

IMF Working Paper

© 1997 International Monetary Fund

This is a *Working Paper* and the author(s) would welcome any comments on the present text. Citations should refer to a *Working Paper of the International Monetary Fund*. The views expressed are those of the author(s) and do not necessarily represent those of the Fund.

WP/97/16

INTERNATIONAL MONETARY FUND

Research Department

Policy Implications of “Second-Generation” Crisis Models

Prepared by Robert P. Flood and Nancy P. Marion¹

Authorized for distribution by David Folkerts-Landau

November 1996

Abstract

After the speculative attacks on government-controlled exchange rates in Europe and in Mexico, economists began to develop models of currency crises with multiple solutions. In these models, a currency crisis occurs when the economy suddenly jumps from one solution to another. This paper examines one of the new models, finding that raising the cost of devaluation may make a crisis more likely. Consequently, slow convergence to a monetary union, which increases the cost to the government of reneging on an exchange rate peg, may be counterproductive. This conclusion is exactly the opposite of that obtained from earlier models.

JEL Classification Numbers:

E42, F31

Author's E-Mail Address: Rflood@imf.org; Nancy.p.marion@dartmouth.edu

¹Robert P. Flood is Senior Economist in the IMF's Research Department, NBER Research Associate and Dartmouth College Research Professor. Nancy P. Marion is Professor of Economics at Dartmouth College. The authors would like to thank Peter Garber, Oliver Jeanne and Maurice Obstfeld for discussions.

Contents	Page
Summary	3
I. Introduction	4
II. Policy Implications	8
III. Conclusion	9
Figures	
1. Obstfeld's Multiple Solutions: Uniform Distribution	10
References	11

Summary

The 1992-93 currency crises in Europe and the 1994 crisis in Mexico renewed interest in modeling speculative attacks on government-controlled exchange rates. Responding to events, economists began to develop models of currency crises with multiple solutions in which a crisis could be modeled as an economy jumping from one solution to another. In these models, a crisis need not be motivated by misaligned economic fundamentals observed before the crisis. Instead, the crisis itself becomes a source of exchange market volatility and is the event that triggers altered post-crisis policy.

This paper examines one of the new models and finds it implies that raising the cost of devaluation may make a crisis more likely. Consequently, if the observed volatility in currency markets is due to the existence of multiple equilibria, slow convergence to a monetary union, which increases the cost to the government of reneging on an exchange rate peg, may be counterproductive. This conclusion is exactly opposite to that obtained from earlier models.

I. INTRODUCTION

Successful attacks on currency parities in Europe and Mexico have led policymakers and academics to think more deeply about speculative attacks and the fragility of fixed exchange rate systems. The policy discussions involve the merits of setting up early warning systems to detect currency parities at risk and suitably institutionalizing parity arrangements. The academic work involves characterizing crisis episodes, extending existing speculative attack models to encompass recent events, and developing a “second-generation” of speculative attack models.

The second-generation models follow a first generation that points to inconsistent government policies as the cause of currency crises.² In much of the early literature, the government fixes the exchange rate but also monetizes a fiscal deficit. Excessive money creation builds up pressure on the exchange rate and pushes the monetary authority into making an adjustment—either devaluing or floating the domestic currency. The second-generation models approach the crisis from the opposite direction. In these models there is no policy inconsistency before the crisis. The crisis itself induces a policy change that makes the crisis self-validating. Thus, whereas first-generation models use excessively expansionary pre-crisis fundamentals to *push* the economy into crisis, second-generation models use the expectation of fundamentals expansion *ex post* to *pull* the economy into a crisis that might have been avoided.

First and second-generation models differ over more than just the conditions that precipitate crises. They can also have different implications for the institutional arrangements that reduce the likelihood of crises. In particular, the first-generation models suggest that strengthening cross-country currency ties will stabilize exchange rates. In some cases, the second-generation models imply just the opposite. The purpose of this note is to examine one of the policy implications of the second-generation models concerning institutional arrangements.

The second-generation models consider an interaction between private sector and government behavior that gives rise to several possible outcomes. In principle, the economy's equilibrium can jump from one outcome to another. Often the solution multiplicity in these models is based on “self-fulfilling expectations.” For example, if private agents start attaching more weight to the probability of devaluation, interest rates will rise and the government may decide that maintaining the fixed exchange rate is too costly. Conversely, if private agents do not expect a devaluation, then interest rates stay lower and a devaluation is less likely.

Other economic examples are constructed similarly. For instance, in one common type of model the private sector determines the wage rate in advance of government action but

²Literature on first-generation models is reviewed in Agenor and Flood (1994). Second-generation models are reviewed by Jeanne (1995).

based in part on the expectation of government action. The government action is limited to possibly devaluing the domestic currency. If the private sector expects no devaluation, it sets wages to reflect the stable currency arrangements and it usually will turn out to be best from the government's perspective to maintain the fixed rate. Conversely, if the private sector expects a devaluation of the currency, then wages will be set to compensate workers for the devalued currency. From the government's perspective, it will often turn out that the best response is to devalue the currency and thus validate the high wages set on the basis of expectations.

Second-generation models are usually built around Kydland-Prescott-style (1979) models of policy rules, but with an escape clause added on.³ The adoption of policy rules may help avoid the unnecessary inflation that accompanies discretionary policy, but rules are less flexible and therefore inferior to discretionary policy at stabilizing the economy against shocks. Rules with an escape clause can be a superior strategy to adopting either rules alone or discretion. Moreover, rules with an escape clause mimic one aspect of the way policy is actually made: the policymaker follows a rule—standard operating procedures—most of the time, but in extraordinary circumstances the policymaker uses discretion to deal appropriately with the situation.

Of course, with the typical incentive structure, the policymaker is tempted to treat all situations as extraordinary ones. Hence, a higher political authority must impose a cost on the policymaker every time the standard rule is violated. Set appropriately, this cost can lead the policymaker to use discretion only when needed and produce a policy regime superior to a simple rule or to pure discretion.

Our point has to do with the second-generation models' message concerning the cost imposed on the policymaker. To make our point, we rely on Obstfeld's (1994) presentation of a devaluation model. In this model, wages are set a period in advance of employment and are based on the labor market's expectation of government policy (devaluation) for the employment period. We use Obstfeld's notation: in logs e_t is the exchange rate quoted as the domestic-currency price of foreign exchange, p_t is the domestic price level, and p^* is the constant foreign price level normalized to zero. Purchasing power parity holds so that $e_t = p_t$.

Domestic output, y_t , follows

$$y_t = \alpha(e_t - w_t) - u_t \quad \alpha > 0 \quad (1)$$

³Escape-clause models were developed by Flood and Isard (1989), named and extended by Persson and Tabellini (1990) and applied to fixed exchange rates by Obstfeld (1991).

where w_t is the (log) wage and u_t is a serially-independent mean-zero shock. Wages for period t are set at the end of period $t-1$ so that expected real wages stay constant,

$$w_t = E_{t-1}e_t \quad (2)$$

The policymaker has one tool in this setup, the exchange rate, and it is chosen each period after seeing the wage for the period. The policymaker initially bears no direct cost from using discretionary policy. Policymaking is explicitly purposeful and minimizes a weighted average of inflation and business-cycle considerations.

$$L_t = .5\theta(p_t - p_{t-1}) + .5(y_t - y^*)^2 \quad (3)$$

where y^* is the policymaker's output target and θ is the relative weight attached to deviations of inflation from a target of zero. The structure and results of this model are well known. As long as y^* is unrealistically high (>0 presently) and wages are set before policy, workers must anticipate that the policymaker exercising discretion will inflate attempting to reach y^* . With that expectation built into wage negotiations, it becomes optimal for the policymaker to validate the expectations. Therefore the model predicts an inflationary equilibrium even though no one is made better off by anticipated inflation. The model also predicts that the policymaker will stabilize the results of shocks but at the cost of higher than ideal average inflation.

Alternatively, the policymaker may consider replacing discretion with a rule. Presently the rule is to hold the exchange rate fixed for all time and thus hold inflation at zero. The rule removes discretion's inflationary bias but at the cost of higher output volatility since no policy response now stabilizes output shocks.

The idea behind the escape clause is to combine the best aspects of the simple rule and discretion. In the present context, the policymaker is instructed to follow the rule unless things get too bad and then and only then use discretion. This scheme has an obvious flaw. The incentives are such that the policymaker wants to declare each period to be a special case requiring discretion, producing the discretionary equilibrium again. One way to circumvent this problem is to force the policymaker to pay a cost, C , whenever the rule is broken. It is well known that such an escape-clause arrangement can be superior to always following the rule or discretion.⁴

⁴See Flood and Isard (1989) or Persson and Tabellini (1990).

Once the cost of deviating from the rule is imposed, the policymaker uses discretion only in periods when the loss from discretion, which now includes the amount C , is less than the loss from holding the exchange rate fixed. Formally, invoke the escape clause when:

$$L^D + C < L^R, \quad (4)$$

where L^D is the period loss under discretion and L^R is the period loss under the rule. When the economy's structure is described by equations (1) - (3), the criterion for indifference between maintaining the fixed exchange rate and devaluing is:

$$\lambda^{1/2}(\alpha\delta(\bar{u}) + \bar{u} + y^*) = (2C)^{1/2} \quad (5)$$

where $\lambda = \alpha^2/(\theta + \alpha^2)$, \bar{u} is a critical value of the output disturbance such that the two policies produce equal values of the loss function and $\delta(\bar{u})$ is a quadratic function of \bar{u} that represents the market's depreciation expectations.⁵

Figure 1, which is Figure 8 in Obstfeld (1994), plots the two sides of equation (5) against values of the output disturbance u . The curved line represents the left-hand side of (5) and the solid straight line (at about 0.028) portrays the right-hand side of the equation for a particular value of C . The distinctive feature of the figure is that the two lines intersect twice, at S_L and S_H . In other words, there are two solutions to equation (5) as is always the case with quadratic equations. The critical threshold for the output disturbance is $\bar{u} = 0.0028$ when S_H is the equilibrium solution and it is $\bar{u} = -0.0208$ when S_L is the solution.

In this example, market participants believe there will be a devaluation when a shock exceeds the critical threshold level \bar{u} . Suppose that the private sector expects that the appropriate equilibrium for the economy is S_H . Then the fixed rate will be abandoned by the policymakers only if u exceeds a value of 0.0028, an event that happens 45.33 percent of the time in the example. Suppose, alternatively, that the private sector anticipates the equilibrium solution S_L . Then the fixed rate will be abandoned when u exceeds a value of -0.0208 and the

⁵This is equation (35) in Obstfeld (1994). The function $\delta(\bar{u})$ that Obstfeld derives assumes a uniform distribution for the output shock, u . Many other choices for the distribution of u , however, produce multiple solutions. The advantage of the uniform is that it produces simple closed-form solutions.

probability of that happening is 84.67 percent. If the economy is currently at the S_H equilibrium and agents become more pessimistic, the economy will jump to the S_L equilibrium, increasing the likelihood that the fixed exchange rate will collapse.⁶

II. POLICY IMPLICATIONS

Obstfeld's (1994) example and many others constructed along the same lines bring up the possibility that a sudden and arbitrary shift in expectations from something like S_H to something like S_L could produce the likely collapse of a fixed exchange rate. While the multiplicity of solutions is an important feature of the model's framework and may indeed account for some of the volatility in foreign exchange markets, it also has some odd policy implications.

This model contains one policy parameter that is outside the control of the policymaker. This policy parameter is C . How should it be interpreted and what advice should be given to governments based on this research? One view is that C measures something like the degree of political commitment, government credibility or institutional support put behind the fixed exchange rate. The greater the institutional support put into the fixed exchange rate, for example, the higher the cost of devaluation. A higher cost, in turn, should strengthen the chances of keeping the exchange rate fixed. In current institutional terms, one might think that the convergence of the European Monetary System (EMS) toward European Monetary Union (EMU) can be represented in the model by an increase in C .

The model seems to be saying the opposite, however, at least for some ranges of C . Notice in Figure 1 that the height of the solid straight line is proportional to $C^{1/2}$, implying that if C is raised, the positive \bar{u} threshold solution becomes more positive while the negative \bar{u} threshold solution becomes more negative. In other words, if the economy is at the S_H solution, then raising the cost of changing the exchange rate makes a devaluation—a crisis—less likely, which makes intuitive sense. On the other hand, if the economy is at the S_L solution, then raising the cost of changing the exchange rate makes a crisis *more* likely.

According to Obstfeld's (1994) model, if the higher authority that sets C is concerned about an arbitrary shift in expectations from the higher S_H to the lower S_L equilibrium, then raising the cost of changing exchange rates, perhaps by entering into a stronger monetary union, *may be exactly the wrong policy prescription*. Holding constant the unspecified mechanism that produces jumps from the high threshold solution to the low one, raising the cost of changing the exchange rate may make crises more likely if the low threshold solution is adopted.

⁶These are the interior solutions that Obstfeld studies. An additional "corner solution" arises as an equilibrium if private agents expect that the government will always devalue.

In Figure 1, we have labeled three points on the right-hand axis as $(2C_1)^{1/2}$, $(2C_2)^{1/2}$, and $(2C_3)^{1/2}$. $(2C_1)^{1/2}$ is produced by the minimum value of C that is consistent with a real-valued solution to equation (5) in the relevant range of shock outcomes. If C is below C_1 the policymaker uses discretion for all possible shock outcomes. For C between C_1 and C_2 the model produces two solutions that fulfill equation (5). $(2C_2)^{1/2}$ is the value at which the curved line hits the right-hand axis. A higher C produces an upper intersection point outside the range of possible shock outcomes. In Obstfeld's numerical example, the curved line in Figure 1 intersects the left-hand axis at $(2C_3)^{1/2}$ and this point is above $(2C_2)^{1/2}$. For C between C_2 and C_3 the model produces two solutions, one on the right edge of the figure and one internal. For $C > C_3$ the only relevant solution is on the right axis. The model is clear on that point—if C is set high enough the fixed rate will survive all disturbances.

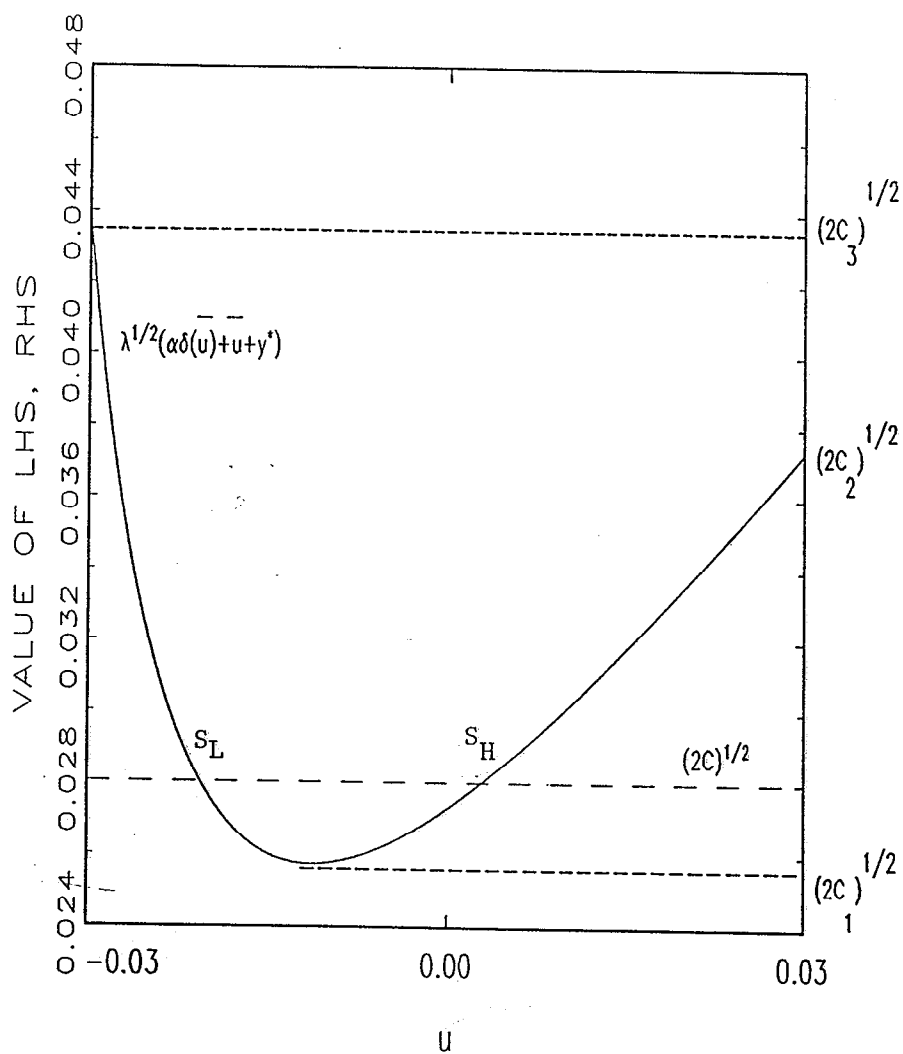
How high is high enough? Is a single common currency high enough or is an even more dramatic loss of sovereignty required? The model is not much help on this crucial point. It turns out that the model's implications about forming expectations are very sensitive to the precise shape of the probability distribution for the shock and to difficult-to-measure parameters in both private and public behavior. Obstfeld uses a uniform distribution for the shock, but if it follows a normal distribution, for example, multiple solutions are not possible in this model. With other distributions, it is simple to generate lots of solutions. Some of these solutions are like the upper solution S_H where increases in C through unilateral promises, multilateral agreements or other institutional investments make a devaluation less likely. Some of the equilibria, however, are like the lower solution where moderately large increases in C are likely to be counterproductive.

III. CONCLUSION

Second-generation attack models like the one presented here are clear on two points: (1) if the cost of devaluing is negligible, devaluations will be a regular occurrence; (2) if the cost of devaluing is set high enough, there will be no devaluations. The policy advice about appropriate exchange-rate arrangements (setting C) in situations in-between negligible costs and extremely high costs, however, is unclear. On the one hand, if it is maintained that multiple equilibria of the type studied by Obstfeld (1994) are important, then the solution to fixed-rate fragility may be to *lessen the degree of commitment to the peg rather than to increase such commitment*. In this view it is never sensible to pursue a policy of slow convergence toward monetary union. On the other hand, if multiple equilibria are just a theoretical curio, then slow convergence makes sense. As C is raised, confidence in the evolving monetary arrangements will also grow.

FIGURE 1

OBSTFELD'S MULTIPLE SOLUTIONS: UNIFORM DISTRIBUTION



References

- Agenor, Pierre-Richard, and Robert Flood, 1994, "Macroeconomic Policy, Speculative Attacks and Balance of Payments Crises," in Frederick van der Ploeg, ed., *The Handbook of International Macroeconomics* (Cambridge: Blackwell Publishers).
- Flood, Robert P. and Peter Isard, 1989, "Monetary Policy Strategies," *Staff Papers*, International Monetary Fund, Vol. 36: 612-32.
- Kydland, Finn E., and Edward C. Prescott, 1979, "Rules Rather than Discretion: The Inconsistency of Optimal Plans," *Journal of Political Economy*, Vol. 85: 473-92.
- Jeanne, Oliver, 1995, "Models of Currency Crises: A Tentative Synthesis with Special References to the 1992-93 EMS Crisis," mimeo.
- Obstfeld, Maurice, 1994, "The Logic of Currency Crises," NBER Working Paper No. 4640, in *Cahiers Economiques et Monetaires*, Bank of France 43: 189-213.
- _____, 1991, "Destabilizing Effects of Exchange Rate Escape Clauses," NBER Working Paper No. 3603.
- Persson, Torsten and Guido Tabellini, 1990, *Macroeconomic Policy, Credibility and Politics*, (Chur, Switzerland: Harwood Academic Publishers).