THE CONVERGENCE OF UNEMPLOYMENT RATE IN THE EUROPEAN UNION

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Abstract
The main objective of this research is to assess the unemployment rate convergence in European Union (EU-27). The inequality and variation indicators showed that during 2004-2013 there was a decrease in the degree of convergence process. The convergence regression approach provided more important results: the convergence is obvious in pre-crisis period, the actual economic crisis generating clear unemployment regional disparities. The regression for the entire period (2004-2013) for the 27 countries of European Union showed a slow convergence of the unemployment rate.
Key words: convergence, unemployment rate, coefficient of variation, Lorenz curve, Gini coefficient, regression
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1. Introduction

In literature the unemployment is considered as an important structural disequilibrium. Moreover, the recent crisis emphasized the need of unemployment reduction as a measure for social protection and economic revival.

The convergence could be assessed using different approaches. The calculation of the variance, coefficient of variation or inequality indicators is a common approach for appreciating the degree of convergence in a certain period. Moreover, the regression analysis could provide important information regarding the evolution of convergence process.

The main aim of this study was to use the two approaches in order to characterize the convergence evolution in EU-27 for unemployment rate. The main results conduct us to consider that the actual economic crisis determined a considerable decrease in convergence process.

2. Literature review

Some authors proposed a model for studying the relationship between unemployment rate, GDP per capita growth and technology. The employment rate in poor countries increases faster than in the rich countries, having a relative reduction in their unemployment rates (Fagerberg, Verspagen, and Caniels, 1997).

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The correlation between unemployment cycles and industrial production in European Union and CEECs was studied in some papers. (Baddeley, Martin and Tyler, 1998) observed the reduction of differences regarding the unemployment rates in different countries of the European Union. The disparities in EU regarding the regional unemployment have a high degree of persistence. The persistence is explained as an equilibrium phenomenon. The regional unemployment disparities were analyzed in Finland, obtaining rather persistent disparities that are explained by the disequilibrium approach (Pehkonenand Tervo, 1998).

The Solow model for OECD countries was used to state that the influence of unemployment on productivity growth depends on the human capital that appears in the production function (Bräuninger and Pannenberg, 2002). Low growth in European area and high unemployment rates determined the idea of reconsidering criteria for convergence starting from these variables (Hein and Truger, 2005). The main problem of European policy-makers is the high unemployment and important regional inequalities (Overman and Puga, 2002).

Equilibrating mechanisms like labour mobility, employment creation, out-of-labour-force movements and wage adjustment did not reduce the unemployment regional disparities in six countries with economy in transition (Bornhorst and Commander, 2006).

Persistent and high disparities of regional unemployment rate were obtained in post-communist countries (Jurajda and Terrell, 2009). The convergence in unemployment is explained by the flow of foreign direct investment and the migration. The persistence of unemployment differentials were also observed by (Perugini and Signorelli, 2010).

The evolution of Regional Unemployment in the EU before and after the recent economic crisis was analyzed (Marelli, Patuelli and Signorelli, 2012). The impact of crisis on the labour market based on regional unemployment have been previously analyzed by (Furceri and Zdzienicka, 2011), (Demidova and Signorelli, 2011), (Arpaia and Curci, 2010), (Guichard and Rusticelli, 2010), (Furceri and Mourougane, 2009) and (Stiglitz, 2009).

3. Methodology

For assessing the degree of convergence there are some variation and inequality indicators. Moreover, a regression approach could be applied in order to appreciate the intensity of convergence process.

The Robin-Hood index is calculated as a ratio between half of the average deviation of the variable (x) and the distribution average.

$$K = \frac{1}{2n}\sum_{i=1}^{n}\left|\frac{x_i}{\bar{x}} - 1\right| \qquad (1)$$

x_i - variable value for country i
$\bar{x}$ - average level of the variable
n- number of countries

The Robin-Hood index measures the amount of transfers from high values of the variable (greater than average) towards low values (less than average) for having a perfect equality of that variable.

Éltetö-Frigyes indexes measure the difference between the average level of the units with higher ($\overline{x_1}$) or lower values ($\overline{x_1}$) and the overall average and the difference between partial average and overall average.

$$EF_1 = \frac{\overline{x_1}}{\overline{\overline{x_2}}} \tag{2}$$

$$EF_2 = \frac{\overline{x_1}}{\overline{\overline{x}}} \tag{3}$$

$$EF_3 = \frac{\overline{x_2}}{\overline{\overline{x}}} \tag{4}$$

The dispersion (variance) is calculated as:

$$\sigma^2 = \frac{1}{n}\sum_{i=1}^{n}(x_i - \overline{x})^2 \tag{5}$$

x_i - thevalue of the variable for country i
i-index for countries

$\overline{x}$ - the mean (average) ($\overline{x} = \frac{1}{n}\sum_{i=1}^{n}x_i$)

The dispersion is utilized for computing the standard deviation ($\sigma = \sqrt{\sigma^2}$) and the coefficient of variation ($CV = \frac{\sigma}{\overline{x}}$).

The dispersion of the logarithm from x is based on the logarithm of individual values and the average value.

$$\sigma_1 \log{}^\uparrow 2 = 1/n \ \sum_1 (i = 1)^\uparrow n \equiv (\log x_1 i / x^-)^\uparrow 2 \tag{6}$$

The Gini coefficient measuresthe average distance between the pair wise individual values of the variable:

$$G = \frac{1}{2 \cdot \overline{x} \cdot n^2}\sum_{i=1}^{n}\sum_{i=1}^{n}|x_i - x_j| \tag{7}$$

Atkinson indexes use a normative parameter (ε) which is the aversion parameter aversion regarding the inequality.

$$A_\varepsilon = 1 - \left[\frac{1}{n}\sum_{i=1}^{n}\left(\frac{x_i}{\overline{x}}\right)^{1-\varepsilon}\right]^{\frac{1}{1-\varepsilon}} \tag{8}$$
, for $\varepsilon \neq 1$

$$A_1 = 1 - \left[\prod_{i=1}^{n} \frac{x_i}{\bar{x}} \right]^{\frac{1}{n}} \text{, for } \varepsilon = 1 \tag{9}$$

The Gini coefficient, Robin-Hood and Atkinson indexes have 1 as maximum value. The Theil's index measures the entropy determined by the differences between variable values. It is computed likea mean of the ratio between individual values and the variable mean, the weights being given by the logarithm of the ratio:

$$T = \frac{\frac{1}{n} \sum_{i=1}^{n} \frac{x_i}{\bar{x}} \ln x_i}{\bar{x}} \tag{10}$$

4.Unemployment rate convergence in EU-27

In this study we are interested in measuring the inequality in unemployment,a variable often used to evaluate the degree of convergence process. The data for unemployment rate European Union (EU-27) was provided by Eurostat, covering the period from 2004 to 2013. In the European Union (EU-27) the unemployment rate has decreased with 15.49% in the period from 2000 to 2007 while it has increased with 53.52% during the crisis (from 2008 to 2013).

The results of our computations for assessing the unemployment rate convergence on the horizon 2004-2013 are presented in the following table. It includes the data regarding some variation and inequality coefficients.

Table 1. Indicators for measuring the unemployment degree of convergence in EU-27

Year	Coefficient of variation (%)	Gini coefficient	Robin-Hood index	EF_1	EF_2	EF_3	σ_{log}^2	$A_1\varepsilon$ (ε =1)	Theil's index
2004	19.88	0.222	0.159	4.244	2.203	0.519	0.030	0.076	0.074
2005	15.2	0.195	0.134	4.068	2.182	0.536	0.023	0.061	0.060
2006	16.72	0.181	0.126	3.564	1.900	0.533	0.020	0.051	0.047
2007	17.8	0.173	0.128	3.111	1.755	0.564	0.018	0.046	0.041
2008	24.99	0.165	0.116	3.645	1.797	0.493	0.018	0.045	0.039
2009	31.01	0.222	0.156	4.865	2.019	0.415	0.028	0.070	0.067
2010	30.39	0.234	0.175	4.568	1.989	0.435	0.034	0.084	0.080
2011	34.87	0.233	0.176	5.167	2.177	0.421	0.034	0.083	0.079
2012	35.06	0.248	0.179	5.814	2.354	0.405	0.038	0.094	0.094
2013	37.59	0.243	0.173	5.38	2.39	0.44	0.03	0.0	0.090

Source: author's calculations

The computations indicate in general a divergence process in the last years. The coefficient of variation has an overall tendency of increase, with a growth with 89.08% in 2013 compared to 2004, reflecting an accentuation of divergence process in EU-27 on the horizon 2004-2013. The variations of Gini coefficient are rather low, the indicator being in the interval [0.165; 0.243]. In the crisis period (2008-2012) the Robin-Hood index and EF1 have slowly increased, showing an accentuation of disparities between countries' unemployment. The other indicators have not only a tendency of increase or a tendency of decrease, but the range is quite low. EF1 has the greatest increase with 26.94% in 2013 compared to 2004. EF3 indicator has decreased with 14.48%, showing a decrease of the disparities between countries with low unemployment rates and the overall average. EF1 and EF2 indicators increased and the gap between countries with high unemployment and the average level, but also the gap between countries with high unemployment and low unemployment have increased during 2004-2013. An accentuation of these differences might be explained by the crisis period. So, the variation and inequality indicators show a slow increase in unemployment inequalities between EU27 countries, fact that suggests a decrease in convergence process from unemployment perspective during 2004-2013.

In order to show the tendencies regarding the convergence in EU-27, a graphical representation was made for inequality and variance coefficients and the average unemployment rate.
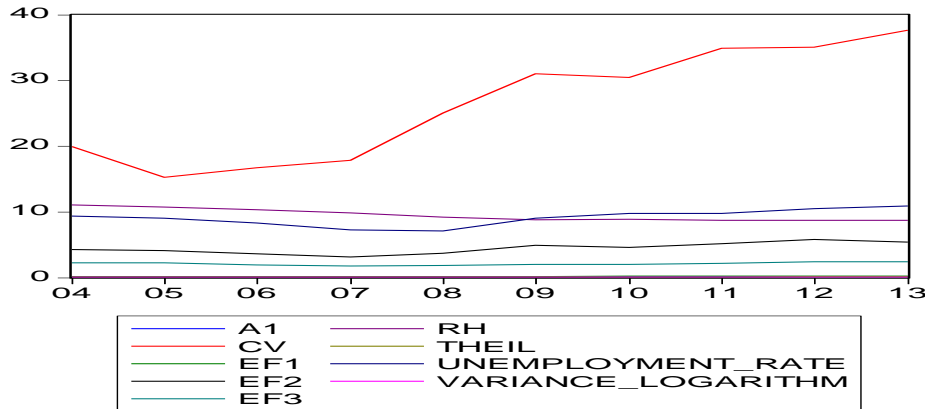
Figure 1 Lorenz curve for unemployment rate
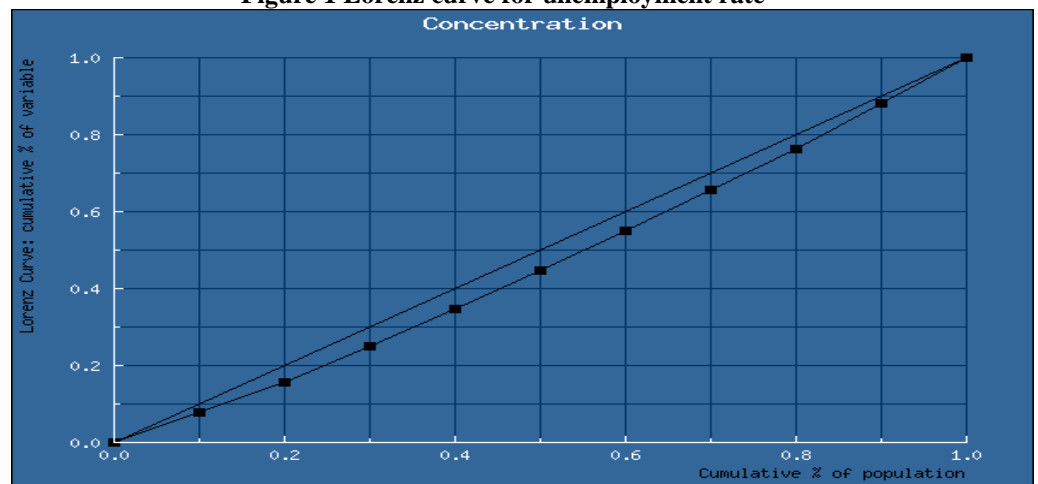
 Source: author's view

The Lorenz curve indicates that the inequalities between countries regarding the unemployment rate are not too large.

Figure 2 The dynamics of convergence indicators and average unemployment rate for EU27 during 2004-2013

Source: author's view

In the analyzed period there is a direct significant correlation between the average unemployment rate and the coefficient of variation. The inequality indicators have an overall tendency of stabilization, while the coefficient of variation has an obvious increase during the crisis.

The convergence is known as long-term concept and on large horizons the regional disparities diminish or disappear in the absence of exogenous shocks. A basic model was estimated for two time periods corresponding to the overall period, before the crisis and during the crisis:

$$\ln \frac{u_t}{u_0} = \alpha_0 + \alpha \cdot \ln u_0 \tag{11}$$

u- the unemployment rate
t- final year
0- initial year

Table 2. Convergence regressions for different time periods

Estimation period for 27 countries in EU	α_0	α	R^2	Prob. for the statistic of Breusch-Godfrey Serial correlation LM test (first order errors' serial correlation)	Prob. for the statistic of White test	Prob. for the statistic of Jarque-Bera test
2004-2013	1.493 (3.503)	-0.608 (-3.022)	0.27	0.074	0.967	0.503
2004-2007	0.638 (2.711)	-0.438 (-3.944)	0.38	0.524	0.4601	0.616
2008-2013	0.941 (2.275)	-0.238 (-1.046)	0.04	-	-	-

Note: t-stat in brackets

The models proposed for overall period and for pre-crisis period are validat 0.05 level of significance, while the model for crisis period is not significant. The slopes of the regression models are in all cases negative. This is an evidence of relative convergence in pre-crisis period and on the entire period, even if the actual economic crisis determined unemployment regional disparities in EU-27. All the residual test (Breusch-Godfrey test, White test and Jarque-Bera test) suggest that the errors are for both valid models independent, homoskedastic and normally distributed (the level of significance equals 0.05).

5. Conclusions

In this study the assumption that the crisis had an important impact on unemployment convergence in EU-27 was checked. In pre-crisis period there was evidence that the convergence process was rather persistent. During the economic crisis the regional disparities have grown, the countries with high employment rates tending to increase their rates compared to average level in EU.

In regression analysis we made the assumption that the convergence takes place in towards only one steady-state. However, the member of EU-27 may present intra-country convergence.

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