward shifting of $c(s(k^*(D), \theta), \theta, D)$ as a function of θ , and if this gain is large enough to offset the first term (the loss) in the RHS, then $dW(D)/dD > 0$. (Refer

to Figure 4.) With a greater D , the speculators are less aggressive, hence the domestic interest rate is lower, and the government derives greater net benefits from keeping the peg (recalling that such net benefits are defined as $v - c(\cdot)$).

Figure 4

For the case where $D = 0$, the first term in the RHS of (9) vanishes, and we have

$$\left. \frac{dW(D)}{dD} \right|_{D=0} = \int_{\theta^*(D)}^{\infty} \left(-\frac{dc(s(k^*(D), \theta), \theta, D)}{dD} \right) dG(\theta) \Big|_{D=0}. \quad (10)$$

Thus, as long as $dc/dD|_{D=0} < 0$ for all $\theta > \theta^*(0)$, a marginal increase in D starting from $D = 0$ must be beneficial to the government. Note that the derivative dc/dD consists of two terms:

$$\frac{dc}{dD} = \underbrace{\frac{\partial c}{\partial s}}_{+} \underbrace{\frac{\partial s}{\partial k}}_{+} \underbrace{\frac{\partial k^*}{\partial D}}_{-} + \underbrace{\frac{\partial c}{\partial D}}_{+}, \quad (11)$$

where the first term corresponds to the indirect effect arising from the reduction in speculators' aggressiveness that results from the government's changed determination while the second term the effect that arises directly from an increase in D . Under normal conditions, the first term is supposed to be negative, while the second positive. If the first term dominates for all $\theta > \theta^*(D)$, $dW(D)/dD|_{D=0}$ is positive, which is the scenario in panel b of Figure 1. In this case we say that the commitment effect is strong enough. We have the following Proposition.

Proposition 4 Suppose $\frac{\partial c}{\partial D}|_{D=0} = 0$ for all θ , and $\frac{\partial k}{\partial D} < 0$. We have $\frac{dW(D)}{dD} \Big|_{D=0} > 0$.

Given government type being commonly known, $dW_i(D)/dD|_{D=0} > 0$ implies that the government will find it in its interest to adopt ERI. Nonetheless, the purpose is to

strengthen commitment instead of signaling; there is simply no private information that the government can signal.

Is it possible that $dW_s(D)/dD|_{D=0} > 0$, while $dW_w(D)/dD|_{D=0} < 0$? (Note in this case we come back to a scenario depicted in panel a of Figure 1.) Possible, but not necessarily. Recall that the two types do not differ in the amount of foreign reserves, and that the defining distinction between a strong and a weak government is that $v_s - c_s(\alpha, \theta, D) > v_w - c_w(\alpha, \theta, D)$, or in a more reduced form, $a_s(D) > a_w(D)$. This defining characteristic is perfectly compatible with the fact that $dW(D)/dD|_{D>0} > 0$ for both types. Therefore, the assumption that the two types have different signs for the $dW(D)/dD|_{D=0}$ is unwarranted, and may lead to more restrictive results that do not carry over to the more general case.

The above analysis greatly limits the usefulness of ERI as a signaling device. Suppose that the model builder establishes a separating equilibrium in which the weak type chooses a low (yet positive) D and the strong a large D . Suppose also that now the government chooses an amount of insurance coverage that is equal to 19.97% of its foreign reserves. Should the public consider this amount as low or high? Even though the model builder is convinced of the appropriateness of the model. It still requires her or him to calibrate the parameters for the model to be useful as a prescriptive tool. Game theory and economics are not good at making quantitative suggestions of this sort.

In the literature, there are signaling models with both types choosing different but positive levels of policy choices in equilibrium. One notable example is the now classic paper on monetary policy by Vickers (1986) which studies a two period signaling game with two types of monetary authority. In the equilibrium focused on, while the weak type (one dislikes inflation in a smaller extent) chooses a high inflation rate, the strong type chooses an inflation sufficiently low enough to separate it from the weak type. Therefore, the game displays interesting dynamics regarding inflation and unemployment over the two

periods. We consider such a model useful in generating interesting insight. However, we are less confident that it can be used a prescriptive theory of the monetary authority's behavior.

6 Which type has a larger optimal commitment level: the strong or the weak?

This Section will use specific functional forms to illustrate how the optimal choice of D varies with the parameters of the government, given that the government type is commonly known.

The following specification is adopted in the simulation. $G(\theta)$ is normal with mean $\tilde{\theta}$ and variance ν^2 , while $H(x|\theta)$ is also normal with mean θ and variance σ^2 . As a consequence, the posterior distribution $F(\theta|x)$ has mean $\mu = (\sigma^2\tilde{\theta} + \nu^2x)/(\sigma^2 + \nu^2)$ and variance $\rho^2 = \sigma^2\nu^2/(\sigma^2 + \nu^2)$. $R(\theta) = 0.5 - (1/\pi) \arctan \theta$. Therefore, $R(\theta)$ is decreasing in θ , $R(-\infty) = 1$, and $R(\infty) = 0$. The defense cost $c(\alpha, \theta, D) = b\alpha^2 + d/(1 - R(\theta))$ where $b > 0$ and $d > 0$. A greater b indicates a greater marginal cost of defense with respect to α . The coefficient d , in contrast, indicates the disutility of keeping the peg when the state is unfavorable. It is easy to reckon that

$$a(\theta, D) = \sqrt{\frac{v - d/(1 - R(\theta)) + DR(\theta)}{b}}. \quad (12)$$

Note that this critical value $a(\theta, D)$ is increasing in θ so long as $D < d$, and is decreasing in θ otherwise. I have carefully checked that for greater values of D , the non-monotonicity does not render the equilibrium uniqueness inapplicable.

Figure 5

Figure 5 reports the simulation results that the optimal D is strictly positive, decreasing in v , and increasing in b and d . In these exercises, $\tilde{\theta} = 0$, $v^2 = 4$, $\mu = 0$, and $\sigma^2 = 0.05$. The same pattern prevails for other parameters that were tried. Since the government is weaker for low ν , large b , and large d , the simulation results show that a weak government's ERI is greater than a strong government's. The underlying insight is that a strong government is more capable of containing the time inconsistency problem, and further commitment strengthening is not particularly useful. Note that in the specification, I assume that D does not enter $c(\alpha, \theta, D)$, i.e., $\partial c(\alpha, \theta, D)/\partial D = 0$. If D enters $c(\alpha, \theta, D)$, then the optimal choice of D will be reduced. Nevertheless, there is no reason to believe that the ranking of optimal D between strong and weak types would be reversed.

Note that the simulation does not imply that during the Asian financial crisis a country like Indonesia would have been willing to commit to a larger D than Hong Kong. In this model, a weak government and a strong government differ not in their foreign reserves but in their trade-off between keeping the peg and other macroeconomic aspects of the economy. It makes little sense, therefore, to discuss the signaling by Hong Kong to separate itself from Indonesia, as the two economies already have observable differences.

Albeit far from conclusive, my simulation result suggests that a weak government may have a greater incentive to issue ERI than a strong government and hence adopting ERI might be a negative signal: there might exist a separating equilibrium where only the weak type adopts the insurance scheme. This suggests a violation of the Spence-Mirrlees condition. (It is not unusual to see the same instrument playing opposite signaling roles in same class of problems. For instance, very high interest rates during defense, while serving as a negative signaling device in Drazen (2000a), serves as a positive one in Chan, Sin, Cheng (2001).) If this is the case, the strong type should avoid adopting it at all. If not, the simulation result still rationalizes public's pessimistic belief that whoever chooses

it is identified as the weak type. This leads to a pooling equilibrium where neither type uses the insurance scheme.

While equilibrium refinement such as the intuitive criterion might be able to kill the pooling equilibrium, political consideration might prevent it from being “too large,” making the pooling equilibrium more likely. For instance, few people will agree to a proposal of using more than 40% of the country’s foreign reserves. In Miller’s proposal, D equalled HK\$50 billion, i.e., about 22% of Hong Kong’s M1, or 6% of foreign reserves at that time. The fact that this modest amount found it hard to be accepted suggests the very difficulty. In the context where the commitment effect of the device is positive the required minimum choice of the device by the strong type might be even greater. This places additional difficulty for the strong type to separate itself from the weak type.

7 Discussion

7.1 The debate on ERI

The idea of ERI surfaced in Hong Kong in the fall of 1997 shortly after the first attack on its dollar, which had been pegged with the US dollar under a currency board arrangement since 1984. During the attack the interbank rate reached a historic level of 300 percent and therefore caused much unease to the economy. A group of economists associated with the newly founded Hong Kong University of Science and Technology (HKUST) came up with a proposal of HK dollar put option scheme, which allows authorized institutions to borrow US dollar from the Hong Kong Monetary Authority (HKMA) with their holdings of Exchange Fund bills and notes as collateral.¹³ According to the proposal, the borrowers

¹³According to Chan and Chen, the merit of using Hong Kong exchange bills and notes as collateral is that no new instruments are required to issue, and hence is easiest to implement. Upon the criticism that this new arrangement brings unexpected windfall gains to holders of HK exchange bills and notes, the proposer responded that later on when new bills and notes are issued, their prices will increase to adjust for its added value. Thus the “unfairness” is only one shot and shall not be seen as an essential component of the proposal (Chan 1998).

are allowed to repay either in US dollar and in HK dollar. In the latter case, the exchange rate used is the pegged rate prevailed at the time the loans were made. The HKMA thus will suffer a loss in reserves if HK dollar is devalued. This thus both enhances commitment and serves as a costly signal.

The proposal gained substantially more attention after Miller lent his support by making a “structured note” proposal to the Hong Kong and China in January 1998. Miller said, “My proposal was originally conceived by some outstanding economists in Hong Kong. Unlike some other East Asian countries Hong Kong has quite a few outstanding economists.”

In its review of Hong Kong financial stability published in April 1998, HKMA rejected the proposal of exchange rate insurance (in the form of HK dollar put option as it was originally proposed) for several reasons.

Other local economists, generally dissatisfied with the HKMA for its defense strategy, suggested that more radical measures like ERI be preceded by patching of existing loopholes of the banking system that caused soaring interest rate during currency attacks (see Tsang (1998)). Shortly after its stock market intervention in August 1998, the HKMA adopted these less controversial measures advocated to stabilize the market. Meanwhile the global financial environment underwent drastic changes, resulting in the US’s more active participation in containing the spread of the Asia crisis into a global one. Since then the attack pressure on HK dollar has come down and the reformed system has performed quite smoothly. So has vanished the discussion of the ERI proposal. Consequently, there is little consensus as to whether the proposal would have worked for HK, or will work in general. The writings by the advocates of ERI are available in two collected volumes edited by Cheng and Lui (1998) and Chan and Kwan (1998).¹⁴

¹⁴In fact there is even dispute as to whether the ERI has been adopted. Some supporters of the ERI argued that it had already been adopted once the HKMA promised made in the fall of 1998 to exchange HK\$ for US\$ in the future at the fixed rate of HK\$7.8 to US\$1, as this measure is allegedly an ERI

7.2 A modified proposal

Two concerns on the ERI pointed out in the HKMA April 1998 report are worth mentioning. The first is that the insurance instrument might turn out to be an instrument for speculation, hence destabilizing the system. Another is that earmarking funds for the insurance purpose increases the HKMA's contingent liabilities, hence weakening its strength in defense. (This corresponds to a very positive $\partial c/\partial D$ in the model.) The proposers agreed to neither point. To the first concern, they argued that the insurance instrument was dominated by other speculative tools and would not be used as a speculative tool. To the second, they argued that earmarking funds in the way as they suggested will increase the public's confidence and hence shall increase rather than reduce the HKMA's overall defense strength.

The model is not suitable to address these issues. In the model speculators by assumption do not purchase ERI and the implications are strongest when $\partial c/\partial D = 0$. (In addition, we have assumed that both the measure of potential speculators and the transaction cost is invariant with the size of D .) That is, we have constructed a model as close to Chan-Chen and Miller as possible, and in particular the model is free from critiques that they disagree. Contrary to their claims in this circumstance, we have found that a separating equilibrium where only the strong type adopts ERI cannot exist. On the other hand, if the ERI is a speculative tool and $\partial c/\partial D$ is positive enough—so that it is no longer a commitment device—then a separating equilibrium where only the strong type uses ERI is more likely to exist. Hence the ERI might be more powerful if it does suffer from the criticisms that its advocates disavowed.

In a more abstract sense, the tension identified between the ERI as a commitment device versus a signaling device arises from a dimensionality problem as we have only one

arrangement. Others economists disagree because the announcement is not binding legally and can be reneged later on costlessly.

instrument (ERI) for two targets. Thus, a proper remedy to the ERI scheme is to give one more dimension of choice. One alternative is to also allow the government to choose whether to sell ERI or to give it out for free. Another is to allow the government to choose to “burn” money—to spend on whatever purpose that does not directly benefit the government—whose amount is independent of the amount of ERI issued. Of course, whether the policy makers or the public will accept such money burning is another issue. Note that however the separation of the two types is now fulfilled by giving up of the insurance premium, rather than by issuing ERI itself.

7.3 Other Applications

Some economists in the region have proposed a related but opposite insurance scheme. Chu (2001) proposes that the government issue catastrophe bonds to insure against currency attacks: the government continues to pay coupons until a crisis driven devaluation occurs. According to these authors, the merits of the proposal are that now the government will get extra funds upon unwanted devaluation to cover loss and it also encourages the public to defend against currency attacks. While this proposal has its own point, whether the benefits will more than offset the costs that arise from reduced defense determination is uncertain. More importantly, whichever the case is, the dimensionality problem identified is also relevant to this proposal. As long as there is only one policy choice, it will not resolve the twin problem of lack of commitment and asymmetric information. In this regard, the present study is relevant to this and other proposals of avoiding future currency crises.¹⁵

We think that my theory is relevant to other public policy making problems as well.

Central bank policy is one such example. Time inconsistency problem arises also in central

¹⁵Taylor (1995) suggests that the government buy local currency put options. By buying such options, the government can exercise them in case of devaluation. The foreign reserves that are gained can then be used. See also Breuer (1999), Lall (1997), Garber and Spencer (1995). They are concerned with the exchange rate defense *during* a crisis.

bank's role of lender of last resort. Ex ante the central bank wants commercial banks to act prudently in their activities and would like them to believe that they will not be rescued in case of failures. Ex post, given the possibility of banking panic, the central bank might want to rescue failed banks, even though the failures are due to their imprudence. This is especially so if the failed banks are "too big to fail." The time inconsistency generally leads to moral hazard among the banking industry and among depositors. To mitigate the problem, the central bank might want to adopt some commitment device that prevents itself from rescuing.

Now imagine that the central bank's preferences are private information and there are two types of central bank: strong and weak. Given any circumstance, compared with the strong type, the weak type is more likely to rescue. The fact that the weak type is more likely to rescue in turn leads to more severe moral hazard problem in the banking sector. The strong type, while wishing to harden its commitment, does not want to be seen as a weak type. Therefore, the strong type central bank may not choose to harden its commitment because of possibly mimicking by the weak type. While the exact equilibrium will depend on the parameters of the model, it is clear that the sheer fact of asymmetric information leaves smaller room for the strong type to strengthen its commitment. This thus suggests an alternative interpretation of "constructive ambiguity"—i.e., simply denying the "too big to fail" doctrine without further actions to dispose of the public's concern about the doctrine.¹⁶

8 Concluding Remarks

I hope that the paper has advanced our understanding of public policy making. While the framework with both the time inconsistency and asymmetric information problems

¹⁶See Rochet and Tirole (1996) on a recent treatment of the "too big to fail" doctrine and "constructive ambiguity."

is quite reasonable, its full implications are not well documented in the literature. The lack of documented knowledge might hinder policy discussion, leading to lower quality of discussion.

The Asian economic crisis has taught us a great lesson about the fragility of fixed exchange rates under increasing financial openness. The first generational models (see Krugman 1979) tell us that maintaining a fixed exchange rate regime under non-sustainable domestic policy or under bad fundamentals deems to fail, and fixed exchange rate will be prescribed only for countries that have responsible domestic policy and sound fundamentals. Among all East Asia economies during the crisis period Hong Kong was perhaps the most notable one that can be classified in this category. Therefore, despite its outlier role in the crisis, the proposal of ERI emerged there deserves our attention because it is targeting on currency crises that economists can at best strive to prevent. Such an ERI proposal or alike are likely to be raised next time a currency crisis occurs. More studies of defense mechanisms thus prevent policy makers from being caught unprepared. I hope that this study has provided a suitable framework for us to discuss the design of defense mechanism against currency crisis, and has improved our understanding of the difficulty of the ERI proposal.

The last Section suggested that ERI coupled with money burning might result in signaling only by the strong type via money burning. I am not particularly optimistic with this modified proposal. To convince the public that the purposeful money burning is inevitable, the public should have enough knowledge of economics to appreciate the idea. They should also be convinced that the money burning is due to neither corruption nor incompetence of politicians or bureaucracy. Given that the more modest proposal of the sale of ERI found it hard to be adopted, the difficulty should not be overlooked. All of these considerations make us doubtful of using signaling model for policy suggestions. The Asia financial crisis has led the profession to study feasible alternatives to the fixed

exchange rate system. The paper has somehow substantiated the legitimacy of this trend.

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