UC Berkeley
Other Recent Work

Title
Destabilizing Effects of Exchange-Rate Escape Clauses

Permalink
https://escholarship.org/uc/item/15n3p5dt

Author
Obstfeld, Maurice

Publication Date
1996-12-01

Peer reviewed

UNIVERSITY OF CALIFORNIA AT BERKELEY

Department of Economics

Berkeley, California 94720-3880

**Destabilizing Effects of Exchange-Rate Escape
Clauses**

Maurice Obstfeld

University of California, Berkeley

December 1996

Abstract

This paper studies policy rules with escape clauses, analyzing as an example fixed exchange rate systems that allow member countries the freedom to realign in periods of stress. While well-designed escape-clause rules can raise society's welfare in principle, limited credibility makes it difficult to implement such rules in practice. An EMS-type institution that imposes political costs on policymakers who realign *may* raise welfare, but can also produce equilibria far inferior to an irrevocably fixed exchange rate. Switches between multiple equilibria may have the character of sudden speculative attacks.

Maurice Obstfeld
University of California, Berkeley, Berkeley, CA 94720-3880
National Bureau of Economic Research, Cambridge, MA 02138
Centre for Economic Policy Research,London W1X 1LB, United Kingdom

Institutional restraints on monetary policy typically provide for exceptional circumstances. In times of economic crisis, a gold standard may be suspended, a monetary growth target breached, or an exchange rate realigned despite a previous international agreement fixing its level. Underlying such escape clauses is the idea that while institutional discipline is on the whole a good thing, social welfare may be improved if policymakers are granted discretion in the face of unusually severe shocks.[1]

This paper studies the merits of policy rules with escape clauses, analyzing as an example fixed exchange-rate systems that allow member countries to realign in times of stress, but only at some personal cost to the policymakers in power. Motivating this example is the debate within the European Monetary System prior to the 1992-1993 crises over the speed of transition to a single European currency from the then-current regime of national currencies linked by pegged but adjustable exchange rates.

The paper's main point is that while well-designed rules with escape clauses can raise welfare in principle, limited credibility makes it difficult for governments to implement them in practice. The problem is that a narrow-band EMS-type institution — which presumably implies a political cost for policymakers who realign — *may* induce an optimal escape-clause equilibrium, but may just as well induce alternative equilibria far inferior to an irrevocably

---

[1]Policy rules with escape clauses are examined by Flood and Isard (1989, 1990), Lohmann (1990, 1992), Persson and Tabellini (1990), and De Kock and Grilli (1993). In Lohmann's (1992) model, an escape clause arises endogenously because society (following Rogoff's 1985 advice) has appointed a conservative monetary policymaker whom it can dismiss at a cost. However, she does not consider the possibility of multiple equilibria in her model. That possibility is the major focus of this paper.

1

fixed exchange rate.[2] Countries can suffer periods in which no realignment occurs, yet unemployment, real wages, and *ex post* real interest rates remain persistently and suboptimally high (probably a good description of Italy's pre-September 1992 experience). Switches between possible equilibria may have the character of sudden speculative attacks on a fixed exchange rate.[3]

The paper is organized as follows. Section I sets out a model based on Kydland and Prescott (1977) and Barro and Gordon (1983) in which a policymaker desires to raise employment above its natural rate through surprise currency depreciation. Because the policymaker has an informational advantage over the private sector, policy interventions can play some stabilizing role. But allowing the policymaker freedom to stabilize entails the cost of positive trend inflation. An optimal fixed exchange rate with realignment clauses, described in section II, efficiently trades off higher mean inflation against more effective stabilization.

The policy rule described in section II is not time consistent. Section III describes how a fixed personal cost of

---

[2]Cukierman (1990) shows how multiple equilibria can arise in a model with a costly devaluation option. In his model, however, exchange-rate changes play no stabilization role, so rigidly fixed exchange rates are, by assumption, socially optimal. The model developed below has very different properties. De Kock and Grilli (1993) uncover multiple trigger-strategy equilibria, analogous to those I describe here, in a model with an expectational punishment mechanism that leads policymakers to realign currencies only when faced with extreme values of economic shocks. Lewis (1989) mentions the possibility of multiple equilibria in a model where governments face fixed costs of entering into temporary international policy-coordination agreements. For general discussions of the drawbacks of non-credible fixed exchange rates, including possible multiple equilibria, see Obstfeld (1985, 1986).

[3]Italy's very high public debt/GDP ratio is an additional source of credibility problems. Calvo (1988) and Obstfeld (1994) present theoretical analyses of multiple equilibria in a setting of public-debt devaluation.

realigning, imposed on the policymaker by society, may induce him to implement the socially optimal escape-clause rule. But this is not the only possible outcome, as section IV shows. Even if society imposes the "correct" fixed cost, there may well be multiple equilibria, some leading to welfare levels far below the one achieved under an unconditionally fixed exchange rate.

Section V summarizes the principal results and concludes.

I. Commitment vs. discretion in a standard model

The analytical framework is a standard model of monetary policy choice in a small open economy (as, for example, in Horn and Persson 1988). On each date t, a policymaker sets the (log) nominal exchange rate e_t (the price of foreign money in terms of domestic money). Simultaneously, an economy-wide *nominal* wage w_{t+1} (also a log), at which workers agree to supply all the labor firms demand on date $t+1$, is determined in the labor market.

There is a single consumption good. Because its foreign-currency price is fixed, the exchange rate can be identified with the domestic price level. Labor-market equilibrium is assumed to require a constant expected real wage of 1. Thus if $E\left\{e_t \mid I_{t-1}\right\}$ is the date $t-1$ conditional expectation of the date t exchange rate, the wage negotiated on date $t-1$ for date t is

$$(1) \quad w_t = E\left\{e_t \mid I_{t-1}\right\}.$$

The conditioning set I_{t-1} includes full and accurate data on the government's incentives, constraints, and information as of $t-1$.

Labor demand on date t is inversely related to the real wage

$w_t - e_t$ and an employment shock u_t that is realized at the start of period t, before date t labor demand is determined but too late to affect the prenegotiated nominal wage w_t. The equation for date t employment, n_t, is

$$(2) \quad n_t = n^* + \sqrt{\alpha} \left[\left(e_t - E\{e_t \mid I_{t-1}\} \right) - u_t - k \right].$$

In (2), n^* is the employment level targeted by the policymaker, while $k > 0$ represents a fixed distortion in the economy that causes employment systematically to fall short of n^*. (Of course, k will be the source of the policymaker's credibility problem.) The shock u_t, which is serially uncorrelated with zero conditional mean, can be thought of as a shock to the distortion k.

The policymaker's preferences entail a tradeoff between employment levels closer to n^* and inflation rates farther from his target of zero inflation. Specifically, on any date t the policymaker's loss function is

$$(3) \quad L_t = (n_t - n^*)^2 + \theta(e_t - e_{t-1})^2$$

Here, $e_t - e_{t-1}$ is home inflation and $\theta > 0$. The loss function (3) is assumed to correspond to society's loss function. Because the model below contains no essential intertemporal links,[4] there is no need to consider the dynamic pattern of societal losses (3).

While labor markets pre-set w_t in ignorance of the realized value of u_t, the policymaker is assumed to set the exchange rate

---

[4] In particular, no "reputational" equilibria will be considered.

after having observed the shock. In general the policymaker will want to use the exchange rate to offset some of the effect of u_t on employment — for example, by unexpectedly depreciating the currency (raising e_t above e_{t-1} by an amount exceeding labor-market expectations) when u_t turns out to be positive.

There are at least two distinct policymaking processes that might govern management of the exchange rate. Under *discretion* authorities choose e_t to minimize L_t given $E\left\{e_t \mid I_{t-1}\right\}$ and u_t. The exchange-rate change a policymaker chooses under discretion is

$$(4) \quad e_t - e_{t-1} = \lambda\left[E\left\{e_t \mid I_{t-1}\right\} - e_{t-1}\right] + \lambda(k + u_t), \quad \lambda \equiv \frac{\alpha}{\alpha + \theta}.$$

Under *commitment*, however, the authority can bind itself *ex ante* for all dates t to an irrevocable exchange-rate rule of form

$$(5) \quad e_t - e_{t-1} = \varepsilon(u_t, k).$$

In what follows I will use the *unconditional* expected policy loss as a "Rawlsian" welfare criterion for ranking policy regimes. Under commitment, then, the authority solves the problem: Find a function $\varepsilon(u_t, k)$ that minimizes the unconditional expectation $E\left\{L_t\right\}$ subject to $e_t - e_{t-1} = \varepsilon(u_t, k)$ and $E\left\{e_t \mid I_{t-1}\right\} = e_{t-1} + E\left\{\varepsilon(u_t, k) \mid I_{t-1}\right\}$ for all $t \geq 0$.[5] It is easy to see that the rule

$$(6) \quad \varepsilon(u_t, k) = e_t - e_{t-1} = \lambda u_t$$

---

[5] In fact, to obtain the commitment equilibrium in this model, it suffices that for any date t, the government be able to bind itself on date $t-1$ to the rule it will follow on date t.

is optimal under commitment, where $\lambda \in [0,1]$ is defined in (4).

Under (6) the authority cushions employment surprises through exchange-rate surprises to a degree inversely related to its relative inflation aversion θ/α; but it makes no attempt to offset the predictable distortion k. Mean inflation therefore is zero under commitment, and the (unconditional) expected policy loss is

$$(7) \quad EL^C = \alpha k^2 + \gamma \sigma_u^2 , \qquad \gamma \equiv (1 - \lambda)\alpha < \alpha,$$

where σ_u^2 is the variance of u.

Under discretion the exchange rate is set by (4). Rational expectations in the labor market ensure that in equilibrium

$$(8) \quad e_t - e_{t-1} = \frac{\lambda}{1 - \lambda} k + \lambda u_t,$$

implying an expected loss of

$$(9) \quad EL^D = \gamma E(\frac{\lambda k}{1 - \lambda} + k + u)^2 = EL^C + \theta \lambda^2 k^2 / (1 - \lambda)^2.$$

EL^D exceeds EL^C for a well-known reason: unless he can commit to zero mean inflation, the policymaker will attempt to offset the distortion k through a surprise reduction in real wages. But the cost of this distortion, αk^2 in (7), is irreducible. Since everyone understands the authority's goals, equilibrium wages incorporate inflation expectations and rise at rate $\lambda k/(1 - \lambda)$ [see (8)]. As a result, the additional expected policy loss implied by a discretionary regime is $\theta \lambda^2 k^2 / (1 - \lambda)^2$.

One particular rule -- suboptimal within the narrow confines of the present model -- is a fixed exchange rate: $e_t = e_{t-1}$, for all t. Expected loss under this rule (if it can be enforced) is

$$(10) \quad EL^F = \alpha E(k + u)^2 = \alpha k^2 + \alpha \sigma_u^2.$$

A fixed rate prevents any policy response to the shock u, so $E(L^F - L^C) = (\alpha - \gamma)\sigma_u^2$, the gain due to optimal stabilization. However, a fixed rate avoids the secular inflation $\lambda k/(1 - \lambda)$ implied by a discretionary regime. So a comparison of EL^F (fixed rates) with EL^D (pure discretion) is ambiguous in general, depending in an obvious way on the values of θ/α, k, and σ_u^2.

II. Nondiscretionary escape clauses

When the potential gains from stabilization are significant, a fixed exchange rate regime that allows discretion in exceptional circumstances may raise welfare compared to an unconditionally fixed rate. At the same time, a regime of pure discretion may be improved if some statutory limits are placed on the policymaker's exchange-rate choices. These observations give rise to the idea of policy rules embodying escape clauses.

This section studies *nondiscretionary* escape clauses: binding rules that specify when the exchange rate is to remain fixed and when discretion is permissible. There is an obvious problem with such rules: how can society enforce them if policy commitments are not feasible? To address this problem, the next section takes up *discretionary* escape clauses, which are invoked when the policymaker chooses, but at a personal cost. The present section's

7

results remain pertinent, though, as they clarify the consequences of discretionary and nondiscretionary escape clauses alike.[6]

Consider a policymaker bound to the exchange-rate rule:

$$(11) \quad e_t = \begin{cases} e_{t-1} & \text{if } \underline{u} < u_t < \overline{u} \\ \underset{e_t}{\text{argmin }} L_t & \text{if } u_t \leq \underline{u} \text{ or } u_t \geq \overline{u}. \end{cases}$$

This rule instructs the policymaker to resort to discretion if u_t assumes an extreme value, i.e., one that lies outside $(\underline{u}, \overline{u})$.

Expectations under rule (11) reflect the possibility of a reversion to discretion, and these expectations, in turn, affect the exchange rate chosen when discretion is indeed "on" [recall (4)]. Let $G(u)$ be the cumulative distribution function for the i.i.d. shock u, and define the probabilities

$$\underline{\pi} \equiv G(\underline{u}) = \int_{-\infty}^{\underline{u}} dG(u), \quad \overline{\pi} = 1 - G(\overline{u}) = \int_{\overline{u}}^{\infty} dG(u).$$

The expected exchange rate under the assumed regime is

$$E(e_t \mid I_{t-1}) = \underline{\pi} E\left\{e_t \mid u \leq \underline{u}\right\} + \overline{\pi} E\left\{e_t \mid u \geq \overline{u}\right\} + (1 - \underline{\pi} - \overline{\pi})e_{t-1},$$

which can be solved, using (4), for the equilibrium expectation

[6]It may seem artificial to consider binding escape-clause rules; after all, once binding rules are admitted to be feasible, many other rules would be better — for example, keep the exchange rate fixed within a set interval of u values, but use the optimal rule (6) outside. The payoff, to repeat, is a benchmark for analyzing escape clauses that arise in reality and are enforced through sanctions applied to policymakers.

(12) $E(e_t \mid I_{t-1}) = e_{t-1} + \delta(\underline{u}, \bar{u}),$

where[7]

$$(13) \quad \delta(\underline{u}, \bar{u}) \quad \equiv \quad \frac{\lambda\left[\underline{\pi}\left(k + E\left\{u \mid u \leq \underline{u}\right\}\right) + \bar{\pi}\left(k + E\left\{u \mid u \geq \bar{u}\right\}\right)\right]}{1 - \lambda(\underline{\pi} + \bar{\pi})} \quad .$$

The unconditional expected loss is denoted by $EL(\underline{u}, \bar{u})$, where

$$(14) \quad EL(\underline{u}, \bar{u}) = (1 - \underline{\pi} - \bar{\pi})\alpha E\left\{[\delta(\underline{u}, \bar{u}) + k + u]^2 \mid u \in (\underline{u}, \bar{u})\right\}$$

$$+ (\underline{\pi} + \bar{\pi})\gamma E\left\{[\delta(\underline{u}, \bar{u}) + k + u]^2 \mid u \notin (\underline{u}, \bar{u})\right\}.$$

Equation (14) is best understood by reference to the last section's results. Under both pure discretion and a fixed exchange rate, the policymaker's expected loss is proportional to $E(\phi + k + u)^2$, where ϕ is the equilibrium expectation of depreciation: $\lambda k/(1 - \lambda)$ under discretion, zero under a fixed rate [see equations (9) and (10), respectively]. With a fixed rate the proportionality constant is α, while under discretion it is the smaller quantity $\gamma = \alpha(1 - \lambda)$ because of the policymaker's ability to stabilize employment (at the cost of higher secular inflation).

The loss (14) averages over these two regimes in a particular way. In states of nature where the fixed rate holds steady, the expected loss is α times the corresponding conditional expectation

---

[7]Even if $\lambda = 1$ (i.e., $\theta = 0$), so that the policymaker puts no weight at all on inflation, the expected depreciation rate in (13) is finite provided at least one threshold is strictly within the support of u. In contrast, equilibrium depreciation is infinite when $\lambda = 1$ in the case of pure discretion [equation (8)].

of $(\phi + k + u)^2$; in states where it does not, the expected loss is γ times the conditional expectation of $(\phi + k + u)^2$ corresponding to discretion. Overall expected loss is the appropriate probability-weighted average. The trend expected depreciation rate $\phi = \delta(\underline{u}, \overline{u})$ is constant across realizations of u and leads to a "peso problem." Under fixed rates there is the possibility of a parity change, while under discretionary exchange-rate management there is the possibility of a return to fixed rates.[8] In general, $\delta(\underline{u}, \overline{u})$ may be positive or negative. Naturally, the model implies pure discretion as $\overline{u} - \underline{u} \to 0$, a pure fixed rate as $\overline{u}$ and $-\underline{u} \to \infty$.

Nondiscretionary escape clauses that strictly dominate both pure discretion and an irrevocably fixed exchange rate often can be designed.[9] Under an optimal escape clause, for example, the incremental stabilization gain from altering a realignment threshold just equals the incremental expected-inflation loss.

Implementing a beneficial escape clause may be problematic, however, because of the assumption that a binding rule governs the cases in which discretion is permitted. In effect, the policy-maker, like Saint-Exupéry's (1943) Little Prince on his visit to

---

[8]The expectation ϕ is independent of u because that shock is i.i.d. Allowing serial correlation in u would complicate the results (and arguably add to their descriptive realism), but wouldn't alter any fundamental insights. For example, for given escape thresholds, positive serial correlation in u would make wages an increasing function of u. Also, the optimal thresholds generally would depend on the previous period's shock realization.

[9]See Persson and Tabellini (1990) for a good discussion of a special case. By construction, no escape-clause rule strictly dominates the optimal rule (6). Notice that when u is distributed symmetrically around zero, the *optimal* bounds are not symmetric: $\underline{u} < -\overline{u}$ because $k > 0$. Even symmetric bounds, such as those analyzed by Persson and Tabellini (1990), may raise welfare compared with discretion or fixed rates.

the incentive compatibility minded monarch of asteroid 325, is commanded by society to do what he wants to do, but only in certain states of the world. Such a rule clearly is *not* incentive compatible: absent a commitment mechanism, the policymaker will *always* do what he wants to do, namely, exercise full discretion.

One way to impose a nonzero probability that a steady exchange rate is optimal *ex post* is to posit a fixed *social* cost χ of currency realignment, over and above the costs captured by the term $\theta(e_t - e_{t-1})^2$ in (3). Even under discretion, such a cost will induce the policymaker to keep e fixed over a range of u realizations. The time-inconsistency problem remains, however, because the policymaker's discretionary behavior generally will not minimize the *ex ante* social loss $EL - (\underline{\pi} + \bar{\pi})\chi$.

A fixed *personal* cost of realignment, imposed on the policymaker only, could reduce the gap between discretionary behavior and the *ex ante* optimal escape-clause rule. For example, a government might lose face politically if forced to alter a rate it had promised to fix. When the authority conducts a cost-benefit analysis of realignment each period, however, its decision to exercise the escape clause is discretionary. I now analyze escape clauses triggered by discretion rather than by a rule.

III. Discretionary escape clauses

A well-designed escape clause is potentially welfare-improving, but can fixed personal costs of currency realignments induce policymakers to implement it under discretion? The answer is of particular interest in light of the old narrow-band EMS, which is often viewed as an institution that imposed fixed personal

realignment costs on officials. I now argue that a discretionary escape clause can easily fail to reproduce the social optimum.

Assume the policymaker faces a personal cost $\underline{c}$ of revaluing the currency (lowering e) and a cost $\bar{c}$ of devaluing (raising e).[10] Under discretion the policymaker takes the market's expected devaluation rate, ϕ, as given. The *ex post* social loss (3) is

$$(15) \quad L^F(\phi,u) \equiv \alpha(\phi + k + u)^2,$$

given u, if the fixed exchange rate is maintained, and is

$$(16) \quad L^D(\phi,u) \equiv \gamma(\phi + k + u)^2$$

if the choice is to realign.[11]

Since the future is unaffected by decisions made today, the policymaker's sole concern is the short-run social-cost differential, $L^F - L^D$, net of the fixed cost to himself of any parity adjustment. The policymaker's optimal decision rule is to devalue the currency for $u \geq \bar{u}$, where $\bar{u}$ is the solution to

$$(17a) \quad L^F(\phi,\bar{u}) - L^D(\phi,\bar{u}) = (\alpha - \gamma)(\phi + k + \bar{u})^2 = \bar{c};$$

---

[10] These costs are taken here as exogenous, although it would be preferable to model them, perhaps as part of an explicit political equilibrium.

[11] The formulation here assumes that realignment carries no extra fixed *social* costs. These could be incorporated without changing the analysis below. The key point about such costs is the one made at the end of the last section: fixed *social* costs alone cannot induce the policymaker to implement the *ex ante* socially optimal rule. An incentive structure that penalizes the policymaker without penalizing the rest of society — for example, a salary cut that accrues to the government budget — is indispensable.

and to revalue for $u \leq \underline{u}$, where $\underline{u}$ is the solution to

(17b) $L^F(\phi,\underline{u}) - L^D(\phi,\underline{u}) = (\alpha - \gamma)(\phi + k + \underline{u})^2 = \underline{c}.$

Figure 1 illustrates how $\underline{u}$ and $\bar{u}$ are determined.[12]

The relationships in the figure suggest how, for example, a *socially* optimal escape-clause rule might be implemented. Let $\underline{u}$ and $\bar{u}$ be optimal switch points; then set $\underline{c}$ and $\bar{c}$ at the levels

(18) $\underline{c} = (\alpha - \gamma)[\delta(\underline{u},\bar{u}) + k + \underline{u}]^2$, $\bar{c} = (\alpha - \gamma)[\delta(\underline{u},\bar{u}) + k + \bar{u}]^2.$

Faced with market depreciation expectations $\delta(\underline{u},\bar{u})$, the authority will pick the optimal boundaries $\underline{u}$ and $\bar{u}$ if the fixed realignment costs specified in (18) are imposed [compare (17) with (18)].

This scheme succeeds *if* the market expects the currency to depreciate at rate $\phi = \delta(\underline{u},\bar{u})$ on average, but there may be no way to ensure that this is the market's expectation. As (17) shows, changing ϕ to ϕ', say, will lead to different switch points, $\underline{u}'$ and $\bar{u}'$, even with the same fixed realignment costs; and an additional rational-expectations equilibrium will arise whenever $\phi' = \delta(\underline{u}',\bar{u}')$. In general, such a self-validating equilibrium produces a strictly lower social welfare level than the optimal one. An equilibrium with a rate of expected depreciation greater than under the optimal rule leads to a higher real wage and, so, to higher unemployment when the escape clause is not invoked.

Why should multiple equilibria arise at all? The answer lies

------

[12]The exchange-rate decision depends on u's current value only, given ϕ, k, and realignment costs, because no other variable in the model enters into the policymaker's cost-benefit analysis.

in the policymaker's inability, under discretion, to forswear credibly the accommodation of expected depreciation. A rise in expected depreciation on date $t-1$, other things the same, can push the economy farther from full employment on date t; as (4) shows, the policymaker will create some date-t inflation to mitigate this employment effect, with the propensity to accommodate measured by λ. Under a discretionary escape clause, different expected switch points imply different exchange rate expectations. Accommodative (high λ) policymakers may alter their preferred switch points so as to ratify a change in expectations. Multiple equilibria would not arise if the contingency triggering the escape clause were exogenous and easily verifiable — for example, a natural diaster or the outbreak of war — but the escape clauses embodied in postwar fixed exchange rate arrangements do not have this feature.

One might hope for more success in implementing a socially beneficial escape-clause rule through more complicated incentive structures — for example, schemes that make the policymaker's penalty depend on the size of a realignment. Indeed, the analysis of Persson and Tabellini (1993) and Walsh (1995a) shows that society may actually attain the minimal expected loss EL^C in (7) by delegating exchange-rate policy to an agent who minimizes the sum of society's loss and a contractual penalty that is a function of depreciation [here, $2\alpha k(e_t - e_{t-1})$]. Obstfeld and Rogoff (1996, ch. 9) offer a general discussion of practical obstacles to implementing optimal central banker incentive contracts.[13] Perhaps the main rationale for examining a pegged-but-adjustable exchange

---

[13]Walsh (1995b) discusses such problems in the specific context of New Zealand's recent experiment.

rate with fixed policymaker realignment costs is the importance of similar regimes in historical and current practice. Arguably both the Bretton Woods system and the EMS fall into this category, but there are countless other examples. Among them are countries attempting to eliminate extreme inflation, which are widely advised to fix their exchange rates at the outset but to retain the option of greater flexibility down the road (Fischer, 1995).

Even for fixed realignment costs, the number of equilibria and their welfare properties depend in a complicated way on the distribution function $G(u)$. For this reason, I now study in detail some specific but empirically plausible examples.

IV. Multiple equilibria: Examples

Without substantive loss of generality, I assume that revaluation is ruled out from the start: only large positive realizations of u occasion discretion, in which case a devaluation occurs. The case of a single equilibrium boundary, $\bar{u}$, accurately portrays devaluation-prone countries while making the algebra much easier.

A devaluation option of this sort imparts a definite inflation bias to the regime; a welfare gain over pure discretion can arise only when the mean inflation bias falls as a result of the limits on the exchange rate's flexibility. On the negative side, the escape clause makes employment more variable compared with a free float: in non-devaluation states, employment is below the level that would prevail under discretion, while in devaluation states, it is higher. Because employment is less variable than under a rigidly fixed exchange rate, however, a mixed regime may — but need not — dominate either polar regime.

15

In line with the simplifying assumption that only devaluation is possible, define $\delta(\bar{u})$ as the expected depreciation rate when the authority holds the exchange rate fixed for $u < \bar{u}$, but devalues otherwise: $\delta(\bar{u}) \equiv \lim_{\underline{u} \to -\infty} \delta(\underline{u},\bar{u})$ [see equation (13)]. All the formulas derived above can be extended to the present simpler setting by replacing $\delta(\underline{u},\bar{u})$ with $\delta(\bar{u})$ and $\underline{\pi}$ with 0.

The specific distribution assumed for u has the tent-shaped density function $g(u) = G'(u)$ (under which $\sigma_u^2 = \mu^2/6$):

$$g(u) = \begin{cases} (\mu - |u|)/\mu^2 & \text{for } u \in [-\mu,\mu] \\\\ 0 & \text{for } u \notin [-\mu,\mu]. \end{cases}$$

Direct calculation yields the inflation bias of the regime,

$$(19a) \quad \delta(\bar{u}) = \frac{\lambda\bar{\pi}\left(k + E\left\{u \mid u \geq \bar{u}\right\}\right)}{1 - \lambda\bar{\pi}} \quad ,$$

$$(19b) \quad \bar{\pi} = \begin{cases} 1 - (\mu + \bar{u})^2/2\mu^2 & \text{for } \bar{u} \in [-\mu,0] \\\\ (\mu - \bar{u})^2/2\mu^2 & \text{for } \bar{u} \in (0,\mu], \end{cases}$$

$$(19c) \quad E\left\{u \mid u > \bar{u}\right\} = \left(\mu^3 + 2|\bar{u}|^3 - 3\mu\bar{u}^2\right)/6\bar{\pi}\mu^2.$$

Naturally, $\delta(\bar{u}) \to 0$ as $\bar{u} \to \mu$ (and the escape option disappears); while $\delta(\bar{u}) \to \lambda k/(1 - \lambda)$ as $\bar{u} \to -\mu$ (in which case discretion prevails with probability one).

Now consider equilibria. Equation (17a) describes how the

policymaker will choose a switch point $\bar{u}$ given expected depreciation ϕ. An equilibrium requires, in addition, that $\phi = \delta(\bar{u})$. Given the fixed cost $\bar{c}$, the set of *interior* equilibrium switch points $\bar{u} \in (-\mu, \mu)$ are the solutions to the (generally very nonlinear) equation in $\bar{u}$,

$$L^F[\delta(\bar{u}), \bar{u}] - L^D[\delta(\bar{u}), \bar{u}] = (\alpha - \gamma)[\delta(\bar{u}) + k + \bar{u}]^2 = \bar{c}.$$

More simply, interior equilibria correspond to values of $\bar{u}$ that solve[14]

$$(20) \quad \delta(\bar{u}) + k + \bar{u} \equiv \Gamma(\bar{u}) = \sqrt{\bar{c}/(\alpha - \gamma)} \equiv \kappa.$$

Corner equilibria such that $\bar{u} = -\mu$ or μ also are possible. If $\Gamma(-\mu) > \kappa$, then $\bar{u} = -\mu$ defines an equilibrium because the policymaker always finds it optimal to exercise discretion if markets expect complete discretion. The policymaker thus incurs the personal cost $\bar{c}$ period after period. [No interior shock u at which $\Gamma(u) > \kappa$ can be an equilibrium switch point, since the policymaker would have a positive incentive to devalue for slightly smaller shock values. But when $\bar{u} = -\mu$ no smaller shock values exist.] Likewise, $\bar{u} = \mu$ defines an equilibrium if $\Gamma(\mu) < \kappa$.

Alternative equilibria are most easily studied by graphing

---

[14]What about solutions to $\delta(\bar{u}) + k + \bar{u} = \Gamma(\bar{u}) = -\sqrt{\bar{c}/(\alpha - \gamma)} = -\kappa$, which also satisfy the preceding quadratic equation? These define smallest positive employment shocks such that the authority would be willing to revalue — not devalue — at cost $\bar{c}$. Such solutions can be disregarded because revaluations have been ruled out. In the numerical cases examined below $\Gamma(-\mu) > 0$, so revaluations are always unattractive even when $\underline{c} = 0$.

the function $\Gamma(u)$ defined by (19) and (20). Several different shapes for this function emerge as the parameters k and λ — which respectively measure the severity of the time-inconsistency problem and the willingness to accommodate — are varied. It is assumed in the three examples below that $\mu = 0.03$.

1. *Equilibrium may be unique.* Consider an economy with a relatively small time-inconsistency problem ($k = 0.0075$) whose society and policymaker are averse to accommodation ($\lambda = 0.5$). The finer graph in figure 2 shows the expected policy loss implied by different possible switch points $u \in [-0.03, 0.03]$ (right-hand vertical axis). The heavier graph shows the $\Gamma(u)$ function that arises in this case (left-hand vertical axis).[15]

In figure 2 the optimal switch point $\bar{u}^*$ is 0.0063 (implying a devaluation probability of 0.312).[16] The policy loss at this point

---

[15] The right-hand vertical axis measures losses in terms of a concrete metric. Recall from (7) that given an employment distortion of size k and a disturbance variance of σ_u^2, the minimal expected loss under the assumed information structure is $EL^C = \alpha k^2 + \gamma\sigma_u^2$. (This loss is achieved if commitment is possible.) I measure loss under any other regime by considering a hypothetical authority with a costless commitment mechanism, and computing the fraction by which σ_u would have to increase to raise his loss to the level implied by the alternative regime. If the alternative regime is one with a devaluation option at $\bar{u}$, this loss measure is

$$L(\bar{u}) \equiv \sqrt{\left[EL(\bar{u}) - \alpha k^2\right]/\gamma\sigma_u^2} - 1.$$

An advantage of the preceding loss measure is that like the $\Gamma(u)$ function defined in (20), it does not depend on the parameter α, only on λ. Abusing language, the left-hand vertical axis in figure 2 refers to κ [also defined in (20)] as the "devaluation cost."

[16] In these examples, the emphasis on fixed devaluation costs that can produce *optimal* switch points is entirely illustrative. The analysis obviously implies that other levels of devaluation cost also can lead to multiple equilibria.

is 25.6 percent — meaning that the cost of this regime relative to the optimal regime is equivalent to having access to commitment, but increasing the standard deviation σ_u from 0.0122 to 0.0153.

The optimal devaluation rule is an improvement over both pure discretion ($\bar{u} = -0.03$, with an associated cost of 0.323) and an unconditional peg ($\bar{u} = 0.03$, with a cost of 0.414). Note that pure discretion dominates a rigidly fixed exchange rate. The example shows that in principle, some limits to exchange-rate flexibility can raise welfare, even though a rigidly fixed rate would not.

Can the optimal switch point be delegated under discretion by imposing the appropriate devaluation cost on the policymaker? In this example it can. The $\Gamma(u)$ function is strictly increasing: setting $\kappa = \Gamma(\bar{u}^*)$ [as equation (20) directs] induces the policymaker to devalue when, and only when, $u \geq \bar{u}^*$. Expected depreciation in this regime is $\phi^* = 0.4$ percent per period (compared with 0.75 percent under a free float, and zero under a fixed rate). And equilibrium is unique: given κ, no expected depreciation rate ϕ' other than 0.4 percent can lead the policymaker to a switch point $\bar{u}'$ where $\phi' = \delta(\bar{u}')$.

2. *There may be several equilibria, one of which entails full discretion.* To obtain an example of this case, imagine that all parameters are as in the previous example, except that society and the policymaker are much more accommodative. Now, $\lambda = 0.9$.

Figure 3 graphs the relevant functions. The optimal switch point is $\bar{u}^* = 0.0049$ (which is below the last example's boundary at $u = 0.0063$, in line with the present authority's greater interest in stabilization). The loss implied by this regime is 1.365, lower than under a fixed rate [$L(0.03) = 2.162$] or pure

discretion [L(−0.03) = 4.895]. The discretionary regime does so poorly because it implies inflation at 6.75 percent per period; under the optimal devaluation rule, however, expected inflation is only 0.96 percent per period.

Now, however, the optimal escape-clause rule cannot always be delegated by imposing a well-chosen cost on a discretionary policymaker. As figure 3 shows, setting $\kappa = \Gamma(\bar{u}^*)$ yields a second interior equilibrium [the other intersection of the horizontal broken line with the $\Gamma(u)$ function]. At the switch point $\bar{u}' = -0.00061$, expected depreciation is $\phi' = \delta(\bar{u}') = 1.5$ percent $> \phi^* = \delta(\bar{u}^*) = 0.96$ percent. If markets believe $\bar{u}'$ is the devaluation threshold, the policymaker will ratify that belief rather than tolerate its effects under the prior exchange parity when u turns out to be above $\bar{u}'$.

Real wages in this second equilibrium are higher than in the first in non-devaluation states. Thus, unemployment is higher whenever the exchange rate remains fixed. When currency depreciation does occur it is sharper in the second equilibrium, because nominal wages are further out of line with the authority's employment goals. An extended model would predict higher *ex post* real interest rates in non-devaluation states at the high-depreciation equilibrium, and a real exchange rate less competitive in either state, other things being equal.

In this example the consequences of being at the $\bar{u}'$ equilibrium are not too severe: the social cost is 1.504, compared with 1.365 at the optimum and 2.162 under a fixed rate. Because society and the policymaker place so heavy a weight on reducing employment fluctuations, the greater scope for stabilization at $\bar{u}'$

20

largely offsets the higher expected inflation there, leaving the second equilibrium still preferable to a pure fixed rate.

Because $\Gamma(-0.03)$ is above the cost κ that gives equilibria at $\bar{u}$ and $\bar{u}'$, however, there is a third *noninterior* equilibrium in which discretion is used regardless of the shock realization. This case of undiluted discretion, as we have seen, is much worse than a rigidly fixed exchange rate. Now the market forecasts that the authority has no chance of defending the fixed exchange rate. These expectations lead to nominal wages that are so high (compared with the existing exchange parity) that devaluation always is the outcome.

What is the intuition behind multiple equilibria? They arise because the $\Gamma(u)$ function is non-monotonic in figure 3. Non-monotonicity reflects the tension between two factors. As the shock threshold $\bar{u}$ rises, expected inflation eventually falls, lowering the first summand of $\delta(\bar{u}) + k + \bar{u} \equiv \Gamma(\bar{u})$. However, the rise in $\bar{u}$ directly *raises* the third summand. When the incentive to inflate under pure discretion is high, the inflation-expectations effect can outweigh the direct effect over some ranges of u, rendering $\Gamma(u)$ alternately increasing, decreasing, and increasing.

3. *There may be several equilibria, none of which is fully discretionary.* Now reduce λ from 0.9 to 0.075 but raise k to 0.015. The best equilibrium is at $\bar{u}^* = 0.0145$ (figure 4), with loss $L(\bar{u}^*) = 0.867$, expected depreciation $\phi^* = 0.39$ percent, and a 0.133 chance of devaluation. This equilibrium dominates a fixed rate because $L(0.03) = 1$.

Imposing the fixed devaluation cost $\kappa = \Gamma(\bar{u}^*)$ might not suffice to produce this relatively attractive equilibrium. There

are two additional interior equilibria, associated with the boundaries $\bar{u}' = -0.0123$ and $\bar{u}'' = -0.0256$, and with the expected depreciation rates $\phi' = 3.0$ percent and $\phi'' = 4.4$ percent, respectively. The implied losses are $L(\bar{u}') = 2.402$, $L(\bar{u}'') = 3.291$, both much higher than that under a pure fixed-rate regime. Indeed, the low-threshold equilibrium is little better than unfettered discretion, where inflation runs at 4.5 percent per period and $L(-0.03) = 3.359$. Note that $\Gamma(-0.03)$ is less than the policymaker cost κ resulting in the three interior equilibria, so full discretion is not an equilibrium at that level of the cost.

If there is a substantial risk of ending up at a bad equilibrium, it might be best to go for an irrevocably fixed exchange rate — perhaps by confronting the policymaker with a prohibitively high devaluation cost. Uncertainty about the $\Gamma(u)$ function would reinforce this conclusion, since a very small mistake in setting $\bar{c}$ could open the door to a catastrophe in the form of an additional, quite undesirable, equilibrium.

The examples show that attempts to delegate to an agent a rule with an escape clause can backfire. Allowing for additional economic disturbances, for revaluation as well as devaluation options, and for the interaction of several official decision makers within frameworks like the EMS prior to August 1993 can only multiply the possibilities. Even relatively inflation-averse societies may face problems in implementing adjustable fixed exchange rates. Acknowledging that uncertainty about the economy's structure and policymaker preferences is pervasive only makes escape options look worse.

V. Conclusion

Simple policy rules can often be amended to include welfare-enhancing escape clauses, which allow the exercise of discretion in well-defined circumstances. But even these amended rules are inherently time inconsistent. To implement them in a discretionary regime, society must confront policymakers with personal (perhaps political) costs of overriding rules.

Unfortunately, imposing the appropriate cost on the policymaker is necessary, but not sufficient, for reaching a socially preferred equilibrium. Market expectations can be self-fulfilling, leading in general to any number of equilibria, most of which are dominated by the original simple rule.

This paper illustrated these propositions by analyzing a fixed exchange rate system amended to include a devaluation option. Numerical examples suggest that a unique equilibrium may exist when a fairly non-accommodative policymaker faces a small time-inconsistency problem. In less favorable circumstances, however, a multiplicity problem plagues attempts to delegate optimal escape-clause rules. The problem is amplified in practice by uncertainty over policymaker preferences and costs.

References

Barro, Robert J. and David B. Gordon, 1983, A positive theory of monetary policy in a natural rate model, Journal of Political Economy 91, 589-610.

Calvo, Guillermo A., 1988, Servicing the public debt: The role of expectations, American Economic Review 78, 1411-1428.

Cukierman, Alex, 1990, Discretion, precommitments and the prospects for a European central bank — fixed parities versus a commonly managed currency, manuscript, Tel-Aviv University.

De Kock, Gabriel and Vittorio Grilli, 1993, Fiscal policies and
        the choice of exchange rate regime, Economic Journal 103, 347–358.

Fischer, Stanley, 1995, The unending search for monetary
        salvation, NBER Macroeconomics Annual 10, 275–286.

Flood, Robert P. and Peter Isard, 1989, Monetary policy
        strategies, International Monetary Fund Staff Papers 36, 612–632.

Flood, Robert P. and Peter Isard, 1990, Monetary policy strategies –
        a correction: Reply to Lohmann, International Monetary Fund
        Staff Papers 37, 446–448.

Horn, Henrik and Torsten Persson, 1988, Exchange rate policy, wage
        formation and credibility, European Economic Review 32, 1621–1636.

Kydland, Finn E. and Edward C. Prescott, 1977, Rules rather than
        discretion: The inconsistency of optimal plans, Journal of
        Political Economy 85, 473–492.

Lewis, Karen K., 1989, On occasional monetary policy coordinations
        that fix the exchange rate, Journal of International Economics 26,
        139–155.

Lohmann, Susanne, 1990, Monetary policy strategies – a correction:
        Comment on Flood and Isard, International Monetary Fund Staff
        Papers 37, 440–445.

Lohmann, Susanne, 1992, Optimal commitment in monetary policy:
        Credibility versus flexibility, American Economic Review 82,
        273–286.

Obstfeld, Maurice, 1985, Floating exchange rates: Experience and
        prospects, Brookings Papers on Economics Activity 2,
        369–450.

Obstfeld, Maurice, 1986, Rational and self-fulfilling balance-
        of-payments crises, American Economic Review 76, 72–81.

Obstfeld, Maurice, 1994, The logic of currency crises, Cahiers
        économiques et monétaires (Banque de France) 43, 189–213.

Obstfeld, Maurice and Kenneth Rogoff, 1996, Foundations of
        international macroeconomics (MIT Press, Cambridge, MA).

Persson, Torsten and Guido Tabellini, 1990, Macroeconomic policy,
        credibility and politics (Harwood Academic Publishers, Chur,
        Switzerland).

Persson, Torsten and Guido Tabellini, 1993, Designing institutions
        for monetary stability, Carnegie-Rochester Conference Series on
        Public Policy 39, 53–89.

Rogoff, Kenneth, 1985, The optimal degree of commitment to an intermediate monetary target, Quarterly Journal of Economics 100, 1169-1190.

Saint-Exupéry, Antoine de, 1943, The little prince (Harcourt, Brace & World, New York).

Walsh, Carl, 1995a, Optimal contracts for central bankers, American Economic Review 84, 150-167.

Walsh, Carl, 1995b, Is New Zealand's Reserve Bank Act of 1989 an optimal central bank contract? Journal of Money, Credit and Banking 27, 1179-1191.
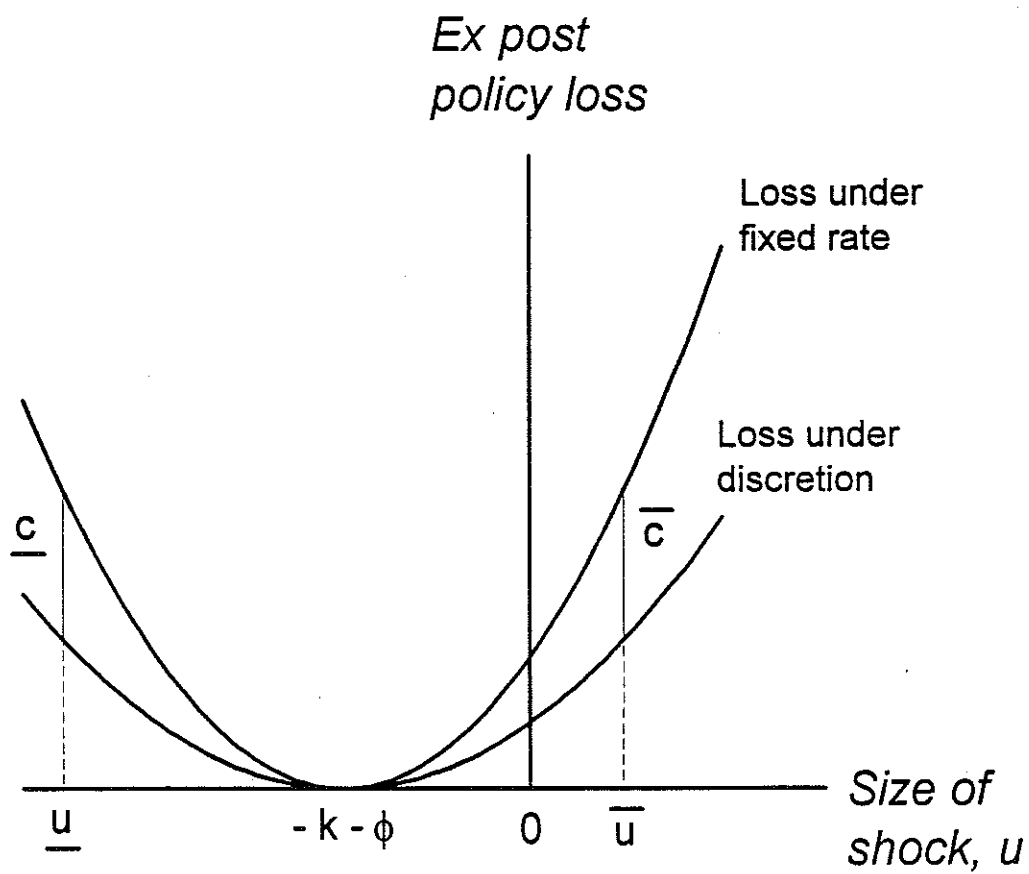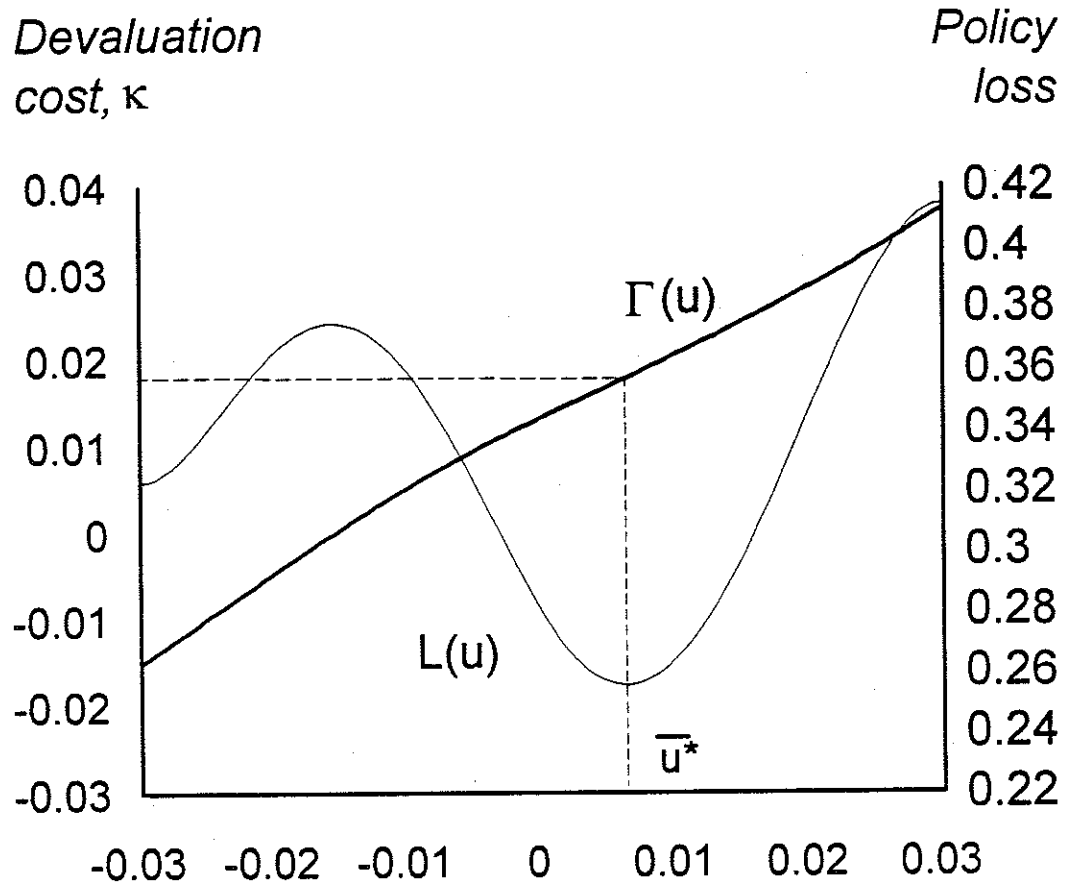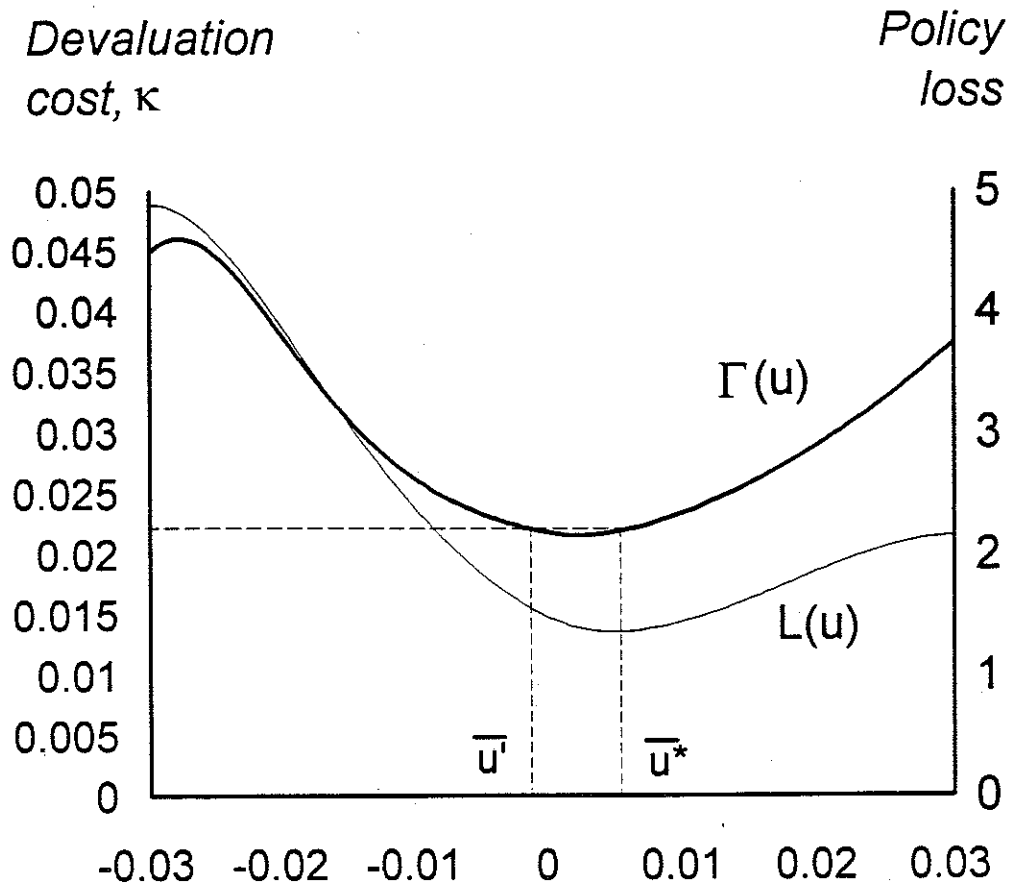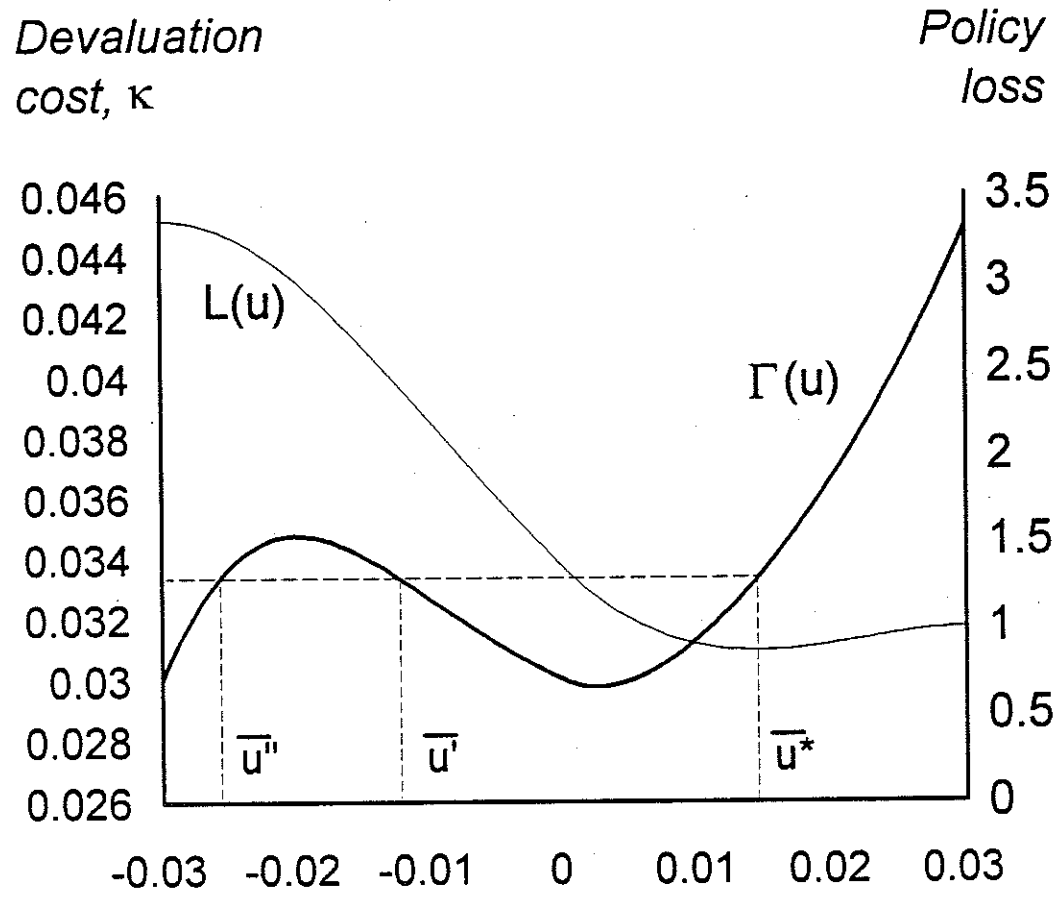
Figure 1

Figure 2

Figure 3

Figure 4

Center for International and Development Economics Research

The Center for International and Development Economics Research is a research unit of the Institute of International Studies which works closely with the Department of Economics and the Institute of Business and Economic Research (IBER). Single copies are free. All requests for papers in this series should be directed to IBER, F502 Haas Building, University of California at Berkeley, Berkeley CA 94720-1922; (510) 642-1922; email: bagdon@haas.berkeley.edu.

C96-076   "Backward-Looking Contracts, Credibility and Inflation Convergence." Piero Ghezzi. December 1996.

C96-075   "Destabilizing Effects of Exchange-Rate Escape Clauses." Maurice Obstfeld. December 1996.

C96-074   "ASEAN in a Regional Perspective." Jeffrey A. Frankel and Shang-Jin Wei. November 1996.

C96-073   "Economic Structure and the Decision to Adopt a Common Currency." Jeffrey A. Frankel and Andrew K. Rose. August 1996.

C96-072   "Favorable External Shocks, Sectoral Adjustment and De-industrialization in Non-Oil Producing Economies." Seung-Gwan Baek. June 1996.

C96-071   "Inequality and Conservation on the Local Commons: A Theoretical Exercise." Jeff Dayton-Johnson and Pranab Bardhan. June 1996.

C96-070   "Method in the Madness? A Political-Economy Analysis of Ethnic Conflicts in Less Developed Countries." Pranab Bardhan. June 1996.

C96-069   "Endogenous Growth Theory in a Vintage Capital Model." Pranab Bardhan and Rodrigo Priale. June 1996.

C96-068   "On the SDR: Reserve Currencies and the Future of the International Monetary System." Barry Eichengreen and Jeffrey A. Frankel. June 1996.

C96-067   "Country Fund Discounts, Asymmetric Information and the Mexican Crisis of 1994: Did Local Residents Turn Pessimistic Before International Investors?" Jeffrey A. Frankel and Sergio L. Shmukler. June 1996.

C96-066   "The Nature of Institutional Impediments to Economic Development." Pranab Bardhan. March 1996.

C96-065   "Efficiency, Equity and Poverty Alleviation: Policy Issues in Less Developed Countries." Pranab Bardhan. March 1996.

C96-064   "The Economics of Corruption in Less Developed Countries: A Review of Issues." Pranab Bardhan. February 1996.

C96-063   "Intertemporal Price Speculation and the Optimal Current-Account Deficit: Reply and Clarification." Maurice Obstfeld. February 1996.

C96-062   "Currency Crashes in Emerging Markets: Empirical Indicators." Jeffrey J. Frankel and Andrew K. Rose. January 1996.

C96-061   "The World Over the Next Twenty-five Years: Global Trade Liberalization, and the Relative Growth of Different Regions." Jeffrey Frankel. January 1996.

C96-060   "Recent Exchange Rate Experience and Proposals for Reform." Jeffrey A. Frankel. January 1996.

C96-059   "Regional Trading Arrangements: Natural or Super-Natural?" Jeffrey A. Frankel, Ernesto Stein, and Shang-Jin Wei. January 1996.

C95-058   "How Well Do Foreign Exchange Markets Function: Might a Tobin Tax Help?" Jeffrey Frankel. November 1995.

C95-057   "What Do Currency Crises Tell Us About the Future of the International Monetary System?" Barry Eichengreen and Charles Wyplosz. October 1995.