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Abstract

In contrast to the existing literature that focuses only on high unemployment driven by labor market regulations, this study emphasizes the impact of labor market regulations on wage payments in 15 European countries over the period 1985 to 2009. Through a simultaneous system of labor demand and supply, we find that the effect of labor market institutions on the behavior of labor demand outweighs the effect on labor suppliers, which pushes up the wage rate and mitigates the unemployment problem. By detailed investigations into all the responses of players in the labor market, it is plausible for policymakers in Europe to figure out the most efficient method for lowering the unemployment rate without hurting wage payments or discouraging labor supply.

Keywords: Unemployment rate, wage, labor market regulations, Europe.

1 Introduction

Labor market regulations (hereafter LMR) have long been blamed in the literature for the unemployment problem in Europe (for example, see Nickell, 1997, 1998, and 2003; Blanchard and Wolfers, 2000; Nickell et al., 2005; among many others). The criticism on strict LMR has led to comprehensive reforms on labor market institutions (Siebert, 1997; Saint-Paul, 2004). This study focuses on the unemployment driven by LMR in Europe as has been emphasized in the existing literature and addresses the impact of LMR on wage payments. In contrast to the existing literature that solely estimates the reduced-form equation model of the unemployment rate, this research sets up a simultaneous system of labor demand and supply and employs the two-stage-least-squares (2SLS) methodology for empirical analysis. Revealing information on the different responses from all market players involved, the simultaneous equation models facilitate our investigation on the price (wage rate) and quantity (unemployment) effects caused by the LMR reforms.

We employ data from 15 European countries, spanning from 1985 to 2009 for the study,[1] and find that various LMR reforms have different impacts on the market players, such that the overall effect of LMR hinges primarily on how the labor market institutions alter the decisions of all the labor market players. On the one hand, decreases in union density, replacement rate, and tax wedge significantly discourage labor supply, because the loose labor market regulations undermine work security and hence discourage labor market participation. On the other hand, de-unionization and tax system reforms seem to play the most significant role in enhancing labor demand. Overall, along with the LMR reforms toward improved flexibility, the job growth effect in Europe outweighs the decreases in labor supply, accounting for the observed unemployment rate reduction and wage payment increases. One important implication of the above findings is that some reforms might cancel out the effect of labor market reforms on demand and supply, such as de-unionization. As a consequence, via detailed investigations on all the responses of players in the labor market, it is plausible for policymakers in Europe to figure out the kind of labor market reforms that could simultaneously alleviate the unemployment problem and increase wage payments without discouraging much of the labor supply.

2 Background

Labor market institutions refer to the regulations set by governments so as to provide an enhanced secure working environment, which is particularly important for unskilled, low-wage workers with less bargaining power. Labor market regulations mainly include unemployment insurance, employment protection legislation, tax wedge (i.e., the gap between earnings and take-home pay, including social insurance expenses), and unionization. The regulations can turn into so-called “labor market rigidities” when they are enacted according to an overly-high standard (e.g., Siebert, 1997; Nickell, 1997, 1998, and 2003; Blanchard and Wolfers, 2000; Nickell et al., 2005; Saint-Paul, 2004). Taking abundant unemployment insurance as an example, a longer duration of an unemployment benefit entitlement might lead to work disincentives for the unemployed (Nickell, 1997, 1998, and 2003; Blanchard, 2000; Di Tella and MacCulloch, 2002; Nickell et al., 2005) and hence shift the labor supply curve leftward. At the same time, improved working standards imply higher labor costs, plausibly discouraging employers from creating additional new jobs (Nickell, 1997; Mortensen and Pissarides, 1999).

Labor market institutions have been blamed for the high unemployment rate in Europe (Nickell, 1997 and 1998; Nickell et al., 2005; Romero-Avila and Usabiaga, 2009), and criticism of them has led to the adoption of labor market reforms since the mid-1980s and early 1990s (Siebert, 1997; Saint-Paul, 2004). For example, the Netherlands increased stricter unemployment benefit administration and provided better coordination in wage setting in the

[1] The 15 countries are Austria, Belgium, Switzerland, Germany, Denmark, Spain, Finland, France, the United Kingdom, Ireland, Italy, the Netherlands, Norway, Portugal, and Sweden.

1990s. In the same era, the United Kingdom government implemented a stricter benefit administration, reduced much of union coverage, and lowered union density and labor taxes (Siebert, 1997; Nickell, 2003).

Figure 1 shows the evolution of LMR measures in Europe. The figure presents the average union density, employment protection, replacement rate, and tax wedge over the 15 countries since 1985. At first glance, aside from the replacement rate, the other three LMR measures decline over time, reflecting the well-known mitigation of labor market regulation addressed above. The replacement rate demonstrates a very different tendency from the other three, increasing over time until 2000.

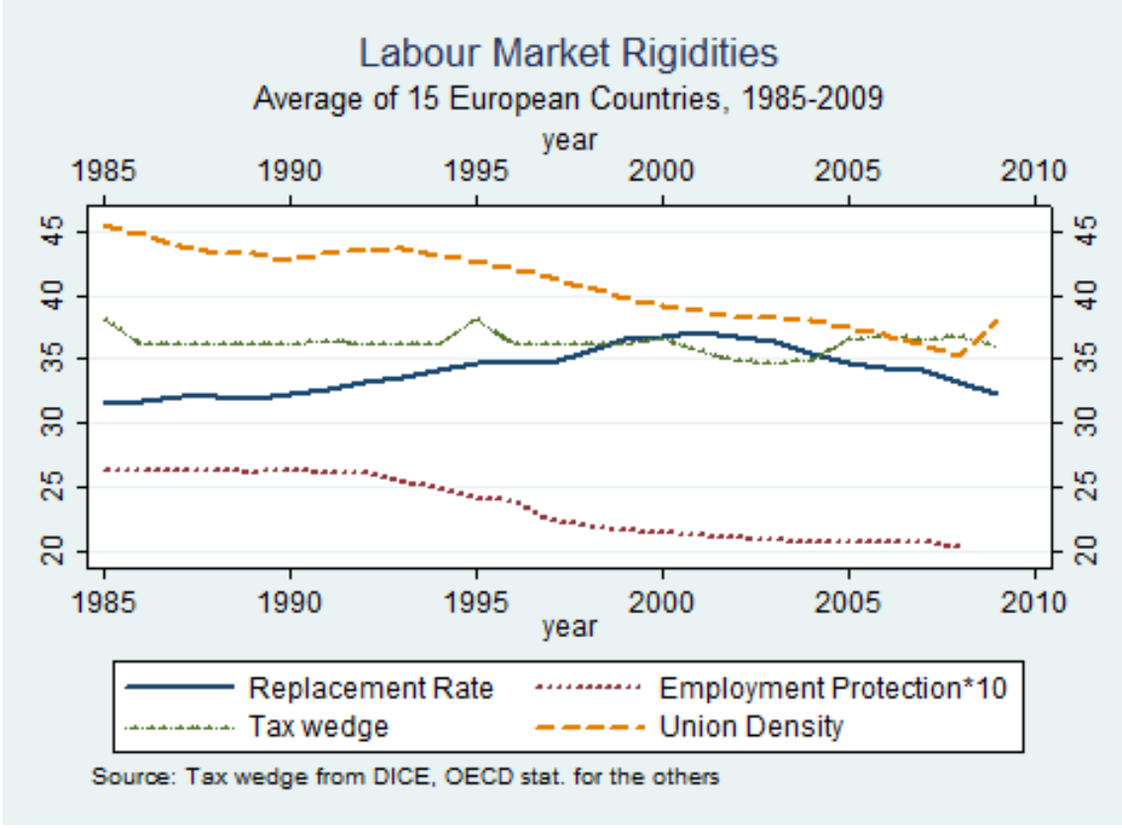

Figure 1. Measurements for labor market regulations, 1985-2009

3 Model Set-up and Methodology

We include LMR into the labor supply L^s and demand L^d functions and then map out their relationship with wage growth and unemployment rate in equilibrium as follows:

$$\textit{Labor supply function}: \ \frac{L^s}{\bar{L}} = g(w; LMR, Fertility), \tag{1}$$

$$\textit{Labor demand function}: \ \frac{L^d}{\bar{L}} = f(w; LMR, \Omega), \tag{2}$$

where $\bar{L}$ and w represent total labor force and hourly wage rate, respectively, with LMR as the labor market regulation vectors that include the four measures in Figure 1, i.e., union density ($Union$), employment protection (EPL), replacement rate (RR), and tax wedge (TAX). The LMR variables measure the degree of labor market regulation with higher values representing more rigorous labor market. The fertility rate ($Fertility$) is the supply shift

variable, altering the supply preference (e.g. Kogel, 2004)[2], and Ω represents the vector of aggregate demand shocks. Based on the related literature and the available data for the 15 countries, Ω contains the GDP growth rate (*GR*), changes in labor productivity (*Productivity*), and technological shocks measured by research and development expenditure (*RD*) and total factor productivity (*TFP*) (e.g., Berman et al., 1998; Bartel and Sicherman 1999; Acemoglu 2002).

We define the unemployment rate as $u \equiv 1 - \frac{L}{\overline{L}}$, where L is the employment rate in equilibrium. Combined with the definition of the unemployment rate, we rewrite the supply and demand functions in equilibrium as follows:

$$\frac{L}{\overline{L}} = g(w; LMR, Fertility) = 1 - u \ .$$

This yields a transformed labor supply function as a function of the wage rate:

$$(L^{s'}): \quad w = G^{-1}(u; LMR, Fertility) \ . \qquad (1)'$$

Similarly, the transformed labor demand function becomes an unemployment equation:

$$(L^{d'}): \quad u = H^{-1}(w; LMR, \Omega) \ . \qquad (2)'$$

Because the wage rate and unemployment rate are endogenous in the simultaneous model, the ordinary least squares estimators are inconsistent. We employ the two-stage-least-squares methodology (2SLS) for empirical analysis. The first stage estimates the reduced-form equations, which give the effects from changes in all the exogenous variables on the two endogenous variables (i.e., wage rate and unemployment rate). Again, the reduced-form estimations are common in the existing literature where either the wage or unemployment equation is estimated alone by a single regression equation. In the second-stage estimation, the so-called structural-form estimation, we replace the two endogenous explanatory variables by the two-fitted variables obtained in the first stage. The structural-form estimation facilitates the marginal effect analysis of all the variables, including the endogenous explanatory variables and the exogenous variables on the decisions of all labor market participants from both the supply and demand sides.

Our empirical set-ups for the wage payment and unemployment equations in the two-stage regression for the panel dataset are as follows:

First-stage estimation (reduced-form equations):

$$w_{it} = \alpha_1 Union_{it} + \alpha_2 EPL_{it} + \alpha_3 RR_{it} + \alpha_4 Tax_{it} + \alpha_5 Fertility_{it} + \alpha_6 RD_{it} + \alpha_7 TFP_{it} + \alpha_8 GR_{it} + \alpha_9 Productivity_{it} + \mu_i + \nu_t + \varepsilon_{1,it} \qquad (3)$$

$$u_{it} = \beta_1 Union_{it} + \beta_2 EPL_{it} + \beta_3 RR_{it} + \beta_4 Tax_{it} + \beta_5 Fertility_{it} + \beta_6 RD_{it} + \beta_7 TFP_{it} + \beta_8 GR_{it} + \beta_9 Productivity_{it} + \omega_i + \eta_t + \varepsilon_{2,it} \ . \qquad (4)$$

Second-stage estimation (structural-form equations):

Labor supply

$$w_{it} = \gamma_1 \hat{u}_{it} + \gamma_2 Union_{it} + \gamma_3 EPL_{it} + \gamma_4 RR_{it} + \gamma_5 Tax_{it} + \gamma_6 Fertility_{it} + \kappa_i + \varphi_t + \varepsilon_{3,it} \qquad (5)$$

Labor demand

$$u_{it} = \delta_1 \hat{w}_{it} + \delta_2 Union_{it} + \delta_3 EPL_{it} + \delta_4 RR_{it} + \delta_5 Tax + \delta_6 RD_{it} + \delta_7 TFP_{it} + \delta_8 GR_{it} + \delta_9 Productivity_{it} + \theta_i + \pi_t + \varepsilon_{4,it} \ . \qquad (6)$$

[2] In OECD countries, the negative relationship between the total fertility rate and female employment is commonly observed (see for example, Kogel (2004)).

Here, w_{it} and u_{it} denote the wage rate and unemployment rate for country *i* at time *t*. Variables μ_j, ω_i, κ_i, and θ_i represent time-invariant individual effects, and ν_t, η_t, φ_t, and π_t are time effects, typically presented by a time dummy, capturing the unknown supply and demand shocks. The reduced-form estimations, Equations (3) and (4), consist of all the exogenous variables shown in the simultaneous system of Equations (1)' and (2)'. The two fitted variables, $\hat{w}$ and $\hat{u}$, obtained in the first-stage estimation, replace the two corresponding endogenous explanatory variables in the second-stage estimation. We summarize the remaining notations and definitions below, and Table A1 in the appendix presents variable definitions and data sources along with the basic statistics.

EPL: Employment protection legislation, a scale variable ranging from 0 to 6, with 6 being the most protected level.
RR: Replacement rate, calculated by the amount of unemployment insurance, divided by the former wages of unemployed workers (%).
TAX: Tax wedge, representing the gap between earnings and take-home earnings (%).
Union: Union density (%).
Fertility: Fertility rate (births per woman).
RD: Gross domestic expenditure on R&D (% of GDP).
TFP: Total factor productivity growth rate (%).
GR: GDP growth rate (%).
Productivity: Labor productivity growth rate (%).

For the expected signs of the coefficient presented in the structural form of the supply equation, mitigating LMR might *decrease* the labor supply if workers feel insecure in a worse working environment, which leads to a higher wage rate. Restrictions on firing could cause higher participation rates if unproductive workers, who would otherwise exit the labor force, are restrained in jobs (e.g., Di Tella and MacCulloch, 2002). Thus, the expected signs of the coefficient estimates of variables measuring LMR are negative, i.e., γ_2, γ_3, γ_4, and $\gamma_5 < 0$. The negative relationship between female employment and the fertility rate leads to a positive of γ_6 (e.g., Kogel 2004). The expected signs of the coefficient estimates of LMR variables in the demand equation are positive, because additional regulations mean higher labor cost, weaker labor demand, and a higher unemployment rate. Thus, δ_2, δ_3, δ_4, and $\delta_5 > 0$. The effect of technology on unemployment is uncertain, depending on the relative effect of technological improvement on skilled workers versus that of less-skilled workers. Finally, economic growth and higher labor productivity lead to a lower unemployment rate. Thus, δ_8 and $\delta_9 < 0$.

4 Empirical Results

The data of this study are based on the OECD Statistics, Eurostat, and the CEP-OECD Database for International Comparison in Europe (DICE) from 1985 to 2009, comprising 15 OECD European Union countries as mentioned in the previous section. The first two columns of Table 1 show the structural-form estimation results and the last two columns report the reduced-form estimation results.[3]

[3] The final analysis dataset has 363 observations, different from the expected 375 observations, because there are missing values in the unemployment rates for Germany from 1985 to 1990, the Netherlands for 1986, and Switzerland from 1985 to 1989.

Table 1. Estimation results of the structural-form equations and reduced-form equations

	Structural-form equations		Reduced-form equations	
	Labor Supply Function (*w*)	**Labor Demand Function (*u*)**	**Hourly Wage Rate *(w)***	**Unemployment Rate *(u)***
	(1)	(2)	(3)	(4)
u	0.326**			
	(0.039)			
w		-0.130		
		(0.606)		
LMR Measurements				
Union	-0.065**	0.065*	-0.040	0.071*
	(0.027)	(0.074)	(0.109)	(0.080)
RR	-0.146***	0.015	-0.131***	0.032
	(0.000)	(0.706)	(0.000)	(0.104)
EPL	0.344	-0.510	0.315	-0.551
	(0.485)	(0.144)	(0.495)	(0.146)
TAX	-0.109***	0.081**	-0.100***	0.094***
	(0.001)	(0.012)	(0.000)	(0.000)
Macroeconomic Shocks				
RD		1.510***	0.894***	1.394***
		(0.000)	(0.002)	(0.000)
TFP		0.745***	0.526**	0.677***
		(0.000)	(0.029)	(0.000)
GR		-0.457***	-0.093	-0.446***
		(0.000)	(0.333)	(0.000)
Productivity		-0.165	-0.357*	-0.119
		(0.246)	(0.056)	(0.359)
Fertility	5.528***		5.828***	-0.760
	(0.000)		(0.000)	(0.628)
Time effect	yes	yes	yes	yes
Fixed effect	yes	yes	yes	yes
Test Statistics				
F test	70.13	4588.92	88.79	6.97
(P-value)	(0.000)	(0.000)	(0.000)	(0.000)
Adjusted-R	0.8882	0.4464	0.9181	0.4335
Over-I.D. test	passed	exactly identified		
Weak I.D. test (F)	13.378	33.41		
Observations	363	363	363	363

Note: 1. P-value are in parentheses. Constant terms are not reported.
2. ***: significant at the 1% level; **: significant at the 5% level; *: significant at the 10% level.
3. The above estimates are obtained by STATA command xtivreg2, which allows for heteroscedastic adjustment. We also apply GMM estimates to correct for possible endogeneity.

4.1 Estimation Results - Structural-form

As far as the institutional effects on labor supply are concerned, we first note that three out of four coefficient estimates related to LMR (γ_2, γ_3, γ_4, and γ_5) are negative with statistical significance at the 5% level, which are consistent with theoretical expectations. The significant LMR variables are *Union*, *RR*, and *TAX*. Specifically, a 10% decrease in *Union* density increases the wage by 0.65%. Hence, the de-unionization observed in the past twenty years has weakened workers' bargaining power in defending their rights, discouraged labor supply, shifted the labor supply curve leftward, and raised wage payments. Similarly, a 10% decrease in replacement rate *RR* increases the wage rate by 1.46% with the same changes in *TAX* generating a 1.09% *increase* in wage payments. These findings mean that decreases in labor market regulations have discouraged workers from joining the labor market due to a worse work environment.

Several findings emerge from the estimation of the labor demand equation (see Column (2)). For labor market institutional effects, most coefficient estimates on the LMR measures are positive and consistent with theoretical expectations with two out of the four variables showing statistical significance: union density and tax wedge. Specifically, a 10% decrease in union density accounts for a 0.65% decrease in the unemployment rate. Similarly, a 10% reduction in tax wedge generates a 0.81% decline in the unemployment rate. The findings imply that more flexible labor market institutions enhance labor demand and alleviate the unemployment problem. This result echoes the existing empirical studies related to the reduced-form analysis on the unemployment rate (e.g., Di Tella and MacCulloch, 2005). However, coefficient estimates on *RR* and *EPL* show no statistical significance in the estimation of the labor demand equation and that of *EPL* is inconsistent with expectation.

A lower fertility rate shifts labor supply rightward, other things being constant, and decreases wage payments. The weak instrumental variable test, indicating a rejection with the F-statistic being 13.378, means that the instrument *Fertility* is appropriately selected. For technological shocks, a 1% increase in *RD* and *TFP* generates as high as approximately 1.51% and 0.745% increases in the unemployment rate, respectively. The results reveal that the decreasing demand for unskilled labor outweighs the increasing demand for skilled labor. These findings reinforce the theoretical predictions by Acemoglu (1998), Machin and Van Reenen (1998), Van Reenen (2011), and Moore and Ranjan (2005) in that skill-biased technological changes decrease demand for less-skilled workers, but increase demand for skilled workers. The coefficient estimates of the other two macroeconomic shift variables *GR* and *Productivity* are also consistent with theoretical expectation with *GR* showing statistical significance. The weak instrumental variable test is also rejected in the labor demand equation with the F-statistic as large as 33.41. Moreover, the overidentification test is passed.

4.2 Estimation Results - Reduced-form

Turning to the reduced-form estimation results (Columns 3 and 4 in Table 1), we find that among the four measures for LMR, *Union*, *RR*, and *TAX* are the most important in determining wage payment and the unemployment rate. Furthermore, *RR* and *TAX* have a negative effect on the wage rate, while *Union* and *TAX* have a positive impact on the unemployment rate. Thus, a decrease in LMR induced by lower *Union*, *RR*, and *TAX* boosts the wage rate and undermines the unemployment rate. This indicates that after a series of interaction between labor supply and demand, the increments of labor demand, caused by more flexible labor market institutions, outweigh the reductions in labor supply. The finding regarding the mitigation of the unemployment rate echoes related studies on the reduced-form estimation model of the unemployment rate in the literature, such as Nickell (1997, 1998, and 2003), Blanchard and Wolfers (2000), and Nickell, Nunziata, and Ochel (2005).

Another important finding is that various LMR reforms have different impacts on the market players. Hence, the overall results of LMR hinge primarily on how the reforms alter the decisions of both labor demand and labor supply. Based on the opposite effect on demand

and supply in the structural-form estimation results, the effect of de-unionization is cancelled out in equilibrium, leading to an insignificant overall effect in the reduced-form estimation. By contrast, certain reforms affect merely one side of the players in the labor market, leaving the other side unchanged, such as an alternation in the replacement rate. The story from simultaneous equations reveals that it is plausible for policymakers to identify the type of reforms that could alleviate the unemployment problem and increase worker wage payments. These findings lead us to conclude that when adopting LMR reforms, European governments should consider not only the different responses of market players, but also the tradeoffs between labor supply and demand. Via detailed investigations into all the responses of the market players, policymakers can now figure out an efficient method to redesign their labor market legislations so as to achieve the aim of a lower unemployment rate and higher wage payments without discouraging much of the labor force participation.

A rather less important finding, but worth mentioning, is that macroeconomic variables have large estimates with high significance. We find that technological shocks push up the wage rate, but exacerbate the unemployment problem. Specifically, enhancements in *RD* and *TFP* tend to increase wage payments with *TFP* significantly pushing up the average unemployment rate. As such, a rapid improvement in technologies observed in many European countries in the past two decades could be one of the driving forces for the deterioration in wage inequality. Technological improvement also leads to a high unemployment rate, which is a finding that echoes related reduced-form studies on unemployment (e.g., Berman et al., 1998; Moore and Ranjan, 2005; Acemoglu and Autor, 2011).

5 Conclusion

Labor market reforms have alleviated the unemployment problem in Europe. Through our empirical investigation, we find that certain kinds of labor market reforms have discouraged labor supply, such as the decline in union density, the replacement rate and tax wedge. At the same time, labor market flexibility due to lower union density and a reduction in tax wedge significantly enhances labor demand. In equilibrium, the degree of labor market rigidity is negatively correlated with wage payments, but positively related to the unemployment rate. As such, when adopting LMR reforms, it is very important for European governments to carefully investigate the responses of all the market players so as to figure out the most efficient method for lowering the unemployment rate, increasing wage payments, and not discouraging much labor supply in the economy. Our empirical results also indicate that the replacement rate is the only measure of LMR that affects labor supply, but not the demand side. Hence, when adopting labor market reforms, particular attention must be paid to the adjustment of the replacement rate in order to avoid overly depressing labor supply.

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Appendix

Table A1. Descriptive Statistics

Definitions	Variable	# of Obs.	Mean Std.	Dev.	Min	Max	Data Source
u	*Unemployment rate (%)*	363	7.729	4.146	1.600	23.900	OECD statistics
w	*Hourly direct pay (USD)*	363	15.836	7.249	1.340	40.740	KILM dataset
Union	*Union density (%)*	363	41.191	22.040	7.576	83.890	OECD statistics
RR	*Replacement rate (%)*	363	34.326	10.671	0.350	64.940	OECD statistics
EPL	*Employment protection legislation (score from 1-6) with 6 being the most protected level.*	363	2.341	0.898	0.600	4.190	OECD statistics
TAX	*Tax wedge (%)*	363	36.273	5.991	10.600	48.400	DICE CEP
RD	*Gross domestic expenditure on R&D % of GDP (%)*	363	1.865	0.674	0.410	4.130	Eurostat
TFP	*Total factor productivity growth rate (%)*	363	1.030	1.488	-7.600	7.100	OECD statistics
GR	*GDP growth rate (%)*	363	2.323	2.417	-8.227	10.917	OECD statistics
Productivity	*Labor productivity growth rate (%)*	363	1.734	1.798	-8.800	10.000	OECD statistics
Fertility	*Fertility rate (*births per woman*)*	363	1.631	0.243	1.150	2.500	WDI