Working Paper Series

Has EMU Had Any Impact on the Degree of Wage Restraint?

Adam S. Posen and Daniel Popov Gould

Abstract

This working paper investigates the European Monetary Unification's (EMU) effect on wage restraint—the degree to which wage increases do or do not exceed productivity growth. We find in cross-sectional investigations that wage restraint either is unchanged or has increased following EMU in the vast majority of countries. This finding contradicts the predictions of a widely cited family of models of coordination of labor market bargaining. In particular, one would have expected Germany to display the greatest decline in wage restraint post-EMU under these models, but in our time-series analysis we find no indication of such a decline. The overall shift toward greater wage restraint is consistent with the models that emphasize the gains from monetary credibility. The time-series evidence on Italy, which shows a significant increase in wage restraint after eurozone entry, also supports this view. That said, the increase in wage restraint in the eurozone is matched by that associated with the increase in credibility seen in the United Kingdom and Sweden after their adoption of inflation targeting post-1992.

Keywords: EMU, wage bargaining, monetary credibility, productivity
JEL codes: E58, E25, J58

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I. INTRODUCTION

The Lucas Critique notwithstanding, applied economic research has paid a great deal of attention in recent decades to the potential for changes in monetary regimes to induce lasting changes in economic structures and behavior.[1] In particular, given the key role of inflation expectations in wage setting and the presumed endogeneity of practices such as indexation to the price environment, theorists have developed increasingly sophisticated models of the interaction between central banks and labor market institutions.[2]

The creation of the euro presents a natural opportunity to investigate these models' predictions. Eurozone member countries' economies, where wage bargaining institutions and practices varied substantially, suddenly underwent a simultaneous shift in monetary regime to the European System of Central Banks (ESCB) and the Eurosystem. This shift would not necessarily have had the same effect on all eurozone economies—the pre-existing extent of unionization, degree of centralization and coordination in wage bargaining, relative size of the economy in the monetary union, and so on could condition a given economy's response.[3] Given this conditionality, theorists were generally building upon the insights of Calmfors and Driffill's (1988) seminal paper on the interaction between centralization of wage bargaining and macroeconomic performance.[4] Interestingly, there was little agreement between the predictions of European theorists and policymakers. Labor economists and political scientists whose approach worked from wage bargaining institutions upward to macroeconomic outcomes tended to emphasize the risks to macroeconomic performance from European Monetary Unification (EMU) causing a mismatch between institutions, which might result in suboptimal coordination. On the other hand, almost all eurozone macroeconomists and central bankers felt that short-run inflation and output volatility would generally improve with the monetary regime shift, and many went further, suggesting that more credible policy would percolate downward and induce structural reform in labor markets.[5]

Two difficulties have limited the success of empirical inquiries into this issue. The first, well-recognized, difficulty is that the number of country observations available to investigators is limited, and so

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1. Lucas (1976) famously argued that known and lasting changes in economic policy would lead to offsetting private behavior such that policy changes would make little or no difference to economic outcomes.
2. See, among others, Bean (1998), Bayoumi and Sgherri (2004), Calmfors (1998), Cukierman and Lippi (1999, 2001), Duval and Elmeskov (2005), Gruener and Hefeker (1999), Hall and Franzese (1998), Iversen and Soskice (1998, 2000), Saint-Paul and Bentolila (2000), and Sibert and Sutherland (2000).
3. Calmfors (2001) and Cukierman and Lippi (2001) give useful albeit partial surveys of the factors involved.
4. These authors acknowledge their debt in turn to Olson (1982), who first outlined why the behavior of interest groups depends upon how "encompassing" their membership is.
5. Posen (1998a, 1999) expressed an early American skepticism on both these counts. Duval and Elmeskov (2005) and Posen (2005) both give references to statements by euro proponents pre-EMU that the euro would strongly induce if not force structural change.

therefore is the degree of freedom to distinguish robustly among competing hypotheses.[6] The second difficulty is that the vast majority of empirical studies tend to focus on aggregate macroeconomic outcomes—normally inflation and/or unemployment—even though the underlying theory usually generates hypotheses about real wage determination.[7] The first difficulty is largely unavoidable, though with time and with different cuts at the problem, some clarity may be achieved. The second difficulty, however, is unnecessary and may in fact exacerbate the first problem. If the competing theories have different implications for real wages or functions thereof, it may be possible to distinguish between them by looking directly at the predictions for those variables and thus not burn degrees of freedom (and confuse the matter) by trying to control for shocks to inflation or unemployment or country-specific effects with respect to those variables.

This paper investigates the empirical implications of the various theories for EMU's effect on wage restraint—the degree to which wage increases do or do not exceed productivity growth. In so doing, we attempt to avoid the second difficulty noted above. Wage restraint in some sense automatically controls for country-specific effects and shocks, beyond those directly accounted for in the observable labor and monetary institutions, because it is defined as a response to a given country's productivity performance, not a function of the level. It is also explicitly and frequently cited as a primary conscious concern of labor leadership, employers, and central bankers, who are presumed to be the actors in these models—and in the reality of wage bargaining and monetary policymaking. We also hope to partially alleviate the first difficulty, of inherently limited observations, by focusing on this dependent variable rather than inflation or unemployment, the determinants of which are perhaps too difficult to pin down. To our knowledge, no paper in this context has made wage restraint itself the focus of its empirical work.[8] In addition, taking advantage of the time that has passed since the launch of the euro, we add to our cross-sectional work a comparison of time-series behavior in two critical countries, Germany and Italy, that differ markedly in what the theories predict would be the effect of EMU on wage restraint.

We find that wage restraint either is unchanged or has increased following EMU in the vast majority of countries, with no instances of significant declines in restraint. This finding contradicts the predictions of a widely cited family of models that rest on labor's representatives in wage bargaining

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6. Blanchard (2005) is particularly articulate on the challenge presented to such cross-national datasets by the existence of a multiplicity of shocks. Calmfors (1993) and Driffill (2005) also note these limitations.

7. Richard Freeman raised this concern in initial comments on Calmfors and Driffill (1988). This is not true of all empirical investigations (e.g., Layard, Nickell, and Jackman [1991] estimate wage equations before turning to unemployment outcomes), but most focus on inflation or unemployment directly. Some of the models, such as those of Cukierman and Lippi (1999, 2001), map directly from real wages to aggregate outcomes.

8. Of course, the concept of wage restraint and its importance is well established. Bruno and Sachs (1985) first brought in the modern concept of the wage gap and related it to institutions, and many of the papers cited in footnote 2 deal with real wage determination. Bean (1994, 2005); Blanchard (1991, 2000); Layard, Nickell, and Jackman (1991); and Nickell, Nunziata, and Ochel (2005) all consider the role of real wage rigidities in determining unemployment. Yet, the empirical linkage between wage restraint and changes in monetary policy regimes to our knowledge remains uninvestigated.

taking into account the external effect of their demands on aggregate inflation. In particular, one would have expected Germany to display the greatest decline in wage restraint under these models, given that the relative importance of its major unions in the central bank's calculus of inflationary pressures declined most with respect to both size and weighting by the central bank (given the shift from Bundesbank to the ECB), and we find no indication of such a decline. If anything, wage restraint in Germany increased post-EMU.

The overall shift in the countries examined toward greater wage restraint is consistent with the models that emphasize the gains to macroeconomic stability from monetary credibility, downplaying coordination or labor centralization issues. The time-series evidence on Italy, which shows a significant increase in wage restraint after eurozone entry, also supports this view, given that the restraint is mostly determined by the degree of monetary credibility (proxied by the Italian interest rate differential versus the lowest government bond rate in the eurozone). That said, the increase in wage restraint associated with increased monetary credibility in the eurozone is matched by that shown to be associated with the increase in credibility seen in the United Kingdom and Sweden after adoption of inflation targeting post-1992. This result emphasizes that the effect being seen is due to monetary regime changes and perhaps global pressures on labor bargaining power and not due to EMU per se, political coordination issues, or international integration that accompanied EMU.

Section II further elaborates on our definition of wage restraint, its operationalization, and the distribution of outcomes in our sample. Section III goes through the implications of five major theories about the determinants of wage restraint for what should happen after EMU and whether or not non-eurozone advanced economies should see a similar effect. Section IV presents our cross-sectional analysis, looking at the extent of wage restraint before and after EMU in a sample of 19 economies (of which eleven are EMU members) and its determinants. Section V sets out our time-series analysis of the movements in wage restraint controlling for the business cycle in Germany and Italy and whether those dynamics changed after convergence in interest rates (our operationalization of monetary credibility) and the shift in monetary decision making from the Bundesbank to the ECB. Section VI considers the implications for two major theoretical approaches to the determinants of wage restraint and for policy, given what seems to be clear evidence in support of one and in apparent rejection of the other.

II. ROLE AND MEASUREMENT OF WAGE RESTRAINT

Central bankers and financial-market observers often refer to the degree of wage restraint in a country or in a given wage negotiation, by which they mean the degree to which increases in real wages are commensurate with increases in (labor) productivity. As argued by Bruno and Sachs (1985), the existence of

a real wage gap—a persistent rise in real wages unmatched by productivity—can explain stagflation in the 1970s. In a more recent example, the extensive and persistent high unemployment in the former East Germany is usually attributed to a lasting wage bargain that overpriced eastern labor relative to its productivity.[9] Others (e.g., Ball and Moffitt 2001, Blanchard and Philippon 2003) attribute part of the rise and in some countries fall of the nonaccelerating inflation rate of unemployment (NAIRU) to the lags with which wage setters recognized shifts in productivity growth. This attribution is of course loosely analogous to "classical" views of unemployment, where labor is overpriced relative to its returns, as opposed to more "Keynesian" views where nominal rigidities and insufficient demand are the root cause.[10]

Assessment of wage restraint continues to play a significant role in the determination of monetary policy now that all central banks in advanced economies, including the ECB, are committed to forward-looking strategies for the stabilization of low inflation. The belief that wage increases "out of line with productivity" are potentially inflationary is widespread. Consider the example of the German economy and Bundesbank behavior in the 1950–70 period, when economic growth was accompanied by union wage restraint, with real wages rising but less than the rate of growth in productivity—and the Bundesbank explicitly threatened to raise interest rates should wage demands be "excessive" (Deutsche Bundesbank 1998; Streeck 1994; Siebert 2005, chapter 4). The decline in the US unemployment rate in the 1990s is widely attributed in large measure to interaction between the outpacing of wage growth by productivity growth and the readiness of the Federal Reserve partly as a result to maintain low interest rates even as past benchmarks for growth and unemployment were surpassed.[11]

It must be noted that wage restraint is not an entirely neutral concept distributionally. An increase in wages above the rate of productivity growth will embody some combination of pass-through of inflationary expectations, of (mis)perception of the rate of productivity growth, *and* of an increase in labor's share of income relative to capital.[12] Since ultimately factors of production would be expected to earn their marginal products over the long term, this is less of an issue for multiyear averages than for any specific year's wage settlement, but after some years of wage restraint, it could well be reasonable for

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9. See the summary and references in Posen (2006, chapter 6). The "overpricing" in turn can be attributed to the incentives for union insiders in then West Germany to prevent low-wage competition for their membership.
10. As Caballero and Hammour (1996) and Blanchard (2005) point out, though, even if a wage gap story can be used to explain much of the rise of European unemployment in the 1970s and early 1980s, it cannot be assigned a leading role in the persistence and, in some European countries, continued rise of unemployment in more recent years, precisely because there has been a period of relative wage restraint.
11. Blinder and Yellen (2001) articulate this position very well from the point of view of Federal Reserve decision makers.
12. As we are considering aggregate measures of wage restraint, we are abstracting from the bargaining over rents and quasi-rents between firms and unions, which are also a component of wage growth when considered at the sectoral or individual firm level.

labor's share to catch up by growing above productivity temporarily.[13] As Caballero and Hammour (1996) and Blanchard and Philippon (2003) point out, on average capital's share of income has been rising along with unemployment in Europe since the mid-1980s, suggesting that in recent years wage restraint has been ample and that the real wage gap therefore is not the source of current unemployment.[14] The relevant point for our analysis is that we focus on year-to-year wage restraint because it is of declared and demonstrated importance to monetary policy decisions, not because it is necessarily an optimal intermediate target for central banks or because it is welfare enhancing in and of itself.

Operationally, we define wage restraint as the difference between the rate of real wage growth and productivity growth for a given country in a given year. A negative (positive) observation indicates below (above) productivity wage growth. We use two measures of productivity from the Organization for Economic Cooperation and Development (OECD). One is multifactor productivity (MFP) growth resulting as the residual from the OECD's growth accounting exercises; the other is growth in GDP per hour worked, calculated from national accounts data. The two measures are highly though not precisely correlated for multiyear averages, so we report all results below for both measures (where data are available). For consistency, we also rely on the OECD's total compensation per employee measure from its *Economic Outlook* as the source for our wage data. While we also undertook parallel investigations with the OECD's more narrowly defined "wage rate, business sector" series, we prefer total compensation because the data coverage is more complete and because the anecdotal evidence is that central banks pay more attention to changes in total compensation than in wages per se. Also, arguably there are wage negotiations where wage increases are kept low, but additional benefits with regard to pensions or the like are part of the package. To get real wage growth, we deflate each observation by the country-specific deflator (productivity growth is of course automatically in real terms).

Table 1 presents basic data on wage restraint for our full sample of 21 countries, comprising the 12 eurozone members, the three EU members outside the eurozone (Denmark, Sweden, and the United Kingdom), and six other advanced economies (Australia, Canada, Japan, Norway, Switzerland, and the United States). For three (Luxembourg, Norway, and Switzerland), data are available only on GDP per hour growth and not on MFP growth. Since the focus of the paper is on the impact of EMU on wage

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13. In current monetary policymaking, the analogy would be made to a supply-shock that embodied a relative price shift. If the relative price of labor was going up due to structural reasons, and not simply as a response to broader price pressures, the central bank could accommodate the relative price shift by only gradually tightening in response to any inflationary effects and largely withholding any interest rate response unless/until there were "second-round effects" of the wage increase on inflation expectations.

14. The outlier status of the US economy with regard to income and wealth inequality is not attributable to wage restraint either. As Dew-Becker and Gordon (2005) and Piketty and Saez (2006) recently demonstrated, the large increase in income going to the top 1 and 0.1 percent of earners in the United States over the recent decade is largely due to the extraordinary rise in executive pay cumulated over several years.

restraint, we compute annual averages for the pre-euro (1991–98) and post-euro (1999–2003 or 2004) periods, subject to data availability. The mean and median change in wage restraint in the sample is negative, meaning greater restraint in the post-euro period, for both measures of productivity. On productivity measured by MFP, the mean change is just short of being significantly different from zero at the 5 percent significance level (it is at the 7 percent significance level) and on the order of one percentage point (of the gap between productivity and wage growth) per year. Two countries, Greece and Sweden, show a significant increase in wage restraint under both measures, and two, Australia and the Netherlands, show a significant decrease in restraint under both measures, as can be seen more clearly in figure 1. Overall most EMU members showed no significant change in wage restraint post-EMU.[15]

III. FIVE THEORIES OF THE DETERMINANTS OF WAGE RESTRAINT

At any given moment, both unions and individual workers are conducting wage negotiations with employers. Results of most negotiations are determined by idiosyncratic factors specific to sectors, firms, or individuals. Other negotiations are largely determined by automatic factors like cost of living allowances, although their significance has declined since the 1970s. The overall macroeconomic environment, including productivity growth, however, also plays a role in wage negotiations, particularly since individual or industry productivity is often difficult to verify in real time. As bargaining becomes more collective and centralized, and especially when it takes place at a national level, such aggregate measures take on an even greater importance. Similarly, as central banks become more focused on maintaining low inflation (rather than reducing high inflation or pursuing other medium-term goals), the extent of wage pressures relative to productivity growth across the economy becomes a more salient issue. From these rather innocuous observations arise a number of theories about how labor and monetary institutions should influence wage restraint. Table 2 summarizes these theories with their empirical implication for restraint and whether they apply solely to eurozone members.

The first set of theories builds directly on Calmfors and Driffill (1988) and concerns the extent to which unions take into account the inflationary impact of their wage bargains as a function of their membership. The more encompassing the membership (i.e., the greater the share of workers represented by the union), the more the union internalizes the cost of inflation induced by wage pressures and thus the more

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15. Greece clearly has by far the largest change in wage restraint. Dropping Greece from our sample would of course drive down the average change observed but also decrease the standard deviation of changes observed, so the number of (eurozone) countries showing a significant increase in wage restraint in fact rises in that subsample. Details available from the authors upon request.

likely it is to exercise wage restraint.[16] In particular, Cukierman and Lippi (1999, 2001) and Iversen and Soskice (1998, 2000) develop models of games between the ECB and unions as compared with the form of wage bargaining within countries before EMU. Both sets of papers predict that after EMU there will be a coordination problem. Unions that used to be large relative to their respective country's total labor force, and whose bargaining their respective country's central banks would have to take into account as a result when the latter was focused on national inflation rates, will after EMU become small(er) relative to the eurozonewide labor market and will not have to be taken into account by an ECB focused on euro-zonewide inflation.

As a result, these models predict that wage restraint will decline after EMU. Unions' incentives for wage restraint are reduced in two ways: one, "excessive" wage demands will have less effect on overall inflation so the cost to the unions' members will be lower; two, and probably more importantly, wage restraint from unions within one country will be less likely to induce monetary ease from the ECB—and therefore growth and employment increases—that benefits their members because the impact on euro-zone-wide inflation will be smaller (countries where unions were already small or decentralized or absent would simply move further toward irrelevance for ECB monetary policymaking). So economies of large size before EMU where the central bank pursued an independent (nationally oriented as opposed to exchange-pegged) monetary policy should exhibit a significant decrease in wage restraint post-EMU—and this should be most marked in Germany, where not only was the economy the largest, while the Bundes-bank most clearly took into account domestic wage developments when setting policy, but also the unions were large, and there was (is) nationwide wage bargaining. There is no reason to think that this shift should affect non-eurozone member countries.

The second set of theories relates to the degree of international competition in product markets and was formalized by Danthine and Hunt (1994). In this framework, unions have some concern for the employment of their membership and recognize that employment will in part depend upon the price competitiveness of their home country's firms on world markets.[17] If wage increases outstrip productiv-ity while other countries' producers benefit from wage restraint, the home country producers could lose market share, and the union members could lose jobs. As a result, the greater the exposure to interna-tional competition, the greater the wage restraint (Danthine and Hunt [1994] portray this as a shift in the

16. In their famous U-shaped curve, Calmfors and Driffill (1988) suggest that extreme decentralization of wage bargaining will also lead to wage restraint because atomistic workers bargaining individually cannot drive up inflationary pressures. For purposes of considering the effects of EMU, the issue is whether economies on the "right" side of the hump with more concentrated wage bargaining move toward the suboptimal center where less internalization takes place, so we focus on that end here.

17. Katzenstein (1984) first suggested this feedback effect in his study of small states in world markets. Such internalization of competitiveness concerns, however, is also a staple of policy discussions where there is tripartite bargaining. See, for example, Honohan and Lane's (2002) depiction of the role of negotiated wage restraint in providing the conditions for the recent Irish miracle.

Calmfors-Driffill curve). In the context of EMU, we can derive the prediction that to the extent that the introduction of the euro increased intra-eurozone trade, whether through increased transparency, lower transaction costs, or other means, there should be greater wage restraint within the eurozone.[18]

A third set of theories comes more directly out of the political science tradition, though economists on the left in Europe sometimes support it. In this approach, the models of games between the ECB and labor unions become matters of outright bargaining between interest groups—where the ECB (like most central banks) is characterized as emphasizing inflation versus growth and employment objectives, while the labor representatives pursue the reverse (Garrett 1998, Hibbs 1987). The greater the political pull of the unions vis-à-vis the central bank, whether through threat of direct action because of union density and centralization or via the influence of elected representatives favoring union objectives, the lower the wage restraint because the central bank would be less willing (politically able) to "cut off" growth in the economy. Absent the threat to tighten policy, the central bank would be unable to prevent a rise in labor share, which would mean real wage growth outpacing productivity. This approach would predict that after EMU, wage restraint would increase because the ECB would be less accountable to democratic control (given its insulation from national politicians), and there is no comparable Europe-wide labor institution to bargain on workers' behalf. In particular, the countries where unions were more centralized and thus had greater political influence at home should see the greatest declines in wage restraint post-EMU.

A fourth set of theories has more to do with globalization and its impact on industrial democracies in general than with EMU per se. Given the effective rise in labor supply from emerging markets, which competes with production workers in advanced economies, and the increase in international capital mobility and institutions that make shifting of production to lower-cost sites easier, first-world workers face increasing pressure to remain competitive, if not decrease their unit labor costs. Add to this the more general trend toward deunionization in the major economies, or at least their private sectors, and the pressure for wage restraint should increase (Dumont, Rayp, and Willemé 2006).[19] This set of theories is in many ways parallel to the second set of theories regarding openness to competition, but rather than emphasizing the change in incentives for given union structures and densities, this framework suggests a decline in those union densities. Thus the empirical prediction of this approach is that wage restraint should increase—both in and outside the eurozone—but primarily for the larger countries where labor

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18. The discussion of the size of the increase in intra-European trade due to the adoption of the euro remains lively, with some very large estimates (e.g., Rose 2000) offered. See Baldwin (2005) and Frankel (2005) for a constructive debate over the accumulated empirical evidence.
19. Whether the trend to deunionization is a result of these forces or is itself an independent cause, at least in part, is beyond the scope of this paper.

was less subject to international competitive pressure in the past than in small countries that are already open.

The final set of theories of the determinants of wage restraint are those proposed by monetary economists and central bankers suggesting positive structural effects from EMU (e.g., European Monetary Institute 1998). In this framework, in economies where the central bank's commitment to price stability was less than credible, unions and workers had less incentive to take into account the costs of their own pursuit of inflationary wage settlements. On the one hand, their real wages were more likely to be eroded by increases in inflation, which would arise out of others' wage and price expectations (and negotiations), so union negotiators would feel they had more at risk from wage restraint; on the other hand, the likelihood of short-term costs to employment from "excessive" wage settlements would be lower because the central bank would be less credible in its threats to tighten policy should wage pressures rise.[20] This is the converse of the Bundesbank story behind the first set of theories discussed and as such is usually thought of as applying to Italy, for example, in the postwar period through the 1970s (or later). A rise in the credibility of central banks' commitment to price stability should therefore induce greater wage restraint by reducing the fear that restraint will be self-defeating and increasing the fear that the central bank will not accommodate wage increases. This theory's empirical prediction is that wage restraint should increase most for those countries that have the greatest increases in monetary credibility, whether through membership in EMU or through other means (such as the adoption of an inflation target).

IV. CROSS-SECTIONAL ANALYSIS OF POST-EMU CHANGES IN WAGE RESTRAINT

As discussed above, the limited number of observations available when considering these issues among the industrialized democracies encourages prudence in the use and interpretation of econometric analysis. Accordingly, when trying to sort out the impact of EMU on wage restraint, and the various theories of the determinants of wage restraint discussed in the preceding section, we stick to a simple approach. For those countries for which we have pre- and post-EMU average wage restraint observations (a total of 18),[21] we estimate ordinary least squares regressions of the form:

$$\Delta WR = \beta_0 + \beta_1 * eurodum + \beta_2 * (\text{union variable}) + \beta_3 * (\text{union variable}*eurodum)$$
$$+ \beta_4 * (\Delta \text{monetary credibility}) + \beta_5 * (\Delta \text{monetary credibility}*eurodum) + \varepsilon \qquad (1)$$

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20. Obviously, we do not assume a stable trade-off between inflation and unemployment or the absence of costs to inflation, hence the mention of "short-term costs to employment," since presumably central bank laxity would at some point induce real costs either from extra inflation and/or sharper tightening of policy.
21. As shown in table 1, we are missing observations for Luxembourg, Norway, and Switzerland.

where "eurodum" denotes membership in the eurozone, "union variable" is a measure of union density or centralization or coordination (taken from the literature), and "Δmonetary credibility" is a measure of the change in the credibility of the central bank's commitment to price stability between the two periods.

We use different trade union variables as a robustness check of our results. The first indicator is "trade union density," obtained from the OECD's *Employment Outlook 2004*, which utilized survey results to calculate this variable. We use the data on density in 1990 and 2000, labelling the variable "TUdense" in the estimation output. As a separate variable to control for trade union influence, we also use collective bargaining coverage, which is expressed as the fraction of the total labor force covered by collective bargaining. The OECD compiled the collective bargaining coverage rates, which it took or estimated from several sources (including direct submissions from national governments). Wherever possible, coverage rates were adjusted for employees (particularly in the public sector) who do not have full rights to bargain, though some public-sector workers obviously do (**OECD's** *Employment Outlook 2004*, chapter 3). **Once** again, we take values for 1990 and 2000 as pre- and post-EMU variables. Centralization and coordination of wage bargaining are the final two measures of trade union sway. These are constructed using survey data, also from the OECD, and are presented in the form of a cardinal scale from 1 to 5, increasing in half-point increments to indicate greater centralization/coordination.

We proxy the change in monetary credibility by the difference between monthly long-term (10-year) government bond yields averaged for 1995m1 to 1997m12 and 1998m1 to 2000m12.[22] A bigger difference indicates a larger decline in government bond rates and thus in inflation expectations and in doubts about the central bank's commitment to price stability. As shown in figure 2, there is a wide range of changes, with almost all economies in the sample seeing a minimum drop in bond rates of 150 basis points between the two periods considered, due presumably to global changes in inflation, the business cycle, and international arbitrage as the US and Japanese rates sank. Within Europe, as one might expect, Italy had the largest gain in credibility from EMU (more than 200 basis points above the eurozone average), with Portugal and Spain gaining next most, and then Greece.[23] Notably, however, Sweden and the United Kingdom also had substantial drops in long bond rates, higher than the average eurozone member, over the period despite staying out of the eurozone.

Given the predictions of the various theories as outlined in table 2, the effects of wage bargaining structure and density, conditional (or not) on eurozone membership, and of monetary credibility should allow us to distinguish between them (if the data are willing). Table 3 presents our results from

22. The data are taken from the IMF's *International Financial Statistics* database. The first average ends in 1997m12 to allow for changes in bond yields in anticipation of EMU, and the horizons are shorter before and after than the wage restraint horizons to focus on the credibility impact of monetary regime shifts at the time.
23. Greece itself did not join the eurozone until January 2001, so the change seen here is assumed to have captured only part of EMU's impact on the economy's inflation expectations, with markets discounting until membership was sure.

these cross-sectional (not panel) estimates (see appendix A for list of variables and data sources). The three sets of estimates present a consistent set of results. An increase in monetary credibility has a significant increasing effect (at the 5 percent significance level) on wage restraint, and this result is not dependent on eurozone membership (the (b) estimations) but is associated with all variation in monetary credibility in the sample.[24] The effect is economically meaningful as well with a 100 basis point drop in long bond rates associated with a 0.42 percent increase in wage restraint (the differential between productivity growth and real wage growth in percent terms). Given an average for the sample of change (increase) in wage restraint of 0.68 percent, this is a substantial effect. Such a large effect associated with decreased long-term interest rates is consistent with the last of the theories discussed in the preceding section: that greater central bank credibility would induce greater wage restraint. Given the imprecise estimates of the constant terms and of most of the coefficients on the other explanatory variables, changes in monetary credibility alone appear to explain 40 percent of the cross-national variation in changes in wage restraint.[25]

Trade union density interacted with economy size (TUdense*gdp) shows up as significant in the third regression, with a negative sign (it also has a negative coefficient significant at the 10 percent level in the first column, the other place it appears). The magnitudes are quite small, however, with coefficient estimates on the order of 0.00001. This would be weak evidence against the fourth set of theories discussed in the preceding section, since it implies that declining trade union density, conditional on being in a country large enough to have had some independence of labor supply, decreases wage restraint. It seems consistent with Calmfors-Driffill's underlying intuition that moving toward decentralization in the mid-range of unionization would reduce incentives to restraint. The average economic size in our sample is US$1,136.29 million (IMF's *World Economic Outlook 1999*). This means that a fall in trade union density from the sample average of 40 to 20 percent would lead to a nontrivial decline in wage restraint of 0.16 percentage point. Yet for the hump-shape argument, it is a problem that the sample mean of the density is 40 percent, since that would seem to put any declines in density to the right of the hump and therefore likely to lead to greater restraint.

Trade union density on its own, when not interacted with size of GDP, does not appear to be significant, just as the other measures of labor union organization and wage bargaining centralization do not, whether interacted with economic size or eurozone membership. This result is inconsistent with the third

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24. Note that wage restraint is defined to be negative (wage growth minus productivity growth), so the more negative the number, the greater the restraint. This is why there is a positive coefficient on the credibility variable: cred1 is also negative, representing a fall in long-term rates from pre-EMU to post-EMU period.

25. Given the size of the increase in intra-eurozone trade, this result seems to be a particularly clear rejection either of the hypothesis that an increase in trade openness and competition should increase wage restraint or of the assumption that a removal of (intra-eurozone) currency variation should make trade more competitive. The relative clarity of this result may be in part a function of the more direct measurement of this explanatory variable than of changes in labor market institutions.

set of theories in section II: that declining political power or centralization of unions after EMU insulated monetary policymaking from dealing with labor would explain the observed increase in wage restraint. The extent of trade within the eurozone (EMUtrade2), presumably the exposure to international competition most directly affected by the launch of the euro, also does not show up as having a significant effect on wage restraint, as opposed to the hypothesized positive coefficient.[26] As with the monetary credibility hypothesis, the determinants of wage restraint in the advanced countries appear on this data to be global (or by country) rather than associated with eurozone membership.

Particularly striking is the apparent rejection of the best formally developed theories of determination of wage restraint: those hypothesizing that a coordination problem would arise after EMU with the countries previously having unions that were large enough to internalize the costs of "excessive" wage demands showing a decline in wage restraint. As suggested in table 1, which shows the sample averages, the cross-sectional analysis in table 3 confirms that there is no association between the centralization or coordination of wage bargaining, whether conditional on size or not, and wage restraint for eurozone members—or for any countries in the sample. Since two distinct sets of models (Cukierman and Lippi 1999, 2001; Iversen and Soskice 1998, 2000) both make the strong prediction that wage restraint should have gone down after EMU, in contrast to the other theories predicting conditional increases in restraint—and instead wage restraint went up on average, and significantly so even when taking account of the institutional factors underlying these models—it seems time to reconsider those models. Before doing so, however, we turn to time-series data to examine from another angle the empirical validity of the clear and contrasting predictions of the first (wage restraint down conditional on EMU and wage bargaining structure) and last (wage restraint up conditional on change in monetary credibility but not on EMU) theories from table 2.

V. TIME-SERIES ANALYSIS OF WAGE RESTRAINT IN GERMANY AND ITALY

We are now into the seventh year since the launch of the euro. It is feasible to undertake time-series analysis of even low-frequency data that span the periods before and after EMU, in order to look for EMU's impact. With regard to wage restraint, the question is whether the adoption of the euro made any difference to year-by-year wage negotiations, given expected central bank reactions or nonreactions according to some theories. In the previous section we analyzed differences in multiyear averages for a set of 18

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26. Given the size of the increase in intra-eurozone trade, and the incidence of that expansion only for eurozone members, this result appears to be a particularly clear rejection of the trade competition increases restraint hypothesis. The relative clarity of this result may in part be a function of the more direct measurement of this explanatory variable than of the coding of labor market institutions, however.

countries; in this section we turn to cyclical variation (or not) in wage restraint as a function of interest rates and structural factors for a pair of countries from 1980 to 2003. While we leave for future research the estimation of the interaction between central bank reaction functions and wage equations, we hope to distinguish between the factors affecting wage restraint by carefully choosing the cases to consider.

Comparing the time-series behavior and determinants of wage restraint in Germany and Italy should allow us to see which effects of the euro are and are not evident. Germany was the economy with the de facto anchor currency of the pre-euro European Monetary System and had some of the largest unions with some of the most centralized and coordinated wage bargaining institutions in Europe. This combination of central bank independence (legally and in interest-rate setting) with centralized wage bargaining should have produced great incentives for wage restraint in Germany pre-EMU, according to the theories that emphasized incentives for union internalization of inflation costs. By the same token, the entry of Germany into the eurozone should have produced a marked drop in wage restraint—the German unions became notably smaller relative to the economic zone relevant for monetary policymaking, and monetary policymaking shifted away most clearly from a focus on German domestic inflation. In short, if the Cukierman-Lippi/Iversen-Soskice story in the spirit of Calmfors and Driffill should show up anywhere, it should be in a significant decline in wage restraint in Germany post-EMU. For fans of the monetary credibility story, there should either be no effect (assuming, as bond markets indeed seem to, that the ECB has just as credible a commitment to price stability as the Bundesbank did) or a slight decline in wage restraint.

For Italy, a different set of expectations is generated. As shown in figure 2, Italy enjoyed the largest credibility gain for its monetary policy commitment to low inflation upon admission to the eurozone. Prior to this credibility gain, Italy should have exhibited low wage restraint according to the theories emphasizing monetary credibility. In an economy where indexing was rife and inflation expectations were high and unanchored, there should have been little incentive for unions to exercise wage restraint—and little reason to think that the central bank would tighten policy in response to excessive wage growth.[27] After EMU, with a large gain in counterinflationary credibility for Italian monetary policy (set by the ECB), Italian unions and wage bargainers should have shown a significant increase in wage restraint.

Even if the ECB were not setting policy on the basis of Italian wage developments, the eurozone more generally would be following a policy consistent with price stability, while the Italian economy would no longer be able to devalue or inflate at (political) will. If the monetary credibility story in the

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27. Some commentators will insist that the Banca d'Italia did have significant counterinflationary credibility from the time of its "divorce" from the Italian Treasury or with the advent of later reforms. This begs credulity, given the revealed drop in long bond rates upon eurozone entry and the prior devaluations from the exchange rate mechanism (ERM)—let alone the desire of Banca d'Italia senior officials to gain eurozone entry.

spirit of the postwar Bundesbank beliefs should show up anywhere, it should be in an increase in wage restraint in Italy post-EMU. Of course, according to the wage bargaining coordination problem theories, Italy as a large economy should be subject to a lesser version of the same phenomenon besetting German wage bargaining with the move into the eurozone and so should show no effect on, or a slight decrease in, wage restraint post-EMU.

To examine the determinants of wage restraint in these two critical country case studies, we look at annual data from 1980 to 2003 for compensation and productivity growth. In contrast to the cross-sectional data on multiyear averages, here we utilize annual *nominal* compensation growth (from OECD 2004) along with contemporaneous GDP per hour growth (from Groningen Growth and Development Centre 2006) to construct wage restraint. The switch from nominal to real wages is to take into account the money illusion and more broadly the difficulty for workers and unions in discerning real productivity growth in real time. The actual computations of real GDP per hour or of the residual from growth regressions that economists produce and we use above only appear with a lag usually of several months to actual events, whereas often wage negotiations are on an annual or two- to three-year basis and are conducted in nominal terms.

To examine the competing hypotheses, we estimate on German and Italian data separately regressions of the form:

$$\text{WR} = \beta_0 + \beta_1 * \text{Output Gap} + \beta_2 * \text{inflation expectations} + \beta_3 * \text{EMU dummy}$$
$$+ \beta_4 * \text{nominal central bank interest rate} + \beta_5 * \text{additional variables} + \varepsilon \qquad (2)$$

where the additional variables include trade within the European Union, trade union density, and the spread between the country's and Swiss long-term bond rates as a proxy for the nation's central bank credibility. In the absence of time-series data on trade union density, we use the share of private-sector employment in the economy. Inflation expectations were obtained by Chinn and Frankel (2003)—they take the average of month-to-month annual consumer price index growth at 12-month leads and use it as an inflation expectation proxy. Our main interest is to see whether the EMU dummy is significant and negative, particularly for Germany, which would be consistent with the wage coordination story, or significant and positive, particularly for Italy, which would be consistent with the monetary credibility story.

Tables 4 and 5 present the results for Germany and Italy respectively (see appendix A for list of variables and data sources). All regressions have 24 observations except those in column II of each table, where data limitations on the trade union density variable limit us to 13 observations. For Germany (table 4), we find the only factor significantly affecting wage restraint is the central bank instrument interest rate (which is consistent with the Bundesbank wage restraint and deterrence story), with rises in that rate

increasing restraint. Interestingly, the sole significance of this variable does not change after EMU, seemingly implying that German wage bargainers continue to keep their eye on the ECB response to their negotiations much as they did on the Bundesbank's response. Surprisingly, even the German output gap and inflation expectations have no significant direct effects on wage restraint in Germany. There is no evidence in any of the estimates that a structural break occurred around German economic unification in 1990–91, so we do not report separate results. This is not entirely surprising given the small share and separation of the eastern German labor market in overall German employment. Finally, there is evidence of a statistically significant (but not economically large) effect of the public budget deficit on wage bargaining (model VI), where a larger deficit increases wage restraint, perhaps in anticipation of either budget cutbacks or monetary response. This factor also accounts reasonably well for year-to-year variation in wage restraint in Germany in all estimates I-V even though the central bank interest rate is the sole significant explanator.

For Italy (table 5), unemployment turns out to be a better measure than the output gap of the importance of the business cycle and has a consistently significant effect in the intuitive direction: an increase in unemployment increases wage restraint. Meanwhile EMU membership per se does not come in significantly for Italy, nor does the central bank interest rate itself—perhaps reflecting the de facto lack of independence of Italian monetary policy over the period. A direct measure of inflation expectations, however, is estimated to have a significant (5 or 10 percent level) and positive coefficient across most specifications, including ones where the EMU dummy is included, meaning that when there is a decrease in inflation expectations, wage restraint increases. In a similar spirit, the spread between the Italian and Swiss long-term government bond rates has a significant positive coefficient; when the spread increases, consistent with a decline in Italian monetary credibility, wage restraint diminishes. That this shows up strongly in Italy is consistent with the predictions of the monetary credibility theory of wage restraint. Unlike in Germany, there is no evidence that budget deficits have any effect on wage restraint, but like in Germany the various measures of trade union structure and trade have no discernable impact.[28]

VI. IMPLICATIONS FOR FUTURE RESEARCH

Enhanced monetary credibility, as proxied by the decrease in the long government bond rate after the launch of the euro, can explain a significant portion of the cross-sectional variation in the observed increase in wage restraint seen in European countries since 1999. The effect of monetary credibility on wage restraint is not limited to eurozone members, though; countries such as Sweden and the United Kingdom, which had a similarly measured gain in central bank commitment to price stability, also saw similar

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28.   In both the German and Italian time-series, one might expect the trade union coordination, centralization, and density variables to have limited explanatory power given their limited variation over the period.

significant increases in wage restraint. This effect occurred completely independently of the wage bargaining institutions in the countries involved. In fact, in contradiction of the theories that suggested a coordination problem would emerge post-EMU between labor representatives and the ECB in large economies where bargaining was centralized and conducted with their national central banks prior to EMU, there is no evidence of a decline in wage restraint in those countries. A closer look at time-series evidence for Germany, where that hypothesized effect was supposed to be strongest, offers no support for the theories; time-series evidence for Italy on the variation of interest rate spreads over time, on the other hand, strongly supports the view that monetary credibility matters irrespective of wage bargaining arrangements.

As always in this literature, given the limited sample of countries involved and the limited data (both cross-sectional and time-series) available on institutional change, these results cannot be taken as dispositive. Yet, despite the data limitations, the results presented here are surprisingly robust and clear, perhaps benefiting from the focus on the narrowly defined wage restraint variable. Given the strength of the predictions of the Cukierman-Lippi (1999, 2001) and Iversen-Soskice (1998, 2000) models that EMU should lead to a decline in wage restraint, particularly in large countries, the apparent rejection of those predictions should be taken seriously. The ECB has put a lower weight on individual countries' cyclical and wage developments—particularly Germany's—than the pre-EMU Bundesbank did when setting monetary policy (Posen and Popov Gould 2006; Hayo 2006), so the rejection is not because the ECB behaved contrary to expectations either in these models or more generally.

For future research, then, these results lead naturally to questions of what on the labor institution side was at work that coordination problems did not arise in wage bargaining post-EMU and, instead, wage restraint rose. When labor representatives appear on the basis of these results to be forward looking and concerned enough with macroeconomic conditions to respond to changes in counterinflationary credibility, it is somewhat surprising that the internalization dynamic for the effect of wage bargaining on inflation pressures does not carry through as well. Perhaps the labor representatives' utility functions in the above models were simply misspecified, with too little regard for employment effects and too much for the costs of inflation. Shiller (1996) and survey work that followed established a healthy dislike for inflation among a wide range of the populace in many of the countries considered here, but that is not equivalent to establishing such a dislike among labor leaders, where anecdotal, political science, and historical evidence has tended to show labor as being far more concerned about output and employment than inflation (at least at low-to-moderate levels of inflation).

Another related possibility is that the importance of these labor and union institutions in wage bargaining behavior was overestimated by theorists. This could have occurred because actual coordination or centralization of labor bargaining in practice is fundamentally mismeasured by the available coded classifications. More moderately, while these institutions could have had some sway, they also could have al-

lowed for a great deal of variation in bargaining behavior over time, and those variations were not picked up in the available measures and thus drove down the estimates of the institutional codings' impact our analyses. This scepticism may seem on the face of it unlikely, given the long emphasis on tripartite bargaining and corporatism in Europe, as well as the supposed recent successes of such mutual accommodation in Ireland, the Netherlands, and Sweden, and so the results here should not be used to impugn institutional factors altogether. Yet, it remains possible that the effect or effectiveness of these labor market institutions is endogenous to the political and economic forces in civil society and so produces the degree of wage restraint in keeping with the political pressures at any given time, largely irrespective of apparent form.[29]

In any event, it may be necessary to go beyond investigating wage restraint (let alone unemployment or inflation outcomes) at the national level and consider sectoral differences in both wage bargaining structures and degree of wage restraint. Such an approach might not only better distinguish between these potential explanations for the absence of impact of wage bargaining structures on changes in wage restraint in the OECD in the last 15 years but also allow for more direct grappling with the alternative hypotheses advanced in section III, particularly regarding the influence of globalization and competition on wage setting.[30]

For analysts of monetary policy, especially in the eurozone, at least one message is clear: The ECB has delivered wage restraint on the Bundesbank deterrence model where adoption of the euro led to credible declines in inflation expectations. This could be taken to indicate that concerns about establishing monetary toughness or the emergence of wage-push inflation pressures are unnecessary, especially since the adoption of inflation targeting in Sweden and the United Kingdom led to similar effects without any suggestion that they went through a similar proving process.

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29. See Posen (1998b) for a general discussion of the endogeneity of institutional impact in political economy and macroeconomics.
30. We are grateful to Philip Lane for this latter suggestion regarding globalization.

APPENDIX A LIST OF VARIABLES AND DATA SOURCES

a. For cross-sectional analysis

Variable name	Variable label	Data source
cntry	country name	
MFPnom	wage restraint: nominal compensation growth minus MFP growth	OECD's *Economic Outlook* (for compensation); OECD's Productivity Database (for MFP, GDP per hour)
GDPnom	wage restraint: nominal compensation growth minus GDP per hour growth	
MFPreal	wage restraint: nominal compensation growth minus MFP growth	
GDPreal	wage restraint: real compensation growth minus GDP per hour growth	
EMUtrade1	country's trade with eurozone countries, average 1995–98	IMF's *Direction of Trade Statistics* database
EMUtrade2	country's trade with eurozone countries, average 1999–2004	
cred1	credibility gain from euro: pre-emptive convergence assumed	Government long-term bond yield data are from IMF's *International Financial Statistics* database
cred2	credibility gain from euro: no pre-emptive convergence assumed	
central1	centralization of bargaining, 1990–94	Driffill (2005)
central2	centralization of bargaining, 1995–2000	
coordin1	coordination index, 1990–94	
coordin2	coordination index, 1995–2000	
collect1	collective bargaining coverage, 1990	
collect2	collective bargaining coverage, 2000	
TUdense90	trade union density, 1990	OECD's *Employment Outlook 2004*
TUdense20	trade union density, 2000	
gdp	1999 GDP, current prices, billions of dollars	IMF's *World Economic Outlook* database
TUdense90*gdp	interacted term: TU density in 1990, GDP	
TUdense20*gdp	interacted term: TU density in 2000, GDP	
eurodum	eurozone member dummy	
cred1*eurodum	interacted credibility with euro dummy	
cred2*eurodum	interacted credibility with euro dummy	
central1*gdp	interacted centralization with GDP	
central2*gdp	interacted centralization with GDP	
central1*eurodum	interacted centralization with euro dummy	
central2*eurodum	interacted centralization with euro dummy	
coordin1*eurodum	interacted coordination with euro dummy	
coordin2*eurodum	interacted coordination with euro dummy	
collect1*gdp	interacted collective bargaining coverage	
collect2*gdp	interacted collective bargaining coverage	

(appendix continues next page)

APPENDIX A *(continued)*

b. For Time-Series Analysis: Germany and Italy

Variable name	Variable label	Data source
year	time variable	
restr_c_r	wage restraint: contemporaneous, real compensation growth	Total compensation data from OECD (2004); GDP per hour from Groningen Growth and Development Centre (2006)
restr_l_r	wage restraint: 1 period lagged productivity growth, real compensation growth	
restr_c_n	wage restraint: contemporaneous, nominal compensation growth	
restr_l_n	wage restraint: 1 period lagged productivity growth, nominal compensation growth	
gap	output gap	OECD (2004)
nongovtempl	share of total employment not in public sector	
unempl	unemployment rate	
structdefchng	percent change in structural deficit	
gdp	GDP, billions of US dollars	
TUden	trade union density	Visser (2006)
inflexpect	inflation expectations	IMF's *International Financial Statistics* database (12-month average m-to-m CPI growth, 12-month lead)
r	Buba/ECB money market interest rate	IMF's *International Financial Statistics* database
spread	Italian-Swiss long-term government bond spread	
trade_eu	Italian trade with eurozone countries, percent GDP	IMF's *Direction of Trade Statistics* database
trade_tot	total Italian trade (X + M), percent GDP	
EMU	start of EMUIII dummy	

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Table 1 Changes in average wage restraint between 1991–98 and 1999–2004

Country	Real compensation minus MFP	Real compensation minus GDP per hour
Australia[b]	0.010*	0.012*
Austria[a]	−0.006	0.004*
Belgium	0.004*	0.003
Canada	−0.007	−0.002
Denmark	0.007*	0.003
Finland	−0.007	0.002
France[b]	−0.009	−0.006
Germany[c]	−0.003	0.004*
Greece	−0.093*	−0.096*
Ireland	−0.001	−0.001
Italy	−0.022	−0.006
Japan[b]	−0.015	-0.015
Luxembourg	n.a.	0.004*
Netherlands	0.011*	0.010*
Norway	n.a.	0.003*
Portugal[a]	−0.006	0.002
Spain[b]	−0.012	−0.01
Sweden	−0.025*	−0.021*
Switzerland	n.a.	−0.017*
United Kingdom	−0.022*	−0.015
United States	−0.004	−0.008
Average of EU12	−0.0117	−0.0086
Average of non-EU12	−0.0079	−0.0065
Mean	−0.0102	−0.0068
Standard error	0.0054	0.0046
Median	−0.0065	−0.0013
Confidence level:		
95 percent	0.0113	0.0096

* = significantly different from the mean, at 5 percent.

MFP = multifactor productivity

n.a. = not available

a. MFP growth 1996–99 average.

b. MFP growth 1999–2002 average.

c. 1992–98 average.

Note: Differences between 1991–98 and 1999–2004 averages of productivity growth and compensation growth are subtracted from each other.

Table 2 Hypotheses on the effect of EMU on wage restraint

Channel of transmission	Effect on wage restraint	Conditionality of effects	Eurozone only?
Relative size of external effects	Decreases	Larger on larger countries or those with independent monetary policy	Yes
Openness to international competition	Increases	Larger on those countries with high intra-EMU trade	Yes
Unions' political bargaining power (not versus firms)	Increases	Larger for those countries with more centralization	Yes
Decreased union density	Increases	Larger for large countries where unions had more security from competition	No
Counterinflationary credibility of central bank	Increases	Larger for those countries who gain more credibility	No

Table 3 Cross-section wage restraint analysis: Regression results

Variable	Model 1		Model 1(b)		Model 2		Model 2(b)		Model 3		Model 3(b)	
	Coefficient	P>t	Coefficient	P>t	Coefficient	P>t	Coefficient	P>t	Coefficient	P>t	Coefficient	P>t
TUdense20	0.0000	0.97	0.0000	0.80					−0.0001	0.29	−0.0001	0.42
TUdense20*gdp	-0.0001	0.09	0.0000	0.39					−0.0000*	0.02	0.0000	0.21
collect1					0.0001	0.33	0.0001	0.42				
collect1*gdp					0.0000	0.44	0.0000	0.92				
central2*eurodum	0.0011	0.73	0.0020	0.60	0.0008	0.82	0.0029					
coordin2*eurodum									0.0068	0.08	0.0062	0.20
cred1	0.0042*	0.04			0.0045*	0.04			0.0038*	0.03		
cred1*eurodum			0.0026	0.40			0.0018	0.53			0.0032	0.27
EMUtrade2	0.0006	0.96	0.0059	0.70	-0.0032	0.82	0.0080	0.67	-0.0044	0.66	-0.0014	0.92
eurodum	0.0045	0.74	0.0026	0.88	0.0072	0.68	-0.0052	0.85	-0.0186	0.24	-0.0114	0.56
_cons	0.0042	0.53	-0.0028	0.69	-0.0051	0.60	-0.0141	0.24	0.0103	0.13	0.0012	0.88
Adjusted R-squared	0.3237		-0.0423		0.297		-0.0383		0.5095		0.0717	
n	16		16		15		17		16		18	

**, * = significant at 1and 5 percent levels, respectively.

Notes: "Real compensation growth-GDP per hour growth" is the dependent variable. Countries include EU-15 members, Australia, Canada, Japan, and the United States. X(b) signifies the same model as model X but interacting the credibility variable with the euro membership dummy. For list of variables and sources, see appendix A.

Table 4 Time-series analysis: German wage restraint, 1980–2003

Variable	Model I		Model II[a]		Model III		Model IV	
	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error
restr_c_n								
gap	−0.0006	0.001	−0.0028	0.002	−0.0006	0.001	−0.0012	0.002
r	0.0054***	0.002	0.0076*	0.004	0.0057**	0.002	0.0062**	0.002
inflexpect	0.3538	0.353	0.6476	0.786	0.3108	0.374	0.3063	0.384
EMU			0.0113	0.013	0.0089	0.011	0.0087	0.011
TUden			−0.0004	0.003				
nongovtempl					−0.1922	0.33		
trade_eu							0.0049	0.109
trade_tot							−0.0623	0.094
spread								
structdefchng								
constant	−0.020***	0.007	−0.0285	0.063	0.1435	0.288	−0.0036	0.04
Adjusted R-squared	0.62		0.7		0.59		0.57	
n	24		13		24		24	

Variable	Model V		Model VI		Model VII	
	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error
restr_c_n						
gap	−0.0012	0.002	−0.0009	0.001	−0.001	0.002
r	0.0064**	0.003	0.0054**	0.002	0.0055**	0.002
inflexpect	0.3615	0.41	0.5218	0.368	0.481	0.405
EMU	0.0041	0.008	0.0058	0.008	0.016	0.022
TUden						
nongovtempl					−0.268	0.662
trade_eu					−0.092	0.205
trade_tot					−0.019	0.098
spread	−0.0019	0.006				
structdefchng			−0.0004*	0	0	0
constant	−0.0228**	0.01	−0.026	0.009	0.231	0.601
Adjusted R-squared	0.59		0.64		0.58	
n	24		24		24	

***, **, * = significant at 1, 5, and 10 percent levels, respectively.

a. Model II: Trade union density time series extends only from 1990 to 2003 for Germany.

Notes: Dependent variable: Wage restraint calculated using annual nominal compensation growth and contemporaneous GDP per hour growth.

Table 5   Time-series analysis: Italian wage restraint, 1980-2003

Variable	Model I Coefficient	Standard error	Model II[a] Coefficient	Standard error	Model III Coefficient	Standard error	Model IV[b] Coefficient	Standard error
restr_c_n								
gap	−0.0005	0.003						
unempl			−0.0122***	0.003	−0.023**	0.009	−0.010*	0.005
r	0.0016	0.003	0.0007	0.002	−0.0048	0.007	0.0017	0.003
inflexpect	1.1634***	0.17	0.781***	0.167	−0.6536	0.891	0.4501	0.261
EMU					−0.0011	0.022	−0.0205	0.013
TUden					0.0117	0.01		
nongovtempl							1.7866	1.416
trade_eu								
trade_tot								
spread								
structdefchng								
constant	−0.0128	0.011	0.128***	0.039	−0.1256	0.296	−1.3656	1.217
Adjusted R-squared	0.82		0.89		0.46		0.89	
n	24		24		13		24	

| Variable	Model V Coefficient	Standard error	Model VI Coefficient	Standard error	Model VII Coefficient	Standard error	Model VIII Coefficient	Standard error
restr_c_n								
gap								
unempl	−0.013**	0.006	−0.013***	0.004	−0.015***	0.004	−0.0091	0.006
r	0.0004	0.003	−0.0006	0.002	−0.0004	0.002	0.003	0.003
inflexpect	0.700***	0.206	0.476**	0.197	0.683***	0.193	0.4276	0.336
EMU	−0.0154	0.02	0.0023	0.013	−0.0125	0.013	−0.0265	0.022
TUden								
nongovtempl							1.8887	1.835
trade_eu	−0.0563	0.452					0.1778	0.494
trade_tot	0.0718	0.1					0.0589	0.134
spread			0.004**	0.002				
structdefchng					−0.0035	0.014	−0.0143	0.017
constant	0.1174	0.108	0.129**	0.052	0.167***	0.054	−1.5261	1.55
Adjusted R-squared	0.88		0.91		0.89		0.88	
n	24		24		24		24	

***, **, * = significant at 1, 5, and 10 percent, respectively.

a. Model II - Trade Union density time series only extends from 1990 to 2003 for Italy.
b. Model IV estimated with wage restraint calculated with 1-period lagged GDP per hour growth, which yields a significant result for inflation expectations.

Note: Dependent variable: Wage restraint calculated using annual nominal compensation growth and contemporaneous GDP per hour growth.

Figure 1 Change in average wage restraint between 1991–98 and 1999–2004
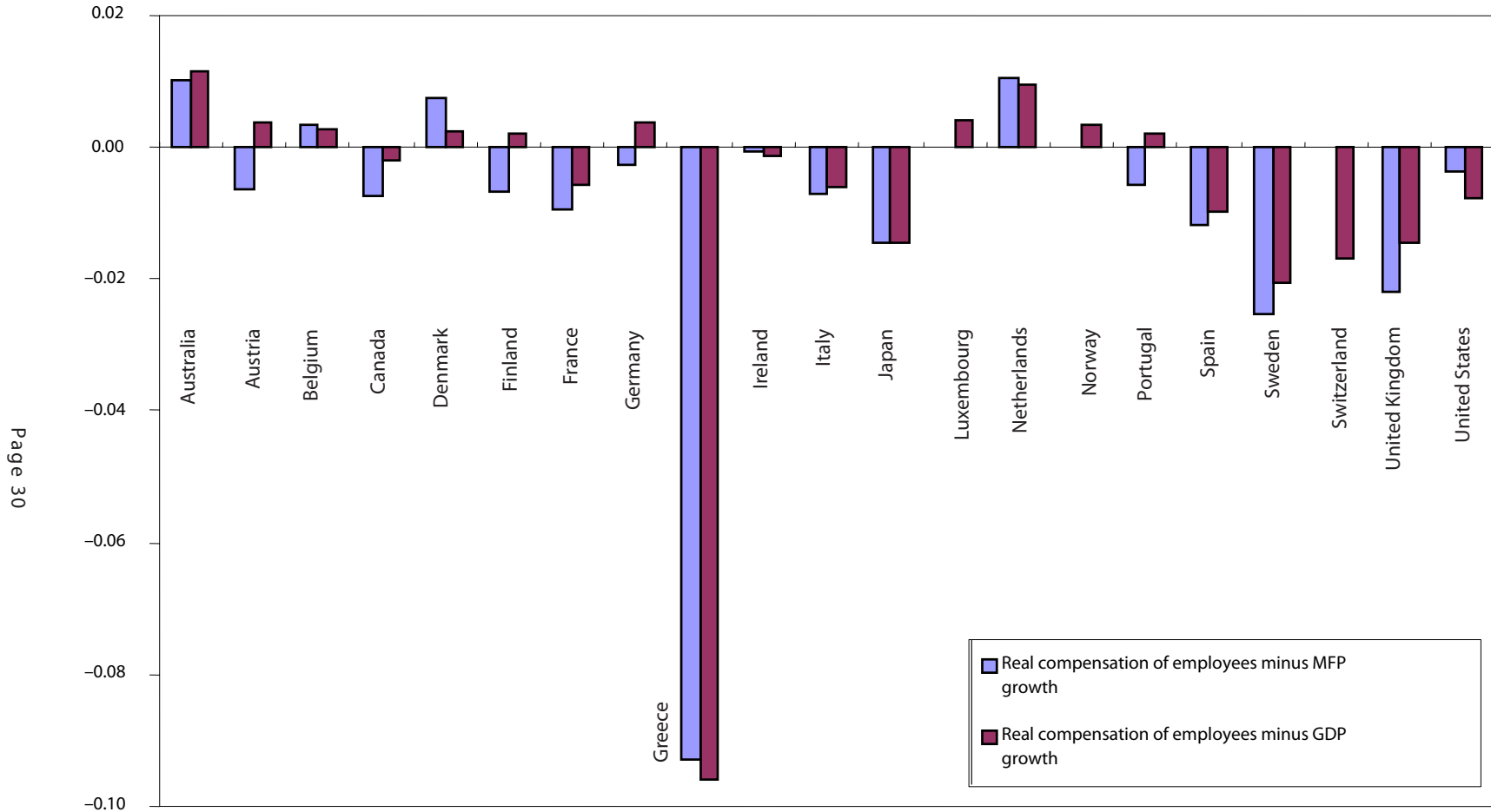
Source: OECD and authors' calculations.

**Figure 2 Credibility proxy: Difference between pre- and post-euro
real long-term government bond rates** (three-year averages)
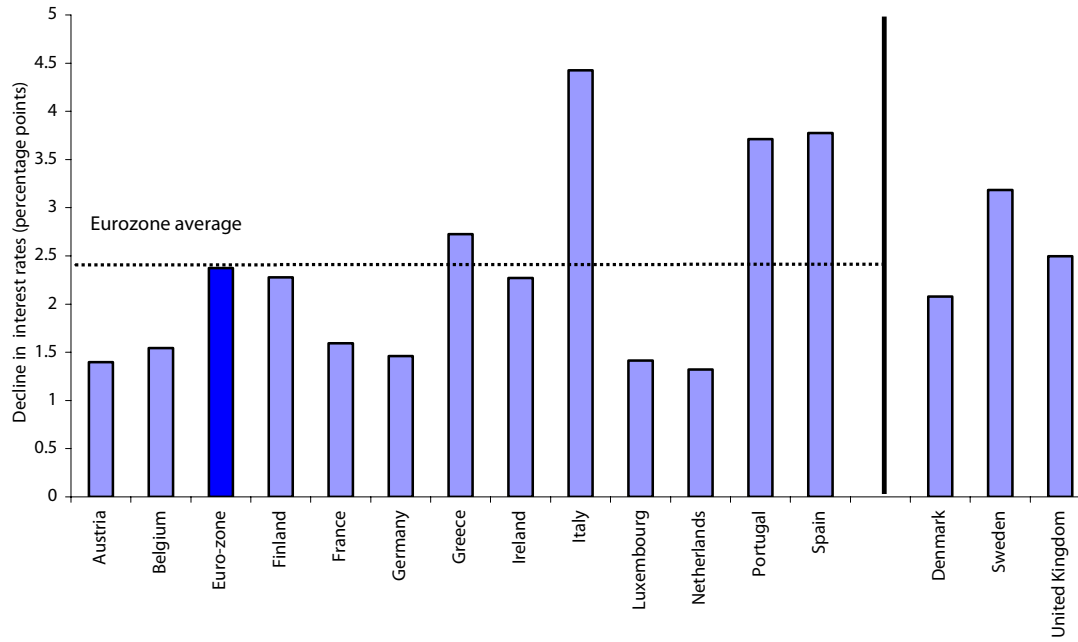
Note: Calculated as the difference between long-term government bond yield averages for 1995m1 to 1997m12 and 1998m1 to 2000m12 periods.

Source: Data are from IMF's *International Financial Statistics.*