

GAME 2

SPECULATIVE ATTACKS: AN INTERACTIVE GAME

Section A: THE THEORY

The theory of fixed exchange rate regime collapses and speculative attacks has evolved through three successive paradigms.

1. In the first paradigm (Krugman, 1977, Flood and Garber, 1984), there are three assumptions that play a critical role in the collapse of the fixed regime. First, there are no capital controls in place. Second, the central bank is assumed to have access to a limited quantity of foreign reserves. And third, the government pursues "the wrong" policies (for instance, the central bank monetizes the budget deficit leading to excessive inflation) which result in a continuous loss of foreign reserves. With limited reserves, this constant attrition is bound to lead to their exhaustion and hence to the abandonment of the fixed parity. It must be stressed that according to this model, the viability of the fixed exchange rate regime is undermined by present and expected government policies. The fixed exchange rate would not survive even in the absence of a speculative attack. Speculative attack merely hasten the inevitable collapse but they do not cause it. This model has been successfully employed to explain some of the devaluations that occurred in the Latin American countries in the 70s and 80s.

2. In the second paradigm (Flood and Garber, 1984, Obstfeld, 1986), the policies pursued at present are fine. The markets, though, expect the government to switch to inflationary policies if the fixed regime is ever abandoned. This model has the feature that the fixed exchange rate regime remains viable as long as there is no massive selling of the domestic currency that exhausts the -limited- foreign reserves of the central bank. If, however, the speculators start perceiving the regime as vulnerable and decide to mount an attack, the government is forced to let the currency go (because it eventually runs out of foreign reserves). Here, the collapse of the fixed regime is not inevitable. It is caused by speculative behaviour and reflects, in a self-fulfilling manner, arbitrary -that is, not based on current economic fundamentals- expectations of a devaluation. This model has been invoked by some economists to explain the EMS crises of 1992 and 1993. According to these economists, the fixed parities would not have been abandoned had it not been for the massive attacks on the currencies that were perceived to be vulnerable (the British pound, the Italian lira and the Spanish peseta),.

3. It is now widely accepted that too much emphasis was given to the role played by limited foreign reserves by the first two paradigms. It seems that it is technically feasible to defend any fixed exchange rate parity (by either borrowing foreign reserves or shrinking sufficiently the domestic monetary base/ raising domestic interest rates). That is, the amount of foreign reserves owned by the central bank does not impose an insurmountable technical constraint on the defense of a fixed parity. Fixed regime are usually abandoned because a government chooses to not use the powerful, very effective weapons that it has at its disposal and which could kill a speculative attack (for instance, by following very contractionary monetary policies). The reason for this choice is that the policymakers are concerned about the implications of the use of these defensive weapons for other important economic variables. For instance, raising nominal (and hence real because of the fixed exchange rate) interest rates at too high levels may have detrimental effects on unemployment,

on the cost of servicing public debt and so on. Hence, under some circumstances, a government may find it preferable to devalue its currency -and thus suffer a credibility loss and perhaps higher inflation- rather than wage a fierce battle that might result in a higher fiscal burden and/or higher unemployment. What I have described is the third paradigm of speculative attacks. According to this model, a fixed regime is abandoned when the policymakers decide that the benefits of a devaluation (for instance, a possible improvement in international competitiveness) outweigh its costs (loss of credibility). This is more likely to be the case if the unemployment rate is high, if public debt is substantial and has a significant short term component (Italy), if the banking sector is troubled (Sweden) and so on. Interestingly, a devaluation may occur with or without a speculative attack, and speculative attacks are not always successful in inducing an exchange rate realignment. In this model, both economic fundamentals and arbitrary expectations on the part of the financial markets are allowed to play a role in the demise of a fixed regime.

We have designed an educational -and hopefully also entertaining- game that contains many of the elements described above. It will give you the opportunity to play either a speculator or a central banker, to do the calculations that they do in real world situations, to devise optimal strategies based on economic theory as well as your risk attitudes and your guesses about what the other market participants are doing now and in the future.

Section II: THE GAME

There are two sets of players: One set consists of international investors who start out with a fixed amount of wealth and who must decide in each period what fraction of their wealth to invest in domestic assets and what fraction to invest in foreign assets. In this version of the game we assume that the private investors trade exclusively with the central bank. (In another version we let the investors trade with one another. If there is an excess demand or excess supply of domestic currency (assets) at the pegged exchange rate then the central bank steps in to absorb any excesses in order to prevent any exchange rate movements. The main advantage of this specification is that it allows people to see what the other market participants are doing and this can make a coordinated attack more likely). In the beginning of the game, the interest rate on domestic assets is higher than that on the foreign assets. Holders of domestic assets, however, suffer a capital loss if there is a devaluation.

The other set of players is called the central bank. The central bank is assumed to be endowed with a fixed level of foreign reserves and to stand ready to exchange domestic for foreign currency and vice versa at a fixed rate. It cares about the exchange rate regime and suffers a loss if there is a devaluation of the domestic currency (perhaps because of the resulting loss of credibility, higher inflation coming from the higher cost of imported goods and so on). It also cares about unemployment and suffers a loss if it lets the unemployment rate climb to too high a level (what is meant by too high will be described below). The bank may use an interest rate instrument to make the domestic assets more attractive, but raising interest rates has an adverse effect on the domestic unemployment rate.

In addition to the domestic interest rate, the unemployment rate in the short run also depends on the exchange rate (international competitiveness) as well as on other factors which are abstracted from in the

analysis shock (for instance, world economic conditions and which are grouped together into a random, exogenous, shock. Consequently, a devaluation can be used to increase employment.

There are different types of central bankers, indexed by their tolerance of unemployment (toughness). The investors do not know what type they face, and neither do they know how much foreign reserves the bank has at its disposal in order to defend the currency. As a result, they do not know if worsening economic conditions will induce a bank to devalue to prevent unemployment from rising even in the absence of a large speculative sale of the domestic assets; or whether a massive sale of domestic assets will be successful in forcing the central bank to devalue. For instance, a bank may raise interest rates if it does not worry too much about unemployment, thus penalizing those who acquire a large position in foreign assets.

Model specification

UNEMPLOYMENT

$$(1) \quad u(t) = u(0) + 0.5 [i(t) - i(t-1)] - 0.1 \Delta s(t) + e(t)$$

where $u(t)$ is the unemployment rate in period t , $u(0)$ is the initial unemployment rate, $i(t)$ is the domestic nominal interest rate in t , $s(t)$ is the exchange rate and $\Delta s(t)$ is the amount of the devaluation, and $e(t)$ is an exogenous, random change in unemployment in period t (the omitted other aggregate demand or supply factors). Equation (1) says that an increase in the interest rate by 1% increases unemployment by half a percentage point, and a 10% devaluation lowers unemployment by 1%.

In order to keep things as simple as possible -but without compromising the analysis- we will assume that there is only one permissible rate of devaluation, namely 20%. That is, either the exchange rate remains fixed or if it is devalued it changes by 20% (otherwise the problem would be more complicated as the central bank would have to choose not only whether it will devalue but also by how much). The value of the fixed exchange rate will be set equal to unity.

CENTRAL BANK OBJECTIVE (WELFARE) FUNCTION

$$(2) \quad W = 0 \text{ if } \Delta e(t) = 0 \text{ (i.e. there is no devaluation) and } u(t) < u^*(i)$$

where $u^*(i)$ is the threshold -tolerance- unemployment level for central bank type i

$$(3) \quad W = -1 \text{ if } \Delta e(t) > 0 \text{ (i.e. there is a devaluation) and } u(t) < u^*(i)$$

$$(4) \quad W = -2 \text{ if } u(t) > u^*(i)$$

(2) says that the central bank suffers no loss if unemployment is contained and the fixed regime survives. (3) says that the bank suffers a loss of -1 if it is forced to devalue. (4) says that the bank suffers a loss of -2 if it lets the unemployment rate exceed $u^*(i)$. Obviously, a central bank that is running out of foreign reserves will never select to raise interest rates to defend the fixed exchange rate regime if that will push unemployment above $u^*(i)$. If on the other hand it has sufficient reserves it may lower domestic interest rates to prevent the crossing of the threshold value.

Note that there are some interesting signalling elements here. Suppose that you observe the bank lowering the domestic interest rate. Should you interpret this as an indication of plentiful reserves (in which case the probability of a collapse is small and hence it pays to hold mostly domestic assets)? Or should you interpret this as meaning that the bank is getting close to its tolerance level for unemployment and hence that

a devaluation is imminent (in which case you would be better off acquiring more foreign assets, that is, participating in a speculative attack against the domestic currency)? Who said that there was not a great deal of risk associated with such decisions? On the other side of the market, the central bank has to decide what kind of game to play, if, when and how to bluff (for instance, to signal toughness even if it has low tolerance for unemployment) hoping that its actions will fool enough investors to prevent them from attacking the currency. Obviously, the more investors participate in an attack, the more likely that the bank will run out of reserves and be forced into a corner: that is needing to raise interest rates

PARAMETER VALUES

$i(0) = 8\%$

$i^* = 5\%$ (i^* is fixed throughout the game)

$u(0) = 7\%$

$u^* = \{7, 8, 9, 10, 11, 12, 13\}$

Initial investor wealth: 50DM, 50FF, $s(0) = 1$

Central bank foreign reserves, $R = \{200, 300, 400, 500\}$ DM {if there are 5 investors; otherwise R will be adjusted accordingly }

The shock $e(t)$ has a uniform distribution on $[0.5, 1.5]$

The individual investors know only the composition of their own portfolio (no collusion)

The players move as follows. In the beginning of each period, the value of the shock to the economy, $e(t)$, becomes public information. The investors then proceed to choose the composition of their portfolio by trading with the central bank. Finally, the bank moves and sets the interest rate and the value of the exchange rate (that is, decides whether it will devalue or not).

The game ends if there is a devaluation. Otherwise it lasts five periods. A devaluation occurs in either one of the following cases: Either the central bank ends up with a negative level of foreign reserves during two consecutive periods but has raised interest rates between these two periods. Or the bank runs out of reserves in some period and does not raise interest rates.

The winner of the game is the individual investor who ends up with the highest level of wealth at the end of the game (the investor's income will be calculated in each period based on the asset composition of his/her portfolio, the interest rates and any capital losses due to a devaluation). A central banker is also a winner if he/she maintains the fixed exchange rate regime through good strategies and good luck.