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Monetary Coordination, Fixed Exchange Rates and Noisy Markets

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Abstract

With common global shocks, a leader-follower fixed-exchange-rate regime improves on a non-cooperative flexible-rate regime when the spillover effects from each country's money supply to the other country's output are symmetric. However, small exchange market shocks, from random capital flows, may undermine the incentives for either country to be the follower. Furthermore, a regime in which exchange rates are fixed when transitory exchange-market shocks are small and flexible with larger shocks always dominates a flexible-rate regime, in marked contrast to (credible) target-zone models that call for pegged rates only at upper or lower bounds in response to large shocks.

F42 International Policy Coordination
F31 Foreign Exchange

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Monetary Coordination, Fixed Exchange Rates and Noisy Markets

1 Introduction

Attempts at international monetary policy coordination have often taken the form of fixing or stabilizing exchange rates. Under the Bretton Wood system (1945-1971), exchange rates were pegged within narrow limits, although with occasional devaluations. More recently, after experiencing large fluctuations in exchange rates and worsening external imbalances, G-7 finance ministers and central-bank governors reached agreements on exchange-market intervention, initially at the Plaza meeting in September 1985 and subsequently in the Louvre Accord in February 1987. The European Monetary System also wants a "zone of stability" for exchange rates.

Even if the stability of the exchange rate *per se* does not have value, the process of fixing the exchange rate may generate desirable effects. The exchange rate can serve as a pure intermediate target if it provides a discipline that avoids selfish independent policies. The obligation to stabilize (or fix) exchange rates imposes a restriction on discretionary monetary policies and the restriction may prevent competitive manipulations by which nobody attains intended goals. Thus, fixing the exchange rate may achieve much of the gain from an explicit coordination with far lower cost. Exchange-rate targeting is less costly, if it works, than an explicit coordination that requires high transaction costs, information costs, and political consensus.

Oudiz and Sachs (1984) conjecture that "new rules for target exchange rate zones might be instituted ... within which countries pursue independent policies. A constrained noncooperative equilibrium might then come very close to the optimal cooperative equilibrium." Hallett, Hotham and Hutson (1989), using simulation analyses to follow up on this conjecture, conclude that: "Generally, for countries to target an agreed exchange-

rate path, in addition to pursuing their ultimate policy goals, does not lead to a welfare improvement relative to a non-cooperative Nash equilibrium."

In terms of theoretical work, Canzoneri and Gray (1985) have developed conditions under which a fixed-rate regime dominates a Nash non-cooperative flexible-rate policy.[1] They found, in the face of a common global shock, that a leader-follower fixed-rate regime improves on the Nash solution when the spillover effects from one country's money supply to the other country's output are symmetric, whether the spillovers are negative (in a beggar-thy-neighbor structure) or positive (in a locomotive structure). Only when the spillovers are asymmetric, which Canzoneri and Gray argue may arise when oil prices are indexed to the dollar (the currency of the leader), does the Nash solution dominate the fixed-rate solution. They make some interesting observations about how various historical episodes may have corresponded roughly to each of these structures.

Canzoneri and Henderson (1991) extend the analysis by considering the effects of a switch in demand from the foreign to the home country. In that case, they report that the home country as leader is better off in a fixed rate regime while the foreign country as follower is worse off than in the non-cooperative flexible rate regime. They also discuss the incentives for one or the other or both countries to renege on the fixed rate rules in a one-shot game. This suggests the importance of expected gains over repeated periods if the countries are to be willing to engage in a fixed rate agreement.

What these models have not considered are influences on demand for foreign exchange that may arise for reasons other than effects induced by monetary changes. In flexible-rate regimes there may be "noise traders," as analyzed for example, by De Long, et al. (1990), and in fixed-rate regimes there may be speculators betting on a breakdown of the current peg. In either regime, rumors of events or of possible policy changes may

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[1] Much of the game-theoretic approach to analyses of this sort was anticipated in pioneering work by Hamada (1974), (1976).

also trigger desired capital flows that affect net demand for foreign exchange. We will investigate the effect of random capital flows that can change the exchange rate if rates are flexible or will call for policy adjustments if there is an agreement to maintain pegged exchange rates.

Suppose there are symmetric global shocks, which create incentives for coordination through a fixed-rate regime. The incentives are weakened, however, if net demand for foreign exchange can change for reasons other than money-supply changes. We will show that, if an exchange-market shock is large enough, one or the other country will prefer not to continue in a fixed-rate regime.

We view flexible exchange rates as a result of non-cooperative behavior, while fixing exchange rates is a form of weak coordination and provides an alternative to an explicit (or strong) coordination in which countries form a joint objective function and derive policy measures to optimize their joint objective.

Following Canzoneri and Gray (1985), we assume that the fixed-rate regime is maintained in a two-country leader-follower framework. Section 2 introduces the model and examines incentives to maintain fixed rates when the shocks are known. Section 3 turns to the question whether, under uncertainty, countries would agree to a pegged regime in advance of knowing the values of the shocks. Section 4 introduces an alternative regime in which exchange rates are fixed for small shocks in the foreign exchange market and become flexible when shocks are large. This regime dominates the Nash flexible-rate regime for any values of the shocks and provides a striking contrast to target-zone regimes.

2 The Model and Effects of Exchange-Market Shocks

The essential features of the Canzoneri and Gray argument can be captured by using the following reduced form economies.

$$y = m + Bm^* + v \tag{1}$$

$$y^* = m^* + Bm + v \tag{2}$$

where y denotes output, or short-run deviations from full-employment output, m is the money supply, and v is a global shock (which Canzoneri and Gray associate with an oil price change). An asterisk indicates the foreign country. The direct effects of money supply on own country output have been normalized to one.

The cross-country transmission parameter B is assumed to be less than one in absolute value. Empirical evidence about the sign is mixed. Bryant, et al., (1988) reporting on simulations from a variety of econometric models with international linkages, find disagreement in both the sign and magnitude of the effects of monetary expansion in the US or in Europe on the real output in the other economy.[2] Our interest is in exploring the extent to which the effectiveness of an instrument which has international repercussions can be undermined by noise in the intermediate target itself, in our case the exchange rate. Thus, B is assumed to be positive for expository convenience but our conclusions do not depend critically on its sign.

Whatever the mechanism by which one country's money supply affects output in the other country, models of exchange-rate determination generally agree that an increase in the domestic money supply tends to result in a depreciation of the domestic currency and an increase in the foreign model supply appreciates the domestic currency. The

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[2] Frankel and Rockett (1988) use these different econometric models to provide a warning not to expect that monetary coordination, even if feasible, will necessary be welfare improving when the true model is not known.

simulations reported by Bryant, et al. (1988) are generally supportive of this view. To avoid cluttering the specification, we assume that the exchange rate e, the domestic price of foreign currency, moves directly with the domestic money supply and inversely with the foreign money supply:

$$e = m - m^* + \delta \tag{3}$$

The additional term δ, which we call the exchange market shock, represents the effects on a flexible exchange rate from random movements in capital flows. If the exchange rate is to be pegged, when a realization of δ is non zero, then either the domestic money supply or foreign money supply or both must be changed.

If part of the linkage by which monetary changes in one country affect output in the other country is through an elasticities effect on imports and exports, then exchange rate changes attributable to other influences, such as random capital flows, should also enter the output equations. This effect would be analogous to a random variable introduced by Canzoneri and Henderson with a positive sign in one country's output equation and negatively in the other country's output equation. This possibility is specified in an appendix, where the solutions with these additional demand switch terms associated with the δ variable are presented.

Our primary interest in what follows, however, is to analyze another channel by which exchange market shocks may lead to one country or the other being unwilling to agree to a pegged rate regime. That channel is the effect of exchange market shocks on changes in the monetary instrument needed to maintain a pegged rate regime.

Home and foreign governments' objective functions are assumed to be the following.

$$\begin{aligned} Min \ \ L &= y^2 + m^2 \\ Min \ \ L^* &= y^{*2} + m^{*2} \end{aligned} \tag{4}$$

Note that these do not include variations in the exchange-rate as part of government objectives. In our stripped down model, variations in m can be thought of as representing undesirable nominal changes, such as variations in prices. These objective functions, together with equations (1) and (2) give rise to the same reaction functions that are found in Canzoneri and Gray (1985), McKibbin (1988), Canzoneri and Henderson (1991), and Argy (1994, ch. 45) with their somewhat more elaborate specifications.

First consider a Nash non-cooperative regime in which each country uses its money supply, taking the other country's money supply as given, to optimize its objective function. The exchange rate is determined by the resulting money supplies and exchange market shock. In this regime, governments do not have any direct incentive to intervene in the exchange market since stability of the exchange rate does not enter the objective functions. Thus the Nash regime may be viewed as a flexible exchange-rate system.

From the first-order conditions of the two countries' optimization problems one obtains the following reaction functions.

$$m = -\frac{Bm^* + v}{2} \tag{5}$$

$$m^* = -\frac{Bm + v}{2} \tag{6}$$

With a positive transmission parameter, B, the money supply of one country reacts negatively to any increase in the other country's money or in the global shock.

Resulting equilibrium values of variables are given by

$$m_N = m_N^* = -\frac{v}{2+B} \tag{7}$$

$$y_N = y_N^* = \frac{v}{2+B} \tag{8}$$

$$e_N = \delta \tag{9}$$

$$L_N = L_N^* = \frac{2v^2}{(2+B)^2} \tag{10}$$

The subscript 'N' stands for the Nash regime. Note that in this regime the exchange market shock, δ, does not affect any economic variables except the exchange rate and that the losses of the two countries depend entirely on the global shock, v.

Now consider a fixed-rate regime. Since n-1 exchange rates exist in an n-country case, one country is enough in our two-country model to fix the exchange rate at an agreed level. Let the home country be the leader, meaning that the home country minimizes its loss subject to the level of the foreign money supply that is needed to peg the exchange rate. The foreign country is the follower who is responsible for keeping the exchange rate at an agreed level. Suppose the two countries agree to peg the exchange rate at the point where all shocks have zero values, that is, $e=0$. Then from equation (3) the foreign country's money-supply rule is given by.

$$m^* = m + \delta \tag{11}$$

The home country chooses m to minimize its loss subject to equation (11).

$$Min \ (y^2 + m^2) = Min\{[m + B(m+\delta) + v]^2 + m^2\}$$

The first-order condition yields the home country's optimal money supply.

$$m_F = \frac{-(1+B)(v+B\delta)}{1+(1+B)^2} \tag{12}$$

Using (12) in (11) one obtains the foreign country's equilibrium money supply:

$$m_F^* = \frac{-(1+B)v + \delta(2+B)}{1+(1+B)^2} \tag{13}$$

The subscript 'F' stands for the fixed-exchange-rate regime. When there is a positive exchange-market shock ($\delta > 0$), the home country decreases its money supply by less than δ, since $[B(1+B)]/[1+(1+B)^2] < 1$. This forces the foreign country to raise m* to maintain the exchange-rate peg. Thus, in the fixed-rate regime an exchange-market shock drives the two countries' money movements in opposite directions

When there is a positive global shock ($v > 0$), the home country should decrease its money stock, other things constant, and the foreign country has to decrease m* by a matching amount. When the global and exchange-market shocks have different signs, the direction of change in the home money stock depends on the relative sizes of $B\delta$ and v.

Resulting outputs, losses, and exchange rate in the fixed-rate regime are given by the following expressions

$$y_F = \frac{v + \delta B}{1 + (1+B)^2} \tag{14}$$

$$y_F^{\bullet} = \frac{v + \delta(2 + B - B^2 - B^3)}{1 + (1+B)^2} \tag{15}$$

$$L_F = \frac{(v + \delta B)^2}{1 + (1+B)^2} \tag{16}$$

$$L_F^{\bullet} = \frac{v^2 - 2B\delta v + \delta^2(B^4 - 3B^2 + 4)}{1 + (1+B)^2} \tag{17}$$

$$e_F = 0 \tag{18}$$

Note that when the shock is absent in the exchange market ($\delta=0$) the fixed-rate regime results in the same Pareto-efficient outcome which would be obtained by an explicit joint coordination[3]. Canzoneri and Henderson (1991) have essentially this same

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[3] In an explicit joint coordination, two countries adjust their money supplies to optimize a joint objective function: $L^J = \underset{m,m^{\bullet}}{Min}[(y^2 + m^2) + (y^{\bullet 2} + m^{\bullet 2})]$, subject to equations (1) and (2). The solution of the joint minimization problem is given by

result and stress that it arises because of the assumed symmetry of the shocks and objective functions.

Comparing the loss from the fixed-rate regime with the Nash flexible-rate regime, we find:

$$L_N - L_F = \frac{B^2 v^2}{(2+B)^2[1+(1+B)^2]} - \frac{B(2v\delta + B\delta^2)}{1+(1+B)^2} \tag{19}$$

$$L_N^* - L_F^* = \frac{B^2 v^2}{(2+B)^2[1+(1+B)^2]} + \frac{2Bv\delta - (B^4 - 3B^2 + 4)\delta^2}{1+(1+B)^2} \tag{20}$$

The first terms in expressions (19) and (20) represent the gains from an explicit joint coordination when there is a global shock, as shown in footnote 3. One can see that a non-zero shock in the foreign exchange market may strengthen or weaken the gains from a fixed-rate regime relative to the gains from an explicit joint coordination.

The signs of (19) and (20) depend on the parameters. More specifically, the conditions under which each country is better off by fixing the exchange rate are given by:

$$m_c = m_c^* = -\frac{(1+B)v}{1+(1+B)^2}$$

$$y_c = y_c^* = \frac{v}{1+(1+B)^2}$$

$$L_c = L_c^* = \frac{v^2}{1+(1+B)^2}$$

These are exactly the same as equations (12) - (17) when $\delta = 0$. The gain from explicit

coordination is $\qquad L_N - L_c = \dfrac{B^2 v^2}{(2+B)^2[1+(1+B)^2]} > 0$

$$L_N - L_F > 0 \qquad \text{if} \qquad \underline{\delta} < \delta < \overline{\delta} \tag{21}$$

where
$$\underline{\delta} = \left\{ \frac{-(2+B)-\sqrt{(2+B)^2 + B^2}}{B(2+B)} \right\} v$$

$$\overline{\delta} = \left\{ \frac{-(2+B)+\sqrt{(2+B)^2 + B^2}}{B(2+B)} \right\} \cdot v$$

$$L_N^* - L_F^* > 0 \qquad \text{if} \qquad \underline{\delta}^* < \delta < \overline{\delta}^* \tag{22}$$

where
$$\underline{\delta}^* = \left\{ \frac{B(2+B)-B\sqrt{B^4 - 2B^2 + 4B + 8}}{(2+B)(B^4 - 3B^2 + 4)} \right\} v$$

$$\overline{\delta}^* = \left\{ \frac{B(2+B)+B\sqrt{B^4 - 2B^2 + 4B + 8}}{(2+B)(B^4 - 3B^2 + 4)} \right\} v$$

As long as shocks in the foreign exchange market remain within the intervals given in (21) and (22), fixing the exchange rate results in a welfare-superior outcome to the Nash flexible-rate regime.

To interpret what is involved here, consider equations (12) -(15). Without the δ shock, these show the coordinated solutions for money and output in both the home and foreign country in response to a global shock. With $v > 0$, both money supplies are negative and both outputs are positive, but as indicated in footnote 3 the overall loss is less than in the Nash flexible-rate regime. If speculative forces call for an appreciation of the foreign currency $(\delta > 0)$, the foreign country needs to increase its money supply (moving closer to zero) to maintain the exchange rate peg. That has the effect of further increasing both foreign and domestic output. The home country responds by further reducing its money supply to offset the output effect. Because the exchange rate shock of

the same sign as the global shock adds to the home country's deviation of its money supply from zero while it allows the foreign country an offsetting change, it takes a smaller δ before the home country would be at least as well off in the Nash flexible rate regime. This is why $0 < \bar{\delta} < \bar{\delta}^*$ when $v > 0$.

A similar asymmetry arises if the exchange-market shock has a sign opposite to that of the global shock. With $v > 0$ and $\delta < 0$, the foreign country needs to reduce further its money supply to keep its currency from depreciating while the home country can react by increasing its money supply somewhat as its output falls back toward zero. Thus, $\underline{\delta} < \underline{\delta}^* < 0$. It takes a smaller negative exchange rate shock before the foreign country would prefer the Nash flexible rate regime.

It follows that the range of the shock δ, with a positive v, over which both countries benefit from fixing the exchange rate is

$$\underline{\delta}^* < \delta < \bar{\delta} \tag{23}$$

The interval given by (23) degenerates as the transmission parameter, B, approaches zero, since the foreign country's (follower's) incentive to fix the exchange rate disappears. This result is intuitive because the foreign country never gains from fixing the exchange rate if there is no policy externality to internalize by the (weak) coordination. Note also that the interval becomes wider as the global shock gets larger.

A graphical interpretation of the result follows. Suppose $v>0$, $B>0$. In Figure 1, R and R^* stand for reaction functions of the home and foreign country, given by equations (5) and (6). Point N represents the Nash non-cooperative equilibrium money supplies given by equation (7). L_N and L_N^* are iso-loss curves of the two countries associated with the Nash equilibrium money supplies. The 45 degree line represents the foreign country's money-supply rule in the fixed-rate regime when the shock in the exchange

market is zero. Note that if a non-zero shock occurs in the exchange market, the money-supply rule of the foreign country (follower) shifts according to equation (11).

If two countries agree to fix the exchange rate at $e=0$ by the leader-follower rule, the home country chooses its money supply to minimize its loss, taking equation (11) as the foreign country's reaction function. For example, suppose $\delta = \delta_1$ in Figure 1. Then the home country will select point A to minimize its loss because the iso-loss curve of the home country touches the foreign reaction line at the point A. Note that at point A both countries have lower losses (higher welfare) than at point N of Nash equilibrium. An economic interpretation of the result is that the home policy maker takes account of the fact that by contracting the home money supply more than in the Nash game in the presence of a positive global shock, the foreign money supply will also contract more, given δ, as can be seen in equation (11). Thus the home country has an incentive to contract more, thereby making both countries better off. Note that in the Nash regime each country, in the presence of a positive global shock, reduces its money supply only up to the point where (private) marginal benefit is equal to marginal cost.

If the shock in the exchange market is larger than $\bar{\delta}$, however, the home country's loss is greater than in the Nash game. At $\delta = \bar{\delta}$, by choosing point B the home country is as well off as in the Nash equilibrium. Thus $\bar{\delta}$ is an upper limit of a shock in the exchange market for which the home country benefits from fixing the exchange rate.

A similar graphical presentation is possible for the foreign country. Consider Figure 2. C is a tangent point between the home iso-loss curve and the foreign money supply rule. The point C is also on the foreign country's loss curve corresponding to the Nash regime. If a shock in the exchange market is less than $\underline{\delta}^*$ the foreign country is worse off than in the Nash regime. Thus $\underline{\delta}^*$ is a lower limit of shock that guarantees the foreign country is at least as well off as in the non-cooperative regime.

To summarize: In the presence of a positive global shock, a flexible-rate regime is preferred by the home country (leader) if the exchange-market shock is too large and by

the foreign country (follower) if the exchange-market shock is too small (too large a negative number). For exchange-market shocks within a critical range, both countries prefer the fixed-rate regime.

In our discussion, we have been implicitly assuming that the fixed rate regime is enforceable. As Canzoneri and Henderson (1991) have pointed out, in such a regime, neither country is on its reaction curve given the other country's money supply. Thus, each country in a one-shot game might choose not to follow the rules of the game. For this reason, it is more interesting to consider a repeated game and think of the expected gains from agreeing in advance to stick to a fixed-rate regime.

3 Uncertainty and Incentives to Peg Exchange Rates

In the prior section, we addressed the question of whether both the leader and the follower would prefer to maintain fixed exchange rates, rather than have the Nash flexible rate regime, after both the global and the exchange-market shocks have been observed. In this section we explore the question of how uncertainty affects these incentives. In other words, would both countries expect to gain by agreeing to a fixed-rate regime?

Suppose the objective is to minimize the expected loss in a repeated game. Assume that the δ and v shocks are independent. From the results of Section 2 one can obtain expected losses corresponding to each regime.

$$EL_N = EL_N^* = \frac{2\sigma_v^2}{(2+B)^2} \tag{24}$$

$$EL_F = \frac{B^2\sigma_\delta^2 + \sigma_v^2}{1+(1+B)^2} \tag{25}$$

$$EL_F^\bullet = \frac{(B^4 - 3B^2 + 4)\sigma_\delta^2 + \sigma_\nu^2}{1 + (1 + B)^2} \tag{26}$$

By comparing the expected losses in (24) through (26) one can show the following conditions under which countries have expected gains from a fixed-rate regime.

$$\sigma_\nu^2 > (2 + B)^2 \sigma_\delta^2 \quad \text{for the home country} \tag{27}$$

$$\sigma_\nu^2 > \frac{(2 + B)^2 (B^4 - 3B^2 + 4)\sigma_\delta^2}{B^2} \quad \text{for the foreign country} \tag{28}$$

Note that $B^4 - 3B^2 + 4 > 1$ so the right side of (30) is not only positive but also greater than the right side of (27). For a given σ_ν^2, (28) puts a tighter limit on σ_δ^2 than (27). So from the conditions for the foreign country, one obtains the range of σ_δ^2 relative to σ_ν^2 for which the weak coordination, via fixed exchange rates, is feasible.

$$\frac{\sigma_\delta^2}{\sigma_\nu^2} < \frac{B^2}{(2 + B)^2 (B^4 - 3B^2 + 4)} \tag{29}$$

Condition (29) says that too much uncertainty in the exchange-rate market (relative to the uncertainty about the global shock) is an obstacle to fixed exchange rates. The condition also indicates that a larger transmission parameter B increases the range of σ_δ^2 for which the fixed-rate regime is preferred by both countries.

There is an intuitive plausibility to the result that the follower, who has responsibility to maintain the exchange rate peg, will tolerate smaller exchange-market variations than the leader before preferring to abandon the fixed-rate regime.

4 A Flexible Fixed-Rate Regime

As shown in the last section, if the expected variance of the exchange-market shock is too large, the follower (and possibly the leader too) prefers not to agree to fixed exchange rates. There is, however, a regime that is a Pareto improvement over the pure flexible regime in that at least one country is always better off without making the other country worse off, no matter how large the exchange-market shock. We will refer to this as a "flexible fixed-rate regime."

The rules are as follows. When an exchange-market shock is larger than the upper limit given by (23), the foreign country should absorb the shock up to the upper limit and let the unabsorbed shock change the exchange rate. That is, if $\delta > \bar{\delta}$ the foreign money supply rule is

$$m^{\bullet} = m + \bar{\delta} \tag{30}$$

The resulting exchange rate is given by

$$e = m - m^{\bullet} + \delta = m - (m + \bar{\delta}) + \delta$$
$$= \delta - \bar{\delta} > 0 \tag{31}$$

The home country, taking the foreign money supply rule (30) into account, will pick point B in Figure 1. The result is that the home country is as well off as in the Nash flexible-rate regime while the foreign country is better off.

The foreign money supply rule should also accommodate a large negative shock. That is, if $\delta < \underline{\delta}^{\bullet}$ the money supply rule of the foreign country in the flexible fixed-rate regime is

$$m^{\bullet} = m + \underline{\delta}^{\bullet} \tag{32}$$

The resulting exchange rate is then

$$e = \dot{m} - m^* + \delta = m - (m + \underline{\delta}^*) + \delta$$
$$= \delta - \underline{\delta}^* < 0 \tag{33}$$

The home country will select point C in Figure 2, resulting in the home country's being better off without harming the foreign country (compared to the Nash regime).

The flexible fixed-rate regime makes (weak) coordination possible even with a large shock in the foreign exchange market by guaranteeing that both countries be at least as well off as in the non-cooperative flexible-rate regime. Therefore in the flexible fixed-rate regime, the expected future losses of the two countries evaluated at period zero are necessarily less than (or equal to) those in the Nash regime.

Figure 3 shows the relationship between the exchange rate and the exchange-market shock in the flexible fixed-rate regime. The graph indicates that when the exchange-market shocks are moderate ($\underline{\delta}^* < \delta < \bar{\delta}$), an intervention is desirable to peg the exchange rate at its target. But when the exchange market shocks are large ($\delta > \bar{\delta}$ or $\delta < \underline{\delta}^*$), government intervention needs to be soft, allowing a deviation of the exchange rate from its target level. Note that even with large shocks to the exchange market, the exchange rate movements are more stable in the flexible fixed-rate regime than in the Nash flexible-rate regime. As indicated earlier, the interval $[\underline{\delta}^*, \overline{\delta}]$ in Figure 3 gets larger as the global shock becomes larger.

This is very different from a target-zone regime. With a target zone, the exchange rate is flexible between upper and lower limits and intervention is necessary if the shocks are too large. In our setting, if the limits are the same, the exchange rate is pegged when a target-zone regime allows flexibility and is flexible when a (credible) target zone calls for pegging.

5. Concluding Remarks

In concluding their review of the literature on international macroeconomic policy coordination, Currie, et al. (1989) argue "that there is an economic rationale for exchange rate targeting, contrary to much of the academic literature. This is partly because exchange rate stability matters in its own right, and exchange rate targeting can help to dampen fads and speculative bubbles in foreign exchange markets. It is also because a regime of exchange rate targeting acts as a discipline on the monetary and fiscal policies of the participating countries."

Frankel (1989) disagrees. He writes: "I am sympathetic to the claim that some portion of exchange rate volatility is noise, unrelated to economic fundamentals. But even if a regime switch to an exchange rate target zone magically eliminated the worst of speculative bubbles, I doubt that countries would again be able to control the exchange rate as closely as they once could." The question presumably is one of willingness rather than ability. Monetary and interest rate adjustments can surely still be used by a follower country to control its exchange rate if the country is willing to give up monetary policy responses to other targets.

There are always questions, of course, about whether countries can find the exchange rates that are justified by fundamentals and maintain fixed rates when there is an inconsistency between the peg and the rate that speculators perceive as justified by market conditions. In our analysis, we have implicitly assumed that an appropriate exchange rate has been found. With symmetric spillovers, fixed exchange rates then provide welfare gains relative to floating rates in the face of transitory global shocks. Even in that case, our analysis shows that noise in foreign exchange markets, attributable perhaps to random capital flows, may itself provide a deterrent to fixed-rate agreements in that at least one country will be unwilling to maintain the peg because of the domestic repercussions that doing so entails.

In our model, which is an extension of one by Canzoneri and Gray (1985), pegging is a way of coordinating policy to internalize the externalities associated with global shocks. The fact that the constraints on the acceptable amount of exchange-market noise are tighter for the follower suggests that it will be harder to get countries to be willing to take responsibility for maintaining a peg to another currency than to agree to have other countries peg to one's own currency. It takes smaller (and with weak cross country effects apparently very small) exchange market noise to destroy incentives to be the follower.

We have also shown within the context of this model that a flexible fixed-rate regime dominates the purely flexible-rate regime for any set of shocks. In contrast to a target-zone regime, this flexible fixed-rate regime calls for fixed rates when exchange market shocks are moderate and flexible rates when exchange market shocks are large. The primary difference is in the perceived "costs" of flexible exchange rates. The rationale for a target-zone presumably rests on the view that the costs of large exchange-rate changes outweigh the costs of keeping the exchange rate within the bands. What might be a breakdown in a target-zone regime becomes a temporary suspension of pegging in a flexible fixed-rate regime.

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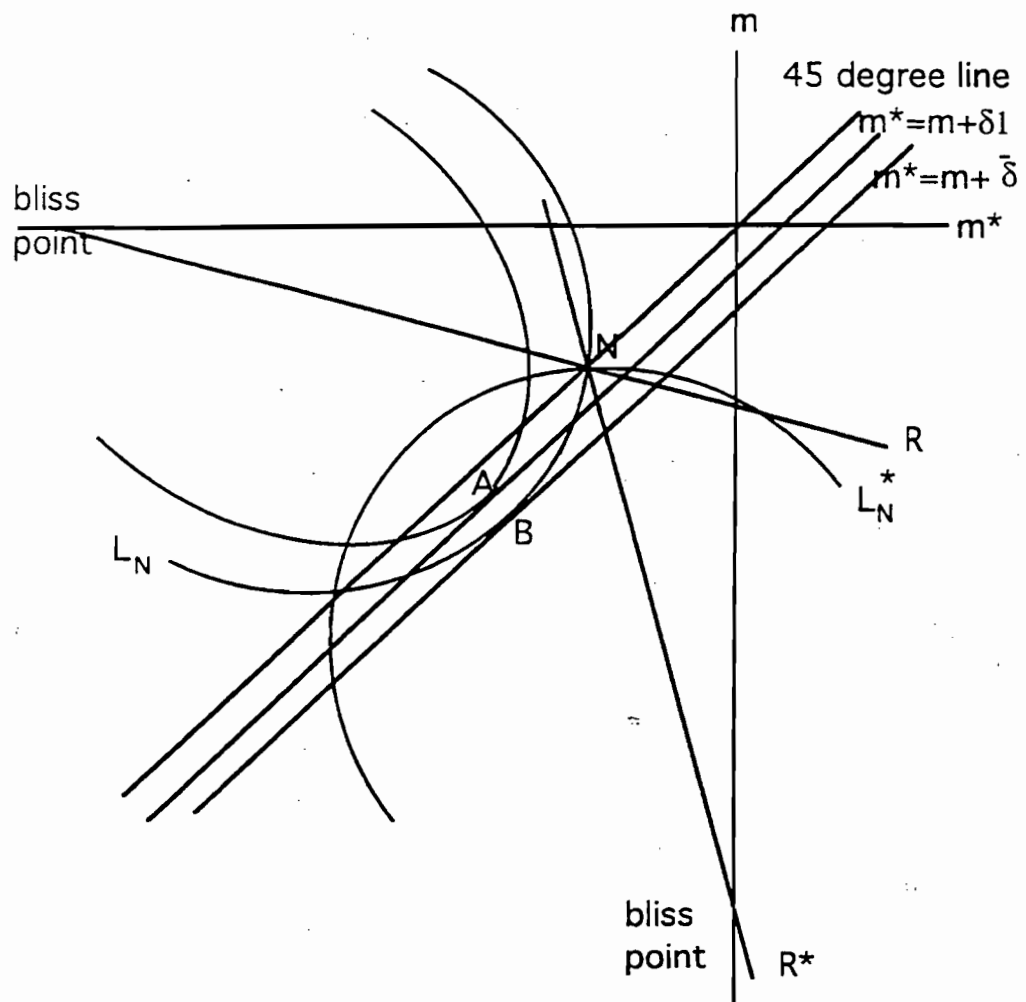
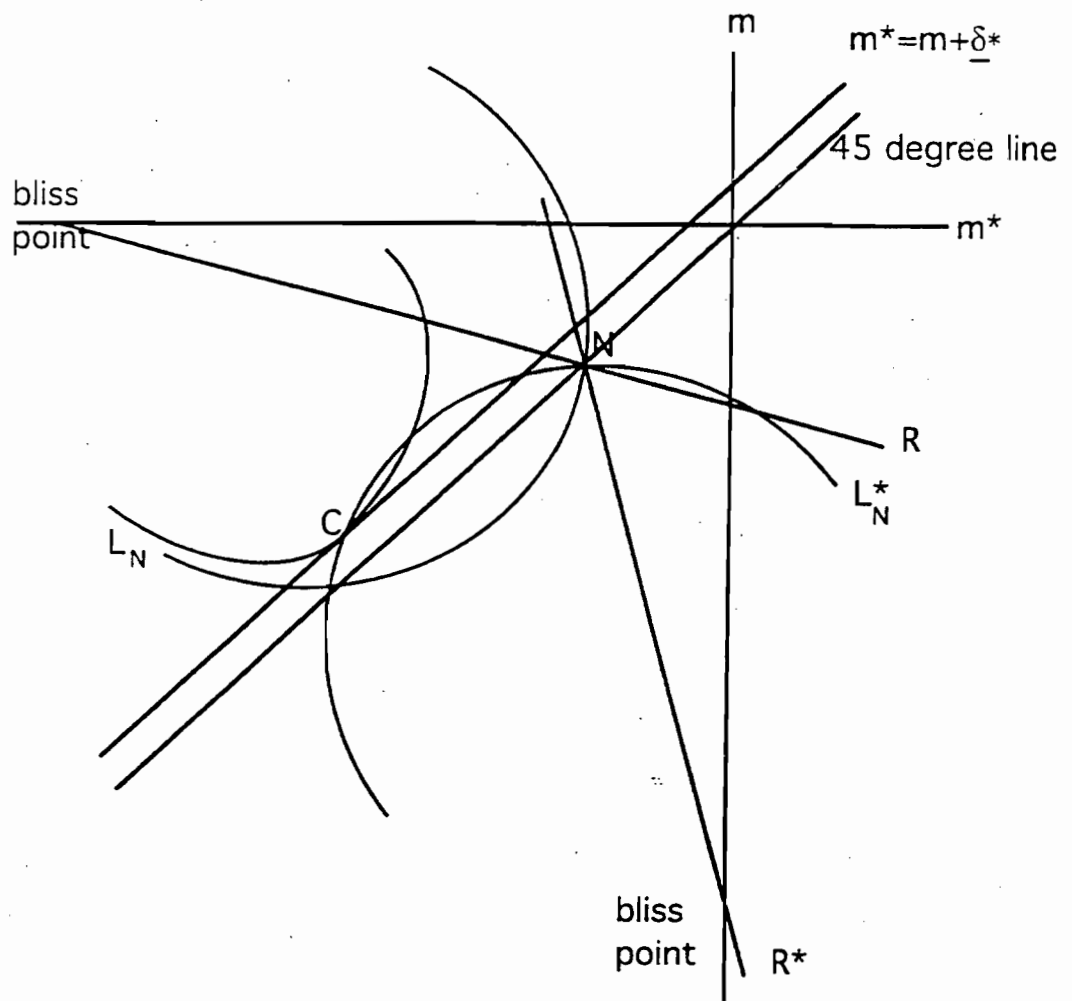Figure 1   Upper Limit of Exchange Rate Shock
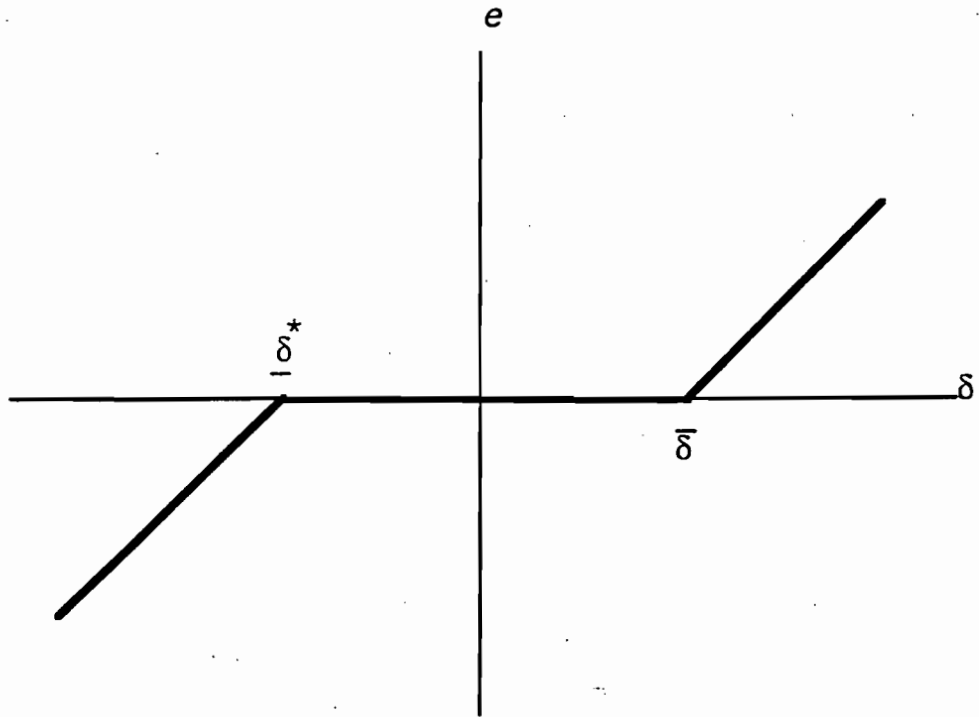
Figure 2   Lower Limit of Exchange Rate Shock

Figure 3 Effects of Exchange Market Shocks in a Flexible Fixed-Rate Regime

Appendix: Solutions with Demand Switch Effects of δ Shocks.

Basic Equations:

$$y = m + Bm^* + D\delta + v \qquad (A.1)$$

$$y^* = m^* + Bm - D\delta + v \qquad (A.2)$$

Reaction Functions:

$$m = -\frac{Bm^* + v + D\delta}{2} \qquad (A.5)$$

$$m^* = -\frac{Bm + v - D\delta}{2} \qquad (A.6)$$

Nash Flexible Rate Solution

$$m_N = -\frac{v}{2+B} - \frac{D\delta}{2-B} \qquad (A.7)$$

$$m_N^* = -\frac{v}{2+B} + \frac{D\delta}{2-B} \qquad (A.7')$$

$$y_N = \frac{v}{2+B} + \frac{D\delta}{2-B} \qquad (A.8)$$

$$y_N^* = \frac{v}{2+B} - \frac{D\delta}{2-B} \qquad (A.8')$$

$$e_N = \frac{(2-B-2D)\delta}{2-B} \qquad (A.9)$$

$$L_N = \frac{2v^2(2-B)^2 + 2D^2\delta^2(2+B)^2 + 4vD\delta(2-B)(2+B)}{(2+B)^2(2-B)^2} \qquad (A.10)$$

$$L_N^* = \frac{2v^2(2-B)^2 + 2D^2\delta^2(2+B)^2 - 4vD\delta(2-B)(2+B)}{(2+B)^2(2-B)^2} \qquad (A.10')$$

Solution under Leader-Follower Fixed-Rate Regime:

Let $A \equiv 1 + (1+B)^2$

$$m_F = \frac{-(1+B)[v+(B+D)\delta]}{A} \tag{A.12}$$

$$m_F^\bullet = \frac{-(1+B)v + \delta(2+B-D-BD)}{A} \tag{A.13}$$

$$y_F = \frac{v+(B+D)\delta}{A} \tag{A.14}$$

$$y_F^\bullet = \frac{v+\delta(2+B-B^2-B^3-3D-4BD-2DB^2)\delta}{A} \tag{A.15}$$

$$L_F = \frac{[v+(B+D)\delta]^2}{A} \tag{A.16}$$

$$L_F^\bullet = \frac{Av^2 - 2A(B+D)\delta v + C\delta^2}{A^2} \tag{A.17}$$

where $C \equiv (2+B-D-BD)^2 + (2+B-3D-4BD-B^2-B^3-2B^2D)^2$

$$e_F = 0 \tag{A.18}$$

Expected losses with independent shocks:

$$EL_N = EL_N^\bullet = \frac{2\sigma_v^2}{(2+B)^2} + \frac{2D^2\sigma_\delta^2}{(2-B)^2} \tag{A.24}$$

$$EL_F = \frac{(B+D)^2\sigma_\delta^2 + \sigma_v^2}{A} \tag{A.25}$$

$$EL_F^\bullet = \frac{A\sigma_v^2 + C\sigma_\delta^2}{A^2} \tag{A.26}$$

For fixed rates to be preferred by the home country ($EL_F < EL_N$), one needs:

$$\frac{\sigma_\delta^2}{\sigma_v^2} < \frac{B^2(2-B)^2}{[(2-B)^2(B+D)^2 - 2AD^2](2+B)^2} \tag{A.27}$$

If B<0 and D is large enough for the denominator to be negative, then $EL_F < EL_N$ for any $\sigma_\delta^2 > 0$.

For fixed rates to be preferred by the foreign country, one needs:

$$\frac{\sigma_\delta^2}{\sigma_v^2} < \frac{AB^2(2-B)^2}{[C(2-B)^2 - 2A^2D^2](2+B)^2} \tag{A.28}$$

Numerical calculations for B from -.10 to -.01 and from .01 to .10 and for D from 0 to 0.10 showed that the foreign country (the follower) always has a much tighter constraint on the relative variance of the δ shock. Within the ranges of the parameters considered, the right side of (A.28) increases monotonically with D and with the absolute value of B. Even the largest critical ratio of the variance of δ to the variance of v (when B = -.10 and D = .10) is still less than 0.001. With B = -.01 and D = .01, the critical ratio is less than .00001. Because of the normalizations used to set up the basic equations, we should not take these numbers seriously, but the formula does suggest that with weak cross country linkages (very small B) only minor variations in exchange market shocks will lead a follower to prefer the flexible-rate regime.

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