A MODEL OF BALANCE OF PAYMENTS CRISIS: MONETARY INDEPENDENCE AS A DETERMINANT OF EXCHANGE RATE DISEQUILIBRIA

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ABSTRACT

What factors determine a government's decision to abandon a currency peg or to continue to use a fixed exchange rate? This question may be logical when one recognizes that governments can borrow international reserves and exercise other policy options to defend fixed exchange rates during currency crises. When the government initiates purposeful actions, the possibility of self-fulfilling crises and multiple equilibria become important. Speculative responses depend on anticipated government responses, which in turn, depend on how price changes affect the government's economic and political positions. This circular flow pattern implies the potential for crises that need not occur, but occur because market participants expect them to occur. This paper presents a model in which crisis and realignment result from the domestic government's fiscal, monetary and economic policies. If these policies are not consistent with the exchange rate regime and based on sound macroeconomic fundamentals, the currency peg can become untenable.

INTRODUCTION

In first generation crisis models, Krugman (1979) and Floyd and Garber (1984) assumed that a government with a persistent balance of payment deficit would use a limited stock of reserves to defend its exchange rate. This policy, of course, would ultimately be unsustainable. When reserves fall to some critical level, attempts by investors to anticipate the inevitable collapse would generate a speculative attack on he currency.

In second generation models (Obstfeld 1995, 1996), a government in choosing whether to defend a pegged exchange rate considers the tradeoff between short-run macroeconomic flexibility and longer-term credibility. The crisis arises because defending a fixed exchange rate is more expensive (i.e., requires higher interest rates) if the market believes that defense of the exchange rate will ultimately fail. As a result, a speculative attack on a currency can develop either as a result of a predicted future deterioration in fundamentals, or purely through a self-fulfilling prophecy. Krugman (1996) extended the self-fulfilling prophecy theory to the Asian crisis. Eichengreen, Rose and Wyplosz (1996) examine a large number of attack episodes, including those in which the exchange rate's defense succeeded and those in which the result was realignment. They found that speculative attack episodes exhibit significant pre-crisis changes in such variables as competitiveness, fiscal deficits, and unemployment which suggests it may be hard to explain crises without postulating that at least some involve self-fulfilling elements and multiple equilibria. Rose and Svensson (1994) concluded that the European Exchange Rate Mechanism's (ERM) credibility did not deteriorate markedly until August 1992 which suggests that most of the system's

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exchange rates were not viewed as unsustainable by markets until the 1992 crisis actually erupted. Jeanne (1996) developed a structural estimation strategy whose results indicate that France's 1992-93 exchange rate crisis had a self-fulfilling aspect. The currency crises of the 1990's can be viewed as three regional crises consisting of the ERM crisis in Europe from 1992 to 1993, the Latin American crises of 1994-95, and the Asian crises of 1997. Financial markets did not anticipate the ERM crisis. Rose and Svensson (1994) argued that interest rate differentials against the target currencies did not begin to widen until August 1992, which was a month before the crisis.

Calvo and Mendosa (1996) argued that the roots of Mexico's balance of payments crisis were in the prevailing high degree of capital mobility and financial globalization. Under these circumstances, shifts of foreign capital flows and anticipation of a banking-system bailout produced large imbalances between stocks of financial assets and foreign reserves, threatening the sustainability of the currency peg. Chang and Velasco (1998) argued that a country's financial system is internationally illiquid if its potential short-term foreign currency obligations exceed the amount of foreign currency available on short notice. They argue that the 1997-98 crisis in Asia was in fact a consequence of international illiquidity. They trace the emergence of illiquidity to financial liberalization, the shortening of the foreign debt structure, and the currency denomination of assets versus liabilities. Kaminsky and Reinhart (1999) argue that problems in the banking sector typically precede a currency crisis. The currency crisis deepens the banking crisis, activating a vicious spiral; financial liberalization often precedes the banking crisis.

Lindert and Pugel (1996) argue that one of the main objectives of government policy is to reduce the variability in exchange rates. However, they also argue that governments have other reasons for adopting a fixed exchange rate such as keeping the exchange rate low to protect certain groups in the country. Or a government may want to do the opposite: keep the exchange rate value of the currency high to benefit groups such as import buyers and to reduce domestic inflation by using the competitive pressure of low import prices. Lindert and Plugel also argue that government policy may reflect other noneconomic goals. The government may believe that it is defending national honor by maintaining a steady exchange rate or a strong currency. Devaluation or depreciation would be viewed as a confirmation of government ineptitude.

While this paper is directed toward the Asian crisis, it must be emphasized that many of the circumstances and factors that were present in the ERM and the Latin crises were also present in the Asian crisis. One of the main factors was the emergence of very large current account deficits. Several of the Asian countries had developed financial weaknesses such as heavy investment in highly speculative real estate ventures financed by borrowing from under-regulated domestic financial institutions. During 1996 the IMF and the World Bank warned the governments of Thailand, Malaysia, and other countries of the risks imposed by their financial situation, and urged corrective policies. However, these warnings were rejected.

The Asian currency crisis of 1997 opened up a new perspective on theories or models that attempt to explain why currency crises occur. Economists attempted to analyze the Asian crisis using conventional currency crisis theories. While these models had been useful in the past, it became increasingly evident that they were missing important aspects of the crisis in Asia. While every crisis is different, the Asian crisis differed from the standard currency crisis in several fundamental ways.

1. When the crisis began, all of the governments were more or less in fiscal balance, and were not engaged in irresponsible credit creation or runaway monetary expansion policies. Their inflation rates, in particular, were quite low.
2. Although there had been some slowdown in growth in 1996, the Asian economies did not have substantial unemployment when the crisis began. Therefore, this would not have been an

incentive to abandon a fixed exchange rate in order to pursue a more expansionary monetary policy, (this was held to be one of the causes of the 1992 ERM crises in Europe).

3. In all of the Asian countries there had been a boom-bust cycle in the asset markets before the currency crisis in which stock and land prices soared, and then plunged, (they plunged even further after the crisis).
4. In all of the Asian countries, financial intermediaries played a central role whether it was the domestic country's commercial banks or foreign commercial banks.

What all of this suggests is that the Asian crisis should not be viewed as a problem caused by fiscal deficits, as in first generation models. Nor should it be viewed as one brought on by short-run macroeconomic policies, as in second-generation models.

The Asian currency crisis should be viewed from an entirely different perspective. When a country (the domestic country) pegs to a currency, it is effectively relinquishing monetary policy to the central bank of the country of that currency. (In this study we refer to the US dollar but the domestic country could peg its currency to any strong currency). We postulate that the domestic country's fiscal policies are influenced by the monetary policy of this country, which in turn has economic and political implications for the domestic country.

The three strongest currencies in world financial markets are the US dollar, the Japanese yen, and the German mark (now the euro) . Most world trade is conducted in US dollars. A country whose currency is pegged to the US dollar gives up its monetary control for the benefits of a stable currency. This position places the domestic country under the influence of the monetary policy of the Federal Reserve and exposes it to the volatility of the US dollar. This study presents a model in which a balance of payment crisis and realignment result from the interaction of the US government's monetary policy and a domestic government that pursues well defined policy goals. A fixed exchange rate regime must maintain the link between the domestic currency and the US dollar. One of the problems for the Asian countries was that the US dollar was stable in terms of commodity prices, but appreciated in value relative to the Asian currencies (value being determined by the US dollar as the monetary standard). This indicated a deflationary policy by the Federal Reserve. The dilemma facing Asian countries was whether to depreciate relative to the US dollar or to maintain the peg. The Federal Reserve chairman, Alan Greenspan (1997), alluded to this problem in a speech given at Stanford University on September 9, 1997 noting that, "As long as individuals make contractual arrangements for future payments valued in dollars and other currencies, there must be a presumption on the part of those involved in the transaction about the future purchasing power of money….There will always be some general sense of purchasing power of money both across time and across goods and services. Hence we must assume that embodied in all products is some unit of output, and hence of price, that is recognizable to producers and consumers and upon which they will base their decision".

If we accept the premise that the US dollar has established itself as one of the dominant and controlling currencies (and the monetary standard) in the world's financial markets, we can postulate that its volatility is a determinant of the domestic country's exchange rate disequilibrium. We consider a simple discrete time model of exchange rate determination containing stochastic market fundamentals, which cause the regime to collapse.

A SIMPLE MODEL OF EXCHANGE RATE DETERMINATION

To present a simple model of exchange rate determination we consider a small, one-sector, open economy. In order to focus on the monetary side of the economy, we assume that its real side is characterized by full employment and that factor endowment and technology are constant. The following equilibrium conditions describe the monetary side of the economy:

$$M(t)/P(t) = a\text{-}bi(t) \quad (1)$$

$$M(t) = S(t)R(t)+D(t) \quad (2)$$

$$P(t) = P^*(t) \cdot S(t) \quad (3)$$

$$i(t) = i^*(t)+S'(t)/S(t) \quad (4)$$

where:

M(t) = quantity of high powered money
S(t) = spot exchange rate
P(t) = general price level
D(t) = domestic credit
i(t) = interest rate
i*(t) = foreign interest rate.

Equation (1) is the real money demand equation, since the output level is fixed. The coefficients, a and b, are positive numbers. Equation (2) gives the money supply, which consists of the foreign currency reserves held by the government (central bank) R(t), plus domestic credit, D(t). The spot exchange rate S(t) is used to express foreign currency holdings in terms of the domestic currency. Equation (3) is the purchasing power parity condition, where the asterisk represents a foreign variable. Equation (4) is the interest parity condition, where a (´) attached to a variable represents the rate of change of that variable with respect to time. Assuming perfect foresight, the expected rate of depreciation is equal to the actual rate of depreciation. Since we are considering a small economy, foreign variables are treated as given exogenously. This allows us to normalize P*(t)=1 and i*(t)=0.

We assume that the spot exchange rate always adjusts to its equilibrium level instantaneously and costlessly. With no government intervention, foreign reserves are fixed at Ro. Domestic credit is assumed to be increasing at the exogenously given rate of μ(>0), i.e. D´(t)=μ. The increase in domestic credit is the main feature of most currency crisis models when the government runs a deficit and finances the deficit by increasing domestic credit (printing money).

Because D(t) is changing at rate of μ, using a linear Taylor approximation, we can represent the domestic credit D(t) at time t as:

$$D(t) = D_0+\mu(t-t_0), \quad (5)$$

where D_0 is the initial domestic credit at time t_0. The change of foreign reserves over time t may be approximated by the following linear expression:

$$R(t) = R_0-\mu(t-t_0),$$

where R_0 is the initial value of foreign reserves. This has been arbitrarily chosen as schedule ABC in Fig. 1.

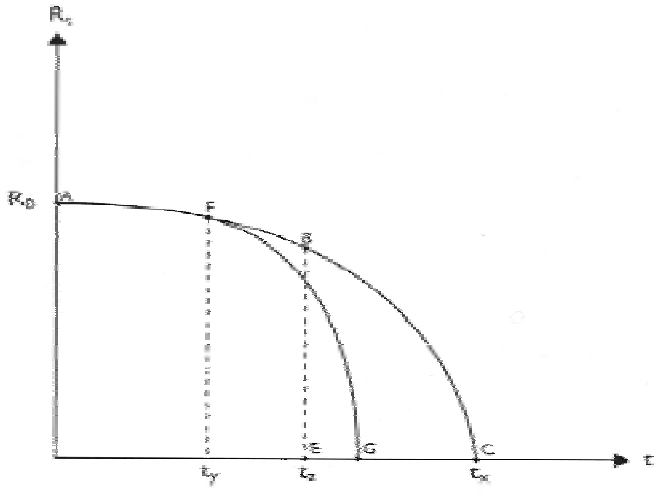

Figure 1

Combining (1), (3) and (4), we have the following equation for the money supply:

$$M(t) = a\,S(t) - b\,S'(t). \qquad (6)$$

Assuming that S' is constant, we can differentiate both sides of equation (6) to obtain:

$$M'(t) = aS'(t).$$

If we assume that reserves are fixed, then the rate of growth of the money supply M(t) equals the rate of growth of domestic credit (μ)

$$S'(t) = \mu/a$$

We can then use this expression to substitute for S' in equation (6). The solution to equation (6) is then given by :

$$S(t) = \alpha + \beta M(t), \qquad (7)$$

with $\alpha = b\mu/a^2$, $\beta = 1/a$..

Recalling that high-powered money consists of foreign reserves and domestic credit, (2) can be substituted into (7) to obtain:

$$S(t) = \alpha\delta + \beta\delta D(t), \qquad (8)$$

where $\delta = 1 / (1-\beta R_0)$.

Factoring the common δ in equation (8), we have

$$S(t) = \delta\,[\alpha + \beta D(t)]. \qquad (9)$$

Equation (9) is represented by line ABCE in Figure 2. Suppose that at time $t=t_0$, the quantity of domestic credit is D_0. This is represented by point B. As domestic credit increases, the currency is devalued and the exchange rate moves up the line BCE. Because of the constant rate of increase in D(t), figure 1 can also be interpreted as showing the change in S(t) with respect to time, with t represented by the horizontal axis.

Using equations (5) and (9), it is easy to write the exchange rate S(t) as follows,

$$S(t) = \delta [\alpha+\beta D_o + \beta(t-t_o)] \quad (10)$$

The exchange rate in (10) depends on the initial value of foreign reserves. If reserves are zero, then $\delta=1$ and equation (10) becomes:

$$S(t[OO3]) = \alpha + \beta D_o^{-} + \beta(t-t_o). \quad (10a)$$

This exchange rate is represented by line GHJ in figure 2.

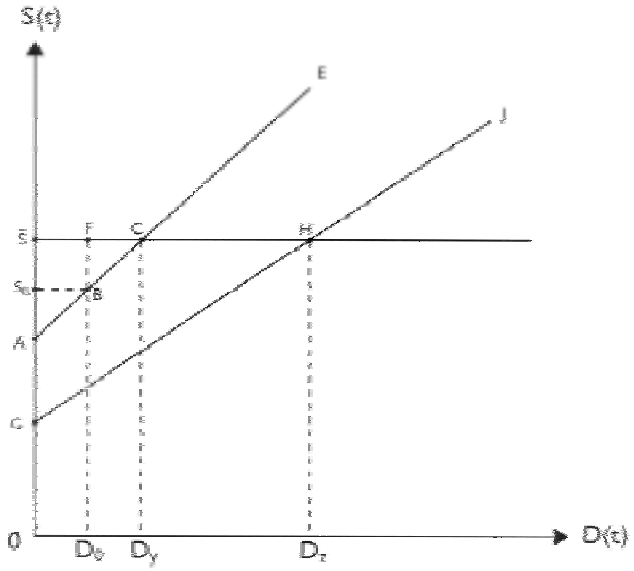

Figure 2

When the exchange rate $S(t) = S_1$ is fixed, (i.e. $S'(t)=0$), equation (6) implies that

$$M(t) = a\, S_1 \quad (11)$$

Thus, the equilibrium stock of money is proportional to the given exchange rate. Therefore, when the government pegs the exchange rate, the economy accumulates foreign reserves and thus money by

running a balance of payment surplus, or the economy losses foreign reserves and thus money by running a balance of payment eficit.

Mexico, Argentina, Brazil, and Peru have experienced currency crises of varying severity. These countries chose to peg their currencies. At some point, each of these countries experienced capital flight and a speculative attack on its currencies.

Continuous government deficits have been identified as one of the major causes of these currency crises. These deficits were financed mainly by printing money, i.e., through an increase in domestic credit held by the central banks. As Salant and Henderson (1978), Krugman (1979), and Flood and Garber (1984) have pointed out, there is an inconsistency between this deficit financing policy and a fixed exchange rate. In the model described above, the money supply is exogenous. An increase in the central bank's domestic credit will be matched by a drop in foreign reserves. Because the foreign reserves held by the central bank are finite, the government cannot maintain a fixed exchange rate regime indefinitely. Krugman (1979) argued that a crisis occurs when the central bank's foreign reserves reach a minimum level. At this point, the government has to devalue its currency or give up its fixed exchange rate policy. The change in foreign reserve follows the arbitrarily chosen schedule ABC in Figure 1. Assuming that the minimum level of reserves is zero, this implies that the crisis occurs at $t=t_x$.

Floyd and Garber (1984), however, argue that if people anticipate the devaluation, speculation will occur which could force the devaluation to happen earlier. For example, shortly before t_x, speculators can purchase the central bank's remaining foreign reserves, R' with an amount of domestic currency equal to SR'. When the exchange rate depreciates to S', the speculators can sell the foreign reserves back to the central bank, and earn a profit of (S'- S)R'. This profit may not be much if R' is small, but the profit rate is very high considering the short duration of time. As a result, whenever the anticipated exchange rate is higher than the pegged rate, one can argue that devaluation will occur before t_x. This means that the crisis will occur when $t=t_z$ and the change in the central bank's foreign reserves is described by ABE in Figure 1.

However, the path ABE assumes costless exchange transactions, that speculators have unlimited resources and know when the fixed exchange rate will be changed. Between t_y and t_z the currency is overvalued (relative to the existing stock of foreign reserves held by the central bank). Therefore, if the government's determination to defend the pegged exchange rate is unknown and speculators do not know at what point a decrease in foreign reserves will lead the government to give up the exchange rate regime, then it is possible that the investors who are most pessimistic about the economy or the resolve of the government may start moving money out of the country at or shortly after t_y. This loss of foreign reserves makes devaluation more likely by causing more people to take similar action. Finally, the capital flight and speculation become so overwhelming that the government cannot defend the exchange rate anymore. The result is a possible adjustment path of foreign reserves as described by schedule AFG in Figure 1.

THE SELF-FULFILLING CURRENCY CRISIS

Krugman (1996) supposes that a fixed exchange rate could be costly to defend, if people expect that it will be depreciated in the future. The use of higher interest rates to defend the currency could either worsen the cash flow of the government (or indebted enterprises) or depress output and employment.

The earlier model can be used to explain the feature of a self-fulfilling currency crisis. Suppose that the central bank currently owns foreign reserves (R_o>0), and that the government keeps domestic credit constant (μ=0). From (8) with α = 0, the flexible exchange rate corresponding to foreign reserves R_o is given by

$$S(t) = \delta\beta D(t). \quad (12)$$

Equation (12) is illustrated by line OAB in Figure 3. Line OAB assumes a positive level of reserve holdings.

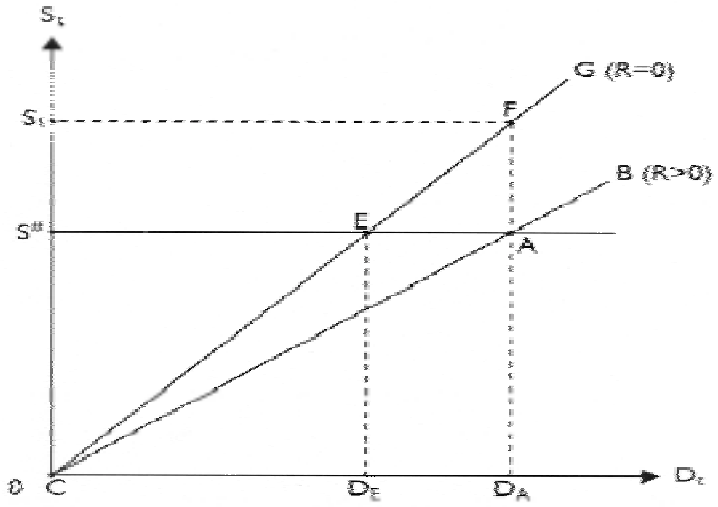

Figure 3

If R_0 = 0, then δ=1. Equation (12) becomes $S(t)= \beta M(t)$

Since β =1/a, we obtain:

$$M(t) = aS(t) \quad (13)$$

The equilibrium stock of money is proportional to the exchange rate. This is similar to (11). In this case there is no deficit and when the government pegs the exchange rate, the economy accumulates foreign reserves and thus money by running a balance of payment surplus.

Let the current domestic credit be D_A and let the exchange rate be pegged at $S^{\#}$. This is depicted by point A in the diagram. Since domestic credit is fixed, the economy can avoid the type of crisis as described above, and can stay at point A indefinitely.

Suppose now that currency speculators believe that there is a positive probability that the government will devalue the currency in the near future. Specifically, if the foreign reserves fall below a minimum level, such a zero, the shadow exchange rate will then be equal to the flexible rate. Floyd and Garber (1984) describe a shadow exchange rate as the exchange rate under the condition R_o=0. Prior to

the collapse at t_z, money remains constant, but its components vary. D(t) rises at the rate μ and reserves decline at the same rate. Since reserves fall to zero, money equals domestic credit (after t_z). It is also assumed that the value of the floating exchange rate depends only on market fundamentals. In figure 3, line OEFG shows the shadow flexible rate and is based on the premise that reserves are zero.

If the speculators have the resources and choose to purchase all of the foreign reserves held by the central bank, the government will give up its fixed exchange rate policy and the exchange rate will jump up to $S_1 > S^{\#}$, as represented by point F in Figure 3. This devaluation occurs despite the fact that the economy is fundamentally solid, with no
domestic credit creation due to deficit financing.

In terms of the resources held by the speculators, Obstfeld (1996) distinguishes among three different cases: (a) when the resources of the speculators are less than Ro; (b) when the resources of each speculator are greater than Ro; (c) when none of the speculators has resources greater than Ro, but when two or more have combined resources greater than Ro. In case (a), devaluation will not occur. In case (b), devaluation will occur when any one of the speculators purchases Ro from the central bank, causing devaluation. In fact, all of them will try to be the first to do so. In case (c), if a sufficient number of speculators believe that devaluation will occur and purchase foreign reserves, devaluation will definitely occur, even though without speculation, the fixed exchange rate regime could have survived indefinitely. If the currency is devalued, the total profit of the speculators is $(S_1 - S^{\#})R_o$.

The crisis that occurs is case (c) has two features: (1) there are multiple equilibria; (2) it is self-fulfilling in the sense that it will not occur if none of the speculators act, but will occur if a sufficient number of them act.

Figure 3 also shows that a self-fulfilling crisis can occur when domestic credit is in between D_A and D_E. As explained before, if the central bank loses all its foreign reserves, the exchange rate becomes flexible, jumping up to a point in between E and F on OEFG. If the initial value of domestic credit is equal to D_E, the speculators will earn no profit.

If the initial domestic credit is less than D_E, no speculation will occur because if the fixed exchange rate breaks down, appreciation of the currency will occur and the speculators lose money. If domestic credit is greater than D_A, the currency is overvalued and speculators will have a bigger incentive to attack the exchange rate.

SUMMARY

This study presents a model that focuses on the relationship of the money supply to the exchange rate of the domestic government. When the government pegs the exchange rate, the economy accumulates foreign reserves and thus money by running a balance of payment surplus, or the economy loses foreign reserves and thus money by running a payment deficit. If, the exchange rate is fixed, the domestic country trades its monetary independence for the advantages of a stable currency. Without a discretionary monetary policy, the money supply will remain constant.

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