ECONOMIC ANALYSIS & POLICY, VOL. 40 NO. 1, MARCH 2010

The Role of Labor Market Institutions on Wage and Inflation Dynamics: Empirical Evidence from OECD Economies

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Abstract: This paper investigates empirically how labor market institutions affect wage and inflation dynamics, particularly the volatility of real wage growth and inflation using a panel data for OECD economies. I also look at how the rate of unemployment is affected by the larger set of labor market variables that captures diverse aspects of the labor market. The main finding of the paper is that benefit replacement rate is the most significant variable in explaining the volatility of real wage growth and inflation. Besides that union density and bargaining coordination also play an important role in explaining the volatilities in these variables. These results for the benefit replacement rate and union density also support the findings of the theoretical models. It is also shown that the labor market institutions have a considerable influence on the level of unemployment as higher levels of benefit replacement rate, longer durations of unemployment benefits, and a higher union density are expected to lead to a higher level of unemployment.

I. INTRODUCTION

The structure of labor markets has recently gained attention in traditional New Keynesian models in the form of search and matching frictions in the labor market a la Mortensen and Pissarides (1994). Christoffer and Linzert (2005), Gertler and Trigari (2006), Trigari (2006) and Krause and Lubik (2005) are some recent examples of this modelling strategy. These models have been quite useful in matching the business cycle dynamics. In a theoretical model setting these models have shown that the way the labor markets and wage setting mechanism is modelled significantly affects the wage and inflation dynamics. Gertler, Sala, and Trigari (2007) find that incorporating staggered wage contracting is important in these models in terms of achieving the relatively smooth behavior of wages. Macit (2007) has shown that allowing for on-the-job search mechanism plays the same role and helps one in obtaining the observed volatility in wages. The models have also shown that the calibration of the parameters for the labor market which can be proxied by various labor market institutions in the data affect the response of wages and inflation to exogenous shocks. Trigari (2006) finds that a higher

parameter value for the value of unemployment benefits along with a smaller number for the bargaining power parameter generates smoother responses in real wages and inflation. Macit (2008) incorporates a fixed firing cost into these models and finds that a higher firing cost reduces the volatility of inflation and real wages and generates more persistent movements in these variables. The findings of these papers have raised the question of whether there exists an empirical evidence that supports these results.

In this paper I carry out an empirical investigation of these findings using panel data for OECD economies for the period 1970 and 1995. In particular I explore the role of labor market institutions in explaining the volatility of real wage growth and inflation. As the labor market institutions that are used can be considered as proxies of parameters in the theoretical models this study will also be an empirical test of the findings of these models. In order to capture diverse aspects of the labor market I take various indicators of the labor market characteristics including employment protection legislation index, benefit replacement rate, benefit duration index, union density, and bargaining coordination index. I calculate the volatility in real wage growth and inflation for each 5-year non-overlapping intervals for the period 1970 and 1995. The main finding of the paper is that benefit replacement rate is the most significant labor market institution explaining the volatility in inflation and real wage growth. Besides that union density which can be taken as a proxy for the bargaining power of the workers also plays an important role for inflation volatility. These results are consistent with the theoretical findings of Trigari (2006) who shows that the value of unemployment benefits and bargaining power parameters are two important parameters of the model. However, the empirical evidence fails to support the results for the firing costs which are proxied by employment protection legislation index.

The role of labor market institutions on macroeconomic dynamics has been a topic of research for many economists. However, most of these studies have focused on explaining the level of unemployment differences across the countries based on labor market characteristics. Blanchard and Wolfers (1999) investigate the interaction between shocks and labor market institutions in explaining the cross-country differences in the rise of European unemployment. Fialova and Schneider (2008) explores the role of labor market institutions in explaining different labor market developments in European countries and they give particular attention to the new European Union member countries. An important issue with these and other related papers is that they focus on a particular aspect of the labor market. In this paper I also look at how the level of unemployment rate is affected by labor market insitutions using the broad set of variables that captures diverse aspects of the labor market. A number of authors have also investigated the relationship between labor market institutions and inflation dynamics. Campolmi and Faia (2006) investigates whether inflation differentials observed among European Union countries can be explained by the differences in their labor market structures. Nunziata and Bowdler (2005) carries out an empirical analysis for the impact of labor market structures on the response of inflation to macroeconomic shocks. Rumler and Scharler (2009) investigates the role of labor market institutions on business cycle volatility and also analyses how the degree unions internalize the macroeconomic consequences of their actions affect inflation volatility. This paper differs from their paper as I use a larger set of labor market institutions and focus on the volatility of real wage growth and inflation persistence besides the volatility in inflation.

The rest of the paper is organized as follows: Section II presents the empirical model and gives a description of the data. Section III discusses the estimation results and Section IV concludes.

II. EMPIRICAL MODEL AND DATA

2.1 Empirical Model

This section presents the econometric model that I use to investigate the relationship between labor market institutions and volatility of real wage growth and inflation. I also present the estimation results regarding the relationship between the labor market institutions and unemployment rate by regressing the unemployment rate on a set of labor market institutions. For the purpose of the relationship between the labor market institutions and the volatility of real wage growth and inflation I regress the standard deviations of the real wage growth and inflation on various indicators for labor market institutions and a set of control variables. The reduced-form equations that are going to be estimated can be summarized as follows:

$$\sigma(\pi_{it}) = \alpha_1 + \beta_1^{'} LMI_{it} + \gamma_1^{'} X_{1,it} + \lambda_i + \varepsilon_{1,it} \quad (1)$$

$$\sigma(w_{it}) = \alpha_2 + \beta_2^{'} LMI_{it} + \gamma_2^{'} X_{2,it} + \lambda_i + \varepsilon_{2,it} \quad (2)$$

$$u_{it} = \alpha_4 + \beta_4^{'} LMI_{it} + \lambda_i + \varepsilon_{4,it} \quad (3)$$

where $\sigma(\pi_{it})$ denotes the volatility of inflation and $\sigma(w_{it})$ denotes the volatility of real wage growth for country i calculated over the 5-year non-overlapping time interval t. LMI_{it} is a vector of variables including labor market institutions and $X_{j,it}$ represent the vector of control variables. λ_i denotes the country fixed effects and u_{it} represents the average unemployment rate for country i over the time interval t. I estimate equations (1) through (3) in a single equation framework using fixed effects estimators.

The vector LMI_{it} contains the variables for labor market institutions including an index measuring the strictness of the employment protection legislation, EPL_{it}, a proxy measuring the level of unemployment benefits namely benefit replacement rate, BRR_{it}, benefit duration index, BD_{it}, union density, UD_{it}, and an index capturing the level of coordination between workers and firms during the wage bargaining process, CO_{it}.

EPL_{it} which measures the strictness of the employment protection legislation is an index that captures the features of the labor market such as difficulty of dismissal, notice of dismissal, severance pay etc. Although the data for employment protection legislation index is taken from Nickell and Nunziata (2001) the ultimate data source is employment outlooks of OECD. The index takes a value between 0 and 2 and a higher index number implies that there are stricter employment protection legislations in that country. A stricter employment protection legislation implies that dismissal of a worker is difficult and costly for a firm which should dampen the volatility of the real wages and inflation and generate more persistence movements in these variables.

The benefit replacement rate, BRR_{it}, measures the level of unemployment benefits as a percentage of average earnings before tax. Nickell and Nunziata (2001) takes the first year of

unemployment benefits when calculating the benefit replacement rate. For instance, for Germany the average index value for BRR for the years between 1970 and 1995 is 0.39 which means that when unemployed a German worker earns 39 percent of his last wage when employed. The benefit duration index, BD_{it}, is a measure of how long the unemployment benefits last for. Nickell and Nunziata (2001) calculate the BD using the following formula:

$$BD = \alpha \frac{BRR_2}{BRR_1} + (1-\alpha)\frac{BRR_4}{BRR_1} \tag{4}$$

where BBR_1 is the unemployment benefit replacement rate received during the first year of unemployment, BBR_2 is the benefit replacement rate that prevails during the second and third year of unemployment, and BBR_4 is the replacement rate received during the fourth and fifth year of unemployment. Nickell and Nunziata (2001) give more weight to the first part of the formula as they set $\alpha = 0.6$. If workers are not entitled for unemployment benefits after one year then one has $BRR_2 - BRR_4 - 0$ which gives us BD = 0. If workers receive the same benefit during the course of unemployment then one gets $BBR_1 = BBR_2 = BBR_4$ which makes BD = 1. A higher value for BRR and/or BD means that workers have a higher reservation wage. That is workers do not have an incentive for extensive wage cuts during bad times as they have relatively better outside options which dampens the volatility of real wages and inflation.

Union density, UD_{it}, is measured as the ratio of total reported union members (gross minus retired and unemployed members) to wage and salaried employees. A high unionization rate means a strong bargaining power for workers which can make wages more volatile.

The bargaining coordination index, CO_{it}, measures the level of coordination between firms and workers during the wage bargaining process. The index takes a value between 1 and 3 higher numbers implying a more coordinated wage bargaining process. Nickell and Nunziata (2001) define COW_{it} as an alternative proxy for the level of coordination. The only difference is that COW measures the short term variation in coordination. The literature considers the bargaining coordination index as an indicator of the degree to which unions internalize the macroeconomic consequences of their wage claims. Therefore, for countries that have highly coordinated bargaining processes one should expect the volatility of real wage growth and inflation to be low as unions are assumed to internalize the macroeconomic consequences of their wage claims.

The vector of control variables $X_{1,it}$ given in equation (1) comprises the volatilities of money growth rate, import price inflation, and total labor productivity growth. The inclusion of import price inflation as a control variable for inflation volatility is motivated by the work of Rumler (2007) and Leith and Mulley (2007) as they show that import prices may influence inflation in open economies. For equation (2) $X_{2,it}$ includes the volatility of the labor productivity growth of the total economy.

2.2 Data Description

The sample that I use includes data from 20 OECD countries namely Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom, and the United States. The labor market institutions data are taken from Nickell and Nunziata (2001)

which is yearly data for the period 1960 and 1995. The data for inflation, labor productivity growth, and real wages is obtained from OECD Economic Outlook database. The real wages are obtained by dividing hourly earnings for manufacturing sector by the consumer price index for the respective period. The data for inflation and real wages is a quarterly data for the period 1970 and 2000. The numbers for money growth and import price inflation are obtained from International Financial Statistics database of IMF. I calculate the standard deviations over 5-year intervals. As the labor market institutions data end in 1995 and the data for macroeconomic variables start from 1970 the panel data set includes 6 observations in the time dimension and 20 observations in the cross-sectional dimension.

A summary of the labor market institutions is given in *Table 1*. The table gives the average values of employment protection legislation index, benefit replacement rate, benefit duration index, union density, and bargaining coordination index over the period 1970 and 1995 for 20 OECD countries. One can observe that there is a huge cross-country variation in terms of the labor market characteristics of the OECD economies. For instance, for employment protection legislation index one can observe values as low as 0.1 (United States) and at the same time values as high as 1.97 (Italy). The same pattern can also be observed for other labor market institutions. Another question that one may raise is that if a country has a strict labor market regulation in terms of one institution then it is possible that the country has protective labor market institutions from other perspectives. For instance, one might conjecture that if a country has a high index number for employment protection legislation then the country might have more generous benefit replacement rate or a higher number for union density. If this is the case then our regressions might have the problem of multicollinearity. In order to check for this one can look at coefficients of cross-correlations for the labor market institutions that are included in the regression. *Table 2* presents cross-correlations for the labor market variables. The results show that there is a very weak correlation across the labor market institutions which leads one not to worry about the multicollinearity problem in the regression analysis. For instance, the weak correlation between the level of employment protection legislation and benefit replacement rate or union density shows that the fact that a country has rigid rules for employment protection does not necessarily imply that there are more generous unemployment benefits or high number of workers that are attached to a labor union.

One can also claim for instance that bargaining coordination and/or union density are relatively high in countries which are subject to more volatile movements in inflation and real wages and not the other way around as it is investigated in this paper. That is one may conjecture that the endogenity problem may arise in the regression models. To avoid this problem of endogenity for the labor market institutions I use the initial values of the five year time intervals for which standard deviations are calculated. It is also seen in the data that although the value of the labor market institutions show large variations across the time intervals for which standard deviations are calculated there is very little variation within the same time interval.[1]

[1] The results do not show a big difference when I take average values of the labor market institutions rather than using the initial values of the five year time intervals.

Table 1: Average values of the labor market institutions over the period of 1970-1995

	EPL	BRR	BD	UD	CO
Australia	0.5	0.23	1.02	0.47	2.15
Austria	1.09	0.31	0.64	0.50	3.00
Belgium	1.48	0.50	0.79	0.51	2.00
Canada	0.30	0.57	0.23	0.36	1.00
Denmark	1.03	0.60	0.71	0.74	2.40
Finland	1.18	0.39	0.59	0.69	2.25
France	1.26	0.58	0.34	0.16	1.85
Germany	1.59	0.39	0.61	0.33	3.00
Ireland	0.47	0.42	0.50	0.54	2.31
Italy	1.97	0.10	0.04	0.44	1.63
Japan	1.40	0.31	0.00	0.27	3.00
Netherlands	1.33	0.67	0.56	0.31	2.00
New Zealand	0.80	0.29	1.03	0.36	1.30
Norway	1.52	0.45	0.45	0.54	2.50
Portugal	1.79	0.46	0.18	0.49	1.88
Spain	1.89	0.65	0.15	0.12	2.00
Sweden	1.47	0.61	0.04	0.80	2.37
Switzerland	0.55	0.39	0.03	0.28	2.25
UK	0.34	0.28	0.65	0.50	1.37
US	0.10	0.28	0.18	0.21	1.00
Mean	1.10	0.42	0.44	0.43	2.06
Standard Devation	0.57	0.16	0.32	0.18	0.60

Table 2: Cross-Correlations across the labor market variables

	EPL	BRR	BD	UD	CO
EPL	1.00	0.22	-0.25	0.04	0.43
BRR	0.22	1.00	-0.12	0.02	0.07
BD	-0.25	-0.12	1.00	0.26	0.02
UD	0.04	0.02	0.26	1.00	0.25
CO	0.43	0.07	0.02	0.25	1.00

III. ESTIMATION RESULTS

3.1 Results

Table 3 shows the results for the regression given in equation (1) that takes the volatility of inflation as the dependent variable. The table includes two different specifications. In the first column as a measure of coordination between workers and firms during the wage bargaining process CO_{it} is used whereas in the second column a different proxy for coordination namely COW_{it} is used. As Nickell and Nunziata (2001) defines the difference between the two indiciators is that COW_{it} contains the short term variation in bargaining coordination.

Table 3: Estimation Results for the Volatility of Inflation

$\sigma(MS)$	0.011	0.007
$\sigma(IMP)$	0.040***	0.038***
$\sigma(PROD)$	0.107*	0.092
EPL	0.276	0.264
BRR	-0.871**	-0.841**
BD	-0.479	-0.443
UD	1.580**	1.511**
CO	-0.085	
COW		0.240**
R^2	0.64	0.66

Notes: In terms of the statistical significance of the coefficient estimates * denotes the significance at 10% level, ** denotes significance at the 5% level, and *** denotes significance at the 1% level. The regression also includes dummy variables for each country to represent the fixed country effects but they are not reported here.

Before getting into the evaluation of the results it will be useful to check whether labor market institutions overall play a role in explaining the variation in inflation volatility. In order to test for this one can carry out a hypothesis testing by setting the null hypothesis as $\beta'_1 = 0$ in equation (1). That is I will test whether all the coefficients for the labor market insitutions are equal to zero which implies that labor market characteristics play no role for explaining inflation volatility. The test can be done by using an F-test with the following test statistics:

$$F = \frac{(R^2_{unrest.} - R^2_{rest.})/J}{(1 - R^2_{unrest.})/(n - K)} \tag{5}$$

where J is the number of restrictions and K is the number of parameters in the unrestricted model. The value of the test statistics is greater than the respective critical value which leads us to reject the null hypothesis that claims $\beta'_1 = 0$.

The first column in the table shows that all the control variables that are included in the regression have the expected signs. One can see that a higher volatility in the growth rate of money supply, the import price inflation, and the productivity growth translates into a higher volatility in inflation. Among these variables the volatility of import price inflation, σ(IMP), seems to be the most significant one and the volatility of the productivity growth has also statistical significance. Surprisingly although it has a positive coefficient the volatility of the money growth, σ(MS), is not statistically significant even at 10% level. In the second column where I use a different proxy for coordination the results for the control variables do not change in terms of the sign of the estimated coefficients and their statistical significance.

I will now elaborate on the results for the labor market variables as the main interest of the paper is to investigate the influence of labor market institutions on inflation and wage dynamics. It can be seen from the first column of the table that only benefit replacement rate, BRR, and union density, UD, are statistically significant variables in explaining the variation in the volatility of inflation. The results show that in a country a higher benefit replacement rate leads to lower volatility in inflation and a higher union density generates more volatile movements in inflation. An economic interpretation of this result can be the following. If a

country has a higher benefit replacement rate that means workers have a better outside option when they become unemployed. As workers will not have an incentive for extensive wage cuts during bad times this will dampen the volatility of the wages which may in turn translate into lower volatility for inflation. The coefficient for benefit duration index, BD, although it is statistically insignificant, has a negative sign which implies that the higher the index number the lower the volatility of inflation. The reasoning behind this is the same as the one in benefit replacement rate as higher durations of unemployment benefits imply a better outside option for workers which dampens the volatility of wages and in turn inflation.

The positive coefficient for the union density implies that in countries where a higher number of workers are attached to a labor union workers have more bargaining power which may increase the volatility of the inflation. The other labor market institutions variable namely employment protection legislation does not play a significant role in explaining the variations in the volatility of inflation.

An important point to emphasize is that the results for the benefit replacement rate and union density support the theoretical findings of the New Keynesian models with search and matching frictions. Trigari (2006) shows that in these theoretical models a higher parameter value for the value of unemployment benefits generates smoother responses in inflation and real wages. She also shows that if the workers' bargaining power is set at a high level that will increase the volatility of inflation and real wages. Here the empirical results that I present support these theoretical findings. The results show that a higher benefit replacement rate which means a higher value of unemployment decreases the volatility of inflation. As one can consider the union density an indicator of workers' bargaining power the regression results show that a higher union density generates more volatile movements in inflation which is in line with the results of the theoretical model. These results are very important as they complement the findings of the theoretical model.

As far as the influence of bargaining coordination is concerned the two columns provide us different results. In the first column the bargaining coordination which is proxied by the variable CO is not significant in explaining the volatility of inflation. However, in the second column of the table where I use a proxy for coordination which measures short term variation in bargaining coordination the COW appears to be significant and is estimated to have a positive coefficient. This result is actually not consistent with the expectation that a high level of coordination during the wage bargaining process should lead to reduced volatility in inflation. A high level of coordination between firms and workers during the wage bargaining process implies that unions will internalize the macroeconomic consequences of their wage claims which will lead to reduced wage volatility and in turn reduced inflation volatility. As one can see from the second column the results for other labor market institutions do not change when COW is used as an indicator for bargaining coordination.

Table 4 shows the results for the volatility of real wage growth as given in equation (2). As in the case of the volatility of inflation the table includes two specifications depending on two different indicators for coordination. For the volatility of the real wage growth the only control variable that is used is the labor productivity growth of the total economy. It is seen in both columns of the table that the volatility of the labor poductivity growth is highly significant in explaining the volatility of real wage growth and as expected a higher volatility in labor productivity growth generates more volatile movements in real wage growth.

Table 4: Estimation Results for the Volatility of Real Wage Growth

$\sigma(PROD)$	0.004***	0.004***
EPL	-0.004	-0.003
BRR	-0.013*	-0.013*
BD	-0.005	-0.004
UD	0.011	0.013
CO	0.001	
COW		0.006***
R	0.51	0.56

Notes: In terms of the statistical significance of the coefficient estimates * denotes the significance at 10% level, ** denotes significance at the 5% level, and *** denotes significance at the 1% level. The regression also includes dummy variables for each country to represent the fixed country effects but they are not reported here.

As I did in the case of inflation volatility it will be again informative to look at overall significance of the labor market institutitons before evaluating the individual results. I will check for the null hypothesis that sets $\beta_2 - 0$ in equation (2) against the alternative that at least one of the parameters inside β_2 is different from zero. Again I use the same test statistics as in (6) and the results show that the value of the test statistics is greater than the respective critical F-value which allows one to reject the null hypothesis which sets $\beta_2 - 0$.

In terms of the influence of the labor market institutions on the volatility of real wage growth the benefit replacement rate appears to be highly signficant. The results show that a more generous unemployment benefit system generates less volatile movements in real wage growth. The main reasoning behind this result is that workers will not allow real wages to adjust extensively as they know that they have a better outside option when they become unemployed. This leads to smoother responses in real wages in case of shocks which leads to lower volatility in the growth rate of real wages. As it has also been mentioned before the benefit replacement rate has been an important parameter in theoretical models that incorporate search and matching structure in an otherwise standard New Keynesian model. Hagedorn and Manovskii (2006) shows that when the benefit replacement rate is set at higher levels the theoretical model is able to generate the relatively smooth behavior of wages over the cycle which the standard models fail to achieve. Here I present empirical evidence that supports this theoretical finding. That is the results show that in countries which have a higher benefit replacement rate real wage growth shows less volatility.

Although it is statistically insignificant the results show that a higher union density is expected to lead to a more volatile movement in real wage growth which is again in line with the findings of the theoretical findings. The results also show that stricter employment protection legislation generates less volatile real wage growth which supports the findings of the model developed by Macit (2008). However, none of these have a significant effect on the volatility of real wage growth.

In the above discussion the volatility of inflation and real wage growth is estimated in a single equation framework. One can also estimate the volatilities of inflation and real wage growth in a system of equations treating the volatility of inflation and the volatility of real wage growth as endogenous variables. Following Rumler and Scharler (2009) when I use

three stage least squares estimation for this purpose which allows the error terms of the two equations to be correlated the results do not show a significant difference compared to fixed effects estimation. *Table 5* shows the results. The benefit replacement rate is highly significant both for inflation volatility and the volatility of real wage growth. The union density is expected to lead to a higher volatility in inflation and in the growth rate of real wage. For inflation volatility a higher benefit duration index is estimated to generate a lower volatility in inflation.

Table 5: Estimation Results for the System of Equations for Inflation and Real Wages

	$\sigma(\pi)$	$\sigma(w)$
$\sigma(MS)$	0.001	
$\sigma(IMP)$	0.031***	
$\sigma(PROD)$	0.157***	0.004***
EPL	0.502***	-0.004
BRR	-0.712**	-0.012*
BD	-0.346*	-0.006
UD	0.606	0.017
CO	-0.036	0.001
R^2	0.64	0.52

Notes: In terms of the statistical significance of the coefficient estimates,* denotes the significance at 10% level, ** denotes significance at the 5% level, and *** denotes significance at the 1% level. The regression also includes dummy variables for each country to represent the fixed country effects but they are not reported here.

Lastly, I will investigate how the level of the unemployment rate is affected by the characteristics of the labor market using this large set of institutions. As it is mentioned before the influence of labor market institutions on the unemployment rate has been a topic of research for many authors. However, most of these studies have paid attention to a particular aspect of the labor market like union density or coordination. The importance of this analysis is that I will elaborate on the role of labor market characteristics for the unemployment rate from the perspective of a comprehensive set of labor market variables that will capture diverse aspects of the labor market. The results are presented in *Table 6*. As can be seen from the table labor market institutions play an important role in explaining the unemployment rate. The results show that if a country has a more generous unemployment benefit system and the benefits last for a longer period then the unemployment rate is expected to be high in that country. The same thing holds for union density as well. That is the unemployment rate is expected to be higher in countries that have a higher share of workers belonging to a labor union. All these variables are statistically significant in explaining the level of unemployment rate. For both specifications of the bargaining coordination it is seen that a high level of coordination between workers and firms during the wage bargaining process leads to a lower rate of unemployment. However, only for the second specification which measures the short term variation in coordination, bargaining coordination has a statistically significant impact on the unemployment rate. Although it is statistically insignificant, the negative sign for the coefficient of employment protection legislation makes sense from the perspective of economic interpretation. A high

index number for employment protection legislation implies that flows from employment to unemployment is low but at the same time movements from unemployment to employment is also low as firms hesitate to hire new employees due to the huge costs that they need to incur in case they need to fire them. Therefore, the net effect on the unemployment rate depends on which factor dominates the other. Here the results show that a highly rigid employment protection legislation is expected to generate lower levels of unemployment.

Table 6: Estimation Results for the Level of Unemployment

EPL	-0.883	-1.145
BRR	9.425***	8.106***
BD	4.185*	3.490*
UD	9.977**	10.610**
CO	-1.192	
COW		-2.507***
R^2	0.62	0.65

Notes: In terms of the statistical significance of the coefficient estimates, * denotes the significance at 10% level, ** denotes significance at the 5% level, and *** denotes significance at the 1% level. The regression also includes dummy variables for each country to represent the fixed country effects but they are not reported here.

3.2 Robustness Check

As mentioned before, the regression results reported above use fixed effects estimator. It will be informative to check the robustness of the results with respect to different estimation methods. For this purpose I report the results for random effects estimator using GLS and maximum likelihood estimation.

Table 7 shows the results for the volatility of inflation. Both columns of the table show that the control variables have the expected signs. That is increased volatilities in the growth rate of money supply, import price inflation, and labor productivity growth are expected to generate more volatile movements in inflation. As in the fixed effects estimator one can see that among these control variables the volatility of import price inflation and the volatility of the labor productivity growth are the significant ones for both specifications. As far as the labor market institutions are concerned the results show that for both random effects estimators the benefit replacement rate and union density are highly significant as in the fixed effects estimation. The results show that a higher benefit replacement rate leads to reduced inflation volatility whereas a higher union density creates increased inflation volatility confirming the previous results. The bargaining coordination which is found to be insignificant in the fixed effects appeared to be significant when I use random effects estimators and it has the expected negative sign. That is the more coordinated the wage bargaining process the lower will be the inflation volatility.

Table 7: Results for the Volatility of Inflation for Different Estimation Methods

	GLS Random Effects	ML Random Effects
$\sigma(MS)$	0.013	0.014
$\sigma(IMP)$	0.041***	0.041***
$\sigma(PROD)$	0.109**	0.108**
EPL	0.193	0.190*
BRR	-0.630**	-0.579**
BD	-0.288	-0.260
UD	1.058***	1.007***
CO	-0.191*	-0.192**

Notes: In terms of the statistical significance of the coefficient estimates, * denotes the significance at 10% level, ** denotes significance at the 5% level, and *** denotes significance at the 1% level.

Next I will analyze the results for the volatility of the real wage growth. *Table 8* shows the results for two different random effects estimators. Labor productivity growth is the only control variable and as in the fixed effects estimator the volatility of the productivity growth increases the volatility in real wage growth and is highy significant for both random effects estimators. As it is shown before, the benefit replacement rate is the only significant variable affecting the volatility of real wage growth. Here the results for random effects estimators confirms the previous results as the benefit replacement rate is still statistically significant and is expected to generate lower volatility in real wage growth. The results also show that a stricter employment protection legislation dampens the volatility of real wage growth and a higher union density increases the volatility of real wage growth.

Table 8: Results for the Volatility of Real Wage Growth for Different Estimation Methods

	GLS Random Effects	ML Random Effects
$\sigma(PROD)$	0.004***	0.004***
EPL	-0.001	-0.001
BRR	-0.001*	-0.006*
BD	-0.007	-0.007***
UD	0.005	0.006*
CO	0.003**	0.003**

Notes: In terms of the statistical significance of the coefficient estimates, * denotes the significance at 10% level, ** denotes significance at the 5% level, and *** denotes significance at the 1% level.

IV. CONCLUSION

In this paper I empirically investigate how wage and inflation dynamics are affected by labor market institutions using the data for the OECD economies. I particularly look at how the volatility in inflation and real wage growth across the OECD countries change depending on a large set of labor market variables. I also analyze whether labor market institutions play a role in explaining the level of unemployment rate using this comprehensive set of labor market data.

The main finding of the paper is that the benefit replacement rate is the most significant labor market institution affecting the volatility of real wage growth and inflation. The results show that a higher benefit replacement rate dampens the volatility of real wage growth and inflation. This finding is consistent with the results of the theoretical models that generate a smoother response of real wages and inflation when the value of unemployment is set at a high level. Besides the benefit replacement rate union density and short term variation in bargaining coordination are also important labor market institutions in explaining the volatility in inflation. The estimation results have shown that a higher union density generates more volatile movements in inflation. Given the fact that union density can be considered as a proxy for the workers' bargaining power this result again supports the findings of the theoretical models which show that a higher bargaining power for workers generate more volatile movements in inflation. As far as the unemployment is concerned I find that a higher benefit replacement rate, a longer duration of unemployment benefits, and a higher union density are expected to lead to a higher rate of unemployment. On the other hand stricter employment protection regulations and a higher level of coordination during the wage bargaining process are estimated to lead to lower levels of unemployment.

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