The Catch-up Process of Relative Wages in European Union New Member States

*Harun UÇAK**

Abstract

In 2004, European Union underwent the largest single expansion, both in terms territory, number of states and population. After that, economic effects of accession for new member states have been studied with different aspects in European Union integration literature. This paper focus on labour market aspect and it is aimed to investigate the existence of catch-up process for eight EU new member states' relative wages. The relative wages are measured by a ratio of new member states to old member with Germany as a representative country and the convergence analysis is applied to testify the process of wage disparities. The results show the existence of convergence and that the wages in new member states have been closer to high-wage level countries' after joining EU.

Keywords: *wages, labour market, integration, convergence*

JEL Classification: F15, F16, J30, J40

1. Introduction

In 2004, the European Union (EU) experienced its largest enlargement since its creation and eight of the new member states (NMS-8) are Central and Eastern European Countries (CEEC) which are also called transition countries. Before the membership, these countries engaged in a transition process involving fundamental institutional and structural changes that have turned former planned economies into market economies. Furthermore, prior to 2004, NMS-8 was facing high wage differentials compared to old member states and these countries joined the EU with relatively low wage levels. Joining the European integrated market included a possible direct effect on the leveling of prices or wages, with a higher frequency of price changes in the short term (Vlach, 2005). Also classical

* Harun UÇAK, Niğde University, Faculty of Economics and Administrative Sciences, Departments of Economics, Nigde 51100, Turkey; e-mail: hucak@nigde.edu.tr

economic theory suggests that goods trade and factor mobility are important powerful mechanisms in factor price convergence among countries.

Current changes in wages NMS-8, result from institutional changes made at the start of the transformation from a command economy to a market economy since the beginning of 1990s. Therefore in the first stage, initial changes in wages were a result of economic transformation and in the second stage these changes have been as a result of an integration process into the EU market.

Given the magnitude of income and wage differentials and the strong degree of integration involved due to the accession, there were mounting concerns among the present EU members that Eastern Enlargement might have a number of undesirable effects on labour markets (Boeri and Brücker, 2001). This was caused by the fear that eventual social costs would have to be paid by the old member states, while they were expecting a cheap labour force from new member states and their position (Mielink, 2005).

The enlargement of the European Union in 2004 was followed by large migration movements from NMS-8 to Western Europe. Wages differences between the new member states and old member states were an important driving force behind this migration (Elsner, 2010). However, workers from NMS-8 received the right to emigrate and take up work in Ireland, the UK and Sweden from the beginning. New member states' full access to the EU labor market was postponed for up to seven years. May 1st, 2011 marked the removal of restrictions on the right to work in any Member State for citizens of these eight member states (European Commission Press Release, 2011). Consequently, the other EU-15 countries stopped national measures that restrict migration from the new member states which joined the EU in 2004.

2. Theory and Methodology

This study attempts to investigate the wage convergence in the context of factor-price equalization theorem and neo-classical growth theory, which is that poorer countries catch up to the richer. Factor-price theorem formulated Samuelson (1948) on the basis of the Heckscher-Ohlin Trade Theory. Samuelson (1948*)* indicated that free trade will lead to both relative and absolute factor price equalization. An often-cited example of factor price equalization is wages. Movements in wages can be used to investigate a partial degree of economic integration across countries. According to the factor-price equalization theorem, wages for identical jobs in both countries tend to approach each other in the integration process among countries.

The empirical method which is applied in this study adopted by many empirical studies based on Solow's (1956) neoclassical growth model. Thereby, the literature on cross-country convergence has focused largely on macroeconomic convergence, that is, in GDP per capita. There are huge amounts of studies devoted to economic growth and convergence (Baumol, 1986; Barro and Sala-i-Martin, 1991; Mankiw et al., 1992; De Long, 1988; Dowrick and Nguyen, 1989). In addition, the regional convergence process in EU has generated considerable interest in recent years. Eckey and Turck (2007) prepared a literature review about convergence of EU regions. Their investigation results generally show the convergence in EU member states in terms of per capita income.

Neoclassical growth theories predict convergence in income per capita across countries and furthermore it is also expected a convergence process on wages. In this context of wage differences among countries, lower wages will tend to grow faster and will catch up the leading ones in the long run.

In this study, the empirical analysis builds on a data set of relative wages (*dw*) of NMS-8. The relative wages are calculated as the differences of logarithmic form wages between NMS-8 and Germany. Germany is chosen as the representative country for old EU member states. The relative wages ($lndw_{i,j,t}$) between the country *i* and *j* are calculated as a ratio of NMS-8 countries' ($w_{i,t}$) wages into Germany's wages ($w_{g,t}$) and they are expressed in logarithmic form.

$$lndw_{i,j,t} = ln\left(\frac{w_{i,t}}{w_{g,t}}\right) \tag{1}$$

The empirical literature uses single equation regressions to study economic convergence across countries and regions, based on the β convergence and it is presented as conditional and unconditional (Barro and Sala-i-Martin, 1991; 1992). In this study, the unconditional convergence of wage differences is investigated.

In calculation of β convergence, the typical estimating equation specifies changes in NMS-8 relative wages as a function of the lagged relative wages and a country fixed effect. The following regression is a panel analog to the Barro regression and it is natural to interpret the coefficient of the lagged relative wages term as a function of the speed of convergence.

$$\Delta lndw_{i,j,t} = \alpha_{i,j} + \beta dw_{i,j,t-1} + \varepsilon_{i,j,t} \tag{2}$$

where

Δ – first-difference operator,

α – the country fixed effect,

ε – the residual term.

β is the convergence coefficient and if convergence hold, it is expected that β coefficient would be negative and statistically significant; β also measures the speed of convergence and it is possible to compare the speed of convergence among relative wages of NMS-S's in different labour market. β convergence implies a catching-up process in which countries with lower wage levels experiences faster subsequent increases in wages than countries with a previously higher wage levels. (Sturm et al., 2009; Li and Huang, 2006).

To estimate the speed of convergence β, firstly it should be checked for unit roots in each series and after that the OLS estimation can be applied if the series are stationary. Furthermore, panel unit root tests also have been widely used in the test of convergence analysis in recent years since Evans and Karras (1996) develop a formal test of the convergence hypothesis with panel unit root tools. Therefore in this study firstly, it is employed the panel unit root methods for evaluating the stationary of NMS-8 relative wages to Germany's wage levels.

The unit root test was applied to relative wage variables to firstly testify whether relative are unit root processes, i.e. series which contain a stochastic trend or unit root which makes them diverge from one another. After rejection of null hypothesis, that is, the level of relative wages converge to a steady-state value, we turn to the issue of the rate of convergence.

This study applies two widely used panel unit root tests which are developed by panel Levin, Lin and Chu (LLC) (2002) and Im, Pesaran and Shin (IPS) (2003), Both of them are based on the well-known Dickey-Fuller procedure LLC test, based on the idea of the homogeneity which is rather restrictive. In opposition, Im, Pesaran and Shin (2003), recommend a test which is a statistic average ADF (Augmented Dickey-Fuller) consisting of inducing heterogeneity between the groups. IPS, allow for heterogeneous panels and propose panel unit root tests which are based on the average of the individual ADF unit root tests computed from each time series whereas LLC is applicable only for homogeneous panels (Baltagi et al., 2007)

Im, Pesaran and Shin (IPS) (2003) proposed a test for the presence of unit roots in panels, which combines information from the time-series dimension with that from the cross-section dimension, so that fewer time observations are required for the test to have power (Giulietti, Otero and Smith, 2008). It is due to the fact that each individual cross-section is independent and the results are combined using a large sample distribution of t-statistics to investigate the null hypothesis on the panel as a whole. The IPS test possesses substantially more power than single-equation ADF test by averaging N independent ADF test (Strauss and Yiğit, 2003).

$$\Delta y_{it} = \alpha_i + \rho_i y_{i,t-1} + \sum_{j=1}^{\rho} \theta_{i,j} \Delta y_{i,t-1} + \varepsilon_{it} \tag{3}$$

for $i = 1, \ldots N$ series. The procedure allows for heterogeneity in ρ and α. The null hypothesis is that $\rho_i = 0$ and the alternative is that a certain percentage of the series has a value of ρ significantly less than zero. The limiting distribution is given as:

$$\sqrt{N}\frac{\overline{t}_{ADF} - \mu_{ADF}}{\sqrt{\left(\sigma^2_{ADF}\right)}} \rightarrow N(0,1) \tag{4}$$

where the moments μ_{ADF} and σ^2_{ADF} are from Monte Carlo simulations, and $\overline{t}_{ADF}$ is the average estimated ADF t-statistics from the sample. The power to reject the null increases by the $\sqrt{N}$. In a word, IPS procedures address the low power associated with single series ADF tests by averaging the test statistics across the panel (N series).

The LLC test statistic also begins with the basic ADF estimation given by equation (1), however in this case it is assumed that the unit root process is common across all cross-sections. In LLC test, deterministic components are an important source of heterogeneity since the coefficient of lagged dependent variable is restricted to be homogenous across all units of panel (Barbieri, 2008). In LLC test, it is assumed that, as opposed to the formulation (1), all the have a common value, ρ, so that the null hypothesis to be tested is

LLC

$$H_0 : \rho_1 = \rho_2 = \ldots \rho_n = \rho = 0$$
$$H_1 : \rho_1 = \rho_2 = \ldots \rho_n = \rho < 0 \tag{5}$$

Thus, an estimator of α is obtained by controlling for the heteroscadasticity across the time series that make up the panel. However IPS has the null and alternative hypotheses which are different from that of the LLC approach.

IPS

$$H_0 : \rho_1 = \rho_2 = \ldots \rho_n = \rho = 0$$

H_1: At least one Value of ρ_1 differs from zero (6)

3. Data

Arbia and Piras (2005), Eckey and Turck (2007) indicated that although much progress had been made by the European Statistical Institute, spatial data availability is still one of the greatest problem in the European context. As a matter of

fact, data availability is still very scarce and in many instances it is very difficult to collect harmonized data-sets allowing consistent regional comparisons. The spatial wages data is still very scarce for labour market information. However in this study, the wages data by area collected from each country's national statistics offices and then develop harmonized concepts and methods of data reconciliation. The data is available for some countries in their national currency, and it is converted from national currency to current Euro by the exchange rate data from eurostat. The data for each labour market constructed from 2007Q1 to 2011Q1 as quarterly and each panel data series includes 136 observations.

T a b l e 1

Data Descriptions

Wages by Activities	
dw1	Total
dw2	Manufacturing
dw3	Construction
dw4	Electricity, gas, steam and air conditioning supply
dw5	Financial and insurance activities
dw6	Mining and quarrying
dw7	Wholesale and retail trade; repair of motor vehicles and motorcycles
dw8	Professional, scientific and technical activities
dw9	Transportation and storage
dw10	Education
dw11	Accommodation and food service activities
dw12	Human health and social work activities
dw13	Public administration and defence; compulsory social security
dw14	Real estate activities
dw15	Administrative and support service activities

Source: Own description of data for convergence analysis.

4. Empirical Result

The first results of this study include the of variables that is checked by LLC and IPS unit root test. Both LLC and IPS tests evaluates the null hypothesis that all of the series contain unit roots against the alternative hypothesis that none does. The LLC and IPS panel unit root test results for relative wages of NMS-8 are reported in Table 1. These results show that the null hypotheses of panel unit root in the level of the series are rejected at the between 1% and 10% significant level. The results of the panel unit root tests confirm that the variables are stationary and it shows that relative wage convergence exists for all labour markets. After rejection of null hypothesis, that is, the level of relative wages converges to a steady-state value, thus, it can be turned to the issue of β convergence and OLS estimation can be applied.

T a b l e 2

Panel Unit Test Results

Kind of Activity	LLC (constant)	LLC (constant + trend)	IPS (constant)	IPS (constant + trend)
lndw1	–4.84166*	–2.84552*	–4.91309*	–2.17556**
lndw2	–2.85504*	–2.08931**	–3.79942*	–1.69072**
lndw3	–3.15517*	–4.51860*	–2.14642**	–4.73279*
lndw4	–2.43465*	–1.89034**	–2.49233*	–2.25095**
lndw5	–2.69467*	–7.95153*	–2.58440*	–5.77373*
lndw6	–3.58327*	–3.74021*	–4.09001*	–3.04672*
lndw7	–1.73818**	–2.32963*	–2.62081*	–1.53431**
lndw8	–5.42167*	–3.20954*	–5.05447*	–1.66620**
lndw9	–4.61273*	–3.58414*	–4.14710*	–2.44347*
lndw10	–3.08576*	–1.93823**	–3.59248*	–4.34771**
lndw11	–3.07320*	–4.85993*	–2.50691*	–4.04207*
lndw12	–2.69468*	–2.21442*	–2.38067*	–2.37428*
lndw13	–1.80831**	–1.86056**	–2.54557*	–2.70181*
lndw14	–1.54753***	–1.88120**	–2.94385*	2.01272**
lndw15	–4.08300*	–4.20161*	–3.80843*	–2.41903*

Notes: * significant at 1%, **significant at 5%, *** significant at 10%.

Source: Own calculations.

Some econometric concerns should be addressed before β convergence estimation. The first problem is the choice of the method for estimation based on panel data: whether one should use the simple pooled least squares model (pooled LS), or the random effects or fixed effects models. The fixed effects model is widely used in the econometric issues (Maddala and Wu, 1999). Following Islam (1995) a number of papers have tried to estimate the speed of convergence among regions using panel data sets and variant of fixed effect model. The fixed effects panel model estimates suggest favorable state conditions and the convergence model is estimated allowing for heterogeneity in the constant term. Thereby, it holds (fixes) the average effects of each country's relative wages. It is accepted as a reasonable approach when the differences between countries can be viewed as parametric shifts of the regression function.

The fixed effects panel estimation results are presented in Table 2. In addition, β convergence is also tested by random effects panel model which is not shown on the table and it is found the existence of convergence. The fixed and random effects panel model found consistent results. The difference which is found in the analysis is that the speed of convergence is higher in fixed effects panel model. The results on Table 2 are shown for fixed effect model after the Haussman specification test which is widely used in panel data estimations. The Hausman specification test compares the fixed versus random effects under the null hypothesis that the individual effects are uncorrelated with the other regressors in the model (Hausman, 1978). The Hausman test proves fixed effects estimator is preferred over the random effects estimator. Finally, wooldridge test for

serial autocorrelation to all data used in this study. The presence of serial autocorrelation is an indication that the dependent variable is characterised by persistent or mean-reverting dynamics. This means that omitted variables are having a large impact on the dependent variable. The scores are given on Appendix 1 and the autocorrelation for the models of lnx4, lnx6, lnx10, lnx11, lnx14 and lnx15 rejected only the significance level of 1%.

T a b l e 3

Fixed Effect Model OLS Results

Variables		Coefficient	Standart error	t-statistics	R^2	Hausman test
	Constant	–0.481966	0.069677	–6.917149		
lndw1	β	–0.462712	0.065774	–7.034881	0.30	46.598424*
	Constant	–0.471242	0.065393	–7.206356		
lndw2	β	–0.431797	0.058598	–7.368818	0.32	50.232046*
	Constant	–0.445997	0.080953	–5.509314		
lndw3	β	–0.414889	0.073588	–5.637979	0.41	29.302700*
	Constant	–0.008294	0.007297	–1.136718		
lndw4	β	–0.522101	0.078726	–6.631571	0.28	30.683801*
	Constant	–0.433550	0.066774	–6.492851		
lndw5	β	–0.557219	0.085088	–6.540737	0.27	37.553612*
	Constant	–0.862993	0.094522	–9.130110		
lndw6	β	–0.788689	0.085447	–9.230169	0.42	77.401158*
	Constant	–0.507641	0.075038	–6.765162		
lndw7	β	–0.476209	0.069414	–6.860377	0.29	44.311453*
	Constant	–0.614518	0.075470	–8.142554		
lndw8	β	–0.563235	0.068234	–8.254525	0.37	63.380186*
	Constant	–0.415554	0.064227	–6.470046		
lndw9	β	–0.418964	0.063660	–6.581293	0.27	38.645398*
lndw10	Constant	–1.210660	0.133711	–9.054314		
	β	–0.786778	0.086471	–9.098767	0.41	75.135692*
	Constant	–0.586524	0.078634	–7.458869		
lndw11	β	–0.548621	0.072702	–7.546185	0.33	54.274866*
	Constant	–0.657186	0.088102	–7.459390		
lndw12	β	–0.509554	0.067247	–7.577319	0.33	53.042679*
	Constant	–0.496551	0.081327	–6.105582		
lndw13	β	–0.470649	0.076853	–6.124040	0.25	31.761299*
	Constant	–0.889815	0.116179	–7.658997		
lndw14	β	–0.686770	0.088925	–7.723008	0.35	56.021745*
	Constant	–0.767830	0.113606	–6.758694		
lndw15	β	–0.493837	0.072524	–6.809305	0.29	42.034416*

Notes: * significant at 1%, **significant at 5%, *** significant at 10%.

Source: Own calculations.

As it is seen on Table 2, there are statistically significant and negative values for parameter β. This means that there is a negative correlation between the initial wage ratios of the NMS-8 and their growth rates. Thereby the relative wage disparities have been decreased among countries since 2007Q1. The speed of β convergence for relative wages of total activity is 0.48 in absolute term. As the results on Table 2, the highest speed of convergence has been seen in the activities

of mining and quarrying as 0.79 in absolute term. However, the convergence speeds in other activities have been on a similar process and it shows that the wages in all type of activities in NM8 have been on a catch-up process to old member states.

Conclusion

The accession to EU in 2004, has several potential effects on the NMS-8' economies and labour markets. These potential effects have been often tested by convergence analyses to investigate the disparities between new and old member states. Earlier studies tested convergence analysis for EU member states or new member states in the context of income and prices as a whole or in different markets. However in these studies, the spatial data abilities have been mentioned as an important problem for more detail researches. This study attempted to investigate the process of wage disparities of new member states and old member states by collecting the data from each NMS-8. Also, Germany's wage levels were used as representative indicators of EU old members.

In this paper, the convergence analyses were tested by panel unit root and OLS regression. Both of the methods produced similar results which show the existence of convergence in all work activities. The wage ratios of NMS-8 into Germany have been converged from the first quarter of 2007 to the first quarter of 2011. It implies that NMS-8 wages have been on a catch-up process and wages have been increased faster than Germany. 15 panel data estimation were examined in the paper, thus the speed of convergence differ among variables. The speed of convergence which is called β convergence is highest for the wage group of mining-quarrying and education. However, it should be also noted that the autocorrelation problem for the wage group of education rejected only in the 1% significance level. The major conclusion of this study show that in general, wages in new member states of EU have been converged to Germany's (as a representative country for older members) wage level, despite there are differences among speeds and the level of statistical significances. Consequently, economic integrations create particularly favourable conditions for wage convergence among their participating countries, by removing the barriers on international movements of factor endowments.

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Appendix 1

Wooldridge Test for Autocorrelation

Model (for lnx1)	F (1, 7) = 1.201	Prob>F = 0.3094
Model (for lnx2)	F (1, 7) = 1.573	Prob>F = 0.2501
Model (for lnx3)	F (1, 7) = 0.032	Prob>F = 0.8631
Model (for lnx4)	F (1, 7) = 8.988	Prob>F = 0.0214
Model (for lnx5)	F (1, 7) = 1.685	Prob>F = 0.2354
Model (for lnx6)	F (1, 7) = 9.016	Prob>F = 0.0199
Model (for lnx7)	F (1, 7) = 1.389	Prob>F = 0.2770
Model (for lnx8)	F (1, 7) = 5.098	Prob>F = 0.0629
Model (for lnx9)	F (1, 7) = 1.260	Prob>F = 0.2986
Model (for lnx10)	F (1, 7) = 9.118	Prob>F = 0.0172
Model (for lnx11)	F (1, 7) = 5.394	Prob>F = 0.0586
Model (for lnx12)	F (1, 7) = 1.000	Prob>F = 0.3506
Model (for lnx13)	F (1, 7) = 0.009	Prob>F = 0.9271
Model (for lnx14)	F (1, 7) = 9.846	Prob>F = 0.0152
Model (for lnx15)	F (1, 7) = 10.692	Prob>F = 0.0137

Note: H0: no first-order autocorrelation.
Source: Own calculations.