UNIVERSITY OF NOTTINGHAM

Discussion Papers in Economics

Discussion Paper
No. 00/4

FINANCIAL FRAGILITY AND CURRENCY CRISES

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February 2000 DP 00/4

Abstract
The standard model of currency crises is amended to distinguish between unemployment aversion and financial fragility. Fragility is assumed to affect the authorities' sensitivity to a combination of high real interest rates and unemployment. An increase in fragility expands the region of potentially self-fulfilling crises at the expense of the "safe" region, particularly if the fundamentals are weak. Although exposure to foreign exchange losses and dependence on the exchange rate as a nominal anchor both raise the cost of (and resistance to) devaluation, this has relatively little effect in the presence of financial fragility and poor fundamentals.

JEL Nos: F31

Keywords: Banks, credibility, exchange rates, inflation, interest rates

1. INTRODUCTION

The theory of currency crises has evolved from the seminal models of Krugman (1979) and Flood and Garber (1984), in which governments were assumed to pursue an exogenously given monetary policy that was inconsistent with a pegged exchange rate, to more complex ideas in which government policy is endogenised and the exchange rate peg is maintained only if it yields a higher value of social welfare than devaluing or floating (see Flood and Marion, 1999, or Jeanne, 1997, for a good introduction). "Loss of resolve" models have thus replaced "loss of reserves" models which focused on the timing of an inevitable speculative attack. A significant feature of the new models is the possibility of multiple equilibria: this possibility arises because stronger expectations of a devaluation itself make a devaluation more likely by pushing up interest rates and raising the welfare cost of maintaining the peg. Analytically these models are similar to "escape clause" models of monetary policy, in which the government deviates from a commitment to zero inflation only in exceptional circumstances, and pays a lump-sum penalty for doing so (Lohmann, 1992).

Cost-benefit models are certainly a more realistic description of recent currency crises than their predecessors. Indeed some models have been explicitly designed to capture important features of the crises in the exchange rate mechanism (ERM) of the European Monetary System by allowing for a government's resolve to be weakened by unemployment (Drazen and Masson, 1994; Masson, 1995; Ozkan and Sutherland, 1995). It is not so clear, however, that these models yield much insight into the *differences* between the ERM crises and more recent crisis episodes such as those in Mexico, Asia and Brazil. Indeed, as discussed in the next section, these models are in danger of explaining too much, since they could easily be interpreted as suggesting that the continuously changing fortunes of political parties are liable to trigger currency crises. This paper is, therefore, an attempt to adjust the standard model to reflect the variety of recent crisis experiences.

2. BACKGROUND

A standard formulation of "second-generation" currency crisis models is that the government minimises a loss function that is quadratic in inflation and output, subject to an expectations-augmented Phillips curve that includes a stochastic (but possibly persistent) shift factor and a cost of abandoning the exchange rate peg (Drazen and Masson, 1994; Masson, 1995; Obstfeld, 1996; Sachs *et al*., 1996). Because inflation is higher when the peg is abandoned, a higher probability of a switch of regime entails higher inflationary expectations and therefore a higher output cost of maintaining the peg. Although higher inflationary expectations also reduce the output gain from surprise inflation in the event of devaluation, the former effect predominates, and so stronger speculation against the peg itself renders devaluation more likely. The shift factor in the Phillips curve is interpreted as a "fundamental" variable (e.g. the real exchange rate) that affects the output cost of the pegged exchange rate.

This model, which is a simple open-economy version of Barro and Gordon's (1983) model of monetary policy, highlights the potential conflict between exchange rate pegging and other policy objectives (employment and growth) in a way which "first-generation" models of currency crises did not. Nevertheless, because of the central role of the government's preference parameter in the model, a crisis potentially arises as much from a shift in the government's "tastes" as from a deterioration in the fundamentals. If preferences vary across the political spectrum, as is assumed in a well-established body of research (Alesina, 1987; Alesina and Roubini, 1990), an increase in the probability of a victory for the "employment party" in the next election might well trigger a currency crisis. Indeed, given the volatility of the electoral fortunes of political parties, one would tend to expect political rather than economic events to dominate the history of currency crises.

This is not borne out by the experiences of the 1990s. Recent crises occurred for identifiable *economic* reasons: poor fundamentals (Britain, France, Brazil) and/or because the willingness of governments to use the interest rate defence had been sapped by difficulties in the banking sector (Mexico, Thailand) rather than because another political party was about to take power. The U.K. was not forced out of the ERM during the months when the Labour Party looked likely to win an election which had to take place by May 1992 at the latest, but rather in September 1992, five months after the Conservative Party had unexpectedly won that election, and when the country had been waiting in vain for over a year for signs that the recession was ending. In Mexico, it is true that the crisis occurred in the aftermath of a Presidential election, but there is no suggestion that the market's perception of differences in the preferences of the candidates played a role in it.[1]

Moreover, the exact representation of the fragility of the banking sector in this model is unclear. Implicitly, fragility is regarded as a factor that increases the weight attached to output (after all, how else can it be represented?), but this is less than fully convincing. In what follows, I propose a modification of the canonical cost-benefit model of currency crises that addresses these issues.

To motivate the subsequent discussion, Table 1 presents basic data on some of the major exchange rate collapses of the 1990s. The European countries that succumbed in 1992/3 were suffering from recession, but their current account balances do not suggest enormous overvaluation. After the collapse of the peg they lowered interest rates and were able to resume growth. Mexico and Thailand had very large current account deficits, and their resort to the interest rate defence was to some extent inhibited by banking sector weaknesses, which were associated in Thailand with the collapse of a property boom. After the collapse of their exchange rate pegs, both countries suffered unexpectedly deep devaluations and negative growth rates. Brazil is a particularly interesting case. Its currency was widely considered to be overvalued, and this was reflected in a large current account deficit. Although, as the table shows, the deficit was smaller than Mexico's or Thailand's as a proportion of GDP, it was larger as a proportion of exports, since Brazil is a considerably less open economy. Nevertheless Brazil was able to resist contagion from the Asian crises in 1997 by raising interest rates to an astonishingly high level. It was only a year later, once these high interest rates had pushed the economy into recession and showed no signs of coming down, that Brazil decided to float – and promptly suffered a very large depreciation.

[1] For discussion of these and the other crises of the 1990s, see Agénor *et al*. (1999), Eichengreen and Wyplosz (1993), Calvo and Mendoza (1996), Dornbusch *et al*. (1995), Krugman (1999) and Sachs *et al*. (1996).

3. THE MODEL

The model which is presented here is very much in the class of “second-generation” currency crisis models, but it embodies a distinction between government preferences (the relative weights on employment and inflation objectives) and structural factors that influence the willingness to resort to the interest rate defence.

The novelty of the model resides in the social welfare function. The government minimises a loss function defined over inflation (π), the unemployment rate (u), a cost of switching exchange rate regimes (C) and the deviation of the *ex post* real interest rate (r) from the world level (r^*). The loss function for each period is:

$$L = 0.5\pi^2 + [b + f\,(r - r^*)]u + jC, \qquad (1)$$

where j is a dummy variable which takes the value 1 in a period when the exchange rate regime changes (and zero otherwise), and a, b and f are parameters (all assumed positive). The first and last terms of this equation are standard. The middle term replaces the standard quadratic in output with a multiplicative term in the real interest rate differential and unemployment. This helps to focus attention on factors that may make governments unusually sensitive to a combination of high interest rates and unemployment, such as the fragility of the financial sector. Weaknesses in the banking system are assumed to increase f, since higher real interest rates and depressed demand both raise the proportion of non-performing loans. The introduction of this “fragility parameter” (f) removes some of the burden of explanation from the “preference parameter” (b), and thus makes a subtle but important difference to the implications of the model.[2] It will be seen that, because the equation is only linear rather than quadratic in (un)employment, the decision whether or not to abandon the exchange rate peg is relatively insensitive to b.

[2] One possible alternative justification for the specification chosen for equation (1) is that governments are more sensitive to the inconsistency between policy and the state of the economy than to unemployment *per se*. Bad outcomes can be blamed on unfortunate circumstances but it is much harder to justify policies that appear designed to make bad outcomes worse. The value of f may also be influenced by such factors as the proportion of housing debt subject to a floating interest rate, as well as by financial sector weakness.

Equation (1) is maximised subject to:

$$u = -a(\pi - \pi^{e}) + hq, \qquad a>0,\ h>0 \tag{2}$$

where q is real exchange rate misalignment and π^e denotes inflationary expectations. The foreign price level is assumed constant. Under floating, q always takes the value zero.

The order of events is as follows. We start at time zero with a pegged exchange rate. In each period, the government issues bonds that are redeemed at the beginning of the next period. It then decides whether to continue pegging the exchange rate for a further period or to float. Once floated, the exchange rate is never pegged again.[3]

Risk-neutral bond-holders require the same rate of return on domestic and foreign bonds. This implies a nominal return of $i = r^* - \Delta e^e$, where e is the nominal exchange rate (foreign currency units per unit of domestic currency). The expected rate of devaluation ($-\Delta e^e$) is equal to the probability that the pegged rate is abandoned (p) times the extent of the devaluation, should one occur (d). There are various ways of modeling d – as a constant (Masson, 1995), or as a choice variable of the government (Obstfeld, 1996). Here I assume that the nominal devaluation is sufficient to eliminate real exchange rate misalignment. Of this devaluation, a proportion λ results in higher domestic prices and a proportion $1-\lambda$ is a real devaluation. Thus we have a nominal interest rate differential

$$i - r^* = -\Delta e^e = pd = \pi^e/\lambda = pq/(1-\lambda), \tag{3}$$

and an *ex post* real interest rate differential of

$$r - r^* = \pi^e/\lambda - \varphi\lambda q/(1-\lambda), \tag{4}$$

[3] This begs the question of why the currency is pegged in period zero. It is convenient to assume that some parameter (such as *f*) was previously at a value where the currency was immune from speculative attack, and in period zero undergoes a step change which is assumed permanent. Some authors assume

because $\pi=0$ if the peg is maintained ($j=0$), and $\pi=\lambda q/(1-\lambda)$ if the exchange rate is floated ($j=1$). Note that, because of the real exchange rate adjustment, the *ex post* real interest rate can be above the world average in both cases.[4]

I have not yet discussed the cost of changing the exchange rate regime (C). This cost will be assumed to be of the form

$$C = z + cq, \tag{5}$$

which implies an element of fixed cost (z) plus a further element that is proportional to the extent of real devaluation (cq). The latter element reflects the post-devaluation increase in the real burden of (unhedged) foreign debt held by the public and private sectors. To the extent that the foreign debt represents liabilities of the banking system, this is a further aspect of financial fragility.

We are now in a position to calculate the first-period cost of maintaining the peg (L_{peg}) and of floating (L_{fl}). Substituting from (2) and (4) into (1) and solving for $\pi=0$ yields

$$L_{\text{peg}} = (b + f\mu pq)(h + a\lambda\mu p)q, \tag{6}$$

where $\mu = 1/(1-\lambda)$. If the exchange rate is floated, there is a real devaluation of q that eliminates the exchange rate misalignment but generates inflation of $\pi=\lambda q/(1-\lambda)$. A similar calculation results in

$$L_{\text{fl}} = 0.5\lambda^2\mu^2 q^2 - a\lambda\mu(1-p)[b + f\mu(p-\lambda)q]q + z + cq. \tag{7}$$

The first term in (7) is the inflation cost; the second term is the welfare gain from surprise inflation (which could be a loss if $p<\lambda$ to a sufficient degree); and the

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that q has a stochastic component. In a multi-period context, however, this is inconvenient since it would involve expectations of expressions that are non-linear in q.

[4] For example, if $\lambda=0.5$, $p=0.6$ and $q=0.05$, then $d=0.10$ and $r-r^*$ is either 0.06 (peg maintained) or 0.01 (peg abandoned).

remainder is the cost of switching exchange rate regimes.[5] The difference between these two, which I shall term the *transitional net benefit of abandoning the peg*, is:

$$T = L_{\text{peg}} - L_{\text{fl}} = [b(h+a\lambda\mu)-c]q + \{af\lambda\mu[p(1+\lambda)-\lambda]+fhp-0.5\lambda^2\mu\}\mu q^2 - z. \quad (8)$$

What happens in subsequent periods? If the peg is not abandoned, then the government faces exactly the same problem, with the same parameter values, as in the first period. Thus the present value of the welfare loss of staying on the peg for ever (V) is

$$V = L_{\text{peg}}/(1-\delta) \quad (9)$$

where δ is the discount factor.

If the government decided to float in the first period, then it cannot ever reverse that decision, but in return enjoys q=0 for ever. The welfare loss under floating depends on the institutional capacity to deliver low inflation without the exchange rate anchor. With an independent central bank and an effective inflation targeting regime, the government may be able to achieve zero inflation under floating rates, yielding a welfare loss of zero (since $\pi=u=0$). At the other extreme, the government is forced to the discretionary equilibrium ($\pi=ab$, u=0) with a welfare loss in each period of $a^2b^2/2$. If we denote the government's credibility under floating rates by θ, then θ can be defined as follows:

$$\theta = 1 - (\pi^e_{\text{fl}}/ab) \quad (10)$$

where π^e_{fl} is inflationary expectations in the first period after the transition to floating exchange rates. It can be seen that θ represents the probability that the government will deliver zero inflation rather than $\pi=ab$. It is therefore also an index of the welfare loss of a floating exchange rate regime in comparison with a pegged rate with no

[5] The middle term is calculated on the assumption that equation (2) is shifted by devaluation to the q=0 position. Nevertheless q still appears because inflation and real interest rates are functions of q. A welfare loss from this term is a somewhat artificial result that arises from a combination of negative unemployment and a negative real interest rate differential.

misalignment.[6] Given q, the government has the choice between repeatedly setting p=0 to convince the private sector of its determination and capacity to resist the temptation to inflate (and suffering some unemployment in the meantime) or capitulating by playing p=ab and enjoying the employment benefits of some surprise inflation initially. This type of problem has been analysed by Backus and Driffill (1985). There is some critical value of q (call it q*) above which the inflationary solution is preferable. Nevertheless the present value of welfare losses under floating rates [W(q)] will have the form:

$$0 \leq W(\mathrm{q}) \leq a^2b^2/[2(1-\mathrm{d})], \qquad W'(\mathrm{q})<0. \tag{11}$$

Combining (10) and (11), we see that the present value (S) of the net benefit of being in a floating rather than a pegged exchange rate regime, *conditional on having been in the same regime in the previous period*, is given by:

$$S = [1/(1-\mathrm{d})]L_{\text{peg}} - W(\mathrm{q}). \tag{12}$$

Thus the total (transitional plus long-term) net benefit of switching regime is:

$$N = T + \mathrm{d}S. \tag{13}$$

If $N>0$, the peg is abandoned; if $N<0$, the peg is maintained. This latter condition is always satisfied if $q=0$. With no real exchange rate misalignment, there is zero devaluation even if the peg is abandoned, so there is no real interest rate differential nor any shift in the Phillips curve. To float would incur the cost of changing regimes (z) for no benefit. In the discussion which follows, I therefore assume a positive q throughout.[7]

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[6] In a crude way q captures the idea, evident from Table 1, that some countries suffer more from an exchange rate collapse than others. In reality, losses may also arise from other sources, most prominently reduced expectations of output growth (because of possible policy reversals (Mexico) or fears that the East Asian economic miracle had run its course) and a credit crunch associated with a severely weakened banking system.

[7] Negative values of q would, if large enough, also lead to abandonment of the peg, accompanied by revaluation and negative transitional inflation. Because $b>0$, a larger $|q|$ is required to trigger a regime change for negative than for positive deviations.

The partial derivatives of the transitional and long-term elements of *N* are presented in Table 2. The partial derivative with respect to unemployment aversion (*b*) is positive for the transition (because the real devaluation reduces unemployment) but ambiguous thereafter, because higher values of *b* are associated with higher inflation under floating rates:

$$N'(b) = [1/(1-\delta)](h + a\lambda\mu + \delta a\lambda\mu p)q - W'(b). \tag{14}$$

This may help us to understand why recent currency crises are not well explained by models in which *b* varies across political parties. Only if θ=1 (full credibility), so that inflation is zero under floating rates [$W'(b)$=0], is *N* definitely increasing in *b*. In general, however, the higher *p* and *q*, the more likely it is that $N'(b)>0$, because of the unemployment effects.

The partial derivative with respect to financial fragility is negative at very low *p*, when there are virtually no expectations of the peg being abandoned, but increases strongly with *p* and also with *q*:

$$N'(f) = \{hp+a\lambda\mu[p(1+\lambda)-\lambda]\}\mu q^2 + [\delta/(1-\delta)](h+a\lambda\mu p)\mu pq^2. \tag{15}$$

This reflects the fact that at low *p*, the interest rate differential is very low. At the other extreme, the losses from the term in *f* can get very large under pegged rates if both interest rates and unemployment are high (a high *p* tends to raise both interest rates and unemployment, whilst *q* affects unemployment).

The partial derivative with respect to real exchange rate misalignment is not inevitably positive but very likely to be so because of the sign of the long-term effects:

$$\begin{aligned} N'(q) = {} & b(h+ a\lambda\mu) - c + 2\mu q\{fhp+af\lambda\mu[p(1+\lambda)-\lambda]-0.5\lambda^2\mu\} \\ & + [\delta/(1-\delta)](h+a\lambda\mu p)(b+2f\mu pq). \end{aligned} \tag{16}$$

It is also strongly increasing in *f* and *p*.

The partial derivative with respect to the probability of the peg being abandoned is unambiguously positive provided that $q>0$:

$$N'(p) = [fh+af\lambda\mu(1+\lambda)]\mu q^2 + [\delta/(1-\delta)][(fhq+ab\lambda+2af\lambda\mu pq)]\mu q. \qquad (17)$$

Note that $N'(p)$ is increasing in both f and p. The strong positive interactions between f, p and q in the formula for N are reflected in the unambiguously positive third derivative as soon as q rises above zero:

$$N_{\mathrm{fpq}} = 2\{[a\lambda\mu(1+\lambda)] + [\delta/(1-\delta)](h+2a\lambda\mu p)\}\mu q. \qquad (18)$$

Of course p cannot move outside the range of zero to one. I now focus on the values of p for which $N=0$. These critical values (denoted p^*) represent the minimum devaluation probability, in the view of the foreign exchange market, required to cause the government to prefer to abandon the peg. Since N is a quadratic in p, there are in general two solutions, but one of them is negative and therefore economically meaningless. If $p^*>1$, the pegged regime is safe from speculative attack; if $p^*<0$, the pegged regime always collapses. For $0<p^*<1$, we are in the region of potentially self-fulfilling crises: with a sufficient proportion of speculators expecting an attack to succeed, the peg is abandoned. What we want to know is how p^* is affected by other variables. In the case of financial fragility we have

$$\mathrm{d}p^*/\mathrm{d}f = -\,N'(f)/N'(p^*). \qquad (19)$$

If this is negative, then an increase in f reduces p^* and makes a currency crisis more likely. In what follows I state a series of propositions that follow from differentiating expressions like (19) in order to understand the factors that affect the sensitivity of p^* to financial fragility and other variables.

Proposition 1. *The impact of a unit increase in financial fragility on* p* *is positive at* p*=0 *and negative at* $p^*=\lambda/(1+\lambda)$ *and* p*=1, *and decreases monotonically with* p*.

Proof

From equation (15) it can be seen that $N'(f) < 0$ for $p=0$ and $N'(f) > 0$ for $p > \lambda/(1+\lambda)$. From (17) $N'(p) > 0$ for all non-negative p. Differentiation of (19) yields:

$$\mathrm{d}[\mathrm{d}p^*/\mathrm{d}f]/\mathrm{d}p^* = [N_\mathrm{p}\, N_\mathrm{fp} - N_\mathrm{pp}\, N_\mathrm{f}]/N_\mathrm{p}^2 \qquad (20)$$

For the proof that this is negative for all $0 < p^* < 1$, see Appendix. #

Proposition 2. *The impact of a unit increase in financial fragility on* p* *increases monotonically in magnitude with real exchange rate misalignment* (q).

Proof

Equation (19) may be written as

$$\mathrm{d}p^*/\mathrm{d}f = -\, x_1/[x_2 + x_3/q] \qquad x_2, x_3 > 0 \qquad (21)$$

It is clear by inspection that the denominator is decreasing in q, so that $|\mathrm{d}p^*/\mathrm{d}f|$ is increasing in q, with the opposite sign to $N'(f)$. #

These two propositions imply that for small p^* (where a crisis requires only a small proportion of speculators to expect the peg to be abandoned), financial fragility makes little difference. In other words, if a successful speculative attack is already highly likely, greater financial fragility does not make it inevitable. At large p^*, however, an increase in financial fragility has a much larger negative effect on p^*, and this effect is magnified at higher q. This implies that, particularly when the fundamentals are poor, a weakening of the banking system is capable of pushing the economy from the region in which it is immune from currency crises ($p^*>1$) to one in which a self-fulfilling crisis is possible ($p^*<1$).

This contrasts markedly with the situation with respect to the “preference” parameter (b): $\mathrm{d}p^*/\mathrm{d}b$ is of uncertain sign at low values of p^* (particularly if q is low), but at higher values tends to be negative (much as with f). However the absolute value tends to decline eventually as q increases, particularly if $W'(b)$ is small, because of the quadratic terms in q in the denominator. Moreover, since both numerator and denominator are linear in p^*, the impact of changes in p^* on dp^*/db cannot be unambiguously determined. The effect of unemployment aversion is also reduced at higher values of financial fragility:

Proposition 3. *Pure preference effects (as represented by the partial derivative of* p* *with respect to unemployment aversion) decline monotonically in magnitude as financial fragility increases.*

<u>Proof</u>

This follows because $N'(b)$ is independent of f and $N'(p)$ is increasing in f. #

Proposition 3 refers to the absolute magnitude and not the sign of dp^*/db. In the special case of q=1, the following proposition holds with respect to the sign of these effects.

Proposition 4. *If* q=1, *then greater unemployment aversion reduces* p*, *but the partial derivative declines in magnitude as real exchange rate misalignment increases*.

<u>Proof</u>

If q=1, then $W'(b)=0$ and $N'(b)$ is positive and proportional to q. It follows from (17) that dp^*/db is inversely related in magnitude to q. #

Together these propositions suggest that shifts in preferences are less likely to precipitate currency crises when structural factors (weak fundamentals and financial fragility) make a currency more vulnerable: a given change in b tends to have less impact on p^* with high f and high q. This result is consistent with the earlier observation that the currency crises of the 1990s appear to be more a consequence of unemployment, misalignment and financial fragility than of shifts in political preferences.

Since $N'(p)$ is quadratic in q, and $N'(q)$ only linear, the marginal effect of an increase in misalignment on p^* declines as q increases.[8] This follows from equations (16) and (17). Because both numerator and denominator are linear in f, however, $\mathrm{d}p^*/\mathrm{d}q$ is not strongly related to financial fragility. If these observations are combined with Proposition 2, an interesting further proposition emerges to the effect that, as the fundamentals deteriorate, a further deterioration becomes steadily less of a threat to the exchange rate peg relative to a weakening of the banking system.

Proposition 5. *The impact on* p* *of an increase in real exchange rate misalignment relative to the impact of an increase in financial fragility declines monotonically as misalignment increases*.

Proof

This proposition is true if $N'(q)/N'(f)$ declines monotonically with q for all $q>0$. Since $N'(q)$ is linear in q and $N'(f)$ is proportional to q^2, the proposition follows provided that p^* is sufficiently large that $N'(f)$ is positive. #

It is clear from Table 1 that a low institutional capacity to resist inflation and high exposure to foreign losses increase the attractiveness of pegged rates. Exposure to foreign exchange losses might derive from the liabilities of the public sector (as in Mexico, where the authorities deliberately issued large quantities of *tesobonos* – bonds indexed to the exchange rate – in place of nominal peso bonds in the months prior to the crisis) or of banks (as in Thailand). Since abandoning the peg leads to a devaluation that is proportional to the degree of real exchange rate misalignment (as measured by c), these costs are obviously greater at higher values of q. From (8), we have

$$N'(c) = -q. \qquad (22)$$

Nevertheless, in terms of the impact on p^*, the effect is swamped by the quadratic relationship between $N'(p)$ and q. The predictions of the model in this respect are the opposite of Velasco (1997), who assumes that more foreign debt creates a seigniorage

[8] This is a feature of the standard model also.

motive for inflation and therefore a greater likelihood of devaluation, and who also assumes purchasing power parity, so that devaluation does not increase the real burden of the debt.

Proposition 6. *Greater exposure to foreign exchange losses increases* p*, *but the effect declines with financial fragility and real exchange rate misalignment*.

<u>Proof</u>

Since $\mathrm{d}p^*/\mathrm{d}c = -N'(c)/N'(p^*) > 0$, this follows immediately from equations (22) and (17). #

With respect to post-collapse credibility (q), the pattern is much the same except the variation with q is even stronger, because W(q) is independent of q.

Proposition 7. *Greater dependence on the exchange rate as a nominal anchor increases* p*, *but the effect declines with financial fragility and real exchange rate misalignment*.

<u>Proof</u>

Since $\mathrm{d}p^*/\mathrm{d}\mathrm{q} = W'(\mathrm{q})/N'(p^*) < 0$, and W'(q) is independent of f and q, this follows from equation (17). #

Together Propositions 6 and 7 imply that factors which raise the transitional or long-term cost of abandoning the peg have a much weaker impact in some circumstances than others, and particularly in conditions where a crisis can occur (because poor fundamentals and weak banks push p^* below one). This means that policy measures such as voluntarily raising the cost of exit from the pegged rate regime (as suggested by Ozkan and Sutherland, 1995) are least effective as a weapon in situations when they are most needed, and are a poor substitute for addressing the problems of misalignment and financial fragility.

4. CONCLUSIONS

In the standard "second-generation" model of a currency crisis, the social welfare function contains a single parameter that is over-burdened, since it is required to represent both political preferences and structural weaknesses such as the fragility of the financial system. The welfare function used here separates these factors, specifying the authorities' anxieties about non-performing loans in the banking sector as an aversion to a combination of high real interest rates and depressed output. This model yields insights into the crises which have *not* happened as well as those which have.

It was shown that banking sector weaknesses expand the region of potentially self-fulfilling crises at the expense of the region where the peg is safe from speculative attack. This effect is particularly strong in the presence of poor fundamentals (severe real exchange rate misalignment). Indeed the strong positive interactions between financial fragility, misalignment and the strength of an attack on a currency are a dominating feature of the model. The worse the fundamentals, the more dangerous is a weakening of the banking system (relative to a further deterioration in the fundamentals) from the point of view of maintaining the peg. The model thus illustrates how the weakening of banks' balance sheets by the collapse of an asset price bubble can precipitate a currency crisis, as in Thailand, if the exchange rate is somewhat overvalued. Greater financial fragility and poorer fundamentals tend, however, to *reduce* the likelihood that increases in unemployment aversion alone will precipitate a crisis, which is consistent with the observation that shifts in political preferences have not played a significant role in recent currency crises.

The model suggests that countries with greater foreign exchange exposure (of either the public sector or the banking sector) or which are more dependent on the exchange rate as a nominal anchor to stabilise prices will tend to resist speculative attacks more strongly, because they suffer more if the attack is successful. This resistance is however undermined by poor fundamentals, financial fragility, or a combination of the two, which have the effect of diminishing the impact of greater costs of devaluation on the minimum attack "strength" required for success. This implies that a policy of raising the costs of moving to a floating-rate system will be of limited effectiveness if objective conditions are unfavourable.

APPENDIX

Proof of Proposition 1

For the numerator of equation (20) to be positive requires that A > B where

$A =$

$\{h+a\lambda\mu(1+\lambda)+[\delta/(1-\delta)](h+2a\lambda\mu p)\}\{fh+af\lambda\mu(1+\lambda)+[\delta/(1-\delta)](fh+2af\lambda\mu p+ab\lambda/q)\}$,

and

$$B = 2[\delta/(1-\delta)]af\lambda\mu\{hp+a\lambda\mu[p(1+\lambda)-\lambda] + [\delta/(1-\delta)](hp+a\lambda\mu p^2)\}.$$

$$\leq 2\, af\lambda\mu[\delta/(1-\delta)]\,\{hp+a\lambda\mu p +[\delta/(1-\delta)]hp+ [\delta/(1-\delta)]a\lambda\mu p^2\},$$

where use has been made of the fact that $p(1+\lambda)-\lambda \leq p$.

The expression for A can be written as

$$A > 2af\lambda\mu[\delta/(1-\delta)]\,\{hp + a\lambda\mu(1+\lambda)p +2[\delta/(1-\delta)]hp + 2[\delta/(1-\delta)]a\lambda\mu p^2\}.$$

Hence A > B. #

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Table 1. Basic macroeconomic variables at times of currency crisis

	GDP growth	Current acc.	Inflation	Interest rates
Finland				
1991	-7.1	-5.5	4.1	7.5
1992	*-3.6*	*-4.6*	*2.6*	*7.5*
1993	-1.2	-1.3	2.1	4.75
U.K.				
1991	-1.5	-1.5	5.9	10.85
1992	*0.1*	*-1.7*	*3.7*	*8.94*
1993	2.3	-1.7	1.6	5.25
France				
1993	*-1.3*	*0.7*	*2.1*	*8.38*
1994	2.8	0.6	1.1	5.82
Mexico				
1994	*4.4*	*-7.0*	*7.0*	*14.1*
1995	-6.2	-0.6	35.0	48.4
Thailand				
1996	5.5	-7.9	5.8	9.2
1997	*-0.4*	*-2.0*	*5.6*	*14.6*
1998	-10.2	5.7	8.1	13.0
Korea				
1997	*5.0*	*-1.8*	*4.4*	*7.05*
1998	-5.8	11.7	7.5	7.24
Brazil				
1997	3.6	-4.2	6.9	24.8
1998	0.8	-5.1	3.2	28.6
1999				

Notes
Current account is expressed as % of GDP; other variables as % p.a. Inflation is consumer price inflation. Interest rates are treasury bill rates, money market rates (Thailand, Korea) or deposit rates (Finland). The years in italics are the years in which the currency crisis actually occurred. Source of data: IMF *International Financial Statistics*.

Table 2. Sign of partial derivatives of net benefit of abandoning peg (*N*)

Parameter description	Parameter symbol	Transitional net benefit	Long-term net benefit
		T	S
Unemployment aversion	b	+	?
Financial fragility	f	+?*	+
Real exchange rate misalignment	q	?	+
Probability of abandoning peg	p	+	+
Sensitivity to *q* of cost of exchange rate regime change	c	–	0
Credibility under floating rates	θ	0	+

Notes

* +? means positive except for small values of p ($<a\lambda^2\mu/[h+a\lambda(1+\lambda)\mu]$).