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DO LABOUR MARKET INSTITUTIONS VARIABLES IMPACT UNEMPLOYMENT? EVIDENCE FROM THE CEE COUNTRIES

Abstract

Purpose: In this study, the aim is to determine whether labour market institutions (LMI) variables impacted the unemployment rate in the Central and Eastern Europe (CEE) countries between 2000 and 2017.

Methodology: Panel data methods that take cross-sectional dependence into account are used for the analysis.

Results: Empirical findings show that real minimum wages, tax wedge, and union density do not impact the unemployment rate in Poland, Latvia, and Estonia, while these variables impact the unemployment rate in Slovakia, the Czech Republic, Slovenia, and Hungary.

Conclusion: As a result of the research, it is concluded that the LMI variables do not have a substantial effect on the unemployment rate in Poland, Latvia, and Estonia. On the other hand, the LMI variables have a substantial impact on the unemployment rate in Slovakia, the Czech Republic, Slovenia, and Hungary. Therefore, it is understood that the LMI variables have an influence on the unemployment in only four out of seven CEE countries.

Keywords: Unemployment, labour market institutions variables, cross-sectional dependence, CEE countries

1. Introduction

Unemployment, defined as the partial or complete exclusion of the labour force from the production process, is a problem not only in developing but also in developed countries. Furthermore, unemployment is not only an economic but also a social problem. Therefore, determining the reasons for unemployment is important for national economy and social life. If unemployment increases, the output gap increases. For this reason, an increase in unemployment negatively affects the economy. On the other hand, if unemployment increases, social problems such as corruption, snatching, and bribery will increase as well. For these reasons, unemployment concerns both economy and sociology.

In this study, the determinants of unemployment in the CEE countries were analysed and the LMI variables were used for the analysis. Knowing whether the LMI variables affect unemployment helps policymakers to make better decisions in tackling unemployment. Therefore, the results of the study are important for policymakers in the decision-making process related to unemployment. This study aims to determine the factors that affect unemployment and find out whether unemployment originates from the LMI variables in the Central and Eastern Europe (CEE) countries between 2000 and 2017.

To analyse the factors which affect unemployment, the methods that do not take cross-sectional dependence into account (e.g., panel fixed effect, random effect, panel generalized least squares (GLS), panel ordinary least squares (OLS)) are used in the literature. Moreover, there are not many studies investigating the determinants of unemployment in the CEE countries. Studies in the literature generally research the determinants of unemployment in high-income Organisation for Economic Co-operation and Development (OECD) countries. This study fills this gap by examining the CEE countries. This study uses panel data methods that take into account the cross-sectional dependence problem. The assumption of cross-sectional independence can lack reliable results in the panel data analysis, and ignoring cross-sectional dependence can cause bias and inconsistency (Bai & Kao, 2006). Therefore, this study is expected to contribute to the literature in this respect.

The paper is organised as follows. After the introduction section, the unemployment model formed in this study covers the second section. Section 3 presents a literature review related to unemployment. Data and the econometric methods used in the paper are presented in Section 4. The estimation results are discussed in Section 5. Section 6 summarises the conclusion and policy recommendations.

2. Model

There are many studies in the literature that examine the causes of unemployment from a theoretical and empirical perspective. Considering the studies examining the issue theoretically, it is seen that the causes of unemployment differ in terms of economic schools.

There is no consensus between the Neoclassical and Keynesian views on the relationship between unemployment and wages. The neoclassical view states that there is a positive relationship between unemployment and wages. In other words, a decrease in wages causes an increase in the level of employment and, accordingly, a decrease in the unemployment rate. The Keynesian view criticises this point of view. According to the Keynesian view, a lower wage rate will lead to lower income for workers and correspondingly to lower demand for goods. Lower demand will reduce output, which will in turn reduce employment. Thus, the Keynesian view states that there is a negative relationship between wages and the unemployment rate (Apergis and Theodosiou, 2008). Neoclassical economists also emphasise that labour supply and labour demand are equal when money or real wages are not rigid. Workers will not work if they suffer a net loss of benefits due to giving up their leisure time (Spencer, 2006: 460-461). On the other hand, the Keynesian view emphasises that insufficient capital accumulation or high interest rates are the causes of high unemployment (Stockhammer and Klär, 2011: 438). Post-Keynesian economics is a movement connected to Keynesian economics that is rather sceptical about traditional microfoundations. Unemployment is seen as a result of demand gaps in the goods market, and wages are analysed as a source of demand and a cost factor (Stockhammer, 2011: 296).

Empirical studies examining the causes of unemployment focus on two issues. These are studies on the Keynesian view and LMI variables. While the debate on unemployment growth in the 1970s focused on shocks, the persistence of high unemployment for another twenty years caused the focus to shift from shocks to the labour market institutions (Blanchard and Wolfers, 2000: C12). According to the mainstream view[1], unemployment is determined by the labour market institutions (Stockhammer, 2011: 306). In this study, the CEE countries are analysed and as these countries are members of the EU, the monetary authority is responsible only for the money market in these countries. A government is also responsible for fiscal policy such as reducing unemployment. For these reasons, only the LMI variables were tested for determining the unemployment determinants. The tax wedge, union

1 See Table 1 for the mainstream view of unemployment determinants.

density, and real minimum wages were usually used as LMI determinants in the literature[2]. Therefore, the LMI variables were used for forming the model of unemployment in this study. The unemployment model used in this study is as follows:

$$UR_{it} = \alpha_0 + \alpha_1 TW_{it} + \alpha_2 UD_{it} + \alpha_3 RMW_{it} + \varepsilon_{it} \quad (1)$$

In equation (1), UR is the unemployment rate. TW, UD, and RMW represent the tax wedge, union density, and real minimum wages, respectively.

3. Literature review

The studies aiming to find out the determinants of unemployment that support the labour market institutions variables are as follows:

Boone and Ours (2004) analysed the effect of active labour market policies on the long-term unemployment rate in 20 OECD countries using panel fixed effect and panel random-effect methods. In this study, the employment rate, union density, unemployment benefit, and the tax rate are used as proxies of active labour market policies. As a result of the analysis, it is found out that active labour market policies are the most influential factor in reducing unemployment. Gianella et al. (2008) investigated the factors affecting unemployment in 23 OECD countries between 1976 and 2003 using the panel pooled regression method. Variables such as product market regulation, union density, the average unemployment benefit replacement rate, the tax wedge, the real interest rate, and the real minimum wage are used in the analysis. It is concluded that product market regulation, union density, and the unemployment benefit replacement rate impact the unemployment rate.

In the classification of the determinants of unemployment stated above, many of the studies focus on high-income OECD countries. In addition, mostly high-income OECD countries are preferred in the literature for the analysis of the determinants of unemployment. Therefore, many studies examine high-income OECD countries empirically to determine whether demand conditions or LMI variables are dominant in labour markets in these countries. These studies are summarised in Table 1.

Table 1 Literature review related to the determinants of unemployment

	Data and method	Dependent variable	Independent variables	Result
Blanchard & Wolfers (2000)	20 OECD countries (1960–1996). Panel data analysis with panel OLS	UR	UBR, BD, UD, COORD, TW, ALMP, MW, LTI, TFPS, TOTS, LDS	Labour market institutions have an important effect on unemployment. So, LMI variables are dominant.
Baker et al. (2002)	20 OECD countries (1960–1999). Panel data analysis with the fixed effect estimator.	UR	UBR, BD, UD, EPL	Labour market rigidities are largely responsible for high unemployment and labour market deregulation is therefore the best route to raising employment rates. Therefore, LMI variables are dominant determinants of unemployment.
Nickell et al. (2005)	20 OECD countries (1961–1995). Time series analysis with non-linear least squares.	UR	UBR, BD, UD, EPL, COORD, TW, LTI, TFPS, LDS, TOTS, money supply	Broad movements in unemployment across the OECD countries can be explained by shifts in labour market institutions. Therefore, LMI variables are dominant factors for unemployment.
Bertola et al. (2007)	20 OECD countries (1960–1996). Panel data analysis with the panel GLS estimator.	UR	UBR, BD, UD, EPL, COORD, ALMP, LTI, TFPS, LDS	Labour market institutions have an important effect on unemployment. Therefore, LMI variables are dominant factors for unemployment.

2 See Table 1 for LMI variables used in the literature.

	Data and method	Dependent variable	Independent variables	Result
Stockhammer & Klär (2011)	20 OECD countries (1983–2003; Panel data analysis with panel OLS and the panel fixed effect estimator.	UR	UBR, BD, UD, EPL, TW, COORD, CBC, PMR, TOTS, ACCU, TFPS, LTI, LDS	The estimation results show that capital accumulation and the real interest rate are found to have statistically significant effects on unemployment. Therefore, LMI variables are not dominant determinants of unemployment.
Avdagic & Salardi (2013)	EU and 32 OECD countries (1980–2009). Panel data analysis with the panel OLS estimator.	UR	UBR, EPL, TW, COORD, UD, TOTS, LTI, CBI	The authors find no systematic support for the conventional view that unemployment is a consequence of labour market institutions and insufficient demand. So, LMI variables are dominant.
Heimberger et al. (2017)	14 EU countries 1985-2012. ordinary least squares (OLS) with panel-corrected standard errors (PCSE)	UR	LMI, EPL, UD, TW, MW, ACCU	While LMI variables have no important effect on UR, insufficient demand has an important effect on unemployment. So, demand conditions are dominant for unemployment determinant.

Note: Illustration on the basis of Stockhammer & Klär (2011, p. 441), and Heimberger et al. (2017). ACCU: capital accumulation, ALMP: active labour market policy, BD: benefit duration, CBC: collective bargaining coverage, CBI: Central Bank Independence index, COORD: wage bargaining coordination, EPL: employment protection legislation, LMI: labour market institutions, LDS: labour demand shock, LTI: long-term real interest rate, MW: minimum wage, PMR: product market regulation, TFPS: deviation of total factor productivity from its trend, TOTS: terms of trade shock, TW: tax wedge, UD: union density, UBR: unemployment benefit replacement rate.

Source: Authors

Apart from the studies specified above, there are also several studies in the literature that analyse the determinants of unemployment in the CEE countries (Riboud et al., 2002; Nesporova, 2002; Fialova & Schneider, 2014; Vodopivec, 2015; Grossmann et al., 2019; Peric & Filipovic, 2021). Riboud et al. (2002) studied the labour market dynamics of six CEE countries (the Czech Republic, Hungary, Estonia, Poland, Slovakia, and Slovenia) compared to OECD countries in the years 1990-2000. In this paper, it is determined that employment protection legislation of the CEE countries is deficient and rigid when compared to OECD countries. It is also stated that the expenditure of the CEE countries on unemployment insurance and active labour policies is considerably lower than the average of OECD countries. Therefore, it is concluded that labour market regulations such as unemployment insurance and active labour policies do not significantly affect unemployment in the CEE countries contrary to OECD countries. Nesporova (2002) investigated the causes of poor employee performance and persistently high unemployment in the transition countries of CEE and Central Asia (CA) between 1990 and 2000. As a result of the research, it is defined that the unemployment rate increased in the CEE and CA countries in the long term. Moreover, it is stated that disadvantages such as low skills, higher age, immobility, health problems, or employer prejudice are essential to increase long-term unemployment in these countries. Fialova and Schneider (2014) estimated the effects of institutional barriers on the labour market flexibility in 25 European Union (EU) countries between 1999 and 2004. Four models are used for determining the factors affecting the labour markets in the EU countries. The panel regression model is used for the estimation of these four models. The first model investigated the role of institutions in unemployment differentials among European countries. As a result of the analysis, only the tax wedge and labour market policies are statistically significant. Moreover, the coefficients of these variables are positive and negative, respectively. In the second model and the tax wedge and labour market policies, it is determined that a minimum wage has a significant positive effect on the unemployment rate. In the third and the fourth model, it is concluded that institutional factors proved to be more powerful. Besides, employment protection legislation, unemployment benefits, taxes on labour, and a minimum wage are all significant in both the third and the fourth model. It is also stated that the effects of these variables are low in the CEE countries compared to EU countries. Vodopivec (2015) analysed whether the minimum wage had an effect on employment between 2005 and 2012 in Slovenia. The time series regression model is applied to estimate the relationship between the minimum wage and employment in this study. As a result of the analysis, it is found out that a minimum wage hike increased the probability of transition from employment to unemployment. Grossmann et al. (2019) examined the effects of minimum wage on employment of low-wage workers in the business sector in the Czech Republic in the period 2012-2017. As a result of the research, it is defined that increases in the national minimum wage in 2013, 2015, 2016, and 2017 did not have a significant negative effect on employment. On the other hand, it was determined that the minimum wage had a positive impact on salaries. Peric and Filipovic (2021) analysed the impact of foreign direct investments (FDI) on the labour force in transition economies through monitoring and quantification of selected labour force market indicators by applying linear mixed-effects models to 17 transition countries during the period 2000-2017. Empirical findings showed that FDI had a positive and significant impact on the employment rate, wages and salaries.

4. Data and methodology

The factors which affected unemployment between 2000 and 2017 in the CEE countries were analysed in this study. Poland, the Czech Republic, Slovakia, Slovenia, Hungary, Lithuania, Latvia, and Estonia are countries considered to be the CEE countries. In this context, it was investigated whether the LMI variables were the reason for unemployment. A tax wedge (TW), a real minimum wage (RMW), and union density (UD) were used as variables to determine the effects of LMI variables on the unemployment rate (UR). These data were obtained from the electronic database of the OECD and World Bank electronic database (WDI). The available annual data in the database were used in the study. RMW is logarithmic; TW, UD, and UR data were the original data. Panel data methods that take into account cross-sectional dependence and structural breaks were used for the analysis. The data used in the study are as follows:

Table 2 Data set

Variables	Data source	Data explanations
UR	OECD	UR is obtained as the percentage of unemployed workers in the total labour force.
TW	OECD	Tax wedge is calculated for a single person at 100% of average earnings and no child.
UD	OECD	Union density is defined as the ratio of union members divided by the total number of employees.
RMW	OECD	Real minimum wages as a constant price at 2016 USD PPPs.

Source: Authors' own organisation based on OECD data

4.1 Panel unit root test

Cross-sectional Augmented Dickey Fuller test (CADF) developed by Pesaran (2007) is applied in the case of cross-sectional dependence. The CADF test assumes that each section is affected separately by the time effect which creates panel data. In addition, this test takes spatial autocorrelation into account. The CADF test can be used when the time dimension is larger than the number of cross-sections in panel data. Moreover, based on the Monte Carlo evidence, Pesaran argues that the CADF is valid when N>T and T>N as well (Guloglu & Ivrendi, 2010).

A general model of the panel procedure with N cross-section units and T periods is as follows:

$$\Delta y_{i,t} = \alpha_i + \beta_i y_{i,t-1} + \delta_i t + \sum_{j=1}^{\rho_j} \gamma_{i,j} \Delta y_{i,t-j} + u_{i,t} \qquad (2)$$

$$t = 1,2,...,T$$

$$i = 1,1.....,N$$

Pesaran assumes that the disturbance terms in equation (2) can be decomposed into their common and individual-specific (idiosyncratic) components as follows:

$$u_{i,t} = \varphi_i f_i + \varepsilon_{i,t} \qquad (3)$$

f_i indicates the unobserved common effect that is

always assumed to be stationary, and ε_{it} shows individual-specific or idiosyncratic disturbances, which are *iid*. The cross-sectional dependence problem can occur for the unobserved common factor (f_t). Pesaran (2007) shows that the common factor can be approximated by the cross-sectional

mean of y_{it} when the average value of φ_i is different from zero. Therefore, the CADF test procedure can reduce the estimating procedure of ordinary least squares (OLS) by the following equations:

$$\Delta y_{it} = \alpha_i + \beta_i y_{i,t-1} + \sum_{j=1}^{\rho i} \gamma_i \Delta y_{i,t-j} + \theta_i t + \delta_i \overline{y}_{i,t-1} + \sum_{j=0}^{\rho i} \mu_i \Delta \overline{y}_{t-1} + \varepsilon_{i,t}, \qquad (4)$$

where and $\alpha_{i,0} = \alpha_i$, a constant, with $i = 1,.....,N$ individuals and $t = 1,.....,T$ time periods. $\overline{y}_{it}$ and t show the cross-sectional mean of y_{it} and t h e trend, respectively. An unobserved common effect in the model can be represented by $\overline{y}_{it}$. Thus, cross-sectional dependence is taken into account by $\overline{y}_{it}$. The CADF statistic tests the null hypothesis of non-stationarity $(\beta_1 = \beta_2 = \beta_3 = ...\beta_n = 0)$ against the alternative hypothesis of stationarity (at least one differs from 0).

The CADF test can be implemented for each panel unit. But it can be applied for all panels only with the cross-sectional augmented IPS (CIPS) test developed by Pesaran (2007). This test can analyse for all panels whose series is stationary under the null hypothesis, and use the Pesaran critical value. The CIPS test is a cross-sectionally augmented version of the IPS test (Akbas & Lebe, 2016).

4.2 Panel co-integration test

This test developed by Westerlund and Edgerton (2007) can be used in both cross-sectional dependence and cross-sectional independence. In this test, the bootstrap method based on the Lagrange multiplier (LM) is used (Akbas & Lebe, 2016). This test analyses co-integration under the null hypothesis and allows autocorrelation to differ from cross-section to cross-section (Westerlund & Edgerton, 2007).

A general model of the panel data procedure is as follows:

$$y_{it} = \alpha_i + x'_{it} \beta_i + Z_{it} \qquad (5)$$

$$Z_{it} = u_{it} + v_{it} \qquad (6)$$

$$v_{it} = \sum_{j=1}^{t} \varphi_{ij} \qquad (7)$$

After describing the model above, in the case of cross-sectional independence, a hypothesis test can be conducted using the LM test, as follows:

$$LM^{+}_{NT^2} = \sum_{i=1}^{N} \sum_{t=1}^{T} \hat{\omega}_{it}^{-2} S_{it}, \qquad (8)$$

where S_{it} is part of the Z_{it} process, which is a fully modified estimation of Z_{it}, and $\hat{\omega}_{it}^2$ is an estimation of long-term variance (u_{it}). The LM test can give biased results in the case of cross-sectional dependence. The asymptotic standard normal distribution of the LM test is also very sensitive to autocorrelation. To overcome this problem, bootstrap methodology can be preferred rather than an asymptotic standard normal distribution (Westerlund & Edgerton, 2007). Bootstrap methodology that follows an autoregressive process is given below:

$$\sum_{j=0}^{\infty} \gamma_{ij} w_{it-j} = e_{it} \qquad (9)$$

The first step in bootstrap methodology is to estimate γ_{ij} in equation (9) using $\hat{w}_{it} = (\hat{z}_{it}, \Delta x'_{it})'$ rather than w_{it} and ρ_i. Then, the residual can be computed as follows:

$$\hat{e}_{it} = \sum_{j=0}^{\rho_i} \hat{\gamma}_{ij} \hat{w}_{it-j} \qquad (10)$$

In the second step, e_t^* is obtained from the empirical distribution of the residuals $\hat{e}_t - \frac{1}{T}\sum_{j=1}^{T} \hat{e}_j$. Then, e_{it}^* and w_{it}^* are used rather than $\hat{w}_{it}$ and $\hat{e}_{it}$ in order to obtain e_t^* and w_{it}^*. In the final step, w_{it}^* is divided as $w_{it}^* = (z_{it}^*, \Delta x_{it}{}')'$, and the bootstrap samples x_{it}^* and y_{it}^* are generated using the following process:

$$y_{it}^* = \hat{\alpha}_i + x_{it}^{*\prime} \hat{\beta}_i + z_{it}^* \text{ with } x_{it}^* = \sum_{j=1}^{1} \Delta x_{ij}^* \qquad (11)$$

4.3 Coefficient estimation

The augmented mean group (AMG) estimator developed by Eberhardt and Bond (2009) is used in this study to estimate the coefficients. The empirical model of the AMG estimator is as follows:

$$y_{i,t} = \beta_i' x_{it} + u_{it} \tag{12}$$

$$u_{it} = \alpha_i + \lambda_i' f_t + \varepsilon_{it} \tag{13}$$

$$x_{mit} = \pi_{mi} + \delta_{mi}' g_{mt} + \rho_{1mi} f_{1mt} + \dots + \rho_{nmi} f_{nmt} + u_{mit}, \tag{14}$$

where $m = 1,\dots,k$ and $f_{mt} \subset f_t$

$$f_t = \psi' f_{t-1} + \varepsilon_t \quad \text{and} \quad g_t = \kappa' g_{t-1} + \varepsilon_t. \tag{15}$$

In equation (12), x_{it} is a vector of observable covariates. In addition, a combination of group-specific fixed effects α_i and a set of common factors f_t with country-specific factor loadings λ_i is employed. In equation (13), an empirical representation of *k* observable regressors is added, which are modelled as linear functions of unobserved common factors f_t and g_t, with country-specific factor loadings, respectively (Eberhardt & Bond, 2009).

The AMG estimates can be derived as averages of the individual country estimates.

$$AMG - Stage(i)\Delta \ln\left[y_{i,t}\right] = \beta' \Delta X_{i,t} + \sum_{t=2}^{T} c_t \Delta D_t + e_{i,t} \tag{16}$$

$$\Rightarrow \hat{c}_t = \hat{\mu}_t^{\bullet}$$

$$AMG - Stage(ii) Ln[y_{i,t}] = \theta_i + \beta' X_{i,t} + c_i t + d_i \hat{\mu}_t^{\bullet} + \vartheta_{i,t} \tag{17}$$

The first stage defines a standard first difference OLS (FD-OLS) estimation of D_t year dummy coefficients of pooled regression. In this stage, the year dummy coefficients are collected, which are affected again as $\hat{\mu}_t^{\bullet}$. This variable is included in each of the *N* standard country regressions in the second stage. As a result, the AMG estimates can be derived as averages of the individual country estimates (Eberhardt & Bond, 2009).

The advantage of the common correlated effects (CCE) estimation procedure is that it can be computed by applying least squares auxiliary regressions, where the observed regressors are augmented by the cross-sectional averages of the dependent variable and the observed regressors are used as proxies for the unobserved factors.

$$Ln\left[y_{i,t}\right] = \alpha_i + \mu_i X_{i,t} + \gamma_1 \overline{\ln\left[y_{i,t}\right]} + \gamma_2 \bar{X}_t + \varepsilon_{i,t}$$
$$i = 1,\dots N; \quad t = 1,\dots T \tag{18}$$

In this equation, the coefficients γ_1 and γ_2 represent the elasticity estimates of $Ln\left[\inf_{i,t}\right]$. Accordingly, $Ln[\text{int}], Ln[exc]$ and $Ln[gdp]$ are contained in X. Finally, ε_{it} is the error term. In this test, the CCE estimator was used for heterogeneity and the CCE pooled estimator (CCEP) was used for homogeneity. Following this procedure, the individual coefficients μ_i in the panel framework were estimated and the CCE mean group (CCEMG) estimator, a simple average of the individual CCE estimators, was computed:

$$\hat{\mu}CCEMG = \sum_{i=1}^{N} CCE_i / N \quad \text{and}$$

$$SE_{(\hat{\mu}CCEMG)} = \frac{\left[\sum_{i=1^{\sigma}}^{N} (\hat{\mu}CCE_i)\right]}{\sqrt{N}} \tag{19}$$

$\hat{\mu}CCEMG$ and $SE_{(\hat{\mu}CCEMG)}$ denote the estimated CCEMG coefficients and their standard deviations, respectively.

5. Empirical findings

The results of cross-sectional dependence and homogeneity tests are reported in Table A1 and Table A2 in the appendix section. CD tests analyse cross-sectional dependence. According to these results, the null hypothesis, which states that there is no cross-sectional dependence, is rejected for all variables and the model. As a result, there is cross-sectional dependence in the CEE countries for all variables and for the model. Delta-tilde and Delta-tilde-adj. tests analyse homogeneity. According to Table A2 in the appendix, the alternative hypothesis is accepted by rejecting the assumption of homogeneity under the null hypothesis. This result suggests that the CEE countries forming the panel have a heterogeneous structure. Based on these results, the panel data methods which take cross-sectional dependence and heterogeneity into account are used in this study.

After cross-sectional dependence and heterogeneity analysis, the stationarity of series can be tested. The results of unit root tests related to UR, RMW, TW and UD are shown in Table 3.

Table 3 CADF and CIPS test results (level)

	UR		RMW		TW		UD	
	CADF	**p**	**CADF**	**p**	**CADF**	**p**	**CADF**	**p**
Poland	-2.118	3	-0.542	2	0.002	5	-2.037	2
Czech R.	-1.649	4	-1.406	2	-2.255	2	-2.955	2
Slovakia	-2.481	4	-1.897	4	-0.956	2	0.003	5
Slovenia	2.187	4	-8.26***	2	-2.341	4	-2.633	3
Hungary	-1.111	2	-1.280	4	-1.838	2	0.001	5
Lithuania	-13.28***	4	-4.339**	2	-1.577	2	0.005	5
Latvia	-0.925	4	-4.088**	4	-2.800	2	-0.876	4
Estonia	-2.009	4	-2.386	3	-2.399	2	-3.388	2
CIPSstat	-2.1674		-2.2026		-1.771		-1.611	

Note: ** and * stand for significance at 5 and 10% levels, respectively. The lag lengths (p) are selected according to the Schwarz information criterion. The critical values for the CADF test were obtained from Pesaran (2007), Table I(b), Case II, and for the CIPS test they were obtained from Pesaran (2007), Table II(b), Case II.

Source: Authors' estimate

According to the CADF test results, the null hypothesis, which states that there is a unit root for UR, is rejected for Lithuania. However, the null hypothesis cannot be rejected for the other seven countries. Therefore, UR is stationary only in Lithuania, and it includes a unit root in the other seven countries.

The null hypothesis for RMW is rejected in Slovenia, Lithuania, and Latvia, but the null hypothesis is accepted for the other five countries. Finally, the null hypothesis for TW and UD is accepted in all eight countries. The CIPS test results revealing the panel statistics indicate that all of the variables include a unit root at the level values.

After the unit root test is conducted for the series' level values, it is necessary to determine whether the differences of the series are stationary. In this context, the unit root test results for the differences of the series are presented in Table 4.

Table 4 CADF and CIPS test results (first difference)

Country	DUR		DRMW		DTW		DUD	
	CADF	**p**	**CADF**	**p**	**CADF**	**p**	**CADF**	**p**
Poland	0.750	4	-1.22	4	-2.286	2	-3.246*	3
Czech R.	-1.640	2	-1.67	3	-4.693***	4	-164.15***	4
Slovakia	-1.742	3	-3.51**	2	-2.331	2	-0.907	4
Slovenia	-1.640	4	-10.0***	2	-3.643**	4	-3.700**	3
Hungary	-0.825	2	-3.58**	2	-1.303	2	-3.285*	4
Lithuania	-3.33*	4	-6.96***	2	-2.537	2	-3.726**	2
Latvia	-1.404	2	-6.41***	3	-2.145	2	73.796***	4
Estonia	-16.7***	4	-3.18*	3	-1.497	3	-3.17*	2
CIPS stat	-3.424***		-4.57***		-2.429**		-13.439***	

Note: ***, ** and * stand for significance at 1, 5 and 10% levels, respectively. The lag lengths (p) are selected according to the Schwarz information criterion. The critical values for the CADF test were obtained from Pesaran (2007), Table I(b), Case II, and for the CIPS test they were obtained from Pesaran (2007), Table II(b), Case II.

Source: Authors' estimate

According to the results of the CADF test conducted by taking the differences of the series, the null hypothesis stating that there is a unit root for UR is rejected in Lithuania and Estonia. Therefore, in these countries, UR becomes stationary when the first difference is taken. For RMW, the null hypothesis cannot be rejected in Poland and the Czech Republic, but it is accepted in the other six countries. For TW, the null hypothesis is rejected in the Czech Republic and Slovenia, but it is accepted in the other six countries. Finally, the null hypothesis for UD is accepted only in the Slovak Republic, but it is rejected in the other seven countries. According to the results of the CIPS test, which is a panel statistics test, the null hypothesis is rejected for all of the variables. Thus, UR, RMW, TW, and UD series become stationary when the first difference is taken. The order of stationarity of these seven series is I (1).

After testing the stationarity of the variables, the possible existence of a long-term relationship between the variables can be analysed. The results of the LM bootstrap test used for the analysis are presented in Table 5.

Table 5 LM bootstrap panel co-integration test results

LM statistic	Bootstrap p-value	Asymptotic p-value
24.756	0.510***	0.000

Note: The critical values for the LM bootstrap test were generated using Monte Carlo simulations with 10,000 replications.

Source: Authors' estimate

The results of the LM bootstrap test indicate that the null hypothesis that there is a co-integration between variables cannot be rejected for the bootstrap p-value, but it can be rejected for the asymptotic p-value. In our model, there is a cross-sectional dependence problem. For this reason, the results of the bootstrap method can be preferred as the bootstrap method takes the cross-sectional dependence problem into account.

The coefficients of the model belonging to UR can be estimated since the variables are co-integrated. The results of the model estimated through the AMG method are indicated in Table 6.

Table 6 Individual country results of the AMG estimator

	Variables		
Country	**RMW**	**TW**	**UD**
Poland	.1421994* (.08238352)	.0707062* (.0369532)	-0.412587 (.6637634)
Czech R.	.1266412*** (.0290259)	-.0236348 (.0335549)	0.204727*** (.03055459)
Slovakia	.2432448 (0.178945)	.0551804*** (.0154503)	0.2893117*** (.08242612)
Slovenia	.4956995 (.6319086)	.0712546 (.1020312)	-0.374658*** (.0671670)
Hungary	-.2577504 (1.120519)	-.076201 (.0524627)	-0.4307802*** (0.156838)
Lithuania	.2207476* (1.202098)	-.3216475 (.3617093)	0.0782712 (.1421008)
Latvia	.1518983*** (.0318119)	.1013649*** (.0373707)	0.7434261 (.4904936)
Estonia	-.4030775 (.339582)	-.0654304* (.0393022)	0.0865874 (.1349688)

Note: Figures in parentheses are Newey–West standard errors. ***, ** and * stand for significance at 1, 5 and 10% levels, respectively.

Source: Authors' estimate

The results of the AMG estimator show that UD is not significant for Poland. Therefore, this variable is not effective in determining UR. RMW and TW are statistically significant and positive. The coefficients of these variables are 0.1421 and 0.07070, respectively. Therefore, an increase in RMW and TW is expected to increase UR.

TW is not significant for the Czech Republic. Therefore, TW is not expected to affect UR. RMW and UD are statistically significant and positive. The coefficients of these variables are 0.1266 and 0.2047, respectively. According to these results, if RMW and UD increase, UR increases as well.

TW and UD are statistically significant and positive for Slovakia. The coefficients of these two variables are 0.0551804 and 0.289311, respectively. RMW is not significant. Therefore, this variable does not affect the unemployment rate. In Slovenia, UD is statistically significant and negative. The coefficient of this variable is -0.374. But, RMW and TW are not significant. Therefore, these two variables do not have any effect on UR. For Hungary, UD is statistically significant and negative; if UD increases, UR decreases. The other two variables are insignificant for Hungary, so these two variables do not affect UR.

In Lithuania, only RMW affects UR. The coefficients of other variables are not significant. Finally, in Estonia, TW is statistically significant and negative. UR is inversely related to TW; if TW increases, UR decreases. The other two variables are statistically insignificant. Therefore, RMW and UD do not affect UR in Estonia.

These results indicate that the labour market regulations are not strongly affected by UR in Poland, Latvia, and Estonia. However, in the Czech Republic, Slovenia, Slovakia, and Hungary, the LMI variables are highly effective. Consequently, it can be said that the LMI variables are dominant in the labour market in the Czech Republic, Slovenia, Slovakia, and Hungary.

In order to check the robustness of estimation results of the AMG estimator, the CCE estimator was applied. The results of the CCE estimator are summarised in Table 7.

Table 7 Individual country results of the CCE estimator

Country	Variables		
	RMW	TW	UD
Poland	.1421994* (.08238352)	.0707062* (.0369532)	-0.412587 (.6637634)
Czech R.	.1266412*** (.0290259)	-.0236348 (.0335549)	0.204727*** (.03055459)
Slovakia	.2432448 (0.178945)	.0551804*** (.0154503)	0.2893117*** (.08242612)
Slovenia	.4956995 (.6319086)	.0712546 (.1020312)	-0.374658*** (.0671670)
Hungary	-.2577504 (1.120519)	-.076201 (.0524627)	-0.4307802*** (0.156838)
Lithuania	.2207476* (1.202098)	-.3216475 (.3617093)	0.0782712 (.1421008)
Latvia	.1518983*** (.0318119)	.1013649*** (.0373707)	0.7434261 (.4904936)
Estonia	-.4030775 (.339582)	-.0654304* (.0393022)	0.0865874 (.1349688)

Note: Figures in parentheses are Newey–West standard errors. ***, ** and * stand for significance at 1, 5 and 10% levels, respectively.

Source: Authors' estimate

The results of the CCE estimator confirm the results of the AMG estimator. Accordingly, UR is not strongly affected by the LMI variables in Poland, Latvia, and Estonia. However, in the Czech Republic, Slovenia, Slovakia, and Hungary, the LMI variables are highly effective. Consequently, it can be said that the LMI variables are dominant factors for unemployment in the labour market in the Czech Republic, Slovenia, Slovakia, and Hungary.

The fact that the LMI variables impact unemployment in the Czech Republic, Slovenia, Slovakia, and Hungary indicates that unemployment can be affected by adjusting the labour market. Labour market regulations fall within the jurisdiction of the government responsible for fiscal policy. This result shows that the governments of these four countries can have an impact on unemployment with their policy implementations. Accordingly, governments in the Czech Republic, Slovenia, Slovakia, and Hungary can affect unemployment by interfering with the tax burden, minimum wages, and union activities. On the other hand, the fact that labour market regulations are not very effective in relation to unemployment in Poland, Latvia, and Estonia shows that policymakers in these three countries cannot affect unemployment through fiscal policy practices alone. Therefore, policymakers in Poland, Latvia, and Estonia may need to benefit from not only fiscal policy but also other economic policies such as a monetary policy to reduce unemployment.

6. Concluding remarks

This study analyses whether the labour market institutions (LMI) variables affected UR in the CEE countries between 2000 and 2017. In addition, it is examined whether the LMI variables impact unemployment in these countries. Panel data methods that take cross-sectional dependence into account are used for the analysis. The findings of the study suggest that RMW, TW, and UD do not have any substantial impact on UR in Poland, Latvia, and Estonia. Thus, the LMI variables do not affect unemployment in Poland, Latvia, and Estonia. On the other hand, the results show that RMW, TW, and UD have a great impact on UR in Slovakia, Slovakia, the Czech Republic, Slovenia, and Hungary. This result indicates that the LMI variables have a great impact on UR. Therefore, the LMI variables are dominant factors for unemployment in Slovakia, the Czech Republic, Slovenia, and Hungary. These results differ from Riboud et al. (2001) and Grossmann et al. (2019). In addition to these results, in this study, only the LMI variables were used as control variables while investigating the causes of unemployment in the CEE countries. Unemployment can be affected by many social and economic factors. Therefore, while investigating the causes of unemployment, future studies may include in the model social factors or monetary factors such as the interest rate and money supply. In this way, the expansion of the model may allow for a more detailed examination of unemployment.

The effect of the LMI variables on unemployment indicates that some policies may have an effect on the labour market. For example, the fact that unemployment in Slovakia, the Czech Republic, Slovenia, and Hungary is affected by real minimum wages, the tax wedge, and union density shows that only fiscal policy implementations impact unemployment. While there is an intervention in the money market with monetary policy, issues such as employment and growth are targeted with fiscal policy. The CEE countries are EU member states. Central banks in the EU aim for price stability as the ultimate goal. Governments are interested in issues such as employment and growth. Therefore, fiscal policy is crucial to combat unemployment in the CEE countries. Therefore, the governments of Slovakia, the Czech Republic, Slovenia, and Hungary have great responsibility to reduce their unemployment rates. In this respect, institutional arrangements should be made with employers to minimise the cost of workers. While these regulations are implemented, it is important to avoid any pressure on the public sector and the rights of employees should be protected at the same time. Institutional arrangements made for wages, taxes and social security contributions should also be adjusted for unionisation. Therefore, unionisation activities should be arranged to contribute to employment growth, not to put pressure on the public sector, and to adopt an economic system dominated by the private sector rather than an economic structure under the supervision of the state. Furthermore, unions should be organised in a way that supports the efficient functioning of the private sector and aims to increase the level of productivity.

Moreover, the fact that the LMI variables are dominant factors determining unemployment indicates that the LMI variables impact a decrease in UR. Thus, policymakers can take precautions to make the labour market more flexible in Slovakia, the Czech Republic, Slovenia, and Hungary. In addition, doing business in a country should be facilitated to increase employment. Business life and the process of starting up a company should be facilitated to overcome this problem. Furthermore, transaction costs and bureaucratic procedures related to the investments can be reduced.

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Appendix

Table A1 Test results of cross-sectional dependence for variables

Variables	CDLM2		CDLM		Bias-adjusted CD test	
	Statistics	p-value	Statistics	p-value	Statistics	p-value
UR	2.896	0.002	-2.559	0.005	2.321	0.003
TW	3.514	0.000	-1.623	0.052	2.994	0.001
UD	3.254	0.000	-2.747	0.003	9.836	0.000
RMW	2.013	0.022	-1.860	0.031	7.271	0.000

Source: Authors' estimate

Table A2 Test results of cross-sectional dependence and homogeneity for the model

Test	Statistics	p-value
CDLM2	13.058	0.000
CDLM	3.527	0.000
Bias-adjusted CD test	4.021	0.000
Delta-tilde	2.202	0.014
Delta-tilde-adj.	2.817	0.002

Source: Authors' estimate