IMF WORKING PAPER

WP/91/10

THE INTERNATIONAL MONETARY FUND

Research Department

Speculative Attacks*

Prepared by Guillermo A. Calvo and Pablo E. Guidotti

January 1991

Abstract

A brief survey of the literature on speculative attacks is provided. The nature and causes of balance-of-payments crises, the implications for the behavior of the current account and the real exchange rate are discussed. Also, potential areas for future research on balance-of-payments crises are suggested.

JEL Classification No.
431

---

* Prepared as an entry for The New Palgrave Dictionary of Money and Finance. We thank José De Gregorio, Bob Flood, and Peter Wickham for their valuable comments.

A speculative attack is a situation in which speculators suddenly acquire a large portion of the government's stock of a resource whose price the government is committed to stabilize. While the nature of speculative attacks has interested economists for a long time, Salant and Henderson (1978) and Krugman (1979) were the first to address this issue in a context in which economic agents have rational expectations and, hence, in which speculative attacks may result from the anticipation of the effects of unsustainable government policies.

While the early literature on speculative attacks (Salant and Henderson (1978) and, later, Salant (1983)) discusses rational speculative attacks in the context of commodities markets (in particular, the gold market), subsequent work (Krugman (1979), Flood and Garber (1984b), Obstfeld (1984, 1986a and b), Dornbusch (1987), and Calvo (1987), among others) focused on balance-of-payments crises resulting from the central bank's attempt to peg the exchange rate in the presence of unsustainable domestic policies. Recently, the issue of balance-of-payments crises has been examined in the context of target zones models of exchange rates (see, for instance, Krugman and Rotemberg (1990)), in which the central bank, instead of pegging the exchange rate, intervenes in the foreign exchange market to restrict exchange rate movements within a given band.

The basic deterministic balance-of-payments-crisis model can be summarized as follows. Following Calvo (1987), consider a one-good, small open endowment-economy completely integrated in international financial markets. Consumer's instantaneous utility is denoted by $u(c_t)$ where c_t stands for consumption at time t, the subjective discount rate equals the fixed international interest rate, r, and money holdings are motivated by a cash in advance constraint, i.e., $m_t=\alpha c_t$ where m_t denotes real money holdings and α is a constant. Assuming that the foreign price level is fixed and equal to unity and that Purchasing-Power-Parity holds, the domestic price level equals the nominal exchange rate, E_t. Moreover, assuming that $u(c_t)=c_t-\phi c_t^2/2$ where ϕ is a constant, the demand for money (equal to the money supply in equilibrium) is, thus, given by

$$m_t = \alpha c_t = \bar{m} - \beta \epsilon_t, \tag{1}$$

where ϵ_t denotes the instantaneous depreciation rate of the exchange rate, $\beta \equiv \alpha^2\lambda/\phi > 0$, and $\bar{m} \equiv (\alpha/\phi)[1-\lambda(1+\alpha r)] > 0$, where λ is the (time-invariant) marginal utility of wealth.

The nominal money supply, M_t, is the sum of reserves, R_t, plus domestic credit, D_t, so that, in equilibrium,

$$M_t = R_t + D_t = E_t(\bar{m} - \beta\epsilon_t). \tag{2}$$

Domestic credit grows at a positive constant rate, μ, to finance, say, an exogenous government budget deficit. It is assumed that capital gains on international reserves are not monetized.

Consider now a situation in which the central bank attempts to peg the nominal exchange rate at the level E^f (and hence sets $\epsilon_t=0$ if it has enough reserves to sustain E^f). Under a fixed exchange rate, the money supply is demand determined. Thus, pegging the exchange rate in the presence of an expanding domestic credit implies that the central bank will loose reserves until they eventually run out.

It is further assumed that when E^f cannot be sustained any longer, the exchange rate is allowed to float with no government intervention. (Obstfeld (1984) explores an alternative scenario where, after a transitional period of floating, the exchange rate is devalued and pegged at a new, higher level.) For the time being, it is also assumed that the central bank faces an upper bound on the funds it can borrow internationally. For the sake of exposition such an upper bound is set equal to zero. (The plausibility of this assumption will be discussed below.)

We now focus on the process leading to the collapse of the fixed exchange rate regime and the speculative attack which characterizes the transition to the flexible exchange regime. Equation (2) shows that, when the nominal exchange rate is pegged (so that $\epsilon_t=0$), a fall of international reserves is required to offset the growth of domestic credit. Thus,

$$R_t + D_t = \bar{m}E^f. \tag{3}$$

When reserves are exhausted and the exchange rate floats, the nominal exchange rate must depreciate at the rate of monetary growth, i.e., $\epsilon_t=\mu$. Thus,

$$E_t = \frac{D_t}{\bar{m} - \beta\mu}. \tag{4}$$

Under perfect foresight, the transition from the fixed to the flexible exchange rate regime must imply no anticipated capital gains; that is, the exchange rate must not "jump" at the time of the regime change. For if the exchange rate were to jump at the time of the regime change, then speculators would earn an infinite rate of return on foreign assets. This, however, would lead speculators to exchange domestic money for foreign

assets--and, therefore, to exhaust reserves--an instant before the anticipated jump takes place, thus contradicting the hypothesis that the exchange rate can jump at the time of the regime change.

The rate of depreciation, of course, jumps upwards from zero to μ, inducing a discrete reduction in the demand for money equal to $\beta\mu$. In order for this reduction of the demand for money to be consistent with no discrete change in the equilibrium exchange rate at the time of the regime change, economic agents ("speculators") must be able to acquire from the central bank the equivalent amount of reserves at the pre-crisis exchange rate. This determines the timing of the speculative attack. The amount of reserves at which the fixed exchange rate regime collapses (and are consumed in the associated speculative attack) equals $E^f\beta\mu$, and can be obtained by combining equations (3) and (4) after setting $E=E^f$.

Useful insights into the behavior of the current account can also be obtained from the basic model. The increase in the nominal interest rate which occurs with the change of regime induces intertemporal substitution of consumption; i.e., consumption is higher during the fixed exchange rate regime than during the flexible exchange rate regime. This implies that a current account deficit precedes the collapse of the fixed exchange rate regime.

Extensions of the basic model can provide insights on the behavior of the real exchange rate (namely, the relative price of traded goods to home goods) in the wake of a balance-of payments crisis. If home goods were to be added to the model (as in Calvo (1987); see also Connolly and Taylor (1984)), it can be shown that the intertemporal substitution of consumption responsible for the current account deficit also induces a real appreciation of the domestic currency (i.e., a lower relative price of tradable to home goods) in the period preceding the balance-of-payments crisis.

The basic model highlights a fundamental element driving the speculative attack: the anticipation of future government policies. As a result of this anticipation, the balance-of-payments crisis may occur even when the level of reserves appears sufficiently large to handle normal balance of payments deficits. (To take an illustrative example, if in our model $\beta=1/2$, $\bar{m}$ equals 10 percent of GDP, and μ equals 10 percent, then the speculative attack would occur at the point when international reserves equal 5 percent of GDP). Thus, to the casual observer it may look as if the crisis takes most people by surprise (given its sudden occurrence) while the fact of the matter is that the speculative attack is the equilibrium outcome of a model in which all the events are fully anticipated.

In the deterministic case, the nominal interest rate remains equal to the international one right up to the time of the speculative attack. Thus, the basic model shows that the "signs" of future trouble may be found not in the money market--where nevertheless the crisis occurs--but in the goods

market, in the form of a current account deficit or a real exchange rate appreciation.

The feature that expected depreciation equals zero up to the crisis may not hold if the rate of domestic credit growth, μ, is stochastic (see Flood and Garber (1984b), Obstfeld (1986b), and Dornbusch (1987)), since the probability that a sufficiently large credit growth would induce a speculative attack can generate a positive expected depreciation even though the crisis actually materializes only later on. (However, the deterministic result would still hold true in continuous time if domestic credit, for example, follows a diffusion process.)

The basic model highlights the important role of expectations about future government policies in triggering a speculative attack. At the root of the balance-of-payments crisis, however, lies the inconsistency of domestic policies, specifically, pegging the exchange rate in a way in which it is inconsistent with the rate of money creation required to finance the public sector deficit.

Speculative attacks, however, need not necessarily be the result of fundamentally inconsistent domestic policies. As shown by Obstfeld (1986b), there may be circumstances in which speculative attacks are purely self-fulfilling events and result in the collapse of an exchange rate regime which would otherwise be perfectly viable. (A similar conclusion is reached by Flood and Garber (1984a) in the context of the gold standard.) These rational and self-fulfilling balance-of-payments crises occur as a result of an indeterminacy of equilibrium when agents expect that government policies may be modified as a result of the speculative attack. A simple example provides the flavor of this argument. Consider a situation in which the existing stock of reserves is given by $R=E^f\beta\mu$. Unlike the basic model, we now assume that the rate of domestic credit expansion equals zero unless a speculative attack which exhausts the stock of reserves occurs, after which the exchange rate floats and domestic credit grows at the positive rate μ. This conditional policy on domestic credit generates a multiplicity of equilibria. One equilibrium is the no-run equilibrium where there is no domestic credit expansion and no one expects a crisis, so that the fixed exchange rate regime is viable. A second equilibrium is one in which agents suddenly expect a crisis, which raises expected depreciation to μ. Since the change in money demand associated with the increase of expected depreciation, by construction, exhausts the stock of reserves, the regime change is triggered and the expectation that a crisis may occur becomes self-fulfilling.

In the discussion so far, an essential element of the process describing a balance of payments crisis is that the central bank has a limit on its ability to borrow. For if it had no borrowing limit, then it could always stave off a speculative attack. Borrowing indefinitely is indeed a theoretical possibility. Consider the situation described by equation (3) where reserves fall over time at the rate of domestic credit expansion.

Once reserves are exhausted, the central bank would be required to borrow to provide reserves to private agents in exchange for domestic currency, in order to continue pegging the exchange rate. Thus, the counterpart of the increase in the central bank's external debt would be an equivalent increase in private foreign assets. In a world in which taxes are of a lump-sum nature, the government could finance the service cost of increasing indefinitely its foreign debt by taxing away the interest income on the increasing stock of private foreign assets. While being a theoretical possibility, the absence of a borrowing limit to the central bank is simply unrealistic, since the incentives for capital flight which would be generated by this process would nullify the government's ability to raise an ever increasing amount of tax revenue. Thus, the presence of an upper bound to central bank's borrowing appears easily justified. It is also worth noting that, as long as there exists such an upper bound, its level is immaterial.

A more fundamental, and still unresolved, issue is whether rational speculative attacks can occur as the outcome of optimal government policy. In particular, one could argue that the speculative attack literature is implicitly about government policy priorities. In the typical model, the government sets inconsistent domestic credit and exchange rate targets. When the two policies collide, the exchange rate policy is abandoned. Providing a convincing explanation for why the government chooses inconsistent policies in the first place, and for why it sets the priorities the way it does (namely, it abandons the exchange rate policy first), remains an important open issue in the balance-of-payments crises literature.

References

Calvo, Guillermo A., "Balance of Payments Crises in a Cash-in-Advance Economy," Journal of Money, Credit, and Banking, Vol. 19 (February 1987), pp. 19-32.

Connolly, Michael B. and Dean Taylor, "The Exact Timing of the Collapse of an Exchange Rate Regime and Its Impact on the Relative Price of Traded Goods," Journal of Money, Credit, and Banking, Vol. 16 (May 1984), pp. 194-207.

Dornbusch, Rudiger, "Collapsing Exchange Rate Regimes," Journal of Development Economics, Vol. 27 (1987), pp. 71-83.

Flood, Robert P. and Peter M. Garber, "Gold Monetization and Gold Discipline," Journal of Political Economy, Vol. 92 (February 1984a), pp. 90-107.

Flood, Robert P. and Peter M. Garber, "Collapsing Exchange-Rate Regimes: Some Linear Examples," Journal of International Economics, Vol. 17 (August 1984b), pp. 1-14.

Krugman, Paul "A Model of Balance-of-Payments Crises," Journal of Money, Credit, and Banking, Vol.11 (August 1979), pp. 311-25.

Krugman, Paul, and Julio Rotemberg, "Target Zones with Limited Reserves," NBER Working Paper 3418, August 1990.

Obstfeld, Maurice, "Balance-of-Payments Crises and Devaluation," Journal of Money, Credit, and Banking, Vol. 16 (May 1984), pp. 208-17.

Obstfeld, Maurice, "Speculative Attack and the External Constraint in a Maximizing Model of the Balance of Payments," Canadian Journal of Economics, Vol.86 (February 1986a), pp. 1-22.

Obstfeld, Maurice, "Rational and Self-Fulfilling Balance-of-Payments Crises," American Economic Review, Vol. 76 (March 1986b), pp. 72-81.

Salant, Stephen W., "The Vulnerability of Price Stabilization Schemes to Speculative Attack," Journal of Political Economy, Vol. 91 (February 1983), pp. 1-38.

Salant, Stephen W. and Dale W. Henderson, "Market Anticipations of Government Policies and the Price of Gold," Journal of Political Economy, Vol. 86 (August 1978), pp. 627-48.