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Minimum Wage and Employment: A Dynamic Heterogeneous Approach for OECD Countries

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Abstract. The effect of minimum wage on employment is one of the most important matters discussed in economics literature however; the theoretical approaches put forward regarding the impact of minimum wage on employment indicate different outcomes. In this regard, the purpose of this paper is to empirically investigate the effect of minimum wage legislation on employment by employing data for OECD countries over the period 1997-2017 and to contribute to this literature where consensus has not yet been achieved on the subject. In order to conduct this investigation, the Augmented Mean Group Estimator has been used. According to empirical results, minimum wage legislation increases the employment in the long run for the OECD countries. On the other hand, these results show that a one percent increase in minimum wage leads to an increase of 0.17% in employment rate. Although country-specific coefficients vary between countries because of the institutional and structural characteristics of countries, they are mostly positive. These findings support the modern liberal approach, which suggests that the impact of minimum wage on employment is negligible or positive.

Keywords: Minimum wage, Employment, Heterogeneous panel data.

JEL Codes: D63, E24, J08, J38

Introduction

The effect of minimum wage on employment is one of the most important themes discussed in the economics literature however; it is difficult to say that there is a general consensus on this issue. For this reason, it is crucial to determine the impact of minimum wage on basic economic parameters, as well as the social benefits

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of minimum wage in today's society where income distribution is gradually deteriorating and the effects of the 2008 global crisis on production and employment are still felt.

The theoretical approaches put forward regarding the impact of minimum wage on employment indicate different outcomes. The competitive market model or simple supply-demand model, suggests that determining a minimum wage above the market wage level in a competitive labour market where workers are homogenous reduces employment (Brown, Gilroy & Kohen, 1982; Flinn, 2010). In competitive labour markets, it is accepted that the wage is set equal to the value of the marginal product (VMP) of the labour force (Stigler, 1946). However, the minimum wage that is a social welfare policy with the primary aim of combating poverty is a labour market regulation in terms of its design and operation (Waltman, 2008). Additionally, this regulation forces the employer into a new arrangement in terms of cost minimization. The employer decreases low-paid employment and this employment is replaced by skilled labor and machinery that are not affected by the minimum wage. Therefore, minimum wage legislation decreases employment according to this model (Card & Krueger, 1995).

Stigler (1946) is one of the first researchers to analyze the impact of minimum wage legislation on employment. He states that if a minimum wage is effective, workers whose marginal product value is below the minimum wage are laid off. These workers force into unregulated markets where they receive lesser wage. Hence, the higher the minimum wage, the higher the number of individuals who are unemployed. Neumark & Wascher (1992), Deere, Murphy & Welch (1995), Neumark & Wascher (2007), Burkhauser, Couch and Wittenburg (2000) are the studies that reach this conclusion that supports the competitive market model.

A group of economists who can be included in *modern liberal perspective*[1] (Clark, 1998) such as Card and Krueger (1995), Card (1992b), Katz and Krueger (1992) are opposed to the view of a competitive market economy. They argue that raising the minimum wage provides employers with incentives to increase labour productivity by improving the skills of the workforce. Moreover, a higher minimum wage would increase employment by increasing both employee satisfaction and efforts

1 Modern Liberals were representatives of an approach that sought to promote social justice by advocating both private property and democracy, and dominates much of the twentieth century (Clark, 1998).

(Clark, 1998). The advocates of this view argue that the neo-classical perspective is based largely on an abstract theoretical logic and does not depend on systematic empirical studies. According to modern liberals there is no evidence proving that a higher minimum wage significantly decreases employment (Card & Krueger, 1995, p. 393).

Card and Krueger (1995, pp. 12-13) relate the positive impact of minimum wage on employment to the labour market model. According to this perspective, labour market model is a monopsony. In the monopsony model, the firms operate with ongoing vacancies. In the case of employing new workers, the dilemmas that firms face due to different wage-setting conditions create a permanent uncertainty over wages. According to Card and Krueger (1995, pp. 12-13), an increase in the minimum wage in the case of the monopsony can reverse the negative employment effect predicted by the traditional theory. A small increase in minimum wage leads to an increase in employment. This is because with new regulation, low-wage firms are forced to behave as high-wage firms that have few vacant positions and experience low labour turnover rates and these firms then choose to fill their vacancies quickly. However, necessary condition is to determine a minimum wage between the actual wage and the wage that equates the marginal cost of the workforce to the marginal product revenue (Brown, Gilroy & Kohen, 1982).

Keynesian perspectives, which are included in the modern liberal approach, also oppose the competitive market model. It is argued that minimum wage should not be considered only by the supply side while evaluating the employment effect and the demand side should also be taken into account. According to the pioneers of this view, real wage changes can affect the output and labour markets by influencing effective demand (Apergis & Theodosio, 2008; Bender & Theodossiou, 1999).

It is possible to discuss the issue with the demand side as opposed to the view that firms reduce number of workers in the case of wage increase. According to Keynes, unemployment is likely to occur due to the increase in real wages and the decrease in profitability, particularly due to the fall in demand during periods of recession. During these periods, firms reduce their prices, lay off workers and reduce their production. On the contrary, increases in demand lead to increased profitability. By increasing production and productivity, firms can compensate for wage increases (Bender & Theodossiou, 1999, pp. 622–623). Therefore, it is not possible to say that minimum wage definitely leads to unemployment.

A group of economists, called "*Social Economics Revisionists*", argue against the competitive market model too. According to the pioneers of this view like Lloyd

Reynolds, Oark Kerr, John Dunlop, and Richard A. Lester, the minimum wage legislation has the potential to increase employment in some instances as well as decrease it in others. They claim that a number of non-economic factors, such as fairness and ability to pay, can affect employment and wage setting. With a high minimum wage, worker turnover rate could decrease or productivity of workers could improve. Adopting better management and production practices with a high minimum wage could also increase employment (Card & Krueger, 1995, p. 9)

On the other hand, the "shock effect" approach suggests that firms can react to increasing wages by increasing productivity and hence employment may not decrease (Brown, Gilroy, & Kohen, 1982, p. 489). It is claimed that the effect of minimum wage on employment is not linear. In other words, a high minimum wage may have a positive impact on the supply side while a negative impact on the demand side, and these two effects balance each other. Consequently, minimum wage increase has a positive effect on employment up to a certain level, and if it reaches higher levels, it is suggested that the negative effect may be outweighed by its positive counter effect (Christl, Koppl & Kucsera 2018, p. 426).

The effect of the minimum wage regained importance with occurrence of the academic meeting titled "New Minimum Wage Research Conference" in 1991. Several studies on the relationship between minimum wage and employment were presented during this conference and many others on the same subject were conducted afterwards.[2]

In the studies on minimum wage and employment, two methodological tendencies are prominent. These are case studies analyzing sectoral or specific region data, and panel data analyses that include many regions as well as time dimension in their models (Neumark & Wascher, 2007, p. 11). Case studies address a specific state or a sector in the state, such as the fast food sector, and examine the impact of minimum wage on employment. For example, Katz and Krueger (1992) analyzed the effects of minimum wage increases in Texas in the fast food sector in 1991, while Card (1992b) investigated the labour market outcomes of the minimum wage increase in the state of California in 1988. Panel data studies assess the impact of minimum wage increases in multiple sectors, regions and countries instead of focusing on a single sector or region (Neumark & Wascher, 2007, p. 11).

2 About these studies, Neumark & Wascher (2007) presented a wide literature discussion and summarized the studies in that period.

Moreover, debates about minimum wage have been focusing on a single market or a certain part of the population. Most studies are specific to United States and investigate the effects of the minimum wage in food sector or its consequences for the youth unemployment. In studies analyzed with the panel data method, the effects of minimum wage legislations in the different states of the USA are also evaluated. On the other hand, case studies for different countries are discussed in the few time series analyses. Šauer, (2018) drew attention to this issue in his recent article and questioned the relationship between macroeconomic variables and minimum wage. According to Šauer, the generalization of the relationship in a single market brings out misleading results (Šauer, 2018, p. 89).

The effects of wage should be discussed in the field of Islamic economics. The studies conducted in this area generally deal with the issue within the framework of the perspective of justice or the issue of income distribution and poverty. It is possible to mention two views in Islamic Economics about the minimum wage legislation. Chapra (1979, p. 15), based on the Quran and hadiths about the protection of the rights of the worker, advocates that "fixation of minimum wages and maximum working hours, creation of appropriate working conditions, enforcement of precautionary measures against industrial hazards, and adoption of technological innovations to reduce hardships would be fully in conformity with the spirit of Islamic teachings". Another approach is the view that wages should be determined in the market within the framework of justice. According to the Iqbal (2018, p. 115), "wage is an 'input price', like any other input price. The same rules mentioned above, (i.e., non-government intervention) apply to wage determination, unless there is a case of unfair play or exploitation. If an employer pays a worker wage equal to his market determined marginal revenue product, he has done justice." Azid (2017) states that Islamic economics is directed towards normative studies on wages and quantitative studies should be increased in this area. An examination of the effect of wage on macroeconomic variables would allow for more comprehensive theoretical discussions on Islamic economic thinking about labor-wage discussions and this paper is important in this respect.

This paper analyzes the impact of minimum wage legislation on employment in OECD countries by considering these constraints. The main purpose is to investigate whether there is a statistically significant relationship between minimum wage and employment in the long run. In the empirical analysis, the Augmented Mean Group (AMG) estimator, presented by Eberhardt & Bond (2009) and developed by Eberhardt & Teal (2010, 2011), is used. The most important characteristic of this estimator is that it allows for heterogeneity of slope parameters. In other words, it is possible to get long-run coefficients that differ across groups (or countries). This estimator is robust to cross-sectional dependence. Moreover, it is an efficient estimator in case of non-stationarity.

In section two of the paper, a brief summary of the empirical literature examining the employment effect of minimum wage is presented. In section three, the data set and empirical strategy used in the study are introduced and then the estimation results are evaluated. In the last section, a concluding summary is given.

Empirical Literature

In the empirical literature there is no consensus as is in theoretical literature on the impact of the minimum wage on employment and various studies obtain different results. Some conclude that minimum wage has a negative impact on employment as asserted by neo-classical perspective while others point out the positive employment effect of minimum wage as claimed by the modern liberal approach.

Neumark and Wascher (1992) examine the effect of minimum wage on employment in the USA over the period 1973-1989 using panel data analysis and find that a 10% increase in minimum wage causes a decrease of 1-2% in the employment of the teens and a decrease of 1.5-2% in employment of young adults. Mincer (1976) finds that the effect of minimum wage on labor force participation and employment is negative, and between 0.15% and 0.37 % depending on ethnicity and age group in his analysis using the USA's quarterly data over the period 1954-1969. Brown, Gilroy and Kohen (1982) analyze the effect of minimum wage on employment in USA and find that a 10% increase in minimum wage reduces the youth employment by 1-3% in all sub-groups changing according to age, gender and ethnicity in their analysis. With revised data in 1983, their empirical results show that this negative effect was limited to 1%.

In the analysis of the developing countries, the effects of minimum wage on macroeconomic parameters differ according to gender, region and age. Neumark et al. (2006) suggest that the change in minimum wage affects only the lower income group in the analysis of six metropolitan areas in Brazil over the period 1996-2001. They state that the increase in minimum wage affects employment negatively and also conclude that this increase does not compress the income distribution in Brazil. Lemos (2004) finds that minimum wage has a slight negative impact on unemployment and according to empirical results, a 10% increase in the minimum wage declines the total working time by 0.16% and the total number of jobs by 0.14% in Brazil according to the panel data analysis he conducted for the period 1982-2000. Carruth and Schnabel (1993) find that nominal minimum wages has an adverse effect on prices, productivity and unemployment in the West Germany over the period 1964-1989 in the long run in their empirical analysis. Montenegro and Pages (2004) show how the regulations affect the distribution of labor in Chile over the period of 1960-1998. According to the results, the job security measures and minimum wages in Chile negatively affect youth and unskilled employment. Ozdemir, Mercan and Erol (2012) use the Granger cointegration method in order to understand the impact of minimum wage, national income and inflation on the unemployment rate using the quarterly data over the period 1978-2010 for Turkey. They conclude that a 1% increase in minimum wage rate increased the unemployment rate by 0.09% and a 1% increase in the general level of price increases the unemployment by 0.03%, while a 1% increase in the national income decreases the unemployment rate by 0.06%. Ozata and Esen (2010) find a one-way Granger causality between real wages and employment in their study of Granger cointegration and causality method using quarterly private manufacturing industry employment and wage data for the period 1998-2008. According to this analysis, real wage Granger-cause employment level and that supports the idea that an increase in real wages decreases the employment level. Askenazy (2003) used internal growth model in his analysis and finds that the minimum wage contributes positively to economic growth, but it increases unemployment. Rybczynski and Sen (2018) analyze the impact of minimum wage on employment by using data from different states of Canada over the period 1981-2011. According to this study, a 10 % increase in minimum wages leads to a 1-4% decrease in youth employment. Moreover, an increase in minimum wage is pointed out as a reason for low employment in adult migrants. Kim and Lim (2018) find a similar result in their analysis with data over the period 2000-2014 for 25 OECD countries. In this study, it is suggested that a 10% increase in the minimum wage reduces employment by 0.7%. Saltiel and Urzua (2017) analyze the employment effects of minimum real wages in Brazil considering a 60% increase in real wages over the period 2003-2012. This analysis reveals that the minimum wage has negative but limited effects on employment in the formal sector. For US restaurant sector, a recent study by Wang et. al. (2018) applies a new method and classifies the states into common groups. According to the four groups of states, they find both negative and positive effects of minimum wage legislation on employment. These results show that generalizing one state or one-sector studies have to be reconsidered.

In addition to these studies that present the negative employment effects of minimum wage, there are many empirical analyses that support the modern liberal approach. In his panel data analysis using the quarterly data for the period 1989-1990, Card (1992a) concludes that in 1990, the United States minimum wage did not reduce the youth employment. Card (1992b) finds that a dollar increase in the minimum wage increased the earnings of low wage earners by 5-10% in the state of California in 1988 and this increase did not cause any decrease in youth employment. Similarly, Card and Krueger (1994) find that employment in fast food restaurants was not affected by minimum wage increase in 1992 in New Jersey. Katz and Krueger (1992) analyze the effects of the federal minimum wage changes on the low wage labour market. They find that employment and price changes in this market that emerge as a result of minimum wage increases are not in line with the changes that neo-classical perspective suggests. To examine the relationship between minimum wage and unemployment, Pantea (2017) analyzes the data of 42 different regions of Romania for the period 2008-2014. According to the findings, the increase in Kaitz index has no negative effect on unemployment. It is pointed out that minimum wage increases would encourage workers to work in labour markets that are monopsonies. Moreover, business cycle, industrial structure and protectionist policies have been indicated as the determinants that affected the unemployment level in Romania between the years 2008 and 2014. Campos et. al. (2018) use Mexico's national survey data for the period of 2012-2013 and perform cross-section and individual panel data analyses. According to the findings, an increase in the minimum wage at one zone does not decrease employment. Secondly, aligning the minimum wages among zones results in an increase in workers' hourly wages and, in some cases, in their total wages. Lastly, they show that the minimum wage increase causes a shift from informal sector to formal sector. Apergis and Theodosiou (2008) find a panel cointegration relationship between minimum wage and employment in the long run for the period of 1950-2005 in their panel data analysis for 10 OECD countries. However, as a result of the panel causality tests, it is determined that the increase in minimum wages has no effect on employment in the short-term. According to the authors, these results coincide with the Keynesian view and the decrease in minimum wage does not increase employment. Moreover, demand side interventions to reduce unemployment are more useful to reduce unemployment. Sturn (2018) reconsider the work of Neumark and Wascher (2004) and investigates the effects of minimum wages on low skilled, female low-skilled, and youth employment for 19 OECD countries from 1997 to 2013. The empirical results show that there is no disemployment effect for low-skilled, female low-skilled, or young workers. The estimated employment elasticities are small and statistically indifferent to zero.

On the other hand, in some studies (Guven, Mollavelioglu & Dalgic, 2011) no causality is found between minimum wage and other macroeconomic indicators. Güven et al. (2011) use the Pesaran cointegration method and Toda-Yamamato causality analysis for the period of 1969-2008 and conclude that there is no cointegration relationship between employment and minimum wage and minimum wage legislations are not the reason of changes in employment. Guven et al. (2011) state that minimum wages should be above average wages for the employment-decreasing effect to occur. Because the minimum wage is below average wage, there is no statistically significant effect in Turkey.

Empirical Analysis

Data and Model

The relationship between minimum wage and employment is analyzed by using annual data for OECD countries between 1997 and 2017 in this paper. Studies that analyze the relationship between minimum wage and employment in the literature are mostly for a single country or for a particular sector in a country. However, the extent to which the empirical findings for some countries or sectors may be generalized to other countries that have different institutional structures with regards to labour markets is debatable (Sturn, 2018). In this context, the reason for the analysis of OECD countries is to make a generalized result with the help of panel data analysis and the reason for selecting the period of 1997-2017 is to include the maximum number of OECD countries based on data availability. Some OECD countries could not be included in the analysis due to lack of data for the relevant period[3]. For the minimum wage, two different variables are used and therefore the possibility of estimating an alternative model emerges. The first one is the minimum real wage. This variable is calculated by deflating the annual and hourly minimum wages with the consumer price index by taking the year 2017 as the base year and then converting the series into the common currency unit (USD) (OECD, 2018). The second one is the Kaitz index. This variable is calculated as the ratio

3 OECD countries included in the analysis are Australia, Belgium, Canada, Czech Republic, France, Greece, Hungary, Japan, Korea, Luxembourg, Mexico, Netherlands, New Zealand, Poland, Portugal, Slovakia, Spain, and USA.

of minimum wages to mean earnings of full-time employees (OECD, 2018). Both variables are commonly used in the literature (Addison, Blacburn & Cotti, 2012; Card & Krueger, 1995; Kim & Lim, 2018; Rybczynski & Sen, 2018; Pantea, 2017; Askenazy, 2003; Brown, Gilroy & Kohen, 1982; Saltiel & Urzua, 2017) and it is possible to get this data from OECD statistical database. The employment to population ratio is used for employment variable. This data is the standard dependent variable that too is frequently used in the literature. According to the purpose of the study, it is defined as the ratio of a specific group (for example adult women or immigrants who are employed) to the total population (Rybczynski & Sen, 2018). In this study, it is defined as the ratio of those employed to the total population in a given country, in a given period and this data has been obtained from the World Bank statistical database.

The estimated model to test the effect of minimum wage on employment is as follows:

$$EMP/POP_{it} = \beta_0 + \beta_1 MINWAGE_{it} + \beta_2 OUTPUTGAP_{it} + \beta_3 GOVERNMT_{it} + \varepsilon_{it} \quad (1)$$

In the equation (1), EMP/POP is employment to population ratio; MINWAGE is the real minimum wage. The output gap is used to control for business cycle fluctuations (Pantea, 2017) and the government's real consumption expenditures to real GDP is used as a measure of the size of the government (Alesina, Danninger & Rostagno, 1999). In equation (1), OUTPUTGAP represents the output gap and GOVERNMT represents the share of government's real consumption expenditures in real GDP. An alternative model using the Kaitz index instead of the real minimum wage is also estimated. This model can be expressed as follows:

$$EMP/POP_{it} = \beta_0 + \beta_1 KAITZ_{it} + \beta_2 OUTPUTGAP_{it} + \beta_3 GOVERNMT_{it} + \varepsilon_{it} \quad (2)$$

In equation (2), KAITZ is the Kaitz index, which is the ratio of minimum wages to mean earnings of full-time employees.

Table 1. Summary Statistics

Variables	Data Sources	Obs.	Mean	Std. Dev.	Minimum	Maximum
EMP/POP	WDI	378	54.7739	6.08348	38.6880	65.8340
MINWAGE	OECD Stat.	378	12897.8	7686.21	987.011	27252.5
KAITZ	OECD Stat.	378	0.37410	0.07621	0.19833	0.54107
OUTPUTGAP	OECD Stat.	378	-0.83982	3.20249	-15.6754	9.80122
GOVERNMT	WDI	378	18.6648	3.36262	8.26160	26.4812

The descriptive statistics of the data set used in the analysis are presented in Table 1. The average of EMP/POP ratio of 18 OECD countries in the analysis is 54.77% over the period 1997-2017. The average minimum wage over the period 1997-2017 is 12,897 USA dollars. Among the countries included in the analysis, the countries with the highest average real minimum wage were Australia (USD 25,484), Luxembourg (USD 24,761) and the Netherlands (USD 22,283). The average of the Kaitz index for the respective country group is 0.37. Among the 18 OECD countries included in the analysis, the countries with the highest average value of this ratio in this period were France (0.50), New Zealand (0.48) and Australia (0.47).

Methodology

Minimum wage and employment relationship is analysed in three steps in this study. In the first step, the stationarity of variables is checked using the panel unit root tests. In the second step, if the variables are found to be non-stationarity at level according to the results of the panel unit root tests, the existence of a long-run relationship between the variables will be investigated with panel cointegration tests in order to avoid the problem of spurious regression. In the last step, if a long-run relationship is found between the variables, the panel error correction model could be estimated.

Panel Unit Root Tests

In the panel unit root tests, the first generation tests assume no correlation between the cross-section units. Therefore, it is accepted that first generation tests do not give reliable results in the case of cross-sectional dependence. In this study, a unit root test proposed by Pesaran (2007) is used which considers the cross-sectional dependence.

The unit root test developed by Pesaran (2007) is one of the second-generation tests frequently used in the literature. Pesaran (2007, p. 265) develops a method "*where the standard ADF regressions are augmented with the cross-section averages of lagged levels and first differences of the individual series*". This test is called the cross-sectionally Augmented Dickey-Fuller test (CADF). The simple average of CADF statistics is a cross-sectionally augmented IPS (CIPS) test (Pesaran, 2007, p. 267).

If the residuals are not serially correlated, the cross-sectionally augmented DF (CADF) regression that is used for country *i* is as follows:

$$\Delta y_{it} = a_i + b_i y_{i,t-1} + c_i \bar{y}_{t-1} + d_i \Delta \bar{y}_t + e_{it} \tag{3}$$

In this equation, $\bar{y}_{t-1} = \left(1/N\right)\sum_{i=1}^{N} y_{i,t-1}$ and $\Delta\bar{y}_t = \left(1/N\right)\sum_{i=1}^{N} \Delta y_{i,t}$ (Hurlin & Mignon, 2007, p.19). In order to test the unit root hypothesis, t-ratio obtained from OLS estimate of $b_i(\hat{b}_i)$ in the cross-sectionally CADF regression (3) is used (Pesaran, 2007, p. 269) and from the regression, t ratio $t_i(N,T)$ is as follows:

$$t_i(N,T) = \frac{\Delta y_i' \bar{M}_w y_{i,-1}}{\hat{\sigma}_i (y_{i,-1}' \bar{M}_w y_{i,-1})^{1/2}} \tag{4}$$

where $\Delta y_i = (\Delta y_{i1}, \Delta y_{i2}, ..., \Delta y_{iT})', y_{i,-1} = (y_{i0}, y_{i1}, ..., y_{i,T-1})'$, $\overline{M}_w = I_T - \overline{W}(\overline{W}'\overline{W})^{-1}\overline{W}', \overline{W} = (\tau, \Delta\bar{y}, \bar{y}_{-1})$, and $\hat{\sigma}_i^2 = \frac{\Delta y_i' M_{i,w} \Delta y_i}{T-4}$ (Pesaran, 2007, p. 270).

Pesaran (2007, p. 276) CADF test is based on the cross-sectionally augmented individual ADF statistics, denoted CADF. The average of individual CADF statistic is CIPS statistics and it is a modified version of IPS test (Im et al., 2003). CIPS statistic is as follows:

$$CIPS(N,T) = t - bar = N^{-1}\sum_{i=1}^{N} t_i(N,T) \tag{5}$$

Pesaran (2007) presents critical values of individual cross-sectionally augmented DF distribution and critical values of average of individual cross-sectionally augmented DF distribution. The CADF and/or CIPS statistics are compared with these critical values. If absolute value of CADF and / or CIPS statistic is larger than absolute value of the critical value, the unit root hypothesis is rejected. In this case, the series is accepted to be stationary.

Panel Cointegration Test

If there is a correlation between the cross-section units, this situation affects the selection of cointegration tests. First generation cointegration tests are considered to be unreliable if there is cross-sectional dependence. Therefore, second generation cointegration tests should be preferred if there is a correlation between the cross-section units.

The Durbin-Hausman test developed by Westerlund (2008) is one of the second-generation tests that allows cross-section dependence and heterogeneity of the slope. To apply this test, the dependent variable must be stationary in first difference which is I(1). However, the independent variable or variables could be I (0) or I(1).

Westerlund (2008) presents two different tests. These are the panel statistic; denoted and the group mean statistic, denoted . Panel statistic is obtained as follows:

$$DH_p = \hat{S}_N(\tilde{\phi} - \hat{\phi})^2 \sum_{i=1}^{N} \sum_{t=2}^{T} \hat{e}_{it-1}^2 \quad (6)$$

The statistic seen in equation (6) assumes that there is a common value for the autoregressive parameter both under the null hypothesis and alternative hypothesis. In this context, hypotheses tests can be formulated as follows:

$$DH_g = \sum_{i=1}^{N} \hat{S}_i(\tilde{\phi}_i - \hat{\phi}_i)^2 \sum_{t=2}^{T} \hat{e}_{it-1}^2$$

$H_0: \phi_i = 1\ (for\ all\ i)$ and $H_1^P: \phi_i = \phi\ ve\ \phi < 1\ (for\ all\ i)$. (7)

The group average statistic in equation (7) does not assume a common value for the autoregressive parameter as opposed to panel statistic, and thus the rejection of the null hypothesis does not mean that entire panel is cointegrated. Hypotheses tests are formulated as,

H_0:ϕ_i=1 (*for all i*) and H_1:ϕ_i<1 (*at least for some i*).

Estimation of Panel Cointegration Coefficients

If there is cointegration relationship between variables, the next step is the estimation of long-run coefficients for these variables. Some considerations are important in choosing the estimator to be used for this estimation. Firstly, as the time dimension (T) gets larger, the probability of the slope coefficient being different for the cross section units increases. The choice of conventional methods (such as fixed effects, random effects) means that the slope parameters are same for all cross section units because these estimators only allow differing the intercepts and all other coefficients and error variances are same across groups (Pesaran et al., 1999, p. 621). The problem of being non-stationary is also possible with large T. The second important issue is the cross-sectional dependence. If there is a correlation between the cross-section units, the preferred estimator should be robust to cross-sectional dependence.

Although the first generation estimators such as the mean group estimator (MG) (Pesaran & Smith, 1995; Pesaran et al., 1997) and the pooled mean group estimator (PMG) (Pesaran et al., 1997) allow for heterogeneity of slope parameters in the panel time series analysis, they are not robust to cross-sectional dependence. The Augmented Mean Group estimator (AMG), (Eberhardt & Bond, 2009; Eberhardt & Teal, 2010) that is one of the second-generation estimators eliminates these constraints. Eberhardt & Bond (2009) suggest that heterogeneity, non-stationarity variables, and cross-sectional dependence cause serious bias in standard panel estimators and that various diagnostic tests confirm this claim. Therefore, they recommend the AMG estimator, a two-step method. The model proposed by Eberhardt & Bond (2009) is as follows:

$$y_{it} = \beta_i^{'} x_{it} + u_{it} \qquad u_{it} = \alpha_i + \lambda_i^{'} f_t + \varepsilon_{it} \tag{8}$$

$$x_{mit} = \pi_{mi} + \delta_{mi}^{'} g_{mt} + \rho_{1mi} f_{1mt} + \ldots + \rho_{nmi} f_{nmt} + v_{mit} \tag{9}$$

$$m = 1,\ldots,k \text{ and } f_{mt} \subset f_t$$

$$f_t = \varphi^{'} f_{t-1} + \varepsilon_t \text{ and } g_t = \kappa^{'} g_{t-1} + \varepsilon_t \tag{10}$$

i=1,...,N and *t=1,...T*, x_{it} is a vector of the observable variable. β_i' is country-specific slope parameter on observed regressor. u_{it} includes unobserved factors and ε_{it} are error terms. α_i is the combination of group-specific fixed effects, f_t is a set of common factors and λ_i are factor loads specific to the cross-section units. λ_i, δ_i and ρ_i are the country-specific factor loads. In equation (10), f_t and g_t are common factors that cannot be observed and they affect all cross-sections. In this equation, an empirical representation of the k observable regressors is provided, which are modelled as linear functions of these common factors.

The estimation using AMG estimator takes place in two steps (Eberhardt & Bond, 2009). The first step can be shown as follows:

$$\Delta y_{it} = b^{'} \Delta x_{it} + \sum_{t=2}^{T} c_t \Delta D_t + e_{it}$$
$$\Rightarrow \hat{c}_t \equiv \hat{\mu}_t^{\bullet} \tag{11}$$

In the first stage shown in equation (11), the model is estimated by using the first differences of the variables. The reason is that the non-stationary variables and unobservable factors are assumed to bias the estimates in the regression model. Thus, the year dummy coefficients indicated by $\hat{\mu}_t^{\bullet}$ are obtained.

In the second step, the estimated model is as follows:

$$y_{it} = \alpha_i + b_i' x_{it} + c_i t + d_i \hat{\mu}_t^{\bullet} + e_{it}$$
$$\hat{b}_{AMG} = N^{-1} \sum_i \hat{b}_i \tag{12}$$

In the second step shown in equation (12), $\hat{\mu}_t^{\bullet}$ is included in the regression of each cross-section unit. A linear trend term is also included in the regression. AMG estimates are derived as the average of individual country estimates.

Analysis Results

Panel Unit Root Tests and Cointegration Test Results

In the first step of the empirical analysis, the stationarity of the variables is tested. At this step, cross-sectional dependence is important in the selection of unit root tests. In each variable used in the analysis, the cross-sectional dependence is analyzed by Breusch and Pagan (2004) LM test, Pesaran (2004) scaled LM test, Baltagi et al. (2012) bias-corrected scaled LM test and Pesaran (2004) CD test. The results of these tests are shown in Appendix Table A2. In these tests, the null hypothesis is "there is no cross-section dependence" and the alternative hypothesis is "there is cross-section dependence". According to the test results, H_0 hypothesis is rejected at 1% significance level and it is concluded that there is a correlation between the cross-section units for each variable. However, for the Kaitz index, the failure to reject the H_0 hypothesis in the Pesaran CD test is an exception. On the other hand, it is concluded that there is a correlation between the cross-section units for this variable by the other three tests. Therefore, it is assumed that there is cross-sectional dependence between cross-section units for all variables used in the analysis. The Appendix Table A3 also shows the homogeneity test results obtained by Pesaran and Yamagata (2008) test. This test investigates whether the slope parameters are homogeneous or heterogeneous with respect to the cross-section units. According to the test results in Table A3, the null hypothesis is rejected and it is concluded that the slope parameters differ according to the cross-section units.

It is accepted that first generation panel unit root test results could be biased if there is correlation between cross-section units. Therefore, in this study, the unit root test proposed by Pesaran (2007), which is one of the second-generation unit root tests is used and the results of this test are presented in Table 2.

Table 2. Panel Unit Root Test Results		
Variables/Tests	Level	First Difference
	Test Stat.	Test Stat.
EMP/POP	-1.800	-3.218***
MINWAGE	-1.642	-3.641***
KAITZ	-1.877	-3.466***
OUTPUTGAP	-1.976	-3.539***
GOVERNMT	-1.644	-3.778***

Note: The superscripts ***, **and * denote the statistical significance at 1%, 5% and 10% levels, respectively. The critical values for the model with intercept from Pesaran are -2.40 (1%), -2.21 (5%), -2.10 (10%).

Table 2 shows the CIPS test results, which only allow a constant. Critical values of t-bar statistics are presented below the table. Since, for each variable the absolute value of CIPS test statistic is smaller than the absolute value of critical values in the level data, the null hypothesis that states presence of unit root cannot be rejected. Therefore, the series are not stationary at level. According to the panel unit root test results of the first differences of the same series, it is seen that all series are stationary at 1% significance level.

Since the series used in the analysis are found to be non-stationary at level, the next step is to test the existence of a long-run relationship between these variables. Since there is also a cross-sectional dependency in the estimated models (Appendix Table A2), the long-run relationships between the variables included in the models (1) and (2) are tested in this study by the Durbin-H cointegration test developed by Westerlund (2008). The cointegration test results are presented in Table 3.

Table 3. Panel Cointegration Test Results		
Test Statistics	**Test Stat. (Model 1)**	**Test Stat. (Model 2)**
Durbin-H Group Statistics	-1.753 (0.040)**	-2.225(0.013)**
Durbin-H Panel Statistics	-2.005 (0.022)**	-1.939 (0.026)**

Note: The superscripts ***, **and * denote the statistical significance at 1%, 5% and 10% levels, respectively while p-values are in parentheses.

The Durbin-H test, which is robust to cross-sectional dependence and parameter heterogeneity, can be applied even if the independent variables are stationary at different levels. Westerlund (2008) provides two different statistics: the group mean statistic (DH_g) and the panel statistic (DH_p). Both group mean statistic and panel statistic allow the rejection of the null hypothesis. Each test for both model 1 and model 2 rejects the H_0 hypothesis at 5% significance level. Consequently, there is a long-run relationship between variables in both models.

The Error Correction Model Results

To test the effect of minimum wage on employment, the error correction model based on the augmented mean group estimator (AMG) developed by Eberhardt & Bond (2009) and Eberhardt & Teal (2010) is used in this study and the results are presented in Table 4. The minimum wage is measured using the minimum real wage in Model 1 and the Kaitz index in Model 2. A positive and statistically significant relationship is found between the minimum real wage and employment (at 1% significance level) in the Model 1. According to the results of the first model, a 1% increase in minimum wage leads to an increase of 0.17% in employment rate. Similarly, the Model 2 results show that there is a positive and statistically significant relationship between Kaitz index and employment (10 % significance level). For the second model, it is concluded that a 1% increase in the Kaitz index would provide a 0.07 % increase in employment. These results are consistent with the claims and the empirical evidence from the modern liberal approach (Card & Krueger, 1995; Katz & Krueger, 1992; Card, 1992).

Table 4. The Results of Augmented Mean Group (AMG) Estimator

Variables/Tests	Model 1 (Dependent Variable: EMP/POP)	Model 2 (Dependent Variable: EMP/POP)
	Coefficients	Coefficients
MINWAGE	0.1706281 (0.007)***	
KAITZ		0.0781493 (0.059)*
OUTPUTGAP	0.0040941 (0.000)***	0.0042621 (0.000)***
GOVERNMT	0.0145136 (0.895)	0.0864997 (0.330)
_CONS	0.9812216 (0.000)***	1.6523920 (0.000)***

Note: The superscripts ***, **and * denote the statistical significance at 1%, 5% and 10% levels, respectively. p-values are in parentheses.

Results of both the models show that the positive difference between the potential GDP and the current GDP increases employment and the negative difference decreases employment. In other words, the relationship between output gap and employment is positive and statistically significant at 99% confidence level. The relationship between the size of the government and employment is not statistically significant. Similar results are obtained from the second model too.

Table 5. Country Specific Coefficients with AMG Estimator (Model 1)

	MINWAGE	OUTPUTGAP	GOVERNMT
Australia	0.44486 (0.000)***	0.00145 (0.531)	-0.55753 (0.028)**
Belgium	-0.01656 (0.914)	0.00670 (0.000)***	0.41215 (0.000)***
Canada	-0.00849 (0.869)	0.00538 (0.001)***	0.42404 (0.018)**
Czech Rep.	-0.03876 (0.001)***	0.00088 (0.261)	-0.18653 (0.071)*
France	-0.07309 (0.329)	0.00901 (0.000)***	1.12340 (0.001)***
Greece	0.55347 (0.000)***	0.00206 (0.000)***	-0.48967 (0.000)***
Hungary	0.09855 (0.000)***	0.00198 (0.061)*	-0.56419 (0.009)***
Japan	0.22633 (0.001)***	-0.00073 (0.204)	-0.53413 (0.000)***
Korea	0.10723 (0.006)***	0.00142 (0.006)***	-0.27897 (0.003)***
Luxemburg	0.38995 (0.000)***	-0.00037 (0.727)	0.00278 (0.987)
Mexico	-0.09464 (0.070)*	0.00165 (0.000)***	-0.03257 (0.006)***
Netherland	0.93835 (0.004)***	0.00483 (0.000)***	0.02544 (0.745)
New Zealand	0.09931 (0.000)***	0.00479 (0.000)***	0.13707 (0.088)*
Poland	0.07815 (0.000)***	0.00801 (0.000)***	-0.41178 (0.154)
Portugal	-0.08533 (0.027)**	0.00571 (0.000)***	0.22072 (0.000)***
Slovak	0.08206 (0.000)***	0.00471 (0.000)***	0.31320 (0.000)***
Spain	0.07723 (0.630)	0.00730 (0.000)***	0.71081 (0.008)***
USA	0.29267 (0.011)***	0.00931 (0.000)***	-0.05300 (0.599)

Note: The superscripts ***, **and * denote the statistical significance at 1%, 5% and 10% levels, respectively. p-values are in parentheses.

The econometric method used in estimation of error correction model gives the opportunity to see the relationship between the minimum wage and employment at country level. In other words, this estimator makes possible to obtain a unique slope coefficient for each country. The results for both models are shown in Table

5 and Table 6. As the real minimum wage is taken as a dependent variable in the Model 1, in most of the countries in the analysis (Australia, Greece, Hungary, Japan, Korea, Luxemburg, Netherland, New Zealand, Poland, Slovakia, USA), there is a significant and positive relationship between the minimum real wage and employment, however in only three countries (Portugal, Mexico and Czech Republic) a negative relationship is found. On the other hand, there is no statistically significant relationship between real minimum wage and employment in four countries (France, Spain, Canada, and Belgium). In Model 2, minimum wage has been measured by the Kaitz index. Although the results differ, the relationship between minimum wage and employment is positive and significant in most of the countries (Belgium, Greece, Hungary, Japan, New Zealand, Poland, Slovakia, and USA). On the contrary, in Australia, Canada, Czech Republic and Mexico; minimum wage legislation reduces employment, while in France, Korea, Luxemburg, Netherland, Portugal and Spain; there is no significant relationship between minimum wage and employment.

For countries where minimum wage has a negative impact on employment, the Kaitz index is lower than its value for other OECD countries (with the exception of Australia)[4]. Considering that the Kaitz index is calculated as the ratio of minimum wages to the average wages, the low index indicates that minimum wage is lower than the average or market wages and makes it difficult to explain the negative effect of minimum wage on employment.

Table 6. Country Specific Coefficients with AMG Estimator (Model 2)

	KAITZ	OUTPUTGAP	GOVERNMT
Australia	-0.26220 (0.000)***	0.00433 (0.009)***	-0.12832 (0.428)
Belgium	0.13985 (0.079)*	0.00759 (0.000)***	0.49249 (0.000)***
Canada	-0.17460 (0.063)*	0.00342 (0.043)**	0.30847 (0.053)*
Czech Rep.	-0.07096 (0.000)***	0.00102 (0.181)	-0.11486 (0.255)
France	0.25237 (0.155)	0.00693 (0.001)***	0.75753 (0.007)***
Greece	0.27349 (0.000)***	0.00433 (0.000)***	0.02569 (0.702)
Hungary	0.16894 (0.016)**	0.00247 (0.041)**	-0.66255 (0.007)***

4 In countries where negative employment effect is observed, the average of the Kaitz index for the relevant period is as follows: Czech: 0.31, Mexico: 0.30, Portugal: 0.34, Australia: 0.47, Canada: 0.38.

Japan	0.22973 (0.000)***	-0.00066 (0.204)	-0.55210 (0.000)***
Korea	0.05696 (0.409)	0.00204 (0.000)***	-0.11860 (0.261)
Luxemburg	-0.17117 (0.542)	-0.00011 (0.940)	0.31441 (0.158)
Mexico	-0.04507 (0.072)*	0.00137 (0.000)***	-0.08385 (0.000)***
Netherland	0.02942 (0.826)	0.00477 (0.001)***	0.18322 (0.063)*
New Zealand	0.26977 (0.001)***	0.00443 (0.000)***	0.08145 (0.384)
Poland	0.25983 (0.000)***	0.00806 (0.000)***	-0.14122 (0.530)
Portugal	-0.7990 (0.159)	0.00592 (0.000)***	0.15608 (0.009)***
Slovak	0.14588 (0.019)**	0.00554 (0.00)***	0.31903 (0.004)***
Spain	0.10902 (0.677)	0.00772 (0.000)***	0.74198 (0.001)***
USA	0.27529 (0.000)***	0.00747 (0.000)***	-0.02177 (0.718)

Note: The superscripts ***, **and * denote the statistical significance at 1%, 5% and 10% levels, respectively. p-values are in parentheses.

Both the general model and more specifically country coefficients indicate a positive relationship between minimum wage and employment. Although there are some exceptions, these results support the modern liberal approach, which suggests that the impact of minimum wage on employment is either negligible or positive. The variation of the country specific coefficients indicate that different institutional and structural characteristics are valid in labour markets and hence, factors such as wage contracts, social security and others are also efficient in the labour market.

The coefficients show that the relationship between the output gap and employment is positive for each country in both models. The negative country specific coefficients that have been found for few countries are not statistically significant. The positive coefficient of the output gap shows that the positive difference between the potential GDP and the current GDP increases employment hence is consistent with its theoretical explanations. The relationship between employment and the ratio of government consumption expenditures to GDP is also analyzed. Some countries have significant positive coefficients, while the others have significant negative coefficients. The difference in the positivity and negativity of the coefficients indicates the difference in composition of government spending.

Conclusion

Minimum wage legislation is a matter of ongoing economic and political debate. Advocates of high minimum wage argue that it increases labour productivity and total demand by increasing the purchasing power of individuals. On the other hand, more political discussions consider high minimum wage as a means of increasing the income of the poor. Those who oppose minimum wage claim that this regulation causes inflation through the increase in total demand, and increases unemployment due to the rise in labour costs (Waltman, 2008; Mankiw, 2016). The results of the empirical studies that are based on these theoretical claims could not come to an agreement on this issue. Therefore, in this paper the effect of minimum wage legislation on employment is investigated and it is aimed at contributing to the literature on the subject where a consensus has not been achieved so far.

The effect of minimum wage on employment is analyzed using the data of OECD countries over the period 1997-2017 by using *Augmented-Mean Group Estimator (AMG)*. The AMG estimator takes into account the heterogeneity. It is also robust to cross-sectional dependence and an effective estimator in the case of non-stationary series.

The results obtained by estimating a linear model with the AMG estimator show that the minimum wage legislation increases employment. These results are consistent with the results obtained by the leading names from the modern liberal approach such as Card and Krueger (1995), Katz and Krueger (1992), and Card (1992). As the estimator used in the analysis allows country heterogeneity, separate slope coefficients are calculated for each of the countries constituting the sample. Although most of these results are consistent with the panel results, for some countries a significant negative relationship is found between minimum wage and employment. The fact that the average wages of these countries are above minimum wage in accordance with the Kaitz index reveals that the negative employment effect can be explained by structural and institutional factors.

Although neoliberal economists view the minimum wage as an inefficient transfer program, these results support the view that it would promote greater equality. In other words, the minimum wage legislation can be a means for reducing income inequality and poverty. Contrary to the mainstream economics claims, the minimum wage legislation would contribute to the increase in standard of living for low-income people. In addition, considering Chapra's approach and the perspective of Islamic economics, this legislation would lead to the protection of workers' rights against employers.

These results may also provide a foundation for further studies. If the countries that are selected in the analysis are a homogenous group, particularly in terms of their institutional characteristics, similar individual coefficients could be obtained. In this sense, it may be possible to analyze different sample groups by means of "*varieties of capitalism*" literature.

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Appendix

Table A1. Correlation Matrix

	EMP/POP	MINWAGE	KAITZ	OUTPUTGAP	GOVERNMT
EMP/POP	1.0000				
MINWAGE	0.3059	1.0000			
KAITZ	0.0623	0.6655	1.0000		
OUTPUTGAP	0.3499	0.0869	0.0974	1.0000	
GOVERNMT	-0.3041	0.2790	0.3992	-0.0850	1

Table A2. Cross-Section Dependence Tests Results

	Breusch-Pagan LM Test Stat.	Pesaran scaled LM Test Stat.	Bias-corrected scaled LM Test Stat.	Pesaran CD Test Stat.
Panel A: For Series				
Variables				
EMP/POP	754.416(0.000)***	34.380(0.000)***	33.930(0.000)***	6.654 (0.000)***
MINWAGE	1427.12(0.000)***	72.837(0.000)***	72.387(0.000)***	30.470(0.000)***
KAITZ	1115.28(0.000)***	55.009(0.000)***	54.559(0.000)***	-0.679(0.4965)
OUTPUTGAP	951.941(0.000)***	45.672(0.000)***	45.222(0.000)***	24.184(0.000)***
GOVERNMT	1018.81(0.000)***	49.495(0.000)***	49.045(0.000)***	19.431(0.000)***
Panel A: For Models				
Model 1	1012.76(0.000)***	49.1493(0.000)***	48.699(0.000)***	-0.124(0.901)
Model 2	1060.50(0.000)***	51.8785(0.000)***	51.428(0.000)***	2.348(0.018)**

Note: The superscripts ***, **and * denote the statistical significance at 1%, 5% and 10% levels, respectively. p-values are in parentheses.

Table A3. Homogeneity Tests

Testler	Model 1	Model 2
$\tilde{\Delta}$	15.865(0.000)***	14.323(0.000)***
$\tilde{\Delta}_{adj}$	17.633(0.000)***	15.919(0.000)***

Note**:** The superscripts ***, **and * denote the statistical significance at 1%, 5% and 10% levels, respectively. p-values are in parentheses.