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Central bank conservatism and labor market regulation

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Abstract

How does central bank conservatism affect labor market regulation? In this paper, we examine the economic forces at work. An increase in conservatism triggers two opposite effects. It reduces the inflation bias of discretionary monetary policy and hence the cost of regulation. It also increases unemployment variability, making regulation more costly. In combination, the two effects produce a hump-shaped relation between conservatism and labor market regulation. To test this prediction, we use data for 19 OECD countries for the period 1980–1994. Our proxies for regulation are unemployment, different labor market institutions, and indices of labor market regulation. Conservatism is proxied by two common measures of central bank independence. We find support for the prediction of a hump-shaped relation between conservatism and labor market regulation.

JEL classification: E58; E63; J38
Keywords: Central bank independence; Labor market regulation; Credibility; Flexibility; Inflation; Unemployment

1. Introduction

Monetary policymakers often express concern about structural problems in the labor market. Typically, they point out that monetary policy is not the solution to structural

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problems and that such problems therefore need to be addressed by other policy measures. This concern is easy to understand, because apart from having their own merits, policies aimed at solving structural problems would also facilitate the central bank's efforts to maintain price stability. The problem is that substantial political costs are a major impediment to labor market deregulation.

In view of this, it seems interesting to explore how the prospects of labor market regulation are influenced by monetary policy. Although monetary policy is neutral in the long run and cannot by itself reduce equilibrium unemployment, we will argue that the monetary policy regime can have real effects by influencing the government's preferred labor market policy.

The starting point of our analysis is the well-known time inconsistency problem associated with discretionary monetary policy, first analyzed by Kydland and Prescott (1977) and Barro and Gordon (1983). The basic idea is that wage setters recognize the policymaker's incentive to exploit the short run Phillips curve and foresee the inflation created by monetary policy. In equilibrium, structural unemployment is unaffected by monetary policy, but inflation is positive. By appointing a conservative central banker, the inflationary bias can be reduced at the expense of greater unemployment variability, as suggested by Rogoff (1985) and others.

In view of this trade-off, there will be two effects of increased conservatism on labor market regulation: a *credibility effect* and a *stabilization effect*. The credibility effect arises because labor market regulation, by increasing equilibrium unemployment, worsens the credibility problem and hence equilibrium inflation. Average inflation is relatively low if the central bank is very conservative and unemployment enhancing regulation is then not very costly in terms of higher inflation. Hence, there will be more labor market regulation if the central bank is more conservative. The stabilization effect works in the other direction. Conservatism increases the variability of unemployment and therefore aggravates the consequences of labor market regulation. To put it differently, if the central bank does not act to avoid bad outcomes, the government has no other alternative than to deregulate the labor market to alleviate the consequences of shocks to unemployment.

In this paper, we add a government and labor market policy to a simple Barro and Gordon (1983) model of discretionary monetary policy and analyze the interaction between the credibility and the stabilization effect. We show that in combination, the two effects give rise to a hump-shaped relation between conservatism and labor market regulation. The reason is that for very high levels of conservatism, the credibility problem is minute. At the same time, the stabilization effect is very strong because the central bank makes little effort to stabilize unemployment. At the other extreme, very low levels of conservatism give rise to a severe credibility problem, whereas the stabilization effect is negligible because the central bank puts much effort into stabilizing unemployment. From this, it follows that neither effect is negligible for medium levels of conservatism. But because each effect is relatively weak compared to the extreme cases, the model predicts more regulation for medium levels of conservatism.

We also carry out an empirical investigation of the relation between central bank independence (as a proxy for conservatism) and unemployment, labor market institutions,

as well as three indices of labor market regulation in 19 OECD countries. The empirical findings provide support for the existence of a hump-shaped relation between conservatism and labor market regulation.

This paper belongs to a growing literature claiming that monetary regimes influence labor market policy. Unlike this paper, the focus in the literature has been on whether a common monetary policy will promote labor market reforms. Berthold and Fehn (1998) argue that labor market reform will be lower if monetary policy is coordinated (as in EMU). This result hinges on the assumption that decisions on labor market reform are made nationally. Hence, lower unemployment in a single country will only reduce inflation in EMU marginally. Consequently, the incentives for reform are greater outside than inside EMU. The same argument has been advanced by Calmfors (2001), who also recognizes that if national governments have precautionary motives, there may be more labor market reform within EMU. Sibert and Sutherland (2000) also expect less labor market reform inside than outside EMU, but for slightly different reasons. They argue that in the presence of international spillovers, uncoordinated national monetary policies lead to higher inflation than a monetary union would. Hence, there will be less reform within a monetary union because a reform brings about a smaller decrease in inflation when inflation is already low.

We consider mechanisms similar to the ones mentioned above, but we depart from the focus on monetary union. Because there has been a move towards more independent and conservative central banks across the world, we find it interesting to analyze how this could affect labor market policy.

2. A model of monetary policy and labor market regulation

We use a model similar to Sibert and Sutherland (2000) and Calmfors (2001) to analyze how the government's choice of labor market regulation depends on the central bank's degree of conservatism. Labor market regulation increases both average unemployment and the impact of temporary shocks to unemployment. Inflation is an additional cost of regulation, because the time inconsistency problem of discretionary monetary policy increases with unemployment. Nevertheless, the government may choose to regulate the labor market for political reasons.

2.1. Sequence of events

We model the interaction between a government and an independent central bank as a sequential game with two stages. In the first stage, the government can change the institutions of the labor market. This choice of regulation is captured by a composite variable, r, which increases unemployment. In the second stage, monetary policy is determined by the central bank. The government's decision is placed in the first stage, because the laws and institutions that regulate the labor market are typically fixed for a longer period of time than monetary policy is. Lengthy parliamentary procedures also help placing the first mover advantage in the hands of the government. The sequence of events is depicted in Fig. 1.

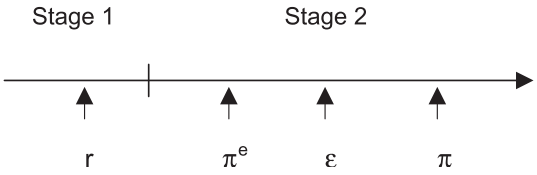

Fig. 1. The sequence of events.

In the beginning of the second stage, the private sector forms rational inflation expectations, π^e. Then the economy is hit by a supply shock $\varepsilon \sim [0,\sigma^2]$. Having observed this shock, the central bank sets the rate of inflation, π. Unemployment is given by

$$u = \bar{u}r - (\pi - \pi^e) - \varepsilon r, \tag{1}$$

where $\bar{u}$ is the natural rate of unemployment that would prevail in the absence of expectational errors and supply shocks (and when regulation, r, equals unity). Regulation magnifies the natural rate and also the impact of the supply shock, ε. Unemployment is also affected by inflation surprises, $(\pi - \pi^e)$.[1] When the government decides on labor market regulation, it has to anticipate how the consequences of this choice depend on future monetary policy. The model is solved by backward induction.

2.2. Preferences

We assume that the central bank has the following standard loss function over the target variables π and u

$$L_{\mathrm{cb}} = \frac{1}{2}\left(\pi^2 + \lambda_{\mathrm{cb}} u^2\right), \tag{2}$$

where λ_{cb} measures the central bank's weight on unemployment deviations. The higher is λ_{cb} the less conservative is the central bank. The government is assumed to minimize the expectation of the following loss function, conditional upon information available in the first stage:

$$L_{\mathrm{g}} = \frac{1}{2}\left(\pi^2 + \lambda_{\mathrm{g}} u^2\right) - \gamma r, \tag{3}$$

where λ_{g} is the weight the government places on unemployment deviations. The third term represents a political gain which the government enjoys if it regulates the labor market.[2]

[1] The interaction of shocks and institutions is emphasized by Blanchard and Wolfers (2000). Like Sibert and Sutherland (2000), we prefer this simple structure to a more complicated setup for which analytical results would be impossible to obtain.

[2] It is widely held that deregulation is a hazardous undertaking (see, e.g., "The right rejected in France" in the Economist, June 7th 1997). More specifically, Visser and Hemerijck (1997) refer to the 1997 election in France when Mr. Chirac's Centre-Right coalition lost more than 200 of its 464 seats in the 577-member parliament, and to the 1994 general elections in the Netherlands when the main managers of reform, the Christian Democrats and the Social Democrats, lost one-third and one-quarter of their electoral support.

The political gain may arise for several reasons. Labor market regulation offers insurance—especially the majority of employed insiders have much to gain and relatively little to lose from it (see, e.g., Saint-Paul, 1996; Bean, 1998). Governments are also allured to regulate markets because the benefits typically occur before the costs. For convenience, we have assumed the political gain to be linear in the amount of regulation. The political gain does not appear in the loss function of the central bank because, unlike politicians, central bankers do not have to please a majority of voters to be reelected. Because the reputation of the central bank takes time to establish, we believe that the government will treat conservatism as an exogenous variable.

We assume that the government attach a higher weight to unemployment deviations than the central bank does, i.e., $\lambda_g > \lambda_{cb}$. This is a quite reasonable assumption given that central banks are often judged by the rate of inflation. The possibility to reduce inflation by appointing a conservative central banker also provides support for the assumption.

2.3. Solving the model

The central bank's choice of inflation and unemployment is found by minimizing Eq. (2) with respect to π, using Eq. (1) and noting that $\bar{u}$, r, and π^e are predetermined variables. This yields

$$\pi = \lambda_{cb}\bar{u}r - \frac{\lambda_{cb}}{1+\lambda_{cb}}\varepsilon r \tag{4}$$

and

$$u = \bar{u}r - \frac{1}{1+\lambda_{cb}}\varepsilon r. \tag{5}$$

Average inflation is positive, and the central bank partly stabilizes the shocks to unemployment.[3] Both unemployment and inflation are increasing in r, the amount of labor market regulation.[4] The government's optimal choice of regulation is found by minimizing the expectation of Eq. (3) subject to Eqs. (4) and (5). This choice is

$$r = \frac{\gamma}{(\lambda_g + \lambda_{cb}^2)\bar{u}^2 + \dfrac{\lambda_g + \lambda_{cb}^2}{(1+\lambda_{cb})^2}\sigma^2} \tag{6}$$

Obviously the amount of regulations increases in the political gain, γ. The effect of conservatism on regulation is less obvious, because the central bank's weight to output

[3] In order to have $u \geq 0$, the model requires the assumption $\varepsilon \leq \bar{u}(1+\lambda_{cb})$.

[4] Another implication of the model is that inflation and unemployment are positively correlated. Walsh (1997) reports that the natural rate of unemployment appears to increase inflation if central bank conservatism is measured by two of the indices that we use in this article. (The indices are LVAU and GMTpol. They are presented in Section 3.) The inflationary bias could originate from market failures or distortionary taxation that increase unemployment above its efficient level.

deviations, γ_{cb}, is contained in both of the terms in the denominator. Upon closer inspection, we can distinguish two effects of conservatism on labor market regulation: a credibility effect and a stabilization effect. We isolate the credibility effect by letting the variance of the supply shock equal zero (σ^2=0). When the second term in the denominator vanishes, the effect of increased conservatism (lower λ_{cb}) is to increase labor market regulation. Increased conservatism reduces the credibility problem and hence equilibrium inflation; and if credibility is not a problem, labor market regulation is not very costly in terms of higher inflation. To isolate the stabilization effect, we eliminate the inflation bias by reducing the natural rate of unemployment, $\bar{u}$, to zero. This eliminates the inflation bias and the first term in the denominator. Looking only at the second term in the denominator the effect of increased conservatism (lower λ_{cb}) is to reduce labor market regulation. Increased conservatism reduces the central bank's efforts to stabilize unemployment. Because supply shocks have a large impact under heavy regulation, regulation is relatively unattractive to the governments if the central bank is very conservative.

After having demonstrated that central bank conservatism has two counteracting effects on labor market regulation, the obvious question is how conservatism affects regulation when both effects are at work. This is determined by the derivative of Eq. (6) with respect to λ_{cb}. The sign of this derivative is determined by the expression

$$\lambda_g\sigma^2(1+\lambda_{cb})-\lambda_{cb}\sigma^2(1+\lambda_{cb})-\lambda_{cb}\bar{u}^2(1+4\lambda_{cb}+6\lambda_{cb}^2+4\lambda_{cb}^3+\lambda_{cb}^4)\gtreqless 0 \qquad (7)$$

It turns out that Eq. (6) implies a hump-shaped relation between conservatism and labor market regulation. To understand the hump-shaped relation, which is depicted in Fig. 2, note that the stabilization effect will dominate if conservatism is high (λ_{cb} is low) enough. In the extreme case of strict inflation targeting (λ_{cb}=0), there is no inflation

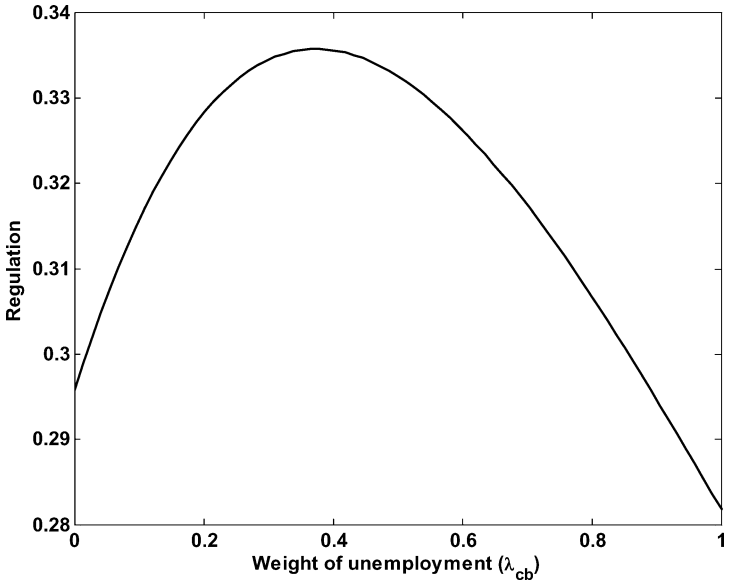

Fig. 2. Central bank conservatism and labor market regulation. (γ=3, λ_g=6, $\bar{u}$=1.1, σ^2=0.5).

bias. Hence, the credibility effect disappears but the stabilization effect remains because the central bank does not stabilize shocks at all. To show that the credibility effect dominates when conservatism is low (λ_{cb} is high) enough, we note that the last term in Eq. (7) will eventually dominate when λ_{cb} increases without bound. Intuitively, when conservatism is low, the central bank's lack of credibility gives rise to a high inflationary bias. On the other hand, the central bank's strong concern for unemployment results in vigorous efforts to stabilize shocks. All in all, the amount of regulation is highest for intermediate levels of conservatism. In such cases the central bank cares more equally about inflation and unemployment, and the government is less worried about either variable.

3. Empirical evidence

The model predicts that central bank conservatism will affect the amount of labor market regulation. For high levels of conservatism, we expect a negative influence, whereas for low levels of conservatism, we expect the relation to be positive. To test these implications, we need data on conservatism and labor market regulation. Because conservatism and central bank independence are related concepts, sometimes even used interchangeably, we will use indices of central bank independence (CBI) as proxy variables for conservatism.[5]

We use Cukierman and Lippi's (1999) index of legal CBI for 19 OECD countries for the years 1980, 1990, and 1994 (henceforth referred to as LVAU), as well as the indices in Grilli et al. (1991) for 16 OECD countries for 1980 and 1990. Grilli et al. report three indices: one index of economic independence (GMTec), one index of political independence (GMTpol), and the sum of them (GMTtot).[6] Political independence is defined as the capacity to choose the final goal of monetary policy. Economic independence is defined as the capacity to choose the instruments with which to pursue these goals. Cukierman and Lippi's index ranges continuously between zero (least independent) and one (most independent), whereas GMTec ranges discretely between 0 (least independent) and 7 (most independent), and GMTpol ranges discretely between 0 and 8, implying that their sum, GMTtot, ranges between 0 and 15. Appendix A displays the indices. In addition to

[5] A potential drawback with this approach is that it may be important to distinguish independence from conservatism, as suggested by Lohmann (1992), Eijffinger and Hoeberichts (1998), Franzese (1999), and Berger et al. (2001). However, Cukierman and Lippi (1999) point out that existing measures of central bank independence measure both the relative objectives of the central bank and the central bank's ability to realize those objectives. They therefore use the "effective degree of conservativeness" and central bank independence interchangeably. Moreover, in Jordahl and Laséen (1999), we show that central bank independence can influence labor market regulation in a similar way as conservatism does, although this relation is not always hump-shaped.

[6] Due to the large amount of studies on the relations between central bank independence and macroeconomic performance, several other indices of central bank independence have been constructed. See, e.g., Alesina (1988), Cukierman (1992), Eijffinger et al. (1998), or Mangano (1998) for a discussion. We have chosen to work with the indices in Cukierman and Lippi (1999) and Grilli et al. (1991), because they are used most frequently in the literature.

the arguments presented in Section 2, the small variation in CBI for a given country also points towards treating conservatism as exogenous.

The situation is more difficult when it comes to labor market regulation, which typically consists of a multitude of different policies. However, because it is well known that labor market institutions are important determinants of unemployment (see, e.g., Nickell, 1997), we can, as a first pass, examine the relation between CBI and the 5-year averaged rate of unemployment. Then, we move on to examine the relation between CBI and three labor market institutions from Nickell and Nunziata (2001), viz. benefit replacement rates, benefit durations, and the tax wedge.[7] Finally, we calculate three composite indices of labor market regulation based on the three mentioned institutions and compare the indices with CBI. As suggested by Beck and Katz (1995), we correct the standard errors of the least squares estimates for the possibility that the disturbances are groupwise heteroscedastic and correlated across countries, as described in Appendix B.

3.1. Unemployment

We use data from Nickell and Nunziata (2001) to calculate the 5-year average of unemployment around the years 1980, 1990, and 1994.[8] Fig. 3 shows that the empirical relation between CBI (measured by LVAU) and unemployment is in fact hump-shaped. To provide a statistical assessment of the relation displayed in the figure, we estimate four regressions of unemployment on CBI and CBI squared. In the regressions, we control for union density, coordination of wage bargaining, and dummy variables for 1980 and 1994.[9] Thus, the empirical specification is

$$u_{it} = \alpha + \beta_1 \mathrm{CBI}_{it} + \beta_2 \mathrm{CBI}_{it}^2 + \gamma \boldsymbol{Z}_{it} + \varepsilon_{it}, \tag{8}$$

where $\boldsymbol{Z}_{it}$ is a vector of control variables. Data on union density and coordination of wage bargaining are from Nickell and Nunziata (2001). The results are displayed in Table 1.

All the coefficients for our measures of CBI and its square enter with the predicted signs. The coefficients for GMTtot, GMTec, GMTpol, as well as their squares, are statistically significant at the 5% level. The coefficient for LVAU is not statistically significant, and the coefficient for its square is only so at the 10% level.[10]

[7] In Jordahl and Laséen (1999), we use other institutional measures from Blanchard and Wolfers (2000). The results are very similar to the ones presented in this article.

[8] Around 1994, it is the 3-year average.

[9] According to Nickell (1997), high unemployment is associated with high unionization and low coordination of wage bargaining. We have also included dummy variables for left- and right-wing governments in order to allow for partisan effects (as in Hibbs, 1977). We used data from Beck et al. (2000), where the governments are classified as left, center, or right. In none of the regressions in this paper did the qualitative results change in consequence of this.

[10] If we also include a dummy for Spain in the regressions, the estimates for LVAU and LVAU squared in column 1 become statistically significant at the 5% level. See, e.g., Dolado and Jimeno (1997) and Marimon and Zilibotti (1998) for explanations of why Spain may be seen as a special case. Both studies emphasize unfavourable initial conditions, such as inefficiencies inherited from the old autocratic system.

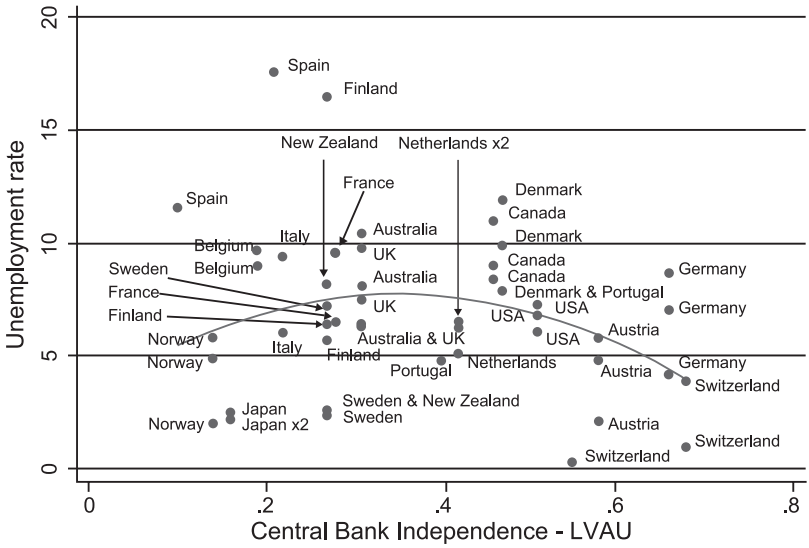

Fig. 3. Unemployment rate and central bank independence.

3.2. Labor market institutions

A drawback to the investigation above is that unemployment may not be a very good proxy variable for labor market regulation. Obviously, there are many other factors which affect unemployment that are excluded from the regressions.[11] Therefore, we also use some more direct measures of labor market institutions.

Nickell (1997) suggests that high unemployment is associated with the following policies: generous unemployment benefits, long duration of benefits, low pressure on the unemployed to obtain work, low levels of active intervention, and high overall taxes, or a combination of high minimum wages for young people and high payroll taxes. In view of this, we use three dependent variables taken from Nickell and Nunziata (2001). Unemployment benefits are measured by the variable Benefit Replacement Rates (BRR). This variable measures the percentage of average first year benefits before tax, averaged

[11] In a related strand of the literature, unemployment is thought to depend on the interaction between labor unions and the central bank. The contributions include Cukierman and Lippi (1999) and Velasco and Guzzo (1999), who both investigate the effects of conservatism and centralization of wage bargaining on real wages, unemployment, and inflation. They argue that, due to the credibility problem, unions are less inclined to moderate their wage demands the more conservative is the central bank. Hence, both models predict a positive relation between conservatism and unemployment. Bratsiotis and Martin (1999) and Soskice and Iversen (2000), on the other hand, argue that monetary accommodation increases unions' wage demands with higher unemployment as the consequence. To the extent that accommodation gives rise to an inflationary bias, these models contradict Cukierman and Lippi (1999) and Velasco and Guzzo (1999). We believe that the labor market institutions that we use as dependent variables, which are not directly related to labor unions, enable us to discriminate against hypotheses from both types of models from this related strand of the literature.

Table 1
Unemployment rate and central bank independence

	(1)	(2)	(3)	(4)
LVAU	23.37 (1.36)			
LVAU squared	−37.02 (1.82)			
GMTtot		1.36** (12.23)		
GMTtot squared		−0.10** (11.07)		
GMTec			2.04** (6.03)	
GMTec squared			−0.30** (5.97)	
GMTpol				1.04** (4.98)
GMTpol squared				−0.22** (5.17)
Union density	−1.30 (0.52)	−3.02 (1.19)	−1.54 (0.62)	−2.61 (1.05)
Bargaining Coord.	−0.91* (2.08)	−1.54** (3.56)	−1.94** (4.74)	−0.94 (1.95)
Dummy 1980	−2.26** (3.48)	−0.66** (12.20)	−0.66** (9.78)	−0.82** (18.36)
Dummy 1990	−1.24 (1.89)			
Constant	7.65 (1.91)	7.90** (56.22)	9.50** (47.30)	9.44** (42.18)
R^2	0.26	0.23	0.23	0.15
Observations	51	32	32	32

The dependent variable unemployment rate is an average over yearly unemployment data in Nickell and Nunziata (2001). LVAU is Cukierman and Lippi's (1999) independence index. GMTtot is the total, GMTec the economic, and GMTpol the political index in Grilli et al. (1991). Union Density and Bargaining Coordination are from Nickell and Nunziata (2001). Coefficients are estimated by OLS. The numbers in parenthesis are t-statistics based on correlated panel corrected standard errors.

* Significant at the 5% level.

** Significant at the 1% level.

over family types of recipients. Benefit Durations (BD) measures a weighted average of benefit replacement rates from the second to the fifth year of unemployment, compared with the first year's replacement rate. Lastly, the variable Tax Wedge (TW) measures the sum of the employment tax rate, the direct tax rate, and the indirect tax rate. Our three institutional variables have also been found to increase the impact of shocks on unemployment (Blanchard and Wolfers, 2000). According to our theoretical model, we expect to find a hump-shaped relation between CBI and the policy variables.

We include (the logarithm of) openness as a control variable. This is reasonable because Agell (1999) argues that openness may lead to increased demand for social insurance through labor market rigidities. The variable Logopen is taken from Penn World Tables (Mark 5.6), where openness is defined as the sum of imports and exports divided by GDP.[12] We also include dummy variables for 1980 and 1994. Thus, the empirical specification is

$$I_{it} = \alpha + \beta_1 \mathrm{CBI}_{it} + \beta_2 \mathrm{CBI}_{it}^2 + \gamma \boldsymbol{Z}_{it} + \varepsilon_{it}, \tag{9}$$

where I_{it} is one of our measures of labor market institutions. Table 2 contains the results of these regressions.

[12] Because the world tables end 1992, we have assumed the logarithm of openness in 1994 to equal the logarithm of openness in 1992.

Table 2
Labor market institutions and central bank independence

Dependent variable: labor market institutions	(1) BRR	(2) BRR	(3) BRR	(4) BRR	(5) BD	(6) BD	(7) BD	(8) BD	(9) TW	(10) TW	(11) TW	(12) TW
LVAU	−0.18				2.34**				0.65**			
	(0.35)				(4.30)				(4.02)			
LVAU sq.	0.10				−3.00**				−0.99**			
	(0.16)				(4.24)				(3.98)			
GMTtot		0.06				0.09**				0.09**		
		(1.60)				(5.12)				(7.64)		
GMTtot sq.		−0.00				−0.01**				−0.01**		
		(1.52)				(8.36)				(10.54)		
GMTec			0.19**				0.41**				0.01	
			(3.12)				(39.44)				(0.51)	
GMTec sq.			−0.02**				−0.04**				−0.00	
			(3.46)				(286.04)				(0.79)	
GMTpol				0.06**				−0.14**				0.11**
				(36.82)				(20.50)				(11.13)
GMTpol sq.				−0.01**				0.02**				−0.02**
				(29.58)				(7.58)				(6.57)
Logopen	0.17**	0.14**	0.13**	0.15**	0.25**	0.26**	0.23**	0.24**	0.08**	0.03**	0.03**	0.06**
	(6.61)	(6.86)	(5.77)	(8.42)	(32.62)	(18.22)	(17.27)	(15.57)	(4.03)	(2.58)	(3.20)	(6.00)
Dummy 1980	−0.07**	−0.05**	−0.05**	−0.05**	−0.05**	−0.07**	−0.07**	−0.07**	−0.06**	−0.05**	−0.06**	−0.05**
	(64.44)	(168.20)	(153.55)	(186.59)	(94.29)	(355.40)	(370.07)	(324.74)	(3.81)	(6.02)	(4.02)	(7.63)
Dummy 1994	0.01				0.03				−0.01			
	(0.75)				(1.28)				(0.21)			
Constant	−0.17	−0.35**	−0.42**	−0.25**	−0.92**	−0.80**	−1.24**	−0.24**	0.14	0.04	0.35**	0.13**
	(1.11)	(4.54)	(7.08)	(3.43)	(8.37)	(6.27)	(12.96)	(3.64)	(1.44)	(0.43)	(4.31)	(4.11)
R^2	0.21	0.19	0.28	0.17	0.18	0.16	0.34	0.2	0.19	0.33	0.11	0.32
Observations	51	32	32	32	51	32	32	32	48	30	30	30

The dependent variables BRR (Benefit Replacement Rates), BD (Benefit Durations), and TW (Tax Wedge) are from Nickell and Nunziata (2001). LVAU is Cukierman and Lippi's (1999) independence index. GMTtot is the total, GMTec the economic, and GMTpol the political index in Grilli et al. (1991). Logopen is the log of openness defined as the sum of imports and exports divided by GDP (Penn World Tables, Mark 5.6). Coefficients are estimated by OLS. The numbers in parenthesis are *t*-statistics based on correlated panel corrected standard errors.

* Significant at the 5% level.

** Significant at the 1% level.

The majority of the regressions provide support for our hypothesis. In all regressions except the one in column 8 with Benefit Durations and GMTpol do the coefficients for CBI and CBI squared enter with the predicted signs, and in 8 out of the 12 regressions they are also statistically significant at the 1% level. The support is strongest with Tax Wedge as the dependent variable. The coefficients for CBI and its square have the expected signs and are statistically significant at the 1% level in all of the Tax Wedge regressions except for the one in column 11 with GMTec. Comparing the four indices of CBI, we note that each one of them fails to support our theory in one regression. The most notable contradiction is found in column 8, where GMTpol exhibits a statistically significant u-shaped relation with Benefit Durations. In view of this evidence, it is quite possible that the mechanisms of our model are working through labor market institutions. Finally, note that the effect of (the log of) openness is positive and statistically significant in all of the regressions.

3.3. Indices of labor market regulation

Although the results provide some support for a hump-shaped relation between conservatism and labor market regulation, each dependent variable (Benefit Replacement Rates, Benefit Durations, and Tax Wedge) is only one potential part the labor market regulation in a country. In principle, one could find support for the hump-shaped hypothesis in these regressions, but still fail to find support for the same hypothesis when all potential parts of labor market regulation are considered. To tackle this problem, we need a composite measure of labor market regulation. As a first step in this direction, we have constructed three indices of labor market regulation: a Continuous Index, a Discrete Index, and an Index of Effective Labor Market Institutions. The Continuous and the Discrete Index are simple averages over our three labor market institutions: Benefit Replacement Rates, Benefit Durations, and Tax Wedge. The Effective Institutional Index is a weighted average over the same components. Appendix C displays these indices.

The Continuous Index uses each country's position on the range between the countries with the minimum and the maximum level of regulation. Thus, in 1994, the Benefit Replacement Rates component of this index is $(0.27-0.22)/(0.7-0.22)=0.11$ for the United States, because the replacement rate in the United States (0.27) is closer to the minimal rate in the United Kingdom (0.22) than to the maximal rate in the Netherlands (0.7).

In the Discrete Index, each component is divided into three levels of regulation; high (score 3), medium (score 2), and low (score 1), such that each of the three scores are assigned to one third of the observations. For example, next to Sweden, Italy had the highest taxes in 1994 and is therefore given the score 3 for the Tax Wedge component this year.

The Effective Institutional Index is constructed in two steps. In the first step, we regress unemployment on union density, coordination of wage bargaining, dummy variables for 1980 and 1994, and the institutional variables Benefit Replacement Rates, Benefit Durations, and Tax Wedge. In the second step, we calculate the predicted impact of the last three variables on unemployment for each observation. With this method of construction, we get a measure of the combined effect of labor market institutions on unemployment. This is an improvement on the regressions in Table 1, because we have now isolated the

Table 3
Indices of labor market regulation and central bank independence

Dependent variable: indices of labor market institutions	(1) Cont.	(2) Cont.	(3) Cont.	(4) Cont.	(5) Discr.	(6) Discr.	(7) Discr.	(8) Discr.	(9) Effect. Index	(10) Effect. Index	(11) Effect. Index	(12) Effect. Index
LVAU	0.91				0.91				4.58			
	(1.65)				(1.65)				(0.77)			
LVAU sq	−1.30				−1.30				−6.75			
	(1.84)				(1.84)				(0.92)			
GMTtot		0.13**				0.42**				0.83*		
		(3.21)				(3.87)				(2.00)		
GMTtot sq		−0.01**				−0.03**				−0.05*		
		(3.67)				(4.43)				(2.13)		
GMTec			0.22**				0.63**				2.31**	
			(5.24)				(4.12)				(5.36)	
GMTec sq			−0.02**				−0.07**				−0.25**	
			(6.72)				(4.86)				(6.44)	
GMTpol				0.06**				0.31**				0.18*
				(4.66)				(5.19)				(2.47)
GMTpol sq				−0.01**				−0.05*				−0.03**
				(3.82)				(4.80)				(3.01)
Logopen	0.22**	0.17**	0.16**	0.19**	0.22**	0.56**	0.54**	0.67**	1.89**	1.61**	1.49**	1.73**
	(8.78)	(13.94)	(10.30)	(10.84)	(8.78)	(14.00)	(11.45)	(14.96)	(9.03)	(11.61)	(9.82)	(10.62)
Dummy 1980	−0.08**	−0.05*	−0.06**	−0.06**	−0.08**	−0.21**	−0.24**	−0.21**	−0.60**	−0.40*	−0.48**	−0.43**
	(12.11)	(2.54)	(7.47)	(3.40)	(12.11)	(11.59)	(12.84)	(20.39)	(8.14)	(2.32)	(7.70)	(3.59)
Dummy 1994	0.01				0.01				0.14			
	(0.38)				(0.38)				(1.02)			
Constant	−0.48**	−0.67**	−0.58**	−0.34**	−0.47*	−1.69**	−1.25**	−0.98**	−3.51*	−5.13**	−5.94**	−2.59**
	(2.64)	(3.04)	(4.28)	(3.37)	(2.64)	(4.86)	(6.45)	(4.30)	(2.16)	(3.01)	(6.79)	(3.25)
R^2	0.43	0.45	0.52	0.31	0.43	0.48	0.51	0.38	0.39	0.36	0.57	0.28
Observations	48	30	30	30	48	30	30	30	48	30	30	30

The dependent variables are the Continuous Index (Cont.), the Discrete Index (Discr.), and the Effective Institutional Index (Effect. Index) of labor market regulation. LVAU is Cukierman and Lippi's (1999) independence index. GMTtot is the total, GMTec the economic, and GMTpol the political index in Grilli et al. (1991). Logopen is the log of openness defined as the sum of imports and exports divided by GDP (Penn World Tables, Mark 5.6). Coefficients are estimated by OLS. The numbers in parenthesis are *t*-statistics based on correlated panel corrected standard errors.

* Significant at the 5% level.

** Significant at the 1% level.

part of unemployment that can be explained by institutional variables. As in the previous regressions, the empirical specification is given by Eq. (9) with one of the indices on the left hand side.

Table 3 shows the results from regressions of our indices of labor market regulation on CBI, CBI squared, openness, and dummy variables for 1980 and 1994. The coefficients for CBI and CBI squared have the predicted signs in all of the regressions. They are, however, only statistically significant in the regressions with GMTtot, GMTec, and GMTpol. The coefficients for LVAU and its square are only statistically significant at the 10% level with the Continuous Index in column 1. The evidence is supportive—but not overwhelmingly so.

4. Concluding remarks

Although monetary policy is not the solution to the problem of structural unemployment, political decisions to regulate the labor market could be influenced by the general policy stance of the central bank. Such an influence, however, seems to contradict conventional wisdom because numerous studies have failed to find a link between unemployment and central bank independence. In this paper, we have argued that a nonlinear relation is needed to capture the forces at work. In particular, due to the trade-off between credibility and flexibility, we expect the relation between conservatism and regulation to be hump-shaped.

Interestingly, our empirical investigation provides evidence in favor of this prediction. We find that unemployment is affected by central bank independence, and that this effect appears to work through labor market institutions. Unemployment generating labor market regulation is overrepresented in countries with medium levels of central bank independence.

The most important limitations of this study are the small data set and the inexact measure of central bank conservatism. Therefore, we believe that future studies should focus on expanding the data set and trying to define and measure the concept of conservatism more accurately.

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Appendix A. Indices of central bank independence

Country	Year	LVAU	GMTtot	GMTec	GMTpol
Australia	1980	0.31	9	6	3
Australia	1990	0.31	9	6	3
Australia	1994	0.31			
Austria	1980	0.58	9	6	3
Austria	1990	0.58	9	6	3
Austria	1994	0.58			
Belgium	1980	0.19	7	6	1
Belgium	1990	0.19	7	6	1
Canada	1980	0.46	11	7	4
Canada	1990	0.46	11	7	4
Canada	1994	0.46			
Denmark	1980	0.47	8	5	3
Denmark	1990	0.47	8	5	3
Denmark	1994	0.47			
Finland	1980	0.27			
Finland	1990	0.27			
Finland	1994	0.27			
France	1980	0.28	7	5	2
France	1990	0.28	7	5	2
Germany	1980	0.66	13	7	6
Germany	1990	0.66	13	7	6
Germany	1994	0.66			
Italy	1980	0.22	5	1	4
Italy	1990	0.22	5	1	4
Japan	1980	0.16	6	5	1
Japan	1990	0.16	6	5	1
Japan	1994	0.16			
Netherlands	1980	0.42	10	4	6
Netherlands	1990	0.42	10	4	6
Netherlands	1994	0.42			
New Zealand	1980	0.27	3	3	0
New Zealand	1990	0.27	3	3	0
Norway	1980	0.14			
Norway	1990	0.14			
Norway	1994	0.14			
Portugal	1980	0.47	3	2	1
Portugal	1990	0.4	3	2	1
Spain	1980	0.1	5	3	2
Spain	1990	0.21	5	3	2
Sweden	1980	0.27			
Sweden	1990	0.27			
Sweden	1994	0.27			
Switzerland	1980	0.55	12	7	5
Switzerland	1990	0.68	12	7	5
Switzerland	1994	0.68			
United Kingdom	1980	0.31	6	5	1
United Kingdom	1990	0.31	6	5	1
United Kingdom	1994	0.31			
United States	1980	0.51	12	7	5
United States	1990	0.51	12	7	5
United States	1994	0.51			

Appendix B. Panel corrected standard errors

Instead of the standard assumption of an error variance matrix, **V**, that is given by

$$\mathbf{V} = \sigma^2 I, \tag{B1}$$

we allow for heteroscedasticity such that

$$\mathrm{Var}\left(\varepsilon_{i,t}\right) = \sigma_i^2, \tag{B2}$$

as well as for contemporaneous correlation across countries within a time period of the form

$$E\left(\varepsilon_{i,t}\varepsilon_{j,t}\right) = \sigma_{ij}, \tag{B3}$$

$$E\left(\varepsilon_{i,t}\varepsilon_{j,s}\right) = 0, \qquad \forall t \neq s. \tag{B4}$$

The panel corrected standard errors are not only consistent estimates of the standard errors of the estimated coefficients, they also have superior small sample properties compared with feasible generalized least squares (Beck and Katz, 1996). We use the Lagrange multiplier test by Breusch and Pagan (1980) to test for contemporaneous correlation across countries (see Greene, 2000: 601). This test statistic is

$$\lambda_{\mathrm{LM}} = \sum_{i=2}^{n} \sum_{j=1}^{i-1} T_i r_{ij}^2, \tag{B5}$$

where n is the number of countries, T_i the number of observations for country i, and r_{ij}^2 is the ijth residual correlation coefficient. To test for groupwise heteroscedasticity, we use the Wald statistic

$$W = \frac{1}{2} \sum_{i=1}^{n} T_i \left(\frac{\sigma^2}{\hat{\sigma}_i^2} - 1 \right)^2, \tag{B6}$$

where, $\hat{\sigma}_i^2$ is the estimated error variance for country i, and the estimate of the common variance, σ^2, is taken from a pooled least squares regression (Greene, 2000: 597).

Appendix C. Indices of labor market regulation

Country	Year	Continuous index	Discrete index	Effective institutional index
Australia	1980	0.50	1.67	4.32
Australia	1990			
Australia	1994			
Austria	1980	0.58	2.33	4.45
Austria	1990	0.60	2.33	4.56
Austria	1994	0.58	2.33	4.29
Belgium	1980	0.60	2.00	5.75

Appendix C (*continued*)

Country	Year	Continuous index	Discrete index	Effective institutional index
Belgium	1990	0.61	2.33	5.50
Belgium	1994	0.60	2.33	5.31
Canada	1980	0.41	1.33	4.49
Canada	1990	0.48	2.00	4.73
Canada	1994	0.48	1.67	4.67
Denmark	1980	0.69	2.67	6.41
Denmark	1990	0.74	3.00	6.55
Denmark	1994	0.80	3.00	6.98
Finland	1980	0.54	2.00	3.99
Finland	1990	0.63	2.33	5.07
Finland	1994	0.66	2.33	5.55
France	1980	0.58	2.67	5.04
France	1990	0.67	2.33	5.51
France	1994	0.68	2.33	5.52
Germany	1980	0.52	2.00	4.48
Germany	1990	0.52	2.00	4.37
Germany	1994	0.52	2.00	4.25
Italy	1980	0.17	1.33	0.40
Italy	1990	0.33	1.67	1.62
Italy	1994	0.52	2.00	3.70
Japan	1980	0.14	1.00	1.90
Japan	1990	0.20	1.00	2.19
Japan	1994	0.13	1.00	2.18
Netherlands	1980	0.68	2.33	6.24
Netherlands	1990	0.66	2.33	6.52
Netherlands	1994	0.60	2.00	6.22
New Zealand	1980	0.48	1.67	4.69
New Zealand	1990			
New Zealand	1994			
Norway	1980	0.57	2.33	4.48
Norway	1990	0.66	2.67	5.72
Norway	1994	0.65	2.33	5.73
Portugal	1980	0.12	1.00	1.71
Portugal	1990	0.51	2.00	5.45
Portugal	1994	0.50	2.00	5.54
Spain	1980	0.42	1.67	5.34
Spain	1990	0.53	2.33	5.55
Spain	1994	0.51	2.33	5.31
Sweden	1980	0.60	2.33	4.87
Sweden	1990	0.68	2.33	5.43
Sweden	1994	0.62	2.33	5.12
Switzerland	1980	0.22	1.33	2.50
Switzerland	1990	0.35	1.67	4.36
Switzerland	1994	0.40	1.67	4.81
United Kingdom	1980	0.49	2.33	3.96
United Kingdom	1990	0.45	2.00	3.51
United Kingdom	1994	0.45	1.67	3.55
United States	1980	0.30	1.00	2.69
United States	1990	0.28	1.00	2.37
United States	1994	0.29	1.00	2.45

Source: authors' own calculations based on Nickell and Nunziata (2001).

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