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Economic Models of Speculative Attacks and the Drachma Crisis of May 1994

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Abstract

Speculative attacks on fixed or 'fixed but adjustable' exchange rate regimes seem to have become a standard feature of the landscape of foreign exchange markets. The supposed excesses of seemingly untethered financial markets have been documented for some time, but only recently have the concerted attacks by speculators on exchange-rate regimes begun to occupy the popular imagination. *Economic models* of this phenomenon, however, have been around for some time, and are useful in characterizing the real-world speculative attacks that have occurred in the last 10–15 years in a number of countries. In this paper, we provide a brief overview of one such model. We also sketch some implications of that model for the speculative attack on the Greek drachma in May 1994.

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The paper proceeds as follows. Section 2 discusses a basic speculative attack model as in Flood and Garber (1984). Section 3 discusses the drachma crisis of May 1994, and the relevance of the speculative attack model to that event. Section 4 concludes the paper.

2. Speculative attack models

The fundamental feature exploited by speculative-attack models is the tension between two policies: a policy of monetization of fiscal deficits and a policy of fixing the nominal exchange rate. The tension must be resolved by the aban-

donment of one policy or the other. In practice, we see the latter policy—the fixed-exchange-rate policy—abandoned more often, and hence the focus is on the collapse of the exchange rate.

The economics of collapsing exchange-rate regimes is simple: monetary financing of expanding fiscal deficits must mean expanding domestic credit. In order to maintain the exchange rate peg in the face of expanding domestic credit, the central bank must sell its foreign exchange reserves. However, since reserves are finite, the peg cannot be maintained forever. It is clear that the fixed-rate regime must collapse eventually—the primary question is the nature of the collapse. Flood and Garber (1984) answered this question by demonstrating that the exchange rate regime will collapse in a final speculative attack in which speculators exhaust the central bank's stock of reserves. The Flood and Garber model is discussed in the next section.

Speculative attacks: the Flood and Garber (1984) model

The Flood and Garber model starts with a simple description of the money market, consisting of a money demand equation

$$M/P = a_0 - a_1 i \tag{1}$$

where M/P denotes real money balances (M is nominal money and P is the price level) and i is the domestic interest rate (the opportunity cost of holding money), and an uncovered interest parity condition

$$i = i^* + (\dot{s}/s) \tag{2}$$

where i^* is the foreign interest rate (assumed fixed for simplicity) and s is the nominal exchange rate (units of domestic currency per unit of foreign currency). Since we will be modeling the central bank's behavior, M will denote base money.

The next important relationship is the central bank's balance sheet,

$$M = R + D \tag{3}$$

e.g. the monetary base consists of international reserves and domestic credit extended by the central bank (all in domestic-currency terms). The price level is determined by purchasing power parity,

$$P = P^* s, \tag{4}$$

where P^* is the foreign price level, assumed fixed for simplicity.

Finally we have the effect of fiscal policy on the domestic money market, namely the expansion of domestic credit so that

$$\dot{D} = \mu > 0. \tag{5}$$

So far we have said nothing about the exchange rate regime. It is simple to characterize the behavior of this simple model economy under a fixed-rate regime. In such a case $s = \bar{s}$ (the fixed exchange rate) and $\dot{s} = 0$. This means that by (4) the domestic price level is constant and by (2) the domestic interest rate is constant, implying that $M = P(a_0 - a_1 i)$ is constant. If the monetary base is constant, then increases in domestic credit are exactly offset by decreases in reserves.

As mentioned above, eventually the central bank must run out of reserves in a speculative attack, after which the exchange rate floats. We next characterize the behavior of the economy *after* this attack. After the attack, reserves are exhausted ($R = 0$) so $M = D$.[5] We can now use (1) along with the other relations to substitute out for the known (imposed) dynamics of D and write money demand in terms of the exchange rate. Replacing P by P^*s, M by D, and i by $i^* + (\dot{s}/s)$ in (1) yields

$$D/P^*s = a_0 - a_1 (i^* + (\dot{s}/s)) \tag{1'}$$

or simplifying in terms of s,

$$s = \beta - \alpha\dot{s} \tag{6}$$

where $\beta = P^*(a_0 - a_1 i^*) > 0$ and $\alpha = a_1 P^*$. Guessing a solution of the form

$$s = \lambda_0 + \lambda_1 D \tag{7}$$

yields

$$\dot{s} = \lambda_1 \dot{D} = \lambda_1 \mu. \tag{8}$$

Substituting (7) and (8) into (6) yields $\lambda_0 = \alpha\mu/\beta^2$ and $\lambda_1 = 1/\beta$. After the speculative attack, the domestic currency depreciates at a rate proportional to the rate of monetization of the deficit, where the constant of proportionality depends on the foreign price level and the parameters of the money demand function.

Now we have described the behavior of the exchange rate before and after the collapse of the fixed-rate regime. The final task is to characterize the transition—the speculative attack. Flood and Garber point out that the attack must occur at the moment when the fixed exchange rate is the same as the floating exchange rate would be in a floating exchange rate regime. The logic of this idea is simple. If the attack occurs before that time—when $s < \bar{s}$—speculators will lose money by buying high and selling low (e.g buying the bank's reserves at the fixed rate and selling them at the relatively more appreciated floating rate). If the attack occurs after that time—when $s > \bar{s}$—speculators are in some

sense too late. A speculator who had attacked a moment earlier than the others would still face a market rate more depreciated than the fixed rate, and could pre-empt other speculators by buying all the reserves at that instant. Since it is hard to imagine that the other speculators would not anticipate this and move their plans for attack earlier in time, the attack cannot occur when $s > \bar{s}$ either. It thus follows that the attack occurs when $s = \bar{s}$. As we are armed with an equation for the time evolution of the floating rate, it is simple to solve for the attack time t^* as a function of initial conditions and the model's parameters. In particular,

$$s = \lambda_0 + \lambda_1 D = \lambda_0 + \lambda_1 (D_0 + \mu t)$$

or since at the moment of the attack, all reserves have been replaced by domestic credit,

$$s(t^*) = \lambda_0 + \lambda_1 D = \lambda_0 + \lambda_1 (R_0 + \mu t)$$

where R_0 is the initial level of reserves at some time 0 (we set $t_0 = 0$). Setting $s = \bar{s}$ and solve for t^*, the attack time:

$$\bar{s} = \lambda_0 + \lambda_1 (D_0 + \mu t^*)$$

or

$$t^* = (\bar{s} - \lambda_0)/\lambda_1\mu - D_0/\mu.$$

$$t^* = (R_0 - \alpha\mu/\beta)/\mu.$$

3. The Greek drachma crisis of May 1994

We next turn to some discussion of whether the simple attack model can explain the experience of an *unsuccessful* attack, namely, the attack on the Greek drachma in May 1994.[6] The Greek authorities removed controls on short-term capital movements in mid-May, well in advance of the European Union's July 1 deadline for the removal. The result was considerable turbulence in the Greek drachma market, though the Bank of Greece managed to defend the drachma through large hikes in short-term interest rates.

We briefly review the background and developments before discussing the relevance of speculative attack models for this episode. Between 1953 and early 1975, the drachma was pegged at 30 per U.S. dollar. Subsequently, the drachma has been under a managed float, with the Bank of Greece determin-

ing the exchange rate against intervention currencies during a daily fixing session. However, commercial banks can independently quote their own rates on the domestic spot exchange market.[7] The authorities have followed a 'hard drachma' policy designed to control inflation; the policy essentially consists of controlling the rate of depreciation of the drachma, with an eye to keeping a wage-price spiral from developing. However, the policy had led to some concerns in the business community that the drachma was overvalued.[8]

These concerns about overvaluation doubtless did not escape the foreign exchange (FX) trading community. In some accounts, there was a considerable amount of rumor in advance of the attack that a devaluation was coming. Offshore speculators were shorting the drachma, and FX dealers were openly predicting a currency crisis.[9] In addition to concerns about overvaluation, dealers also had concerns about the high public debt, and in particular the level of external borrowing by the Greek government. Public debt rose from about 93 percent of GDP to about 120 percent of GDP in 1993, or roughly two times the average for the EU. At the same time, foreign borrowing increased from 10 percent of total borrowing in 1990–1992 to 30 percent in 1993.[10] These aspects of the public debt, combined with the very high interest rates that these securities yielded (among the highest in Europe), led to some concerns about the Greek government's ability to pay.[11]

Generally, the liberalization of foreign exchange markets would be taken as a positive sign by FX market participants, but given the context described above, the May liberalization was surrounded by turbulence. However, May 1994 was not the first time that capital markets had been liberalized in Greece. In recent years, Greece has incrementally liberalized its foreign exchange market; in 1992, Greece formally accepted the obligations of Article VIII of the IMF's Articles of Agreement, which signals openness on capital transactions, and in 1993 liberalized many capital and foreign exchange transactions.[12] In fact, as of early 1994, relatively few restrictions remained, and while there had been some downward pressure on reserves in certain periods (particularly in the fall of 1993), reserves generally showed an upward trend (Chart 1). The drachma showed a trend of steady depreciation against the dollar, but the currency generally remained within the Bank of Greece's control and in particular within the realms of the 'hard drachma' policy pursued by the Greek authorities.[13]

About one week prior to the actual liberalization, rumors circulated that in the second week of May, 1994, the remaining controls on short-term capital movements would be removed, along with rumors that a devaluation might accompany the liberalization. During the week of May 9–13, the Bank of Greece spent about $1 billion, or about one-quarter of its liquid reserves, defending the drachma.[14] In the second week of May, the remaining controls on short-term capital were lifted, along with remaining controls on short-term forward and swap contracts.[15] Soon thereafter, the drachma came under more substantial pressure, depreciating sharply (Chart 2). Forward premia likewise

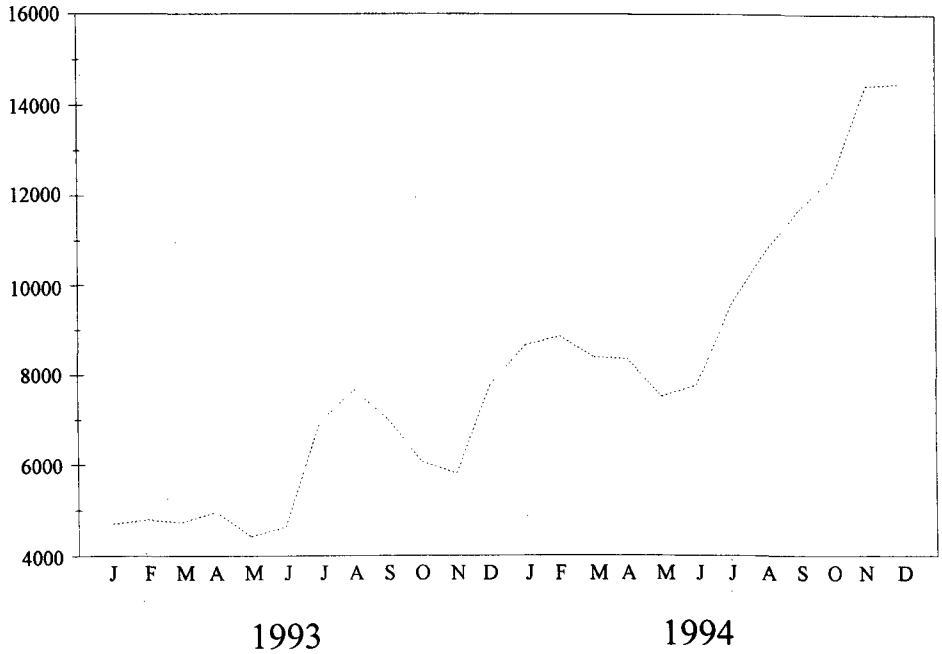

Chart 1. International reserves (in (US$). Source: IMF, International Financial Statistics.

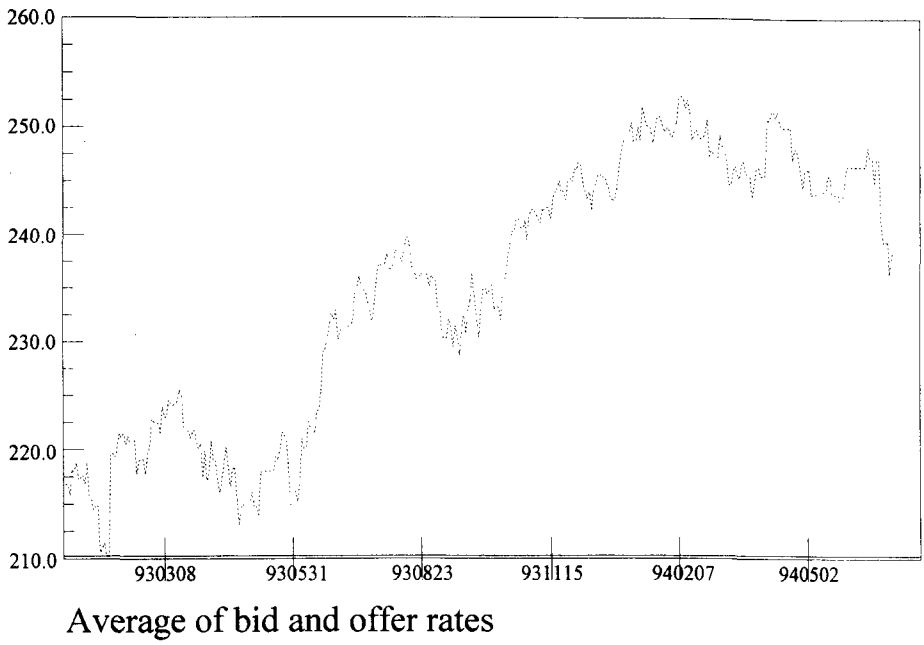

Chart 2. Exchange rate (drachma/dollar), 1993–1994. Source: Haver Analytics.

rose sharply after having decreased over the previous months (Chart 3).[16] The Bank of Greece reacted by intervening and hiking domestic interest rates to record levels. Overnight penalty rates were raised to 185 percent, causing banks to sharply raise lending rates for working capital and driving one-month deposit rates as high as 50 percent.[17] A similar strategy was employed by various other European central banks during the ERM crisis of September 1992, with varying degrees of success.[18] The strategy worked; the higher domestic interest rates attracted capital inflows and made speculation against the drachma a very expensive proposition. Certainly from the perspective of the spot rate, the strategy appeared to have worked; the drachma appreciated sharply against the dollar in mid-June, more than regaining the ground lost during May. However, the remaining high forward premium, even after the revaluation of the drachma, might have indicated some market reluctance to believe that the revaluation was permanent.[19]

The episode raises a number of questions that (one hopes) the speculative attack literature can shed some light on. First, was this episode a speculative attack? If so, what prompted the attack, and why was it unsuccessful? We address each of these questions in turn.

There is no doubt that from some perspective, the May 1994 episode was a speculative attack. The policy of monetary financing of the deficit was no doubt in conflict with the 'hard drachma' policy, which while less dramatic that

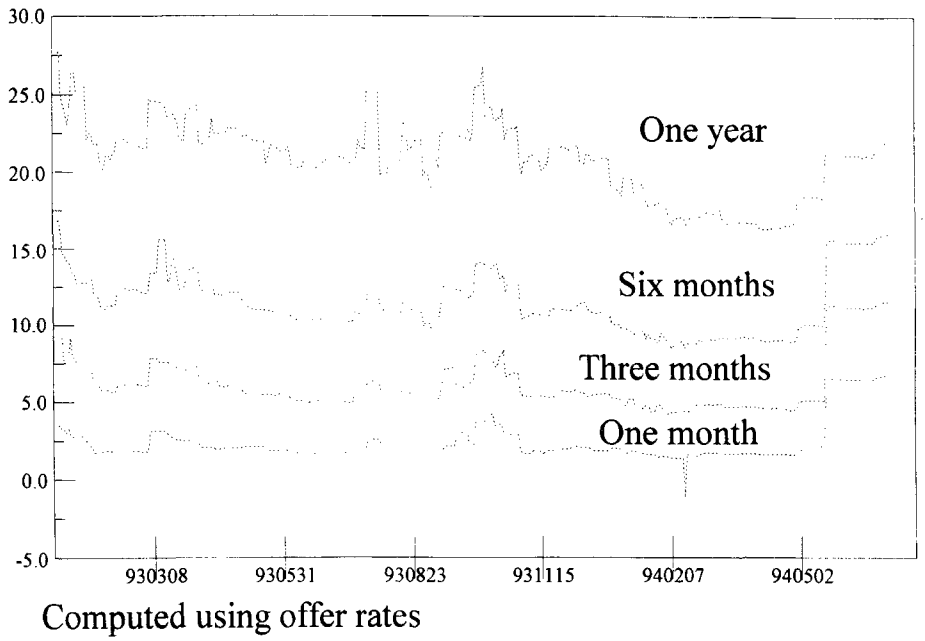

Chart 3. Forward premium, 1993–94. Source: Haver Analytics.

a strict fixed-rate policy like the one discussed in the introduction, has the same effect of introducing a tension between two policy goals. Likewise, the attack came with speculators attempting to buy the central bank's remaining stock of reserves, just as in the highly stylized example.

There were clearly several relevant forces in the run-up to the attack. First, the drachma had appreciated in real terms prior to the attack, leading some to conclude that a devaluation would have to come eventually. Second, the fiscal deficit had increased dramatically in 1993, with an especially large increase in the external financing of that deficit. Third, the Greek authorities had substantially liberalized its foreign exchange market just prior to the attack (or, in an alternative interpretation, their plans to do so had been discerned by FX traders). This latter fact suggests that the drachma was attacked because, for the first time, it was relatively easy (or the same thing, relatively cheap) to do so.

It also suggests that the reason the attack was unsuccessful was because suddenly it became much more expensive to attack the drachma. Extraordinarily high interest rates meant that borrowing drachma and selling them to the central bank for other currencies would only pay off if the drachma depreciated very sharply indeed. With banks doing repurchase agreements at 40–50 percent, FX traders would have had to have been pessimistic indeed about the drachma's prospects.[20] As mentioned above, this same strategy worked well for some other central banks during the September 1994 EMS crisis.[21]

4. Conclusion

Speculative attack models provide an encapsulated view of an important and increasingly relevant type of episode in foreign exchange markets. Most importantly, they provide a window on the fundamental types of tensions that cause exchange rate crises—namely, tensions between the exchange-rate policy (typically to maintain a fixed rate or a crawling peg) and other policies (typically an expansionary fiscal policy resulting in increasing fiscal deficits). The attack on the Greek drachma in May 1994, though unsuccessful, fits into just such a framework, and demonstrates some of the complexities of the real world that are taken into account in more complicated models of speculative attacks.

Notes

1. We thank George Tsibouris for helpful suggestions. Any errors are our own. The views expressed here are our own and do not necessarily reflect the views of the International Monetary Fund.
2. See e.g. Millman (1995) and Roberts (1995).

3. See e.g. Blanco and Garber (1986).
4. We do not provide a survey of speculative-attack models. For a good recent survey see Agenor, Bhandari and Flood (1991). See also Flood and Garber (1994) for a number of the relevant papers.
5. It would be simple to specify some nonzero minimum level of reserves $R_$, which when reached would lead the central bank to stop supporting the fixed exchange-rate regime. However, the economics of the case where $R_ = 0$ is identical to the case where $R_$ is nonzero, and requires less algebra.
6. For a discussion of other currency crises from the perspective of a speculative attack, see International Monetary Fund, *International Capital Markets Report, Part I*, April 1993, and *International Capital Markets Report*, May 1995.
7. See International Monetary Fund, *Exchange Arrangements and Exchange Restrictions*, 1995. For a discussion of the transition of the drachma to its current system in 1975, see Paleologos (1993).
8. See *EIU Country Report: Greece*, 3rd Quarter 1994, p. 20.
9. See "The End of a Greek Adventure?", *Euromoney*, September 1994, pp. 170–173.
10. Ibid. It should be noted that with the January 1994 revision in the Greek national accounts, nominal GDP was revised upwards by about 20–25 percent, so that ratios using pre-revision data would be somewhat higher.
11. *Euromoney*, ibid.
12. See International Monetary Fund, *Exchange Arrangements and Exchange Restrictions*, 1994.
13. See e.g. *Euromoney*, op. cit.
14. *EIU Country Report: Greece*, 3rd Quarter 1994, p. 16.
15. Various sources give different dates for the liberalization: the *EIU Country Report* for the third quarter of 1994 gives a date of May 14 (p. 20), while *Exchange Arrangements and Exchange Restrictions* 1995 (IMF) gives a date of May 16.
16. In fact, the forward premia imply a sharp depreciation in the drachma for some time before (and after) May 1994.
17. See Hope (1994).
18. See International Monetary Fund, *International Capital Markets Report, Part I*, April 1993.
19. Of course, since forward positions are priced off interest rates, the high premium may merely have reflected interest differentials (Grabbe 1991); indeed, domestic interest rates remained high after the attack (Hope 1994).
20. *EIU Country Report*, 3rd Quarter 1994, p. 16.
21. See International Monetary Fund, *International Capital Markets Report, Part I*, April 1993.

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