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WAGE DYNAMICS NETWORK

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LABOR MARKET INSTITUTIONS AND MACROECONOMIC VOLATILITY IN A PANEL OF OECD COUNTRIES

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Wage Dynamics Network

This paper contains research conducted within the Wage Dynamics Network (WDN). The WDN is a research network consisting of economists from the European Central Bank (ECB) and the national central banks (NCBs) of the EU countries. The WDN aims at studying in depth the features and sources of wage and labour cost dynamics and their implications for monetary policy. The specific objectives of the network are: i) identifying the sources and features of wage and labour cost dynamics that are most relevant for monetary policy and ii) clarifying the relationship between wages, labour costs and prices both at the firm and macro-economic level.

The WDN is chaired by Frank Smets (ECB). Giuseppe Bertola (Università di Torino) and Julian Messina (Universitat de Girona) act as external consultants and Ana Lamo (ECB) as Secretary.

The refereeing process of this paper has been co-ordinated by a team composed of Gabriel Fagan (ECB, chairperson), Philip Vermeulen (ECB), Giuseppe Bertola, Julian Messina, Jan Babecký (CNB), Hervé Le Bihan (Banque de France) and Thomas Mathä (Banque centrale du Luxembourg).

The paper is released in order to make the results of WDN research generally available, in preliminary form, to encourage comments and suggestions prior to final publication. The views expressed in the paper are the author's own and do not necessarily reflect those of the ESCB.

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CONTENTS

Abstract

In this paper we analyze empirically how labor market institutions influence business cycle volatility in a sample of 20 OECD countries. Our results suggest that countries characterized by high union density tend to experience more volatile movements in output, whereas the degree of coordination of the wage bargaining system and strictness of employment protection legislation appear to play a limited role for output volatility. We also find some evidence suggesting that highly coordinated wage bargaining systems have a dampening impact on inflation volatility.

Keywords: Business Cycles, Inflation, Labor Market Institutions

JEL Classification: E31, E32

Non-technical Summary

In this paper we investigate empirically how institutional characteristics of the labor market influence business cycle volatility in a panel of 20 OECD countries. The novel aspect of our analysis is that we focus explicitly on the volatility of macroeconomic variables across countries.

From a theoretical point of view, labor market institutions may be relevant for business cycle dynamics for several reasons. Calmfors and Driffill (1988) argue that the extent to which unions internalize the macroeconomic consequences of their actions has implications for macroeconomic outcomes. Taking this argument on step further implies that institutional characteristics of the wage bargaining process influence the response of macroeconomic variables to disturbances. Moreover, a large literature initiated by Andolfatto (1996) and Merz (1995) argues that search and matching processes between employers and workers determine the dynamics of job and worker flows over the business cycle. To the extent that search and matching processes are influenced by the institutional environment, this literature provides another theoretical basis for our empirical analysis.

Since unions are more likely to take macroeconomic consequences into account when wage bargaining is coordinated, we expect output and inflation volatility to be lower in countries characterized by highly coordinated wage bargaining systems.

An additional channel through which labor market institutions may influence aggregate fluctuations is via their impact on job and worker flows. To capture this channel we add a proxy for the strictness of employment protection legislation. Stricter employment protection legislation makes firing more costly and is therefore expected to dampen output volatility.

In addition, we analyze union density as a potential determinant of business cycle volatility. We view union density primarily as a proxy for the bargaining power of unions. Strong unions may be less prone to wage moderation in case of an adverse shock and, thus, we expect that business cycle volatility is larger in countries characterized by higher union density.

Our empirical approach consists of performing fixed-effect panel regressions of the standard deviations of the output gap as well as inflation on the three labor market institutions mentioned above and several control variables. We find that labor market institutions and in particular the characteristics of unions indeed determine the volatility of output to some extent. As expected, stronger unionization has a significantly positive impact on output volatility, whereas the extent to which wage bargaining is coordinated has only a small impact on output volatility. In line with the view that in highly coordinated wage bargaining systems, unions internalize the macroeconomic consequences of their actions, we find that inflation volatility is actually lower in economies where coordination is high.

As an additional analysis we explicitly consider the role of labor market institutions in the transmission of macroeconomic fluctuations. More specifically, we add interaction terms of the institutional variables with measures of the fluctuations in the terms of trade and in import price inflation. We find that higher coordination dampens both, output and inflation volatility, which suggests that unions operating in a highly coordinated system of wage bargaining tend to reduce business cycle volatility.

Overall, our results suggest that unions act only to a limited extent as absorbers of macroeconomic disturbances. One the one hand, we find that a higher degree of coordination does not necessarily stabilize output. However, on the other hand, coordination stabilizes inflation rates. In this sense, monetary policy may benefit from increased coordination of wage bargaining.

1 Introduction

In this paper, we investigate empirically how institutional characteristics of the labor market influence business cycle volatility in a panel of OECD countries. In a seminal paper, Calmfors and Driffill (1988) argue that the extent to which unions internalize the macroeconomic consequences of their actions has implications for macroeconomic outcomes and specifically for the unemployment rate. In this paper, we take this argument one step further and ask how institutional characteristics of the wage bargaining process influence the response of macroeconomic variables to disturbances.

In addition to determining the framework within which wages are negotiated, labor market institutions may be relevant for the business cycle via their impact on job and worker flows. Based on the search and matching framework (see Mortensen and Pissarides, 1994), recent business cycle research emphasizes the implications of labor market institutions for aggregate fluctuations (see e.g. Veracierto, 2008; Zanetti, 2006).

The novel aspect of our analysis is that we focus explicitly on the volatility of macroeconomic variables across countries. Although the role of labor market institutions for macroeconomic performance, and in particular long-run unemployment, has been investigated extensively in the literature (see e.g. Blanchard and Wolfers, 2000), only few papers explore the implications for the business cycle. Nunziata (2003) studies the effect of labor market institutions on cyclical adjustment of employment and hours worked. Nunziata and Bowdler (2005) study the implications of labor market institutions for inflation dynamics but without taking volatility into account. Fonseca et al. (2007) also explore how labor market institutions are related to the business cycle, but their analysis is concerned with international co-movement and not volatility.

In terms of the empirical strategy we pursue in this paper, our analysis is closely related to the literature that studies the determinants of business cycle volatility in a cross-section framework. Karras and Song (1996) investigate potential sources of business cycle volatility in a sample of OECD countries and find that volatility is related to monetary as well as real factors. Ferreira da Silva (2002), Buch and Pierdzioch (2005) and Beck et al. (2006) find that financially more developed economies experience smoother business cycles. Kose et al. (2003a) and Kose et al. (2003b) analyze the impact of globalization on macroeconomic volatility. Fatás and Mihov (2003) study the role of fiscal policy for output volatility. In contrast to these papers, we exploit not only the cross-section variation, but also the variation along the time dimension by using a panel data set.

We find that labor market institutions and in particular the characteristics of unions determine to some extent the volatility of output. Stronger unionization has a significantly positive impact on output volatility, which may be related to the bargaining power of unions. The extent to which wage bargaining is coordinated has only a small impact on output volatility. In line with the view that in highly coordinated wage bargaining systems, unions internalize the macroeconomic consequences of their actions, we find that inflation volatility is lower in economies where coordination is high. Overall, however, we find only limited evidence in favor of the hypothesis that unions act as shock absorbers.

The paper is organized as follows: Section 2 discusses the role of labor market institutions for the business cycle and briefly surveys the related literature. Section 3 describes our empirical strategy and the data, while Section 4 presents the estimation results and Section 5 concludes the paper.

2 Labor Market Institutions and Aggregate Fluctuations

In this section we motivate the hypothesis that labor market institutions influence the dynamics of output and inflation over the business cycle. Calmfors and Driffill (1988) point out that the organization of the wage bargaining process may have implications for macroeconomic outcomes. However, their analysis is primarily concerned with the level of the unemployment rate, therefore the question remains, how a union that internalizes the consequences of its actions responds to shocks that call for an adjustment of real wages. Consider for instance an adverse shock that leads to a slow-down in economic activity and an increase in the inflation rate. Unions may react with higher nominal wage claims to compensate the loss in purchasing power resulting from higher inflation. Consequently, production costs increase due to higher wages and production may slow down even further.

However, if unions internalize the macroeconomic implications of their high wage claims, they may prefer to let the real wage adjust. In this case, the initial shock is dampened and the impact on employment, output and inflation is less pronounced. Thus, unions that internalize the macroeconomic consequences of their wage claims can indeed reduce the impact of disturbances on the economy. Put differently, by responding appropriately, they may act as a shock absorber.

Since unions are more likely to take macroeconomic consequences into account when wage bargaining is coordinated, we expect output and inflation volatility to be lower in countries characterized by highly coordinated systems of wage bargaining.

Overall, unions in coordinated systems may ensure the appropriate degree of real wage flexibility to promote macroeconomic adjustment. Several studies document that real wage flexibility is closely related to the institutional environment in which wage negotiations take place (see e.g. Clar et al., 2007, and the references therein).[1] Thus, the present paper is also related to this strand of the literature.

So far, our discussion has focussed on unions and the organization of the wage bargaining process. In addition, labor market institutions may influence aggregate fluctuations via their impact on job and worker flows. In other words, the search and matching process between employers and workers may depend on the institutional setting. Merz (1995) and Andolfatto (1996) were among the first to analyze the implications of search and matching frictions in a business cycle framework. They find that embedding these aspects into a real business cycle model improves the ability of these models to match empirically observed labor market dynamics. Veracierto (2008) analyzes the impact of firing costs in a real business cycle model.

More recently, several authors have incorporated search and matching frictions into variants of the New Keynesian model, which currently appears to be the workhorse model for business cycle analysis (see e.g. Krause and Lubik, 2007; Christoffel et al., 2006; Walsh, 2005). They find that in general, the ability of the model to replicate key business cycle characteristics is improved when labor market frictions are modeled. Trigari (2006) studies the implications of search and matching for inflation dynamics in a New Keynesian Model. Campolmi and Faia (2006) take labor market institutions explicitly into account and

[1] The importance of real wage flexibility in general is also frequently emphasized in the literature (see e.g. Pichelmann, 2007).

explore to what extent differences in institutions can explain cyclical inflation differentials across countries. Zanetti (2006) uses a similar framework and finds that an increase in firing costs decreases output volatility while the volatility of inflation increases. The reason is that firing costs make the adjustment of employment costlier than the adjustment of prices and therefore output fluctuations are damped. Inflation, however, becomes more volatile, since firms react to shocks by adjusting prices.

3 Empirical Strategy and Data

To investigate the relationship between labor market institutions and macroeconomic volatility, we start by regressing the standard deviation of the output gap, as measured by the cyclical component of the real per capita GDP on proxies for the institutional characteristics of the labor market. Specifically, our empirical analysis is based on:

$$\sigma(y_{it}) = \alpha + \beta' LMI_{it} + \gamma' X_{it} + \mu_i + \lambda_t + \epsilon_{it}, \tag{1}$$

where y_{it} is the output gap and $\sigma(\cdot)$ denotes the logged standard deviation.[2] The vector LMI_{it} contains variables related to the structure of the wage-bargaining process and X_{it} is a vector of control variables. We allow for two-way fixed effects in equation (1) by including country fixed effects, μ_i, and time fixed effects, λ_t.

Our sample includes 20 OECD countries (Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, UK and the US). The quarterly series cover 1970:1 to 2006:4. The macroeconomic variables are obtained from the OECD Economic Outlook (ECO) database. To calculate real GDP per capita we divide real GDP by the total working age population. We calculate y_{it} as the deviation from the Hodrick-Prescott (HP) trend.[3] Standard deviations are calculated over 5-year non-overlapping intervals.

Data for Labor Market Institutions are taken from Nickell et al. (2001), where the ultimate data source for most variables are various OECD employment outlooks, e.g. OECD (1999).

[2]We follow Fatás and Mihov (2003) and use the log of the standard deviations which allows us to interpret the coefficient estimates as elasticities or semi-elasticities. Qualitatively, our results are not affected by this transformation.

[3]Results are similar when the growth rate of per capita GDP is used instead of the output gap.

Since the macro data start in 1970 and the labor market institutions variables end in 1995, we have a panel data set with 6 (five-year interval) observations in the time dimension and 20 observations in the cross-sectional dimension.

Note that although labor market institutions are usually assumed to be exogenous, this need not be the case. One could argue for instance that union density and employment protection are relatively high when economies face volatile business cycles and not the other way around. To guard against this possibility of reverse causality we use the initial values of the interval over which standard deviations are calculated.[4]

LMI_{it} contains a proxy for the coordination of the wage bargaining process, CO_{it}, union density, UD_{it}, and an index capturing the strictness of employment protection legislation, EP_{it}. CO_{it} is a summary measure reflecting whether wage negotiations take place at the firm, industry or national level and also the role of government and employers federations in the wage bargaining process. CO_{it} ranges from 1 to 3 where higher values indicate a higher level of coordination. As it is standard in the literature, we use the coordination of the wage bargaining process as our main proxy for the degree to which unions internalize the macroeconomic consequences of wage claims. As described in the previous section, we expect unions to internalize the macroeconomic effects of their behavior to a greater extent in highly coordinated systems. Hence, it appears conceivable that output and inflation evolve in a smoother fashion in economies characterized by more coordinated wage bargaining systems. In one specification we also include an alternative proxy for the coordination of wage bargaining, COW_{it}. The difference to the former is that COW_{it} contains more short-term variation in coordination (see Nickell et al., 2001).

We include union density as a proxy for the bargaining power of unions (see also Nunziata and Bowdler, 2005). Union density, UD_{it}, refers to the net union membership rate of employees (gross minus retired and unemployed members). We interpret high unionization rates as an indication for a strong bargaining position of unions. Since wage moderation may be rather limited in this case, the response to shocks may be more pronounced. Thus, we expect that business cycle volatility is larger in countries characterized by higher values of UD_{it}.

[4]Using averages taken over the 5-year intervals instead of initial values leaves our results largely unaltered.

Finally, we include a measure for the strictness of employment protection legislation to proxy firing costs. Employment protection legislation, EP_{it}, is again a summary measure that broadly summarizes constraints on the dismissal of workers (e.g. period of notice before dismissal and severance pay). Higher values of the EP_{it} index, which is defined between 0 and 2, correspond to stronger labor market frictions. According to Zanetti (2006), we expect output volatility to be smaller in countries with stricter employment protection legislation while inflation volatility should be higher in those countries.

The vector of control variables X_{it} in (1) contains the log of the standard deviation of government consumption as a percentage of GDP, $\sigma(GOV)$, the logged standard deviation of the terms of trade, $\sigma(TOT)$, - where GOV and TOT are deviations from their HP trends - and per capita GDP in the initial period of the 5-year interval, Y_0. The choice of these control variables is motivated by the existing literature. We include $\sigma(GOV)$ to control for unsystematic fiscal policy as suggested by Fatás and Mihov (2003). Beck et al. (2006) find that output volatility is influenced by fluctuations in the terms of trade and that countries with higher per capita GDP experience smoother cycles.

Throughout the paper we calculate robust standard errors – allowing for heteroskedasticity of unknown form.

4 Results

Table 1 shows the estimation results for (1). The table presents three different specifications. In the second column the results for our baseline specification are reported. In the third column we test for a non-linear effect of the coordination variable in the spirit of Calmfors and Driffill (1988). The last column shows the results when we use an alternative proxy for coordination.

We see from the second column of the table that the volatility of the cyclical component of government consumption, $\sigma(GOV)$, has a positive and strongly significant impact on the volatility of the output gap. This result is in line with Fatás and Mihov (2003) who find that discretionary fiscal policy tends to result in more volatile business cycles. $\sigma(TOT)$ turns out to be insignificant at standard levels and Y_0 enters positively and significantly, but only at the ten percent level. The positive sign of Y_0 is somewhat at odds with the findings reported in the literature, where countries with higher GDPs are found to experience smoother cycles. However, these studies typically analyze samples that also include less developed countries, whereas our sample consists entirely of developed countries. Similarly, less developed countries are also likely to be more exposed to fluctuations of terms of trade, which could explain why we do not find a significant effect of terms of trade fluctuations on output volatility. The remaining columns of the table show that these results are robust with respect to different specifications.

Concerning the institutional variables which we are primarily interested in, Table 1 shows that employment protection, EP, does not appear to exert a significant influence on the volatility of the output gap. This result is in line with the findings reported in the empirical literature on employment protection and job flows. Empirically it has proven hard to establish a relationship between employment protection and job flows. Several studies argue that despite large differences in employment protection across countries, differences in market outcome are rather small (see e.g. Bertola and Rogerson, 1997). Overall, the insignificance of EP in our estimation casts some doubt on the importance of firing costs for aggregate volatility.

Turning to union density, we see that countries characterized by higher union density tend to experience more volatile fluctuations in the output gap. The point estimate of 1.15 implies that a change in union density by one standard deviation increases the volatility of the output gap by 21 percent.[5] This result is robust across specifications and consistent with the interpretation that higher unionization as measured by UD indicates that unions have stronger bargaining power which may result in less wage moderation and thus in higher macroeconomic volatility.

We also see that the proxy for coordination, CO, enters with a positive and marginally significant coefficient. Thus, so far we find no evidence in favor of the hypothesis that more coordinated wage bargaining systems are characterized by lower output volatility. In the third column we add the square of CO to allow for a non-linear relationship between wage coordination and output volatility. Neither CO nor CO^2 turn out to be significantly different from zero in this specification. In the last column, we replace CO by COW which is an alternative proxy for coordination. Here we see that the coefficient on COW remains

[5] In our sample the variable UD has a mean of 0.43 and a standard deviation of 0.19.

positive and again turns out to be significant at the 10 percent level.

Thus, our results indicate that labor market institutions influence output volatility to some extent. However, we find no support for the hypothesis that countries characterized by highly coordinated wage bargaining systems experience greater macroeconomic stability. Output volatility may even be amplified in coordinated systems, although the effect is only marginally significant. A rather robust result is that high union density is associated with higher output volatility. Hence, our results presented so far cast some doubt on the role of unions as shock absorbers. Moreover, firing costs which are emphasized in the search and matching literature do not appear to influence output volatility.

Next, we evaluate the cross-sectional stability of our results. That is, we delete one country at the time from the sample and re-estimate equation (1) for the resulting 20 subsamples. Table 2 reports the minima and maxima of the point estimates for the institutional variables over these subsamples. In addition to the minima and maxima, the table also shows the corresponding t-ratios and the country which is dropped.

According to the table, EP is always insignificant, regardless of which country is excluded. For UD and CO the minima of the point estimates are no longer significantly different from zero at standard levels. Overall, however, UD and CO are both significant in 17 out of 20 regressions when dropping individual countries. In addition, the minima and maxima are obtained when different countries are dropped, therefore we conclude that the results do not appear to be driven by any particular country.[6]

4.1 The Transmission of Volatility

To study more closely how labor market institutions impact upon business cycle volatility, we now explore how institutions propagate disturbances that hit the economy. To do so, we extend our baseline equation to include interaction terms. In particular, we interact $\sigma(TOT)$ and $\sigma(GOV)$ with EP, UD and CO in (1) to capture the role that institutional aspects play for the transmission of fluctuations in the terms of trade and government spending.

[6] We also repeated the analysis with data starting in 1985 to see if the period before the Great Moderation influences our results. Qualitatively, our results are quite robust. Detailed results are available upon request.

Note that one could interpret $\sigma(TOT)$ in terms of structural shocks as in Beck et al. (2006).[7] However, we prefer a more general interpretation and do not view terms of trade fluctuations as a proxy for a specific, underlying structural shocks.

The second column of Table 3 shows that none of the interaction terms involving $\sigma(GOV)$ turn out to be significantly different form zero at standard levels, indicating that labor market institutions play no role for the transmission of fluctuations in government spending. From the last column of the table we see that union density tends to significantly amplify the effect of terms of trade fluctuations on output volatility, whereas in this specification, higher coordination significantly dampens output volatility.

Overall, adding interaction terms confirms our earlier findings on the amplifying effect of union density on output volatility, while it contrasts our previous results by delivering a dampening effect of coordination on output volatility when we take the transmission of terms of trade fluctuations explicitly into account. Thus, these results are more in favor of the role of unions as a shock absorber in highly coordinated wage bargaining systems.

4.2 Inflation Volatility

Since it appears conceivable that labor market institutions influence not only fluctuations in real activity, but also inflation dynamics, we now extent our analysis to cover inflation volatility. One way to proceed would be to estimate an equation analogous to (1) with inflation volatility instead of output gap volatility as the dependent variable. However, such an approach would ignore potentially important interrelationships between output and inflation volatility. For instance, the standard New Keynesian business cycle model (see e.g. Woodford, 2003) suggests that inflation dynamics are partly driven by real marginal cost. To the extent that the output gap mirrors fluctuations in marginal cost, output gap volatility may feed back into the volatility of the inflation rate.

Thus, we adopt a general specification and estimate a system of equations where output and inflation volatility are both treated as endogenous variables. More specifically, we include inflation volatility, $\sigma(\pi_{it})$, as a right-hand-side variable in (1) and we specify an

[7] Beck et al. (2006) argue that terms of trade disturbances give rise to variation in input prices and can therefore be interpreted as productivity shocks.

additional equation for inflation volatility as the dependent variable:

$$\sigma(y_{it}) = \alpha_1 + \beta_1\sigma(\pi_{it}) + \gamma_1' LMI_{it} + \delta_1' X_{1,it} + \mu_i + \lambda_t + \epsilon_{1,it}, \tag{2}$$

$$\sigma(\pi_{it}) = \alpha_2 + \beta_2\sigma(y_{it}) + \gamma_2' LMI_{it} + \delta_2' X_{2,it} + \mu_i + \lambda_t + \epsilon_{2,it}, \tag{3}$$

where π_{it} is the quarterly change in the consumer price index and $X_{1,it}$ and $X_{2,it}$ are vectors containing control variables. We also estimate specifications, where we augment (2) and (3) by interaction terms.

As control variables in the inflation equation, we include an index for central bank independence, CBI, and the logged standard deviation of import price inflation, $\sigma(IMP)$, in addition to $\sigma(GOV)$ and Y_0 in $X_{2,it}$. Data on the consumer price index and on import price inflation are obtained from the OECD Economic Outlook (ECO) database.

Since independent central banks are more likely to put a larger weight on price stability, we expect CBI to dampen inflation volatility. Moreover, several studies document empirically that the impact of coordination of wage bargaining on macroeconomic outcomes depends also on its interaction with institutional characteristics of central banks. Cukierman and Lippi (1999) develop a model of the strategic interaction between monetary policy and unions that incorporates labor market institutions. They find that central bank independence influences the relationship between coordination and macroeconomic outcomes. The CBI index is obtained from Van Lelyveld (2000) which is an update of the Cukierman (1992) index of the legal independence of central banks. Its values range from 0 to 1, where 1 indicates the maximum possible independence of central banks.

Note that in (2), the predetermined variables IMP and CBI are not included and in (3), TOT is excluded. Therefore, this choice of control variables ensures identification of the system. To allow $\epsilon_{1,it}$ and $\epsilon_{2,it}$ to be correlated, we estimate the system (2) and (3) by three-stage least squares.

It has to be pointed out that if we use the richest specification of (3) allowing for country and time fixed effects, we do not find a statistically significant effect of labor market institutions on inflation volatility. However, once we drop time fixed effects from (3), the impact of institutions turns out to be statistically significant. Note also the time dummies are jointly insignificant at standard levels in (3). Therefore, we report the results from the system estimation only for the case where time dummies are not included in (3).

Table 4 shows the results. In columns two and three the table shows the estimation results for the system (2) and (3). The remaining columns of the table show the results we obtain, when we augment the system by interaction terms to explicitly study the transmission of volatility.

We see from columns two and three that, although output gap volatility has a positive and significant impact on inflation volatility, inflation volatility does not directly affect the volatility of the output gap. We also see that the volatility of import price inflation significantly impacts upon the standard deviation of inflation. In addition, countries with higher initial levels of per capita real GDP tend to have less volatile inflation rates. This result is similar to Nunziata and Bowdler (2005) who find a negative impact of per capita GDP on the level of inflation.

Turning to the labor market variables, we find that UD tends to increase output volatility, which is in line with our previously reported results. A high level of coordination dampens inflation volatility. CO has the expected negative sign and is highly significant in (3). That is, our results indicate that inflation volatility tends to be lower in countries characterized by highly coordinated systems. Thus, we find that, although a higher degree of coordination may not stabilize output, it contributes to stable inflation rates.

The last two columns show the results when we add interaction effects to the system. We interact the institutional variables with $\sigma(TOT)$ in (2) similar to our previous analysis. Since $\sigma(TOT)$ is not included in (3) we interact $\sigma(IMP)$ instead to study the transmission to inflation volatility. We find that employment protection legislation and union density tend to amplify the effect of terms of trade fluctuations on output volatility, although the interaction term involving EP is only marginally significant. Coordination, however, significantly dampens the transmission of fluctuations in the terms of trade to output volatility. These findings confirm our previous results. Turning to the results for inflation volatility, the last column of Table 4 shows that coordination has a negative and strongly significant impact on the propagation of import price fluctuations.

Overall, we find that coordination dampens output and inflation volatility at least when the transmission of fluctuations in TOT and IMP, respectively, is considered. Thus, these results are more in favor of a role of unions as a shock absorber in highly coordinated wage bargaining systems. Nevertheless, our results still indicate that strict employment protection legislation and a high union density tend to increase output volatility in the transmission of terms of trade fluctuations.

5 Concluding Remarks

In this paper we explore the extent to which labor market institutions shape the adjustment of output and inflation over the business cycle. We find that countries characterized by a high union density tend to experience larger fluctuations in output. If we interpret high unionization rates as an indication of stronger bargaining power, then this result is in line with the idea that stronger unions successfully resist wage moderation during economic downturns and thereby amplify shocks that hit the economy. Employment protection legislation, in contrast, does not appear to play a role in this context.

We also find some evidence in favor of the hypothesis that inflation rates are less volatile in economies characterized by highly coordinated wage bargaining systems. Thus, our results are consistent with the hypothesis that by internalizing the consequences of their actions, unions operating in coordinated systems contribute to the stability of inflation rates. In this sense, monetary policy may benefit from increased coordination. However, concerning the effect of coordination on output volatility, we find only little evidence in favor of a dampening effect.

Thus, our results suggest that unions act only to a limited extent as shock absorbers. This result might be due to limited information about the shocks that hit the economy. Even if unions take the consequence of their actions into account and try to dampen shocks, this objective may be complicated by the fact that the appropriate response may depend on the type of shock. Since unions, just like policy makers, may only observe fluctuations in aggregate variables without being aware of the type of underlying shock, they may simply not have enough information to fully stabilizing.

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Table 1: Labor Market Institutions and Output Gap Volatility

$\sigma(GOV)$	0.51	***	0.51	***	0.55	***
	(6.19)		(6.12)		(6.34)	
$\sigma(TOT)$	-0.05		-0.06		-0.08	
	(-0.61)		(-0.62)		(-0.82)	
Y_0	0.81	*	0.81	*	1.05	**
	(1.75)		(1.73)		(2.45)	
EP	0.03		0.03		0.06	
	(0.22)		(0.22)		(0.41)	
UD	1.15	**	1.13	**	1.11	*
	(1.99)		(2.06)		(1.83)	
CO	0.39	*	0.64			
	(1.81)		(0.58)			
CO^2			-0.06			
			(-0.25)			
COW					0.15	*
					(1.83)	
Obs	119		119		119	
R^2	0.64		0.64		0.63	

Notes: t-statistics in parenthesis. * denotes significance at the 10%, ** at the 5% and *** at the 1% level. In addition to the variables displayed in the table, the equation contains country and time fixed effects.

Table 2: Cross Sectional Stability

	Min	Country	Max	Country
EP	-0.04	Denmark	0.17	Sweden
	(-0.27)		(0.61)	
UD	0.72	Spain	1.53	Denmark
	(1.36)		(2.26)	
CO	0.25	UK	0.61	Italy
	(1.38)		(2.92)	

Notes: The tables gives the minima and maxima of the coefficients when one country at the time is dropped, as well as the country which is dropped. t-statistics in parenthesis.

Table 3: Adding interaction effects

$\sigma(GOV)$	0.41	0.53	***
	(1.32)	(6.25)	
$\sigma(TOT)$	-0.05	-0.24	
	(-0.56)	(-0.93)	
Y_0	0.80	0.83	*
	(1.64)	(1.75)	
EP	0.62	0.64	
	(0.84)	(1.55)	
UD	3.14	5.56	***
	(1.61)	(3.83)	
CO	-0.05	-0.45	
	(-0.08)	(-1.06)	
$EP * \sigma(GOV)$	0.14		
	(0.79)		
$UD * \sigma(GOV)$	0.44		
	(1.05)		
$CO * \sigma(GOV)$	-0.12		
	(-0.68)		
$EP * \sigma(TOT)$		0.15	
		(1.47)	
$UD * \sigma(TOT)$		1.04	***
		(3.53)	
$CO * \sigma(TOT)$		-0.20	**
		(-2.14)	
Obs	119	119	
R^2	0.65	0.68	

Notes: t-statistics in parenthesis. * denotes significance at the 10%, ** at the 5% and *** at the 1% level. In addition to the variables displayed in the table, the equation contains country and time fixed effects.

Table 4: System Estimation (3SLS)

dependent variable	$\sigma(y)$		$\sigma(\pi)$		$\sigma(y)$		$\sigma(\pi)$	
$\sigma(\pi)$	-0.38				-0.24			
	(-0.64)				(-0.89)			
$\sigma(y)$			0.71	***			0.49	**
			(2.59)				(2.41)	
$\sigma(GOV)$	0.56	***	-0.27		0.56	***	-0.13	
	(5.23)		(-1.40)		(7.00)		(-0.87)	
$\sigma(TOT)$	-0.06				-0.21			
	(-0.73)				(-0.92)			
$\sigma(IMP)$			0.16	***			0.62	***
			(2.73)				(3.06)	
Y_0	0.59		-1.47	***	0.63		-1.68	***
	(0.95)		(-6.55)		(1.26)		(-8.36)	
CBI			0.47				0.41	
			(1.22)				(1.02)	
EP	0.14		0.25		0.86	*	0.21	
	(0.54)		(1.33)		(1.72)		(0.90)	
UD	1.15	**	-0.77		6.06	***	-0.80	
	(2.23)		(-1.24)		(4.00)		(-1.43)	
CO	0.30		-0.48	**	-0.75		-0.02	
	(1.39)		(-2.03)		(-1.38)		(-0.10)	
$EP * \sigma(TOT)$					0.20	*		
					(1.69)			
$UD * \sigma(TOT)$					1.15	***		
					(3.41)			
$CO * \sigma(TOT)$					-0.26	**		
					(-2.15)			
$EP * \sigma(IMP)$							0.03	
							(0.25)	
$UD * \sigma(IMP)$							0.18	
							(0.64)	
$CO * \sigma(IMP)$							-0.27	***
							(-2.83)	
Obs	119		119		119		119	
R^2	0.64		0.69		0.73		0.74	

Notes: t-statistics in parenthesis. * denotes significance at the 10%, ** at the 5% and *** at the 1% level. In addition to the variables displayed, the output equation contains country and time fixed effects and the inflation equation contains time fixed effects.

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