# Monetary Cohabitation in Europe

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It is still uncertain whether the European Union will have a single currency, the Euro, by the end of this century.[1] But two things seem certain about how it would come about. First, not all member states would be involved: some that would like to join are not likely to be accepted, whereas some that would be accepted are not likely to join. Second, intensified political integration would not precede monetary unification. The Euro will remain an international agreement whereby sovereign states delegate monetary policy to a supranational agency, the European Central Bank (ECB).

This particular arrangement poses two specific problems. One is how the ECB should pursue its monetary policy. Even though the Maastricht Treaty explicitly states that price stability is to be the primary goal, the operational consequences of that goal have not been spelled out in a specific quantitative mandate to which the ECB can be held accountable.

The second problem is that of ''monetary cohabitation.'' How is monetary policy to be coordinated between the ''ins'' and the ''outs''—those member states that have and have not adopted the Euro? Absent coordination, exchange-rate volatility could undermine the Single Market. Since the 1992 EMS breakdown, the lira has depreciated by 26 percent, and the deutsche mark has appreciated by 16 percent—both in real effective terms. Such wild exchange-rate changes, let alone outright ''competitive devaluations,'' will not be tolerated without eventually introducing some form of trade barrier.[2]

The solution to these problems is still unresolved. But an emerging official view, put forward by the European Monetary Institute (EMI), is that the ECB should follow the German model and adopt an intermediate money target, and the outside countries should be required to target the Euro, in some reformed version of the EMS. A recent report on European integration (Dewatripont et al., 1995) argues that strict and specific inflation targets assigned both to the ECB and the outside national central banks would be a better solution. This paper argues further in favor of inflation targets.

## I. A Stylized Model

Based on Persson and Tabellini (1995), we build a linear-quadratic model closely related to that in Matthew Canzoneri and Dale Henderson (1988). It pieces together well-known building blocks from the literatures on credibility and policy coordination in monetary policy. Two countries each specialize in the production of one good.[3] Monetary policy is subject to a credibility problem but can stabilize shocks to the economy. It has spillover effects abroad, and there is an incentive to engage in competitive devaluations.

All variables are defined as rates of change. The real-exchange-rate change $z$ is

$$z = s + q^* - q \quad (1)$$

* Persson: Institute for International Economic Studies, Stockholm University, S-106 91 Stockholm, Sweden, CEPR, and NBER; Tabellini: Bocconi University, Italy, IGIER, and CEPR. The arguments in the paper are spelled out more fully in Persson and Tabellini (1996). The ideas grew out of discussions over a recent CEPR report on European integration (Dewatripont et al., 1995); we are particularly grateful to Francesco Giavazzi and Jürgen von Hagen for many conversations. We thank the Bank of Sweden Tercentenary Foundation for financial support, Lars Svensson for comments, and Christina Lönnblad for secretarial assistance.

[1] In this paper, we do not discuss the desirability of a common currency in Europe, taking its prospective creation and likely characteristics as given.

[2] There are already demands in France that the ''compensatory amounts,'' protecting farmers in the hard-currency countries, be extended to other sectors (see Mathias Dewatripont et al., 1995).

[3] By studying only two countries we ignore all collective-choice problems in ECB's monetary policy, as well as heterogenity in size and structure among the outside countries.

where $s$ denotes the nominal depreciation of the outside currency. "Outside country" variables have no asterisk, whereas "monetary union" variables have one. Thus $q$ and $q^*$ respectively denote producer price inflation outside and inside the monetary union. Outside CPI-inflation, $p$, is

$$(2) \qquad p = q + \beta z$$

where $\beta$ is the foreign share in the outside country's consumption. Producer price inflation satisfies

$$(3) \qquad q = m + \nu$$

where $m$ is money growth and $\nu$ is a demand or "velocity" shock. "Natural" output growth (or employment) is normalized to zero. Actual output growth (employment), $x$, obeys an expectations-augmented Phillips-curve:

$$(4) \qquad x = \gamma(q - q^e) - \varepsilon$$

where $\gamma$ is a parameter, $q^e$ is the rationally expected value of $q$, and $\varepsilon$ is a supply shock. The equilibrium value of $z$ relates the relative supply of outside goods, $x - x^*$, to its relative demand:

$$(5) \qquad z = \delta(x - x^*) + \phi$$

where $\delta$ is the inverse (relative) demand elasticity of outside goods. We interpret $\phi$ as a "speculative shock" to the nominal exchange rate.[4] The shocks $\nu$, $\varepsilon$, and $\phi$ are independently distributed with an expected value of zero.

The policy instrument $m$ is chosen by the outside country's central bank. Policy preferences come from the loss function

$$(6) \qquad L = \tfrac{1}{2}[p^2 + \lambda(x - \theta)^2 + \mu(z - \xi)^2]$$

where $\lambda$ and $\mu$ are positive weights, whereas $\theta$ and $\xi$ are stochastic targets for employment and the real exchange rate, respectively. Assuming ambitious employment targets, $E(\theta) > 0$, creates a systematic "inflation bias," as in the credibility literature. Assuming $E(\xi) > 0$ creates a systematic incentive for competitive devaluations, in the context of the model. Informally, we can think of $\xi$ as the clout of the export industry, lobbying for higher profitability through a weaker exchange rate.[5]

The monetary union is modeled exactly as in (2)–(4) and (6), with the exception that $z$ enters with an opposite sign. We assume equal "structural" parameters, $\beta$, $\gamma$, $\lambda$, and $\mu$ across countries, but we allow differences in realized targets and shocks (e.g., $\theta \neq \theta^*$, $\varepsilon \neq \varepsilon^*$) and in variances of shocks (e.g., $\sigma_\varepsilon^2 \neq \sigma_{\varepsilon^*}^2$), and we allow arbitrary covariances across pairs of structural shocks (e.g., $\sigma_{\varepsilon\varepsilon^*} \gtreqless 0$, say). Events unfold as follows: (i) Policy targets $\tau = (\theta, \theta^*, \xi, \xi^*)$ are revealed; (ii) private expectations $(q^e, q^{*e})$ are formed; (iii) structural shocks $\omega = (\varepsilon, \varepsilon^*, \nu, \nu^*, \phi)$ are revealed; (iv) policies $(m, m^*)$ are simultaneously set; and (v) macroeconomic outcomes are realized.

As a benchmark, consider the hypothetical situation when the two central banks can commit to cooperation *ex ante*. Before stage (i) above, they choose state-contingent policy rules $m(\tau, \omega)$ and $m^*(\tau, \omega)$ that minimize their joint losses, $E(L + L^*)$ subject to the constraint of rational private expectations $q^e = E_\tau(q^*(\tau, \omega))$ and $q^{*e} = E_\tau(q^*(\tau, \omega))$. [$E(\cdot)$ denotes the unconditional expectation whereas $E_\tau(\cdot)$ denotes the conditional expectation given $\tau$.] The first-order condition for $m(\tau, \omega)$, is:

$$(7) \qquad p(\tau, \omega) + \lambda\gamma x(\tau, \omega) + 2\mu\gamma\delta z(\tau, \omega) + \delta\beta\gamma[p(\tau, \omega) - p^*(\tau, \omega)] = 0.$$

The optimal policy rule thus trades off direct effects on domestic prices and employment (the first two terms), direct real-exchange-rate effects at home and abroad (the third term), and indirect effects on CPI-inflation (the fourth term). It can be shown that the optimal policy rule stabilizes domestic supply shocks somewhat and domestic demand shocks com-

[4] In a less stylized model, $\phi$ could capture shocks to future expected inflation.

[5] An alternative (perhaps equally ad hoc) way of modeling the incentive to engage in competitive devaluations would be to let $z$ enter the right-hand side of (4) with a positive sign: a real depreciation would stimulate employment.

pletely. As $\tau$ is observable and real variables are neutral to expected policy, none of the targets in $\tau$ enters the solution.

## II. Incentive Problems and Implementation

Suppose, more realistically, that commitments and cooperation are infeasible. The outside central bank thus minimizes $L$ with respect to $m(\tau, \omega)$, taking $m^*(\tau, \omega)$, $E_\tau(q(\tau, \omega))$, and $E_\tau(q^*(\tau, \omega))$ as given. The first-order condition for $m(\tau, \omega)$ can be written as

$$(8)\quad p(\tau, \omega) + \lambda\gamma x(\tau, \omega) + 2\mu\gamma\delta z(\tau, \omega) + \beta\delta\gamma[p(\tau, \omega) - p^*(\tau, \omega)] = \lambda\gamma\theta + \mu\gamma\delta\xi + \mu\gamma\delta z(\tau, \omega) - \beta\delta\gamma p^*(\tau, \omega).$$

Clearly the left-hand sides of (7) and (8) are identical. The right-hand side of (8) reflects two binding incentive constraints. First, the "credibility" (*ex post* optimality) constraint makes the outside central bank ignore the effect of its policy on private expectations formation: the *ex post* incentive to stimulate growth gives a familiar inflation bias (the first term). Second, the "individual rationality" constraint makes the outside central bank ignore externalities on the monetary union: this gives rise to a competitive depreciation bias (the second term). In this case, the observable targets thus enter the solution. But the incentives to expand employment and depreciate the real exchange rate are correctly anticipated, so equilibrium inflation is higher without any real effects. The remaining terms appear because ignoring the externalities distorts the stabilization of shocks. Specifically, the outside country ignores the consequence that an appreciation of its real exchange rate exports inflation abroad: if, for instance, the monetary union is hit by a negative supply shock so that $p^* > 0$, outside monetary policy will be too contractionary.

Following the closed-economy analyses of Persson and Tabellini (1993) and Carl Walsh (1995), we now show that appropriate institution design can resolve these problems and implement the cooperative *ex ante* optimum. Assume that a performance contract can be imposed on both central banks. Specifically, each central bank faces a linear, but state-contingent, performance contract in realized inflation. The outside central bank thus faces a "penalty" $T(p(\tau, \omega); \tau, \omega) = t(\tau, \omega)p(\tau, \omega)$ for exceeding its inflation target, here equal to zero (by assumption). Finally, assume that the central bank minimizes the sum $L(\cdot) + T(\cdot)$. This modifies the first-order condition (8) at one point only: a new term, $-(1 + \beta\delta\gamma)t(\tau, \omega)$, appears on the right-hand side. From (7) and (8), the outside central bank has appropriate incentives if

$$t(\tau, \omega) = [\lambda\gamma\theta + \mu\gamma\delta\xi + \mu\gamma\delta z(\tau, \omega) - \beta\delta\gamma p^*(\tau, \omega)]/(1 + \beta\delta\gamma)$$

where $z$ and $p^*$ are evaluated at the *ex ante* optimum. Solving for $z$ and $p^*$, the marginal penalty can be rewritten in terms of the structural shocks:

$$(9)\quad t(\tau, \omega) = \frac{1}{1 + \beta\delta\gamma}[\lambda\theta\gamma + \mu\gamma\delta\xi - t^{\varepsilon^*}\varepsilon^* - t^{\varepsilon\varepsilon^*}(\varepsilon - \varepsilon^*) + t^{\phi}\phi].$$

The coefficients $t^{\varepsilon^*}$, $t^{\varepsilon\varepsilon^*}$, and $t^{\phi}$ are complicated expressions with a (likely) positive sign in the structural parameters.

The marginal penalty in (9) is intuitive. The two first terms balance the outside central bank's systematic incentives to expand employment and depreciate the real exchange rate; stronger incentives call for stiffer penalties. The three final terms correct the stabilization bias; the penalty is weaker if the monetary union suffers a negative supply shock ($\varepsilon^*$ positive), a less severe supply shock ($\varepsilon - \varepsilon^*$ positive), or a speculation against the Euro ($\phi$ negative). In these cases $p^* > 0$, and outside monetary policy is too contractionary. Offsetting this bias calls for a weaker marginal penalty on inflation.

The incentive scheme for the ECB should be analogous. But if $E(\theta) > E(\theta^*)$ or $E(\xi) > E(\xi^*)$, such that the outside country has a worse credibility problem or a stronger incentive to engage in competitive devaluations, the ECB should face milder (average) penalties for departing from its inflation target.

### III. Alternative Mechanisms

In our linear model, state-contingent contracts over *any* pairs of nominal variables are capable of implementing the *ex ante* optimum policies.[6] However, complete contracting is unlikely, for reasons discussed in Persson and Tabellini (1993, 1995). Simplicity and verifiability problems may require state-independent marginal penalties $t$ and $t^*$. Under this constraint and linearity of (1)–(5), the optimal penalty is simply the expected value of (9): $t = \lambda\gamma E(\theta) + \mu\gamma\delta E(\xi)$. This simple contract eliminates the systematic incentives to expand employment and depreciate the real exchange rate, but not the suboptimal response to shocks. Alternative nominal targets continue to be equivalent.

Even a simple *linear* penalty may be difficult to enact. For instance, if the central bank is risk-averse, a linear contract still implies a nonlinear loss, such that the central bank tries to stay close to the announced target. If so, alternative targets are certainly nonequivalent, since they impose very different policy responses to shocks.

The situation after the creation of the Euro may also create specific nonlinearities via reputation effects. The ECB will have to build up a track record and a mode of communicating its intentions to financial markets. This is likely to be difficult if it allows for large deviations from its target. Similarly, outside central banks that are required to target the Euro may have to establish a tight peg to become credible. Such constraints reinforce the different properties of alternative nominal targets.

As an illustration, consider two simplified mechanisms for coordination, where the central banks can only be induced (alternatively, commit) to follow simple rules without any deviations or escape clauses. In the first, the "EMI-regime," the ECB sets a non-state-contingent $k$-percent rule $m^*$, and the outside central bank sets a constant rate of nominal depreciation $s$. Clearly, the best such rules are $m^* = s = 0$, removing the permanent inflation and competitive depreciation biases. With these rules, the model can easily be solved for the macroeconomic variables. Here, we show the solutions for output:

$$(10)\quad x(\tau,\omega) = \gamma\nu^* - \varepsilon + \frac{\gamma\delta}{1+\gamma\delta}(\varepsilon - \varepsilon^*) - \frac{\gamma}{1+\delta\gamma}\phi$$

$$x^*(\tau,\omega) = \gamma\nu^* - \varepsilon^*.$$

A few things are worth noticing. First, velocity shocks in the monetary union $\nu^*$ are not stabilized as in Sections I and II, so that $x^*$ (and $p^*$) are subject to an additional source of fluctuations. Moreover, these shocks spill over on outside macroeconomic variables. Second, the arrangement is quite asymmetric: supply shocks $\varepsilon^*$ in the monetary union spill over on $x$, but $\varepsilon$ does not spill over on $x^*$. Moreover, the outside country, assigned to defend the exchange rate from speculative shocks, $\phi$, bears a disproportionate cost in terms of output volatility.

The second coordination mechanism is instead a symmetric "inflation-target regime," where both central banks set simple rules for $p$ and $p^*$. Best among such arrangements is $p = p^* = 0$.[7] The solution to the model implies

$$(11)\quad x(\tau,\omega) = -\varepsilon + \frac{\gamma\beta\delta}{1+2\gamma\beta\delta}(\varepsilon - \varepsilon^*) - \frac{\gamma\beta}{1+2\gamma\beta\delta}\phi$$

$$x^*(\tau,\omega) = -\varepsilon^* - \frac{\gamma\beta\delta}{1+2\gamma\beta\delta}(\varepsilon - \varepsilon^*) + \frac{\gamma\beta}{1+2\gamma\beta\delta}\phi.$$

[6] As discussed in Persson and Tabellini (1993), the equivalence remains in more general settings; however, with nonlinearities, performance contracts written over other variables than $p$ are more informationally demanding.

[7] One may argue that it is easier to control $m$ (or $s$) than $p$. This could easily be modeled by adding a "control error" to equation (3). However, even if $m$ is easier to hit, macroeconomic fluctuations are not necessarily smaller in an $m$-targeting regime than in a $p$-targeting regime. Depending on covariance properties, the opposite may well happen.

The contrast to the EMI-regime is stark. Now, the solution is completely symmetric, and the fluctuations due to inside velocity shocks are eliminated. Moreover, speculative shocks to the exchange rate, $\phi$, are partly stabilized by both countries.

It is straightforward to compute the expected losses to both countries in the two regimes (see Persson and Tabellini, 1996). Ruling out extreme parameter values, the outside country is always better off in the inflation-target regime. The monetary union is also likely to be better off. The gains can be substantial if velocity shocks inside the monetary union ($\nu^*$) and speculative shocks ($\phi$) are large. This is precisely what we expect in the transition period after the creation of the Euro.

## IV. Concluding Remarks

Influential policymakers in Europe argue that the ECB should adopt an intermediate money target and that outside countries should be required to stabilize their exchange rates towards the Euro. In this paper, we have tried to show why a system of mandatory inflation targets is better.

To peg their Euro exchange rates unilaterally, the outside countries would destabilize their economies to absorb speculative and other shocks. If all countries instead target inflation, the burden of coordination will be more equally shared. This symmetry makes the inflation-target regime much more politically viable.

For the ECB, an inflation target has two advantages over an intermediate monetary aggregate. First, it automatically offsets velocity shocks. With a strict monetary target these shocks instead destabilize prices, output, and the real exchange rate. Velocity shocks are likely to be important inside a newly created monetary union. Second, an inflation target would also facilitate holding the ECB accountable for its actions and thus enhance its political legitimacy.

Strict and symmetric inflation targets help monetary cohabitation in two ways. First, as competitive devaluations eventually result in higher inflation, they are ruled out by inflation targets. Second, inflation-targeting restores domestic credibility to a low-inflation policy. Speculative attacks against some European currencies have been triggered by fears that high public debt will eventually be monetized. Reinforcing the commitment to price stability reduces uncertainty about future inflation and leads to smaller nominal-exchange-rate volatility.

These two features could, in principle, also be achieved by (symmetric) money targets. However, such targets would not call for action in the wake of speculative shocks to the exchange rate. By contrast, countries with inflation targets, such as New Zealand, Canada, the United Kingdom, and Sweden, follow closely the nominal exchange rate, as an indicator of future inflation: a nominal depreciation then calls for a more restrictive monetary policy, ceteris paribus. This response is stabilizing with respect to the exchange rate itself.

How could a European system of inflation targets be implemented in practice? All countries in the European Union would have to participate. And the inflation behavior would be monitored by a European institution, most naturally by the European System of Central Banks (the ECB plus the outside national central banks). The penalties for missing the target would also be recommended by a European institution; the most natural candidate being the Council of Ministers. In this respect, the arrangement would be similar to the "excessive deficit" procedure in the Maastricht Treaty.

Unlike that procedure, decisions would not be directed toward countries, but directly toward the central banks, since (as prescribed by the Maastricht Treaty) these would have to be independent from government interference. The penalty for missing the announced target could take several forms. A mild penalty would be public blame; a harsher penalty would be a recommendation to fire the governor.

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