UNEMPLOYMENT, LABOUR-MARKET REFORM AND MONETARY UNION

by

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The paper analyses various mechanism through which monetary union in Europe may affect unemployment. The focus is on the political incentives for labour-market reform. There will be more reform outside than inside the EMU to the extent that a national inflation bias can be reduced. But if there is a precautionary motive for low average unemployment in order to reduce the utility cost of macroeconomic variability, there could be more reform in a monetary union. Labour-market reform to increase wage flexibility as a substitute for domestic monetary policy and transition costs of reform are also analysed. The net effect of monetary union on unemployment is ambiguous.

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Western Europe has since more than a decade been plagued by high unemployment. In this situation, most EU countries will in 1999 enter into a monetary union (EMU) with a common currency. So it is natural that one of the key concerns in the discussion on monetary unification in Europe is how unemployment will be affected (see, e.g., George, 1997, or Kosters et al., 1998). The aim of this paper is to help bring more structure to this discussion.

The conventional wisdom is that asymmetric shocks in a monetary union may lead to cyclical unemployment, because real exchange-rate changes are more difficult to achieve when there is no nominal exchange rate that can vary. This is not the focus here. Instead, I analyse the relationship between monetary union and structural (equilibrium) unemployment.

The motivation for my topic is the consensus that European unemployment is not cyclical, but reflects structural rigidities. This has lead to the conclusion that reforms to improve the functioning of labour markets are required (OECD, 1994; Alogoskoufis et al, 1995; Lindbeck, 1996; Calmfors et al., 1998). Many such measures have been proposed: less generous unemployment insurance, less stringent employment-protection legislation; less of minimum-wage regulations; changes in the legal framework for wage bargaining; a larger scope for individual wage contracts as opposed to collective agreements; more effective active labour-market programmes; and education efforts to avoid skill mismatches. This paper focuses on the *political-economy* question of how the incentive for such labour-market reform may be changed by monetary union. As the EU treaty does not provide for a common employment policy, a key assumption is that labour-market institutions continue to be determined nationally, even though monetary policy is centralised.

The outline is as follows. Section 1 surveys existing literature of relevance. The subsequent sections look at *four* different mechanisms. Section 2 sketches an extended Barro-Gordon model, in which both monetary policy and labour-market institutions are determined. Section 3 examines the relationship between employment variability and the incentive to reduce equilibrium unemployment. Section 4 emphasises the link between real-wage and money-wage rigidity. Section 5 focuses on the transition from one set of labour-market institutions to another. Section 6 concludes.

1. Starting points for the analysis

Although there has been little research on the effects of monetary union on labour-market institutions, there exist two strands of literature that form relevant starting points.

The first literature deals with the time-inconsistency problem of monetary policy. Following Kydland and Prescott (1977), and Barro and Gordon (1983a,b), this research analyses the *inflation bias* that may exist in a discretionary policy setting. The bias arises when policy-makers try to achieve an employment goal in excess of the equilibrium rate. An important limitation of this literature is that it does not address the question of how the equilibrium rate of unemployment is determined.

The determination of equilibrium unemployment is, however, the topic of some recent political-economy research. The key hypothesis is that labour-market rigidities are the outcome of rational choices by the political majority. It may be in the interest of labour to design labour-market institutions in such a way that wages can be raised at the expense of profits, even though this leads to unemployment (Saint-Paul 1996; DiTella and MacCulloh, 1996; Fredriksson 1997). Moreover, the interests of employed insiders and unemployed outsiders are likely to diverge (Saint-Paul 1993, 1995). The former group, which constitutes the political majority, may design labour-market institutions mainly with the aim of achieving high real wages for itself also when this hurts the employment prospects of outsiders. So labour-market reform to reduce unemployment may not be politically viable, because it would reduce the welfare of the employed majority.

The political-economy literature has usually not dealt with the relationship between demand-management policies and labour-market rigidities. The models are real models, where monetary policy and inflation play no role.

To analyse the links between monetary union and equilibrium unemployment, it is natural to combine these two strands of literature. Earlier attempts at this have been

made by Sibert and Sutherland (1997), Calmfors (1997) and Hefeker (1998). This paper develops this line of research.

I shall analyse both cases with an inflation bias and cases without. The latter cases are of interest because the recent fall in inflation in many countries suggests the possibility that ways may have been found to handle the inflation problem. But it is also possible that the recent low inflation inside the EU is a temporary phenomenon associated with the attempts to fulfil the convergence criteria for being admitted into the EMU and with a high degree of slack in the European economies. If so, inflation-bias problems are likely to remain also in the future.

2. A baseline model

To obtain a baseline model, I extend the Barro-Gordon model of inflation. I assume that the government in a representative country does not care only about inflation and unemployment, but also about labour-market institutions (the amount of reform). Although labour-market reforms can refer to many areas, I capture them by a single composite variable. One can think of them as measures that reduce the real wages of the political majority of employed insiders. Therefore, the government attaches a cost to reforms. Alternatively, it may do so because labour-market institutions are valued in themselves, e.g., because they offer insurance to workers (unemployment compensation) or limit the exposure of employed insiders to shocks (employment protection legislation).

More specifically, I assume the following quadratic loss function for the government in a representative country:

$$L = \frac{1}{2}\left[(\pi - \pi^{*})^2 + \lambda (u - u^{*})^2 + \gamma s^2\right], \qquad (1)$$

where L = the disutility of the government, π = actual inflation, π^{*} = the inflation goal, u = actual unemployment, u^{*} = the unemployment goal, and s = the amount of labour-market reform. λ and γ indicate the relative weights attached to unemployment and

reform, respectively. I normalise the measure of reform so that $s \geq 0$.[1] Country subscripts are not written out unless they are necessary to avoid misunderstandings.

I assume a standard unemployment function for the representative country:

$$u = u^* - b(p - p^e) + e, \qquad (2)$$

where u^* = equilibrium unemployment, p^e = expected inflation, e = a stochastic shock, and b = the responsiveness of unemployment to unanticipated inflation (defined positive as all parameters below). This "surprise-unemployment" equation can be thought of as the outcome of money-wage contracts that are concluded on the basis of price expectations before shocks have been realised and monetary policy decided.

The stochastic shock can be decomposed into two parts: an asymmetric shock, v, which is specific to the country in question, and a symmetric shock, m, which is common to all the potential members of the monetary union, so that

$$e = v + m \qquad (3)$$

v and m are independent, symmetrically distributed and have zero means. The variances are s_e^2, s_v^2 and s_m^2, respectively.

Equilibrium unemployment in a representative country depends negatively on the amount of structural reform, so that

$$u^* = \tilde{u} - ds, \qquad (4)$$

where $\tilde{u}$ = the equilibrium rate of unemployment in the absence of reform (s =0). I assume that $\tilde{u} > ds$.

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[1] The functional form is chosen for simplicity. But the separability assumption could be discussed. For instance, it could be argued that the marginal disutility of lowering unemployment benefits should depend upon the amount of unemployment. On one hand, with higher unemployment, policy makers might consider lower incomes for the unemployed to have higher marginal disutility. On the other hand, the marginal disutility of reducing unemployment benefits could be considered lower in this situation, because the tax costs of the employed then fall by more (Wright, 1986; Saint-Paul, 1996). I disregard such complications.

The same homogenous good is produced in all countries. Determining inflation in an individual country outside the monetary union is thus equivalent to determining the path of the exchange rate.

2.1. Labour-market reform outside the EMU

I study a one-shot game where both labour-market institutions and monetary policy are determined. I first look at a country that does not participate in the EMU. The government is assumed to decide on labour-market institutions. Monetary policy is delegated to an independent central bank, which acts in a discretionary way. The bank has a loss function of the same form as (1), but with a lower unemployment aversion parameter λ_a. I assume the following sequence of decisions: (1) labour-market institutions are determined; (2) money wages are set; (3) shocks occur; and (4) monetary policy is decided.

The model is solved through backward induction. Given labour-market institutions (and thus equilibrium unemployment), inflationary expectations and the realised shock, the central bank chooses inflation so as to minimise its loss function subject to (2). With rational expectations, the well-known outcome is

$$\pi = \pi^{\$} + \beta\lambda_a(u^* - \alpha^{\$}) + \frac{\beta\lambda_a}{1+\beta^2\lambda_a}\varepsilon. \qquad (5)$$

If $u^* > \alpha^{\$}$, inflation exceeds the inflation goal, $\pi^{\$}$, by $\beta\lambda_a(u^* - \alpha^{\$})$. The inflation bias is thus increasing in the deviation of equilibrium unemployment from the unemployment goal, $u^* - \alpha^{\$}$, in the responsiveness of unemployment to unanticipated inflation, β, and in the central bank's unemployment-aversion parameter, λ_a.

When deciding on labour-market institutions, the government takes the dependence of inflation on equilibrium unemployment into account. Thus, s is chosen so as to minimise the expectation of (1) subject to (2), (4) and (5). The optimisation gives

$$\frac{\partial E(L_n)}{\partial s} = -\delta\lambda(u^* - \alpha^{\$}) - \delta\beta^2\lambda_a^2(u^* - \alpha^{\$}) + \gamma s = 0, \qquad (6)$$

where the *n* index denotes non-participation. The amount of labour-market reform is such that the marginal gain balances the marginal loss. The marginal gain arises for two reasons. Reform lowers equilibrium unemployment and hence expected unemployment (the first term). Reform also lowers expected inflation, because lower equilibrium unemployment reduces the inflation bias (the second term). The marginal loss arises from the direct utility cost of reform itself (the third term).

Solving (6) for *s* gives the optimal amount of reform outside the EMU as

$$s_n = \frac{d(1+b^2\sigma_a^2)(\tilde{u}-k)}{d^2(1+b^2\sigma_a^2)+g}. \qquad (6a)$$

2.2 Labour-market reform inside the EMU

This section analyses labour-market reform in the case of participation in the EMU. Then, a common inflation rate, π_u, for all the participating countries is determined by the monetary policy of the European Central Bank, ECB. Because the EU treaty does not foresee centralisation of employment policy, I continue to assume that labour-market institutions are determined by national governments.

The monetary union is made up of *n* countries. For analytical convenience, I assume *n* to be large. (This means that my analysis is most directly relevant for small EU member states.)[2] The countries are identical in all respects (except for the value of the asymmetric shock, *v*, at each point of time). I assume that the ECB has a loss function that looks exactly like the loss functions of the national central banks, but where the variables refer to the whole monetary union. The function is

$$L_u = \frac{1}{2}\left[(\pi_u - \pi^*)^2 + (1+\lambda)(u_u - k)^2 + \gamma s_u^2\right], \qquad (7)$$

[2] However, all qualitative conclusions remain the same if *n* is small or if I allow the countries to differ in size.

where the *u* subscript denotes aggregate union variables. u_u and s_u are averages of the national values, i.e., $u_u = \sum_{i=1}^{n} u_i / n$ and $s_u = \sum_{i=1}^{n} s_i / n$, where *i* is the country subscript.

Because *n* is large, the asymmetric shocks cancel out, so that $\sum_{i=1}^{n} v_i / n \approx 0$. Hence, aggregate union unemployment is

$$u_u = \frac{1}{n}\sum_{i=1}^{n} u_i = u_u^* - b(p_u - p_u^e) + m, \qquad (8)$$

where union equilibrium unemployment, u_u^*, is the average of national equilibrium unemployment rates, i.e.,

$$u_u^* = \frac{1}{n}\sum_{i=1}^{n} u_i^* = \tilde{u} - \delta s_u . \qquad (9)$$

The ECB chooses union-wide inflation, p_u, to minimise its expected loss function (7) subject to (8). This gives

$$p_u = p^e + b\lambda_u (u_u^* - \tilde{u}) + \frac{b\lambda_u}{1 + b^2\lambda_u} m \qquad (10)$$

The optimal amount of reform in the representative country is found by setting $p = p_u$ and minimising the expectation of (1) subject to (2), (4) and (10). I then take union equilibrium unemployment, u_u^*, as exogenous because labour-market reform in an individual country has a negligible effect on u_u^*. I also let $\lambda_u = \lambda_a$. I obtain

$$\frac{\partial E(L_p)}{\partial s} = -d\lambda(u^* - \tilde{u}) + \gamma s = 0, \qquad (11)$$

where the *p* subscript denotes participation in the monetary union. The second term - the reduction of inflation - in the optimisation condition (6) for the non-participation case is missing in (11). So the marginal benefit from labour-market reform is smaller inside than outside the monetary union, because the reduction of equilibrium

unemployment in an individual member state has only a negligible effect on union equilibrium unemployment and hence on union inflation. It follows from (11) that the amount of reform with participation is

$$s_p = \frac{\alpha(\tilde{u} - k)}{\alpha^2 + \gamma}. \qquad (11a)$$

Comparing (6a) and (11a), it is immediately seen that $s_n > s_p$. So the amount of reform is larger outside the EMU than inside.[3]

The reason why there is less reform inside than outside the monetary union is that national governments fail to internalise the positive externalities on other member states that occur when a fall in equilibrium unemployment induces a reduction in the common inflation rate. This failure means that participation in the EMU reduces government welfare. This welfare loss comes in addition to the loss caused by increased unemployment variability when monetary policy no longer stabilises asymmetric shocks inside the monetary union.[4]

2.3 The robustness of the results

I have taken the unemployment-aversion parameters λ_a and λ_u as exogenous. An alternative is to allow for delegation to an *optimally* conservative central bank, i.e., to

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[3] This result was first pointed out by Sibert & Sutherland (1997) and Calmfors (1997) in independent contributions. The Sibert and Sutherland analysis differs from the one here, because they also let actual foreign inflation affect domestic utility and foreign inflation surprises affect domestic unemployment by lowering foreign real wages and hence triggering a relocation of firms' activities.

[4] Symmetry ensures that $s_u = s_p$ with participation. This allows me to write the expected loss function on the general form $E(L) = f(s) + g(\sigma_v^2, \sigma_m^2)$, where $f(s) = [(1 + \beta^2\lambda_a^2)(\tilde{u} - k - s)^2 + \gamma s^2 + m(\sigma_v^2 + \sigma_m^2)]/2$ and $m = (\beta^2\lambda_a^2 + \lambda_u)/(1 + \beta^2\lambda_a)^2$. It is easy to show that $E(L_n) = f(s_n)$ and $E(L_p) = f(s_p) + (\lambda_u - m\gamma)\sigma_v^2/2$. Hence, $E(L_p) - E(L_n) = f(s_p) - f(s_n) + (\lambda_u - m\gamma)\sigma_v^2/2$. The FOCs (6) and (11) imply that $f(s_n)$ is a minimum of $f(s)$, whereas $f(s_p)$ is not. Thus, $f(s_p) - f(s_n) > 0$. Because $\lambda_a < 1$, it also follows that $(\lambda_u - m\gamma)\sigma_v^2 = [\beta^4\lambda_a^2 + \beta^2\lambda_a(2\lambda_u - \lambda_a\gamma)]\sigma_v^2/(1 + \beta^2\lambda_a)^2 > 0$.

find the λ_a and λ_u that give the optimal trade-offs between inflation and stabilisation, as suggested by Rogoff (1985). The natural way to model the decision problem in this case is to choose simultaneously both the central banker and the amount of reform in the first stage of the game. In the second stage, the appointed central banker determines inflation.

With non-participation, the decision problem in the first stage is thus to find the λ_a and s that minimise the expectation of (1) subject to (2), (4) and (5). Assuming an interior solution, the outcome is two optimisation conditions. The first is (6) as before. The second is

$$\frac{\partial E[L_n]}{\partial \lambda_a} = b^2 \lambda_a (u^* - \hat{u})^2 + \frac{b^2 (\lambda_a - \lambda)}{(1 + b^2 \lambda_a)^3} \sigma_\varepsilon^2 = 0. \qquad (12)$$

The first term in $\partial E[L_n]/\partial \lambda_a$ is the marginal loss from a larger inflation bias of appointing a central banker with a higher λ_a. The second term is the marginal gain from more stabilisation in this case. If $u^* > \hat{u}$, (12) can be shown to give the well-known result that a conservative central banker with $\lambda_a < \lambda$ will be appointed.

Inside the EMU, s is chosen nationally in the same way as in section 2.2. I assume that the conservativeness of the ECB, λ_u, is chosen by an agent representing the governments of all the member states in the EMU. This agent is assumed to minimise an expected aggregate government loss function, $E[L_u^g]$, which looks exactly as (7), but where the governments' unemployment aversion parameter λ has been substituted for λ_u. The choice of λ_u is made taking (8) and (10) into account. Assuming a Nash equilibrium, the two FOCs now become (11) and

$$\frac{\partial E[L_u^g]}{\partial \lambda_u} = b^2 \lambda_u (u_u^* - \hat{u})^2 + \frac{b^2 (\lambda_u - \lambda)}{(1 + b^2 \lambda_u)^3} \sigma_m^2 = 0. \qquad (13)$$

(13) shows the same type of trade-off between inflation and stabilisation as in the individual country and can be shown to give $\lambda_u < \lambda$ if $u_u^* > \hat{u}$.

Because the optimisation conditions for *s* have the same form as with exogenous central bankers, the earlier conclusion that there is more reform outside than inside the EMU still holds. But the endogenisation of central bankers adds the twist that the ECB will be made more conservative than a national central bank outside the EMU. This is seen by evaluating $\partial E(L_u^g)/\partial \lambda_u$ at $\lambda_u = \lambda_a^n$, where λ_a^n is the optimal level of conservatism outside the EMU given by (12). In a symmetric equilibrium, $u_u^* = u^*$. As there is less reform inside than outside the EMU and thus higher equilibrium unemployment, it follows directly that $\beta^2\lambda_u(u_u^* - \hat{u})^2$ in (13) is larger than $\beta^2\lambda_a(u^* - \hat{u})$ in (12). (The marginal loss of a less conservative central banker is larger inside than outside the EMU, because higher equilibrium unemployment means a stronger inflation bias.) Because $\sigma_e^2 > \sigma_m^2$ it also follows that the absolute value of $\beta^2(\lambda_u - 1)\sigma_m^2/(1+\beta^2\lambda_u)$ in (13) is smaller than $\beta^2(\lambda_a - 1)\sigma_e^2/(1+\beta^2\lambda_a)$ in (12). (The smaller variance of shocks for the whole EMU area than for an individual country means that the marginal gain from stabilisation is smaller.) Hence, $\partial E(L_u^g)/\partial \lambda_u > 0$ for $\lambda_u = \lambda_a^n$. Therefore, there is an incentive to choose λ_u so that $\lambda_u < \lambda_a^n$.[5]

The crucial assumption behind my result that there is more reform outside than inside the EMU is the existence of a national inflation bias. Without such a bias, there would be the same amount of reform inside and outside the EMU. Consider, for example, the possibility that the central bank can be instructed to minimise a loss function where the unemployment target has been set equal to the equilibrium rate, i.e., $\hat{u} = u^*$.[6] Then the second term in (5) and the second term in (6) drop out, and the optimisation condition for reform becomes the same inside and outside the EMU.

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[5] This follows because $\partial E(L_u^g)/\partial \lambda_u > 0$ for $\lambda_u \geq 1$, $\partial E(L_u^g)/\partial \lambda_u < 0$ for $\lambda_u = 0$ and $\partial^2 E(L_u^g)/\partial \lambda_u^2 > 0$ for $0 \leq \lambda_u \leq 1$.

[6] Other methods to eliminate the inflation bias is an optimal linear contract punishing the central banker for inflation (Walsh, 1995; Persson & Tabellini, 1993) or the choice of an appropriate inflation target (Svensson, 1997).

2.4. An alternative interpretation

The model has analysed the *political* incentives for legislated labour-market reform. An alternative interpretation is to let *s* represent the real wage (a higher *s* meaning a lower real wage), so that the unemployment equation (4) becomes an ordinary labour-demand equation. Equation (1) could then be reinterpreted as a trade-union preference function, according to which the representative trade union cares not only about the real wage and (un)employment, but also about inflation.

With this interpretation, the representative trade union can be seen to choose an expected real wage (a money wage given the expected price level) before shocks are realised and monetary policy decided. The optimisation condition may be different depending on whether or not the county participates in the monetary union. If it does, one can safely assume that the wage decision of a trade union in an individual country has such a small effect on aggregate equilibrium unemployment in the EMU that the effect on the inflation bias can be neglected.

But if wage setting in the representative country is fairly centralised, the wage decision of an individual trade union could have a non-negligible effect on national equilibrium unemployment in the case of non-membership, i.e., d in (4) could be fairly large. Then, there will also be a non-negligible effect on the inflation bias. To reduce this, it will pay for the representative trade union to hold back real wages. If so, the wage-setting logic of trade unions tends to cause lower equilibrium unemployment with non-participation than with participation in the monetary union. This point has been made by Cukierman et al. (1997), and Grüner and Hefeker (1998). The conclusion hinges on the assumption of a high degree of centralisation: with decentralised wage-setting in the individual country, the effect on the inflation bias is negligible both inside and outside the monetary union.

3. Unemployment variability and equilibrium unemployment

It has become a commonplace in the theory of inflation to use quadratic loss functions, because they are analytically convenient. They have the special property that the

marginal disutilities of inflation and unemployment are linear, and thus that the utility costs of variations in these variables are independent of their equilibrium values. However, one could argue that what policy makers are primarily interested in is to avoid *very bad* macroeconomic outcomes like the Great Depression or the world-wide inflation of the 1970s, and that they attach an extra value to reducing the risks of them. A quadratic loss function may fail to capture this adequately. The argument would be very similar to the precautionary-saving argument in the theory of consumption, which builds on the assumption of a convex marginal utility of consumption (Leland, 1968).

In this section, I explore the possibility that the marginal losses of deviations from the unemployment and inflation goals, respectively, increase more rapidly the larger the deviations, i.e., that they are convex functions. Formally, this means that $\partial^3 L/\partial u^3 > 0$ for $u > u^*$, $\partial^3 L/\partial u^3 < 0$ for $u < u^*$, $\partial^3 L/\partial \pi^3 > 0$ for $\pi > \pi^*$, and $\partial^3 L/\partial \pi^3 < 0$ for $\pi < \pi^*$. One implication would be that the larger variations in unemployment that are to be expected in the EMU, when monetary policy can no longer stabilise asymmetric shocks, should be regarded as more serious the higher the equilibrium rate of unemployment (relative to the unemployment goal). Such a value judgement was expressed by the Swedish Government Commission on the EMU (Calmfors et al., 1997).

A simple government loss function with the desired properties is:[7]

$$L = \frac{1}{4}\left[\left(\pi - \pi^*\right)^4 + \lambda\left(u - u^*\right)^4 + \gamma s^4\right]. \qquad (14)$$

The national central bank has a loss function of the same form, but with a lower unemployment aversion parameter λ_a. The ECB has the same loss function as the national central bank (and thus the same unemployment aversion parameter), but with aggregate union variables as arguments.

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[7] For symmetry reasons, I enter also *s* as a fourth-degree term in (14), but I could just as well have used the earlier quadratic form.

3.1 Non-participation in the EMU

To solve the government's optimisation problem with respect to *s* in the case of non-participation in the EMU, I again first derive the central bank's inflation rule. It is obtained by minimising the bank's loss function subject to (2). The outcome is

$$p = \pi^e + \sqrt[3]{b\lambda_a}(u^* - \hat{u}) + \frac{\sqrt[3]{b\lambda_a}}{1+\sqrt[3]{b^4\lambda_a}}\varepsilon. \qquad (15)$$

As in the quadratic case, expected inflation exceeds the inflation target if equilibrium unemployment is higher than the unemployment goal, and is increasing in equilibrium unemployment. Variations in inflation stabilise shocks partially.

The optimisation condition for labour-market reform is obtained by minimising the expectation of (14) subject to (2), (4) and (15). It is

$$\begin{aligned} \frac{\partial E[L_n]}{\partial s} &= -d\lambda(u^* - \hat{u})^3 - d\phi^4(u^* - \hat{u})^3 + \gamma s^3 \\ &-3d\lambda\lambda^2(u^* - \hat{u})\sigma_\varepsilon^2 - 3d\phi^2 k^2(u^* - \hat{u})\sigma_\varepsilon^2 = 0, \end{aligned} \qquad (16)$$

where $\lambda = 1/(1+\sqrt[3]{b^4\lambda_a})$ is the fraction of the initial unemployment shock that remains after monetary policy stabilisation, $\phi = \sqrt[3]{b\lambda_a}$ and $k = \sqrt[3]{b\lambda_a}/(1+\sqrt[3]{b^4\lambda_a})$.[8]

The first three terms in (16) capture the same effects of reform as in the quadratic case: the marginal gain from lower expected unemployment, the marginal gain from lower expected inflation, and the direct marginal loss from reform itself, respectively. The last two terms are new and represent additional gains. The fourth term captures that lower equilibrium unemployment reduces the utility cost of variations in unemployment. The fifth term reflects that lower equilibrium unemployment reduces

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[8] In the derivation, it should be noted that the assumption of symmetric distributions ensures that $E(v^3) = E(m^3) = 0$, and the assumption of independence that $E(v^2 m) = E(m)E(v^2) = 0$ and $E(m^2 v) = E(v)E(m^2) = 0$.

expected inflation and hence the utility costs of variations in inflation when shocks are stabilised through monetary policy.

My reformulation of the loss function thus introduces an additional *precautionary* motive for labour-market reform.[9] For example, as illustrated in Figure 1, variability in unemployment increases the expected marginal loss of a given equilibrium rate of unemployment, and thus strengthens the incentive for unemployment-reducing reform. (Suppose that unemployment can take two values, both with the probability of 0.5. If the range of variation increases as depicted, the expected marginal loss is given by E_B instead of E_A).

3.2 Participation in the EMU

Aggregate unemployment in the EMU is still given by (8). It follows that inflation inside the EMU is determined by an equation that looks exactly as (15) except that union equilibrium unemployment, u_u^*, and the common shock, η, are substituted for u and ε, respectively. With participation, inflation is taken as exogenous when the national government decides on reform.

The optimisation condition is derived by minimising the expectation of (14) subject to (2), (3) and (4). It is

$$\frac{\partial E(L_p)}{\partial s} = -\lambda(u^* - \hat{u})^3 + \gamma s^3 - 3\lambda(u^* - \hat{u})\sigma_\nu^2 - 3\lambda(1-2(u^* - \hat{u}))\sigma_\eta^2 = 0. \qquad (17)$$

Compared to the quadratic case (11), the last two terms are new. They capture the additional marginal gains from reform that arise because lower equilibrium unemployment reduces the utility cost of variations in unemployment. The third term captures the gain associated with asymmetric shocks and the fourth term the gain associated with symmetric shocks. The reduction in utility cost is larger for asymmetric

[9] The specific form of my loss function is not crucial, but it simplifies the exposition. The crucial assumptions are that the government's loss function exhibits convex marginal disutilities of inflation and unemployment, and that the central bank stabilises employment shocks partially.

than for symmetric shocks with the same variance, because the latter are partially stabilised by the common monetary policy. Unlike in the non-participation case, reform does not affect inflation and hence not the utility cost of variations in it.

The consequences for labour-market reform of participation in the EMU can be derived from a comparison of (16) and (17). As there are no longer simple solutions for s_n and s_p, I do this by evaluating $\partial E(L_p)/\partial s$ at the level of reform given by (16) and noting that $\partial^2 E(L_p)/\partial s^2 = 3\left[\delta^2(u^* - \delta)^2 + \gamma s^2 + \delta^2(\sigma_v^2 + \delta^2(\lambda^2\sigma_m^2)\right] > 0$.

As before, the gain from reform tends to be smaller in the participation case, because reform does not then reduce expected inflation (the second term in (16) is missing in (17)). But one has now also to compare the strength of the precautionary motives in the two cases. On one hand, there is a precautionary motive for reform to reduce the utility cost of variations in inflation in the non-participation case (the fifth term in (16)). On the other hand, there is a stronger precautionary motive for reform to reduce the utility cost of unemployment variations in the participation than in the non-participation case. The reason is that the *net* unemployment variations tend to be larger in the former case, because monetary policy then does not stabilise asymmetric shocks: the sum of the third and fourth terms in (17) is larger in absolute terms than the fourth term in (16) as $\sigma_v^2 + \lambda^2\sigma_m^2 > \lambda^2\sigma_e^2 = \lambda^2(\sigma_v^2 + \sigma_u^2)$.

The precautionary motive for reform is stronger in the non-participation than in the participation case if

$$\frac{\lambda_a}{\lambda\left(3\sqrt{\beta^4\lambda_a} + 2\right)} > \frac{\sigma_v^2}{\sigma_v^2 + \sigma_m^2}. \qquad (18)$$

This is more likely the smaller the unemployment aversion of the government, λ, the larger the unemployment aversion of the central bank, λ_a, and the smaller the variance of asymmetric shocks relative to the variance of common shocks.

If (18) holds, there is more reform outside than inside the EMU, just as in section 2. This follows because $\partial E[L_p]/\partial s$ then becomes positive at the level of reform given by (16).

If the opposite inequality to (18) holds, the outcome is ambiguous. However, if the inflation bias of the central bank can be eliminated, for example by giving the central bank the unemployment target $\hat{u} = u^*$, the conclusion becomes clear cut. Then, the two inflation terms (the second and fifth terms) in (16) drop out. So the only difference between non-participation and participation is that the precautionary motive for reform to reduce unemployment variations is stronger in the latter case, as discussed above. (This is illustrated by the difference between B and A in Figure 1). Thus in this case, the conclusion in section 2 is reversed, and there will be more reform inside than outside the EMU.

The above result rests on the premise that *net* shocks after monetary policy stabilisation are larger inside than outside the EMU. This has been questioned. The argument is that shocks could to a large extent be policy-induced and that the EMU would impose more discipline on policy-makers, for example through the fiscal rules in the Maastricht treaty (Fatas, 1997; Hamilton, 1997). One way of capturing this is to assume that the variances of the exogenous shocks *v* and μ are so much larger outside than inside the monetary union that the net variances after stabilisation are also larger, i.e., $\lambda^2[\bar{\sigma}_v^2 + \bar{\sigma}_\mu^2] > \tilde{\sigma}_v^2 + \lambda^2\tilde{\sigma}_u^2$, where the $\bar{\sigma}^2$:s refer to non-participation and the $\tilde{\sigma}^2$:s to participation. If this were to be the case, the precautionary motive for reform would instead always be stronger outside than inside the monetary union. So the model suggests that participation in the EMU can lead to more labour-market reform only if unemployment variations then increase. Joining the EMU cannot lead to both more reform and less employment variability.

4. Structural reform and labour-market flexibility

So far, I have assumed that labour-market reform affects only equilibrium unemployment, but not the sensitivity of unemployment to shocks and to monetary

policy. This assumption is not self-evident. Much of the discussion on structural reform has been cast in terms of the need to increase labour-market *flexibility* so as to improve the ability to cope with macroeconomic shocks (e.g., OECD, 1994).

The literature on European unemployment has stressed real-wage flexibility as a critical factor. It has been argued that an increase in the responsiveness of real wages to unemployment will reduce both equilibrium unemployment and the impact of shocks on unemployment (Layard et al., 1991). But theory is less clear about the effects of labour-market reform (such as a change in the level or duration of unemployment benefits) on real-wage flexibility than about the effects on the average real-wage level and hence the equilibrium rate of unemployment. However, there is, for example, some empirical support for the hypothesis that less generous unemployment compensation and more of active labour market policy increase real-wage flexibility (e.g., Layard et al., 1991; and Heylen, 1993). I shall proceed as if there is indeed such a link between labour-market reform and real-wage flexibility.

Consider an economy where all firms, as before, produce an identical (traded) good, and where there are two types of wage contracts. In one sector, wages are set *before* shocks occur and monetary policy (inflation) is determined, just as in the earlier sections. In the other sector, wages are instead set *after* shocks have occurred and inflation has been decided. This is a crude way of capturing that wage contracts are for different periods and of varying length. Expressing all wage and price variables in log form, the economy can be represented by the following equations

$$w_1 - p^e = -au^e + c \tag{19}$$

$$w_2 - p = -au + c \tag{20}$$

$$u_i = \beta(w_i - p) + e + \varepsilon \qquad i=1,2 \tag{21}$$

$$u = tu_1 + (1-t)u_2 . \tag{22}$$

Equation (19) represents wage-setting in sector 1, where the wage, w_1, is set on the basis of the expected price, p^e, and expected aggregate unemployment, u^e. Equation

(20) captures wage-setting behaviour in sector 2, where the wage, w_2, is set on the basis of the actual price, *p*, and actual aggregate unemployment, *u*. Equation (21) is an ordinary labour-demand equation showing how unemployment, u_i, in each sector depends on the real wage there, $w_i - p$, and an exogenous (gross) shock, x, which is the same for both sectors. Equation (21) gives aggregate unemployment as a weighted average of the unemployment rates in the two sectors.

Given rational expectations, and because $p - p^e = \pi - \pi^e$, (19)-(22) together give the aggregate unemployment equation

$$u = \frac{\beta c + e}{1 + \beta a} - \frac{t\beta(\pi - \pi^e)}{1 + \beta a(1-t)} + \frac{x}{1 + \beta a(1-t)}, \qquad (23)$$

where the first term represents equilibrium unemployment, the second term the effect of unanticipated inflation, and the third term the effect of the exogenous shock.

Suppose that labour-market reform increases the responsiveness of real wages to unemployment (the parameter *a*). Then there are three effects on aggregate unemployment: (1) equilibrium unemployment is reduced (the first term); (2) unanticipated inflation will have a smaller unemployment-reducing effect (the second term); and (3) an exogenous shock will have a smaller unemployment-increasing effect (the third term). The last two effects are easy to understand. The more flexible the real wage in the flex-wage sector, the more will wage adjustments dampen the employment impact of an unanticipated shock. This is an illustration of the general principle that a reduction of real rigidities mitigates the effects of nominal rigidities (Ball and Romer, 1990).[10]

Now, let $x = \varepsilon + \eta$, where ε is an exogenous (gross) asymmetric shock component and η an exogenous (gross) symmetric component. Then, I can express the *net* shocks (*after* wage adjustments have occurred) in my earlier equation (3) as

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[10] An alternative possibility would be to let labour-market reform affect the length of wage contracts. If shorter contract periods are assumed to be a component of reform, this could be captured by letting a smaller fraction of contracts be concluded before shocks and inflation have become known (a reduction of *t*). From (23), the consequence must be a smaller responsiveness of aggregate unemployment to both shocks and monetary policy. Pursuing this line of analysis would give results that are very similar to those below.

$$v = h(s)\varepsilon \tag{24}$$

$$u = h(s)\varepsilon + \eta, \tag{25}$$

where $h' < 0$. I can also express the responsiveness of unemployment to unanticipated inflation, β, in my earlier equation (2) as

$$\beta = -h(s)\gamma. \tag{26}$$

I now also reformulate the earlier equation (4) as

$$u^* = u(s)\gamma, \tag{27}$$

where $u' < 0$.

4.1 Non-participation in the EMU

Outside the EMU, the government minimises the expectation of (1) subject to (2), (3), (5), (24), (25), (26) and (27). To simplify, I let $\lambda_a = \lambda$ and obtain

$$\begin{aligned}\frac{\partial E(L_n)}{\partial s} &= u'\lambda(u^* - \alpha) + u'\beta^2\lambda^2(u^* - \alpha) + \gamma s + \beta\lambda^2\gamma h'(u^* - \alpha)^2 \\ &+ \frac{\lambda hh'}{(1+\beta^2\lambda^2)^2}(\sigma_\varepsilon^2 + \sigma_\eta^2) = 0,\end{aligned} \tag{28}$$

where σ_ε^2 and σ_η^2 are the variances of the gross shocks ε and η, respectively.

The first three terms in (28) are the same as in (6). They represent the direct reduction of expected unemployment due to lower equilibrium unemployment, the reduction of the inflation bias due to lower equilibrium unemployment, and the direct utility cost of labour-market reform, respectively. The other two terms are new.

The fourth term represents an additional marginal gain from reform because there is now an additional reduction of the inflation bias, $\beta\lambda(u^* - \alpha)$, over and above the reduction following from lower equilibrium unemployment. This occurs because

reform reduces the responsiveness of unemployment to unanticipated inflation, β. So the incentive to inflate is lowered also because the perceived pay-off from inflation decreases.

The fifth term captures the impact of larger wage flexibility (a lower h) on the variability of unemployment. The term expresses the net of two opposing effects. On one hand, there is a direct effect, which tends to reduce the unemployment impact of an exogenous shock. On the other hand, there is a counteracting effect, because the effectiveness of monetary policy as a stabilisation tool in the case of shocks is reduced when $\beta = th\beta$ falls. This tends to increase unemployment variability. But as monetary policy offsets shocks only partially, the latter effect is of second-order importance. So the net effect is a reduction of unemployment variability. This represents a marginal gain.

4.2 Participation in the EMU

When analysing the EMU case, one must now take into account that the responsiveness of unemployment to unanticipated inflation and to exogenous shocks can differ between member states, because they may, in principle, choose different levels of reform. Aggregate union unemployment is then $u_u = u_u^* - \beta_u(p_u - p^e) + \eta_u$, where $\beta_u = \sum_{i=1}^{n} \beta_i / n$, $\eta_u = h_u \varepsilon$ and $h_u = \sum_{i=1}^{n} h_i / n$ is the fraction of an initial common unemployment shock remaining in the union after wage adjustments. Union inflation then becomes

$$p_u = p^e + \beta_u \lambda_u (u_u^* - u^*) + \frac{\beta_u \lambda_u}{1 + \beta_u^2 \lambda_u} \eta_u . \qquad (29)$$

The amount of labour-market reform is now derived by minimising the expectation of (1) subject to (2), (3), (24), (25), (26), (27), and (29). I assume that $\lambda_u = \lambda$ and take β_u and h_u as exogenous. In a symmetric equilibrium, where $u_u^* = u^*$, $\beta_u = \beta$ and $h_u = h$, the FOC is

$$\frac{\partial E(L_p)}{\partial s} = u'(u^* - \hat{u}) + \gamma s + (hh')\sigma_\nu^2 + \frac{(hh')}{(1+b^2)h^2}\sigma_m^2 = 0. \qquad (30)$$

The first two terms are the marginal gain from reform because of lower expected unemployment and the direct utility cost, respectively. The third and fourth terms are the gains that occur because reform increases wage responsiveness and hence reduces the net unemployment variations (after monetary policy stabilisation) that arise from asymmetric and symmetric shocks, respectively.

Comparison of (28) and (30) shows that it is unclear how the effects on labour-market flexibility influence the relative amount of labour-market reform inside and outside the EMU.[11] On one hand, the incentive for reform is strengthened outside, because there is now a *double* gain in terms of lower inflation when the impact of unanticipated inflation on unemployment is reduced (the fourth term in (28)). On the other hand, the incentive tends to be stronger inside than outside, because the gain from wage flexibility is larger when monetary policy is no longer used to stabilise asymmetric shocks. This follows because the absolute value of $(hh')\sigma_\nu^2 + (hh')\sigma_m^2/(1+b^2)h^2$ in (30) is larger than the absolute value of $(hh')(\sigma_\nu^2 + \sigma_m^2)/(1+b^2)h^2$ in (28).

My analysis confirms partly the intuition that relinquishing monetary policy independence strengthens the incentive for labour-market reform to increase wage flexibility as a substitute for exchange-rate policy. But the analysis also points to the less obvious existence of an additional incentive for reform outside the monetary union, because more wage flexibility means a smaller effect of unanticipated inflation on employment and hence a weaker temptation to inflate. The latter effect presupposes the existence of an inflation bias for the central bank.

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[11] I evaluate $\partial E(L_p)/\partial s$ at the level of reform with non-participation given by (28). I assume that $\partial^2 E(L_p)/\partial s^2 = (hu')^2 + (u'')(u^* - \hat{u}) + \gamma + [(h')^2 + hh'']\sigma_\nu^2 + [(h')^2 + hh'' + b^2(hh'')$

5. Complementarity between labour-market reform and monetary policy

My analysis has produced ambiguous results on the link between monetary union and labour-market reform. If there exists an inflation bias that can be reduced with lower equilibrium unemployment, there may be more reform outside than inside the EMU. This section examines the possibility that this could occur also without such an inflation bias. I focus on a regime with an *inflation target*, as recently adopted by some countries. The analysis stresses how the *transition* from one set of labour-market institutions to another could result in too low inflation. This is welfare-decreasing in itself, but with downward money-wage rigidity it could also become more difficult to achieve the real-wage reduction necessary to reduce unemployment.[12]

To make my point, I need a model where domestic and foreign goods are imperfect substitutes. I assume the following unemployment equation:

$$u = p - e - p_f + \eta, \tag{31}$$

where u is the unemployment rate, p is the log of the price of domestic goods, e is the log of the exchange rate, p_f is the log of the price of foreign goods, and η is a random shock with zero mean. The equation can be derived from assumptions of constant returns to scale with respect to labour input and Cobb-Douglas utility functions on the part of consumers. The upshot is that unemployment depends negatively on the real exchange rate, $e + p_f - p$.[13]

$-3\beta^2[h'(\cdot)]^2\sigma_m^2/(1+\beta^2\sigma_\eta^2)^3 > 0$ for all relevant s. A sufficient condition for this is that $u'' > 0$, $h'' > 0$ and $\sigma_m^2 = 0$.

[12] This has been emphasised by, e.g., Bean (1994), Gordon (1996) and Calmfors et al. (1997).

[13] With Cobb-Douglas utility, the equilibrium condition for domestic goods is $PY = \alpha PY + \alpha_f EP_f Y_f$, where P is the price of domestic output, Y is domestic output, P_f is the foreign-currency price of foreign goods, Y_f is foreign output, E is the exchange rate, α is the expenditure share of domestic goods in domestic consumption, and α_f is the expenditure share of domestic goods in foreign consumption (Agell et al., 1996). The LHS is the value of domestic output. The RHS is the sum of domestic and foreign demand. I let $Y = N$, where N is employment, and note that $u \approx -\ln(N/M)$, where M is the labour force. Y_f and M are assumed to be random variables. Rearranging the goods

Constant returns to scale mean that $p = w$, where w is the domestic wage. The wage is set before shocks occur and monetary policy is decided so as to try to achieve the equilibrium rate of unemployment, $u^* = \tilde{u} - \delta s$. Hence, the wage-setting condition is $E(u) = \tilde{u} - \delta s$, which gives

$$w = \tilde{u} - \delta s + E(e) + E(p_f), \tag{32}$$

and together with (31)

$$u = \tilde{u} - \delta s + \eta. \tag{33}$$

The government still has the loss function (1), but inflation now refers to the CPI, so that

$$p = \alpha \Delta p + (1-\alpha)(\Delta e + \Delta p_f) = \alpha \Delta w + (1-\alpha)(\Delta e + \Delta p_f), \tag{34}$$

where α and 1-α are the weights of domestic and foreign goods in the CPI, respectively.

In the non-participation case, the domestic central bank has the inflation target π^*, which coincides with the inflation goal in the government's loss function (1). The bank always adheres to the target, so that

$$p_n = \pi^*. \tag{35}$$

In the participation case, the ECB has the same inflation target, which it also always reaches. With many countries in the union, it holds approximately that

$$\Delta p_f^p = \pi^*. \tag{36}$$

The monetary-policy assumptions imply perfect foresight with respect to prices. So the only uncertainty refers to the shock η.

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market equilibrium condition, taking logs and making appropriate normalisations gives (31), where $\eta = \ln M + \ln(1-\alpha) - \ln \alpha_f - \ln Y_f$.

Consider now the case where labour-market reform is being contemplated. Assume that the government can only choose between keeping the same labour-market institutions, s_1, as in the preceding period, or instituting a reform, s_2. I still assume a one-shot game, so that the government evaluates the consequences of reform by looking at the expectation of the one-period loss given by (1).

5.1 Reform with money-wage flexibility

I begin by letting money wages be perfectly flexible. Consider first *membership* in the monetary union. Then, the exchange rate is irrevocably fixed, so that $\Delta e = E(\Delta e) = 0$. If reform is carried out in the domestic economy, expected unemployment becomes $\tilde{u} - \delta s_2$ according to (33). The change in the price of domestic output relative to the preceding period is $\Delta p_2^p = \Delta w = -\delta(s_2 - s_1) + \Delta p_f = -\delta(s_2 - s_1) + \pi^*$, and inflation is $p_2^p = \alpha\Delta p + (1-\alpha)\Delta p_f = -\alpha\delta(s_2 - s_1) + \pi^*$. Domestic inflation thus falls below π^*. This occurs because the real exchange rate must depreciate, if the higher expected output consistent with lower equilibrium unemployment is to be sold. The expected loss with reform inside the union is $E(L_2^p) = \alpha^2\delta^2(s_2 - s_1)^2 + \lambda(\tilde{u} - \delta s_2 - u^*)^2 + \lambda\sigma_\eta^2 + \gamma\sigma_\varepsilon^2$, where σ_η^2 is the variance of η.

Without reform (status quo), inflation is at the target level, since then $\Delta p = \Delta w = \Delta p_f = \pi^*$. Expected unemployment is $\tilde{u} - \delta s_1$. The expected loss is then $E(L_1^p) = \lambda(\tilde{u} - \delta s_1 - u^*)^2 + \lambda\sigma_\eta^2 + \gamma\sigma_\varepsilon^2$. It follows that the expected loss difference between reform and status quo is

$$E(L_2^p) - E(L_1^p) = \alpha^2\delta^2(s_2 - s_1)^2 + \lambda\left[(\tilde{u} - \delta s_2 - u^*)^2 - (\tilde{u} - \delta s_1 - u^*)^2\right] + \gamma(s_2^2 - s_1^2). \quad (37)$$

So there are three effects of reform: (1) a utility loss because domestic inflation becomes too low (the first term); (2) a utility gain because domestic equilibrium unemployment is reduced (the second term); and (3) a direct utility cost of reform itself (the third term).

Consider next *non-participation* in the monetary union. In the reform case, the domestic central bank prevents inflation from falling below the inflation target by depreciating the currency. The depreciation is $\Delta e = \alpha(s_2 - s_1)$, and the rate of price change for domestic goods then becomes $\Delta p = \pi^{\$} - (1-\alpha)(s_2 - s_1)$. To accommodate the higher output, there is the same *real* depreciation, $(s_2 - s_1)$, as with participation, but it is now achieved through a combination of exchange-rate depreciation and lower price change for domestic goods.

The expected loss of reform in the non-participation case is $E(L_2^n) = (\tilde{u} - s_2 - k)^2 + \sigma_\eta^2 + \gamma s_2^2$, whereas the expected loss without reform is the same as in the participation case, i.e., $E(L_1^n) = E(L_1^p)$. Hence, the expected difference in disutility between reform and status quo now is

$$E(L_2^n) - E(L_1^n) = \left[(\tilde{u} - s_2 - k)^2 - (\tilde{u} - s_1 - k)^2\right] + \gamma(s_2^2 - s_1^2). \qquad (38)$$

Comparing (37) and (38), it is clear that reform is less favourable to the government inside than outside the monetary union, because inflation falls below the government's goal in the former case. It may well be that (38) is positive, whereas (37) is not. If so, reform is undertaken outside but not inside the monetary union.

5.2 Reform with downward money-wage rigidity

A more realistic assumption is that money wages or the rate of money wage growth is rigid downwards, at least in the short run. Economic theory is bad at explaining this phenomenon, but is seems to be an empirical regularity (Akerlof et al., 1997). To capture it, I let

$$w = \max\begin{cases} w_{-1} + c \\ \tilde{u} - s + e + p_f, \end{cases} \qquad (39)$$

where $0 \leq c < \pi^*$. I assume that the rigidity constraint binds both inside and outside the monetary union in the present period (but not in the preceding one) in the case of reform.

I again first consider participation in the EMU. Inflation in the domestic economy with reform is $p_2^p = \alpha c + (1-\alpha)\pi^* < \pi^*$, whereas it is $p_2^p = \pi^*$ without. Unemployment with reform becomes $u_2^p = \tilde{u} - \delta s_1 + c - \pi^* + \eta$.[14] Without reform, equilibrium unemployment stays the same as in the preceding period, so that unemployment then becomes $u_1^p = \tilde{u} - \delta s_1 + \eta$. Unemployment is thus lower with reform only to the extent that the inflation target of the ECB exceeds the minimum rate of money wage growth.

It follows that the expected loss is $E(L_2^p) = \alpha^2 (c - \pi^*)^2 + \lambda (\tilde{u} - \delta s_1 + c - \pi^* - u^*)^2 + \lambda \sigma_\eta^2 + \gamma s_2^2$ with reform and $E(L_1^P) = (\tilde{u} - \delta s_1 - u^*)^2 + \lambda \sigma_\eta^2 + \gamma s_1^2$ without. Thus, the expected difference in disutility between reform and status quo is

$$E(L_2^p) - E(L_1^p) = \alpha^2 (c - \pi^*)^2 + \lambda \left[(\tilde{u} - \delta s_1 + c - \pi^* - u^*)^2 - (\tilde{u} - \delta s_1 - u^*)^2 \right] + \gamma (s_2^2 - s_1^2). \quad (40)$$

As before, there are losses from a downward deviation from the inflation goal (the first term) and from reform itself (the third term), and a utility gain from lower unemployment (the second term). However, both the reduction in unemployment and the deviation from the inflation goal are smaller than with a flexible money wage.

Consider then non-participation. Again, inflation is not allowed to deviate from the target in the case of reform. With a binding money-wage constraint, the rate of price change for domestic goods becomes $\Delta p_2^n = \Delta w = c$. It follows that the exchange rate must be depreciated by $\Delta e = \alpha(\pi^* - c)/(1-\alpha)$, if the inflation target is to be met.[15]

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[14] The condition for the money-wage constraint to bind in the participation case is $\delta(s_2 - s_1) > \pi^* - c$. This is seen from (39), if it is noted that $w_{-1} = \tilde{u} - \delta s_1 + e + p_f - \pi^*$.

[15] $w_{-1} = \tilde{u} - \delta s_1 + e + p_f - \pi^*$ and (39) together imply that the condition for the money-wage constraint to bind in this case is that $\delta(s_2 - s_1) > (\pi^* - c)/(1-\alpha)$.

Unemployment with reform becomes $u_2^n = \tilde{u} - \delta s_1 + [c - \varphi\gamma/(1-\alpha\gamma) + \eta$, whereas it is $\tilde{u} - \delta s_1 + \eta$ without reform.

The expected loss with reform is $E(L_2^n) = [\tilde{u} - \delta s_1 + c - \varphi\gamma/(1-\alpha\gamma) - \sigma]^2 + \lambda\sigma_\eta^2 + \gamma s_2^2$ and without reform the same as in the participation case, i.e., $E(L_1^n) = E(L_1^p)$. Hence, the expected loss difference between reform and status quo is

$$E(L_2^n) - E(L_1^n) = \left[\gamma(\tilde{u} - \delta s_1)\gamma + c - \varphi\gamma/(1-\alpha\gamma) - \sigma\right]^2 - [\tilde{u} - \delta s_1 - \sigma\gamma]^2 + \gamma(s_2^2 - s_1^2). \quad (41)$$

Comparison of (40) and (41) shows that reform is more favourable outside than inside the monetary union also with rigid money wages. But this now follows *both* form the absence of a downward deviation from the government's inflation goal in the non-participation case and from the larger fall in unemployment that is a consequence of this. So again, reform might be undertaken outside the monetary union but not inside.

Obviously, my one-period framework is much less appropriate in this section than in the earlier ones, because the utility loss from too low inflation should be seen as a transitory effect, whereas the reduction of equilibrium unemployment is a permanent effect. Still, a multi-period extension of the model would not change the qualitative argument. My analysis does illustrate the general principle of *complementarity* between policies (Alogoskoufis et al., 1995; Lindbeck, 1996; Coe and Snower, 1997; Calmfors et al., 1998). Labour-market reform may be politically more viable, and possibly, more effective in lowering unemployment if it is accompanied by appropriate monetary policy. This explains why the incentive for reform could be stronger outside than inside the monetary union also in the absence of an inflation bias.[16]

6 Discussion

[16] A possible intertemporal extension would be to a model with a fixed cost of reform (so that gradual reform does not pay off). If one assumes that the re-election probability of the government depends on its present performance, because this forms the basis for voters' judgement of its competence, the first-period effect of reform are likely to be very important in such a setting, too.

I have extended the Barro-Gordon model of inflation to analyse how monetary union is likely to affect the amount of labour-market reform. A key assumption is that labour-market institutions continue to be determined nationally also when a common monetary policy is adopted.

In my baseline model, there is more reform outside than inside the monetary union. The reason is that monetary policy suffers from an inflation bias. With monetary policy independence, national labour-market reform reduces this bias in addition to lowering equilibrium unemployment. But with a common monetary policy, national reform has a negligible effect on inflation.

In my second model, I introduce a *precautionary motive* for labour-market reform. Variations in inflation and unemployment are regarded as more costly the higher the average rates of inflation and unemployment. With an inflation bias, it is unclear how the precautionary motive affects the relative strength of incentives for reform inside and outside the EMU. But if the inflation bias can be eliminated through appropriate monetary institutions, the incentive for reform becomes stronger inside than outside the monetary union in this model. The explanation is that the marginal gain of reform to reduce equilibrium unemployment becomes larger, when monetary policy can no longer stabilise asymmetric shocks and the variance of unemployment increases.

In my third model, labour-market reform affects both equilibrium unemployment and *wage flexibility*. This adds two effects. On one hand, the incentive for reform tends to be stronger inside the monetary union, because there is a need for more wage flexibility as a substitute for exchange-rate policy. On the other hand, the incentive for reform tends to be stronger outside the monetary union to the extent that more wage flexibility reduces the impact of unanticipated inflation on employment and hence the temptation to inflate. In general, it is unclear in this model when the incentive for reform is stronger. However, there is clearly more reform inside than outside the union, here, too, if the inflation bias can be eliminated through the choice of appropriate monetary institutions.

A fourth section analyses an *inflation-target regime* with no inflation bias. Here, the incentive for reform is always stronger outside than inside the monetary union, because

national labour-market reform will cause downward deviations from the domestic inflation goal when exchange rates are irrevocably fixed. If money wages are rigid downwards, the real-wage reduction necessary to reduce equilibrium unemployment may also fail to materialise. Outside the union, monetary policy will be pursued in such a way that the domestic inflation goal is always met.

My conclusion that joining the monetary union could weaken the incentive for labour-market reform follows from the assumption that reform is not co-ordinated between member states. But one could argue that a common monetary policy would strengthen the incentive for centralisation of employment policy. One reason is that the effects on aggregate inflation can be internalised in this way. The common monetary policy can also be used to facilitate reform, if it is co-ordinated among the members of the monetary union. Moreover, EU agreements on impopular - but effective - employment measures might serve as a commitment technology increasing the costs of abstaining from labour-market reform (very much as ERM participation represented a commitment technology for monetary policy in some EU countries in the 1980s).

Nevertheless, there is little to suggest that there will be substantial centralisation of labour-market policy in the EU in the foreseeable future. Labour-market institutions seem usually to be regarded as belonging to the core of national decision-making. Nor is it clear, when going beyond my model, that such centralisation is necessarily beneficial. The uncertainty about the optimal portfolio of policies against unemployment represents a strong case for allowing different countries to experiment in different ways. Differences in the relative importance of asymmetric versus symmetric shocks or in the impact of the common monetary policy could also explain why the need for labour-market reform could differ between member states in a monetary union.

My overall conclusion is that monetary union will affect the incentive for labour-market reform in several ways, but that the net effect is ambiguous. This suggests the need for looking at actual country experiences. Unfortunately, these are very diverse. One one hand, labour-market institutions in the U.S., which is a large currency union, seem to be conducive to low unemployment. On the other hand, the pace of labour-market reform in the 1980s and 1990s has been very slow in most EU economies

pursuing hard-currency policies within the ERM of the same type as expected in the EMU. This applies to Belgium, France and Germany, although the Netherlands is an exception. The most far-reaching labour-market reforms in the OECD during the last two decades have been achieved in Britain and New Zealand without any pressures from international monetary arrangements (OECD, 1997).

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Figure 1: The marginal loss of unemployment