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Interdependent Expectations and the Spread of Currency Crises

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In this paper we analyze how the mutual interdependence of private sector expectations influences the stability of fixed exchange rate regimes in different countries. When countries trade with one another, the crisis probabilities are interdependent because monetary policy in each country affects welfare both at home and abroad. Wage setters react to a trading partner's imminent crisis, because a loss of international competitiveness changes their governments' optimal escape clauses. Thus, not only actual devaluations but an increasing crisis probability in one country may trigger currency crises elsewhere. We show that both fundamental weakness and spontaneous shifts in market sentiment may play a role in the transmission of currency crises. [JEL F33, F41, E58]

The spread of currency crises is a hotly debated topic among international economists. Two explanations have gained prominence in the literature (Masson, 1999).[1] First, interdependencies between two economies may be the reason why a

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[1]Masson, in fact, presents three explanations for the simultaneous occurrence of crises. The first explanation, which Masson calls *monsoonal effects,* is logically different from the other two (which we discuss below). Monsoonal effects refer to a shock that hits more than one country and therefore triggers more than one crisis. This explanation does not offer reasons why a crisis in one country might trigger a crisis in another; rather, it focuses on common environmental factors. The other two explanations, however, describe the impact that a crisis in one country can have on the stability of fixed exchange rates in other countries. In this paper we present only these two explanations for the *spread* of currency crises.

currency crisis in one country is transmitted to another. A currency crisis can spread from country to country through trade or financial links, as a crisis in one country affects other countries' fundamentals through economic links. Consider trade links: the crisis-induced devaluation of one country's currency can lead to a deteriorating trade balance and, thus, a reduction in output and employment in other countries, reducing the stability of the fixed exchange rate systems of bilateral trade partners and of competitors in export markets.

Second, *contagion* may be responsible for the simultaneous occurrence of currency crises. Contagion refers to the phenomenon in which a crisis in one country triggers crises elsewhere in the world without a corresponding shift in fundamentals. Crises spread contagiously if they lead to shifts in market sentiment that have no fundamental reason. A crisis in one country may be perceived as an indicator of equally severe problems in other countries that are considered by the international capital market to be in a similar macroeconomic position; or the crisis may lead to a reassessment of information about other countries. Calvo (1999), Lagunoff and Schreft (1999), and Kodres and Pritsker (2002) theoretically analyze this explanation for the transmission of crises.

In this paper we concentrate on economic interdependence to explain contemporaneous currency crises. Economic interdependencies take the form of trade links, which have been found to be highly significant for crisis transmission in numerous empirical studies (for example, Eichengreen and Rose, 1999; Glick and Rose, 1999; Kaminsky and Reinhart, 2000; and Forbes and Rigobon, 2002). Financial links also provide a channel for the transmission of currency crises; they play a significant role in the spread of crises, especially in emerging markets (Caramazza, Ricci, and Salgado, 2000; and Kaminsky and Reinhart, 2000). We do not discuss the relative importance of trade and financial links (see Van Rijckeghem and Weder, 2001). For this paper, the crucial distinction is between the two categories for the explanation of spreading currency crises and not between different explanations within a category.

We present a model that explores how the interdependencies of private sector expectations in different countries contribute to the spread of foreign exchange market turmoil. In contrast to related papers by Corsetti and others (2000) and Loisel and Martin (2001), we do not examine how currency devaluation in one country influences policymakers in other countries to maintain a fixed exchange rate. Instead, we focus on the relationship of private sector expectations in the periphery countries. Our aim is to investigate how the private sector in periphery country A reacts to an increase in periphery country B's crisis probability, and what repercussions this interaction has for optimal monetary policy in country A. We do not confine our focus to the interaction between the policymaker and the private sector in one country, as is done in typical second-generation models such as those of Obstfeld (1994, 1996) and Jeanne (1997); rather, we concentrate on the interaction of private sectors in two countries. We show that both crisis-induced devaluations and a rising crisis probability exert a beggar-thy-neighbor effect. The rising crisis probability in one country increases the probability of a loss of international competitiveness for its trade partners. The increased probability of an expansionary monetary policy to restore international competitiveness is embed-

ded in private expectations and, given a fixed exchange rate, immediately leads to a recessionary situation, thereby weakening the fixed exchange rate.

Our model implies that, counterintuitively, a country does not necessarily benefit from a trading partner's loss of competitiveness. If the probability of a crisis increases and inflation expectations rise accordingly, the real exchange rate will appreciate and the country will suffer from a loss of competitiveness. The stability of the exchange rate peg in other countries should therefore be strengthened. But the crucial question is whether the initial loss of competitiveness in the first country will be reversed in the future. If a full-blown currency crisis becomes more likely, wage setters in the neighboring countries will expect the first country to be more competitive in the future and, accordingly, their countries to lose competitiveness. These wage setters will then expect their governments to be less willing to maintain the pegged exchange rate; the result will be that their exchange rate regimes are weakened immediately.

Masson (1999) also considers the mutual dependence of private sector expectations and uses this framework in his model to study various explanations for contemporaneous currency crises. The key difference between Masson's model and ours is that Masson does not model the policymaker as an optimizing agent, which is the characteristic feature of the so-called second-generation models (cf. Jeanne, 1999). Masson's model instead uses the classical approach to currency crises, which is based on the work of Krugman (1979) and Flood and Garber (1984).

We present our model in Section II and derive the optimal opting-out clause for the policymaker in Section III. In Section IV the equilibrium condition is derived and the interdependencies of the crisis probabilities are examined. Section V is devoted to the analysis of the spillovers of exchange rate turmoil and to the discussion of some policy implications. Section VI concludes.

I. The Model

In our model, we consider a world consisting of three economies; two small periphery countries (countries A and B) peg their exchange rate to the currency of the third, economically large country (the center country C). We assume that each economy produces only one good and that these goods are imperfect substitutes for one another. The structure of our model is based on typical models of the policy coordination literature—in particular, the model of Canzoneri and Henderson (1991)—and is similar to the model used by Buiter, Corsetti, and Pesenti (1998). As is usual in the second-generation approach to currency crises, we focus on the interaction between the policymaker and the wage setters, ignoring the game between the policymakers in both periphery countries, which is the subject of the policy coordination literature. We model only country A's economy but assume that country B's economy is a mirror image. We analyze the effect of an increase in B's crisis probability, which we take as exogenous to the stability of A's fixed exchange rate. All variables are expressed in logs.

Country A produces according to a Cobb-Douglas function.

$$y_{A,t} = (1 - \alpha)n_{A,t}, \quad 0 < \alpha < 1. \tag{1}$$

$y_{A,t}$ and $n_{A,t}$ are the deviations of output and employment from their natural rates, which we normalize to zero in logs.

The international demand for the good produced in A depends on the real exchange rate between the periphery countries and on the real exchange rate between countries A and C. Furthermore, it is influenced by a stochastic shock $\eta_{A,t}$, which has a continuous probability density function (p.d.f.) that monotonically rises in $[-\infty,0]$ and falls in the interval $[0,\infty]$. The p.d.f. is symmetric around zero, that is, $f(\eta_{A,t}) = f(-\eta_{A,t})\ \forall \eta_{A,t}$. The goods market of A, therefore, is in equilibrium if equation (2) holds.

$$y_{A,t} = \delta q_{A,t} + \varepsilon(q_{A,t} - q_{B,t}) - \eta_{A,t}, \quad \delta, \varepsilon > 0, \tag{2}$$

where the real exchange rate $q_{i,t}$ is defined as $q_{i,t} = s_{i,t} + p_{C,t} - p_{i,t}$ so that a rising (real) exchange rate $s_{i,t}$ ($q_{i,t}$) means a (real) devaluation.[2] $p_{i,t}$, $i = A, B, C$ are the product prices. Moreover, the center country C leaves its monetary policy unchanged and $p_{C,t} = 0\ \forall t$.

Money market equilibrium is expressed by the Cambridge equation:

$$m_{A,t} - p_{A,t} = y_{A,t}, \tag{3}$$

where $m_{A,t}$ is the money supply in country A. Aggregate employment can now be derived from the competitive firms' profit maximization problem. The labor demand is extended until the marginal product of labor equals the real wage, which is defined as the nominal wage $w_{A,t}$ minus the producer price level, that is, $-\alpha n_{A,t} = w_{A,t} - p_{A,t}$.[3] Now, using equations (1) and (3), aggregate employment can be derived:

$$n_{A,t} = m_{A,t} - w_{A,t}. \tag{4}$$

Trade unions and firms enter into wage negotiations before the random shock is drawn and money supplies are set. The trade unions aim to set the nominal wages so that all union members will be employed if no shock hits. In this case, employment reaches its natural rate, that is, $n_{A,t} = 0$.[4] Thus, the nominal wage is set equal to the expected money supply, $w_{A,t} = E_{t-1}m_{A,t}$ (Canzoneri and Henderson, 1991). Now, aggregate employment $n_{A,t}$ and the producer price level $p_{A,t}$ can be expressed as a function of the realized and the expected money supply.

$$n_{A,t} = m_{A,t} - E_{t-1}m_{A,t}. \tag{5}$$

$$p_{A,t} = \alpha m_{A,t} + (1 - \alpha)E_{t-1}m_{A,t}. \tag{6}$$

[2] We abstract here from a real interest rate influence on aggregate demand. Buiter, Corsetti, and Pesenti (1998) use a more general model in which an interest channel for the transmission of monetary policy is considered to study the collapse of the Exchange Rate Mechanism of the European Monetary System.

[3] Actually, profit maximization requires $ln(1 - \alpha) - \alpha n = \hat{w} - p$. For notational simplicity we define $w \equiv \hat{w} - ln(1 - \alpha)$.

[4] More formally, wage setters minimize $E_{t-1}(n_{A,t})^2 = E_{t-1}(m_{A,t} - w_{A,t})^2$. Thus, we employ a quite simple objective function for the trade union to keep the model tractable. A comprehensive analysis of the economics of the trade union can be found in Booth (1995).

II. Optimal Opting-Out Clause

Optimal Monetary Policy Under Fixed and Floating Exchange Rates

The policymaker's objective function is expressed by[5]

$$L_{A,t} = (n_{A,t} - k_A)^2 + \theta_A(p_{A,t} - p_{A,t-1})^2 + \chi C_A, \quad \theta_A > 0. \tag{7}$$

The policymaker's employment target exceeds the natural rate, which is zero;[6] k_A is the difference between the two rates. If the policymaker opts out of the fixed exchange rate system, he must bear a fixed personal cost of realignment, C_A, representing the loss of political reputation or credibility.[7] χ is a dummy variable, which is equal to one if the prevailing exchange rate system is abandoned and zero if the policymaker continues to fix the exchange rate. To facilitate further calculations, we consider the change in the producer price level (GDP deflator) as a policy target instead of the consumer price index[8] and assume that $p_{A,t-1} = 0$.

If the policymaker decides to devalue, the money supply will be

$$m_{A,t}^{FL} = \frac{(1 - \alpha(1 - \alpha)\theta_A)E_{t-1}m_{A,t} + k_A}{1 + \alpha^2\theta_A}. \tag{8}$$

The case of a flexible exchange rate is denoted by the superscript "*FL*." Equation (8) is the policymaker's reaction function. It tells how the policymaker should optimally set the money supply for given market expectations if monetary policy is not subordinated to an exchange rate target. Employment and the price level, which is identical to the inflation rate because of our assumption that $p_{A,t-1} = 0$, can now be easily calculated:

$$n_{A,t}^{FL} = \frac{k_A - \alpha\theta_A E_{t-1}m_{A,t}}{1 + \alpha^2\theta_A} \quad \text{and} \quad p_{A,t}^{FL} = \frac{\alpha k_A + E_{t-1}m_{A,t}}{1 + \alpha^2\theta_A}. \tag{9}$$

In second-generation models, a currency crisis is interpreted as a rational policy decision of the policymaker, who compares the social loss under a fixed exchange rate with the value of the loss function under a flexible exchange rate. If the loss under a fixed exchange rate exceeds the loss of the optimal monetary policy according to the policymaker's reaction function (8) by an amount greater than C_A, the policymaker will rationally decide to abandon the fixed exchange rate. A currency crisis, therefore, reflects a policy decision in favor of the optimal autonomous monetary policy. Before the condition steering the change of the exchange rate system can be derived, the value of the loss function for the continuation of the exchange rate peg must be computed.

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[5] The policymaker's objective function (9) is interpreted as a social loss function reflecting the social costs resulting from the social "bads" unemployment and inflation.

[6] That is, the policymaker cares about all workers, not just unionized workers.

[7] C_A can be interpreted as the level of commitment to the fixed rate (see Flood and Marion, 1999).

[8] This approach is quite common in the policy coordination literature (see, for example, Ghosh and Masson, 1994).

Pegging the exchange rate entails the loss of monetary policy autonomy. Assuming that $s_A^{FX} = 0$, the money supply that the policymaker has to set to maintain the fixed exchange rate can be calculated as follows:

$$m_{A,t}^{FX} = (1 - \alpha)(1 - (\delta + \varepsilon))\beta E_{t-1} m_{A,t} - \varepsilon\beta(s_{B,t} - p_{B,t}) - \beta\eta_{A,t}, \tag{10}$$

with $\beta \equiv \frac{1}{1 - \alpha(1 - (\delta + \varepsilon))}$. The superscript "*FX*" refers to the fixed exchange rate case. Now employment and the inflation rate can be derived:

$$n_{A,t}^{FX} = -(\delta + \varepsilon)\beta E_{t-1} m_{A,t} - \varepsilon\beta(s_{B,t} - p_{B,t}) - \beta\eta_{A,t}. \tag{11}$$

$$p_{A,t}^{FX} = (1 - \alpha)\beta E_{t-1} m_{A,t} - \alpha\varepsilon\beta(s_{B,t} - p_{B,t}) - \alpha\beta\eta_{A,t}. \tag{12}$$

Shadow Exchange Rate and Devaluation Threshold

As noted above, the optimal choice of the exchange rate regime is governed by a comparison of the social loss that arises in the alternative regimes under consideration of the lump-sum cost C_A. Formally, the policymaker will stop defending the fixed exchange rate and resort to the optimal monetary policy according to his reaction function if the following condition is fulfilled:

$$L_{A,t}^{FX} - L_{A,t}^{FL} > C_A. \tag{13}$$

The policy decision about the loss-minimizing exchange rate regime can most easily be expressed with the help of the shadow devaluation rate (SDR).[9] The SDR is defined as the difference between the pegged exchange rate and the exchange rate that materializes when the optimal monetary policy according to equation (8) is implemented.

$$\Delta\tilde{s}_{A,t} = \tilde{s}_{A,t} = \frac{1}{\beta(\delta + \varepsilon)}[n^{FL} - n^{FX}]. \tag{14}$$

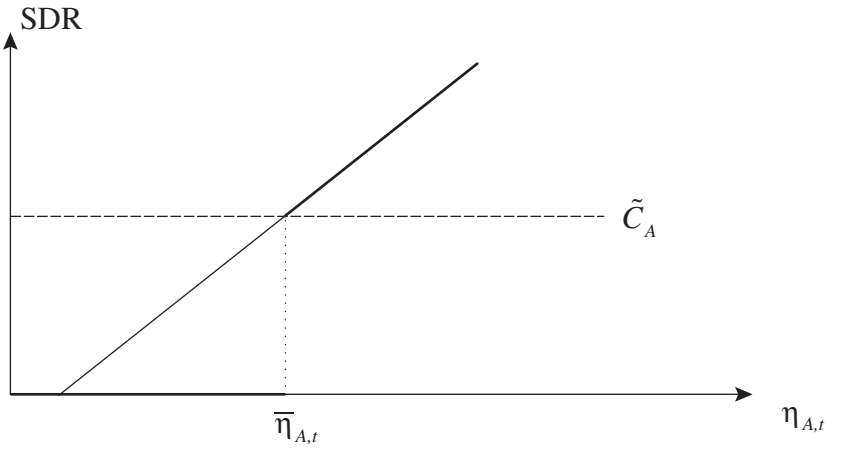
Owing to the assumption that the level of the pegged exchange rate is equal to zero in logs, the shadow devaluation rate, $\Delta\tilde{s}_{A,t}$, coincides with the shadow exchange rate, $\tilde{s}_{A,t}$. The SDR is a linear function of the employment gap between the fixed and floating rate regimes. In this sense, the SDR can be understood as measuring the welfare opportunity cost of defending the pegged exchange rate. Equation (13) can now be reformulated. Using equation (14) as well as the first-order condition for the optimal monetary policy when no exchange rate target binds, the policymaker's optimal opting-out clause in terms of the SDR is as follows:[10]

$$|\Delta\tilde{s}_{A,t}| \geq \tilde{C}_A \equiv [\beta(\delta + \varepsilon)]^{-1}\sqrt{C_A(1 + \alpha^2\theta_A)^{-1}}. \tag{15}$$

[9] Cavallari and Corsetti (2000) introduced the SDR into the second-generation currency crisis models.

[10] We consider only the case of a devaluation of the previously fixed exchange rate. Revaluations are assumed to be impossible.

Figure 1. Shadow Devaluation Rate and Currency Crisis



As in first-generation crisis models (see Flood and Garber, 1984), a threshold value exists for the SDR that triggers a crisis. Figure 1 illustrates the optimal opting-out clause (15).

As in all second-generation models, the prevailing exchange rate system is state-contingent. For a shock that is sufficiently high to push the SDR beyond the threshold $\tilde{C}_A$, the optimal policy is to abandon the fixed exchange rate and resort to an expansionary monetary policy to counteract the negative employment effect of the demand shock.[11] Otherwise, defending the fixed exchange rate is the dominant strategy. The thick lines in Figure 1 mark the actual devaluation rate. For shocks $\eta_{A,t} < \overline{\eta}_{A,t}$ the actual devaluation rate is zero; for shocks larger than $\overline{\eta}_{A,t}$ the realized devaluation rate coincides with the SDR. The threshold value of the shock, $\overline{\eta}_{A,t}$, that equates the SDR to the lump-sum opting-out cost $\tilde{C}_A$ is defined as

$$\overline{\eta}_{A,t} = (\delta + \varepsilon)\tilde{C}_A - \varepsilon(s_B - p_B) + \frac{(\alpha(1-\alpha)\theta - (\delta+\varepsilon)\beta E_{t-1}m_{A,t} - k_A)}{\beta(1+\alpha^2\theta_A)}.^{12} \qquad (16)$$

A currency crisis is precipitated if $\eta_{A,t} > \overline{\eta}_{A,t}$. We will occasionally make use of this formulation of the opting-out clause in the remainder of the paper.

[11] In our model, currency crises are clearly expansionary; in reality, many currency crises have a contractionary effect on output. Two remarks seem necessary here. First, empirical research shows that currency crises in emerging markets and in industrialized countries are fundamentally different (for example, Calvo and Reinhart, 2002). While crisis-induced devaluations in emerging markets may trigger a short-lived slowdown in growth or even a contraction in output resulting from a typically high foreign indebtedness (dollarized liabilities), this is not the case in industrialized countries (a well-known example for the expansionary effect of a currency crisis is the United Kingdom after abandoning the ERM). Second, we do not intend to explain a specific crisis episode. We are presenting a model for the theoretical study of the spread of a crisis along trade links.

[12] An increase in the money supply expectation resulting from an increase in the crisis probability leads only to a fall in the shock's threshold value if $\alpha(1-\alpha)\theta/(\delta+\varepsilon) > 1$ holds.

III. Interdependence of Crisis Probabilities

In second-generation models, the expectations of the private sector and the optimal policy decision of the policymaker are interdependent. For an equilibrium, market expectations must be rational given the policymaker's behavior and the policy decision must be optimal given private sector expectations. This interdependence may give rise to more than one equilibrium as Obstfeld (1994, 1996), Jeanne (1997), and Masson (1999), among others, have shown. If multiple equilibria exist, the optimal opting-out rule of the policymaker is not unambiguously defined for given economic fundamentals.

Assuming that giving up the fixed exchange rate always entails a devaluation (that is, revaluations are not possible), the probability of a currency crisis in country A in period $t + 1$ is equal to the probability that the SDR is pushed beyond its threshold $\tilde{C}_A$. We will denote the crisis probability that wage setters rationally form in period t by $\mu_{A,t}$.

$$\begin{aligned}\mu_{A,t} &= \mu_{B,t}\, Pr\, ob((\Delta\tilde{s}_{A,t+1} | s_{B,t+1} = s^{FL}_{B,t+1}) > \tilde{C}_A) \\ &\quad + (1 - \mu_{B,t})\, Pr\, ob((\Delta\tilde{s}_{A,t+1} | s_{B,t+1} = s^{FX}_{B,t+1}) > \tilde{C}_A) \\ &= \mu_{B,t}\,(1 - F(\bar{\eta}_{A,t+1} | s_{B,t+1} = s^{FL}_{B,t+1})) \\ &\quad + (1 - \mu_{B,t})(1 - F(\bar{\eta}_{A,t+1} | s_{B,t+1} = s^{FX}_{B}))\,. \end{aligned} \tag{17}$$

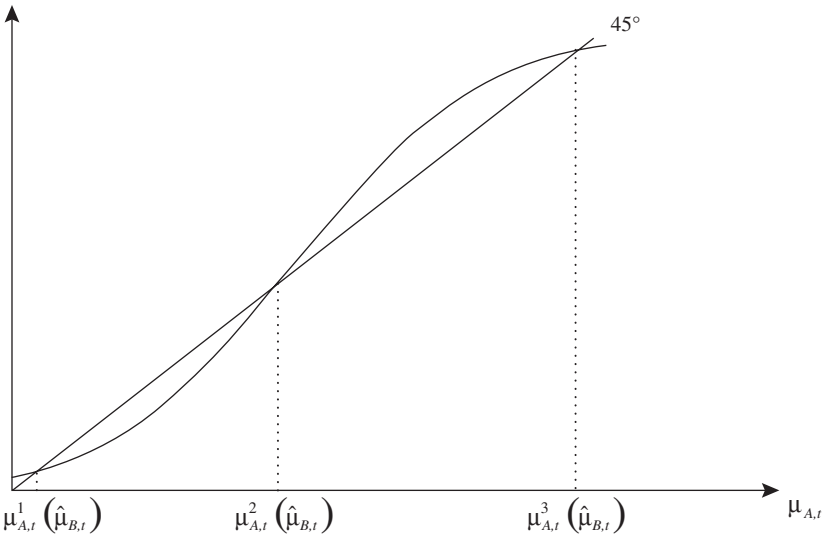
$F(\cdot)$ is the cumulative density function (c.d.f.) of $\eta_{A,t}$. Both sides of equation (17) depend on $\mu_{A,t}$, which opens up the possibility of multiple equilibria. The right hand side of equation (17) depends on $\mu_{A,t}$ through the conditional rational money supply expectations (see equation (16)), which are defined as

$$E_t(m_{A,t+1} | s_{B,t+1} = s^{FL}_{B,t+1}) = \mu_{A,t} E_t m^{FL}_{A,t+1} + (1 - \mu_{A,t}) E_t(m^{FX}_{A,t+1} | s_{B,t+1} = s^{FL}_{B,t+1}) \text{ and}$$
$$E_t(m_{A,t+1} | s_{B,t+1} = s^{FX}_{B}) = \mu_{A,t} E_t m^{FL}_{A,t+1} + (1 - \mu_{A,t}) E_t(m^{FX}_{A,t+1} | s_{B,t+1} = s^{FX}_{B}).$$

Equation (17) shows that the crisis probabilities in the periphery countries A and B depend on each other, because monetary policy decisions in B affect the optimal opting-out rule in A and vice versa.[13] A currency crisis in country B affects relative international prices and will therefore lead to a redirection of global demand. The spillover effects on country A will decrease A's employment rate and therefore increase the opportunity cost of maintaining the peg (the SDR increases). Being aware of this interdependence, the private sector in A forms its expectations by considering both the possibility of a currency crisis in B and the possibility that country B will continue to fix its exchange rate. Therefore, the probability of a currency crisis in A is the sum of these two conditional probabilities weighted with the respective probabilities of their occurrence. The critical realizations of the demand shock $(\eta_{A,t+1} | s_{B,t+1} = s^{FL}_{B,t+1})$ and $(\bar{\eta}_{A,t+1} | s_{B,t+1} = s^{FX}_{B})$ can be derived from equation (16) by imposing the conditions $s_{B,t+1} = s^{FL}_{B,t+1}$ and $s_{B,t+1} = s^{FX}_{B}$.

[13] Masson (1999) derives an analogous equation; however, in his model, the crisis probability is defined as the probability that central bank reserves fall below some threshold value, as in the classic currency crisis models along the lines of Krugman (1979) and Flood and Garber (1984).

Figure 2. Equilibrium Condition and Multiple Equilibria



A graphical representation of the equilibrium condition (17) is presented in Figure 2 (see Jeanne, 1997, and Masson, 1999, for similar graphs). The left hand side of equation (17) corresponds to the 45-degree line as the locus of all equilibria, while the right hand side, which reflects the crisis perception of the market, is represented by the S-shaped curve. The location of the S-shaped curve depends on country A's structural parameters and on the crisis probability of B, $\mu_{B,t}$.[14] In this paper, we focus on the latter. Rational expectations equilibria of the model are given by the intersections of the curved lines with the 45-degree line. Figure 2 illustrates a situation in which multiple equilibria are consistent with a given crisis probability in country B, denoted by $\hat{\mu}_{B,t}$.

The existence of more than one equilibrium depends on the location of the S-shaped curve; that is, on the crisis probability in B. If the likelihood of a crisis in B were very low, the S-shaped curve in Figure 2 would be located below the 45-degree line. Then, only one intersection and a low crisis probability in country A would result (low value of μ_A). A high crisis probability in B means graphically that the S-shaped curve would lie above the 45-degree line, again giving only one intersection (high μ_A). Hence, if B's crisis probability is sufficiently high or sufficiently low, the crisis probability in A is unambiguously defined. A crisis in A is either almost inevitable or very improbable.[15] Between these extremes, multiple

[14] The dependence of the crisis probability on the home economy's fundamentals is discussed at length in Obstfeld (1996) and Jeanne (1997).

[15] The preconditions for multiple equilibria to occur are explicitly derived in Jeanne (1997) and Masson (1999).

equilibria may occur (see the graphed curve). Sudden shifts of market sentiment can alter the optimal opting-out rule, although country B's crisis probability remains unchanged. Market expectations are not uniquely determined and may change spontaneously, thereby inducing a shift of equilibrium.

Because of the interdependence of private sector expectations, the social costs of defending the exchange rate in country A depend on the crisis probability for country B. In other words, an increase in the SDR (or a fall in $\overline{\eta}_{A,t}$) can be brought about not only by a full-blown crisis in B; an increase in country B's crisis probability is enough to bring about this result. If a crisis in B becomes more likely, the private sector in A adjusts its expectations accordingly. Higher wages will be demanded in country A as the probability of a crisis-induced shift in international demand in favor of country B increases, making an expansionary monetary policy reaction by A more likely. Since market expectations determine the wage rate in the following period, aggregate employment shrinks if the exchange rate is still pegged, that is, if the employment gap $n^{FL}_{A,t+1} - n^{FX}_{A,t+1}$ increases. Therefore, the policymaker's incentive to opt out of the fixed exchange rate system rises and is reflected by a lower devaluation threshold $\overline{\eta}_{A,t}$ and a higher SDR, respectively. If market expectations coordinate on a higher crisis probability, it is optimal for the government to alter its opting-out clause in accordance with private sector expectations. The spillover effects of a full-blown crisis are thus brought forward in time.

This line of argument offers a convenient and intuitive way to reinterpret the conditions for multiple equilibria and self-fulfilling crises. To enter the zone of multiple equilibria, a fundamental vulnerability in the form of sufficiently high unemployment must exist, as previous work has stressed (see, for example, Obstfeld, 1996, and Jeanne, 1997). The preconditions for multiple equilibria discussed above in terms of the crisis probability of country B, $\mu_{B,t}$, can easily be recast in terms of the employment gap between the fixed and floating rate regimes. Multiple equilibria can occur if the employment gap has risen to a sufficiently high level as the result of a shock or, to express it differently, if the SDR as a measure of the opportunity cost of maintaining the exchange rate peg is sufficiently high.

IV. Transmission of Exchange Rate Instability: Policy Implications

The model shows that the crisis probabilities in the periphery countries are linked to each other. The probability of a currency crisis in country A depends on the crisis probability of country B and vice versa. Bearing this in mind, we can ask how an increasing crisis probability in one of the periphery countries affects the stability of the fixed exchange rate in the other periphery country.

Suppose that wages in country B rise as a result of an increase in the market's crisis perception, thus impairing the stability of country B's pegged exchange rate. How is the stability of A's fixed exchange rate affected by the enhanced fragility of country B's rate peg; that is, are rising wages in country B good or bad news for country A? One may be tempted to conclude that increasing wages in country B strengthen A's exchange rate peg. Wage increases in B weaken B's international

competitiveness through an appreciation of its real exchange rate.[16] Hence, country A's international competitiveness should increase relative to B's, and its fundamentals should improve (employment increases), making the defense of A's pegged exchange rate less costly. However, our results challenge this line of reasoning.

$$\frac{\partial \mu_{A,t}}{\partial \mu_{B,t}} = F(\overline{\eta}_{A,t+1} | s_{B,t+1} = s_B^{FX}) - F(\overline{\eta}_{A,t+1} | s_{B,t+1} = s_{B,t+1}^{FL}) > 0. \quad (18)$$

Equation (18) makes clear that the widespread policy view summarized above is predicated on a simplistic understanding of international interdependence. This paper focuses on an important argument that counters the traditional view.[17] A higher instability in one of the periphery countries (in our case, country B) is transmitted to the other periphery country (A) via the economic links between the two. Country A's exchange rate system is weakened not only by a devaluation in country B—as described by Corsetti and others (2000) and Loisel and Martin (2001)—but also by the imminent loss of country A's international competitiveness. In Figure 2, we can see that an increase in country B's crisis probability shifts the S-shaped curves to the left. The market anticipates that the willingness of the policymaker in A to defend the fixed exchange rate against adverse shocks shrinks if country B devalues, and the increasing probability of this situation is reflected in private expectations. These expectations, in turn, lead to a reduction in the employment rate. Thus, the negative effect of a currency crisis in country B on the stability of country A's fixed exchange rate materializes before country B actually devalues.

How much the stability of A's fixed exchange rate is impaired depends on how much $\mu_{B,t}$ increases. Starting from a very low and unique crisis probability in country A, we can create several scenarios (see also Masson, 1999). First, an increase in $\mu_{B,t}$ can have a negligible effect on A's crisis probability. Although the greater instability of B's fixed exchange rate spreads, it does not touch A's situation significantly; that is, the number of equilibria is unchanged. Second, it is possible to imagine that country A is pushed into the zone of multiple equilibria by a sufficiently strong increase in $\mu_{B,t}$. The situation is now completely different. The stability of A's exchange rate is significantly impaired—sunspots can now trigger a currency crisis in A. This scenario combines elements of the fundamental (economic interdependencies) and nonfundamental (contagion) channels of crisis transmission discussed in the introduction. While exchange market turmoil is transmitted through existing economic interdependencies, arbitrary shifts in market sentiment determine whether and exactly when a crisis occurs. Third, A's crisis probability may be pushed to a level beyond the zone of multiple equilibria, to the point at which very weak shocks are sufficient to bring about a currency crisis.

[16] Equation (12) shows that an increase in wages (an increase in the expected money supply) produces an appreciation of the periphery countries' bilateral real exchange rate vis-à-vis that of the center country through an increase in their price levels.

[17] We are grateful to an anonymous referee for suggesting this way of interpreting our results.

The model implies that, despite sound fundamentals, currency crises may occur if economic interdependencies between countries are taken into consideration. Even if economic policy is consistent with the exchange rate goal, spillovers from other countries can weaken a fixed exchange rate so much that a currency crisis can hardly be avoided. Several scenarios are conceivable. Full-blown currency crises in both periphery countries are equally as possible as no crisis in either country. Or one country may slide into a crisis while the other avoids a crisis. Country B, where the turmoil started, may succeed in preventing a crisis, while the stability of country A's fixed exchange is so badly impaired by B's increasing crisis probability that a currency crisis is only a matter of time. Thus, a country does not necessarily benefit from a trading partner's initial loss of competitiveness. If this initial loss of competitiveness (resulting from an increase in the market's crisis probability and then in wages) can be expected to result in a gain in competitiveness when the fixed exchange rate is abandoned, the neighboring countries may be worse off *at once.*

V. Conclusion

Economic links, especially trade links, between countries are a key culprit for the transmission of currency crises. Empirical studies show that once a currency crisis occurs, additional crises occur via international trade links. Against this background, we analyzed how the interdependence of private sector expectations in different countries influences the stability of fixed exchange rate regimes. The crisis probabilities of countries trading with one another are interdependent because wage setters react to an imminent loss of international competitiveness stemming from an increase in the crisis probability of a trading partner. If a currency crisis in one country is perceived to be increasingly likely, the probability of a devaluation of its trading partners to restore international competitiveness rises as well. How much the stability of other countries' fixed exchange rates is impaired depends on the increase in the crisis probability of the country where the turmoil started.

Our model shows that a loss of international competitiveness may not be good news for a country's trading partners. The initial loss of international competitiveness brought about by an increase in the market's crisis perception makes a future full-blown crisis in the first country more likely. Through their anticipatory behavior, wage setters in the neighboring countries alter their governments' opting-out clauses immediately, thus bringing the spillover effects of a crisis forward in time.

In our model, a crisis in one country spreads because it exerts a negative effect on other countries' fundamentals and motivates policymakers to abandon a fixed exchange rate. However, our model does not rely on an exclusively fundamental explanation. Spontaneous shifts in market sentiment may also play a role in precipitating currency crises if a sufficient fundamental weakness exists that makes a country vulnerable to arbitrary expectational shifts. This fundamental vulnerability is exposed when the increasing crisis probability of a trading partner leads to an increase in the unemployment rate because of the interdependence of private sector expectations.

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