Will EMU Increase Eurosclerosis?

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Abstract

In this paper we study the relationship between labor market institutions and monetary policy. We use a simple macroeconomic framework to show how optimal monetary policy rules depend on labor institutions (labor adjustment costs, and nominal and real wage rigitidy) and social preferences regarding inflation, employment, and real wages. We also calibrate our model to compute how the change in social welfare brought about by giving up monetary policy as a result of joining the Economic and Monetary Union (EMU) depends on institutions and preferences. We then use the calibrated model to analyze how EMU affects the incentives for labor market reform, both for reforms that increase the economy's adjustment potential and for those that affect the long-run unemployment rate.

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1 Introduction

Over the last ten years, Europe has been engaged in a major policy project: monetary union. At the same time, it has continued facing a major policy problem: unemployment. An ironical observer might therefore ask why so much political capital has been spent on an arrangement that is so remote from the main problem at hand. The answer belongs to politicians, but it is the economist's task to study how monetary union might change the way in which labor market policy is conceived. This question has two sides. First, we may ask what is the best policy to reduce European unemployment, and whether it is changed by Economic and Monetary Union (EMU). Second, we may take a more positive, political economy perspective and ask how the decisions that will actually be taken in the field of labor market policy will be different from the ones that would have been pursued absent EMU.

At face value, a well-trained economist would argue that EMU and labor market policy are largely unrelated. The standard view holds that monetary policy does not affect real variables in the long run.[1] Monetary union will affect the member economies' responses to asymmetric shocks, and, to the extent that the credibility of the European Central Bank (ECB) is different from that of the original national central banks, their common long-run inflation rate. But European unemployment, which has been high for so long, is usually attributed to long-run *real* rigidities in wage setting, that prevent real labor costs from adjusting downwards in order to eliminate unemployment. That is, Europe's problem is that the *natural* rate of unemployment is too high, whereas the monetary stance only affects short-run deviations from that natural

[1] There exists however a line of thought that emphasizes hysteresis phenomena (Blanchard and Summers, 1986, Gottfries and Horn, 1986), according to which a temporary aggregate demand shock has permanent effects on unemployment, that is, it changes the natural rate of unemployment forever. However, the mechanisms that have been proposed for such hysteresis have been dismissed as too weak to generate permanent effects of temporary shocks (Layard, Nickell and Jackman, 1991). Rather, they increase the time it takes for actual unemployment to return to the natural rate following an aggregate demand shock.

rate. The first-order answer is therefore that monetary union should not affect labor market policy.

This argument, however, places too much emphasis on the long run. For private agents that discount the future, the transition to a new long-run equilibrium is at least as important as that new equilibrium. This is particularly so when one takes a political economy perspective, as governments are short-lived and could not care less about what the labor market will look like thirty years from now. The transition path to a new equilibrium following a change in labor market policy will heavily depend on the macroeconomic stance; monetary policy may play an important role in making the transition better, or more acceptable to voters. An important effect of EMU is that it will remove that instrument from national governments, preventing them from using it as an auxiliary policy instrument to deliver the best possible transition path to a new natural rate of unemployment.

National monetary policies also help to insulate one country from a shock occurring in other countries. In this respect, while convergence has been achieved in fiscal and monetary indicators, and while steps have been taken to impose convergence of future fiscal policies, labor market policies have not been harmonized and will remain largely idiosyncratic.[2] This reflects in great part divergence of views about the causes of unemployment and the appropriate remedies (compare, for example, the reforms undertaken in the UK and those undertaken in France), which implies that labor market policy will be a source of asymmetric shocks within EMU. These shocks will spillover from the country where they occur to other countries, and will generate conflicts between countries over the appropriate monetary response from the ECB. Indeed, such a shock, and not a small one, has happened just one year after EMU took off, namely the introduction of the 35-hour workweek in France in January 2000.

In this paper we analyze the relationship between labor market reform and mone-

[2] See Bean *et al.* (1998) for evidence and discussion.

tary policy in connection with EMU. We start by providing a short survey which allows us to place our analysis in relation to the (scant) existing literature on EMU and labor market policy (Section 2). We then introduce a simple macroeconomic framework allowing us to characterize optimal monetary policy when performed at the national level (Section 3). We then examine how such policy depends on the type of labor institutions and social preferences defined over various objectives –employment, real wages, and inflation– prevailing in the economy (Section 4). Characterizing EMU as the inability to carry out country-specific monetary policy and calibrating both labor institutions and policy preferences allows us to find how each type of institution modifies the welfare cost entailed by joining EMU. Interestingly, no general proposition can be established saying that rigidities are always harmful under EMU. Whether a given institution is more costly or more beneficial under EMU than under a sovereign monetary policy depends on social preferences. On the basis of these results, we then assess how EMU modifies the incentives for labor market reform (Section 5). We distinguish between reforms which only improve the economy's dynamic adjustment potential with no long-run effects, from those which also lower the steady-state unemployment rate. For the latter we find that while EMU clearly makes sizable reforms harder, it may make small reforms easier. We end with a set of conclusions (Section 6).

It is worth advancing our main policy conclusions:

- EMU creates incentives to alter the economy's structure in order to improve its response to shocks. However, depending on which institution one is talking about, and on the country's preferences, this may well lead to more rigid labor markets. For example, employment protection destabilizes prices but it stabilizes employment. EMU increases the incentives to get rid of employment protection except if society cares a lot about stabilizing employment, in which case it would actually create incentives to tighten employment protection legislation—this does not occur in our simulations but it could for governments that put a high weight

on employment.

- EMU reduces the incentives for a large scale reform of the labor market that would substantially lower unemployment, because monetary policy is very useful in order to get the best possible transition path to the new equilibrium. Consequently, we expect more timid reforms to prevail under EMU.

- Optimal monetary policy at the time of a labor reform involves a sharp depreciation in the short run, which speeds the transition toward the higher employment level. This is consistent with the *two-handed approach* view, according to which macroeconomic stimulus should accompany structural reforms.

- In this respect, an important limitation to structural reforms under EMU is their potential *deflationary* impact. If deflation is to be avoided, the maximum size of a reform will be smaller the lower the common trend of inflation in the monetary union.

- Finally, to overcome the disincentive effects of EMU on labor market reform, there is a case for *coordination* of labor market reforms across European countries. This will allow the ECB to engineer a monetary expansion in the Union at the same time as all member countries engage in structural reforms, thus implementing the two-handed approach at the union-wide level.

2 Literature on EMU and labor market reform

Until recently, most macroeconomic work on EMU has revolved around its desirability and viability. The traditional discussion has focused on two issues. First, whether EMU member countries did or did not satisfy the classic conditions established by Mundell (1961) for an optimum currency area –e.g. labor mobility, wage and price flexibility, and the presence of fiscal transfers from a central authority–, whose non-fulfillment

could create problems in the event of asymmetric shocks. Second, the determinants of the likelihood that those shocks will happen.[3] Except for the four European Union (EU) countries currently outside EMU, that discussion seems dated. As of 2000, EMU is up and running, and the most likely scenario is that it will be viable. It is time to move on to the issue of how EMU will affect macroeconomic developments in the Euro countries.

Since EMU entails a change in a monetary arrangement, it is natural to expect it to affect mostly nominal variables, such as the level of inflation or the degree of nominal wage inertia. Inflation is likely to be low, in view of the mandate for price stability enshrined in the statute of the ECB. The current EMU-wide inflation target of the ECB is a band going from zero to 2%. As to nominal wage inertia, there are theoretical predictions either way, as Calmfors (1998) has noted. It will decrease if the lack of response of the ECB to country-specific shocks leads to larger demand shocks on average, and this induces wage setters to shorten wage contract periods. Inertia may however increase due to resistance to money-wage cuts in a low inflation environment, for various reasons (for instance, coordination failures, *hold-out* clauses, or social norms about fairness). Empirically, both Calmfors (1998) and Burda (1999) present informal evidence suggesting a trend towards increased nominal wage flexibility.

But EMU may have real, rather than just nominal, effects as well.[4] Some effects would be direct. For example, EMU may increase the degree of competition in European labor markets, through increased economic integration. The single currency has reduced transaction costs and suppressed exchange rate volatility, both of which should increase trade flows among EMU member countries. It also increases transparency about price differentials across countries, which should enhance competition throughout the Euro zone. Both channels should increase the wage elasticity of labor

[3] See Bean (1992) or Wyplosz (1997).

[4] A discussion of the range of potential effects of EMU on European unemployment appears in Viñals and Jimeno (1998).

demand and as a result weaken the bargaining power of labor unions, which should itself yield higher real wage flexibility.[5] One may be skeptical about direct effects, because they depend on EMU leading to significantly higher trade flows than those already spurred by the European Single Market which started in 1993. It can be argued that the trade effects of EMU might not be very large, in view of the small empirically estimated effects of exchange rate volatility on trade.[6]

Also, Danthine and Hunt (1994) have pointed out that a single product market in the EU implies a *de facto* reduction of the degree of centralization of wage bargains. This may change the trade-offs faced by wage setters in countries with very centralized bargaining, like Scandinavian ones. This flattening out of the Calmfors-Driffill (1988) hump shape –as Burda (1999) puts it– means that it may not be so advantageous to have a nation-wide bargain any more, and this could shake collective bargaining in EU countries towards more decentralized structures.[7]

Recent work has focused on indirect, rather than direct, links, through which EMU might lead governments to modify labor market regulations. Let us briefly spell out the steps of the argument, since they are partly relevant to our story too. Persistently high unemployment rates have characterized most continental European countries since the 1970s, with the average unemployment rate in the 11 Euro countries hovering around 10% in the last 15 years of the century. The currently leading hypothesis is that high structural unemployment rates can be explained, to a large extent, by the type of labor market institutions prevailing in those countries, such as firing costs, unemployment benefits, collective bargaining regulations, etc. (see Layard *et al.*, 1991, and Blanchard and Wolfers, 1998).

[5] See Andersen and Sorensen (1993) for a theoretical model about this channel, and Andersen *et al.* (2000) for a discussion of other channels.

[6] See Commission of the European Communities (1990). Nevertheless, Rose (2000) claims that a currency union has further, much stronger trade effects.

[7] Cukierman and Lippi (1999) argue that European labor unions will become more agressive as a result of EMU, because the effects of their actions will be diluted in the EMU-wide labor market.

In spite of both this academic view and the tremendous costs imposed by high unemployment, most EU governments have been unable or unwilling to reform their labor market institutions, or they have done so in a very slow and partial way.[8] The leading explanation for the lack of reform is that existing institutions represent a political equilibrium. The recent political economy literature provides various mechanisms through which deviating from that equilibrium entails significant political costs which serve to entrench it (see, e.g., Saint-Paul, 1996). An intriguing question is therefore whether EMU, while bearing no direct relation to it, could help solve the European unemployment problem, by providing an exogenous shock that will rock the status quo in a way that favors reform.

Indeed, the conventional wisdom prevailing today is that EMU will eventually remove some barriers to labor reform. Governments of EMU countries have lost monetary policy as a tool to offset economic shocks and they may also see their hands tied regarding fiscal policy by the Stability and Growth Pact. Bean (1998) argues that once the easy option to devalue their currency has been lost, they will have no alternative but to try to make their economy more flexible through labor market reform. This is a version of the TINA (There-Is-No-Alternative) argument which became famous in the UK during the Thatcher years.

A few authors, however, provide arguments against this view. Both Sibert and Sutherland (1997) and Calmfors (1998) do so by extending Barro and Gordon's (1983) well known monetary policy model, where governments dislike deviations of inflation and unemployment from some target values, but cannot credibly commit on a policy rule. Labor market reform is costly for the government, presumably for political reasons. But it is also desirable: it directly reduces equilibrium unemployment and, because it also reduces the inflation bias (the reward from being able to surprise price

[8] See, e.g., Bertola and Ichino (1995) or Saint-Paul (1996). The UK and The Netherlands can be considered as exceptions to this rule. See Nickell and van Ours (2000) for a description of the labor markets in these two countries.

and wage setters), it ends up indirectly reducing inflation as well. In this sense, labor reform yields a double dividend. Now, the ECB is not guided by the inflation and unemployment rates of a particular country, but by (some) EMU averages. Then the marginal benefit from labor reform is smaller inside than outside EMU, because unemployment in an individual member country has a smaller impact on the monetary policy of the ECB than it had on the national central bank's policy, and thereby a lower impact on EMU-wide equilibrium unemployment and inflation rates as well. The prediction is, therefore, that there will be less reform as a result of EMU.

There exist other arguments for why labor reform may be either easier or harder inside than outside EMU. Bean (1998) points out that it might be harder if the costs from reform come upfront while the benefits take longer to materialize.[9] In such case, outside EMU monetary policy can be used to ease short-run costs, so that reform is viable in the first place, but not inside EMU. On the other hand, in the absence of an inflation bias, there is a stronger incentive for labor reform inside EMU if policymakers wish to avoid very bad outcomes regarding unemployment (i.e., they have a precautionary motive), since the ECB does not stabilize country-specific shocks (Calmfors *et al.*, 1997).

Finally, Saint-Paul and Wasmer (1999) study national labor market policies as the outcome of a strategic game between national governments and the European Central Bank, so that the multi-country aspect of EMU plays a key role.

Our model differs from the ones discussed so far in several respects. First, we explicitly distinguish among different labor market rigidities. More specifically, we make a distinction between four kind of rigidities: those which increase the ability of incumbent employees to get rents, those which reduce the response of real wages to labor market disequilibrium, those which increase nominal inertia in wage setting, and those which increase the cost of adjusting employment. We show that they have different impacts

[9] This argument is inspired in the well-known *two-handed approach* to European unemployment defended by Blanchard *et al.* (1986).

on the cost of belonging to EMU, or, conversely, that EMU membership affects the incentives for labor market reform in different directions depending on which type of rigidity we are considering. Second, we incorporate political economy considerations in our analysis by allowing social preferences to reflect incumbent employees' (or unions') preferences for real wage stability. Third, we relax the assumption that only long-run inflation and unemployment outcomes matter and take into account the role of monetary policy in the transition between steady states. In this way, our approach reflects the two arguments put forth by Bean (1998), as just discussed. Fourth, we calibrate a set of parameters which proxy for the different labor market institutions, so as to gauge the likely importance of contending channels.[10] Finally, we de-emphasize the role of monetary policy credibility by assuming that even absent EMU, the government can precommit on a monetary policy rule. This assumption reflects our belief that absent EMU, governments would have used other devices to achieve credibility, such as central bank independence, which already existed in many countries before they joined EMU.

3 A simple macroeconomic framework

3.1 Macroeconomic setup

Before dealing with EMU, it is necessary to set up a framework that speaks to the largely untouched issue of the links between monetary policy and labor market policy. Such framework can then be used to analyze what happens if monetary policy is decided by a supra-national central bank rather than a national one.

We shall use a simple Aggregate Demand/Aggregate Supply model consisting of the following equations:

$$y_t = \delta(e_t - p_t) + \varepsilon_t \tag{1}$$

$$y_t = l_t + h + \theta_t \tag{2}$$

[10] Bean (1998) provides a related numerical simulations for the UK on the effects of a generic labor reform which reduces the long-run unemployment rate.

$$p_t = w_t - \theta_t - h + \lambda(l_t - l_{t-1}) + \beta\lambda(l_t - E_t l_{t+1}) \quad (3)$$

$$w_t = (1-\alpha)(q + (1-\varphi)p_t + \varphi e_t + \gamma l_t) + \alpha(w_{t-1} + p_{t-1} - p_{t-2}) \quad (4)$$

where y denotes output, e the nominal exchange rate (with an increase in e meaning a depreciation), p the price level, w the nominal wage, h a productivity index which may also reflect hours of work per employee, and l employment, all of them in logs, while E denotes the expectations operator.

Equation (1) is the IS curve, which is reduced to its simplest determinants. The parameter δ jointly captures the elasticity of imports and exports to the real exchange rate and the degree of openness of the economy. ε_t is an aggregate demand shock with zero mean and variance σ_ε^2. We take the nominal exchange rate as our policy variable, which allows us to ignore the LM curve and makes it easier to extend the model to a monetary union case. We have not introduced interest rates either.[11] In fact, the econometric evidence suggests that interest rates do not play a major role in the IS curve.[12]

Equation (2) is the production function, which says that output is equal to employment times hours times productivity. Note that we have ignored the dynamics of capital accumulation.

Equation (3) sets the price equal to the marginal cost of labor.[13] The term $\lambda(l_t - l_{t-1})$ represents current marginal labor adjustment costs: the more employment grows relative to past employment, the greater the marginal cost of labor and the greater the price.[14] Hence, $\beta\lambda(l_t - E_t l_{t+1})$ represents future discounted marginal labor

[11] At the very least, introducing them would require the use of the interest parity condition: $i_t = i^* + E_t e_{t+1} - e_t$. This would complicate the dynamics unless the path of future expected exchange rates is flat, in which case equation (1) simply amounts to a normalization of the foreign nominal interest rate to zero. Note also that there is little evidence in favor of uncovered interest parity (see Obstfeld and Rogoff, 1997).

[12] It is usually hard to find significant effects of real interest rates in consumption and investment equations, and the sign of the estimated coefficient often crucially depends on the country and the period. See the surveys on consumption, Muellbauer (1993), and investment, Chirinko (1993).

[13] There could be a constant markup on marginal cost, which is implicitly normalized to one.

[14] This is again quite standard (see Layard *et al.*, 1991, ch. 9).

adjustment costs, with β as the discount factor. θ is a productivity shock with zero mean and variance σ_θ^2.

Finally, equation (4) represents wage setting behavior. Wages are a weighted average of past wages and current wage aspirations. Past wage contracts are assumed to include a cost of living adjustment, hence the lagged inflation term (which leads to an *accelerationist* Phillips curve). Wage aspirations include a rent or wage markup, q, on the consumption wage and are an increasing function of employment –thus capturing a positive feedback from labor market tightness to wage setting–. The parameter φ captures the weight of imported goods in the consumer price index.

Labor market policies and institutions are captured by several variables:

1. q reflects wage pressure, or *insider bargaining power*. The higher q, the higher the rent that incumbent employees can grab on the job. q can also be interpreted as capturing any outside factor that boosts wages, such as unemployment benefits.

2. γ reflects real wage flexibility, that is, how much wages respond to outside labor market conditions. The lower γ, the more insiders can insulate wage setting from outside labor market conditions.

3. λ reflects labor adjustment costs (hiring and firing costs), which are in part determined by regulation. Employment protection legislation and hiring regulations, such as the prohibition of temporary work agencies or the establishment of a compulsory priority hiring list, all increase λ.

4. α is the degree of nominal wage rigidity. Following Taylor (1980) and Calvo (1983), it may reflect the fraction of nominal wage contracts that are not renegotiated in any given period. It may also reflect social norms against nominal wage cuts, as documented in Bewley (1998) and Akerlof, Dickens, and Perry (1996). α is to some extent affected by policy regarding contract length, backward indexation, etc. Finally, we can also interpret it as representing the importance of

minimum wages, assuming that these are indexed on last period's average nominal wage. Under this interpretation, α would be the fraction of workers being paid the minimum wage.

One difficulty is that these parameters do not correspond exactly to real-world labor market institutions. For example, firing costs will increase the adjustment cost λ, but at the same time they are likely to increase workers' bargaining power (Lindbeck and Snower, 1988), thus increasing q and possibly reducing γ.

3.2 Monetary policy

We now turn to the specification of the objective function of the policymaker. The standard practice, following Barro and Gordon (1983), is to assume that the government cares about output and inflation. We depart from standard practice by allowing public decisions to be affected by pressure groups representing the interests of incumbent employees. Thus we shall assume that policymakers minimize the following loss function:

$$V_t = E_{t-1} \sum_{s=t}^{+\infty} (1+r)^{-(s-t)} U_s \tag{5}$$

where r is the discount rate and U_s the instantaneous utility function, given by:

$$U_s = -\rho \left[w_s - (1-\varphi) p_s - \varphi e_s - \eta h - \varpi^* \right]^2 - (1-\rho) \left[b \pi_s^2 + (1-b)(l_s - l^*)^2 \right] \tag{6}$$

where $\pi_t \equiv p_t - p_{t-1}$ denotes the inflation rate, ϖ^* the union's desired level for its objective, and l^* the government's employment level objective.[15]

The first term in brackets reflects the political power of insiders (as opposed to their bargaining power reflected in parameters q and γ). The utility of insiders depends on their real consumption wage and their leisure, i.e. it is decreasing in hours of work. The second term is the usual social welfare function in terms of inflation and output,

[15] While originally posed in ad-hoc manner, the social welfare function of Barro and Gordon (1983) can be derived as a second-order approximation within a utility-maximizing framework. See Rotemberg and Woodford (1997) and Erceg *et al.* (1999).

except that, given supply shocks, it makes more sense to use employment rather than output.[16] The parameter b captures the weight of inflation in this welfare function. The union objective and the welfare function come with weights ρ and $1-\rho$, with ρ therefore measuring the political power of incumbent employees.

3.3 Long- and short-run equilibria

This model allows us to describe the exchange rate policy followed by the government under various hypotheses and to see how it depends on labor market institutions. The first step is however to characterize the solution as a function of the monetary policy followed. Assuming a stationary monetary policy rule, real variables will fluctuate along their long-term averages, which are computed by setting all shocks to zero, current values equal to past values, and expectations equal to realizations for all variables. They are given by:

$$\bar{l} = \frac{(\delta-\varphi)h-\delta q}{\varphi+\gamma\delta};\ \bar{\omega}=h;\ \bar{x}=\frac{(1+\gamma)h-q}{\varphi+\gamma\delta};\ \text{and}\ \bar{y}=\delta\frac{(1+\gamma)h-q}{\varphi+\gamma\delta}$$

where, hereafter, we define $x_t \equiv e_t - p_t$ as the real exchange rate and $\omega_t = w_t - p_t$ as the real (product) wage**.** Note that we can express the solution in terms of x and ω. The inflation rate is equal to the exogenous trend of nominal depreciation, which we assume is equal to zero (under commitment this is optimal, since there is no long run trade-off between inflation and real variables). Thus: $\bar{\pi}=0$. The price level is indeterminate unless there is a nominal anchor, which is obviously the case under EMU. However with a national monetary policy it is not optimal to have a nominal anchor, since it is inflation and not the price level that appears in the objective function in equation (6).

The short-run equilibrium can be solved by using standard rational expectations techniques. We proceed in two steps. First, we assume there is a pre-set monetary

[16] There is no a priori reason why a benevolent policymaker would like to stabilize output in the face of supply shocks. In the first best, full employment outcome output should react one for one with supply shocks, if labor supply is inelastic.

policy rule and then solve for the state variables of the model –as deviations from their long-run equilibrium values–, whose expressions are functions of the policy parameters. Second, given this relationship, we derive the parameters of the optimal policy rule. The details are in Appendix 1 and further discussion is provided in the next section.

4 Labor institutions and optimal monetary policy

We aim at finding out how optimal monetary policy depends on labor market institutions. The non-linear way in which the parameters enter the solution for both the endogenous variables and the policy rule leads us to calibrate all the parameters, so that they are deemed to be representative of OECD economies, and then solve numerically for the optimal policy rule. We start by justifying the parameter choices made, we then briefly discuss the procedure for finding the optimal monetary policy, and we finally present the simulation results.

4.1 Calibration of parameters

4.1.1 Labor market institutions and political economy parameters

We need to choose values for the parameters capturing labor adjustment costs, real wage flexibility, and nominal inertia (λ, γ, and α, respectively) that characterize the state of the labor market. For each of the parameters we choose two values, one representing a *flexible* economy and the other a *rigid* one. These values are based essentially on the estimates of Layard, Nickell, and Jackman (1991) for 19 OECD countries over the period 1969-85. These authors also provide simple cross-section regressions of the country-specific coefficients on several proxies for the a priori relevant institutions with reasonably favorable results.

Out of the 19 countries for which they provide estimated parameters, we compute the averages over the countries showing the upper and lower values so as to define the rigid and flexible economies (respectively, lower and upper in the case of γ). These

average values turn out to be quite similar across various empirical studies.[17] Table 1 shows our calibrated parameters (see Appendix 2 for details).

Our parameter space therefore defines eight virtual economies, each of them being labeled in Table 2 with an appropriate *nickname*. Although the parameter ranges are quite similar across empirical studies, the rankings of countries with regard to specific parameters are not so similar. Thus, we must exercise some judgement in the choice of nicknames. Bruno and Sachs (1985) established the stylized fact of the US having nominal wage rigidity and real wage flexibility, while both continental Europe and the UK had the opposite.[18] We take Scandinavian countries to be more like the US in this respect and Japan to enjoy overall flexibility. As to labor adjustment costs, we only label the UK and the US as being flexible.

As to social preferences, we know of no evidence regarding the union political influence parameter ρ and, more surprisingly, of little evidence regarding the inflation aversion parameter b. A ballpark estimate for b in 22 OECD countries is 0.74 (from Lippi, 1998, see Appendix 2). We choose two alternative values for each of ρ and b. We characterize economies as having either politically weak unions ($\rho = 0.1$) or politically strong unions ($\rho = 0.5$). With respect to inflation, they can be either inflation averse ($b = 0.9$) or inflation prone ($b = 0.1$). In order to streamline the discussion below, we also give nicknames to the resulting combinations, as shown in Table 3. We call an inflation-averse government with a low influence of labor unions "Conservative" and one with a high influence "Christian Democrat", while an inflation-prone government with a low influence of unions is dubbed "New Labour" and one with a high influence is called "Socialist". Hereafter we shall refer to these as policymaker types. We will dispose of the inverted commas from now on, but it should be kept in mind that these nicknames are simply useful shorthand.

[17] In particular, we check the estimates against those of Alogoskoufis and Manning (1988), Grubb (1986), and Newell and Symons (1985).

[18] See also the cross-country results for an alternative measure of real wage flexibility in Viñals and Jimeno (1998).

4.1.2 Other parameters

We also need to quantify a few other parameters (see Appendix 2 for details). Both the real exchange rate elasticity δ and the price weight of imports φ are set to 0.2, following estimates and data averages for OECD countries. The rent q affects averages but not the response to shocks, and therefore does not affect optimal monetary policy. Thus we set it to zero for now. It will play a key role, however, when we consider the incentives for labor reform in EMU.

Two important parameters characterize the degree of noise in the economy, namely the shock variances σ_ε^2 and σ_θ^2. For our simulations we adopt Bayoumi and Eichengreen's (1993) estimates of the standard deviation of demand and supply shocks, derived from a structural vector autoregression (VAR). Their estimates suggest the values $\sigma_\varepsilon^2 = \sigma_\theta^2 = 0.0004$. We must however note that these variances should be sensitive to which assumptions are made in identifying the VAR.

We need also describe the remaining preference parameters appearing in the utility function (6). The desired long-run objectives are set to $\varpi^* = 1$ and $l^* = 0.1$. With a long-run equilibrium (log) employment level of $\bar{l} = 0$ these values imply that there is an unwanted unemployment rate of 10%. The interest rate entering the objective function is set to 0.1 (and accordingly β to 0.9) . Lastly, although our model would allow us to study the effects of changes in hours of work, we will not discuss this issue further, and so from now on we set hours of work h to zero.

4.2 Optimal policy rule

Our space of 5 parameters with 2 alternative values each defines 32 alternative virtual economies.[19] For each of these we compute the optimal monetary policy in *steady state*. By steady state we mean that at date $t = 0$ –when the monetary policy rule is

[19] Labor market institutions should be endogenous to social preferences, and so some of the combinations considered might not be politically viable. For simplicity, we shall disregard this issue in our analysis.

chosen to maximize the objective function in equation (5)– the initial values of prices, employment, and wages are equal to their long-run average levels.

In Appendix 1 it is shown that the optimal monetary policy determines each period's *real* exchange rate as a function of the three relevant state variables—employment, real wages, and inflation—in the preceding period, and the two current shocks—ε_t and θ_t. That is,

$$\hat{x}_t = x_0 \hat{l}_{t-1} + x_1 \hat{\omega}_{t-1} + x_2 \hat{\pi}_{t-1} + x_3 \varepsilon_t + x_4 \theta_t, \tag{7}$$

where a hat denotes deviations from steady-state values.[20]

Optimal policy is defined in terms of the set of parameters $x_i = \{x_0, x_1, x_2, x_3, x_4\}$, each of which may be either positive or negative. It is optimal for monetary policy to react to past deviations of employment, real wages, and inflation from their long-run equilibrium levels, and also to current aggregate demand and supply shocks. Simultaneously stabilizing employment, real wages, and inflation will usually entail conflicts which the x_i coefficients resolve as a function of the weights given to these objectives in equation (6).

4.3 Monetary policy, labor institutions and policy objectives

Table 4 presents the results from our simulations for the different combinations of policymaker preferences and labor market configurations. Our goal is to describe how the cost of joining EMU depends on an economy's labor market institutions. We define EMU as fixing the nominal exchange rate irrevocably, i.e.: $x_i = 0$, for $i = 1, ..., 5$. In other words, monetary policy cannot respond to the developments in the economy. To the extent to which supply and demand shocks in any particular country are correlated with those in the other EMU member countries, EMU monetary policy will be partially

[20] Hence, even though the policy variable being used is the *nominal* exchange rate, the rule is expressed in terms of the real one. The corresponding nominal exchange rate is determined implicitly by (7).

geared towards inflation and employment developments in each country. This degree of gearing should be expected to vary over time. While our characterization of EMU is an extreme one, it has the advantage of bringing out the relationship between the costs of EMU and labor market structure in sharp relief. But it should be kept in mind that the costs from EMU that we compute are an upper bound on the ones that would arise if any cross-country correlation in macroeconomic aggregates was considered.

The welfare cost associated with EMU is given by the difference between the policymaker's welfare with the optimal policy and that under EMU. If all the structural parameters characterizing the economy remain constant, then in our model this cost is clearly always positive, since the optimal monetary policy improves over any alternative. Thus, to justify EMU from a welfare perspective we would have to assume the existence of some gain from EMU which is not formalized in our model (e.g. a political gain or a reduction in transaction costs). This choice is consistent with the fact that, as indicated in Section 2, the sorts of structural changes to be brought forth by EMU are unclear. We nevertheless analyze at the end of this section how our results change if we allow for one gain from EMU which is plausible to expect, namely a reduction in the variance of demand shocks.

Let us now discuss Table 4. The values reported are the costs from EMU, namely the difference between the welfare losses for a country with a given set of labor institutions and preferences inside EMU and those outside EMU. In order to properly compare welfare losses across economies with different preferences (i.e. ρ and b) we normalize each loss by the present discounted value of the steady state utility corresponding to the specific preference pair.[21]

The first result is that, ironically, the countries that lose less from EMU are of the Anglo-Saxon type, i.e. the UK and the US, while the ones that lose most are the Fully Rigid economy and Scandinavia, closely followed by Europe and Japan. This is true

[21] Which is given by $[(1+r)/r][\rho\,(\varpi^*)^2 + (1-\rho)(1-b)\,(l^*)^2]$.

across preference structures. This conclusion is of course worth what our nicknames are.

The table allows us to explain these differences by tracing them back to the effects of specific labor market institutions on the cost of EMU. For each, we present the average cost of EMU for the four economies with a rigid institution and for the four with a flexible one, and then the average rigid-flexible difference. Let us start with the *labor adjustment cost* index λ. Table 4 shows that having a rigid employment protection legislation, say, instead of a flexible one increases the cost of belonging to EMU for all policymaker types. To see why, we need to examine how these costs affect the variances of the three variables included in the objective function (6).[22] As expected, higher labor adjustment costs stabilize employment but destabilize both prices and real wages. With our parameter space, the former effect is much smaller than the latter two, and so employment rigidity always raises the cost of EMU, for any type of policymaker preferences. There are quantitative differences, however: not being able to use monetary policy to offset those higher variances is particularly costly for a Conservative. The reason is that this type of policymaker cares a lot about inflation (b is high) and, even though it does not care much about the real wage variance (ρ is low), the destabilization of prices is much larger than that of wages, yielding an overall lower welfare.[23]

This does not mean that any rigidity increases the cost of EMU. Consider for example *real wage flexibility* γ. Table 4 indicates that having rigid real wages actually reduces the cost of EMU –with the exception of the Socialist policymaker–, although the difference is small relative to the case of labor adjustment costs. The reason is that a lower γ stabilizes prices, while destabilizing employment and real wages. While we may have expected a lower γ to lower the variance of real wages as well, the opposite

[22] These variance effects are reported in Table A2 of Appendix 3.

[23] Note that the Christian Democrat policymaker is inflation averse as well, but the overall weight of inflation is much lower because of the higher weight now placed on real wage stability ($\rho = 0.5$), with the net result of a lower loss than for the Conservative one.

obtains in general equilibrium under EMU through the higher employment variance, despite the fact that a lower γ reduces the response of wage aspirations to changes in employment (cfr. equation (4)). This makes a higher wage rigidity more costly under EMU the higher is political union power. Given its price stabilization effect, EMU is on the other hand less costly the higher the degree of inflation aversion. As a result, only with a combination of a high union weight plus a low inflation weight (e.g. the Socialist policymaker case) can rigid real wages make EMU more costly than having flexible wages.

Finally, let us consider *nominal wage inertia*, α. Rigidity entails a higher welfare cost under EMU for inflation-prone policymakers, while the opposite is true for inflation averse ones. Why? Because nominal wage rigidity stabilizes prices but destabilizes employment and real wages. Thus nominal wage rigidity has the same variance effects as real wage rigidity but, as would be natural to expect, it raises the variance of real wages (vis-a-vis flexible nominal wages) significantly more than real rigidity does. As a result, within countries with high nominal wage rigidity, EMU is costly not just for those with politically powerful unions (Socialist) but also marginally for those with weak unions too (New Labour).

So far we have computed the costs associated with EMU for different labor market and preference structures, which amounts to assuming that those structures will remain unaffected by EMU. One of the variables which may however be directly lowered by EMU is the degree of uncertainty. In reality, a fraction of demand shocks arises from speculation in foreign currency markets. Since EMU suppresses all variation in bilateral exchange rates, it is natural to assume it will reduce the variance of demand shocks. We therefore check the robustness of our results by re-running our simulations for the case in which EMU lowers that variance by one-third. In this particular choice we follow Canzoneri *et al.* (1996) (see Appendix 2).

The reduction in the variance has two effects, with respect to the case of an un-

changed variance.[24] First, with lower variability, the costs from EMU are reduced in all cases. Second, the reduction in the demand shock variance means that the increase in the variance of real wages caused by nominal wage rigidity is lower than before, so that such rigidity now reduces the cost of EMU even in the New Labour case. Overall, however, the qualitative results are unchanged.

To conclude, both the cost of EMU and the impact of specific labor market institutions on this cost crucially depend on the policymaker's preferences. Stringent employment protection legislation tends to increase the cost of EMU, especially for a Conservative policymaker. On the other hand, nominal and real wage rigidity may reduce the cost of EMU as long as the combination of low inflation aversion and politically powerful unions –the Socialist case– does not prevail. These results are summarized in Table 5, both for individual policy objectives and for the combinations of them which we have been considering. In the table, a "+" sign (respectively "–") indicates that a more rigid institution increases (respectively reduces) the cost from EMU membership when the policymaker's objective is to stabilize the variable in the corresponding column.

When thinking about the impact of a given labor market institution on the cost of EMU, it is useful to think in terms of *substitutability* between that institution and the use of active monetary policy. If it is substitute, then having more of it reduces the cost of EMU membership. Substitutability depends both on the institution and public preferences. For example, if one wants to stabilize inflation, employment protection is a poor substitute since it increases the volatility of marginal costs. Therefore, it increases the costs of EMU membership for an inflation-averse policymaker. By contrast, it is a good substitute for monetary policy if one wants to stabilize employment; in this case more employment protection should reduce the cost of EMU. However, as we have seen, the employment stabilizing effect is quite small so that even with $b = 0.1$ this

[24] The results are reported in Table A3 of Appendix 3.

effect does not show up in our simulations. Furthermore, the stabilizing effect of an institution in general equilibrium may be quite different from its direct effect. At face value, greater real wage rigidity should lower the volatility of real wages, and therefore it should reduce the cost of EMU when unions are strong. However, it turns out that in general equilibrium a lower γ actually increases real wage volatility, so that the conclusion is reversed.

Interestingly, there is no general proposition telling us that *labor market rigidity* makes EMU more costly. It all depends on public preferences and the specific rigidity we are talking about. However, a casual reading of the experience of European countries in the 1980's and 1990's suggests that, during the convergence process to EMU, social preferences have drifted from output and employment stability to price level stability. According to our results, given the level of employment protection in these countries, we would expect such a shift to increase the cost of EMU.[25]

5 Labor market reform and EMU

The preceding section tells us what is the cost, on average, of losing monetary autonomy for an economy that stays with the same labor market institutions. In this section, we consider the issue from a more dynamic perspective, looking at the cost of EMU for an economy which considers a *change* in its institutions. Formally, we now look for a policy rule that maximizes welfare under initial conditions that are given by the difference between the pre-reform and the post-reform steady states.[26]

[25] Alternatively, it might be argued that governments will care less about inflation inside EMU because, having lost control of monetary policy, they will not be held accountable for domestic inflation. We do not find this argument very persuasive, since in the end what matters is what the public cares about.

[26] This can be seen as a way to tackle the Lucas critique, namely that estimated parameters characterizing the past behavior of any economy should not be invariant to changes in policy variables. Such critique is of course very relevant regarding a clear and important regime change like EMU. Our approach is to use the model to provide an informed guess as to how the parameters characterizing the economy will change once the monetary policy regime changes.

We would expect that the more costly is EMU under a given institutional arrangement, the greater the effect of EMU on the incentives to reform that institution. For example, we have seen that the burden of EMU is greater the larger the firing cost. Thus, we should logically expect the gains from reducing firing costs to be higher under EMU than absent EMU. This, in effect, is the so-called TINA argument described in Section 2 for the supposedly beneficial impact of EMU on labor market reform. But that reasoning ignores another aspect of monetary policy, namely that it can be used to reduce the cost of the transition to the post-reform steady state, and this transitional role is lost if the country belongs to a monetary union. This is the second argument advanced by Bean (1998), as mentioned in Section 2. In fact, this latter aspect turns out to be crucial, because labor market reform represents a large shock relative to the standard deviation of demand and supply shocks, so that the transitional role tends to be quantitatively more important than TINA.

We shall therefore distinguish between two types of reforms. The first one changes the economy's potential to adjust to shocks, but has no impact on its average long-run equilibrium. If the economy starts at this equilibrium, labor reform therefore does not induce any transitional dynamics of its own. The impact of EMU on reform incentives can then simply be recovered from the steady state costs of the pre- and post-reform institutions as calculated in the preceding section. The second type of reform is associated with a change in the long-run average steady state of the economy. In this case, the larger the effect of reform on, say, employment, the greater the initial post-reform deviation of employment from average steady-state values, and the greater the value of using monetary policy along the transition path. In other words, EMU is more likely to reduce incentives for reform the larger the reform. Thus, large reforms are clearly harder under EMU, but some small reforms may be easier, a point we will return to below.

In order to analyze specific reforms we compute the impact of EMU on reform

incentives, which is defined as follows:

$$\begin{aligned} I &= (W_{RE} - W_{\bar{R}E}) - (W_{R\bar{E}} - W_{\bar{R}\bar{E}}), \qquad (8) \\ &= \text{(Value of reform under EMU) – (Value of reform absent EMU)} \end{aligned}$$

where R (respectively $\bar{R}$) stands for reform (respectively no reform), E (respectively $\bar{E}$) for EMU (respectively no EMU), and W is the corresponding value of the policymaker's objective function. We clearly also have:

$$\begin{aligned} I &= (W_{\bar{R}\bar{E}} - W_{\bar{R}E}) - (W_{R\bar{E}} - W_{RE}) \\ &= \text{(Cost of EMU absent reform) – (Cost of EMU under reform)} \end{aligned}$$

5.1 Increasing the economy's adjustment potential

In the case of a change in one of the parameters that affect the economy's response to shocks but not its long-run average levels of output, employment, and wages, the reform generates no transitional dynamics if the actual initial values of these variables are precisely equal to their long-run levels. In this case the policy rule following reform only reflects the response to shocks and it is rigorous to use Table 4 to compute the impact effect I in equation (8). We follow this approach for three types of reforms: a reduction in employment protection, a reduction in nominal wage inertia, and (in a special case where it does not affect long-term averages), an increase in real wage flexibility.

A reduction in *firing costs*, λ, might also lower insider workers' bargaining power, thus having at the same time a negative impact on q and possibly a positive impact on γ. However, let us proceed in steps and consider first the impact of a reduction in the employment inertia parameter λ alone (we analyze changes in q in the next subsection).[27] As indicated in Table 5(B), the average impact of EMU on the incentives to reduce firing costs from its rigid level of $\lambda = 8$ to its flexible one of $\lambda = 1$ is

[27] Even without having any impact on q or γ, linear adjustment costs might still have an effect on steady-state employment, but the sign of this effect is highly dependent on certain features of the

positive for any government. The average differences in welfare between countries with rigid employment and those with flexible employment in Table 4 shows that this incentive is particularly high for the Conservative policymaker. As previously discussed, this happens because a high λ stabilizes employment but destabilizes both real wages and prices, especially the latter, which is the pre-eminent objective for this type of policymaker.

As to *nominal wage inertia*, α, again the impact of EMU on reform incentives is given by the welfare effect of the change from the rigid level of $\alpha = 0.8$ to the flexible one of $\alpha = 0.45$. Table 5(B) indicates that both a New Labour and a Socialist policymaker would have an incentive to increase nominal wage flexibility under EMU. Again, the reason is that nominal wage rigidity stabilizes prices but destabilizes real wages and employment, with the latter objective being the one that those governments would like to stabilize the most. Table 4 indicates that, with our parameter space, this incentive is quite mild, specially in the case of New Labour (for which the incentive actually disappears if EMU brings about a reduction of the variance of demand shocks).

Lastly, we can discuss *real wage flexibility*, γ, in one particular case. If q (insider rents) remains equal to zero, as we have been assuming until now, then an increase in γ does not affect the long-term values of real wages, prices or employment –which remain equal to zero–. In this case a higher γ means that real wages are more responsive to shocks but the long-run level of employment remains the same. Then the impact of EMU on reform incentives can be computed exactly as for the other two institutions. Table 5(B) shows that only for the Socialist policymaker does EMU provide an incentive to increase γ. This is because real wage rigidity (a lower γ) stabilizes prices, while destabilizing employment and real wages, and this particularly hurts a policymaker which values employment stability. Within our parameter space, the incentive is again

production function and the distribution function of shocks to it (see Bentolila and Bertola, 1990, and Bentolila and Saint-Paul, 1994). In our case, labor adjustment costs are implicitly quadratic, so that they clearly have no impact on average employment.

mild.

5.2 Increasing the economy's average performance

As already mentioned, whenever a reform changes the long-run average output and employment level of the economy, the impact of transitional dynamics on welfare will typically dwarf the contribution of shocks, because shocks are small relative to the output and employment gaps generated by the reform. A corollary is that the optimal monetary policy will in general be quite different from the steady-state one derived in the previous section.

Consider now the prototypical case of a labor market reform that increases employment in the long run –e.g. reduces the natural rate of unemployment–, namely a reduction in insiders' rents, q. To streamline the discussion, let us limit ourselves to a *Neutral* government, with no political power of insiders and with equal weights on inflation and unemployment (i.e. $\rho = 0$ and $b = 0.5$). Moreover, we only report results for two alternative economies, Europe (rigid employment and real wages, flexible nominal wages) and the Fully Flexible economy.

To illustrate how monetary policy plays an instrumental role in smoothing the transition to a new steady state following reform, we compare the economy's dynamic response to the reform under EMU to what we get if the optimal monetary policy is followed.

Let us start with the Fully Flexible economy. Figure 1 represents the response of employment and real wages to a reduction in q by 0.1 under EMU (starting from our benchmark of $q = 0$). Figure 2 plots the corresponding path for the price level. Under EMU, labor market reform puts the economy in a situation similar to a recession in the short run. The initial rate of unemployment is above the natural rate, which has fallen because of the reform. This moderates wages so that employment increases, while the induced moderation in prices creates a strong disinflation which boosts competitiveness.

The latter allows the economy to absorb the increase in productive capacity, but it is indeed so rapid that employment ends up overshooting the long-run natural rate, and inflation picks up again. Thus, under EMU, labor market reform (or any other shock) induces oscillatory dynamics around the new steady state.

How would monetary policy react if it could be set optimally? Figure 3 plots the optimal response of the nominal exchange rate and the path for the price level absent EMU. The first years of the reform are marked by a rapid depreciation of the exchange rate, which causes the same real depreciation as disinflation did in the previous case, while also bringing the gains of greater price stability. As is apparent in Figure 4, the optimal monetary policy implies a faster real depreciation in the short run than under EMU, while it (almost) avoids the subsequent overshooting of the real exchange rate. This is also true for employment (Figure 5), while the short-run fall in real wages is greater than under EMU since there is much less of a disinflation. Note also that the optimal policy is well approximated by a constant price-level rule, which is consistent with bringing employment as quickly as possible to the new natural rate by means of a sharp depreciation. The optimal monetary policy validates the so-called *two-handed approach*, which claims that aggregate demand stimulus should go along with structural reforms (see Blanchard *et al.*, 1986, and Bean, 1998).

How do these results change for the economy with the labor market configuration we have called "Europe"? Labor adjustment costs make employment overshooting less severe, but it is still there under EMU and can be eliminated absent EMU (Figure 6). The optimal monetary policy is still a depreciation, but because of employment's greater inertia, it is less sharp and more spread over time than for the flexible economy (Figure 7). Real wages fall more than in the flexible economy, because a greater fall in labor costs is needed to get the same increase in employment, as labor adjustment costs are higher. It is still true that the real wage drop is greater under the optimal policy than under EMU (Figure 8). Finally, the optimal monetary policy is associated with a

slow reduction in the price level, while strong disinflation is observed in the EMU case (Figure 9). Indeed, these simulations imply an inflation differential, relative to the long-run value of $\pi = 0$, of around –6 % in the short run. If our parametric characterization of the European economy is not wide off the mark and we take it as a desirable goal to avoid deflation, then this result suggests that the ECB's target inflation rate of 2% is too low in the sense that any individual country engaging in labor market reform would have a deflation (see Blanchard and Jimeno, 1999, and Gros *et al.*, 1999, for related arguments). One solution to avoid this would be to have a target inflation rate of about 6% instead of 2%. If this sounds unappealing, it should nevertheless be kept in mind that there is a trade-off: for any EMU-wide inflation rate there exists a maximum level of non-deflationary labor market reform (i.e. a maximum reduction in q). The other solution is a coordinated labor market reform across the Euro countries, with the ECB implementing the optimal monetary policy at the monetary union level. We return to this issue below.

How does EMU membership affect the incentives for reform? If there were no shocks to the economy, then the cost of EMU membership would be zero absent labor market reform. By contrast, it would be strictly positive for an economy that considers reforming its labor market, since EMU precludes implementing the two-handed approach. Things are more complex if there are shocks. In this case, it may be that the optimal policy to accompany the reform offsets the one that stabilizes shocks, so that less monetary activity is needed under reform than absent reform. If so, EMU membership actually makes reform easier.[28] This argument is however valid only if the size of shocks is not too small relative to the size of the reform. Otherwise the effect of losing the two-handed approach is dominant. In other words, the reforms that are

[28] The issue is as follows. We define optimal policy as a pre-set response (the x_i coefficients) to deviations of variables from their steady-state values. With reform, however, setting a given dynamic path for the exchange rate e would also be part of the optimal policy. Thus if, for instance, the optimal policy without reform called for an $x_i > 0$ but with reform it was optimal to have $x_i < 0$ at a specific date, then EMU (e.g. $x_i = 0$) would be less costly with than without reform.

facilitated by EMU membership are small reforms –of an order of magnitude similar to the typical shock hitting the economy– while large reforms are discouraged.[29] In the case of the moderate reduction in q by 10% that we consider here and for the structural parameters we have chosen, our calibrated variance of the shocks is not large enough for EMU to facilitate reform; the cost of EMU under reform is higher than the cost of EMU absent reform, so that EMU reduces reform incentives. This is illustrated in Table 6.

Note that the negative sign on the differential cost I does not necessarily imply that the reverse reform (an increase in q) would become more viable under EMU. A change in *any* direction would require an activist monetary policy, so that the loss of monetary autonomy reduces the incentives for reform either way. In this sense, EMU need not aggravate Eurosclerosis –if defined as raising q–, but it clearly tends to foster structural inertia.

To illustrate how EMU membership reduces the scope for reform, we have looked at the welfare effects of various sizes of reforms both absent EMU and under EMU, for the same *Neutral* government. For the "European" economy, assuming an initial rent of $q = 0.1$, the reform which most increases welfare, absent EMU, is a reduction in the rent q by 30%, i.e. a move to $q = -0.2$. By contrast, under EMU the reform which most increases welfare is a reduction in q by 20%, i.e. a new value equal to $q = -0.1$. Furthermore, the gain from reform, in welfare terms, is 8.8% absent EMU and 6.8% under EMU. If we assume that there is an upfront cost of implementing the reform, this implies that for a range of this cost (i.e. if it is greater than 6.8% but smaller than 8.8%), reform will take place absent EMU but not under EMU.

This result has one important implication. Policymakers of individual EMU member countries considering whether to undertake a labor market reform, so as to achieve lower equilibrium unemployment, will foresee that such reform will also deliver an idio-

[29] Intuition suggests that similar results to those obtained for a reduction in q would arise for an increase in γ in a setup with a nonzero q.

syncratic, deflationary shock to their economies. EMU implies that monetary policy will not be able to respond to such a shock so as to deliver the best possible transition path to the new equilibrium. Given social preferences and reasonable time-discount factors, the transition path under EMU may just be too costly in terms of welfare, so that reform will not be undertaken in the first place. This proposition is clearly strengthened if societies and/or policymakers have shorter effective horizons (in other words, a higher discount factor).

Is there a way out of the dilemma? Individual governments might be able to use fiscal, rather than monetary policy, to stimulate demand at the time of a labor reform. This avenue however seems to be severely curtailed by the Stability and Growth Pact (see Eichengreen and Wyplosz, 1998). Alternatively, if there was a common agreement for carrying out labor market reforms across all EMU member countries, then the ECB could accompany such reforms with the appropriate monetary policy. This type of behavior is not as far-fetched as it may sound. For instance, in the US the Federal Reserve was willing to adequately relax the monetary policy stance to go along with the severe fiscal consolidation undertaken by the Clinton Administration in the first half of the 1990's (see Blanchard, 1999, p. 92).

An important issue that would need to be addressed at some stage is that different EMU member countries would need different types and intensities of labor market reform, and so they would get a correspondingly different dose of a deflationary impact from reform. Trade and finance links among countries would also make for asymmetric impacts. While this aspect would need to be considered, it seems much more important that it was widely understood that the overall tone of the ECB's monetary policy would not allow labor market reform to bring about a deflation in any country.

6 Conclusions

Most countries belonging to the European Union have experienced persistently high unemployment rate in the last 25 years. The leading explanation attributes this phenomenon to a few key labor market institutions in EU countries. On the other hand, for 11 of the 15 EU countries, the most important institutional change at the turn of the millennium has been the abandoning of national monetary policies in favor of a European Central Bank. A natural and important question to ask is whether this change in the monetary policy regime will either foster or hinder the reform of Euro zone labor markets.

In this paper we analyze this issue in the context of a simple macroeconomic model. We derive optimal, credible monetary policies from the maximization of a social welfare function which takes into account not just long-run equilibrium magnitudes of inflation and unemployment, but also the values of these variables at all times. More specifically, it takes into account the adjustment path to equilibrium after the economy is hit by supply and demand shocks. We also broaden the standard social welfare function to allow for labor unions to influence policy choices by giving an additional preference weight to real wages.

We simulate the model using parameter values taken from estimates in standard macroeconomic models of the labor market and find that the optimal monetary policy varies significantly depending on the labor market institutional setup prevailing in the economy. As a result, those institutions play a key role in determining the welfare losses entailed by giving up an independent national monetary policy. However, such welfare losses also depend on social preferences for inflation, unemployment, and real wages. For instance, while labor adjustment costs seem to decrease welfare as a result of joining EMU, they are more harmful for societies featuring a high degree of inflation aversion and a low political influence of labor unions. On the other hand, both nominal and real rigidity may even raise welfare as a result of EMU membership, as long as the

combination of a low degree of inflation aversion and politically powerful unions does not prevail.

Thus, the often-held idea that the more rigidity the higher the cost from joining EMU is an oversimplification, in the sense that it matters what labor institution we are talking about, what are the features of other labor market institutions in the economy, and what are the social preferences. Flexibility is not always a substitute for stabilization; it all depends on which variable (e.g. prices vs. employment) society wants to stabilize and which characteristic of the labor market we are talking about.

In the last part of the paper we adopt a dynamic perspective and discuss the incentives for reform inside EMU, as opposed to outside it, by assessing the change in welfare entailed by labor market reform in the two alternatives. We distinguish between reforms that allow for faster adjustment of the economy to shocks, like reductions in nominal wage inertia or in employment inertia, and reforms that alter the economy's long-run performance, like reductions of rents obtained by insider wage setters. We again show how the incentives created by EMU with regard to each institution depend on social preferences. An overall conclusion from our analysis is that it does not seem generally that *Eurosclerosis* will increase under EMU, in the sense that more rigid institutions will be adopted. But the results clearly indicate that big changes in institutions will be harder to implement. On the other hand, some gradual reforms toward flexibility may be made easier by EMU. Our main conclusion is therefore that the tendency toward gradualism will be reinforced by EMU membership.

Finally, as argued at various places in the paper, a natural way to regain the benefits of an adequate monetary stance along the transition path to a new steady state, following a structural reform, is simply to put together a *coordinated* reform package across several members of the union, with the ECB implementing the optimal transitional monetary policy at the European level. This allows the two-handed approach to be implemented at the Union level instead of the national level.

Appendix 1. How to solve the model

This appendix provides details on the steps that are needed in order to solve the model. The model's equations are given by:

$$\begin{aligned} y_t &= \delta(e_t - p_t) + \varepsilon_t \\ y_t &= l_t + h + \theta_t \\ p_t &= w_t - \theta_t - h + \lambda(l_t - l_{t-1}) + \beta\lambda\left(l_t - E_t l_{t+1}\right) \\ w_t &= (1-\alpha)(q + (1-\varphi)p_t + \varphi e_t + \gamma l_t) + \alpha(w_{t-1} + p_{t-1} - p_{t-2}) \end{aligned}$$

and we shall use the notation introduced in the text: $\omega_t = w_t - p_t$ for the real (product) wage, $x_t = e_t - p_t$ for the real exchange rate, and $\pi_t = p_t - p_{t-1}$ for the inflation rate.

As indicated in the text, the long run values of the model's variables are given by:

$$\bar{l} = \frac{(\delta - \varphi)h - \delta q}{\varphi + \gamma\delta};\ \bar{\omega} = h;\ \bar{x} = \frac{(1+\gamma)h - q}{\varphi + \gamma\delta};\ \text{and } \bar{y} = \delta\frac{(1+\gamma)h - q}{\varphi + \gamma\delta}$$

The inflation rate is equal to the exogenous trend of nominal depreciation, which we assume is equal to zero. Thus, $\bar{\pi} = 0$ and the price level is indeterminate unless there is a nominal anchor.

A Optimal monetary policy without a monetary union

Throughout this appendix we solve only for the case where policymakers can credibly commit on the optimal policy, thereby neglecting the issues highlighted by the credibility literature. We make a change of variable, expressing policy in terms of the real exchange rate rather than the nominal one. Thus policy is characterized by:

$$\hat{x}_t = x_0\hat{l}_{t-1} + x_1\hat{\omega}_{t-1} + x_2\hat{\pi}_{t-1} + x_3\varepsilon_t + x_4\theta_t$$

The model's equations can be rewritten so that only real variables and the inflation rate appear, namely:

$$\begin{aligned} \hat{y}_t &= \delta\hat{x}_t + \varepsilon_t \\ \hat{y}_t &= \hat{l}_t + \theta_t \\ 0 &= \hat{\omega}_t - \theta_t + \lambda\left(\hat{l}_t - \hat{l}_{t-1}\right) + \beta\lambda(\hat{l}_t - E_t\hat{l}_{t+1}) \\ \hat{\omega}_t &= (1-\alpha)(\varphi\hat{x}_t + \gamma\hat{l}_t) + \alpha\left(\hat{\omega}_{t-1} - \hat{\pi}_t + \hat{\pi}_{t-1}\right) \end{aligned}$$

This allows us to solve the system recursively:

$$\begin{aligned}
\hat{y}_t &= y_0\hat{l}_{t-1} + y_1\hat{\omega}_{t-1} + y_2\hat{\pi}_{t-1} + y_3\varepsilon_t + y_4\theta_t \\
\hat{l}_t &= l_0\hat{l}_{t-1} + l_1\hat{\omega}_{t-1} + l_2\hat{\pi}_{t-1} + l_3\varepsilon_t + l_4\theta_t \\
\hat{\omega}_t &= \omega_0\hat{l}_{t-1} + \omega_1\hat{\omega}_{t-1} + \omega_2\hat{\pi}_{t-1} + \omega_3\varepsilon_t + \omega_4\theta_t \\
\hat{\pi}_t &= \pi_0\hat{l}_{t-1} + \pi_1\hat{\omega}_{t-1} + \pi_2\hat{\pi}_{t-1} + \pi_3\varepsilon_t + \pi_4\theta_t
\end{aligned}$$

where:

$$\begin{array}{lll}
y_0 = l_0 = \delta x_0; & y_1 = l_1 = \delta x_1; & y_2 = l_2 = \delta x_2 \\
y_3 = l_3 = \delta x_3 + 1; & y_4 = \delta x_4; & l_4 = \delta x_4 - 1
\end{array}$$

and the 10 coefficients $\{\omega_i, \pi_i\}$ are solution to the linear system:

$$\begin{aligned}
0 &= \omega_0 - \lambda + \lambda\delta x_0(1+\beta) - \beta\lambda\left[\delta^2 x_0^2 + \delta x_1\omega_0 + \delta x_2\pi_0\right] \\
0 &= \omega_1 + \lambda\delta x_1(1+\beta) - \beta\lambda\left[\delta^2 x_0 x_1 + \delta x_1\omega_1 + \delta x_2\pi_1\right] \\
0 &= \omega_2 + \lambda\delta x_2(1+\beta) - \beta\lambda\left[\delta^2 x_0 x_2 + \delta x_1\omega_2 + \delta x_2\pi_2\right] \\
0 &= \omega_3 + \lambda(\delta x_3 + 1)(1+\beta) - \beta\lambda\left[\delta x_0(\delta x_3 + 1) + \delta x_1\omega_3 + \delta x_2\pi_3\right] \\
0 &= \omega_4 - 1 + \lambda(\delta x_4 - 1)(1+\beta) - \beta\lambda\left[\delta x_0(\delta x_4 - 1) + \delta x_1\omega_4 + \delta x_2\pi_4\right] \\
\omega_0 &= (1-\alpha)\varphi x_0 + (1-\alpha)\gamma\delta x_0 - \alpha\pi_0 \\
\omega_1 &= (1-\alpha)\varphi x_1 + (1-\alpha)\gamma\delta x_1 - \alpha\pi_1 + \alpha \\
\omega_2 &= (1-\alpha)\varphi x_2 + (1-\alpha)\gamma\delta x_2 - \alpha\pi_2 + \alpha \\
\omega_3 &= (1-\alpha)\varphi x_3 + (1-\alpha)\gamma(\delta x_3 + 1) - \alpha\pi_3 \\
\omega_4 &= (1-\alpha)\varphi x_4 + (1-\alpha)\gamma(\delta x_4 + 1) - \alpha\pi_4.
\end{aligned}$$

Welfare

The next step is to compute the policymaker's welfare function. We define $V(\hat{z}_{t-1})$ as:

$$V(\hat{z}_{t-1}) = E_{t-1}\sum_{s=t}^{+\infty}\frac{U_s}{(1+r)^{(s-t)}}$$

with $\hat{z}_t = (\hat{l}_t, \hat{\omega}_t, \hat{\pi}_t)'$ and

$$\begin{aligned}
U_t &= -\rho\left(w_t - (1-\varphi)p_t - \varphi e_t - \varpi^*\right)^2 - (1-\rho)\left[b\left(\pi_t\right)^2 + (1-b)\left(l_t - l^*\right)^2\right] \\
&\quad -\rho\left((1-\varphi)\hat{\omega}_t + \varphi\hat{x}_t + (1-\varphi)\bar{\omega} + \varphi\bar{x} - \varpi^*\right)^2 \\
&\quad -(1-\rho)\left[b\left(\hat{\pi}_t\right)^2 + (1-b)\left(\hat{l}_t + \bar{l} - l^*\right)^2\right] \qquad \text{(A.1)} \\
&= U(\hat{z}_t)
\end{aligned}$$

Developing it, we see that its expectation may be written as:

$$E_{t-1}U(\hat{z}_t) = K^* + \Lambda^* \hat{z}_{t-1} + \hat{z}'_{t-1}\Omega^* \hat{z}_{t-1},$$

where:

$$\begin{aligned} K^* &= -\rho\left([(1-\varphi)\bar{\omega} + \varphi\bar{x}] - \varpi^*\right)^2 - \rho\left[(1-\varphi)\omega_3 + \varphi x_3\right]^2 \sigma_\varepsilon^2 \\ &\quad -\rho\left[(1-\varphi)\omega_4 + \varphi x_4\right]^2 \sigma_\theta^2 - (1-\rho)\, b\pi_3^2\sigma_\varepsilon^2 - (1-\rho)\, b\pi_4^2\sigma_\theta^2 \\ &\quad -(1-\rho)(1-b)\left(\bar{l} - l^*\right)^2 - (1-\rho)(1-b)\, l_3^2\sigma_\varepsilon^2 - (1-\rho)(1-b)\, l_4^2\sigma_\theta^2 \end{aligned}$$

$$\Lambda^* = -2\begin{bmatrix} \rho([(1-\varphi)\bar{\omega} + \varphi\bar{x}] - \varpi^*)\left[(1-\varphi)\omega_0 + \varphi x_0\right] + (1-\rho)(1-b)\left(\bar{l} - l^*\right) l_0 \\ \rho([(1-\varphi)\bar{\omega} + \varphi\bar{x}] - \varpi^*)\left[(1-\varphi)\omega_1 + \varphi x_1\right] + (1-\rho)(1-b)\left(\bar{l} - l^*\right) l_1 \\ \rho([(1-\varphi)\bar{\omega} + \varphi\bar{x}] - \varpi^*)\left[(1-\varphi)\omega_2 + \varphi x_2\right] + (1-\rho)(1-b)\left(\bar{l} - l^*\right) l_2 \end{bmatrix}'$$

$$\begin{aligned} \Omega^* &= -\rho H_0' H_0 - (1-\rho) b H_1' H_1 - (1-\rho)(1-b) H_2' H_2; \\ H_0 &= \begin{bmatrix} (1-\varphi)\omega_0 + \varphi x_0 \\ (1-\varphi)\omega_1 + \varphi x_1 \\ (1-\varphi)\omega_2 + \varphi x_2 \end{bmatrix}; H_1 = \begin{bmatrix} \pi_0 \\ \pi_1 \\ \pi_2 \end{bmatrix}; H_2 = \begin{bmatrix} l_0 \\ l_1 \\ l_2 \end{bmatrix} \end{aligned}$$

The evolution equation of $\hat{z}_t$ is given by:

$$\hat{z}_t = M\hat{z}_{t-1} + N\eta_t,$$

where the matrices M and N are defined as:

$$M = \begin{bmatrix} l_0 & l_1 & l_2 \\ \omega_0 & \omega_1 & \omega_2 \\ \pi_0 & \pi_1 & \pi_2 \end{bmatrix}; \quad N = \begin{bmatrix} l_3 & l_4 \\ \omega_3 & \omega_4 \\ \pi_3 & \pi_4 \end{bmatrix}$$

and η_t is the vector of shocks $\eta_t = (\varepsilon_t, \theta_t)'$. V must have the form:

$$V = K + \Lambda\hat{z}_{t-1} + \hat{z}'_{t-1}\Omega\hat{z}_{t-1}$$

Using the definition of U, we can write V in recursive form:

$$V(\hat{z}_{t-1}) = E_{t-1}U(\hat{z}_t) + \frac{1}{1+r}E_{t-1}V(\hat{z}_t)$$

This can be conveniently rewritten as:

$$\begin{aligned} K + \Lambda\hat{z}_{t-1} + \hat{z}'_{t-1}\Omega\hat{z}_{t-1} &= K^* + \Lambda^*\hat{z}_{t-1} + \hat{z}'_{t-1}\Omega^*\hat{z}_{t-1} \\ &\quad + \frac{1}{1+r}\left(K + \Lambda M\hat{z}_{t-1} + \hat{z}'_{t-1}M'\Omega M\hat{z}_{t-1} + N'\Omega N \odot \Sigma\right) \end{aligned}$$

where $\Sigma = E\eta\eta'$ and $\odot$ denotes the scalar product of two matrices: $A \odot B = \Sigma_{i,j} a_{ij} b_{ij}$.

The latter equation must hold for all $\hat{z}$, which allows us to compute K, Λ, and Ω:

$$\Lambda = \Lambda^*(I - \frac{1}{1+r}M)^{-1}$$

As for Ω, it must be a solution to:

$$\Omega = \Omega^* + \frac{1}{1+r}M'\Omega M$$

Forward integration allows us to find the solution:

$$\Omega = \sum_{k=0}^{+\infty} \frac{M'^k \Omega^* M^k}{(1+r)^k}$$

Finally, by equating constant terms we get K:

$$K = \frac{1+r}{r}K^* + \frac{1}{r}N'\Omega N \odot \Sigma$$

B Equilibrium with a monetary union

In the EMU case we cannot rewrite the model in terms of x, ω, and π. Instead we have to use a four-dimensional system in $(\hat{l}, \hat{\omega}, \hat{\pi}, \hat{p})$. Belonging to EMU forces an economy to have a nominal anchor and it therefore precludes the real exchange targeting which is optimal absent EMU. Thus $\hat{p}$ reappears since the real exchange rate is, by definition, given by $x = -p$. Let $\hat{v}_t = (\hat{l}_t, \hat{\omega}_t, \hat{\pi}_t, \hat{p}_t)'$. Then it follows that:

$$\hat{v}_t = A\hat{v}_{t-1} + BE_t\hat{v}_{t+1} + C\eta_t$$

where:

$$A = Q^{-1}\bar{A}; B = Q^{-1}\bar{B}; C = Q^{-1}\bar{C}$$

$$Q = \begin{bmatrix} 1 & 0 & 0 & \delta \\ -\lambda(1+\beta) & -1 & 0 & 0 \\ -(1-\alpha)\gamma & 1 & \alpha & (1-\alpha)\varphi \\ 0 & 0 & 1 & -1 \end{bmatrix}$$

$$\bar{B} = \begin{bmatrix} 0 & 0 & 0 & 0 \\ -\beta\lambda & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix}; \bar{A} = \begin{bmatrix} 0 & 0 & 0 & 0 \\ -\lambda & 0 & 0 & 0 \\ 0 & \alpha & \alpha & 0 \\ 0 & 0 & 0 & -1 \end{bmatrix}; \bar{C} = \begin{bmatrix} 1 & -1 \\ 0 & -1 \\ 0 & 0 \\ 0 & 0 \end{bmatrix}$$

This system has the following solution:

$$\hat{v}_t = M^E \hat{v}_{t-1} + N^E \eta_t$$

where M is solution to

$$M^E - B\left(M^E\right)^2 = A$$

and N is given by

$$N^E = (I - BM^E)^{-1} C.$$

Welfare

To compute welfare we use the same steps as in the non-EMU case. However, let us do it with a more compact notation. Equation (9) can be written as:

$$U_t = U_0 + U_1 \hat{v}_t + \hat{v}_t' U_2 \hat{v}_t$$

where:

$$U_0 = -\rho\left((1-\varphi)\bar{\omega} + \varphi\bar{x} - \varpi^*\right)^2 - (1-\rho)(1-b)\left(\bar{l} - l^*\right)^2$$

$$U_1 = \begin{bmatrix} -2(1-\rho)(1-b)\left(\bar{l} - l^*\right) \\ -2\rho(1-\varphi)\left((1-\varphi)\bar{\omega} + \varphi\bar{x} - \varpi^*\right) \\ 0 \\ 2\rho\varphi\left((1-\varphi)\bar{\omega} + \varphi\bar{x} - \varpi^*\right) \end{bmatrix}'$$

$$U_2 = \begin{bmatrix} -(1-\rho)(1-b) & 0 & 0 & 0 \\ 0 & -\rho(1-\varphi)^2 & 0 & \rho\varphi(1-\varphi) \\ 0 & 0 & -(1-\rho)b & 0 \\ 0 & \rho\varphi(1-\varphi) & 0 & -\rho\varphi^2 \end{bmatrix}$$

We now have:

$$U(\hat{v}_t) = K^{*E} + \Lambda^{*E} \hat{v}_{t-1} + \hat{v}_{t-1}' \Omega^{*E} \hat{v}_{t-1},$$

where:

$$K^{*E} = U_0 + N^{E\prime} U_2 N^E \odot \Sigma; \Lambda^{*E} = U_1 M^E; \text{ and } \Omega^{*E} = M^{E\prime} U_2 M^E$$

V must now be of the form:

$$V^E = K^E + \Lambda^E \hat{z}_{t-1} + \hat{z}_{t-1}' \Omega^E \hat{z}_{t-1}$$

Hence:

$$\begin{aligned} K^E + \Lambda^E \hat{v}_{t-1} + \hat{v}_{t-1}' \Omega^E \hat{v}_{t-1} &= K^{*E} + \Lambda^{*E} \hat{v}_{t-1} + \hat{v}_{t-1}' \Omega^{*E} \hat{v}_{t-1} \\ &\quad + \frac{1}{1+r} \begin{pmatrix} K^E + \Lambda^E M^E \hat{v}_{t-1} \\ + \hat{v}_{t-1}' M^{E\prime} \Omega^E M^E \hat{v}_{t-1} + N^{E\prime} \Omega^E N^E \odot \Sigma \end{pmatrix} \end{aligned}$$

Hence:

$$\Lambda^E = \Lambda^{E*}(I - \frac{1}{1+r}M^E)^{-1}$$

$$\Omega^E = \sum_{k=0}^{+\infty} \frac{M^{E\prime k}\Omega^* M^{Ek}}{(1+r)^k}; \text{ and } K^E = \frac{1+r}{r}K^{*E} + \frac{1}{r}N^{E\prime}\Omega^E N^E \odot \Sigma$$

Appendix 2. Calibration of parameters

A Labor market parameters

Layard, Nickell, and Jackman (1991), hereafter LNJ, estimate for 19 OECD countries over the period 1969-85 the following price and wage equations:

$$\begin{aligned} p_t - w_t &= (1-\beta')(p_{t-1} - w_{t-1}) + \beta_0 - \beta_1 u_t - \beta_{11}\Delta u_t - \beta_2 \Delta^2 p_t \\ w_t - p_t &= (1-\gamma')(w_{t-1} - p_{t-1}) + \gamma_0 - \gamma_1 u_t - \gamma_{11}\Delta u_t - \gamma_2 \Delta^2 p_t \end{aligned}$$

where u_t denotes the unemployment rate and the remaining symbols are as in the text. Long-run parameters are given by $\overline{\beta}_i = \beta_i/(1-\beta')$ and $\overline{\gamma}_i = \gamma_i/(1-\gamma')$, for $i = 0, 1, 2$.

In order to employ their estimated parameters we need to match these equations to our own price and wage equations, repeated here for convenience:

$$\begin{aligned} p_t &= w_t - \theta_t - h + \lambda(l_t - l_{t-1}) + \beta\lambda(l_t - E_t l_{t+1}) \\ w_t &= (1-\alpha)(q + (1-\varphi)p_t + \varphi e_t + \gamma l_t) + \alpha(w_{t-1} + p_{t-1} - p_{t-2}) \end{aligned}$$

The correspondence of parameters is established by the variables they are attached to, but also by the fact that LNJ provide favorable evidence obtained from simple cross-section regressions of the country-specific coefficients on several proxies for the institutional arrangements which should explain them according to the theory.

A. Our parameter for *labor adjustment costs*, λ, corresponds to β_{11}, the hysteresis parameter in the price equation. LNJ present a cross-country regression (p. 420) where β_{11} is found to be correlated with the share of manufacturing employees with short tenure (negatively) and with measures of severance pay and notice periods (positively). The latter two were not significant, but we have estimated a regression of the same coefficients on a newly constructed employment protection variable taken from Blanchard and Wolfers (1999) obtaining a positively-signed coefficient with a t-ratio of 3.4.

B. Our parameter for *real wage flexibility*, γ, corresponds to $\overline{\gamma}_1$, the long-run effect of unemployment on the real wage. In a cross-country regression (p. 418) $\overline{\gamma}_1$ is found to be correlated with unemployment benefit duration, replacement rates, and dummy variables for corporatism (negatively), and with the share of manufacturing employees working in small firms and dummy variables for employer and union coordination (positively).

C. Our parameter for *nominal wage inertia*, α, corresponds to $1-\gamma'$, the inertia parameter in the wage equation. This is easily seen by realizing that setting $\varphi = 0$ our wage equation can be rewritten as:

$$w_t - p_t = (1-\alpha)(q + \gamma l_t) + \alpha(w_{t-1} - p_{t-1}) - \alpha\Delta^2 p_t$$

While straightforward, this bears clarification because LNJ actually call γ_2 the nominal wage rigidity parameter. Of course, in our model γ_2 and $1-\gamma'$ coincide. LNJ present cross-section estimates (p. 429) where γ_2 is found to be negatively correlated with the variance of the growth rate of nominal GDP and a dummy variable for the length of wage contracts, as well as with dummy variables for the degree of indexation and synchronization of wage contracts (the latter two are not significant). We have performed the same regression on the coefficient $1-\gamma'$, obtaining similar results.

How do we arrive at the values characterizing rigid and flexible institutions? We computed the means for the countries ranked in positions 2 to 7, from highest to lowest, for the rigid value, and those ranked 13 to 18 for the flexible value (respectively flexible and rigid values, in the case of γ). This rule was chosen to leave out potential outliers (countries ranked in positions 1 and 19) and to leave some room in between (countries ranked 8 to 12). To check the robustness of the parameter values, we applied the same procedure to the estimates on similar parameters obtained in three other papers on varying sample periods and countries: Alogoskoufis and Manning (1988), Grubb (1986), and Newell and Symons (1985) (as reported in LNJ, pp. 454-466).

Table A1 provides a comparison of estimates. The last column contains our *consensus* estimate. Two features are worth noting. First, the values are quite consistent across studies. Second, the rankings across countries are not very coincidental, as indicated by the low correlation coefficients shown for each parameter.

B Other parameters

Demand and supply shock variances (σ_ε^2 and σ_θ^2). We adopt the estimates from Bayoumi and Eichengreen (1993). They estimate a bivariate VAR on GDP growth and inflation. Supply and demand shocks are independent by construction. Supply shocks are allowed to have permanent effects on output levels, while demand shocks are not. Both have permanent effects on the level of prices. They use annual data on 11 EU countries over the period 1960-88. Estimated standard deviations for supply and demand shocks are quite similar across countries, both having average values around 2%. For supply the estimates range from 1.2% (France) to 3% (Greece) and for demand from 1.4% (Germany) to 3.4% (Ireland).

Reduction in demand shock variance (σ_ε^2) due to EMU. Canzoneri *et al.* (1996) estimate a VAR for each of 6 OECD countries (Austria, the Netherlands, France, Italy, Spain and the United Kingdom) vis-a-vis Germany, in output, public spending, and the exchange rate, and allow for three types of shocks: supply, government spending and money/finance. They find that money shocks explain on average 33% of the variance of output which is due to aggregate demand shocks (i.e. government spending plus money/finance) over a one-year period.

Open economy parameters. The real exchange elasticity δ is computed as the weighted average of the long-run estimated elasticities of exports and imports of manufactured goods with respect to the real exchange, using export and import ratios as weights. This is then multiplied by the manufacturing share in GDP plus one-half times the complementary share (since the remaining sectors, notably services, are less open than manufacturing). The estimated elasticities are for France, Germany, Italy, and the UK, from Artus and Knight (1984) and correspond to the period 1980-1985. The price weight φ is simply calibrated by the share of imports in GDP from the *OECD Economic Outlook*. These calculations yield a value of $\delta = \varphi = 0.2$.

Inflation preference parameter (b). There is surprisingly little evidence on the weights of inflation and unemployment in the central bank's objective function as captured in the Barro-Gordon (1983) framework. For the US, some estimates (Favero and Rovelli, 1999) and calibrations (Rotemberg and Woodford, 1997) suggest that the weight of unemployment might actually be zero. Broadbent and Barro (1997), on the other hand, find that output surprises have a weight of about one-third as high as the inflation variance. The most comprehensive analysis so far has been carried out by Lippi (1998, ch. 8), who estimates the objective function for 49 countries over the period 1965-1992. Transforming his estimates to our metric –they are in terms of output, rather than employment deviations, and so we use (the inverse of) a common labor share of 0.67 in the transformation), the estimated value for the inflation weight, b, is 0.63 (s.e.=0.25), while for 22 OECD countries it is 0.74 (s.e.=0.18).

Table A1. Comparison of estimates of rigid and flexible parameters.

Parameters	Layard *et al.*	Newell-Symons	Grubb	Alogosk.-Manning	Consensus
Labor adjustment costs (λ)					
Rigid	8.1	10.9	–	–	8.00
Flexible	1.0	2.1	–	–	1.00
Maximum	14.4	18.2	–	–	
Minimum	-0.2	0.2	–	–	
Correlation with LNJ	1.0	0.39	–	–	
Real wage flexibility (γ)				–	
Rigid	1.2	0.7	0.9	1.0	1.25
Flexible	8.6	4.5	2.5	8.1	4.00
Maximum	14.5	7.2	6.5	123.0	
Minimum	0.7	0.0	0.3	1.1	
Correlation with LNJ	1.0	0.78	0.36	0.37	
Nominal wage inertia (α)					
Rigid	0.82	0.80	–	0.96	0.80
Flexible	0.46	0.51	–	0.72	0.45
Maximum	0.94	0.86	–	0.98	
Minimum	0.00	0.32	–	0.56	
Correlation with LNJ	1.0	0.27	–	0.22	

Note: Correlation coefficients calculated with the subsamples of countries which overlap with the ones included in Layard *et al.* (1991).

Appendix 3. Further simulation results

Table A2. Effect of EMU on the variance of employment, prices, and real wages for different labor institutions (%).

Labor Institutions	λ	γ	α	Employ-ment	Prices	Real wages
Fully Rigid	R	R	R	0.1	26.8	17.5
Rigid Wage	F	R	R	0.5	5.8	3.6
Scandinavia	R	F	R	0.1	27.0	17.2
United States	F	F	R	0.5	7.1	3.5
Europe	R	R	F	0.0	31.8	10.8
United Kingdom	F	R	F	0.3	11.9	3.2
Japan	R	F	F	0.0	32.1	9.8
Fully Flexible	F	F	F	0.2	15.6	3.0
Average				0.2	19.8	8.6
Labor adjustment costs (λ)						
Rigid				0.1	29.4	13.8
Flexible				0.4	10.1	3.3
Difference Rigid-Flexible				-0.3	19.3	10.5
Real wage flexibility (γ)						
Rigid				0.2	19.0	8.8
Flexible				0.2	20.5	8.4
Difference Rigid-Flexible				0.1	-1.4	0.4
Nominal wage inertia (α)						
Rigid				0.3	16.7	10.5
Flexible				0.1	22.9	6.7
Difference Rigid-Flexible				0.2	-6.2	3.8

Note. The first column is found by setting $\rho = 0$ and $b = 0$, the second one by setting $\rho = 0$ and $b = 1$, and the third one by setting $\rho = 1$. The bottom panel reports the average cost for the 4 countries which share the indicated characteristic. Other parameters: $\beta = 0.9$, $r = 0.1$, $\sigma_\varepsilon^2 = \sigma_\theta^2 = 0.0004$, $q = 0$.

Table A3. Effect of labor market institutions and political preferences on the cost of EMU with reduced demand uncertainty (%).

				Union political power			
				Weak (ρ=0.1)		Powerful (ρ=0.5)	
				Inflation aversion		Inflation aversion	
				Prone (b=0.1)	Averse (b=0.9)	Prone (b=0.1)	Averse (b=0.9)
				New	Conser-	Socialist	Christian
Labor Institutions	λ	γ	α	Labour	vative		Democrat
Fully Rigid	R	R	R	1.8	11.1	0.9	1.9
Rigid Wage	F	R	R	0.6	3.0	0.2	0.5
Scandinavia	R	F	R	1.8	11.2	0.9	1.9
United States	F	F	R	0.6	3.6	0.2	0.5
Europe	R	R	F	1.6	12.6	0.5	1.7
United Kingdom	F	R	F	0.8	6.3	0.2	0.8
Japan	R	F	F	1.6	12.6	0.5	1.7
Fully Flexible	F	F	F	1.1	10.1	0.2	1.1
Average				1.2	8.8	0.5	1.3
Labor adjustment costs (λ)							
Rigid				1.7	11.9	0.7	1.8
Flexible				0.8	5.8	0.2	0.7
Diff. Rigid-Flexible				0.9	6.1	0.5	1.1
Real wage flexibility (γ)							
Rigid				1.2	8.3	0.5	1.2
Flexible				1.3	9.4	0.5	1.3
Diff. Rigid-Flexible				-0.1	-1.1	0.01	-0.1
Nominal wage inertia (α)							
Rigid				1.2	7.2	0.6	1.2
Flexible				1.3	10.4	0.4	1.3
Diff. Rigid-Flexible				-0.1	-3.2	0.2	-0.1

Notes. The cost of EMU measures the welfare cost, according to welfare function (5) in the text, of moving from the optimal parameters x_i to $x_i = 0$ for all i. All costs are normalized by the steady-state welfare corresponding to the specific political preference parameter pair and in percentage terms. The bottom panel reports the average cost for the 4 countries which share the indicated characteristic. Other parameters: $\beta = 0.9$, $r = 0.1$, $\sigma_\varepsilon^2 = 0.00027$, $\sigma_\theta^2 = 0.0004$, $q = 0$.

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Table 1. Parameter set for labor market institutions.

	Labor market institutions		
Degree of flexibility	Labor adj. costs (λ)	Real wage flexibility (γ)	Nominal wage inertia (α)
Rigid	8.00	1.25	0.80
Flexible	1.00	4.00	0.45

Note: Values chosen according to several empirical studies (see Appendix 2).

Table 2. Virtual economies according to parameter configurations for labor market institutions.

	Labor market institutions		
Country	Labor adj. costs (λ)	Real wage flexibility (γ)	Nominal wage inertia (α)
Fully Rigid	R	R	R
Rigid Wages	F	R	R
Scandinavia	R	F	R
United States	F	F	R
Europe	R	R	F
United Kingdom	F	R	F
Japan	R	F	F
Fully Flexible	F	F	F

Table 3. Space generated by policy preference parameters.

	Inflation aversion	
Union political power	Prone ($b = 0.1$)	Averse ($b = 0.9$)
Weak ($\rho = 0.1$)	New Labour	Conservative
Strong ($\rho = 0.5$)	Socialist	Christian Democrat

Table 4. Effect of labor market institutions and political preferences on the cost of EMU (%).

				Union political power			
				Weak (ρ=0.1)		Powerful (ρ=0.5)	
				Inflation aversion		Inflation aversion	
				Prone (b=0.1)	Averse (b=0.9)	Prone (b=0.1)	Averse (b=0.9)
Labor Institutions	λ	γ	α	New Labour	Conser-vative	Socialist	Christian Democrat
Fully Rigid	R	R	R	3.5	21.0	1.8	3.7
Rigid Wage	F	R	R	1.0	4.5	0.3	0.7
Scandinavia	R	F	R	3.5	21.2	1.7	3.7
United States	F	F	R	1.1	5.5	0.3	0.8
Europe	R	R	F	3.1	24.0	1.1	3.4
United Kingdom	F	R	F	1.3	8.9	0.3	1.2
Japan	R	F	F	3.1	24.2	1.0	3.4
Fully Flexible	F	F	F	1.5	11.6	0.4	1.5
Average				2.3	15.1	0.9	2.3
Labor adjustment costs (λ)							
Rigid				3.3	22.6	1.4	3.5
Flexible				1.2	7.6	0.3	1.1
Diff. Rigid-Flexible				2.1	15.0	1.1	2.5
Real wage flexibility (γ)							
Rigid				2.2	14.6	0.9	2.3
Flexible				2.3	15.6	0.9	2.3
Diff. Rigid-Flexible				-0.1	-1.0	0.0	-0.1
Nominal wage inertia (α)							
Rigid				2.3	13.1	1.1	2.2
Flexible				2.3	17.2	0.7	2.4
Diff. Rigid-Flexible				0.0	-4.1	0.3	-0.1

Notes. The cost of EMU measures the welfare cost, according to welfare function (5) in the text, of moving from the optimal parameters x_i to the parameters $x_i = 0$ for all i. All costs are normalized by the steady-state welfare corresponding to the specific political preference parameter configuration and in percentage terms. The bottom panel reports the average cost for the 4 countries which share the indicated characteristic. Other parameters: $\beta = 0.9$, $r = 0.1$, $\sigma_\varepsilon^2 = \sigma_\theta^2 = 0.0004$, $q = 0$.

Table 5. Effect of labor market institutions on the cost of EMU.

A. By policymaker's individual objectives:

	Stabilize:		
Labor institution	Prices	Employment	Real wage
Employment protection (λ)	+	–	+
Real wage rigidity ($1/\gamma$)	–	+	+
Nominal wage inertia (α)	–	+	+

B. By combinations of objectives:

	Union political power			
	Weak (ρ=0.1)		Powerful (ρ=0.5)	
	Inflation aversion		Inflation aversion	
	Prone (b=0.1)	Averse (b=0.9)	Prone (b=0.1)	Averse (b=0.9)
Labor institution	New Labour	Conser-vative	Socialist	Christian Democrat
Employment protection (λ)	+	+	+	+
Real wage rigidity ($1/\gamma$)	–	–	+	–
Nominal wage inertia (α)	+	–	+	–

Note: Panel A: A "+" (respectively "–") sign indicates that a more rigid institution increases (respectively reduces) the costs from EMU membership when the policymaker's objective is to stabilize the variable in the corresponding column. Source: Table A2. Panel B: Effect of each labor institution on the cost of EMU for each combination of policymaker's preferences. Source: Table 4.

Table 6. Effect of EMU on the incentives to reduce insiders' rents (q).

Country	Cost of EMU without reform (1)	Cost of EMU with reform (2)	Effect of EMU on incentives (I) (1) – (2)
Fully Flexible	7.9	10.9	-3.0
Europe	15.9	16.3	-0.4

Note: Percentage costs of EMU, computed for a reform consisting of a reduction from $q = 0$ to $q = -0.1$. For Fully Flexible, $\lambda = 1, \gamma = 4$, and $\alpha = 0.45$; for Europe, $\lambda = 8, \gamma = 1.25$, and $\alpha = 0.45$. Other parameters: $\beta = 0.9$, $r = 0.1$, $\sigma_\varepsilon^2 = \sigma_\theta^2 = 0.0004$.

Figure 1: Dynamic response of employment and the real wage to a reduction in insider rents (q) in EMU. Fully Flexible economy.

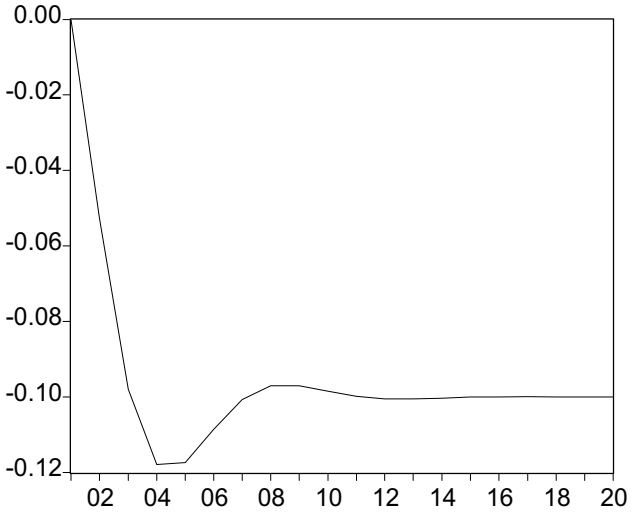

Figure 2: Dynamic response of the price level to a reduction in insider rents (q) in EMU. Fully Flexible economy.

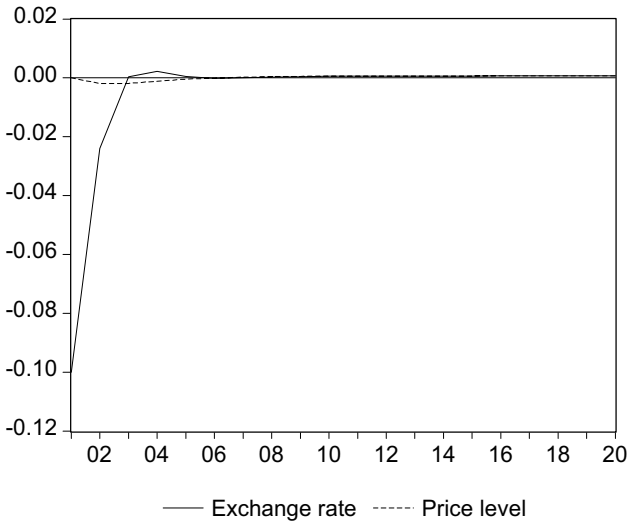

Figure 3: Dynamic response of the exchange rate and the price level to a reduction in insider rents (q) outside EMU. Fully Flexible economy.

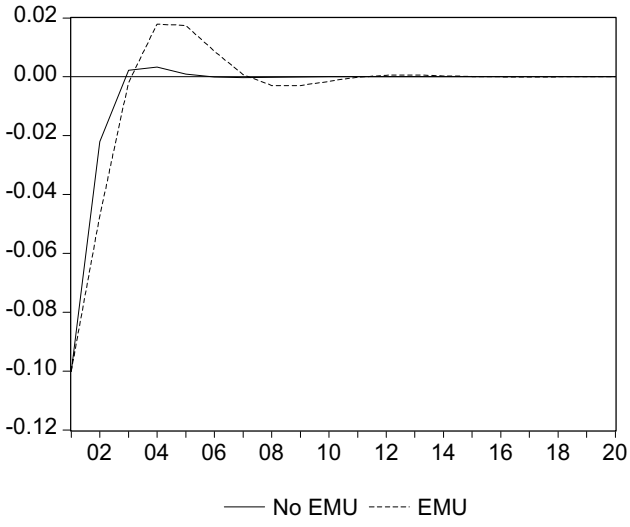

Figure 4: Dynamic response of the real exchange rate to a reduction in insider rents (q) in and outside EMU. Fully Flexible economy.

Figure 5: Dynamic response of employment and the real wage to a reduction in insider rents (q) outside EMU. Fully Flexible economy.

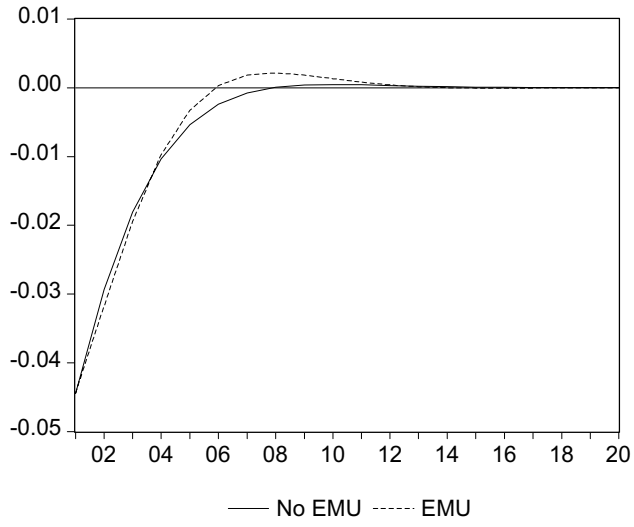

Figure 6: Dynamic response of employment to a reduction in insider rents (q) in and outside EMU. "European" economy.

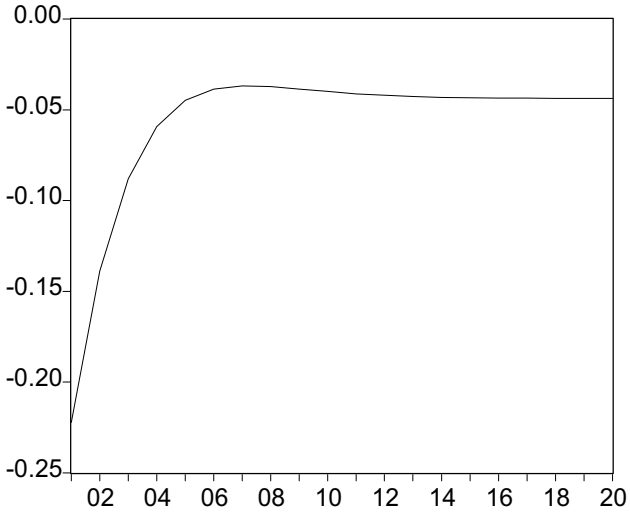

Figure 7: Dynamic response of the exchange rate to a reduction in insider rents (q) outside EMU. "European" economy.

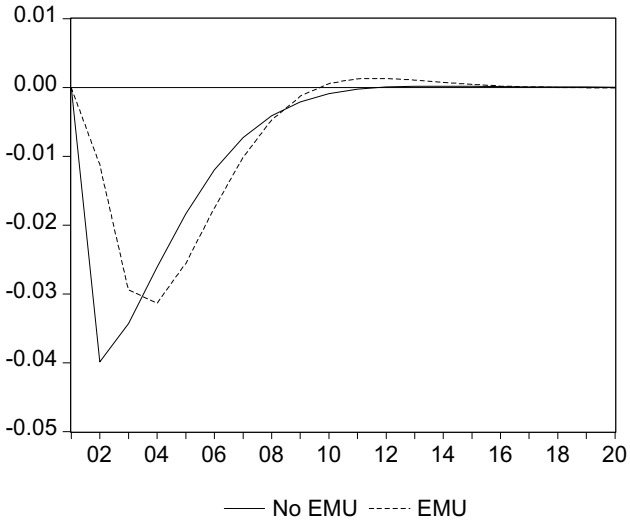

Figure 8: Dynamic response of the real wage to a reduction in insider rents (q) in and outside EMU. "European" economy.

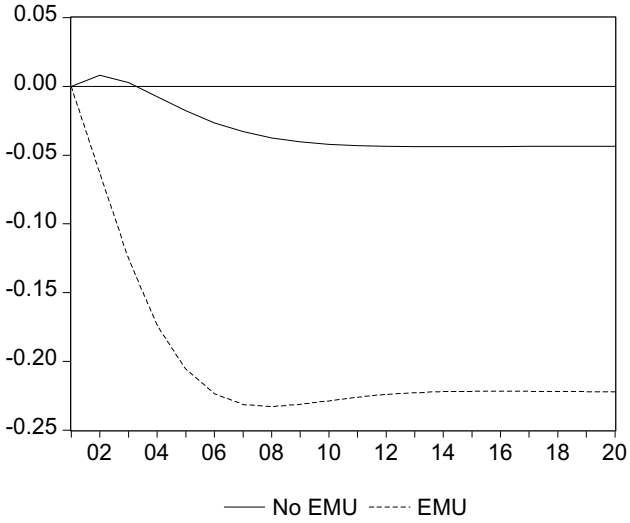

Figure 9: Dynamic response of the price level to a reduction in insider rents (q) in and outside EMU. "European" economy.