ELSEVIER

Journal of Development Economics
Vol. 45 (1994) 1–16

JOURNAL OF
Development
ECONOMICS

Credibility and exchange rate management in developing countries

Pierre-Richard Agénor *

Research Department, International Monetary Fund, Washington, DC 20431, USA

Received February 1992; final version received May 1993

Abstract

The paper discusses the role of credibility factors in the conduct of exchange rate policy in developing countries. The analysis is based on a simple framework in which policymakers are concerned about inflation and external competitiveness. Price setters in the nontradable sector of the economy engage in a strategic game against the authorities. The model generates a 'devaluation bias' which undermines the credibility of a fixed exchange rate. The role of reputational factors, signaling considerations, and joining a currency union as possible solutions to this bias is examined.

Keywords: Credibility; Exchange rate management; Developing countries

JEL classification: C7, E3, F4

1. Introduction

Policymakers in developing countries typically face a dilemma when using the exchange rate as a policy instrument. Although a nominal depreciation may improve the trade balance and the balance of payments, it is usually associated with a rise in the price level, which may turn into inflation and ultimately erode

* I would like to thank, without implication, Alex Cukierman, Paul Masson, Steven Kamin, Peter Montiel, Anna Lennblad and an anonymous referee for helpful discussions and comments. A much more detailed version of this paper was issued as working paper no 91/87 of the International Monetary Fund. The views expressed in this paper do not necessarily reflect those of the Fund.

SSDI 0304-3878(94)00023-6

external competitiveness. Conversely, maintaining the exchange rate fixed to stabilize prices in the presence of a large current account deficit is often not a viable option, if the country faces a shortage of foreign exchange reserves or an external borrowing constraint. In recent years the exchange rate has been, nevertheless, increasingly used as a policy instrument in developing countries, many of them moving away from pegging to a single currency to more flexible exchange rate arrangements, such as composite pegs. To a large extent, this occurred because of the substantial fluctuations among the major currencies in the post-Bretton-Woods years. In addition, some countries opted for more flexible arrangements in order to 'disguise' the depreciation of the domestic currency, enabling governments to avoid the political costs of announced devaluations.

Despite this notable evolution towards increased use of the exchange rate as a policy tool, there has recently been a variety of arguments proposed in favor of adopting a fixed exchange rate regime. [1] The debate has recently focused on the role of the exchange rate as an anchor for the domestic price level and on the 'credibility effect' that a fixed rate may attach to a disinflation program when the commitment to defend the parity is clearly established. [2] Without central bank credibility, private agents will continue to expect a high inflation rate, and this will increase the cost of any attempt to stabilize domestic prices. Establishing credibility means convincing the public that the central bank will not deviate from its exchange rate or money supply target in order to secure short-term benefits associated with surprise inflation. This requires that the public be convinced that the authorities have some incentive to refrain from introducing monetary surprises. It has been argued that by acting as a constraint on macroeconomic policies, a fixed exchange rate may enhance the credibility of the central bank's commitment to maintaining a low and stable rate of money growth.

This paper proposes a simple framework to examine, in a developing-country context, recent arguments favoring a fixed exchange rate regime that are motivated by inflation inertia caused by policymakers' lack of credibility. Section 2 presents the model, establishes the basic time-inconsistency proposition, and determines the degree of credibility of a fixed exchange rate by examining how the policymaker is induced to behave under alternative policy rules. Section 3 focuses on how the 'devaluation bias' generated by the time-inconsistency problem faced by the policymaker can be alleviated by building up 'reputation' or by the need to signal

[1] These arguments relate to the role of exchange rate stability in the promotion of trade flows, foreign investment, etc. See Aghevli et al. (1991) for a recent review of the literature on the choice of an exchange rate regime.

[2] This literature has developed to a large extent from Barro and Gordon's (1983) seminal work on monetary policy, which emphasizes the interdependence between the behavior of private, forward-looking agents and centralized policymakers. In this context, credibility issues emerge because of an incentive for policymakers to pursue a strategic advantage and seek short-run gains by reneging on previously announced policies, leading to time-inconsistency problems. For a survey of this literature, see Cukierman (1992).

policy commitment. Section 4 examines the costs and benefits of joining an international monetary arrangement in which the country surrenders the power to alter the exchange rate. The concluding section summarizes the main results of the paper and draws together the major implications of the analysis for exchange rate policy in developing countries pursuing a fixed exchange rate regime.

2. Credibility of a fixed exchange rate: A framework

Consider a small open economy producing traded and nontraded goods. The economy's exchange rate is determined by a policymaker who cares about external competitiveness and price stability. The foreign-currency price of traded goods is determined on world markets. Agents in the nontraded goods sector set their prices so as to protect their position relative to the traded goods sector, and to respond to domestic demand shocks. Agents in the nontraded goods sector are assumed to set prices *before* the policymaker sets the exchange rate. [3] The domestic rate of inflation, π, is given by

$$\pi = \delta\pi_N + (1-\delta)(\epsilon + \pi_T^*), \quad 0 < \delta < 1, \tag{1}$$

where ϵ denotes the rate of devaluation of the nominal exchange rate, π_N the rate of increase in the price of nontradables, π_T^* the rate of increase in the price of tradables, and $1-\delta$ the degree of openness. The government's loss function, L^g depends on deviations of the rate of depreciation of the real exchange rate from a target rate Θ, and the inflation rate:

$$L^g = -\alpha\left[(\epsilon + \pi_T^* - \pi_N) - \Theta\right] + \lambda\pi^2/2, \quad \alpha, \lambda \geq 0. \tag{2}$$

The former objective reflects the assumption that the authorities are concerned with an improvement in competitiveness, which results from a depreciation of the real exchange rate. The rate of change of the real exchange rate enters the loss function linearly, because the authorities are assumed to attach a negative weight to a real appreciation relative to their target. [4] The government's objective is to minimize its loss function given by (2).

Agents in the nontraded goods sector change prices in reaction to fluctuations in the (expected) domestic price of tradable goods, and to an exogenous demand disturbance to their sector, d_N, which occurs at the beginning of the period and becomes known immediately. Their loss function is therefore taken to be

$$L^p = \left[\pi_N - (\epsilon^a + \pi_T^*) - \Phi d_N\right]^2/2, \quad \Phi \geq 0, \tag{3}$$

[3] Without this assumption, there would be no incentive for the authorities to adjust the exchange rate. Price stickiness may result from a variety of factors. The existence of 'menu costs', for instance, may prevent agents from revising nontradable prices following a nominal exchange rate adjustment.

[4] Note that the real exchange rate target could be expressed in *level* form; the rate of change formulation used here is simply easier to work with analytically.

where ϵ^a denotes the expected rate of depreciation of the exchange rate. The price setters' objective is to minimize L^p.

When the authorities decide whether or not to devalue the exchange rate, they know prices set in the nontraded goods sector. Substituting (1) in (2) and setting $\pi_T^* = 0$ for simplicity, the optimal rate of adjustment of the nominal exchange rate is given by [5]

$$\epsilon = \frac{\delta}{1-\delta}\left[\frac{\alpha}{\lambda\delta(1-\delta)} - \pi_N\right]. \tag{4}$$

The optimal rate of inflation in the nontradable sector is

$$\pi_N = \Phi d_N + \epsilon^a. \tag{5}$$

In the non-cooperative Nash game implied by this behavior, the equilibrium values of the nontradable inflation rate and the rate of devaluation $(\tilde{\pi}_N, \tilde{\epsilon})$ are found by imposing rational expectations and solving simultaneously Eq. (4) and (5). This yields:

$$\tilde{\pi}_N = (\kappa + \Phi d_N)/\Omega \geq 0, \tag{6a}$$

$$\tilde{\epsilon} = (\kappa - \nu\Phi d_N)/\Omega \gtreqless 0, \tag{6b}$$

where $\nu = \delta/(1-\delta)$, $\Omega = \nu/\delta \geq 1$, and $\kappa = \alpha\nu/\lambda\delta(1-\delta)$.

Eqs. (6a) and (6b) indicate that, in the absence of demand shocks, the optimal discretionary policy requires a positive rate of inflation in the nontradable sector. When demand shocks are present, that is, $d_N \neq 0$, whether the rate of devaluation $\tilde{\epsilon}$ is positive or negative depends on the relative importance of the real exchange rate target and the inflation objective in the government's loss function. When the latter predominates, [6] the optimal policy may call for a *revaluation* of the nominal exchange rate.

Substituting (6a)–(6b) in (1)–(3) yields the solutions for the inflation rate and the policymaker's loss function under discretion:

$$\tilde{\pi} = \kappa/\Omega, \tag{7a}$$

$$\tilde{L}^g = \alpha(\Phi d_N + \Theta) + \lambda(\kappa/\Omega)^2/2. \tag{7b}$$

[5] Note that Eq. (4) would not be independent of Θ if the cost of deviations from the real exchange rate target in the loss function (2) were quadratic. This would occur if the policymaker were concerned not only with competitiveness of the tradable sector, but also with the beneficial effects of an appreciation of the real exchange rate (for instance, a real appreciation could benefit the economy by lowering the cost of imported intermediate goods). The major implications of the analysis would not, however, be qualitatively altered by this extension.

[6] That is, when λ is 'high', when α is 'low', or more generally when $\alpha/\lambda < \delta(1-\delta)\Phi d_N$. Note that the case $\alpha = 0$ (so that $\tilde{\epsilon} = -\delta\Phi d_N$ and $\tilde{\pi} = 0$) in the non-cooperative game corresponds also to the solution of the Stackelberg game in which the policymaker minimizes the loss function (2) – with $\alpha > 0$ – subject to (1) and the reaction function of the private sector, (5).

Eq. (7a) indicates that the economy's inflation rate is independent of the demand shock and increasing with the relative weight attached to competitiveness in the policymaker's loss function, α/λ. Inflation is positive, because if it were zero, the policymaker would always have an incentive to devalue. Thus, the policymaker incurs a net loss unless d_N takes on large negative values – which improve competitiveness and reduce the rate of increase in nontradable prices.

Consider now the case in which the policymaker is able to commit himself to a predetermined exchange rate. Formally, this means that in minimizing its loss function, the policymaker takes into account the effect of its actions on private sector behavior, knowing it will not renege. In this case the policymaker will announce and maintain a fixed exchange rate – or a rate of devaluation $\epsilon = 0$. [7] If the private sector believes the announcement and acts on that basis, (5) yields $\bar{\pi}_N = \Phi d_N$ which, in turn, implies $\bar{\pi} = \delta \Phi d_N$ and

$$\bar{L}^g = \alpha(\Phi d_N + \Theta) + \lambda \bar{\pi}^2/2, \tag{8}$$

or, if $d_N \equiv 0$,

$$\bar{L}^g = \alpha\Theta. \tag{8'}$$

From (7b) and (8'), $\bar{L}^g < \tilde{L}^g$ when $d_N = 0$. Thus, the no-devaluation equilibrium gives a value of the loss function that is *less* than that obtained under the non-cooperative solution. This reflects the fact that the policymaker is not able to achieve the gain in competitiveness sought in the discretionary regime, because price setters simply increase nontradable prices accordingly. Thus, a binding commitment entails a gain in the form of a lower inflation rate with no loss in competitiveness. [8]

Consider now the case where the government announces at the beginning of the period its intention to maintain the exchange rate fixed (that is, $\epsilon = 0$), but decides to deviate from this policy and to implement a discretionary change once price decisions are taken. If price setters believe the zero-devaluation announcement, they will once again choose $\ddot{\pi}_N = \Phi d_N$. Substituting this result in (4), the optimal rate of devaluation chosen by the policymaker becomes

$$\ddot{\epsilon} = \kappa - \nu \Phi d_N. \tag{9}$$

[7] However, the government would still be subject to the same credibility problem as in the discretionary equilibrium if it merely announces a fixed exchange rate. To work, the commitment must be perceived as binding. We assume this can be achieved for the moment, and will return to this issue below.

[8] However, if the effect of the demand shock on nontradable prices is large enough, the loss under precommitment can exceed that obtained under discretion, that is, $\bar{L}^g > \tilde{L}^g$.

The minimized value of the policymaker's loss function under this cheating regime is

$$\ddot{L}^{g} = -\alpha\left[\kappa - \Phi d_{N}/(1-\delta) - \Theta\right] + \lambda\ddot{\pi}^{2}/2, \tag{10}$$

where $\ddot{\pi} = (1-\delta)\kappa$.

For $d_N = 0$, it can be verified that $\ddot{L}^{g} < \bar{L}^{g} < \tilde{L}^{g}$. [9] The discretionary solution produces the largest loss for the authorities, resulting in a positive rate of devaluation and inflation. Because the loss is lower when the policymaker succeeds in 'fooling' the private sector than when it commits itself without reneging, there is an incentive to deviate from the fixed exchange rate target if price setters can be made to believe that the current parity will be adhered to, so that, for $d_N = 0$, $\ddot{\epsilon} = \kappa > \tilde{\epsilon} = \kappa/\Omega > \bar{\epsilon} = 0$. However, although the rate of depreciation is *higher* under cheating than under discretion, the overall inflation rate is the same under both regimes ($\tilde{\pi} = \ddot{\pi}$), since, for $d_N = 0$, $\bar{\pi}_N = 0$ and $\tilde{\pi}_N = \kappa/\Omega \geq 0$. The rate of inflation in the nontradable sector is *lower* when price setters are fooled than in the discretionary regime. Moreover, under discretion, the rate of depreciation of the real exchange rate is zero, since $\tilde{\pi} - \tilde{\pi}_N = 0$. The authorities are incapable of altering the real exchange rate by a nominal devaluation. By contrast, if the private sector can be successfully misled by the fixed exchange rate announcement, $\ddot{\epsilon} - \ddot{\pi}_N = \kappa$. Such a strategy, however, entails reputational costs, an issue that is examined below.

The three different solutions are represented in Fig. 1. [10] In the $\pi_N - \epsilon$ space, the locus *PP* reflects the reaction function of the private sector (given by Eq. (4)) and has a positive slope, while *GG* depicts the policymaker's reaction function under discretion (given by Eq. (5)) and has a negative slope. The non-cooperative equilibrium is located at the intersection of curves *GG* and *PP*, that is, at point *A*. The precommitment solution obtains at point *B*, while the cheating solution obtains at point *C*. The discretionary solution is characterized by a 'devaluation bias'. Private agents know that once they set prices of nontradables, the policymaker has the incentive to devalue so as to depreciate the real exchange rate and improve the balance of payments. They therefore set prices at a higher level, to the point where they believe the authorities are unwilling to trade off a higher inflation rate for a more depreciated real exchange rate. The precommitment solution, although not the best possible, provides a better outcome than the discretionary alternative. This provides an argument in favor of a fixed exchange rate – assuming the commitment can be made binding and perceived as such by price setters. The implications of the model are qualitatively similar to those obtained by Andersen and Risager (1991), Cukierman (1992), and Horn and Persson (1988) who developed more direct extensions of Barro and Gordon's (1983) framework.

[9] For positive demand shocks, the loss under cheating will always be less than that obtained under discretion ($\ddot{L}^{g} < \tilde{L}^{g}$), whatever the value of d_N.

[10] The Figure assumes that $\alpha/\lambda > \delta(1-\delta)\Phi d_N$, which ensures that $\tilde{\epsilon} > 0$.

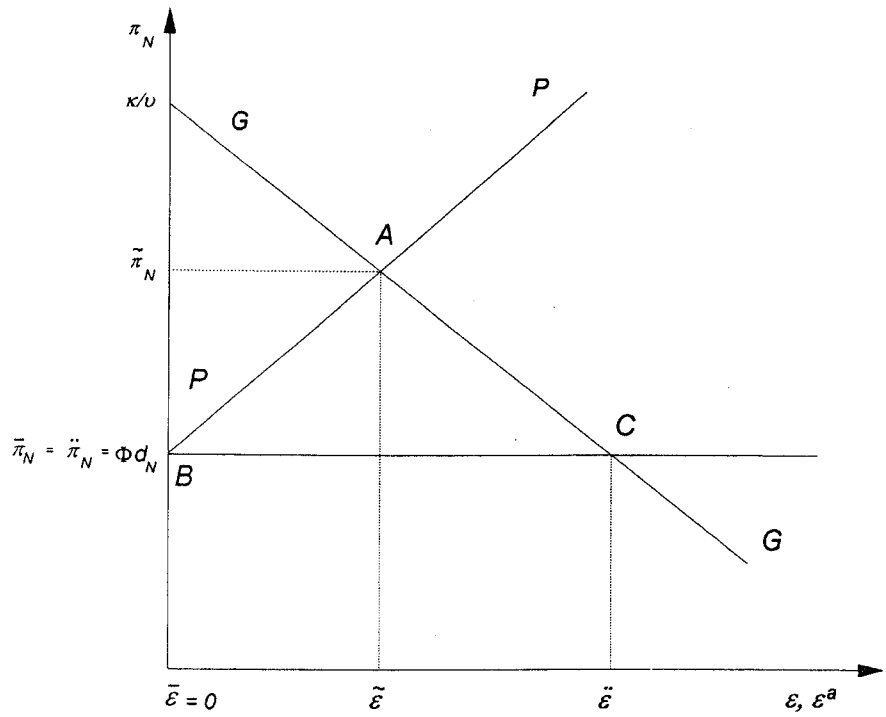

Fig. 1. Determination of alternative equilibria.

Precommitment to a preannounced zero-devaluation rule can be successful only if the authorities would incur some penalty if they deviate from their rule. One form that this penalty can take is that if the policymaker were to deviate from the preannounced rule, the public would not believe its announcements in the following period(s), so that the economy reverts to the discretionary equilibrium. In this context, a zero-devaluation rule – that is, a fixed exchange rate target – is credible if the temptation to deviate from the rule is less than the discounted value of the 'punishment' associated with reversion to the discretionary equilibrium. Following Barro and Gordon (1983) and Horn and Persson (1988), the degree of credibility of a fixed exchange rate, C, can be defined as the difference between the present value of the punishment and the temptation:

$$C = (\ddot{L}^g - \bar{L}^g) - \gamma(\bar{L}^g - \tilde{L}^g)/(1-\gamma), \tag{11}$$

where γ is the discount factor of the policymaker.

Substituting Eqs. (7b), (8) and (10) in (11) and setting $d_N \equiv 0$, it can be shown

that a necessary condition for the degree of credibility of a fixed exchange rate to be positive is

$$\tilde{\pi} \geq 2\alpha(1-\gamma)/\lambda(1-\delta) > \bar{\pi} = 0. \tag{12}$$

Eq. (12) indicates that a fixed exchange rate can be credible only if the inflation rate that would obtain in a discretionary regime is high enough to 'discourage' any attempt to devalue. Using (7a), it can be shown that (12) requires, in turn, $\gamma \geq 0.5$. A fixed exchange rate, under perfect information about the policymaker's preferences, is the optimal strategy provided that the future costs of higher inflation are not sufficiently discounted so as to fall short of the current gain from a depreciation of the real exchange rate resulting from a devaluation. Credibility requires that the short-term benefits from a nominal devaluation be foregone in order to secure the gain from low inflation over the long term. [11]

3. Reputation, signaling, and exchange rate commitment

In this section, we briefly consider how reputational factors and signaling considerations may help mitigate the time inconsistency problem faced by the policymaker when choosing an exchange rate policy. [12]

Following Rogoff (1989), let us assume that there is a continuum of types of policymakers that differ with respect to the cost incurred from reneging on a fixed-exchange rate commitment. Private beliefs are updated as time proceeds on the basis of observed exchange rate policy: the longer the policymaker sticks to a fixed exchange rate, the lower will be the expected rate of devaluation. But if the policymaker abandons the fixed exchange rate, private agents will raise devaluation expectations (to the discretionary level) and will adhere forever to such beliefs. A sequential process of this type leads agents to revise continually upwards the threshold level of cost below which they assume the government has an incentive to renege – provided, of course, that no devaluation occurs. As a result, devaluation expectations tend to fall over time. Although agents may never discover the 'true' value of the cost attached to reneging by the policymaker, the behavior of expectations creates an incentive to commit to a fixed exchange rate rule. 'Reputation', in this context, can be viewed as a mechanism that translates

[11] An increase in the degree of 'openness' (as measured by a fall in δ) reduces the temptation to devalue, since it increases the effect of exchange rate changes on overall inflation, and thus increases the punishment. The net effect on exchange rate credibility of an increase in openness is therefore unambiguously positive.

[12] A more detailed discussion of these issues is provided in a previous version of this paper, available upon request.

into a progressively lower expected rate of depreciation. [13] Rogoff's (1989) analysis suggests that a government facing a relatively low cost of reneging may be tempted to devalue very early in its term in office. But if the policymaker's horizon is long enough (or if the discount rate is high enough), the temptation to devalue is lowered because of the costs resulting form high devaluation expectations.

The implication of the above analysis is that even policymakers who are concerned with a balance-of-payments target may tend, at the start of their term in office, to act as if they do not in order to maintain the impression, among private agents, that inflation is their primary target and therefore lower expectations. Such policymakers, nevertheless, may devalue near the end of their term in office in an attempt to increase competitiveness. A nominal devaluation will 'work', in this context, as long as the policymaker has a reputation of being a 'pegger', or as long the cost of reneging on the exchange-rate commitment is not 'large'. The critical element on which this result rests is the public's lack of information about the policymaker: even if the authorities are committed to maintaining a fixed exchange rate, private agents cannot know this with certainty. [14] Complete credibility in this context is impossible to achieve. This analysis also shows, however, how reputational factors can help mitigate the time-inconsistency problem. A policymaker who is more concerned about a balance-of-payments target retains an incentive to avoid the discretionary outcome early in his term in office because doing so secures more favorable price behavior on the part of private agents.

Consider now a situation where there are only two types of policymakers that differ in the relative weights they attach to the 'internal' target (inflation) and the 'external' target (the real exchange rate). The first type, called D-policymakers ('devaluers') attaches a value to both low inflation and to a more depreciated real exchange rate. The second type, called P-policymakers ('peggers'), attaches a lower weight to the real exchange rate in its loss function. Price setters do not know the type of policymaker in office, but they have a prior probability that the policymaker is of type P. As time proceeds, private agents observe the exchange rate policy and revise their assessment of the policymaker's type.

In the presence of imperfect information about policymakers' preferences, as shown by Vickers (1986), a policymaker who cares relatively more about inflation can signal his preferences to the private sector by inducing a temporary recession. Policymakers with relatively greater concern about output and employment are unwilling to bear this cost, so the signal successfully conveys the policymaker's

[13] In other models that follow Barro (1986), reputation is explicitly defined in probabilistic terms. However, these models have the unattractive feature of involving a phase of randomizing strategy by the policymaker – a limitation that is absent in Rogoff's framework.

[14] Driffill (1987) considers the case where private agents are unable to monitor perfectly the policymaker's actions due to exogenous disturbances.

intention to disinflate. In the context of the above framework, Vicker's analysis suggests that even a government who cares relatively more about inflation (i.e. a P-type policymaker) may have an incentive to devalue by less than it would otherwise find optimal, in order to signal its preferences to the public. One way for the P-type policymaker to reveal his identity might be to select an exchange rate policy that is such that the D-type policymaker would not find optimal to replicate. Such a policy would not, of course, be without cost for the P-type policymaker, but could be a credible signalling device under some circumstances.

Assume that, for simplicity, the policy horizon is limited to two periods. The precise conditions under which the P-policymaker will depart from his optimal, perfect-information response in the first period in order to successfully reveal its type can readily be established. [15] By devaluating by less than it would find otherwise optimal, an anti-inflation government is able to signal immediately and unambiguously its commitment to price stability to private agents,and is able to secure the gain from lower inflation expectations in the second and subsequent periods.

The above result provides an interesting argument in support of an exchange rate freeze in stabilization programs, of the type that has been observed recently in many Latin American countries and Israel (see, for instance, Kiguel and Liviatan (1990)). Fixing the exchange rate (or more generally lowering the rate of depreciation of the exchange rate) may prove successful in signaling the anti-inflationary commitment of the policymaker, and will therefore enhance the credibility of a stabilization program. Indeed, an extension of the argument suggests that it may ultimately be beneficial for a government to *revalue* its currency to convey unambiguous information about its policy preferences. Chile, for instance, revalued its currency twice in 1977, in an attempt to demonstrate the government's resolve to fight inflation.

There are, however, situations in which signaling considerations are incapable of mitigating the time-inconsistency problem of a fixed exchange rate. For instance, both types of government may have a high rate of time preference, in which case the optimal solutions under perfect information and uncertain preferences may not be very different from each other. Intuitively, this is because D-type policymakers have a reduced incentive to masquerade as a P-type. Another situation – which may prove particularly relevant for developing countries – may be that, when implementing a disinflation program, countries are faced with a large current account deficit and a financing constraint. If the deficit is unsustainable and perceived as such by private agents, a 'high' rate of depreciation will appear inevitable and will undermine any signaling attempt. Finally, there are

[15] These conditions involve the determination of a separating equilibrium, which obtains after eliminating other types of equilibria by appealing to several refinements to solution concepts. Details are provided in a previous version of this paper, available upon request.

other ways for a P-type policymaker to send signals that would enable the public to clearly identify his preferences: signals may be sent via the removal of capital controls, a drastic cut in the budget deficit, the appointment of a 'conservative' central banker, etc. An interesting extension to the present analysis would be, therefore, to examine in a more detailed model the benefits and costs of alternative signaling strategies.

4. Credibility effects of monetary unions

An alternative way to attach credibility to a fixed exchange rate regime (and signal the policymaker's commitment to low inflation) would be for the authorities to surrender the power to alter the exchange rate. This could be achieved, for instance, by forming a monetary union under which a group of countries adopt a common currency and fix their parity against a major currency – for developing countries, the CFA Franc Zone or the East Caribbean Currency Area provide examples of such an arrangement. One way for a government to establish credibility for an anti-inflationary policy is to appoint a 'conservative' central banker, who is highly averse to inflation (Rogoff, 1985). It has been argued that membership to a monetary union plays an equivalent role: it allows member countries, in effect, to appoint a 'strong' central banker, establishing credibility by linking the country's monetary policy to the anti-inflationary preferences of the dominant central bank. By 'tying their hands' when joining a fixed-exchange rate arrangement, therefore, 'weak' policymakers can combat inflationary expectations more effectively. [16] In these circumstances, it may be desirable for the authorities to adopt an institutional arrangement that imposes large–political or otherwise – costs to reneging on such precommitment. The important and general point emphasized in this line of reasoning is that, to be credible, such monetary arrangements have to be based on institutional features that make it costly to alter the exchange rate.

There are, however, costs associated with foregoing the use of the exchange rate as a policy instrument, particularly in the presence of large external shocks. The credibility of a country's commitment to the 'rules of the game' of a monetary union – and thus the extent to which membership in a union can overcome time-inconsistency problems – must depend on the nature of such costs. This section briefly examines these issues by extending the model developed

[16] See Giavazzi and Pagano (1988) and Lane and Rojas-Suarez (1992) for a discussion of the 'credibility effect' attached to membership to the European Monetary System. Italy, for instance, is thought to have been able to solve its precommitment problem by tying the lira to the German mark. An alternative explanation is that the fixed exchange rate regime has constrained Italian monetary policy to follow Germany's monetary stance.

previously so as to capture the institutional and macroeconomic constraints imposed by an international monetary arrangement.

Consider a country that has to decide whether or not to maintain its exchange rate fixed within the framework of a monetary union with its major trading partner. [17] Suppose, moreover, that inflation in the partner country is positive, that is, $\pi_T^* > 0$. Assume that both the policymaker and private agents learn about a change in foreign prices immediately after its occurrence, and take their decisions afterwards. For simplicity, let $d_N = 0$ and $\Theta = 0$. The discretionary solution is now given by

$$\tilde{\pi}_N = \kappa/\Omega \geq 0, \tag{13a}$$

$$\tilde{\epsilon} = (\kappa/\Omega) - \pi_T^* \gtreqless 0, \tag{13b}$$

which yields an overall inflation rate equal to

$$\tilde{\pi} = \tilde{\pi}_N = \kappa/\Omega, \tag{14}$$

and a rate of change of the real exchange rate equal to zero ($\tilde{\epsilon} + \pi_T^* - \tilde{\pi}_N = 0$). The associated loss for the policymaker is

$$\tilde{L}^g = \lambda(\kappa/\Omega)^2/2. \tag{15}$$

If the authorities decide to maintain the nominal exchange rate fixed, and if such a policy is believed by price setters ($\bar{\epsilon} = 0$, $\bar{\pi}_N = \bar{\pi} = \pi_T^*$ so that $\bar{\epsilon} + \pi_T^* - \bar{\pi} = 0$), the loss function is equal to

$$\bar{L}^g = \lambda(\pi_T^*)^2/2. \tag{16}$$

A comparison of Eqs. (15) and (16) shows that the loss under a (credible) commitment to maintain the exchange rate fixed is higher than under discretion when $\pi_T^* > \kappa/\Omega$ – in which case the policymaker may decide to renege on his commitment to a fixed parity. When the foreign price shock is small, its direct inflationary impact is limited, and the rate of appreciation of the nominal exchange rate required to offset its impact in the discretionary regime is also small. If the commitment to the fixed exchange rate is credibly enforced, the rate of appreciation of the real exchange rate is the same under both regimes. But the overall effect on inflation under precommitment is π_T^* (since prices of nontradables are adjusted upwards) while under discretion it is κ/Ω.

The analysis suggests therefore that, for a government possessing a loss function which trades off inflation and competitiveness, the desirability of 'tying one's hands' as a solution to the time-inconsistency problem depends on whom one's hands are tied to. If joining a monetary union subjects a country to large nominal shocks, and if private agents in the nontradable sector adjust prices to

[17] The foreign country is assumed not to face time inconsistency problems. An extension of the analysis to a two-country framework is discussed in a previous version of this paper, available upon request.

changes in foreign prices – preventing therefore any sustained real exchange rate misalignment – the credibility gain may be outweighed by the cost of lost autonomy. When the economy is not subjected to large adverse nominal shocks (that is, when union members have stable, low inflation rates), a case can be made for the authorities to precommit to a fixed exchange rate as a means of demonstrating their resolve to maintain financial discipline. But when the economy is subject to large nominal shocks, it may be optimal to alter the exchange rate. Thus, while it may be desirable for policymakers to attach a greater weight to price stability than that perceived by society as a whole (as suggested by Rogoff (1985)), this weight should not be so large that the exchange rate is never altered.

In practice, exchange rate arrangements involving a peg typically incorporate an 'escape clause' or a contingency mechanism that allows members to deviate from the declared parity under exceptional circumstances. [18] To examine this issue in the above setting, suppose that π_T^* is now a random variable that follows a uniform distribution over the interval $(0, c)$, and occurs *after* private agents make their price decisions. Suppose also that the domestic country maintains a fixed parity when foreign price shocks are 'small' but is allowed to alter the fixed exchange rate discretionarily if the foreign price shock is 'large'. The probability that the contingency mechanism will be invoked is therefore $q = \text{Prob}(\pi_T^* \geq \mu)$ where $0 \leq q \leq 1$, and $\mu \leq c$ denotes a given threshold. Under the assumption regarding the distribution of π_T^*, this probability is given by

$$q = \text{Prob}(\pi_T^* \geq \mu) = \int_{\mu}^{c} (1/c)\, d\pi_T^* = (c - \mu)/c. \tag{17}$$

Price setters form expectations prior to the realization of the foreign price shock. If they are aware of the policy rule followed by the authorities, the expected rate of depreciation of the exchange rate will be given by

$$\epsilon^a = q\text{E}(\epsilon \mid \pi_T^* \geq \mu) + (1 - q) \cdot 0,$$

or [19]

$$\epsilon^a = q(\kappa - \Omega\bar{\pi}_T^*)/(1 + \nu q), \tag{18}$$

where $\bar{\pi}_T^* = \text{E}(\pi_T^* \mid \pi_T^* \geq \mu) = (c + \mu)/2$. Suppose, for the sake of the argument, that in what follows $\bar{\pi}_T^* \leq \kappa/\Omega$ so that $\epsilon^a \geq 0$. Eq. (18) indicates that when $q = 0$ the expected rate of depreciation is also zero. By contrast, when $q = 1$ the expected devaluation rate is $\epsilon^a = \kappa/\Omega - \bar{\pi}_T^*$, a solution that can be interpreted as

[18] A case in point is the Bretton Woods system. The optimality properties of monetary policy rules that combine discretionary elements and state-contingent mechanisms have been discussed by Flood and Isard (1989), Obstfeld (1991), and Persson and Tabellini (1989).

[19] Minimizing Eqs. (2) and (3) with $d_N = \Theta = 0$ with respect to π_N and ϵ respectively and substituting for π_N in the first equation yields $\epsilon = \kappa - \nu\epsilon^a - \Omega\pi_T^*$. Taking the conditional expectation of this equation and solving for ϵ^a yields Eq. (18).

the rate that would prevail in the purely discretionary regime examined above with a stochastic foreign inflation rate. [20] In general, as long as there is a positive and less-than-one probability that the contingency mechanism will be invoked, the expected rate of depreciation is lower than under pure discretion since $q < 1$. The discretionary exchange rate policy when the escape clause is activated is given by [21]

$$\tilde{\epsilon} = \left(\kappa + \Omega\nu q\bar{\pi}_T^*\right)/(1 + \nu q) - \Omega\pi_T^*, \tag{19}$$

which is lower than the value that would prevail under pure discretion (obtained by setting $q = 1$ in (19)), since devaluation expectations are lower. An implication of Eq. (19) is that the higher q is – or, equivalently, the lower μ is – the more effective is a contingency mechanism in mitigating the devaluation bias of a discretionary regime ($\partial\tilde{\epsilon}/\partial q < 0$). A high value of q does, however, generate real costs in circumstances in which foreign price shocks turn out to be 'small'. To illustrate this result, note that in a purely discretionary regime, the *actual* (ex post) change in the real exchange rate is given by, using (18) and (19) with $q = 1$ and noting that $\tilde{\pi}_N = \epsilon^a + \pi_T^*$:

$$\tilde{\epsilon} + \pi_T^* - \tilde{\pi}_N = -\Omega(\pi_T^* - \bar{\pi}_T^*), \tag{20}$$

which essentially reflects unanticipated changes in the foreign inflation rate. By contrast, in a regime in which the possibility to invoke an escape clause exists, the actual rate of depreciation of the real exchange rate is determined by the size of the foreign price shock. If the realized value of π_T^* is 'large', and the contingency mechanism is triggered, Eqs. (18) and (19) yield

$$\tilde{\epsilon} + \pi_T^* - \tilde{\pi}_N = \left[\kappa(1 - q) + q\Omega^2\bar{\pi}_T^*\right]/(1 + \nu q) - \Omega\pi_T^*, \tag{21}$$

which indicates (by comparison with (20)) that the real rate of depreciation is lower than under pure discretion. However, if π_T^* turns out to be 'small', the authorities will maintain the nominal exchange rate fixed. The change in the real exchange rate will in this case be given by $(\pi_T^* - \tilde{\pi}_N)$, that is, $-\epsilon^a$. Eq. (18) indicates therefore that in 'normal circumstances', a high probability of using the contingency mechanism may have a negative effect on competitiveness, since nontradable prices are set at a level that may be higher than they would otherwise be if instead $\epsilon^a = 0$. This suggests, therefore, that if this type of mechanism is to be considered as part of an exchange-rate arrangement, q should not be 'too high', that is, the threshold above which a discretionary adjustment of the exchange rate is allowed should not be 'too low'.

[20] Strictly speaking, it is the unconditional expectation of the rate of foreign inflation (rather than $\bar{\pi}_T^*$) that determines the anticipated rate of devaluation in the purely discretionary regime. The difference, however, is small if c is large and can be abstracted from for simplicity.

[21] Eq. (19) obtains by substituting Eq. (18) in the equation for ϵ derived in footnote 19.

5. Concluding remarks

The purpose of this paper has been to examine the time-inconsistency problem in the conduct of exchange rate policy in small, open, developing countries. [22] The analysis has been based on a simple model in which the interactions between price-setting behavior in the nontraded goods sector and concerns over the behavior of the real exchange rate create a temptation for the policymaker to pursue an active exchange rate policy. In this setting, inflation arises because price setters rationally fear that the authorities will try to devalue in order to depreciate the real exchange rate. The analysis also shows that a binding commitment to a fixed exchange rate, if feasible, would result in lower inflation with no loss in competitiveness. If commitment is not feasible – or not credible – the outcome is biased towards an inflationary process resulting from exchange rate devaluations, even in the absence of demand shocks. The incentive structure under a pegged arrangement thus may not be conducive to the adoption of an immutably fixed exchange rate (with attendant financial discipline) but rather to periodic devaluations.

The degree of credibility of a fixed exchange rate has been analyzed under the general assumption that a no-devaluation rule is credible only if it is rational for the public to believe that the authorities have the incentive to adhere to it. Credibility can be achieved if the policymaker worries enough about his reputation and balances future losses of credibility against immediate prospective balance-of-payments gains. Alternatively, when the preferences of the policymaker are uncertain, eschewing devaluation may provide a valuable signal to the private sector, thus increasing the incentives for the authorities to adhere to an announced exchange rate target. The analysis has also focused on the rationale for joining an international monetary arrangement, which is intended to lead to permanently fixed exchange rates. Following Giavazzi and Pagano (1988), it has been argued that one could view an exchange rate union as a mechanism that enhances the pegging government's credibility by raising the cost of inflationary policies. Governments can make binding commitments to the rules in the zone while they cannot precommit to macroeconomic rules outside the system because there are significant costs to the option of dropping out: these costs are related to the gains from macroeconomic cooperation that member countries would forego by going it alone. Such monetary arrangements may even provide some degree of discretion through an escape clause mechanism, provided that devaluations occur only under exceptional circumstances.

[22] Although the paper highlighted particular policy considerations deemed relevant for developing countries, the major implications of the analysis may also be relevant for small, industrialized countries.

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