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Dai, Meixing

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Meixing Dai *

Abstract: This paper examines how the transparency in monetary policy decision can impact the likelihood of currency crisis in a simple open economy model with public debt. In the presence of opacity, it is found that if the debt is high, the government will devaluate and *vice versa*, and the self-fulfilling multiple equilibria solution disappears. Furthermore, the opacity reduces the threshold of public debt above which the government is considered as totally lacking the credibility in its pre-commitment to maintain fixed the exchange rate.

Key words: central bank transparency, public debt, currency crisis, speculative attack.

JEL classification numbers: E52, E58, F31, F37, O23.

Corresponding address:

* Université de Strasbourg, BETA-*Theme*, 61, avenue de la Forêt Noire – 67085 Strasbourg Cedex – France ; Tel (33) 03 90 24 21 31 ; Fax (33) 03 90 24 20 71 ; e-mail : dai@cournot.u-strasbg.fr.

1. Introduction

Since the breakdown of Bretton Woods' system, the world economy is characterized by financial instability. The incompatibility between accommodative domestic fiscal and monetary policy and fixed exchange rate under high degree of capital mobility has inspired the development of what we call the first generation of currency crisis models (Krugman, 1979; Flood and Garber, 1984). These models focused on budgetary deficits and the effect of its continuing monetary financing. The crises at the beginning of 1990 affecting the European monetary system and some Latin American countries have given rise to the development of second generation of currency crisis models (Obstfeld (1986, 1994, 1996), Sachs *et al.* (1996)), which explained the crisis as the result of a conflict between a nominal exchange rate peg and the desire of pursuing an expansionary monetary policy, leading to the existence of multiple equilibria. The incapability of these previous models to explain the 1997 Asian crisis has lead to the emergence of the third generation of currency crisis models (Corsetti *et al.* (1999), Krugman (1999), Chang and Velasco (2001), Mendoza (2002), Aghion *et al.* (2001)), mostly based on financial accelerator mechanism (Bernanke *et al.* (1999)).

Most of these models assume generally that all agents have perfect information or observe the same signals without error. Morris and Shin (1998) suggest that the multiplicity of equilibria in some currency crisis models is in fact "apparent" and is due to this kind of unrealistic assumption. By using a more realistic assumption that agents privately observe fundamentals with small errors, they establish a very strong result that multiplicity of equilibria in a standard second generation model is eliminated. This result makes self-fulfilling expectations and their required belief coordination irrelevant. Based on their analysis, they urge governments to adopt transparent policy which means policy that makes the fundamentals common knowledge. However, the lack of common knowledge may not be sufficient to rule out multiple equilibria if all speculators observe the same public information about the fundamentals (Sbracia and Zaghini (2001)) or the fundamentals are relatively strong (Chan and Chiu (2002)). Defining transparency as a reduction in the dispersion of private signal noise, Heinemann and Illing (2002) find that a reduction in the dispersion of private signal noise lowers the critical state that triggers a crisis. They also strengthen the Morris and Shin's uniqueness result using the solution concept of rationalizable equilibrium.[1] Chang and Majnoni (2002) study contagion in a model in which financial crises can occur due to both weak fundamentals and adverse self-fulfilling expectations. More transparency about fundamentals exacerbates contagion from one country to another when the first suffers from a fundamentals driven crisis. Vaugirard (2007) highlights the international spread of bank runs in a third-generation model of financial crises through an informational channel and has shown that gREATER TRANSPARENCY about the liquidation costs of banks' assets DOES NOT ELIMINATE CONTAGION UNLESS THE CRISIS IN THE CATALYST COUNTRY IS PURELY SUNSPOTS-DRIVEN. IN THE PRESENCE OF OPACity, the liberalization of capital inflows may undermine bank stability in emerging markets since uninformed international investors rationally provide large amounts of funds at low cost, enabling insolvent banks to accumulate bad loans (Giannetti (2007)).

HOWEVER, IN previous currency crisis models, it is assumed that the central bank (or government) is perfectly transparent about its preferences and NO ATTENTION HAS PAID TO THE EFFECT OF CENTRAL BANK TRANSPARENCY ON THE LIKELIHOOD OF CURRENCY CRISIS. IN PRACTICE, CENTRAL BANKS ARE NOT ALWAYS TRANSPARENT EVEN THOUGH THEY ARE INCREASINGLY MORE TRANSPARENT SINCE THE 1990S. ACCORDING TO Williams (2008), the financial sector may have played a leading role in demanding information from the government, more particularly from monetary authorities. As central banks have

[1] For a survey of the literature about the pros and cons of information transparency on the exchange rate market, see Allegret and Cornand (2006).

become more independent, so the demand for transparency[2] has increased, both for reasons of accountability and legitimacy, and the need to guide the expectations of financial market participants (Crowe and Meade (2008)). MANY CENTRAL BANKS HAVE ATTEMPTED TO INCREASE MONETARY POLICY EFFECTIVENESS BY USING COMMUNICATION AND TRANSPARENCY PRACTICES TO SHAPE EXPECTATIONS OF FUTURE POLICY DECISIONS AND HENCE influence interest RATES ACROSS THE TERM STRUCTURE. It is suggested that more policy transparency and communication may lead to greater predictability of central bank actions, which, in turn, reduces the uncertainty or noises in financial markets (de Haan *et al.* (2007)). SEVERAL STUDIES HAVE EXAMINED EMPIRICALLY THE EFFECTS OF CENTRAL BANK TRANSPARENCY ON FINANCIAL MARKETS AND HAVE SHOWN THAT, WITH GREATER TRANSPARENCY, THESE MARKETS BECOME MORE EFFICIENT AND ARE MORE RESPONSIVE TO MONetary policy (Muller and Zelmer (1999), Siklos (2000), Clare and Courtenay (2001), Rafferty and Tomljanovich (2002), Ehrmann and Fratzscher (2007)). In this respect, the transparency of monetary policy is often justified by its advantageous effects on financial stability in speeches of central bankers (Issing (2001)).

In part prompted by the 1994 peso and other emerging market crises, the International Monetary Fund (IMF) has adopted at the end of the 1990s a code of good conduct[3] to increase the transparency of official operations in emerging market economies. In the case of Mexico, its central bank has increased monetary reporting from thrice a year to weekly monetary disclosures following the peso crisis (Wilson and Saunders (2004)). Convinced by the benefits of more transparency in monetary policy making, more and more central banks of emerging market countries have adopted inflation targeting frameworks. This is a great change in central banking in emerging market countries since the currency and financial crises of the 1990s. However, these inflation targeting regimes, at least for some time, have coexisted with (crawling) exchange rate bands (Amato and Gerlach (2002)). Some countries, such as Hungary and Poland, newly entered in the European Union, are in the Exchange Rate Mechanism II before their adhesion to the Economic and monetary union (EMU), and need large foreign financing. Many of these countries have also large public deficit and are confronted in the recent global financial crisis to large outflows of funds. In this context, the exchange rate objective of these countries may not be credible for market participants.

In this paper, we study the implications of central bank transparency (or opacity) for the likelihood of currency crisis for emerging market and transition countries with different levels of public debt. For our purpose, we use a model akin to that of Sachs *et al.* (1996) which establishes a direct linkage between public debt and currency crisis.

The rest of the paper is organized as follows. The next section presents the model where private sector is uncertain about the preferences of the government (including central bank). In the section after, we solve the model and examine then the effects of opacity on equilibrium solutions. We conclude in the final section.

2. The model

Our study is based on the model of second generation developed by Sachs *et al.* (1996), allowing for the possibility of a self-fulfilling panic that helps to understand several features of the 1994 Mexican crisis as well as the Hungarian currency crisis during the 2008 global financial crisis. Self-fulfilling expectations became decisive in generating a panic and hence a speculative attack only after the government ran down gross reserves and ran up short-term

[2] For a survey of theoretical issues about central bank transparency see Geraats (2002). For a survey of empirical studies, see Crowe and Meade (2008).

[3] It includes a code of good practices in fiscal transparency adopted in 1998 and a code of good practices on transparency in monetary and financial policies adopted in 1999.

foreign currency debt to a certain level. In this kind of models, multiple equilibria can occur for some levels of reserves or debt, but not for others. We modify the model by introducing the uncertainty about the preference of the government including central bank and fiscal authorities.

The small open economy is populated by a private sector composed of many atomistic agents. Its government[4] has a loss function formulated in terms of inflation and tax variability around of zero targets:

$$L = \frac{1}{2}(\alpha\pi^2 + \tau^2), \qquad (1)$$

where π is the rate of inflation and τ the flow of government tax revenue. Reflecting the preference of the public, the policy decision-maker dislikes both inflation (hence devaluation) and taxes. The hypothesis of small open economy coupled with the hypothesis of the purchasing power parity implies that the rate of inflation is assumed to be equal to the rate of devaluation. With fixed exchange rate and under the hypothesis of the absence of inflation abroad, we have $\pi = 0$.

The government could be more or less transparent in its monetary policy decisions through the disclosure of information about its preferences, i.e. the relative weight (α) assigned to the inflation objective. This corresponds to political transparency in the terminology given in Geraats (2002). In the following, we define the complete transparency of monetary policy as a benchmark situation where the central bank is allowed by the government to communicate the exact value of α to the public, in other words, the variance of α is zero ($\sigma_\alpha^2 = 0$). In this case, the average value of α perceived by the public denoted by $E(\alpha) = \overline{\alpha}$ is equal to its realized value, i.e. $\overline{\alpha} = \alpha$. When the variance of α is superior to zero ($\sigma_\alpha^2 > 0$) and increases, central bank transparency decreases or alternatively central bank opacity increases. In the presence of opacity, the perceived value of α could be different from the true one, i.e. $\overline{\alpha} \neq \alpha$.

The budget constraint of the government is given by:

$$ib = \tau + \theta(\pi - \pi^e), \qquad \theta > 0, \qquad (2)$$

where π^e is the expected rate of devaluation or inflation, and i is the world gross real rate of interest, which is assumed to be exogenous to the small open economy under the condition of perfect capital mobility. b is the inherited real stock of net commitments of the consolidated government. The term $\theta(\pi - \pi^e)$ can be interpreted as inflation tax revenue, which falls with expected inflation and increases with actual inflation. In effect, an increase in expected inflation reduces the demand for money and therefore the inflation tax base goes down and an increase in the rate of inflation corresponds to an increase in inflation tax rate. Alternatively, in the presence of non-indexed government debt, the term $\theta(\pi - \pi^e)$ can be interpreted as the gain to the government, associated with unexpected devaluation which reduces the real value of outstanding government debt.

3. The equilibrium

3.1. Perfect transparency

Acting with discretion and taking as given the public's expectations of devaluation, the policymaker, sets π and τ to minimize its loss function (1) subject to its budget constraint (2). The solution to this problem is:

[4] It is equivalent to consider a partially independent central bank which takes account of fiscal objective and government's budget constraint.

$$\tau = \frac{\lambda}{1-\lambda}\theta\pi, \qquad \text{with } \lambda = \frac{\alpha}{\alpha+\theta^2} < 1, \tag{3}$$

$$\theta\pi = (1-\lambda)(ib + \theta\pi^e). \tag{4}$$

Using equations (3) and (4), the loss for the policymaker becomes:

$$L^d(b,\pi^e) = \frac{1}{2}\lambda(ib + \theta\pi^e)^2. \tag{5}$$

where the superscript *d* stands for "devaluing".

If the policy-maker has pre-committed not to devalue, so that $\pi = 0$, then according to constraint (2), solvency dictates that:

$$\tau = ib + \theta\pi^e. \tag{6}$$

The corresponding loss of the government under pre-commitment to fixed exchange rate is:

$$L^f(b,\pi^e) = \frac{1}{2}(ib + \theta\pi^e)^2, \tag{7}$$

where the superscript *f* stands for "fixing".

It's straightforward to see that $L^d(b,\pi^e) < L^f(b,\pi^e)$. To make the fixed exchange rate a credible choice for the government, it is admitted that the policy-maker faces a fixed private cost of engineering a surprise devaluation: government that commits to a peg and then reneges on the promise typically face costs - loss of pride, voter disapproval, maybe even removal from office - that need not be proportional to the size of the devaluation or to any other macroeconomic variable. If expected rate of devaluation is π^e, the government finds it optimal to devalue if $L^d(b,\pi^e) + c < L^f(b,\pi^e)$, where $c > 0$ is the cost that the policy-maker pays. Taking account of equations (5) and (7), this implies:

$$ib_t + \theta\pi_t^e > k, \qquad \text{with } k = \sqrt{\tfrac{2c}{1-\lambda}}. \tag{8}$$

Hence, a devaluation will occur in equilibrium whenever inherited debt or expectations of devaluation are sufficiently high.

Consider now the behaviour of atomistic private agents who form rationally their expectations of devaluation. Under fixed exchange rate regime, these agents understand perfectly the incentive of the government to devaluate as summarized in equation (8) and behave accordingly. Several outcomes can result from the interaction between the government and private agents.

In the case of perfect transparency, the solutions are given by Sachs *et al.* (1996):

1) $\pi^e = \pi = 0$ if $ib_t < \lambda k$. For low levels of debt such that $ib_t < \lambda k$, only one equilibrium with no expected devaluation is possible: attaching a positive probability to devaluation cannot be rational, for no devaluation will take place regardless of what agents expected. In this range the fixed exchange rate enjoys full credibility;

2) Two equilibria are possible if $\lambda k < ib_t < k$ depending on expectations of market participants. We have $\pi = 0$ if private agents expect that $\pi^e = 0$. Devaluation condition (8) shows that it is rational to set $\pi^e = 0$ if the accumulated stock of debt is sufficiently low such that $ib_t < k$ and the government will fulfil this expectation. If the private agents expect a devaluation of the size $\pi^e = \frac{1-\lambda}{\lambda\theta} ib$, then such expectation will be validated by the government;

3) $\pi^e = \pi > 0$ if $ib_t > k$. In this case, the debt is too high so that a devaluation will inevitably take place. The fixed exchange rate regime has no credibility.

3.2. Imperfect transparency

The multiple equilibrium solution is obtained under the assumption of perfect foresight of private agents in a model without uncertainty. It is based on an argument that the expectations of devaluation (positive expected rate of inflation) or no devaluation (zero expected rate of inflation) can be self-fulfilling. In a model without uncertainty, the rational private agents are assumed to always anticipate exactly what will happen in equilibrium. This assumption could be relaxed in the present model once the uncertainty about the government preferences is introduced. In this case, when the government does not devaluate, the private agents can however anticipate a positive devaluation rate of domestic currency.

Consider now that the government is opaque about its preference so that the value of α is not known with certainty by the private agents. These agents, when forming their expectations of devaluation, have knowledge of the average value and variance of α. Assuming rational expectations, taking mathematical expectations of equation (4) leads to:

$$\theta\pi_t^e = [1 - E(\lambda)](ib + \theta\pi^e) . \qquad (9)$$

where $E(.)$ is the expectation operator. Using the second-order Taylor development to obtain an approximation of $E(\lambda)$, i.e. $\bar{\lambda} \equiv E(\lambda) \approx \frac{\bar{\alpha}}{\bar{\alpha}+\theta^2} - \frac{\theta^2}{(\bar{\alpha}+\theta^2)^3}\sigma_\alpha^2$, and substituting the latter into equation (9), we obtain:

$$\pi^e = \frac{[(\bar{\alpha}+\theta^2)^2 + \sigma_\alpha^2]\theta ib}{\bar{\alpha}(\bar{\alpha}+\theta^2)^2 - \theta^2\sigma_\alpha^2} , \qquad (10)$$

where $\bar{\alpha}(\bar{\alpha}+\theta^2)^2 - \theta^2\sigma_\alpha^2 > 0$. This condition results from imposing $E(\lambda) \approx \frac{\bar{\alpha}}{\bar{\alpha}+\theta^2} - \frac{\theta^2}{[\bar{\alpha}+\theta^2]^3}\sigma_\alpha^2 > 0$.

The solution of π^e given in equation (10) shows that the private agents always expect a positive rate of devaluation when the government is imperfectly transparent, whatever is the level of public debt. Generally, π^e increases with the level of debt and interest rate. It increases with the degree of opacity and decreases with the average value of $\bar{\alpha}$ (the degree of conservativeness of the central bank) as shown by the following derivatives:

$$\frac{\partial\pi^e}{\partial\sigma_\alpha^2} = \frac{(\bar{\alpha}+\theta^2)^3\theta ib}{[\bar{\alpha}(\bar{\alpha}+\theta^2)^2 - \theta^2\sigma_\alpha^2]^2} > 0 ,$$

$$\frac{\partial\pi^e}{\partial\bar{\alpha}} = -\frac{\theta(\bar{\alpha}+\theta^2)^4 + (\bar{\alpha}+\theta^2)[2\theta^3 + \theta(\bar{\alpha}+\theta^2) + 2\bar{\alpha}\theta]\sigma_\alpha^2}{[\bar{\alpha}(\bar{\alpha}+\theta^2)^2 - \theta^2\sigma_\alpha^2]^2} ib < 0 .$$

Taking account of equations (8) and (10), we find that there is only one equilibrium solution according to the level of debt:

1) $\pi = 0$ if $ib < \bar{\lambda}k$ with $\bar{\lambda} = \bar{\lambda}' - \frac{\theta^2\sigma_\alpha^2}{(\bar{\alpha}+\theta^2)^3}$ and $\bar{\lambda}' = \frac{\bar{\alpha}}{\bar{\alpha}+\theta^2}$. The inequality $ib < \bar{\lambda}k$ is obtained by considering that the devaluation condition (8) is not checked and by using equation (10). For low levels of debt, the private agents expect a devaluation according to equation (10), i.e. rationally attaching a positive probability to devaluation. However, the government has no incentive to devaluate. Consequently, only the equilibrium with no devaluation is realised. Due to opacity of the government, the fixed exchange rate regime does not enjoy full credibility although the government is pre-committed to not to devaluate and keeps effectively unchanged the fixed exchange rate.

2) $\pi = \frac{\theta(\bar{\alpha}+\theta^2)^3}{(\alpha+\theta^2)[\bar{\alpha}(\bar{\alpha}+\theta^2)^2 - \theta^2\sigma_\alpha^2]} ib$ if $ib > \bar{\lambda}k$. The last inequality is obtained by using the devaluation condition (8) and equation (10). The solution of π is obtained by using equations (4) and (10). In this case, the debt is too high so that a devaluation will inevitably take place, i.e. $\pi > 0$. The fixed exchange rate regime has no credibility.

Due to opacity, the interval ($\lambda k < ib_t < k$) where there are multiple equilibria under perfect transparency disappears and joins the zone where the debt is considered as too high and hence a devaluation is unavoidable (Figure 1).

We find also that the government devaluates less than what is expected. In the case where the level of debt is low and the government does not devaluate, the gap between the rate of devaluation and the expected rate ($\pi - \pi^e$) is equal to $\frac{-[(\bar{\alpha}+\theta^2)^2+\sigma_\alpha^2]\theta ib}{\bar{\alpha}(\bar{\alpha}+\theta^2)^2-\theta^2\sigma_\alpha^2} < 0$. When the level of debt is high and the government devaluates, the gap is equal to $\frac{-(\alpha+\theta^2)\theta\sigma_\alpha^2 ib}{(\alpha+\theta^2)[\bar{\alpha}(\bar{\alpha}+\theta^2)^2-\theta^2\sigma_\alpha^2]} < 0$.

Furthermore, the opacity reduces the level of debt which is compatible with maintaining fixed exchange rate regime. Assume that $\alpha = \bar{\alpha}$ (i.e. the private agents have correctly estimated the true value of α) so we have $\lambda = \bar{\lambda}'$ and hence $\bar{\lambda} k < \lambda k$. In other words, the presence of uncertainty about the government preference reduces the threshold of public debt above which the government is considered as lacking totally the credibility to maintain unchanged the exchange rate.

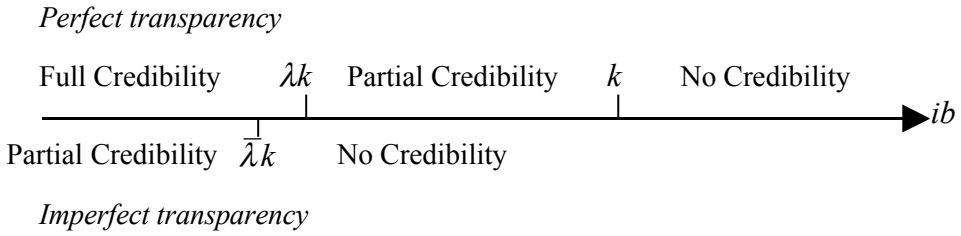

Figure 1. Debt levels and multiple equilibria under perfect and imperfect transparency.

4. Conclusion

We have shown in a simple open economy model with public debt how the introduction of opacity in the monetary policy decision-making has eliminated the multiple equilibria solution given in Sachs et al. (1996). The presence of opacity implies that private agents always expect a devaluation, i.e. the fixed exchange rate regime is never fully credible. Consequently, only one equilibrium solution subsists according to the level of public debt, i.e. devaluating if the level of debt is too high and *vice versa*. Furthermore, the opacity reduces the threshold of public debt above which the government is considered as totally lacking the credibility in its pre-commitment to not to devaluate.

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