The Effect of Trade Union Density on Inflation Performance in OECD Countries

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In this paper I examine the impact of union membership rates on the inflation performance of 20 OECD countries. Using panel data and fixed effects regressions I estimate a positive effect of unionization which is in line with previous findings and can be due to central bankers not tolerating higher levels of unemployment caused by the unions' real wage demands. The effect of unionization is declining in bargaining coordination and income per capita. The results are robust to controlling for possible sources of endogeneity.

keywords: inflation, trade unions, fixed effects, central bank independence

JEL classification: J51, E24, E31, E58

INTRODUCTION

Inflation is primarily thought of as a highly cyclical variable which is influenced by certain demand and supply side shocks in the short run, but which is ultimately a monetary phenomenon in the long run (i.e. fully influenced by the central bank). However, recent literature raises the question whether the long run-equilibrium rate of inflation is determined also by the structural properties of the labor market and the wage setting process, and not just by the preferences of monetary policy.

A possible channel through which labor market institutions can influence inflation is that they increase the equilibrium real wage and unemployment which in turn encourages central banks to be expansionary. The empirical evidence supports this theory. Cukierman and Lippi (1999) find an inverted U-shaped relationship between inflation and union centralization which also interacts with central bank independence. Bowdler and Nunziata (2007) extend this model and also consider trade union density as a possible factor determining equilibrium inflation. Their results show that trade union density affects inflation positively and this result is robust under various settings. They also examine interactions with other labor market characteristics and central bank independence and find significant relationships.

My aim in this paper is to conduct an analysis similar to that of Bowdler and Nunziata (2007) but on an extended sample, and see if the results still hold. The main variable of interest is trade union density and its possible interactions with other factors like central bank independence and different labor market characteristics. I use panel data of 20 OECD countries from 1961 to 2000 which lengthens the previous time coverage by one 5-year period. Fixed effects and instrumental variables regressions are employed to control for possible sources of endogeneity.

The paper is organized as follows: in Section 1 I briefly summarize the literature on the theoretical background of how labor market structure can influence inflation outcomes; in Section 2 the data is described; in Section 3 I present the econometric model and discuss the empirical results; finally, I conclude.

1. LABOR MARKET STRUCTURES AND INFLATION

The classic model of Barro and Gordon (1983) says that discretionary monetary policy could exploit the short run tradeoff between inflation and unemployment (i.e. move along the short run Phillips-curve) as long as inflation expectations do not adjust: by generating surprise inflation an expansive policy can temporarily reduce real wages and thus unemployment (demand for labor increases as it gets cheaper). The monetary authority can therefore choose an optimal combination of inflation and unemployment which maximizes a theoretical social welfare function. But as soon as inflation expectations and nominal wages adjust, real wages and unemployment go back to their equilibrium level while higher inflation remains. Since monetary policy cannot influence the level of unemployment permanently, whereas trying to reduce it can result in accelerating inflation, it is better for a central bank to commit itself to price stability.

However, as Kydland and Prescott (1977) point out, this commitment is not credible as it is time inconsistent. A policymaker optimizing on the short run has an incentive to generate surprise inflation (above the announced target) after inflation expectations and nominal wages have been set, and thereby reduce unemployment. The commitment to low inflation can be credible if the weight of unemployment is decreased in the central bank's goal function. Since politicians usually optimize on the short run, seeking re-election, a longer term perspective can credibly be given to central bankers by making them independent from the government. To the extent that central bankers are more inflation-averse than elected politicians, higher central bank independence will result in lower equilibrium inflation.

In addition to the preferences of monetary policy (proxied by central bank independence) other possible determinants of equilibrium inflation were also explored. Openness to trade can limit the benefits of a monetary expansion because the terms of trade adjustment induced by higher inflation restricts the unemployment gain and this effect is stronger the more open an economy is. That reduces the incentives for central banks to make surprise inflation (Romer 1993).

The effect of labor market institutions is studied by Cukierman and Lippi (1999) and by Bowdler and Nunziata (2007). To some extent trade unions represent monopoly power in labor supply which makes the equilibrium real wage and the natural unemployment higher than the competitive level. The higher equilibrium unemployment rate might induce central bankers to generate surprise inflation more frequently (given certain preferences on inflation and unemployment). This can be either because monetary policy is not that hawkish to maintain price

stability and attaches a bigger weight to unemployment or because even if central bankers are very tough on inflation, they interpret the rise in unemployment as a sign of a recessionary cycle (negative output gap). In the latter case the warranted monetary policy response would indeed be an expansion since there is no tradeoff between inflation and unemployment targets if the economy is not at its potential (i.e. there is an output gap): insufficient demand causes unemployment to rise while it limits price increases. A monetary expansion would make both unemployment to fall back to its natural level and inflation to *rise back* to target. However, if the rise in unemployment is not a deviation from the natural level but is due to the increase of the natural level itself, there's no downward pressure on inflation and an expansive monetary policy misinterpreting the cause of higher unemployment will only achieve higher inflation while unemployment cannot be reduced permanently. To the extent higher unionization increases the natural rate of unemployment the mechanisms described above can lead to higher equilibrium inflation.

Cukierman and Lippi (1999) study the effect of trade union *centralization*. According to their hypothesis centralization initially affects inflation positively as it means higher monopoly power, but after a certain point it also means that the unions are more aware of the inflationary consequences of their wage-demands since they are no longer just a drop in the ocean (having negligible effects on macro variables) but one of the main players. Provided that unions also dislike inflation this results in an inverted U-shaped relationship: after a certain point the awareness effect will dominate the one coming from monopoly power. The authors support their theory with empirical evidence. They also report significant interaction between centralization and central bank independence. The peak of the inverted U is further away the more independent the central bank is. Supposedly unions think that monetary policy will be more hawkish and they can increase the real wage further without fearing inflation.

Bowdler and Nunziata (2007) however find that the evidence for the Cukierman-Luppi hypothesis is somewhat weaker after controlling for country and time fixed effects. Instead they take a more detailed look on labor market institutions and consider trade union density and the degree of employment protection as well. Their results show that trade union density has a significantly positive effect on inflation and while it interacts with union coordination and employment protection, the latter ones don't have a direct effect. The same holds for central bank independence. The interaction terms suggest that union density asserts a smaller effect on inflation if there is higher coordination among unions (they are more aware of the macro effects) and if the central bank is more independent which is the same as the CL-hypothesis but for union density instead of centralization. In the followings I will test these results on an extended dataset.

2. DATA

I use panel data for 20 OECD countries[1] between 1961 and 2000. This extends the period covered by Bowdler and Nunziata (2007) by 5 additional years. The originally annual data is converted into non-overlapping 5-year periods where the value of a particular variable is computed as the average of the values from the corresponding 5 years. The reason for this transformation is that the variable of interest is equilibrium inflation and not the fluctuations in inflation induced by the business cycle. The dataset was constructed by me. The variables are the following:

- *inf* is the annual rate of change in the consumer price index (inflation) transformed in the following way: inf=ln(1+inflation) where inflation is expressed as a decimal (OECD 2012).
- *open* is the value of imports plus exports divided by nominal GDP (own calculations based on OECD, 2012).
- *lgdp* is the logarithm of real GDP per capita measured in PPP adjusted US dollars at constant prices with the base year 2005 (OECD, 2012).
- *tu* is trade union density which measures the proportion of union members in the whole labor force. The range is between 0 and 1 (OECD, 2012).
- *coord* is an index measuring wage bargaining coordination among trade unions. The range of this index is between 1 and 3 and it increases in the degree of coordination (Nickell, 2006).
- *epl* is an index measuring employment protection legislation on a range between 0 and 2. It increases in the level of protection (Nickell, 2006).
- *cbi* is the Cukierman-index of central bank independence which is constructed from various legal characteristics. Its range is between 0 and 1 (Cukierman 1994 in Armingeon et al 2008). I updated this data for the 1990s based on Polillo and Guillén (2005). Data is missing for Portugal before 1985.
- *unemployment* is the cyclical component of a Hodrick-Prescott filtered unemployment series expressed in percentage points, with a smoothing parameter of 400 recommended for annual data (own calculations based on OECD, 2012).

Not every variable is available for every country in every time period so there are a few missing observations. Along the lines of Bowdler and Nunziata (2007) I also constructed demeaned versions of certain variables: interpreting the effect of trade union density at the average values of the interacted variables is easier if those variables have a mean of zero so the coefficient of the interaction term can be neglected.

[1] Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom, United States

3. EMPIRICAL RESULTS

In order to estimate the effect of trade union density on inflation performance I use panel regression models. Panel data allows me to control for unobserved time and country fixed effects which address potential endogeneity. In general form the models look like the following:

$$inf_{it} = \beta_0 + \beta_1' \boldsymbol{labor}_{it} + \beta_2' \boldsymbol{inf\_aversion}_{it} + \beta_3' \boldsymbol{interactions}_{it} + \alpha_i + \lambda_t + \varepsilon_{it} \quad (1)$$

where *i* refers to a country, *t* denotes non-overlapping 5-year time periods, ***labor*** is a vector of labor market characteristics, ***inf_aversion*** is a vector of variables measuring inflation aversion (like central bank independence or openness) and ***interactions*** is a vector of various interactions between variables of the two previous groups. α_i denotes unobserved country fixed effects which differ across countries but are constant through time while λ_t is a vector of time dummies controlling for unobserved time fixed effects which differ in time but affect every country in the same way. ε_{it} is the error term.

First I test the Cukierman-Lippi hypothesis which states that union centralization and inflation has an inverted U-shaped relationship: after a certain point unions are becoming more and more aware of the macro consequences of their wage demands and this effect will reduce and, eventually, dominate the effect of monopoly power. In the above specification this inverted U shape can appear if the coefficient of the square of union coordination (which I use instead of centralization along the lines of Bowdler and Nunziata (2007)) is negative. The other hypothesis that this effect is weaker the more independent the central bank is could be translated into a positive sign for the interaction term between *cbi* and *coord* plus a negative sign for the interaction between *cbi* and the square of *coord* (this can ensure that the peak of the inverted U is more to the right).

As can be seen in Table 1, the evidence for this hypothesis is quite weak, which is in line with the findings of Bowdler and Nunziata (2007). Column 1 reports the regression without fixed effects but controls for other possible measures of inflation-aversion. The estimate for the squared term is negatively signed and significant but the interaction terms are not statistically different from zero. These estimates, however, are subject to omitted variable bias since there can be other unobserved factors which determine equilibrium inflation and are correlated with union coordination. After controlling for time fixed effects in Column 2, the situation is quite similar whereas most of the variables lose significance after controlling for time and country fixed effects as well in Column 3. This suggests that the estimates for GDP/capita and central bank independence, though correctly signed, were biased before including country fixed effects, and they only picked up the effects of other unobserved cross-country differences. The squared term of coordination, however, remains significant at the 5% level which provides some evidence for the first of the CL-hypotheses.

Table 1 – Testing the Cukierman-Lippi hypotheses in the OECD 1961-2000

	(1)	(2)	(3)
central bank independence	-0.059252**	-0.034863*	-0.041147
	(0.0207)	(0.0139)	(0.0227)
openness	-0.007764	-0.013143*	0.021675
	(0.0101)	(0.0066)	(0.0289)
log real GDP/capita	-0.052645***	-0.048246***	-0.025414
	(0.0113)	(0.0104)	(0.0275)
z_coord	-0.010126*	-0.010582***	-0.003457
	(0.0043)	(0.0028)	(0.012)
z_coord_sq	-0.015720*	-0.016310***	-0.032961*
	(0.007)	(0.0045)	(0.0126)
ZcoordZcbi	0.002987	0.010745	0.04243
	(0.0321)	(0.0212)	(0.0677)
Zcoord_sqZcbi	0.064568	0.034978	0.030879
	(0.0434)	(0.0292)	(0.0889)
dependent variable	inflation	inflation	inflation
time fixed effects	no	yes	yes
country fixed effects	no	no	yes
R-squared			0.777333
Adj. R-squared			0.705294
No. of obs.	136	136	136

* p<0.05, ** p<0.01, *** p<0.001

Regressions for non-overlapping 5-year periods in 20 countries. Standard errors are reported in parentheses. Regression intercepts are not reported.

As a next step, I consider other labor market characteristics like trade union density and employment protection legislation as in Bowdler and Nunziata (2007). To address possible sources of endogeneity coming from omitted variable bias I always include time and country fixed effects which control for unobserved factors being constant across countries and through time, respectively. Throughout the regressions I use White robust standard errors so that inference and t-statistics remain valid under heteroskedasticity as well.

The results are reported in Table 2. Column 1 shows the effects of different labor market characteristics without including other factors which describe inflation-aversion. Trade union density has a significantly positive effect while it also interacts with bargaining coordination. The negative and significant coefficient of the latter suggests that as coordination gets stronger, the unions become more aware of the macro consequences of their wage demands (higher inflation and unemployment) and this will moderate the positive effect of union density. However, at the average value of bargaining coordination trade union density still has a positive influence (in this case the coefficient of the demeaned interaction term can be neglected). These results support the hypotheses laid out in Section 1.

Table 2 – Labor market institutions and inflation performance in the OECD 1961-2000

		(1)	(2)	(3)	(4)	IV
labor market structure	trade union density	0.053328*	0.035812	0.048725*	0.048238*	0.059098
		(0.0234)	(0.0231)	(0.0223)	(0.0215)	(0.0315)
	employment protection	-0.026341	-0.018804	-0.024977		
		(0.0225)	(0.0245)	(0.0245)		
	bargaining coordination	0.022584	0.051881**	0.055582**	0.048217**	0.048694**
		(0.0132)	(0.0172)	(0.0172)	(0.0143)	(0.0173)
	tu_zcoord	-0.086369**	-0.112698**	-0.121519***	-0.106505***	-0.104745**
		(0.0322)	(0.0334)	(0.0324)	(0.0284)	(0.0349)
	tu_zepl	0.066831	0.044921	0.062289		
		(0.0418)	(0.0396)	(0.0389)		
inflation aversion	central bank independ.		-0.047549*	-0.075830*	-0.060255**	-0.061171**
			(0.02)	(0.0336)	(0.0215)	(0.0219)
	log real GDP/capita		-0.034752	0.016972		
			(0.0232)	(0.0345)		
	openness		-0.001227	0.008801		
			(0.0252)	(0.0438)		
	tu_zcbi			0.04086		
				(0.0961)		
	tu_zgdp			-0.116782**	-0.096837**	-0.103585**
				(0.0442)	(0.0295)	(0.0336)
	tu_zopen			-0.032167		
				(0.0838)		
	dependent variable	inflation	inflation	inflation	inflation	inflation
	R-squared	0.763056	0.787075	0.801707	0.797105	
	Adj. R-squared	0.742601	0.760459	0.7712	0.777311	
	No. of obs.	152	136	136	136	134

* p<0.05, ** p<0.01, ***p<0.001

Regressions with **country and time fixed effects** for non-overlapping 5-year periods in 20 countries. **Robust standard errors** are reported in parentheses. Regression intercepts are not reported.

Since the above results are prone to omitted variable bias, in Column 2 I also include other possible determinants of equilibrium inflation. These are factors measuring inflation-aversion in a country. In this setting union density loses significance (though the sign is appropriate) but retains its effect through the interaction with bargaining coordination. The latter becomes significant on its own along with central bank independence. After including additional interaction terms in Column 3, these results are preserved and even trade union density becomes significant again. The null hypothesis that the coefficients of insignificant variables in Column 3 all equal zero cannot be rejected at the usual significance levels (F-statistic is 0.59 which corresponds to a p-value of 0.74); therefore I drop them and arrive to the last specification which is presented in Column 4. This specification is robust even when including the Cukierman-Lippi interactions from Table 1 (first for coordination then for union

density): they are not significantly different from zero while the other estimates remain similar. This result confirms the suspicion that the CL-hypotheses do not hold in their original form.

We can interpret the results of Column 4 in the following way. Trade union density and bargaining coordination influence equilibrium inflation positively and the effect of trade unions is weaker if coordination levels are above average and if the country's income per capita is higher than the average. Inflation is lower the more independent the central bank is. These are in line with the expectations: the greater monopoly power associated with higher unionization rates pushes up equilibrium real wages and the natural rate of unemployment which in turn encourages central bankers to implement a more expansionary monetary policy. All other things equal, however, a more independent central bank will have stricter preferences for price stability and this will result in lower inflation. The effect of union density is mitigated by above average coordination levels since more coordinated unions are more aware of the macro consequences of real wage increases and to the extent that they dislike these consequences they will moderate their demands. Bowdler and Nunziata (2007) also provide an explanation why countries at the top half of the income distribution might experience a smaller effect of unionization. According to this hypothesis unions are less aggressive in demanding higher real wages if living standards are already high. Therefore all these results are plausible and could be supported with theory.

At some points, however, they are in contrast with the findings of Bowdler and Nunziata (2007). The authors found that trade union density also interacts with employment protection levels and central bank independence but central bank independence (along with coordination levels) does not enter directly into the model. The latter result is indeed a bit surprising since according to it central bank independence has no direct effect on equilibrium inflation levels, which is in sharp contrast with what the Barro-Gordon model suggests. These differences between my results and theirs can be due to the fact that, apart from having an extended time coverage, I also updated the Cukierman-index of central bank independence for the 1990s which introduced greater time variation to this variable. This might be the reason for the significance of the *cbi* term in my model while the nearly constant *cbi* was dropped out from their model and only entered through interactions. On the other hand, I have not managed to find this data for Portugal before 1985 which is also a factor behind differences in results.

Time and country fixed effects only allow controlling for such unobserved variables which are either constant through time or across countries. Omitted variable bias can come from other factors which are different in time and for each country. Oil price shocks, for example, affect world inflation and could be thought of as constant across countries and captured by time fixed effects. However, one can argue that these shocks have different effect on each country as they can have second-round effects on inflation which will depend on structural features of the economy in question. Unfortunately, I didn't have data on crude prices but Bowdler and Nunziata (2007) show that

including the oil price does not affect the findings, so this source of endogeneity is unlikely to be a problem. Running the last two specifications from Table 2 but with core inflation as the dependent variable (which excludes food and energy prices from the price index) the regressors affect core inflation in pretty much the same fashion as the affect headline inflation.

Another possible source of endogeneity is reverse causation from inflation to trade union density. It can be the case that periods characterized by higher inflation give rise to an increased sense of uncertainty which in turn encourages workers to join unions that offer protection and preservation of the real wage even in the presence of high inflation. This problem can be tackled by finding an instrument for unionization which is correlated with union density but which inflation is very unlikely to affect. Since union density changes very slowly over time, an obvious candidate is lagged union density: inflation 5 years ahead is very unlikely to influence this (expectations are not that forward-looking) while unionization clearly has a relationship with its past values (Bowdler and Nunziat 2007). In the last column of Table 2 I report an IV panel regression where *tu* is instrumented by its lagged value from the previous 5-year period. The results are still robust, although union density is less significant (only at the 6% level). However, this is a natural outcome when using IV which is less precise than OLS.

CONCLUSION

In this paper I was investigating the effect of trade union density on inflation performance in 20 OECD countries in the second half of the 20th century along the lines of Bowdler and Nunziata (2007). Higher unionization rates may affect equilibrium inflation positively by raising the equilibrium real wage and unemployment through their monopoly power on labor supply which in turn will prompt less hawkish central bankers to implement expansionary monetary policy. The results are in line with this theory and also show that above average bargaining coordination among unions mitigate this positive effect of union density as wage-bargainers become more aware of the undesirable macro consequences of their demands. Richer countries also experience weaker effects coming from unionization possibly because real wages are already high and unions are less aggressive in bargaining. The results are robust to various checks for endogeneity but at some point they are in contrast with what Bowdler and Nunziata (2007) found. This can be due to differences in the data used, but nevertheless, the main finding of positive effect of unionization is the same.

This result has a policy relevance in the sense that if lower union membership rates can be achieved, this could contribute not just to restoring the competitive equilibrium (lower real wages and higher employment) but also to greater price stability. This contrasts with the textbook view of inflation being ultimately a monetary phenomenon in the long run and not being a function of real variables or structural parameters. However, my results also show that more conservative central banks (proxied by central bank independence) can be successful in counterbalancing the inflationary effect of higher trade union density. Since labor market policy might consider other aspects as well (like the rights of workers or

the preferences of society in the wage bargaining process) it doesn't have price stability as its primary focus and objective. That's why central banks are still better equipped to deliver price stability. Nevertheless, a country characterized by higher unionizations rates should pay more attention to central bank independence if price stability is to be achieved.

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