Journal of International Management, Educational and Economics Perspectives

JIMEP.

THE EFFECT OF MINIMUM WAGE LEVEL ON LABOR EFFICENCY: AN ANALYSIS ON OECD COUNTRIES

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ABSTRACT

In this study, the effect of the changes in the minimum wage on the labor productivity is analyzed in the countries where the minimum wage, which is the minimal payment in exchange for the labor, is determined by the legal authorities. Australia, Belgium, Canada, Czech Republic, France, Greece, Netherlands, Spain, Japan and the United States are in the list of the High Income Countries and Turkey and Hungary are in the list of Upper and Middle-Income Countries of the World Bank, which are the subjects of the current study. By using the minimum wage and labor productivity data of the years between 1995 and 2011, the estimations are made by panel data analysis method. As a result of the analysis, it was determined that the changes in the minimum wage had statistically significant effects on the labor productivity.

Keywords: *Minimum Wage, Labor Productivity, Panel Data*

Jel Codes*: J30, J24, C23*

MİNİMUM ÜCRET SEVİYESİNİN ÇALIŞMA ETKİNLİĞİNE ETKİSİ: OECD ÜLKELERİ ÜZERİNE BİR ANALİZ

ÖZET

Bu çalışmada, emeğin karşılığı olarak ödenmesi zorunlu olan en düşük ücret düzeyi asgari ücretin yasal otorite tarafından belirlendiği ülkelerde, asgari ücretteki değişmelerin işgücü verimliliği üzerindeki etkileri analiz edilmektedir. Çalışmaya konu olan 12 OECD ülkesinden, Avustralya, Belçika, Kanada, Çek Cumhuriyeti, Fransa, Yunanistan, Hollanda, İspanya, Japonya, Amerika Birleşik Devletleri Dünya Bankası'nın Yüksek Gelirli Ülkeler listesinde yer almakta Türkiye ve Macaristan ise Üst Ve Orta Gelirli Ülkeler listesinde yer almaktadır. 1995-2011 yılları arasına ait asgari ücret ve işgücü verimliliği verileri kullanılarak, panel veri analizi yöntemi ile tahmin edilmektedir. Yapılan analizler sonucunda asgari ücretteki değişmelerin işgücü verimliliği üzerinde istatistiksel açıdan anlamlı sonuçları ortaya çıkardığı tespit edilmiştir.

Anahtar Kelimeler*: Asgari ücret, İşgücü Verimliliği, Panel Data*

Jel Kodu: *J30, J24, C23*

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1.INTRODUCTION

Employment is one of the most basic issues in the science of economics. It is the main provider in the lives of the humanity. Besides being the most issue dealt with in economics from past to present, employment has kept being a problem of the whole world.

The employment issue brings forward issues about what the minimum wage should be and how it should be determined, as well as the welfare issues. The determination of employment of endeavored ones and the level of their wages have been other issues. In parallel with the level of minimum wage issue, the debate on the ways of increasing it led the wage productivity (marginal productivity theory) to rise. Whether the increase in minimum wage can increase the labor productivity or work or vice versa is a debatable issue. Both theories are expected to function. This study investigates the effect of labor productivity on the increase of minimum wage of the employees whose aims are to have higher quality life standards, and it also investigates whether the increase in minimum wage leads an increase in social welfare by causing a higher labor productivity and production or not.

2. THEORIES OF WAGES, MINIMUM WAGE AND LABOR PRODUCTIVITY

2.1. Theories of Wages

The determination of the wage, which is expressed as the proportion of the labor from the production, is explained in five different groups among the economists. The first one of them is the Iron Law of Wages of David Ricardo, dated 1817 and according to him, there are both a natural price and a market price of labor. When the market price gets higher than the natural price, the increase in the marriages and the births will raise the labor supply whereas the decrease in marriages and the births will reduce the labor supply when the prices goes below the natural price; therefore, the wages will always be around the minimum subsistence level (Kazgan, 1993: 78-79).

The second one is Wage Fund Theory of John Stuart Mill and according to this theory, the wage level shows changes depending on the relation between the number of employees and the funds reserved for the wages. If the wage fund shows a faster increase than the population, the level of wages will increase; however, if the population shows a faster increase than the wage fund, the wages will decrease (Talas, 1976). The third one is the value theory of Karl Marx, and according to Marx, only element determining the value of a commodity is labor. The surplus created by paying a wage only to meet the subsistence level is abused by employers (Dunn and Rachel, 1971: 33-34).

The fourth one is Marginal Productivity Theory; this is an optimistic wage theory since it accepts that the wages can increase depending on the productivity of the labor. According to this theory, the wage should be regulated according to the employees' contributions on the marginal product. As well as the value of capital and land, the wage level depends on the labor productivity. As the labor productivity increases, the proportion of the labor in the product increases as well. Therefore, it is possible to increase the employees' wage and their welfare by increasing the labor productivity (Dunlop, 1966: 7). The fifth one is the theory of Bargaining Power; it is also called as the Power theory. It expresses that the employees can increase their bargaining power by unionization. According to this theory, the fundamental element determining the wages is the bargaining power. It becomes possible for employees to get wages equal to their productivity as their union power increases (Dinler, 2010).

2.2. Minimum Wage

Minimum wage is a result of the concept of wage. Although it was stated in the International Labor Conference that the definition of wage pertains to personal suggestions and rules, some descriptive tools and instruments were added to the definition of ILO. According to the Protection of Wages Convention No. 95, 1949, the concept of wage is defined as "remuneration or earnings, however designated or calculated, capable of being expressed in terms of money and fixed by mutual agreement or by national laws or regulations" (ILO report III, 1992: 9).

The process of determining the wage is a situation which faces the employers with the employees. While the employee seeks for the wage that maximizes his benefit, the employer want to

determine the wage at a level that can minimize the cost. In this struggle, the employee's fear of losing his job makes it possible for the employer to set the wages at a low level. This situation requires a public intervention about the minimum level of the wages. The minimum wage, tried to be determined to be at a level that could prevent the employers from abusing the employees, has been an important social policy tool of the governments in nearly all of the countries since 1800s.

Today the practice of minimum wage is an economic necessity. The practice of minimum wage demonstrates some differences nowadays. In some countries, it is determined by the legal authority and is valid across the whole country while in other countries, regional minimum wage is determined. Another type of minimum wage is practiced on the basis of sectors. The minimum wage is determined at different levels and sometimes it can be really low (Dobija, 2011: 780). While the minimum wage is determined by collective labor agreement in some countries such as Germany, Austria, Denmark, Finland, Sweden, Italy and Cyprus, it is determined at a national level in countries such as Belgium, France, Netherlands, England, Ireland, Spain, Luxembourg, Portugal, Greece, Czech Republic, Estonia, Latvia, Lithuania, Hungary, Malta, Poland, Slovakia and Slovenia (Yılmaz and Terzi, 2006: 121).

Minimum wage is defined as a payment which both is sufficient to provide a suitable subsistence level for the employee and prohibits the employers to pay a lower wage (Arabacı, 2007: 53). The minimum wage is defined as the "just and favorable remuneration ensuring for himself and his family an existence worthy of human dignity, and supplemented, if necessary, by other means of social protection" in the item 3 in Article 23 of the Declaration of Human Rights (Şeker and Küçükbayrak, 2012: 5). Moreover, the minimum is used as an economic policy reducing the poverty and helping the subsistence level (Watanabe, 2013: 288).

Beyond being a social policy protecting especially the rights of unskilled labor and increasing their life standards, the changes in the real level of minimum wage can lead increases in minimum wage on the market. While the increasing wage effects the wage distribution in economy, it effects the employment of labor at the same time. The change in the employment also effects the production and the labor productivity on the market (Croucher and Rizov, 2012: 266). The minimum wage have an influence on areas such as alternative policy on struggle against poverty, family income, total employment and distribution of resources (Stigler, 1946: 358). At the same time, while the wage can be a factor in the increase in labor productivity, the increase in labor productivity can make it possible for higher wages.

2.3. Labor Productivity

When the financial doctrines are reviewed, it is observed that there isn't a direct definition of productivity. Instead, it is seen that the concept is tried to be explained in relation with the concepts of efficient (productive) labor, capital stock, technological advancement and scale economies (Aydın, 2014: 13).

In the general sense, the productivity, expressing the relation between the input and the output, means producing making use of the resources the best way possible without extravagancy. Therefore in the technical sense, the productivity is expressed as the proportion among the produced commodity, the amount of service and the input used in the production of these commodities and the amount of service, and this measure is generally formulated as output/input (Yükçü and Atağan, 2009: 4).

Although there isn't a consensus on this general definition, it is frequently used in literature. However, this definition shows neither a unique measure nor a single aim. There are a number of aims at measuring the productivity. They are as follows (OECD Manual, 2001: 11);

1-Technology: The technological advancement is tried to be determined along with the increase in productivity.

2–Efficiency: It is conceptually different from technical advancements. The maximum amount of output is targeted with the available technology.

3–Actual Cost Savings: It is a pragmatic method. While it seems possible to distinguish between the economic scale, technological changes and efficiency changes, it is not that possible in practice. Therefore, the productivity measure in practice can be viewed as a search for the actual cost savings.

4–Comparison of the Manufacturing Processes: It could be useful to measure the productivity so that the inefficiency in business economics could be determined.

5–Life Standards: Productivity is accepted as the most common measure of life standards. Income per capita in an economy is a measure of productivity. Thus, the measure of labor productivity gives us clear information about life standards.

The measure of labor productivity helps major economic institutions explain both social development and economic growth (Freeman, 2008: 5). A number of factors are documented which could affect the labor productivity (Kelly, 2000: 1). These factors can be personal (ability, seniority, gender, etc.) and organizational (wage, communication and interpersonal relations, stress, etc.) (Karahan, 2009: 271-272). The labor productivity, obtained by the methods aforementioned, makes it possible for manufacturers and the government to increase the minimum wage. Therefore, the relationship between the labor productivity and the level of minimum wage, which has a vital importance for unskilled labor, is addressed. Whether the level of minimum wage leads an increase in labor productivity or the labor productivity leads an increase in minimum wage is an issue drawing attention.

3. LITERATURE SUMMARY AND DATA SET

3.1. Literature Summary

Most of the studies about the relationship between the labor productivity and minimum wage are generally towards determining the factors effecting the labor productivity or researching relationship of labor productivity with other variables, which were thought to effect it. Some of the study summaries are as follows;

Strauss and Wohar (2004) analyzed the labor productivity, wages and prices in manufacturing industry in USA between 1956 and 1996. According to the panel regression analysis conducted with the data of 459 manufacturing industries, a two-way relationship between labor productivity and real wages.

Ayvaz, Baldemir and Ürüt (2006) investigated the effects of foreign investments on the productivity and development. Capital efficiency and labor productivity are involved in the regression as dummy variables. As a result, it was determined that the foreign investments had a positive effect on labor productivity. Güneş (2007) tested the relationship between the productivity and real wage in manufacturing industry by using the error correction model (VECM) and Johansen and Granger Causality tests, and he determined a positive relationship.

Bovi (2007) analyzed the relationship between the employment and labor productivity by VAR method. According to the analysis involving the data of GDP and labor input in Italy between 1980 and 2004, a correlation between labor productivity and employment was determined. According to Trpeski and Tashevska (2009)'s analysis of the relationship between the labor productivity and wage in Macedonia, a strong relationship between the labor productivity and net wage in the agriculture, forestry, fishery and mining industries, and a weak relationship in transportation and communication industries were determined. Koshel et al (2008) analyzed how the productivity and manpower are effected by the population in Japan in comparison with the USA between 1978 and 2003. As a result, they argued a negative relationship between the productivity and employee turnover rate.

Paris (2010) investigated the relationship between the labor productivity and gross value added in manufacturing industry on the sectorial basis in Greece between 1963 and 2006. According to the analysis conducted on the sectorial basis by OLS method, a positive relationship between the labor productivity and gross value added was determined.

As a result of his comparative empirical study about the labor productivity and minimum wage in Poland and Ukraine, Dobija (2011) argued that Poland was better than Ukraine in terms of minimum wage; the labor productivity in Poland was based on the competition in private sector but

had nothing to do with the competition in public sector; and extensive reforms were required to be done for a competitive environment. Znotina and Jermolajeva (2011) determined that the labor productivity depended on the working capacity, facility means, ability and equipment in their study covering the years between 1998 and 2008 in Latvia.

Filippetti and Peyrache (2013) investigated the reason of the increase in labor productivity during the enlargement process in Europe between 1993 and 2007. They argued that the technology gap was supplied by the new EU member for a short time but differences were demonstrated in terms of this technology gap, which effected the labor productivity.

Jiang, Dietzanbacher and Los (2014) analyzed the inequality of the labor productivity between the regions in China. They argued that the employment proportion between the regions had a positive effect on labor productivity. Maia and Menezes (2014) analyzed Brazil and USA between 1981 and 2009 in terms of growth, labor and productivity, comparatively. According to the analyses categorizing the economic activities into sectors, they argued that Brazil had a low labor productivity considering the high growth rate when compared to USA.

Tang (2014) analyzed the effects of real wages and inflation on the labor productivity in Malaysia by using the Granger Causality test. According the data of the years between 1970 and 2007, while there was a non-monotonic second degree relationship between the labor productivity and real wages in short and long term, inflation had a negative effect on labor productivity.

In consideration of these studies, it is planned to investigate the relationship between the labor productivity and minimum wage involving more than one countries. It is thought that the OECD countries, which covered a distance in development process and whose data are available, are convenient to involve in the research and it is considered appropriate to use panel data method in the analyses in order to determine the relationship between labor productivity and minimum wage.

3.2. Data Set

In this study, the data of labor productivity, calculated annual by The Conference Board Total Economy Database, and minimum wage, calculated by OECD, of Australia, Belgium, Canada, Czech Republic, France, Greece, Netherlands, Spain, Japan, USA, Turkey and Hungary between the years of 1995 and 2011, which are the OECD countries, were used. The data used in the study are presented in Table 1.

Table 1: Descriptive Statistics

Variable	Explanation	Avg.	Sd.
Asg	Minimum Wage	6.915615	0.3835394
Isg	Labor Productivity	41.39669	1.020641

4. ECONOMETRIC METHOD AND RESULTS OF THE ANALYSIS

4.1. Panel Unit Root Tests

In order to check the stationarity of the data in econometric analyses, panel unit root tests should be conducted. The latest panel unit root tests in literature are the tests developed by Levin and Lin (LL) (1993), Im, Peseran and Shin (IPS) (2003), Maddala and Wu (MW) (1999) and Hadri (2000). The equation number 1 is used in Im, Peseran and Shin (IPS) test.

$$\Delta y_{it} = \rho_i^{*} y_{i,t-1} + \sum_{i=1}^{\rho_i} \theta_{iL} \Delta y_{i,t-L} + z_{it}^{'} \gamma + u_{it} \qquad (1)$$

The null hypothesis and the alternative hypothesis are $H_0 : \rho_i^{*} = (\rho_i - 1) = 0$ and $H_1 : \rho_i^{*} < 0$ (for at least one section serial), respectively. The ρ_i can alter according to each serial, in other words,

it is heterogeneous for each serial in the panel. It is expressed in the alternative hypothesis of IPS test that at least one serial is stationary. In the IPS method, the averages of ADF unit root calculated for each section serial are calculated:

$$\bar{t} = \frac{1}{N}\sum_{i=1}^{N} t_{\rho} \qquad (2)$$

Im, Peseran and Shin (1995, 1997) demonstrated the normal distribution of test statistics. In Fisher ADF test;

$$P = -2\sum_{i=1}^{n} \ln p_i \qquad (3)$$

The statistic above had 2N degree of freedom and had χ^2 distribution. The ρ_i represented the ρ value obtained from the unit root test conducted for each section serial.

Table 2 The Results of Unit Root Test

H_0: There is unit root in each serial in the panel.				
IPS	**Level**		**First Difference**	
Variables	T statistics I(0)	Significance (p) I(0)	T statistics I(1)	Significance (p)I(1)
Lasg	-0.6204	0.9999	-2.2111	0.0034
Lisg	-1.2568	0.8123	-3.0072	0.0000
Fisher ADF	**Level**		**First Difference**	
Lasg	12.9061	0.9676	39.3669	0.0250
Lisg	28.5145	0.2389	92.8523	0.0000

According to IPS and Fischer ADF unit root test results, it is seen that the minimum wage and labor productivity are not stationary and both variables become stationary in the first difference in the table.

4.2. Panel Data Analysis

One of the advantages of the panel data system is that it provides a possibility to get rid of data constraints as well as working with multiple variables (Gujarati, 2003: 638). Balanced panel data set analysis is conducted in the study. A panel regression model with m variable is simply expressed as;

$$Y_{it}=\beta_{1it} + \beta_{2it} + \ldots\ldots\ldots B_{mit+} X_{mit} + \varepsilon_{it} \qquad (4)$$

and i=1,2,...,G represents the section unit and t=1,2,...,n represents the time period. Moreover, the average of non-probability error term ε is assumed to be zero and with constant variance. Therefore, the followings are valid; $E[\varepsilon_{it}]=0$ and $Var[\varepsilon_{it}]=\sigma_{\varepsilon}^2$. The slope coefficients from β_{1it} to β_{mit} are the unknown reaction coefficients. Moreover, a variety of assumptions about the constant term of the model, slope coefficients and error term are made during the estimation of the model (Özer, Biçerli, 2003-2004: 71). Two main approaches can be used in regressions conducted by panel data. These are Fixed Effects Model (FEM) and Random Effects Model (REM).

4.2.1. Fixed Effects Model

In FEM, the differences in the behaviors of the units are tried to be revealed by the differences in the constant term. However, the slope coefficients are assumed to be constant. It is accepted that the

individual effects, which can't be observed in FEM, are related to the exploratory variables in the model (Greene, 2003: 285). For this reason, the differences between the units are modelled as parametric change in regression function (Gujarati, 2003:640-646).

$$Y_{it} = \bar{\beta} + \sigma_i + \beta_{2it} + X_{2it} + \ldots\ldots\ldots B_{mit+} X_{mit} + \varepsilon_{it} \qquad (5)$$

In the equation number (1), i=1,2,...,G and t=1,2,...,n represents the constant term pertaining to the unit $\beta_1 i = \beta_1 i + \alpha ii$; $\bar{\beta}$ represents the average constant term. αi represents the average difference from the constant term for the unit i. The method that would be used in the estimation of the equation number (1) depends on whether the αi is fixed or random.

4.2.2. Random Effects Model

The constant term in the equation number (2) will be a random variable with non-constant β_{1i} and average β. In this case, the constant term value for each unit is as $\beta_{1i} = \beta + \mu i$. Here, μi is the random error term with zero average and constant variance.

$$yit = \beta + \beta_{2it} X_{2it} + ... + \beta_{kit} X_{kit} + \varepsilon_{it} + \mu_i \qquad \text{or}$$

$$y_{it} = \beta + \beta_{2it} X2it + ... + \beta_{mit} X_{mit} + ui \qquad (6)$$

(ui) is a combined error term and the components are individual error terms (μi) and panel error term (εit). The first one of the basic assumptions of REM, the normal distribution of both individual and panel error terms, and the second one is that the individual error terms are related to neither each other nor panel error term (Gujarati, 2003: 650-651).

In order to determine whether the fixed effects or random effects are more consistent and effective in panel data analysis, Hausman test statistic is used depending on the Wald criteria (Değer et al. 2006). The test results used in determining fixed effects or random effects model are presented in Table 3.

Table 3: Hausman Test Results

	$chi^2(3)$	**Significance(p)**
Hausman Test	42.46	0.0000

According to Hausman Test results, the fixed effects estimator was decided to be more consistent by rejecting the h_0 hypothesis arguing that the difference between the parameters weren't systematic.

Table 4: Fixed Effects Output

Dependent variable: lasgd1 / **Independent Variable**	**Coefficient**	**Standard Error**	**T**	**P>T**
lisgd1	1.347687	0.3938862	3.42	0.001
Constant	-0.0225033	0.0116424	-1.93	0.055
sigma_u	0.07008523			
sigma_e	0.1274415			
rho	0.23220705			

F test	F(1,179) =11,71
N	192
Intragroup R^2	0.0614
Inter Groups R^2	0.53063
General R^2	0.0174
corr(u_i, Xb)	-0.2207
F test thatallu_i=0	F(11,179)=4.60

For F, t and Hausman test statistics* and ** represents %1 and %5 significance levels, respectively. Generalized by Cross-Section Weights, least squares test conducts analyses by removing multiple variances

According to the fixed effects model output results, labor productivity is significant in explaining the dependent variable. It is observed that labor productivity has a positive effect on minimum wage, the dependent variable. It is seen that the F statistics with 1,179 degree of freedom is significant, which tests the significance of independent variable on the dependent variable. Unit effect (corr u-i, xb) represents the correlation coefficient between the unit effect and other variables; Sigma_u stands for the standard error of the unit effect; Sigma_e demonstrates the standard error of the residual error; Rho represents the proportion of the variance of the unit error in the variance of the compound error.

4.3. Pedroni Cointegration Test

Pedroni (1995, 1997, 1999) developed seven tests, four of which are within-dimension statistics and three of which are between-dimension statistics, in order to test the presence of cointegration relationship in the panel series. The method of Pedroni (1995, 1997, 1999) can be presented in the equation number 7 below.

$$Y_{it} = \alpha_i + \delta_i t + \beta_{1i} X_{1it} + \beta_{2i} X_{2it} + ... + \beta_{Mi} X_{Mit} + e_{it} \qquad (7)$$

t = 1,….,T ; i = 1,…..N ; m = 1,…..,M

The abbreviations here are; T: Time dimension observation number, N: The number of units in the panel, M: The number of regression variables, α_i : The fixed effects pertaining to the units, $\delta_i t$: The special dynamic effects pertaining to the units. The seven test statistics calculated by Pedroni is as follows:

Panel v-statistics $T^2 N^{3/2} Z_{\upsilon N,T} \equiv T^2 H^{3/2} \left(\sum_{i=1}^{N} \sum_{t=1}^{T} \hat{L}_{11i}^{-2} \hat{e}_{i,t-1}^2 \right)^{-1}$ (8)

Panel p- statistics

$$T\sqrt{N} Z_{\tilde{p}N,T}^{-1} \equiv T\sqrt{N} \left(\sum_{t=1}^{N} \sum_{t=1}^{T} \hat{L}_{11i}^{-2} \hat{e}_{i,t-1}^2 \right)^{-1} \sum_{t=1}^{N} \sum_{t=1}^{T} \hat{L}_{11i}^{-2} \left(\hat{e}_{i,t-1} \Delta \hat{e}_{i,t} - \hat{\lambda}_1 \right) \qquad (9)$$

Panel t- statistics (non-parametric)

$$Z_{tN,T} \equiv \left(\hat{\sigma}_{N,T}^2 \sum_{t=1}^{N} \sum_{t=1}^{T} \hat{L}_{11i}^{-2} \hat{e}_{i,t-1}^2 \right)^{-1/2} \sum_{t=1}^{N} \sum_{t=1}^{T} \hat{L}_{11i}^{-2} \left(\hat{e}_{i,t-1} \Delta \hat{e}_{i,t} - \hat{\lambda}_1 \right) \qquad (10)$$

Panel t- statistics (parametric)

$$Z^{*}_{tN,T} \equiv \left(\hat{s}^{*2}_{N,T} \sum_{t=1}^{N} \sum_{t=1}^{T} \hat{L}^{-2}_{11i} \hat{e}^{*2}_{i,t-1} \right)^{-1/2} \sum_{t=1}^{N} \sum_{t=1}^{T} \hat{L}^{-2}_{11i} \left(\hat{e}^{*}_{i,t-1} \Delta \hat{e}^{*}_{i,t} \right) \quad (11)$$

Group p- statistics

$$TN^{-1/2} \hat{Z}_{\tilde{p}N,T-1} \equiv TN^{-1/2} \sum_{i=1}^{N} \left(\sum_{t=1}^{T} \hat{e}^{2}_{i,t-1} \right)^{-1} \sum_{t=1}^{T} \left(\hat{e}_{i,t-1} \Delta \hat{e}_{i,t} - \hat{\lambda}_{i} \right) \quad (12)$$

Group t- statistics (non-parametric)

$$N^{-1/2} \hat{Z}_{\tilde{p}N,T-1} \equiv N^{-1/2} \sum_{i=1}^{N} \left(\hat{\sigma}^{2}_{i} \sum_{t=1}^{T} \hat{e}^{2}_{i,t-1} \right)^{-1/2} \sum_{t=1}^{T} \left(\hat{e}_{i,t-1} \Delta \hat{e}_{i,t} - \hat{\lambda}_{i} \right) \quad (13)$$

Group t- statistics (parametric)

$$N^{-1/2} \hat{Z}^{*}_{tN,T} \equiv N^{-1/2} \sum_{i=1}^{N} \left(\hat{\sigma}^{2}_{i} \sum_{t=1}^{T} s^{*2}_{i} \hat{e}^{*2}_{i,t-1} \right)^{-1/2} \sum_{t=1}^{T} \left(\hat{e}^{*}_{i,t-1} \Delta \hat{e}_{i,t} \right) \quad (14)$$

$$\hat{e}_{i,t} = \rho_{i} \hat{e}_{i,t-1} + v_{it} \quad (15)$$

The four within-dimension statistics are obtained by gathering the auto regression coefficients (ρ_i) for different sections in the panel; the three between-dimension statistics depends on the averages of the auto regression coefficients for each section.

Table 5: Pedroni Cointegration Test Results

	Test Statistics	**Probability Value**
Panel v- statistics	-2.049194	0.9798
Panel rho- statistics	-0.910639	0.1812
Panel PP- statistics	-2.174656*	0.0148
Panel ADF- statistics	-2.561386**	0.0052
Grouprho- statistics	0.297278	0.6169
Group PP- statistics	-2.380327**	0.0086
Group ADF- statistics	-4.990247**	0.0000

** %1 significance level, *%5 significance level.

According to Pedroni test results related to the series of minimum wage and labor productivity, H0 hypothesis (there is no cointegration between the series) was rejected. There of the panel statistics are significant at 1% level and one is at 5% level in the test results.

5.CONCLUSION

Employment and wages are fundamental issues in macroeconomics. The increase in wage and minimum wage, which is the equivalent of the unskilled labor, leads an increase in social welfare. The increase in minimum wage can raise the social welfare by increasing the labor productivity, or an increase in labor productivity can lead an increase in minimum wage. Within this context, this study, including the data of 16 OECD countries between 1995 and 2011, investigated the relationship between minimum wage and labor productivity. The estimations were made by panel data analysis

using the data of minimum wage and labor productivity of the years between 1995 and 2011. As a result of the analyses, it was determined that the changes in minimum wage had statistically significant effects on labor productivity.

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