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CURRENCY CRISES: A PERSPECTIVE ON RECENT THEORETICAL DEVELOPMENTS

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FIGURE

1 INTRODUCTION

Historians of economic thought will view the 1990s as a decade of great upheavals in the theory of currency crises. New generations of models have come to life at an alarming pace, an acceleration in fecundity that no doubt reflects the speed with which exchange-rate arrangements have fallen apart. Although this profusion of new models is undoubtedly justified by the variety of the recent crises—from the European Monetary System (EMS) to Mexico and Asia—it also raises the question of which key analytical points, behind the inevitable claims to novelty made by their proponents, distinguish one generation from another. This paper takes a first step toward answering that question by considering recent developments in the theory of currency crises within the context of a common analytical framework. The paper compares two theoretical approaches, one based on the speculative-attack model of Krugman ([1979] 1992) and Flood and Garber ([1984] 1994a) and the other associated with the work of Obstfeld (1994) and called here "the escape-clause" model. On the empirical side, the discussion puts special emphasis on the primary event that motivated the development of the escape-clause approach—the crisis of the exchange-rate mechanism (ERM) of the EMS in 1992–93—but it also discusses the Mexican and Asian crises.

Until the early 1990s, the prevailing intellectual framework for thinking about currency crises was the speculative-attack model developed by Krugman and Flood and Garber. The speculative-attack model views currency crises as runs on foreign-exchange reserves at central banks. Its main contribution is to show that the run need not be ascribed to the irrationality of market participants, but that it can be explained, instead, by the very rationality of their expectations. If the reserves did not flee, speculators could foresee the date of the devaluation and

Previous versions of this paper benefited from comments by Robert Flood, Peter Isard, Paul Masson, Gian Maria Milesi-Ferretti, and an anonymous referee. The paper was influenced by discussions with Barry Eichengreen, Marcus Miller, Maurice Obstfeld, Andrew Rose, and Charles Wyplosz. Some of these discussions took place while the author was visiting the Department of Economics at the University of California at Berkeley, the hospitality of which is gratefully acknowledged. I also thank Catherine Fleck for her precious help in editing the final version of the paper. This paper reflects the views of its author, not necessarily those of the International Monetary Fund.

make sure profits. The main message of the speculative-attack literature is that the reserve flight that occurs during a currency crisis is provoked by rational arbitrage.

The speculative-attack model has yielded important insights about the anatomy of currency crises, but it has proved to be less illuminating about the underlying causes. In most models, the speculative attack is provoked by a monetary or fiscal policy that, by assumption, is inconsistent with the maintenance of the fixed currency peg. A bad fundamental, then, is not difficult to diagnose: it is simply a monetary or fiscal policy that makes a devaluation inevitable. In retrospect, what appears as tautological naiveté in defining the fundamentals owes more, I would argue, to the historical context in which the speculative-attack literature evolved than to an intrinsic limitation of the approach. One of the main contributions of the speculative-attack literature has been to show that the currency panics associated with the failure of the 1970s and 1980s stabilization plans in Latin American countries were not a sign of market malfunctioning, but the perfectly natural consequence of the monetary and fiscal policies followed in these countries. The purpose of the literature was not to explain why Latin American countries were implementing monetary and fiscal policies that were inconsistent with their announced exchange-rate objective.

The limitation of the speculative-attack model in explaining the underlying causes of currency crises became more frustrating after the EMS crisis of 1992–93. Although excessively expansionist monetary or fiscal policies may have been an issue in some countries, such as Italy or Spain, they were clearly not significant in others, such as France and the United Kingdom. The credibility of the latter countries' commitment to the ERM was eroded by the combination of mounting unemployment and the high interest rates imposed upon them by the German monetary-unification shock. These factors not only increased the temptation to devalue and to implement an expansionary monetary policy, they also made raising the interest rate to defend the currency more painful. The first challenge to theorists, thus, was to develop a framework that would define the determinants of currency credibility more broadly and holistically than the speculative-attack model did.

The EMS crisis raised a second theoretical challenge related, not to the nature of the economic fundamentals, but to the nature of the fundamentals' relationship with speculation. Even invoking a broader set of economic fundamentals did not solve all the puzzles of the EMS crisis. Unemployment had been increasing and German interest rates had been high for years before the crisis; in fact, German interest rates

were decreasing at the time of the crisis. How is it, then, that the crisis erupted so abruptly and unexpectedly? This question gave rise to another more controversial theme: that the speculation was not determined solely by the economic fundamentals, but that it was also self-fulfilling.

Thinking about these questions led researchers to develop a new set of models, which I regroup in this paper under the term "escape-clause" models.[1] The escape-clause model of currency crises views fixed-exchange-rate arrangements as conditional commitment devices. A country that adheres to a fixed-exchange-rate arrangement commits itself to maintain the exchange rate within a range in order to gain benefits such as an anti-inflationary reputation or credibility. Its commitment, however, is limited, in the sense that the country's policymaker can always exercise an escape clause, that is, devalue, revalue, or float; this is all the difference between a fixed currency peg and a common currency. The policymaker makes this decision by weighing the benefits of maintaining the fixed peg against the costs of change, taking into account the broad economic environment. A currency crisis, from this perspective, is a situation in which private agents, given the prevailing conditions and their beliefs about the policymaker's objectives, perceive that the policymaker is on the brink of exercising the escape clause.

The first contribution of the escape-clause model is that it has led the profession to reconsider the notion of "fundamentals." The notion of fundamentals in the escape-clause approach is much more encompassing than in the speculative-attack models and, in the limit, can involve any variable that influences the policymakers' decision whether or not to defend the fixed peg. In addition to "hard" observable fundamentals, such as unemployment or the trade balance, it includes "soft"

[1] A number of authors have identified the key characteristic of the new models with the presence of an optimizing policymaker (Isard, 1995; Sutherland, 1995) or the fact that exchange-rate policy is endogenous (Cavallari and Corsetti, 1996; Buiter, Corsetti, and Pesenti, 1998). Other names, such as "new crisis" (Krugman, 1996) or "second generation" (Flood and Marion, 1996, 1999), choose to stress the novelty of the approach more than its content. The first version of the present paper (1994) coined the term "cost-benefit" approach, which survived for a short time in the literature (see, for example, Velasco, 1996). Although the term "second generation" seems to have fared best in the evolutionary selection of names. I resist adopting that terminology here because it is often used to refer to models of currency crises that include multiple equilibria. Their inclusion, as I argue below, is not the most relevant criterion by which to distinguish recent developments from the Krugman-Flood-Garber model.

fundamentals, such as the beliefs of the foreign-exchange-market participants about the more or less cooperative nature of the game that is played by the members of the fixed-exchange-rate arrangement or the policymakers' reputational capital.

The second contribution of the escape-clause model, and the one that has received most of the attention in the literature, is that it provides a new theory of self-fulfilling speculation and multiple equilibria. In most escape-clause models, causality does not flow exclusively from the fundamentals to market expectations. It runs both ways, and this circularity can generate multiple equilibria. An increase in devaluation expectations, for example, can become self-validating, because it makes maintaining the fixed-exchange-rate peg more costly by forcing the authorities to raise the interest rate. Under these conditions, the authorities' optimal policy may be to validate market expectations *ex post*, that is, to devalue if speculators expect a devaluation, or to maintain the fixed peg if they do not. Whether and when a crisis occurs is determined by the self-fulfilling mood of the market—what Keynes called its "animal spirits"—and is not necessarily related to fundamental developments.

It may seem surprising, in retrospect, that the debate between the self-fulfilling and fundamentalist views of currency crises, which still continues, was revived by the EMS crisis of 1992–93. It seems clearer now that there is not much in the EMS crisis that makes it *more* suggestive of multiple equilibria than other crises are. Although some features of the EMS crisis, such as the disconnection between fundamental developments and the timing of crises, are suggestive of multiple equilibria, these features are not really specific to the EMS crisis. What the EMS crisis did show, however, was the inadequacy of models in which the crisis appears as the mechanical consequence of excessively expansionary monetary policy. New models based on the conflict between the competing objectives of policymakers would have to be developed. Although this conflict can be thought of completely separately from multiple equilibria, it happens that the escape-clause models generically give rise to multiple equilibria and have thus become the vehicle for a debate on self-fulfilling speculation. In retrospect, the emergence of this particular theme at this particular time looks like a theoretical accident.

The reasons why the multiplicity of equilibria have become such a popular feature of escape-clause models go beyond the EMS crisis. First, the inclusion of multiple equilibria is consistent with a widely held view among economists and practitioners that speculation is

motivated by many factors, not only, or even primarily, by the economic fundamentals. George Soros' (1994) "theory of reflexivity," for example, although it is presented by its author as a general criticism of economic theory, can easily be interpreted in the context of an economic model with multiple equilibria.[2] Second, their inclusion is consistent with a number of features of many currency crises, including contagion and other stylized facts that are otherwise difficult to explain, as well as the already mentioned disconnection between fundamental developments and the timing of crises. Last but not least, multiple equilibria provide a political compromise between the view that crises result from a market failure and the view that they are self-inflicted by governments implementing bad policies. The view that speculation is self-fulfilling is often resisted because it seems to absolve policymakers from all blame in the crises their countries suffer. The escape-clause approach shows, however, that the self-fulfilling and "fundamentalist" views are not mutually exclusive. For a currency to be vulnerable to self-fulfilling speculation, the fundamentals must first put it in a state of fragility. The occurrence and precise timing of a crisis may be impossible to predict solely on the basis of the fundamentals, but the latter nevertheless play a crucial role, to the extent that it is the deterioration in fundamentals that makes the currency ripe for an attack.

The taxonomy adopted in this paper is different from that used in much of the recent literature, which is based on the distinction between first- and second-generation models of currency crises. First-generation models are often defined as those in which speculation is determined solely by the fundamentals; second-generation models are defined as those in which it can be self-fulfilling. Although this distinction may be a natural one when discussing the policy implications of theory, it may be confusing for a newcomer to the theory of currency crises who wishes to build a clear analytical understanding of its most recent developments. I prefer to emphasize here the difference between models in which the policies that ultimately bring down the fixed-exchange-rate peg are taken as exogenous and models in which these policies are endogenized. This classification seems more compatible with the general evolution of thought in macroeconomics, in which government policy also evolved from being included as an exogenous

[2] By "reflexivity," Soros means that the causal relationship between market expectations and the economic fundamentals runs both ways, so that the former may not be uniquely determined by the latter. The two equations presented by Soros (1994, chap. 1) reproduce exactly the structure of a model with multiple equilibria.

variable in macroeconomic models to being explicitly modeled as the result of a more or less constrained process of optimization. It brings out more clearly, moreover, the point that the contribution of the new models is not only, or even essentially, about multiple equilibria. On the one hand, some variants of the basic speculative-attack model developed in the 1980s involve multiple equilibria (Flood and Garber, [1984] 1994b; Grilli, 1986; Obstfeld, 1986). On the other hand, as Krugman (1996) points out, it is not true that all escape-clause models lead to multiple equilibria. Thus, the multiplicity of equilibria should not necessarily be the distinguishing feature of the first-generation, as opposed to second-generation, models (a point also made by Drazen, 1998; Eichengreen and Jeanne, 1998; and Corsetti, Pesenti, and Roubini, 1999).

The recent Asian crisis has prompted some economists to call for a "third-generation" model of currency crises, a terminology that is, again, somewhat discomfiting. The names we choose are important insofar as they structure the way we think about facts. In the Asian crisis, some phenomena that were apparent before the crisis, such as the link between banking and currency crises and the contagion of crises across countries, became exacerbated. New models were therefore developed, putting the analytical focus on these phenomena. As I argue below, however, these new models fall naturally under the speculative-attack or escape-clause approaches, and it is not yet clear at this stage what theoretical principle would organize them into a distinct theoretical approach. The name "third generation" also has the inconvenience of suggesting that the Asian crisis is as different from the EMS crisis as the latter was from its predecessors, and that it is now time to put previous models back on the shelf and start developing a new framework. This view neglects important dimensions by which the escape-clause model transcends its origin. The main message of the escape-clause model is that currency crises should be analyzed in the context of a conflict among contradicting policy objectives. This is a good starting point for analyzing not just the EMS crisis of 1992–93 but older events and the most recent ones as well.[3] In the limit, any crisis can be analyzed in the escape-clause perspective, the point being to specify clearly the terms of the dilemma with which the policymaker is faced.

[3] The same escape-clause model, for example, can be applied to the analysis of the French franc crisis of 1992–93 and the sterling crisis of 1931 (Jeanne, 1997b; Eichengreen and Jeanne, 1998). See also Bordo and Schwartz (1996).

This paper is organized as follows. Chapter 2 presents a simple model of the exchange rate to allow for a comparison between old and new approaches in the context of a common framework. Chapters 3 and 4 discuss the respective properties of the speculative-attack and escape-clause models. Chapter 5 concludes the paper by discussing the merits of the two approaches with reference to the recent crises in Southeast Asia.

2 THE FRAMEWORK

The model of the exchange rate presented in this chapter will serve as a framework for the analysis that follows. In order to focus attention on the logic of currency crises, the model is as simple and uncontroversial as possible; it is essentially a two-period version of the open-economy neoclassical synthesis framework.

The model shows a world economy comprising two countries, a domestic and a foreign country, and a time frame of two periods, short term and long term. The exchange rate of the domestic currency, that is, the price of the foreign currency in terms of the domestic currency, is denoted by E. The question asked throughout this paper is under what conditions will the domestic currency remain pegged to the foreign currency at rate $\overline{E}$.

The model assumes that the domestic price level is rigid in the short term but adjusts to the monetary conditions in the long term. Thus, P_1, the domestic price level in period one, is an exogenous variable of the model, whereas P_2, the price level in period two, is endogenous and satisfies purchasing-power parity:

$$P_2 = E_2 P^* , \tag{1}$$

where P^* is the (exogenous) foreign price level in both periods.

For the sake of simplicity, and without any loss of generality, we assume that the first-period domestic price level is given by $P_1 = \overline{E}P^*$. This means that P_1, which is an exogenous variable and does not *a priori* satisfy purchasing-power parity, is, nevertheless, consistent with such parity. This assumption, which would be easy to relax, has the merits of simplifying the algebra and making clear that a currency crisis occurring in the first period is not caused by a real overvaluation of the domestic currency.

Private agents allocate their financial portfolio between two types of assets: domestic bonds and foreign bonds. Assuming risk neutrality and perfect mobility of capital (an important assumption of the model, which is not met if there are foreign-exchange controls, for example), domestic and foreign bonds are perfectly substitutable. The first-period nominal yield (1 plus the nominal interest rate) on domestic bonds

must be equal to the yield on foreign bonds times the factor of depreciation of the domestic currency relative to the foreign currency between periods one and two:

$$I_1 = \left(\frac{E_2}{E_1}\right) I^* \ , \tag{2}$$

whereas the second-period interest rate is exogenous and set (for the sake of simplicity) at $I_2 = I^*$.

Domestic agents hold domestic money because it is useful in making transactions. We assume that the demand for domestic money is given by a standard LM equation:

$$\frac{M_t}{P_t} = \frac{Y}{\upsilon} I_t^{-\alpha} \qquad \alpha > 0 \ , \qquad t = 1,2 \ , \tag{3}$$

where M_t is the quantity of money in period t, Y is a production index, assumed to be constant, and υ is a measure of the velocity of money.

The endogenous variables are the first-period nominal-interest rate, I_1, the exchange rates, E_1 and E_2, and the second-period price level, P_2. The reduced form of the model can easily be computed as

$$E_2 = \left(\frac{M_2}{\overline{M}}\right) \overline{E} \tag{4}$$

$$I_1 = \left(\frac{M_1}{\overline{M}}\right)^{-\frac{1}{\alpha}} I^* \tag{5}$$

$$E_1 = \left(\frac{M_1}{\overline{M}}\right)^{\frac{1}{\alpha}} \left(\frac{M_2}{\overline{M}}\right) \overline{E} \ , \tag{6}$$

where $\overline{M}$ is the quantity of money consistent with the maintenance of

the fixed peg at periods one and two, given by

$$\overline{M} = \frac{YP^{*}\overline{E}}{\upsilon I^{*\alpha}} \ . \qquad (7)$$

Equation (4) states that, in the long run, the exchange rate is proportional to the quantity of domestic money. Equation (5) reflects the *liquidity effect* of monetary policy: an increase in the quantity of money decreases the nominal interest rate in the first period. Finally, equation (6) shows that the exchange rate in period one depends on the quantity of money in periods one and two. A transitory increase in the quantity of money in period one depreciates the domestic currency by reducing the nominal interest rate. An increase in the quantity of money in period two has the same impact, through its effect on the long-term exchange rate.[1]

[1] Note that a *permanent* increase in the quantity of money in period one depreciates the domestic currency more in the short term than in the long term—Dornbusch's overshooting result.

3 SPECULATIVE ATTACKS

The seminal papers in the speculative-attack literature are those by Krugman ([1979] 1992), who built on Salant's and Henderson's (1978) analysis of the gold standard, and by Flood and Garber ([1984] 1994a), who gave the speculative-attack model its canonical form. The purpose of this chapter is to present the logic of these models in the context of the two-period framework presented above.[1] The first section gives the main assumptions and presents the logic of the run on reserves. The second section discusses speculative-attack models based on fundamentals. The third section reviews models with multiple equilibria.

The Logic of Speculative Attacks

The first crucial assumption of the Krugman-Flood-Garber model is that the monetary-policy instrument is neither the quantity of money nor the interest rate, but is, rather, one component of the central bank's balance sheet, that is, domestic credit. Writing the supply of money as the sum of domestic credit and foreign-exchange reserves,

$$M_t = D_t + R_t , \qquad t = 1,2 , \tag{8}$$

we assume that the variable determined by the monetary authorities is domestic credit, D. The level of reserves, R, is then determined residually, as the difference between the demand for money and domestic credit.[2]

This assumption means that the monetary authorities, after they have monetized a given level of domestic credit, do not respond to changes in the level of foreign-exchange reserves by making concomitant changes in domestic credit. In other terms, the central bank neither

[1] This paper does not attempt, however, to provide an exhaustive review of the literature on speculative attacks. The interested reader may refer to Agénor, Bhandari, and Flood (1992), Blackburn and Sola (1993), or Garber and Svensson (1995).

[2] Note that according to equation (8), variable M should be interpreted as the monetary base, whereas the money-demand equation should involve broad money. This discrepancy raises no serious problem in theory if there is a stable relationship between the monetary base and the broader monetary aggregate that appears in LM, but it matters if one tries to give an empirical content to variable D.

sterilizes reserve flows nor augments their impact on money supply "inside" period one or two. One can justify this assumption by the fact that reserve flows are very sudden during currency crises and do not necessarily leave enough time for the monetary authorities to intervene. Alternatively, the monetary authorities are able to adjust domestic credit to reserve movements instantaneously but are reluctant to do so because their objective with respect to domestic credit overrides their exchange-rate commitment.

The second crucial assumption of the model is that the amount of reserves must stay above a floor $\underline{R}$:

$$R_t > \underline{R} , \qquad t = 1,2 . \tag{9}$$

This constraint sets a limit on the amount of reserves that the central bank commits to the defense of the domestic currency. The monetary authorities may, for example, wish to spare a cushion of reserves $\underline{R}$ so as to preserve their ability, after the devaluation, to intervene in the foreign-exchange market, possibly to defend a new fixed peg. The floor on the foreign-exchange reserves is not necessarily positive. The bank may borrow foreign currency from its foreign counterparts or private agents in the foreign-exchange market. If these operations are massive—and they will typically be very large during a currency crisis—the bank may become a net debtor in terms of foreign currency, which corresponds to $\underline{R} < 0$. The assumption $R > \underline{R}$ then sets a limit on the amount of foreign currency that the bank is able, or wishes, to borrow equal to $-\underline{R} > 0$.

A speculative attack is a run on the foreign-exchange reserves of the central bank. In order to clarify some assumptions of the speculative-attack model that are often left implicit in the literature, it may be useful to recall the logic of the run equilibrium as discussed by Diamond and Dybvig ([1983] 1995).

The model of a run relies on a sequence that takes place *inside* period one or two. At the beginning of the period, private agents address their demands for foreign-exchange reserves against domestic currency to the domestic central bank. This demand is served by the bank at rate $\overline{E}$ as long as some foreign-exchange reserves remain available. If total demand is larger than $R_t - \underline{R}$, the constraint (equation 9) prevents all demanders from being served. Demanders are then randomly allocated in a queue, which determines the order in which they will be served, and at which rate. The first ones in the queue are served

at rate $\overline{E}$ until the reserves are exhausted. The following ones are faced with a different rate, the shadow flexible exchange rate, which is determined by the postdevaluation monetary conditions. Thus, there will be two different exchange rates in the same period if an attack occurs. The shadow flexible exchange rate is the exchange rate that prevails when the central bank holds no reserves in excess of the floor. Formula (6) implies that the shadow flexible exchange rates in periods one and two are given by

$$\hat{E}_1 = \left(\frac{D_1 + \underline{R}}{\overline{M}}\right)^{\frac{1}{\alpha}} \left(\frac{D_2^e + \underline{R}}{\overline{M}}\right) \overline{E} , \tag{10}$$

$$\hat{E}_2 = \left(\frac{D_2 + \underline{R}}{\overline{M}}\right) \overline{E} , \tag{11}$$

where D_2^e is the period-two level of domestic credit expected in period one.

The central point of the speculative-attack model is that a run is an equilibrium if and only if private agents expect it to be associated with a devaluation, that is, if the shadow flexible exchange rate is higher than the fixed rate:

$$\hat{E}_t > \overline{E} . \tag{12}$$

Private agents, knowing that the domestic currency is about to be devalued, will try to outrun the devaluation. Such behavior is completely rational, for if an attack occurs, each individual agent is better off participating in the attack in order to have a chance of being at the beginning of the queue and taking advantage of the better exchange rate. If the shadow flexible rate implies a revaluation, private agents will keep their domestic assets and there will be no speculative attack.[3]

[3] As Grilli (1986) has shown, it is possible to build speculative attacks leading to a revaluation if one assumes that reserves cannot go above a ceiling. This is the kind of speculative attack that may confront "strong" currencies. The reserve ceiling may arise from a desire of the domestic monetary authorities to limit the increase in the quantity of money.

The literature on speculative attacks generally assumes that if condition (12) is satisfied, the run on the foreign-exchange reserves will be the unique equilibrium. This assumption is generally justified by the fact that private agents are faced with a "one-way bet." The risk incurred by speculators is one-sided. Because it is a devaluation, not a revaluation, each individual speculator loses nothing by running alone on the reserves but is exposed to a loss by not running if others do. In game-theoretical terms, attacking the domestic currency is a dominant strategy, and standard refinements of Nash equilibria (involving, for example, a slight uncertainty about the action chosen by the other players) will lead to the selection of the speculative attack as the only "robust" equilibrium.[4]

A rigorous interpretation of the speculative attack in terms of game theory would require writing the speculators' payoffs of attacking and not attacking. This is done by Obstfeld (1996b) in the context of a model with two large speculators. Obstfeld also assumes that exchanging the domestic currency against the foreign currency involves a small transaction cost; he then shows that attacking is not always a dominant strategy and that it can even be strictly dominated. The attack must involve some coordination among the speculators, and it can succeed only if they have enough domestic currency to throw into the battle against the bank.

Speculative Attacks Caused by "Bad" Fundamentals

How is the occurrence of a speculative attack determined by domestic credit, the exogenous variable of the model? A speculative attack occurs at period one if the shadow exchange rate is higher than the fixed parity:

$$\hat{E}_1 > \overline{E} \ . \tag{13}$$

If the attack has not occurred in the first period, it is expected to take

[4] The argument in Krugman ([1979] 1992) is slightly different and makes use of the perfect-foresight nature of his model. All speculators know that the fixed-currency peg will be abandoned before the date on which the reserves will be exhausted in the absence of a speculative attack. The attack cannot occur at this time; if it were to occur, it would involve a jump in the exchange rate. Rational backward induction would then imply that the attack must occur exactly when the shadow exchange rate is equal to the fixed parity.

place in the second period if

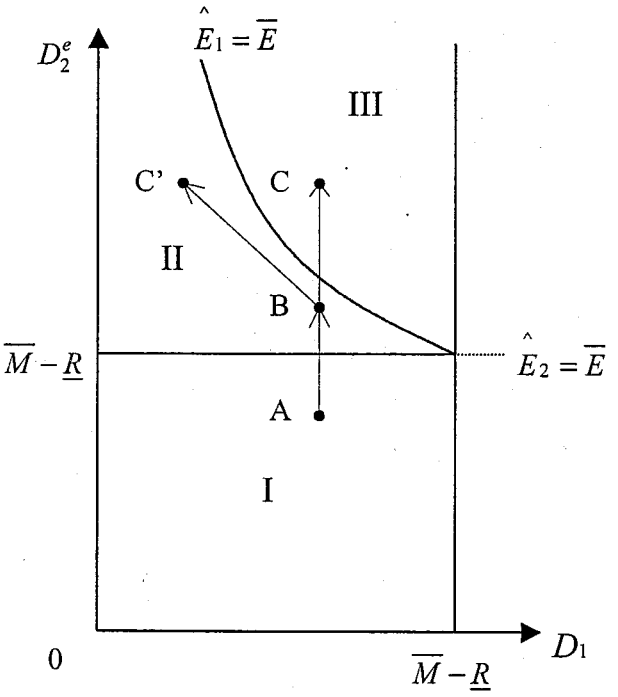
$$\hat{E}_2 > \overline{E} \,. \tag{14}$$

Figure 1 represents, in the space D_1, D_2^e, the *loci* in which these conditions are satisfied as equalities. A speculative attack occurs in period one if current and expected domestic credits determine a point in region III, in which condition (13) is satisfied. In region II, the fixed peg is not attacked in the first period, but it is expected to collapse in the second period. In region I, the fixed peg is expected to survive in both periods.

The important point is that the occurrence of the speculative attack is determined not only by the current stance of monetary policy, but also by market expectations about future monetary policy. Starting from a situation in which the credibility of the fixed peg is perfect,

FIGURE 1

DOMESTIC CREDIT AND THE OCCURRENCE OF SPECULATIVE ATTACKS



such as point A in the figure, a rise in the expected level of domestic credit may move the economy from region I to region II, where a speculative attack begins to be anticipated (point B). This expectation leads to an outflow of unsterilized reserves, which reduces the supply of domestic money and raises the interest rate. As long as the economy remains in region II, however, the reserve outflow is not large enough to exhaust the reserves in period one. If expected domestic credit increases further, however, so as to put the economy in region III, the reserves constraint becomes binding, and a speculative attack is triggered in period one (point C). Thus, an increase in expected future domestic credit can bring about an attack, even if the current level of domestic credit seems consistent with the fixed peg.

This very simple model does not do justice to the many insights offered by the speculative-attack literature. First, the point originally made by Krugman ([1979] 1992) and Flood and Garber ([1984] 1994a) was that in continuous time, the exchange rate—unlike foreign-exchange reserves—does not jump at the time of the attack. If it did, the speculators, knowing in advance the date of the attack, could realize unlimited profits by arbitrage. The assumption of perfect foresight was relaxed by a number of authors who assume, instead, that the domestic-credit process is stochastic, implying that the date of the attack is uncertain and that the period leading up to it exhibits a peso effect in the domestic interest rate (Flood and Garber, [1984] 1994a; Grilli, 1986; Obstfeld, 1986; Buiter, 1987; Dornbusch, 1987; Claessens, 1991; Goldberg, 1991). Other authors have scrutinized the behavior of the domestic real economy before and after a speculative attack. In the context of a model including traded and nontraded goods, Calvo (1987) finds that the attack is preceded by a real appreciation and followed by a persistent real depreciation of the domestic currency. Willman (1988) introduces nominal rigidities into the model and finds that the level of output and the trade balance deteriorate before the attack and improve afterward.[5]

Beyond their differences, these models share a feature that makes all of them models of speculative attacks: they portray the currency crisis as a run on the foreign-exchange reserves at the central bank, and this

[5] Other extensions include the study of speculative attacks against target zones (Krugman and Rotemberg, 1992) and crawling pegs (Connolly and Taylor, 1984). Some authors have analyzed the way in which the dynamics of the attack are modified when the monetary authorities seek to establish a new, fixed, currency peg (Obstfeld, 1984; Grilli, 1986), or a crawling peg (Dornbusch, 1987) after the devaluation.

run occurs as soon as the shadow flexible exchange rate is higher than the fixed parity. The models share another feature, which, although not constitutive of the speculative-attack approach, has nevertheless come to be identified with it: they define the exogenous economic fundamentals narrowly, that is, they include only monetary and fiscal policies.[6] Overall, the speculative-attack literature has adopted the somewhat tautological view that currency crises are caused by monetary or fiscal policies that are inconsistent with maintaining the fixed currency peg, and it has not addressed the question of where these policies originate.[7]

Self-Fulfilling Speculative Attacks

The previous section showed how a speculative attack may precipitate a devaluation made inevitable by the course of monetary or fiscal policy. This section presents a view of speculation in which the speculators may or may not provoke a devaluation, independently of the economic fundamentals. The collective behavior of speculators, not the policy actions of the government, determines the occurrence of the speculative attack.

As Obstfeld (1986) shows, this change in perspective can be obtained at the cost of a small modification of the model.[8] One simply needs to assume that the second-period monetary policy depends on the government's decision whether or not to devalue in the first period. The

[6] In stochastic models, it is usually assumed that the exogenous variable is domestic credit, which follows a Markov process. Buiter (1987), Willman (1988), and Van Wijnbergen (1991) assume that the expectations on domestic credit are determined by the monetization of the public debt, an "unpleasant monetary arithmetics" that allows them to extend the definition of the fundamentals to fiscal policy.

[7] As already stated, this narrow view of the causes of crisis does not derive from an intrinsic limitation of the speculative-attack model. It would have been possible to direct the model toward endogenizing domestic credit. An example of this is given by Velasco (1987), who emphasizes that the rise in domestic credit may be the result of a banking crisis that forces the monetary authorities to provide liquidity to the banking sector (see also Calvo, 1998). It should also be noted that most empirical applications of the speculative-attack model involve channels that do not appear in the benchmark model, such as the impact of trade deficits on reserves (Blanco and Garber, [1986] 1994).

[8] The possibility of self-fulfilling attacks à la Obstfeld is also underlined by Grilli (1986). There are other ways to generate multiple equilibria in the basic Flood-Krugman-Garber framework. Flood and Garber ([1984] 1994b), for example, note that self-fulfilling attacks could result from bubbles in the shadow exchange rate. Flood and Marion (1996) propose a model of self-fulfilling speculative attacks that relies on another form of multiple equilibria in the determination of the underlying shadow exchange rate. Savastano (1992) presents a model of self-fulfilling attacks based on a Laffer curve in the collection of seigniorage revenue.

monetary authorities choose D^f in the second period if they have managed to maintain the fixed peg in the previous period, and D^d if they have not. The reaction function of the monetary authorities may thus be written as

$$(R)\quad \begin{cases} \text{no devaluation in period one} \Rightarrow D_2 = D^f \\ \text{a devaluation in period one} \Rightarrow D_2 = D^d\ . \end{cases}$$

Let us assume that monetary policy is more expansionary in period two if a devaluation has occurred in period one, that is, $D^d > D^f$. This can be the case, as argued by Obstfeld (1986), if the government is cut off from external borrowing after a devaluation and has to monetize its public debt to a larger extent than before (an argument modeled by Van Wijnbergen, 1991). Or it may be that the government, having foregone the benefits of its commitment to the fixed currency peg, switches to the optimal monetary policy under floating, which may be more expansionary than the policy required to maintain the fixed peg.[9] If we assume, furthermore, that (D_1, D^f) is in region I of Figure 1, and that (D_1, D^d) is in region III, then the model admits two equilibria. In the first equilibrium, the domestic currency is not attacked in period one, and the authorities maintain the fixed peg in period two by implementing a moderate expansion of domestic credit. In the second equilibrium, the domestic currency is attacked in period one, and the authorities validate the attack *ex post* by a more vigorous expansion of domestic credit. The fate of the currency is then determined by the "animal spirits" of speculators, or to put it more formally, by an exogenous sunspot variable coordinating their expectations on one equilibrium or the other.

Self-fulfilling speculative attacks are observationally equivalent to attacks based on fundamentals—the behavior of speculators looks the same, and in both cases, the attack is justified *ex post* by an expansionary shift in period-two monetary policy—but they imply very different views of the role of speculation. In the previous section's model, speculation was purely the reflection of an underlying fundamentals problem, for which the responsibility lay squarely with the domestic authorities. This section's model, however, allows an interpretation of the crisis that is less favorable to speculators, because it is their collective behavior that causes the collapse of the currency. The domestic policymaker is partly responsible for the crisis by making himself or

[9] The monetary policy chosen under floating is not necessarily optimal, however; consider, for example, the case in which opting out involves a switch to discretion.

herself suspected of having the response function (R). But what is the origin of this response? In order to investigate further the determinants of the government's response to speculation, one needs a model that endogenizes the policymaker's actions. This is precisely the purpose of the escape-clause approach to currency crises.

A Critique

The speculative-attack model has often been criticized for failing to account for the main features of the EMS crisis. Speculative-attack models predict that a crisis should be preceded by excessively expansionary monetary or fiscal policy associated with a real overvaluation of the currency and with a trade deficit. As I mentioned in the introduction, some of the ERM currencies that were attacked by speculators exhibited none of these features and were, instead, fragilized by the contradiction between their countries' domestic objective—containing the rise in unemployment—and their commitment to the EMS. In order to understand such situations, one needs to model expectations about future monetary policy in a way that is less rudimentary than in the speculative-attack model and that considers the response of the monetary authorities to a wide range of variables. In the context of our two-period version of the speculative-attack model, one would like to have an equation such as

$$D_2^e = F(X_1, X_2, \ldots) \ , \tag{15}$$

where the X_i are variables that matter for the government's decisions about monetary policy, such as unemployment and the state of the banking system. One problem the Krugman-Flood-Garber model has, in this regard, is that, in order to remain simple, it uses assumptions—such as the perfect flexibility of prices—that make monetary policy largely irrelevant for anything real in the economy. This difficulty is one of the reasons why the theory was reconstructed within a different setting, but it could have been surmounted within the speculative-attack framework.

A less commonly acknowledged weakness of the speculative-attack model relates to the specification of the monetary authorities' behavior in a speculative attack. It is crucial for the logic of the run that the monetary authorities do not adjust domestic credit instantaneously to changes in market expectations. There is some evidence, however, that monetary authorities can sterilize reserve flows instantaneously, and that they do so during currency crises (see Flood, Garber, and Kramer,

1996, for the case of the 1994 Mexican peso crisis). But if, in our model, the central bank can adjust variable D_1 to contemporaneous developments in market expectations, it can make the domestic currency immune to runs by adopting a monetary-policy rule that keeps the shadow exchange rate below the fixed parity. Written in terms of the level of domestic credit, this rule is given by

$$D_1 < \overline{M} \min\left[\left(\frac{\overline{M}}{D_2^e + \underline{R}}\right)^{\alpha}, 1\right] - \underline{R} . \tag{16}$$

This inequality ensures that the run is not an equilibrium at period one, by constraining D_1, D_2^e to be in region I or II of Figure 1. The rule implies that the monetary authorities may have to respond to a rise in the level of expected domestic credit by restricting domestic credit in period one—that is, by going to a point such as C′ instead of C in Figure 1.

The intuition behind this rule becomes obvious once it is written in terms of the nominal interest rate and reserves:

$$I_1 = I^* \frac{E_2^e}{\overline{E}} , \qquad R_1 > \underline{R} . \tag{17}$$

In plain words, the monetary authorities can defend the fixed peg by raising the nominal interest rate to the level that offsets the devaluation expectations, while keeping reserves above the minimum level This can be achieved by unsterilized changes in domestic credit. Thus, viewing currency crises as runs on the foreign-exchange reserves obscures one simple and important fact: the possibility for the central bank to maintain the currency peg by raising the nominal interest rate.

Once the role of the interest rate is acknowledged, the logic of currency crises appears in a different perspective.[10] There is always a level of the nominal interest rate that offsets the devaluation expectations of the private sector and maintains the fixed parity. If raising the interest rate were not costly in one way or another, a government would never be drawn out of a fixed-exchange-rate system—that is, currency crises would not occur. If currency crises do occur, and

[10] Much of this argument is common with that of Bensaid and Jeanne, 1997.

governments sometimes decide not to continue defending the parity, this must be because raising the interest rate has some cost, which is sometimes higher than the benefit of maintaining the fixed peg. The question that should be at the core of the theory of currency crises, therefore, is why are the monetary authorities, who are always *able* to implement rule (16) or (17), not always *willing* to do so. By dodging this question, the speculative-attack model misses an important link in the logic of currency crises.

4 THE ESCAPE-CLAUSE APPROACH TO CURRENCY CRISES

In the speculative-attack model, the speculators' problem is essentially ballistic. It is to determine the optimal time for running on the foreign-exchange reserves, given an exogenous monetary trajectory. The escape-clause model offers a more holistic view of currency crises, in which each speculator has to determine how the broad economic conditions, including the expectations of other speculators, will influence the policymaker's decisions about the exchange rate. The devaluation is no longer the consequence of an exogenous reserves shortage—it is assumed that the central bank can attract reserves by raising the interest rate—but of the incentives faced by the policymaker when considering whether or not to devalue.

The escape-clause model began to evolve into a consistent body of theory following the 1992–93 EMS crisis, when Obstfeld (1994) and others set out to give a theoretical account of the events.[1] This chapter presents a simple illustrative model in which the variable driving the currency crisis is unemployment. It then discusses extensions of the model in which exchange-rate stability depends on other fundamentals, such as public debt and the policymaker's reputational capital, or involves systemic effects. The chapter concludes by offering some perspectives on the literature of self-fulfilling speculation.

An Illustrative Model: Unemployment and Currency Crises

Returning to the two-period exchange-rate model, I replace the assumptions of the speculative-attack model with two others. First, I assume that the monetary authorities can sterilize reserves flows instantaneously and set the quantity of money in periods one and two at any desired level. There is thus no need to distinguish between domestic credit and foreign-exchange reserves on the asset side of the central bank's balance sheet, and monetary policy can be defined as setting variables M_1 and M_2. Next, I assume that the government always

[1] Policy rules with an escape clause are examined, in a domestic context, by Lohmann (1992) and Persson and Tabellini (1990). Models of fixed-exchange-rate regimes with an escape clause were also studied, before Obstfeld (1994), by Flood and Hodrick ([1986] 1994), Flood and Isard ([1989] 1994), Obstfeld ([1991] 1997), and de Kock and Grilli (1993). Obstfeld (1994) was the first to present the escape-clause model as an alternative to the speculative-attack model and to compare the two to the 1992–93 EMS crisis.

maintains the fixed parity in the first period ($E_1 = \overline{E}$) but may devalue in the second period, and decides whether or not to do so by considering the implications of its decision for unemployment.

The amount of the devaluation, if it takes place, is d. This means that the monetary authorities, if they devalue, set the quantity of money at $M_2 = (1 + d)\overline{M}$ in period two, implying $E_2 = (1 + d)\overline{E}$. (It is not very difficult, although analytically more cumbersome, to endogenize the amount of the devaluation; see, for example, Obstfeld, 1994.) Because the domestic price level is consistent with purchasing-power parity in both periods, the domestic rate of inflation between periods one and two, $\pi = P_2/P_1 - 1$, is equal to d if the government devalues and zero if not.

The government decides whether or not to devalue by considering the implications of this decision for the domestic unemployment rate in period two. The level of the unemployment rate is determined by an expectations-augmented Phillips curve:

$$U_2 = \rho U_1 - \alpha(\pi - \pi^e) , \tag{18}$$

where U_1 and U_2 are the deviations of the unemployment rate from its natural level at periods one and two, respectively, and π^e is the expected rate of inflation. A customary justification of this relationship is that the second-period nominal wage is predetermined in the first period, so that unexpected inflation increases employment above the natural rate by reducing the real wage. Equation (18) also includes a persistence effect in the dynamics of unemployment, which may be caused by rigidities in the domestic labor market (Drazen and Masson, 1994).

We assume that the domestic policymaker decides whether or not to devalue in period two by minimizing the loss function

$$L = (U_2)^2 + \delta C , \tag{19}$$

where δ is a dummy variable indicating the policymaker's decision (equal to one if he or she devalues, zero if not), and C is the cost of opting out of the fixed-exchange-rate arrangement.

There is an abundant literature on the nature of this opting-out cost, or, equivalently, the nature of the benefits of a fixed-exchange-rate arrangement for its members. The literature on optimum currency areas, and also most economic agents, would point to the adverse effects of increased exchange-rate volatility on international trade and investment. This cost has proved elusive to understand theoretically and to detect

empirically; see, for example, Frankel and Wei, 1995, for the case of the EMS. The literature on the EMS has also stressed the benefits of a fixed peg in terms of anti-inflationary credibility (Giavazzi and Giovannini, 1989). From that point of view, the cost C should be interpreted as the loss of credibility or reputation associated with a devaluation, and this is the way the opting-out cost has usually been endogenized in the escape-clause model of currency crises (de Kock and Grilli, 1993; Bensaid and Jeanne, 1998). The opting-out cost may also result from the risk of retaliatory "beggar-thy-neighbor" devaluations by other members of the fixed-exchange-rate arrangement and the shift to uncooperative monetary-policy equilibria. More broadly, there are a number of benefits in belonging to a fixed-exchange-rate arrangement that may be understood only in the wider context of the ongoing relations with the other members of the arrangement. For example, an important objective for countries such as France, in staying at the core of the ERM, was to maintain its influence on the evolution of the system and the shape of the future monetary union (Drazen, 1998).

There is nothing stochastic in this model. Private agents form their expectations in perfect foresight, expecting a devaluation with either probability zero or probability one. The equilibria are characterized by proceeding backward, looking first at the optimal decision of the policymaker in period two, given the expectations of the private sector, and then determining the conditions under which these expectations are rational.

If the private sector expects no devaluation ($\pi^e = 0$), the government's loss function is $L^D = (\rho U_1 - \alpha d)^2 + C$ if it devalues and $L^F = (\rho U_1)^2$ if it does not. Not devaluing is the optimal decision if

$$\frac{C}{\alpha d} - 2\rho U_1 > -\alpha d \ .$$

If the private sector expects a devaluation ($\pi^e = d$), the domestic government is faced with the choice between defending the fixed currency peg, which yields a loss $L^F = (\rho U_1 + \alpha d)^2$, and devaluing, which yields a loss $L^D = (\rho U_1)^2 + C$. Devaluing is now the optimal decision if

$$\frac{C}{\alpha d} - 2\rho U_1 < \alpha d \ .$$

Defining the "fundamental" as

$$\Phi = \frac{C}{\alpha d} - 2\rho U_1 , \qquad (20)$$

we are led to distinguish between three cases:

- Heaven: if $\Phi > \alpha d$, there is one unique equilibrium, in which the fixed currency peg is maintained in period two;
- Hell: if $\Phi < -\alpha d$, there is one unique equilibrium, in which the policymaker devalues in the second period (and this is perfectly anticipated by the private sector);
- Purgatory: if $-\alpha d < \Phi < \alpha d$, there are two equilibria, one in which the policymaker devalues in period two, and the other in which there is no devaluation.

Although very stylized, this model yields two important results, one related to the nature of the fundamentals, and the other related to the connection between the fundamentals and the devaluation expectations. First, the fundamentals developments susceptible to destabilizing the fixed-exchange-rate arrangement are a rise in the unemployment rate or a fall in the opting-out cost. When the rate of unemployment, U_1, increases, the fixed-exchange-rate system may switch from a stable to an unstable state, in which a currency crisis may occur, or may even become the sole equilibrium. The reason is that because the loss function of the government is convex in the unemployment rate, the temptation to devalue increases with the level of unemployment.

Second, devaluation expectations are not always uniquely determined by the fundamentals. In some fundamentals zones, market expectations are uniquely determined. They involve the certainty of no devaluation when the fundamentals are excellent (in "heaven") and the certainty of a devaluation when the fundamentals are very bad (in "hell"). In these cases, the net benefit of the fixed-exchange-rate peg for the policymaker is positive or negative in period two, irrespective of market expectations, so that the equilibrium is unique.

Between heaven and hell lies a grey zone ("purgatory") in which a devaluation is possible but not certain. The intuition behind the multiplicity of equilibria is that devaluation expectations, by raising the level of wages, increase the level of unemployment that the government has to bear in order to maintain the fixed peg. The discontinuous expansion of the set of equilibria that takes place when the fundamental enters the interval $(-\alpha d, \alpha d)$ is called a *bifurcation* in the theory of nonlinear

dynamics. Thus, a short way of characterizing the relationship between the fundamentals and speculation in this model is to say that speculation can become self-fulfilling following a bifurcation in the fundamentals (Jeanne, 1997a).

In the model, as in everyday language, I define a currency crisis as a situation in which the devaluation probability increases abruptly to unusually high levels. The model can encompass two competing explanations of the way in which a currency crisis may come about, one based on the fundamentals and the other based on self-fulfilling speculation. According to the first explanation, a currency crisis may arise from a deterioration of the fundamentals, that is, a decrease from a high level of Φ to a low level of Φ. In this case, it is clear that the crisis is *caused* by the fundamentals. If the fundamentals are in the intermediate range, however, with multiple equilibria, the crisis may also be caused by a self-fulfilling jump in devaluation expectations. The crisis is still caused by the fundamentals, but in the much weaker sense that it is made possible by the fact that Φ lies within the range $(-\alpha d, +\alpha d)$. Strictly speaking, it is not triggered by developments in fundamentals (it can occur while the fundamentals remain the same); it is generated by the "animal spirits" of the market, which, in the theoretical literature, are usually modeled as a "sunspot" variable coordinating market participants on high or low devaluation expectations. The last section of this chapter discusses some problems related to the selection of the equilibrium.

The essential properties of our model are robust to a number of changes in the assumptions. Many discussions of currency crises stress the cost of high interest rates, an idea that is not difficult to capture in the context of the model. One simply needs to replace the Phillips curve assumption by a monetary-policy channel involving the interest rate. Let us drop equation (18) and assume that the domestic rate of unemployment is now determined by

$$U_2 = \rho U_1 + \alpha \log\left(I_1 \frac{P_1}{P_2}\right), \tag{21}$$

where $I_1 P_1 / P_2$ is the real interest rate between periods one and two. Because of perfect foresight, this interest rate can be interpreted either as the *ex ante* real interest rate observed at period one or the *ex post* real interest rate observed at period two. The assumption, in the first case, would be that the unemployment rate at period two depends on the *ex ante* real interest rate of the previous period because of some

lags in the transmission of monetary policy, and, in the second case, that it depends on the *ex post* real interest rate through the balance-sheet channel of monetary policy.[2]

Using equation (21) and the approximation $\log(1 + d) \simeq d$, it is not difficult to show that the equilibria are characterized as before, with the fundamental variable now given by

$$\Phi' = \frac{C}{\alpha d} - 2\rho U_1 - 2\alpha \log I^* , \qquad (22)$$

The novelty, with respect to the model based on the Phillips curve, is that foreign monetary policy is now part of the fundamentals. A restrictive shift in the foreign monetary policy (that is, an increase in I^*) tends to generate currency crises by raising the domestic rate of unemployment, a point originally made by Ozkan and Sutherland (1998) in their model of the EMS crisis.[3] As before, multiple equilibria can arise because the devaluation expectations of period one increase the level of unemployment at period two. The only difference is that the monetary-policy channel now involves the interest rate, rather than wage setting.

Other natural extensions of the basic model include relaxing the perfect-foresight assumption, considering more general time structures, and endogenizing the opting-out cost and the amount of the devaluation. The models in Obstfeld ([1991] 1997; 1994), for example, can be viewed as infinite-time stochastic versions of the model presented above. The government minimizes a loss function depending on output and a fixed opting-out cost. It devalues when the output shock goes beyond a predetermined level, which depends on the parameters and the stochastic structure of the model. It is also possible to endogenize the opting-out cost as the cost of switching to the discretionary monetary regime (de Kock and Grilli, 1993; Bensaid and Jeanne, 1998).

One can also endogenize the amount of the devaluation, d, in the context of a tradeoff between inflation and unemployment (see, for example, Obstfeld, 1994). Interestingly, endogenizing d brings out a point where the speculative-attack and escape-clause models are not

[2] The case in which the cost of defending the currency depends on the *ex ante* real interest rate of the current period is considered in Krugman (1996) and Jeanne and Masson (2000). These papers are discussed in the last section of this chapter.

[3] Ozkan and Sutherland (1998) present a model in which the foreign (German) interest rate follows an exogenous continuous-time stochastic process and the domestic policymaker optimally devalues when this interest rate exceeds a triggering level.

easy to reconcile. In the speculative-attack model, a sufficient condition for an attack is that the shadow exchange rate must be larger than the fixed parity. In the escape-clause model, the shadow exchange rate can also be endogenized as the exchange rate chosen by the policymaker after he or she has opted out. A shadow exchange rate that is higher than, but very close to, the fixed parity, however, does not trigger a crisis, because, in that case, the benefit of devaluing is too small to make up for the fixed opting-out cost. The shadow exchange rate must be *far enough* from the fixed parity for an attack to occur (Cavallari and Corsetti, 1996).

The Quest for the Fundamentals: From the "Hard" to the "Soft"

In the escape-clause model, the only condition that a variable must satisfy in order to qualify as an economic fundamental is to directly or indirectly enter the objective function of the policymaker. Even if one restricts the economic variables that appear directly in the policymaker's objective function to the most basic ones, such as output, unemployment, or inflation, a number of other variables could qualify as fundamentals, insofar as they indirectly influence the level of output, unemployment, or inflation. One way in which the escape-clause literature evolved was by incorporating into the formal analysis the economic variables that seemed to matter in the EMS and Mexican peso crises: in particular, the real exchange rate and fiscal variables such as the level and maturity structure of public debt. This extension of the set of fundamentals also encompassed much "softer" variables, such as the reputation of the policymaker or the more or less cooperative rules of the game played by the participants in a fixed-exchange-rate system.

The most obvious reason why a policymaker may be tempted to devalue is to offset an overvaluation of the currency. In some sense, this idea has already been captured by the stylized model presented in the previous section. Assuming that the Phillips curve (18) results from the predetermination of the nominal wage under rational expectations, a high level of unemployment in period two will result from an excessive level of the domestic wage in terms of foreign currency, or, in other terms, an overvaluation of the domestic currency. Currency overvaluation may be costly for reasons other than unemployment—most notably, trade imbalance, and maybe, under some circumstances, deflationary pressures. Andersen (1998), for example, presents a model in which the shock triggering the crisis is in the foreign price level. The domestic country must choose between staying in a fixed-exchange-rate system (at the cost of importing foreign inflation or

deflation), or opting out and switching to the discretionary regime forever. It is shown that the optimal decision involves opting out when the foreign price shock exceeds some specified level. This model not only adds foreign price developments to the list of fundamentals, it also helps us to understand the contagion of crises as a "domino" effect. A devaluation by one country constitutes a shock for the other members of the fixed-exchange-rate arrangement, which may induce them to devalue.

Another reason why the policymaker may be tempted to devalue is to inflate away the existing stock of public debt, an insight modeled by, among others, de Kock and Grilli (1993), Obstfeld (1994), and Velasco (1996). The decision whether or not to devalue may be viewed as a problem of optimal taxation, in which the choice is between monetary seigniorage and fiscal taxes. A larger public debt, other things being equal, will tend to tip the balance toward a devaluation. The level of public debt at any given time, moreover, is affected by the devaluation expectations that have prevailed in the past, through the level of interest rates. This circularity can generate multiple equilibria—a point originally made in the context of sovereign-debt crises by Calvo ([1988] 1996). There is an intermediate level of public debt at which the currency is vulnerable to self-fulfilling speculation (Velasco, 1996). Obstfeld (1994) presents a model that is representative of this approach in order to interpret the 1992 crisis of the Italian lira. It is a two-period model, in which the government may finance its second-period budget deficit by taxing the economy or by creating money and devaluing the domestic currency. The government minimizes a quadratic loss function depending on the levels of taxation and depreciation. Self-fulfilling currency crises may occur because devaluation expectations tend to raise the nominal interest rate and the burden of the debt, which induces the government to devalue in the second period. Sachs, Tornell, and Velasco (1996) interpret the 1994 Mexican peso crisis along similar lines.

The Mexican peso crisis showed that not only the level, but also the maturity structure, of public debt matters. The incentives faced by the policymaker when deciding whether or not to devalue are not the same if a large fraction of public debt may have to be repaid at short notice. Cole and Kehoe (1996) present a model of debt crisis—which could easily be reinterpreted as a model of currency crisis—in which the fundamental determinants of the crisis include both the level and the maturity structure of public debt. Their model is an escape-clause model, to the extent that the decision whether or not to default on the public debt is

taken by a government that weighs the costs and benefits of each policy option.[4] If, during a given period, foreign investors do not roll over their short-term loans to the government, the government is faced with a choice between two costly options, reducing public spending or defaulting. The incentives to default depend on the size of the debt that will come to maturity at a given period, which itself is determined by the overall size of the debt as well as its maturity structure.

The fundamentals discussed up to now—be they unemployment, public debt, or currency overvaluation—share the characteristic of being observable and measurable, at least in theory. Some fundamentals, however, are not observable: for example, the opting-out cost, *C*, in the stylized model of this chapter's first section. Other things being equal, it is in the policymaker's interest to make the market believe that his or her level of opting-out cost, *C*, is very high, that is, to develop a reputation for "toughness."[5] The policymaker's reputation may be viewed as a fundamental determinant of currency stability in the same way as the trade balance or unemployment are regarded, and this fundamental may be improved over time by policy actions. A strategy often adopted by policymakers is to build a reputation for toughness or, as Krugman (1998) puts it, to play the "confidence game."

The policymaker's reputation has been incorporated in the escape-clause model by Drazen and Masson (1994), and Masson (1995).[6] These authors consider a framework very similar to the stylized model given above but assume that the public does not know whether the domestic policymaker has a low or high opting-out cost, that is, whether he or she is an "easy devaluer" or a "hard pegger." This complicates the relationship between unemployment and the credibility of the fixed peg in an interesting way. On the one hand, increasing unemployment decreases the credibility of the peg by increasing the temptation to devalue. On the other hand, it reinforces credibility through a reputational mechanism: not devaluing signals that the monetary authorities are of the hard-pegger type. Whether it is the temptation or the reputation effect that dominates depends on the parameters of the model.

[4] One interesting particularity of Cole and Kehoe (1996), in this regard, is that the objective function of the government has explicit microeconomic foundations. Cole and Kehoe adopt a dynamic general-equilibrium framework and assume that the government maximizes the utility of the domestic representative agent.

[5] This does not mean that it is optimal to make *C* very high, if this cost actually corresponds to a social cost. Flood and Marion (1999) study the optimal *ex ante* determination of the opting-out cost, *C*, in a fixed-exchange-rate regime with an escape cause.

[6] See also Velasco (1996); Benigno and Missale (1997); Bensaid and Jeanne (1997, 1998).

Drazen and Masson (1994) develop their point with reference to the franc fort policy,[7] but it is more general and can be viewed as a warning about the gains to be expected from playing the confidence game with international investors. The credibility of a fixed peg is usually determined by considering a potentially broad set of fundamentals; the policymaker's reputation is only one of them. Investing in reputation may not help to stabilize the currency if such enhancement is obtained at the cost of damaging other relevant fundamentals.

An apparently less costly way to solve the credibility problem is to delegate the defense of the currency to an independent central banker who has a reputation for being a hard pegger. Bensaid and Jeanne (1998) show, however, that such arrangements may be suboptimal. Like Drazen and Masson (1994), Bensaid and Jeanne (1998) depart from the benchmark escape-clause model by assuming that the private sector does not know the opting-out cost of the monetary authorities. These scholars show that under this informational asymmetry, self-fulfilling currency crises take the form of a war of attrition between the monetary authorities and the speculators; the speculators continuously explore the opting-out cost of the monetary authorities until the peg is abandoned. A tough central banker is ready to bear a higher unemployment rate than a soft government is before devaluing, but even a tough central banker will give in at some point, and speculators may set out to explore his limit of resistance. As a result, the central banker is no less vulnerable to self-fulfilling speculation than is a soft government, and the banker has the additional inconvenience of defending the fixed peg for too long.

The models considered up to this point involve only two countries and, so, implicitly treat a fixed-exchange-rate *system* as the sum of independent unilateral pegs. Buiter, Corsetti, and Pesenti (1998) argue that because the countries participating in a fixed-exchange-rate system are linked together by trade externalities, purely bilateral models cannot offer a reasonable picture of crises such as that of the EMS in 1992–93.[8] In a fixed-exchange-rate system, each member country's incentives to devalue depend on the other member countries' policy actions or reactions, and the equilibrium outcome is determined by the more or less cooperative nature of the relationships inside the system.

[7] They conclude that the temptation effect has dominated the reputation effect in France, at least since 1987. Masson (1995) reaches a similar conclusion for the British pound from 1990 to 1992.

[8] See also Loisel and Martin (1998) for an escape-clause analysis of currency crises in exchange-rate systems. Loisel and Martin analyze the way in which international cooperation can alter the possibility of self-fulfilling currency crises.

Thus, the fundamentals should include not only the beliefs of foreign-exchange-market participants about each individual country, but also their beliefs about the nature of the *game* played by national monetary authorities. Building on this insight, Buiter, Corsetti, and Pesenti (1998) interpret the EMS events of 1992–93 in the context of a policy-optimizing model of systemic currency crises. In a cooperative equilibrium, countries at the periphery of the system react to a positive demand shock in the center country by implementing a modest coordinated realignment. A noncooperative equilibrium, by contrast, involves large devaluations by a subset of countries at the periphery. Buiter and his coauthors ascribe the unexpected burst of speculation of September 1992 to the large and solitary devaluation of the Italian lira on September 14, which led foreign-exchange-market participants to suddenly revise their beliefs about the game played by the European monetary authorities and to put more weight on the noncooperative scenario.

In a similar spirit, Drazen (1998) argues that the benefit of belonging to a collective fixed-exchange-rate arrangement has the same nature as belonging to a club, in the sense that it depends on the number and quality of other members. The membership benefit of a given country is reduced when other countries drop out of the arrangement, which may explain why currency crises are intrinsically systemic. Exchange-rate clubs may be implicit, so that this kind of contagion may affect countries that are not linked by a formal exchange-rate arrangement.

Are Currency Crises Self-Fulfilling?

The currency instability of the 1990s has triggered a major effort in empirical research to identify the fundamental determinants of currency crises. It is a fair generalization to say that this literature has found crises difficult to predict on the basis of the observable economic fundamentals.[9] It is generally found that a degradation of the fundamentals significantly increases the probability of a crisis. This probability evolves sluggishly, however, and remains low, even in periods when crises are observed, so that the precise timing of a crisis involves a considerable element of randomness. One possible objection to these studies is that they leave out "soft" fundamentals, which may be difficult for the econometrician to measure, such as the beliefs of market participants about the perceived health of the banking system or the

[9] See, for example, the early-warning-indicator approach of Kaminsky, Lizondo, and Reinhart (1998) or the probit estimation of Frankel and Rose (1996). Berg and Pattillo (1999) provide a good review of this literature.

political willingness to defend the currency. If this were the whole answer, however, market participants would perform better than econometricians at predicting crises. Empirical evidence suggests that this is not the case (Rose and Svensson, 1994; Goldfajn and Valdes, 1998).

These results are not completely surprising if one considers the typical course of currency crises. Invariably, the fundamentals problems to which the crisis is ascribed after the fact—whether these are domestic unemployment, real overvaluation of the currency, a liquidity mismatch, or banking fragility—have built up progressively in the period leading up to the crisis in the indifference of markets, even when these problems were perfectly observable. The crisis when it finally erupts, moreover, is generally *not* concomitant with exceptional developments in the fundamentals. The relative disconnection between the dynamics of the fundamentals and those of expectations is difficult to reconcile with a purely fundamentals-based theory of crisis and has led a number of economists to consider seriously the hypothesis that speculation involves a self-fulfilling component (Obstfeld and Rogoff, 1995). The appeal of the escape-clause model, in this regard, is that it provides a political compromise between the "fundamentalists" and the proponents of the self-fulfilling view. The occurrence of crises and their precise timing involve multiple equilibria, but these equilibria can grow only on the fertile ground of deteriorated fundamentals.

The empirical literature provides ample evidence that devaluation expectations are subject to abrupt shifts that seem unrelated to the economic fundamentals. This evidence has been presented by some authors in the context of the Markov-switching-regimes model developed by Hamilton (1994, chap. 22). Piard (1997) and Psaradakis, Sola, and Tronzano (1997) show that Markov-switching-regimes models in which speculative activity jumps up or down following the realization of a shock unrelated to the fundamentals do a better job of explaining the experience of the French franc than simple linear models do. The same methodology is applied by Martinez-Peria (1998) to a broader sample of EMS countries; by Gonzalez-Garcia (1999) to the 1994 Mexican peso crisis, and by Cerra and Saxena (1999) to the 1997 crisis of the Indonesian rupiah. The regime shifts identified by the estimation can be interpreted as jumps between multiple equilibria. Such an interpretation is buttressed by the finding of Jeanne and Masson (2000) that a Markov-switching-regimes model of the devaluation expectations can, in fact, be interpreted as a linearized reduced form of a structural escape-clause model with sunspots.

More structural empirical work is harder to find, in large part because it is difficult to estimate nonlinear models with multiple equilibria. Jeanne (1997a) estimates an escape-clause model for the crisis of the French franc on monthly data from 1991 to 1993 using the maximum-likelihood method. The main finding is that, although the different episodes of crisis were associated with bad fundamentals (most notably a high rate of unemployment), the jumps in expectations that occurred in September 1992, the first quarter of 1993, and July 1993 are better interpreted as self-fulfilling. Interestingly, it is found that the fundamentals bifurcated in August 1992, just before the September 1992 crisis.

This evidence has been criticized on several grounds, most notably for being presented essentially by default. The empirical literature interprets the excessive volatility of devaluation expectations as evidence of multiple equilibria, but it does not test this interpretation against alternatives. This objection is a serious one, because models with multiple equilibria may be observationally close to purely fundamentals-based models with rational learning. Krugman (1996) considers the example of a country in which unemployment mounts inexorably and the prior beliefs of market participants lead them to believe that the government will devalue when the unemployment rate reaches a threshold level of, say, between 10 and 12 percent. Devaluation expectations jump up when unemployment reaches 10 percent and fall back down when it exceeds 12 percent, a phenomenon that looks like a self-fulfilling jump in expectations, even though it is the consequence of rational learning.

Other models, such as Caplin's and Leahy's (1994) model of "crash and wisdom after the fact," might explain how a currency crisis can suddenly burst under a fundamental pressure that has built slowly over time. A crucial feature of Caplin's and Leahy's model is that each investor receives a *private* signal about the true state of the economy that is not revealed to other investors until the time of the crisis. In most models of financial markets, private information is efficiently diffused to all investors through the observation of an aggregate variable, such as the price level. This is not the case in the world of Caplin and Leahy, where investors have to pay a fixed cost to reallocate their portfolios and for that reason do not immediately reveal the nature of their information by their actions. As a result, the crisis may simmer for some time, until a threshold is reached and all investors withdraw at the same time. The information that was dispersed among many investors is suddenly aggregated in a crash.

The models of informational cascades of Banerjee (1992) and Bikhchandani, Hirshleifer, and Welch (1992) also rely on the idea that information is dispersed among many investors, but their logic is somewhat different. Investors are assumed to make their decisions sequentially, each one observing the decisions made by the investors ahead of him in the line. If the signals received by individual investors are noisy enough, it may be optimal for each investor to ignore his private information and imitate his predecessors. Again, the private information of investors is not revealed by their actions. The aggregate outcome is determined by the signal that the first investor in the line happened to receive. Chari and Kehoe (1997) show that informational cascades can make international capital flows excessively volatile, in the sense that one piece of information received by one investor may trigger a sudden reversal in the capital account.

These models have appealing features, but it is not clear that they can account for the stylized features of currency crises as convincingly as models with multiple equilibria can. It is not clear, in the Caplin-Leahy model, what the fixed cost of attacking the currency is.[10] Informational-cascade models need the decision process to be sequential, which does not seem to be a realistic feature of financial markets. More important, these models need the assumption that information is private, but foreign-exchange markets may be the markets where information is the most public. The problems to which the recent crises were ascribed after the fact—whether to the rise of unemployment in the EMS before 1992–93 or to the buildup of dollar-denominated debt in Mexico prior to 1994—are well known.[11] The problem does not seem to be that market participants lacked access to this information but, rather, that they ignored it.

The self-fulfilling hypothesis has also been criticized at the purely theoretical level. In a paper from which this section borrows its title, Krugman (1996) argues that the escape-clause model requires implausible assumptions about the monetary-policy channel in order to produce multiple equilibria. Krugman argues that in the real world, devaluation expectations make themselves costly by raising the *ex ante* interest rate,

[10] Note that this cannot be a small cost of the "menu" variety, because a small cost would not prevent speculators from reacting to bad news for a protracted period of time.

[11] A case can be made, however, that the extent to which the corporate sector was involved in short-term debt in U.S. dollars prior to the crisis in Southeast Asia was not fully known to foreign investors. But this ignorance was public: it is not clear what private signals investors had about the true situation.

and he shows that under this assumption, multiple equilibria do not arise if the fundamentals deteriorate deterministically over time. The date of the crisis is uniquely determined, following a backward induction logic that is similar to Krugman's 1979 (1992) article on speculative attacks—allowing him to question the theoretical specificity of the escape-clause model. As noted by Kehoe (1996) and Obstfeld (1996a) in their comments on Krugman's paper, this result hinges crucially on the fact that, through the *ex ante* interest rate, the policymaker's decision is effectively sensitive to the devaluation expectations formed in the *current* period, whereas in other escape-clause models, the same decision is dependent on the expectations formed in the *previous* period. This apparently innocuous difference in timing seems to alter the properties of the model to a surprising extent.

Jeanne and Masson (2000) attempt to shed some light on this puzzle. The analysis in their paper is based on a framework that is a reduced form for a broad class of models, including that in Krugman (1996). They show that although this class of models does not give rise to multiple equilibria when the economic fundamentals exhibit a deterministic trend, or are nonstationary stochastic processes, they may give rise to an *arbitrarily large* number of equilibria if a condition on the fundamentals is satisfied. This property is in sharp contrast to the models of Obstfeld (1994, 1996b), Velasco (1996), or Jeanne (1997a), where the number of equilibria is no larger than three, and it comes purely from the timing with which devaluation expectations affect the policymaker's decision. The paper also considers a hybrid model, in which the policymaker's devaluation decision is affected by the devaluation expectations formed in both the current and previous periods, and shows that, in this case, the dynamics of devaluation expectations can become cyclic or chaotic.

Even those economists who support the thesis of self-fulfilling speculation express some dissatisfaction with the state of the art of modeling multiple equilibria. The assumption, in particular, that the economy jumps from one equilibrium to another following the realization of an extraneous sunspot shock raises a number of questions. To the extent that the sunspot variable instantaneously coordinates the expectations of all market participants, one would like to relate this variable to an event that is publicly observable. It has sometimes been suggested that public statements by well-known figures, such as famous hedge-fund managers, might serve as a focus variable giving the signal of the attack (IMF, 1998). It is not the case, however, that the declarations of George Soros *always* move the market, and if the sunspot

variable changes over time, the question is only pushed one step further—how do market participants coordinate on the variable triggering the attack?

It can be argued in defense of sunspots that they are best viewed as a theoretical black box covering very complex market phenomena, which informational and computational limits put out of reach of deterministic forecasting. In a sense, the economist is in the same situation as the meteorologist trying to predict storms. The best that the economist can ever hope to achieve is to make probabilistic statements on the likelihood that a crisis will erupt at a particular time. This does not mean, however, that explicitly modeling the dynamics of the beliefs of market participants is a pointless exercise. Indeed, such developments might be quite useful in helping us understand the kinds of phenomena that are susceptible to triggering a jump from one equilibrium to another, and in refining our probabilistic statements—somewhat as stylized models of the dynamic interaction of low- and high-pressure zones may improve the predictive power of the meteorologist.

A first step in this direction has been accomplished in a paper by Morris and Shin (1998). These authors present a reduced-form version of an escape-clause model of currency crises, in which the cost of defending the currency depends on the number of speculators attacking the currency, as well as on an exogenous stochastic fundamental. Speculators receive heterogeneous noisy signals about the value of the fundamental. If the actions of individual speculators were publicly observable, multiple equilibria would arise. They do not arise in Morris' and Shin's model, however, because individual speculators base their decisions whether or not to attack solely on their private signals, not on the observation of what other speculators are doing. This effectively rules out self-fulfilling attacks in which each speculator runs on the currency for the sole reason that everybody else does. The framework in Morris and Shin lends itself to the analysis of several interesting questions but, like Caplin's and Leahy's model, or models of informational cascades, it probably goes too far in the assumption that information is decentralized among atomistic agents. In the real world, there are numerous channels—word-of-mouth communications, media—producing public information about the economy as well as the mood of market participants, and it is conceivable that these channels can be manipulated by large agents. Incorporating these phenomena into the analysis of shifts in market moods seems a difficult but promising and exciting challenge for future research.

5 CONCLUDING COMMENTS: ASIA AND BEYOND

A lot has happened since the first version of this paper was written in 1994. I therefore conclude by outlining the way in which the recent Asian meltdown is shaping current developments in the theory of currency crises. I shall not attempt to review the literature on the Asian crisis, which is already large, but to point out, instead, the directions in which the theoretical literature is moving under the pressure of the Asian events, and to interpret these developments in light of the classification developed in this paper.

Is the Asian crisis an essentially new crisis? One feature often presented as integral to the Asian crisis is the connection between banking problems and currency instability. The relationship between banking and currency crises is not a new phenomenon—see, for example, Kaminsky's and Reinhart's 1996 (1999) study, which predates the Asian crisis—but it is striking in the Asian case. This has prompted some economists to call for a "third-generation" model of currency crises that would be centered on the nexus between financial fragility and currency crisis (Krugman, 1999). Other economists, however, argue that we need only a set of extensions to the existing framework that better take into account the banking and financial sides of the economy (Chang and Velasco, 1998b). I implicitly adopt the second view here, by showing how the models that have been proposed so far for the Asian crisis fall under either the speculative-attack approach or the escape-clause approach.

It is widely acknowledged that the crisis-hit economies in Asia were made fragile by a liquidity mismatch between the asset and liability sides on the balance sheet of the corporate sector. This liquidity mismatch was augmented in some cases by a currency mismatch, whereby liabilities in dollars were backed by assets in domestic currency. There seems to be some disagreement between those who think that the crises primarily reflected this liquidity problem (Chang and Velasco, 1998a, 1998b; Radelet and Sachs, 1998) and those who argue that the crises were the deterministic and inevitable consequence of underlying problems in the fundamentals (Corsetti, Pesenti, and Roubini, 1999). Both sides of this debate, however, share the view that the liquidity mismatch was one of the main factors that made the crisis possible or inevitable.

International liquidity crises can be analyzed according to the same logic as bank runs in the model of Diamond and Dybvig ([1983] 1995). A natural extension of the theoretical literature has thus been to make the Diamond-Dybvig model monetary and international. This is done by Goldfajn and Valdes (1997) and Chang and Velasco (1998a). Goldfajn and Valdes stress the spillover effects between banking and currency crises. Deposits at domestic banks are part of the domestic liabilities that investors will attempt to convert into reserves in a currency crisis, so that a run on the currency is typically associated with a run on the banking system. Conversely, foreign investors running on the banking system for reasons unrelated to the currency will drain the foreign-exchange reserves, inducing a currency crisis. Chang and Velasco present a model in a similar vein but insist more on the multiplicity of equilibria in banking and currency crises and the implications of such equilibria for normative analysis.

A critique of these models in the spirit of the escape-clause approach would be that, as in all speculative-attack models, they do not account for the various ways in which monetary authorities can defend the currency, in particular by raising the interest rate. The cost of raising the interest rate is that it further weakens the banking system through different channels, in particular by decreasing the price of the assets that serve as collateral on loans. An interesting direction for research would be to incorporate these effects into models of banking and currency crises.

Another theme propelled to the forefront of research by the recent crises is *contagion*. It appeared, first with the Tequila effect following the Mexican peso crisis, and then more forcefully with the Asian and Russian meltdowns, that crises have a tendency to propagate very quickly to neighboring countries and even to distant unrelated emerging markets. A number of explanations have been put forward for this phenomenon.[1] One explanation could be that the economies involved in the same speculative wave shared the same kind of macroeconomic weakness or were hit by the same external shock.[2] The recent, but already large, empirical literature on contagion suggests, however, that explanations in terms of common internal or external fundamentals do

[1] The discussion that follows draws on Drazen (1998) and Masson (1998).

[2] Thus, it is sometimes argued that Southeast Asian economies were fragilized by the high level of U.S. interest rates, the U.S. Federal Reserve having the same impact on Asian currencies pegged to the dollar as the Bundesbank had on the rest of the EMS in 1992–93. This channel, which Masson (1998) calls "monsoonal," is captured by the version of the escape-clause model presented in the first section of Chapter 4.

not explain the large international comovements that we observe among a number of crisis indicators (see Kaminsky and Reinhart, 1998, for a review). A third explanation, encountered above in the discussion of the escape-clause model, is based on trade spillovers. A devaluation in one country encourages that country's trade partners to devalue in order to compete in the same third markets. The general size of trade flows, however, does not suggest that trade links are large enough to be the main channel of contagion.[3] Drazen (1998) discusses other mechanisms of contagion that involve what might be called "informational spillover." A problem in one country leads investors to revise their beliefs about other countries that share the same unobservable fundamentals or the same model of economic development or regulation. For example, to the extent that Thailand and other Southeast Asian countries were perceived to share the same model of close relationships between banks and firms and the same weakness in banking supervision, a bank failure in Thailand was bad news not only for Thailand (and its creditors), but for the whole region. These fundamentals, argues Drazen, are all the more difficult to measure in that they may involve commonalities in political systems and other "soft" variables. Masson (1998) argues, moreover, that "pure contagion" should be viewed as the consequence of multiple equilibria. If the sunspot variables that coordinate market expectations are correlated across countries, crises are likely to erupt at the same time in different countries irrespective of the fundamentals—provided, of course, that the fundamentals lie in the zone of multiplicity in all countries. Self-fulfilling crises have, in other words, an inherent tendency to become systemic.

This quick overview does not do justice to the many insights that the new literature on contagion has to offer, but it suggests that the escape-clause model provides a natural framework within which to think about contagion. If contagion is to be explained in terms of fundamentals, the literature suggests that these fundamentals must be extremely "soft"—of the kind introduced by the escape-clause approach into models of currency crises. The alternative is the self-fulfilling view of currency crises—for which the escape-clause approach again provides the benchmark model. Many discussions of contagion do not rely on completely worked-out models but invoke, instead, arguments that make sense in the context of the escape-clause approach. Indeed, several of the few

[3] It is sometimes argued that the most relevant spillovers occur in financial markets, because third-country investors liquidate their positions in one country to cover losses incurred in the crisis-hit country.

models of contagion that we have, such as Drazen's (1998) or Masson's (1998), adopt this method.

To conclude, if there is a general lesson to draw from the variety of the recent crises, it is that the system itself is structurally fragile. This new awareness has put the idea of a "new architecture" for the international financial and monetary system back in the forefront of policy debate. A number of proposals for reform have been put forward, some of which give more emphasis to preventing crises through measures aimed at making international capital less mobile. Proposed measures include controls on short-term capital flows, orderly workout procedures (Eichengreen and Portes, 1995), a Tobin tax on foreign-exchange transactions (Eichengreen, Tobin, and Wyplosz, 1995; Jeanne, 1996), and greater transparency. Others seek to reinforce or create at the global level institutions such as an effective lender of last resort to cope with capital mobility. One of the main challenges ahead for currency-crisis theorists will be to address more effectively the systemic questions that lie at the core of this debate.

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