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Trade and FDI Effect on Wages: Evidence from 20 OECD Countries

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ABSTRACT

This study analyzes trade and FDI effect on wages in the 20 OECD countries. These countries are divided into six samples according to their geographical position. Panel cointegration and panel OLS methods are conducted during the study. The empirical model is built up on the base of the study of Onaran and Stockhammer (2006). The panel cointegration results show that there is a long-run relationship between wages, trade, and FDI. The panel estimation results indicate that both trade and FDI have significant effects on wages. It is found that trade has positive effects on wages. Although FDI has a significant effect on wages, the sign of the effect differs among samples. Moreover, the size of the effect of the FDI appears quite small that FDI does not have an economically significant effect on wages.

Key words: Wages, Trade, Foreign Direct Investment, Panel Unit Root, Panel Cointegration, Panel Estimation.

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LIST OF ABBREVIATIONS

CPI	Consumer Price Index
EU	European Union
EX	Exports
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
ILO	International Labor Organization
IM	Imports
LP	Labor Productivity
M	Manufacturing Wage Index
OECD	Organization for Economic Co-Operation and Development
OLS	Ordinary Least Squares
U	Unemployment Rate
UNCTAD	United Nations Conference on Trade and Development
UK	United Kingdom
USA	United States of America
TED	Total Economy Database
VAR	Vector Autoregression
W	Wages
WDI	World Development Indicators

*“By virtue of exchange, one man's prosperity
is beneficial to all others.”*

Frederic Bastiat

1. INTRODUCTION

The aim of this thesis is to analyze the trade and FDI effect on wages in the twenty developed OECD countries using the framework provided by Onaran and Stockhammer (2006). The trade and FDI effects on wages are estimated by using the panel ordinary least squares (OLS) method. The countries are divided into six groups. As explanatory variables openness ratio, inward FDI stock, labour productivity and unemployment rate are used to explain the effects on wages. Two estimation equations are introduced, where in the first specification the effect of the openness on wages is measured. In the second specification, all the explanatory variables are included to the estimation. This thesis goes beyond the previous studies by investigating the long-run relation by performing cointegration analysis between wages, trade and FDI.

The main conclusion from the analysis is that there is a long-run relation between wages and trade and FDI where both trade and FDI have significant effects on wages. Although the trade effect have a positive impact on wages in almost all samples, we do not find any support that FDI influences the wages positively in the economy since the sign of the effect differs between samples. Moreover, the size of the effect of the FDI appears quite small that FDI does not have an economically significant effect on wages.

The study is organized as follows: the next section provides a brief discussion of the theory and previous empirical work about the relation of trade and FDI effect on wages. In the third section, the empirical methodology is explained. The fourth section gives information about the data sources and description, and presents a short analysis of the development of the wages, FDI and openness. Section five presents the panel unit root and cointegration tests. In the sixth section, panel estimations are conducted and trade and FDI effects are interpreted. Section 7 reviews the main results of the study.

2. LITERATURE REVIEW

In this section, firstly, we make a short discussion about the economic theories on the trade and FDI relation with wages. Then, some of the recent empirical studies are presented. In the economic theory, there are different arguments about the expected results of the opening up the economy. Therefore, we discuss the three general theories briefly where the focus will be on the traditional trade theory, bargaining theory of political economy and international competition arguments as in the Onaran and Stockhammer's (2006) paper.

According to the traditional trade theory, where Heckscher-Ohlin and Stolper-Samuelson models constitute the base of the theory, countries that have comparative advantages in the labor intensive sectors will enjoy wage increases by the increases in the international trade and FDI inflows due to production rises in the labor intensive sectors. However, an increase in the openness may not affect wages immediately.¹ Milner and Wright (1998) assert that wage changes due to production increase may not occur in the short run, since wages are increasing relative to the domestic price of importable goods, whereas decreasing with exportable and non-tradeable goods. Moreover, Onaran and Stockhammer (2006) claim that due to immobility of the capital in the short run, optimal allocation of the production can not be reached across sectors. Therefore, the effect on wages will be uncertain because real wages are depending on the relative importance of exportable, importable and non-tradeable goods in the short run. However, after reaching the optimal allocation across sectors in the long-run, we will expect to see positive effects of the international trade and FDI inflows on wages.

Political economists underline the possible negative effects of liberalizing trade due to increase in the competition, which decreases the bargaining power of the workers and hence may decrease the wages (Onaran, 2004). Moreover, Rodrik (1997) argues that with the rise of globalization the closer the domestic and foreign workers become by the international trade and FDI movements, the lower bargaining power the unions will held and thereby; workers will gain lower surpluses which will decrease their wages. Brock and Dobbelaere (2006) claim that with globalization, increased competition leads to a shift in bargaining power from workers to capital over rent distribution that helps companies to obtain extra profits.

¹ For more information see Bhagwati et al. (1998, pg. 53) and Krugman and Obstfeld (2002, pg. 67)

On the other hand, international competition argument asserts that the rise of international trade promotes the workers in the skill intensive sectors, while international trade adversely influences the unskilled workers.² Moreover, Onaran (2001) claims that with international competition an increase in the capital intensity of production will also affect the skilled workers. Since rise in the capital-intensive production will put the skilled labor under pressure due to substitution effects between capital and labor, which will result in a reduction of the wages of skilled labor.

Table 1, which we take from the study of Onaran and Stockhammer (2006), summarizes the effects of international factor mobility on wages for three economic theories –traditional trade theory, bargaining theory of political economy and international competition argument. FDI inflows indicate the international factor mobility. Moreover, CS stands for the sectors using capital-intensive with skilled labor. CU, LS and LU are the sectors with capital-intensive with unskilled, labor intensive with skilled, and labor intensive with unskilled labor, respectively. Positive effects are indicated with “+” and negatives with “-”. Since we are interested in the long-run effects of the capital mobility on wages, we do not present the short-run effects. According to traditional trade theory, FDI inflows have positive effects on wages in the all sectors. On the other hand, negative influence of openness is expected in the bargaining theory of political economy. However, for the international competition argument, the effect is ambiguous.

Table 1. The Effect of Factor Mobility on Wages

	Traditional Trade Theory	Political Economy	International Competition
	FDI Inflows	FDI Inflows	FDI Inflows
CS	+	-/0	-
CU	+	-/0	-
LS	+	-	-
LU	+	-	-
Total	+	-	-/?

Note: “0” stands for no effect of FDI inflows on wages, while “?” stands for ambiguous effect of FDI inflows.

Having presented a short summary of the theories, now some of the recent studies about the trade and FDI effect on wages with different estimation methods are discussed.

² See Krugman and Obstfeld (2002, pg.103)

Onaran and Stockhammer (2006) estimate the effect of FDI and trade openness on wages in the Central and Eastern European Countries with cross-country sector specific data. In the analysis, the panel OLS method is employed for the manufacturing industries for the period 2000-2004 with fixed country and time effects. They regress log of real wages on explanatory variables which are unemployment rate, labor productivity which is measured as log of real output per worker, ratio of FDI inward stock to GDP, ratio of exports and imports from European Union to GDP. They find a positive significant effect of FDI on wages, where a 10% point increase in the FDI to GDP ratio leads to 1.2% increase in real wages. However, the effects of exports and imports on wages appear insignificant. Furthermore, they find significant negative effects of unemployment and positive effects of labor productivity on wage. Moreover, they perform the tests for the capital-skill, labor-skill, capital-unskilled and labor-unskilled intensive sectors. FDI only has a significant effect on the capital-skill intensive sectors that a 10% point increase in the FDI to GDP ratio leads to 2.1% increase in real wages. On the other hand, exports are significant only in the capital-unskilled intensive sectors, where an increase in exports decreases wages. There is no significant effect of imports found in any sectors.

Majid (2004) analyzes the effect of openness and FDI on wages across three different country groups, which are developed countries, developing countries and all countries for the period between 1983 and 1998. He performs the estimations using panel ordinary least squares method with fixed time effects. Explanatory variables used in the model are ratio of FDI to GDP and openness indicator, which is the ratio of sum of exports and imports to the GDP. Moreover, the three-year lag of these variables is used to estimate the effect on wages that allows observing the effect of trade and FDI in the same year and after three years. Firstly, wages are regressed with trade and FDI separately and the results indicate that both variables have negative effect on wages. For instance, a 10% point increase in the Trade to GDP ratio decreases the level of wages 2%, while 10% increase in FDI to GDP ratio leads to 0.9% reduction in wage level. On the other hand, the effect turns out to be positive for trade when three-year lags are used, while three-year lag FDI still has a negative effect. However, only three-year lag trade effect in the developed countries is found significant.

To measure whether the omitted variables affect the estimation results or not, Majid (2004) includes the real GDP per worker as an explanatory variable to the model to see if the trade and

FDI effects remain still significant. The results show that the trade effect turns out positive for developed countries. Moreover, the negative effects of trade and FDI for the remaining estimations are reduced. He reaches similar results for the estimations with the lag of variables. Positive effect of trade increased for all groups, where the insignificant effect of trade turned significant for all group. In particular, trade effect in developing countries has become significant and increased from 0.078 to 0.137. Finally, all the variables are regressed within the same regression. The trade effect appears negative for all estimation groups. However, for the lagged variables, trade has significant positive effect for developed countries and negative but smaller effect in developing countries. On the other hand, FDI affects wages significantly and negatively in all models, whereas GDP per worker has positive influence.

Bella and Quintieri (2000) analyze the effect of international trade on the labor market of the Italian manufacturing sector between 1975 and 1989 for 71 industries. The OLS estimation method is employed and domestic sales, exports, imports, product wage and labor compensation are used as explanatory variables. The main findings from the research are that exports affect wages positively, while imports have an opposite effect and decrease wages. For instance, a 10% increase in the exports leads to 4.9% increase in wages, while same magnitude effect of imports leads to 8% decrease in wages. Moreover, they also assert that skilled workers enjoy the wage increase due to an increase in exports more than unskilled workers, while they are not as much as influenced as unskilled workers from wage decrease due to rise in imports.

Mutascu and Fleischer (2009) investigate the FDI effect on wages for Romania by using a vector autoregressive model (VAR) for the period between 2002 and 2009 with monthly data. FDI is measured as the FDI flow to the country and wages are the national level averages. The estimations are performed with four lags of the variables. For all lags, FDI is found significant. However, only the third lag of FDI has negative impact on wages, whereas the remaining lags affect wages positively. Moreover, the magnitude of the effect is increasing with the lags that while a one point increase in the third lag of the FDI raises wages 0.0117 point, the fourth lag increases 0.0126 point.³ This result can be an indicator of the FDI effect on wages in the long-run that in many cases it is expected to see the effect of FDI in the following years.

³ Although the second lag of FDI has a negative on wages, in absolute terms the effect of FDI is still increasing with the lags.

Vijaya and Kaltani (2007) investigate the impact of FDI on wages in the manufacturing industries. The estimation is conducted with 19 countries, which cover both developed and high-middle income countries, for the period 1987 to 2000 by using panel data method with random country effects. They test the impacts of both the ratio of FDI to GDP, FDI inflows and FDI inward stock on wages where all the variables are presented in logarithms. Among these variables, only FDI inflows have significant effect on wages that 10% increase in FDI inflows leads to 0.5% decreases in wages. The estimations are repeated for females and males. However, none of the variables is found significant for males, while FDI inflows are significant for females. Authors explain this different impact between genders by assuming that labor force that has the lowest bargaining power will be affected most from the changes in the capital and labor strengths where women constitute the higher portion of this low bargaining group.

To sum up, although it is certain that FDI and international trade have an impact on wages, we can not clearly say that either FDI or trade has a positive or negative effect on wages since the sign of the effects are changing among countries and with the choice of variables. In addition to that, it is expected to see the FDI effect on wages in the long-run. Therefore, in most of the researches FDI inward stock is preferred rather than FDI inflow to capture FDI's long-run effects. As discussed above, the theories approach to the trade-wage relation by introducing skilled-unskilled and capital-labor intensities of the sectors. Moreover, some of the researches focus on the trade effects on skilled and unskilled labor wages, although they have a very short time period of data for the analysis. However, the existing data for sector analysis of wages and for skilled and unskilled labor are not adequate, since it is hard to find sector-specific data in all countries with the same periods for skilled and unskilled labor. Due to these limitations, we will use aggregate data to eliminate time and country data problem. Although trade and FDI effects on wages are investigated with different methods such as OLS, VAR, panel OLS, etc., there is no previous research testing the long-run relation by employing cointegration analysis between wages, trade and FDI. Therefore, we will contribute to the existing studies by investigating the long-run relation between these variables by employing cointegration analysis.

3. EMPIRICAL METHODOLOGY

Panel data refers to multi-dimensional data, where the data contains observations across time periods and across countries, regions or individuals. Baltagi (2001) outlines some of the advantages and restrictions of using panel data. In particular, using panel data allows heterogeneity for individuals, regions and in our case countries, where it is missing in aggregated time series data. Moreover, panel data offers more variability that generally removes the collinearity problems and gives more reliable coefficient estimates due to the combination of a large number of cross-section observations. Therefore, panel data gives more degrees of freedom and more efficiency. On the other hand, choices of variables, measurement errors, missing data, etc. are the limitations to the panel data.⁴

A simple panel data with two variables and a deterministic trend looks like:

$$y_{it} = x'_{it}\beta + z'_{it}\gamma + e_{it} \quad (1)$$

where $i=1,\dots,N$ denotes individuals, regions, countries, etc. and $t=1,\dots,T$ stands for time. T is large and $N=1$ reflect the time series data, while i is large and $T=1$ is the only cross-sectional data. y and x are the dependent and independent variables with dimensions $(Tx1)$ and (TxN) , respectively. If each cross-section has the same number of time series observations, then the panel is called “balanced panel”. However, if it differs among cross-sections, then it will be an “unbalanced panel”. z_{it} is the deterministic trend, where it can take the form of fixed effects, α_i . With fixed effects, the model allows for heterogeneity such that each individual has its separate intercept. e_{it} is the residual term with the standard properties $iid(0, \sigma_e^2)$.⁵

We apply panel data to our model where the aim of our empirical research is to analyze the effect of the trade and FDI on wages in the twenty OECD countries. Following previous empirical research of Onaran and Stockhammer (2006), we are going to estimate two different specifications for six sample groups:

⁴ For further information see Gujarati (2003, pg. 637-638)

⁵ See Harris and Solis, 2005 pg. (190-191)

The first specification:

$$W_{it} = \beta_i + \beta_1 Open_{it} + \varepsilon_{it} \quad (2)$$

The second specification:

$$W_{it} = \beta_i + \beta_1 Open_{it} + \beta_2 LP_{it} + \beta_3 FDI_{it} + \beta_4 U_{it} + \varepsilon_{it} \quad (3)$$

where i is the country index and t is the time index. W_{it} stands for real wages in logarithms deflated by CPI. $Open_{it}$ shows the openness ratio which is the sum of real exports and imports divided by real GDP measured with 2000\$ prices. LP_{it} is the log of the labour productivity. FDI_{it} indicates the ratio of the inward FDI stock to GDP and U_{it} is the unemployment rate. β_i is the cross-country specific fixed effects.

In the first model, we estimate the effect of openness on wages as in Majid (2004). Then, in the second specification, we include all the variables. Although Onaran and Stockhammer (2006) use export to GDP and import to GDP ratios in their models, we have used the openness ratio instead and followed Majid's specification in trade effects. On the other hand, FDI inward stock is preferred rather than FDI inflows since FDI stock reflects the long-run cumulative effect of the foreign capital. The model covers both log values and ratios. The coefficient of the variable, LP, can be interpreted as elasticities since it is specified in logs. However, the coefficients of the remaining variables -Open, FDI and U- are estimated as semi-elasticities, where in semi-log models absolute change in the Open, LP and U leads to percentage change in the wages.⁶

To estimate the long-run relationship between wages and, openness and FDI, we will perform cointegration tests. In order to test for cointegration, we first check the variables for non-stationarity. Then, cointegration tests are performed with non-stationary variables. Finally, the size of the effects of the openness and FDI on wages is estimated by using panel OLS method. By using panel cointegration tests, we avoid the spurious regression problem. In the case of no cointegration relation, the way to solve the spurious regression problem is to take the first difference of the variables and estimate the model. However, since we have found cointegration relation, the first difference is not taken. In particular, Marrocu, et al. (2000) assert that if the first difference is taken where cointegration relation found among variables, then the model will be

⁶ Detailed information about semi-log models can be found Gujarati (2003, pg. 178-180)

misspecified since the model does not take into account of the long-run relation between variables. During the analysis, the econometric programme Eviews 7 is used for the estimations.

4. DATA

4.1 Description and Sources

To test the effect of the trade and FDI on wages, we have chosen twenty developed OECD countries. These countries are divided into six different groups.⁷ Due to availability of the data, the observation period differs among groups. Sample groups and observation periods are presented in Table 2.

Table 2. Sample Groups and Observation Periods

Sample Groups	Included Countries	Period	Number of Countries
Sample 1	All the Countries in the Sample	1983-2006	20
Sample 2	European Countries	1983-2006	14
Sample 3	Non-European Countries	1980-2006	6
Sample 4	Scandinavian Countries	1980-2006	4
Sample 5	Western Countries	1980-2006	3
Sample 6	Mediterranean Countries	1980-2006	4

Table 3 shows the data source and description of the variables, which indicate that different databases are used to collect data information. For the wage data, we have used two data sources, manufacturing wage data in local currencies from ILO and manufacturing wage index from OECD. By the introduction of Euro as a common currency in the EU, some of the European countries left their currencies and accepted Euro as national currency. The wage data in ILO is presented in Euros for the countries after the years that they accept Euro as a local currency. In particular, for Netherlands the wages are in Euros after 2001, while it was in Netherland guilder before 2001. Therefore, the wages in the countries that have accepted Euro are converted into the

⁷ All the countries in Sample 1 cover Australia, Austria, Canada, Denmark, Finland, France, Greece, Ireland, Italy, Japan, Korea, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, UK and USA.

Sample 2 includes only the European countries, whereas Sample 3 corresponds to Non-European Countries in the Sample. Sample 4 consists Denmark, Finland, Norway and Sweden. Sample 5 includes France, Netherlands and UK. Sample 6 covers Greece, Italy, Portugal and Spain.

former currency to have the wages in the same currency with the exchange rates given by the ILO.

Table 3. The Description and Source of The Data

Variable	Symbol	Description	Source
Wage	W	Wages in the Manufacturing Sector	ILO
Consumer Price Index	CPI	Consumer price index (2005 = 100)	WDI
Manufacturing Wage Index	M	Manufacturing Wage Index (2005=100)	OECD
Unemployment Rate	U	Total Unemployment Rate, (% of total labor force)	ILO and WDI
Labor Productivity	LP	Labor productivity per hour worked in 2009 US Dollars	TED
Foreign Direct Investment	FDI	FDI inward stock (% of GDP)	UNCTAD
Exports	Ex	Exports of goods and services (constant 2000 US\$)	WDI
Imports	Im	Imports of goods and services (constant 2000 US\$)	WDI
Gross Domestic Product	GDP	Real GDP (constant 2000 US\$)	WDI

ILO: International Labor Organization, (2010).

OECD: Organization for Economic Co-Operation and Development, (2010).

UNCTAD: United Nations Conference on Trade and Development , (2010).

TED: Total Economy Database, (2010).

WDI: World Development Indicators, (2010).

Since the wage data are given in nominal values, the consumer price index is used to convert them into real terms. We have employed the manufacturing wage index to construct wage data for some years since some of the countries do not have the wage data for the whole period.

However, the calculations of the data with the manufacturing wage index are also made for the remaining years to compare the reliability of the results. The results ensure the reliability of the data conversion. Furthermore, since we are looking for the trade and FDI effect on hourly wages, monthly wages are transformed into per hour wages where the ratio of month/hour is indicated in the ILO. Finally, for some periods we only have wage data for men, where the data for total wages are missing. To calculate the total wages, the ratio of men wages to total wages is found and wages of men is multiplied with this ratio to find the total wages for those periods.⁸ These results are compared with the manufacturing wage index to crosscheck, where I find no statistical discrepancy in using either manufacturing wage index or ILO wage data for the missing years.

Unemployment data are obtained from the ILO and WDI sources. Data for FDI inward stock are taken from UNCTAD and Labor Productivity from TED. Exports, imports and GDP data are extracted from the WDI database. To calculate the openness ratio, the sum of the exports and imports are divided with the gross domestic product.

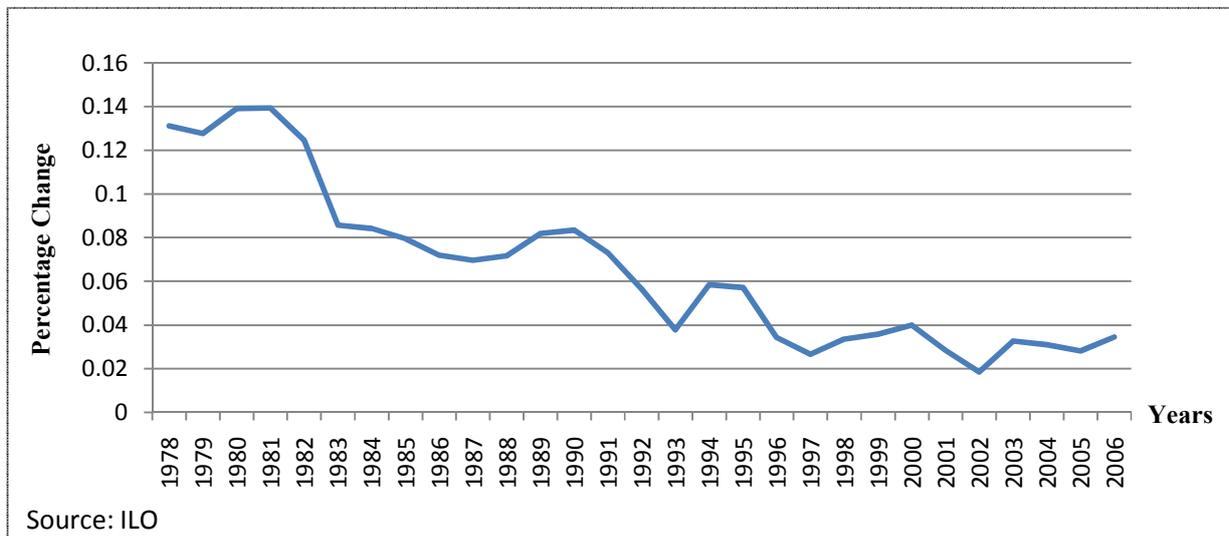
4.2 Data Analysis

In this section, we provide an overview of the time series of the variables used in the estimation, which are real wage growth, ratio of inward FDI stock to GDP and openness ratio. In order to show the time development of the data, we illustrate the average of the variables across countries for the given period. For cross-sections, the average annual changes of the variables are presented. By doing this, we can see the development of the variables through time and compare the average country-specific results. In figures, we use the total data, which covers all the countries in our sample.

Figure 1 shows the average percentage changes in the real wages for the period between 1978 and 2006. Although there has been an increase in the wages in real terms, the percentage increase in the wages have been gradually decreasing. In particular, in the early of the 1980's, the wage growth was around 14% per year, while it has decreased below 8% after the end of the decade. However, after 2002 the wages have followed a more stable pattern, where the real wage growth occurs between 3% and 4%.

⁸ For country specific data conversion and creation see Appendix part.

Figure 1. Real Wage Growth Between 1976 and 2006: Average of 20 Countries



On the other hand, when we look at country-specific average percentage changes in wages for the same period in Figure 2, Greece and Korea appear to enjoy highest wage growth where the wage growth is higher than 13% per year, while Japan has the lowest wage growth which is around 2.6% per year. Moreover, Mediterranean countries seem to enjoy higher wage growth on average relatively to the other countries.

Figure 2. Country-Specific Average Real Wage Growth Between 1978 and 2006

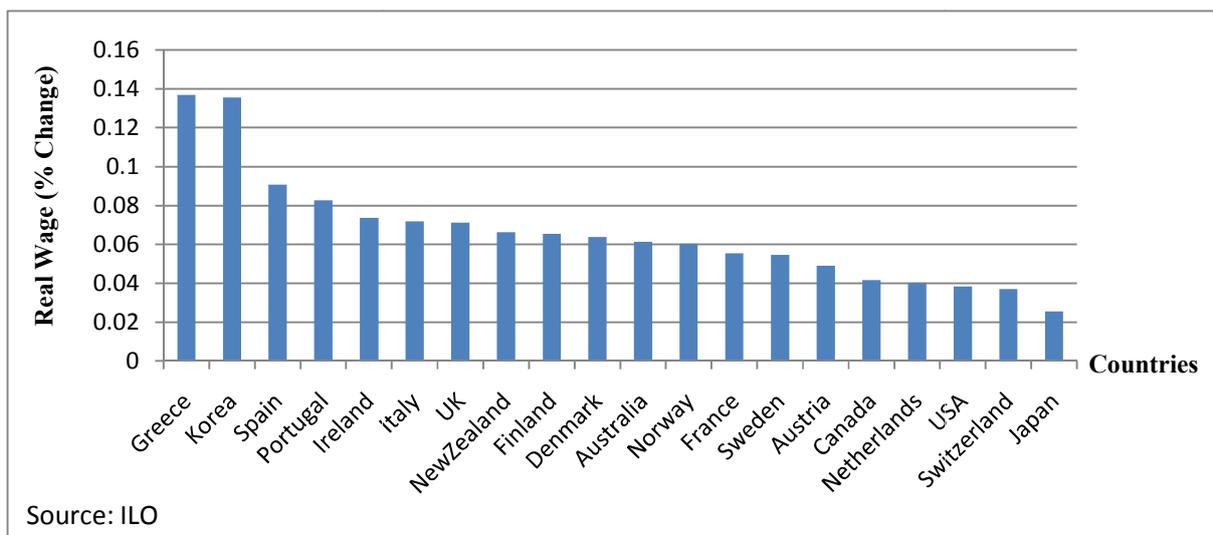
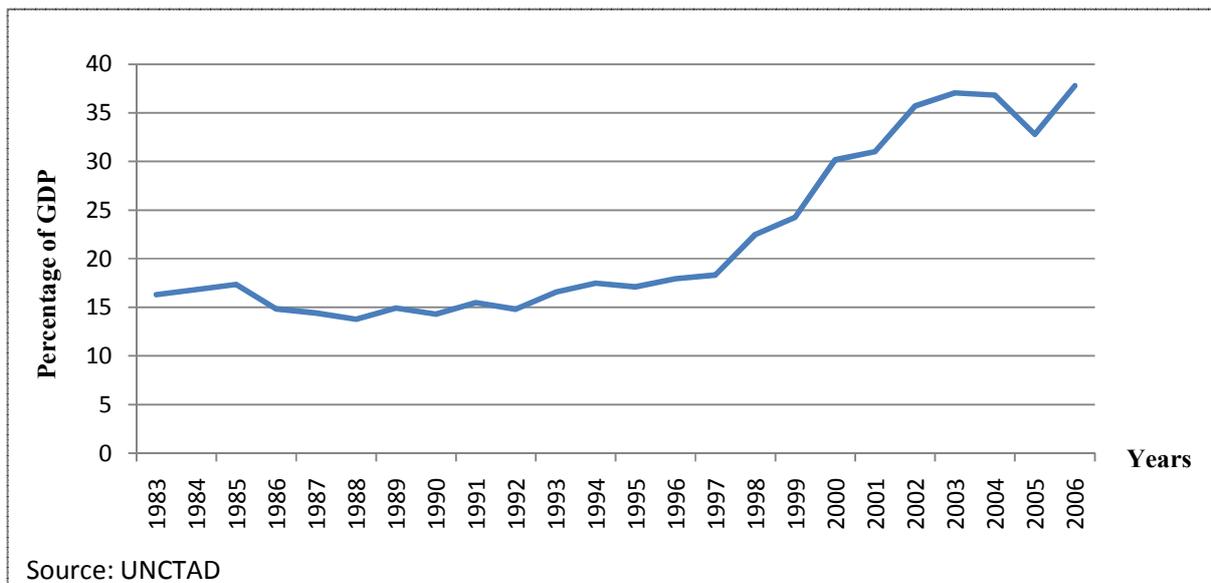


Figure 3 illustrates the movement of the average ratio of the inward FDI stock to GDP from 1983 to 2005. Even though the FDI/GDP ratio was stable until the beginning of 1990's, there has been a sharp increase in the FDI/GDP ratio from the early of the 1990's where it has reached its peak values in 2000's.

Figure 3. Ratio of Inward FDI Stock to GDP Between 1983-2006: Average of 20 Countries

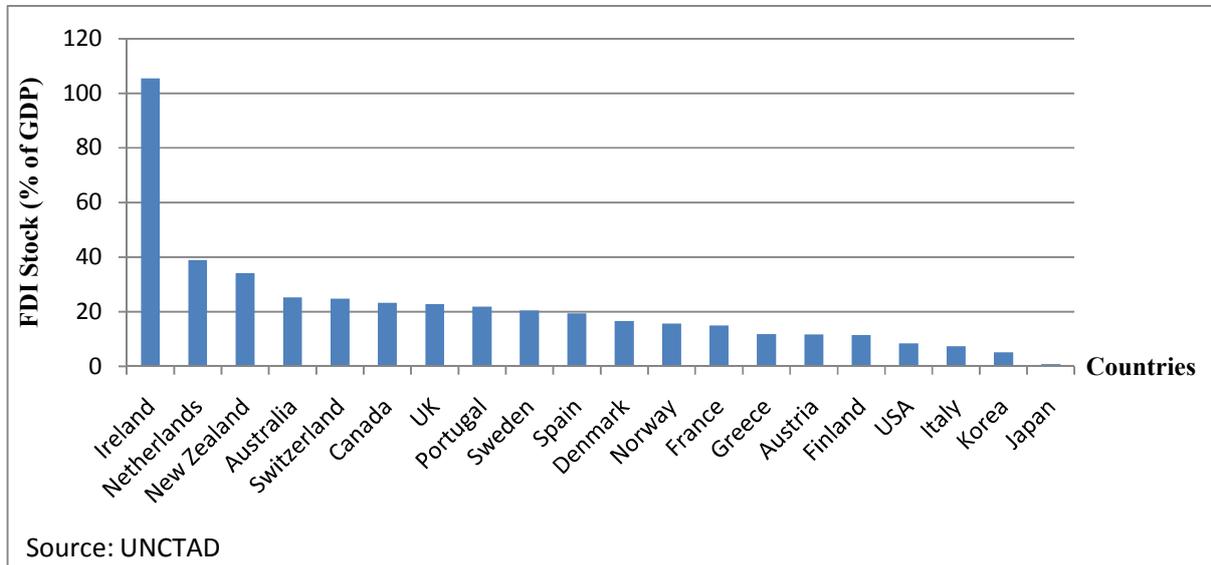


Gast and Roland (2008) explain this boom in FDI by the enlargement in the market. Furthermore, they claim that OECD countries prefer to increase their economic integration with their neighbour countries. Since the most of the OECD countries are located in Europe and they are neighbour with each other, inward FDI is expected to increase not only in the developing countries but also in the developed countries. Therefore, the large share of FDI has remained in the OECD countries.

In Figure 4, the average of country-specific ratio FDI stock to GDP from 1983 to 2006 are presented. Ireland, which is also called the Celtic Tiger because of having higher rates of GDP growth by catching foreign investments, is clearly seen the most attractive country for FDI.⁹ In particular, the inward FDI stock has exceeded the GDP level on average.

⁹ Further information for Ireland case can be found Luisa and Patrick (2002).

Figure 4. Country-Specific Average of the Ratio of Inward FDI Stock to GDP Between 1983-2006



The Netherlands and New Zealand follow Ireland by having around 39% and 34% inward FDI stock ratio, respectively. On the other hand, Japan attracts the least FDI among these countries. Moreover, Italy, Korea and United States appear to have lower FDI stock ratio relatively to other OECD countries.

Figure 5. Openness Ratio Between 1975-2007: Average of 20 Countries

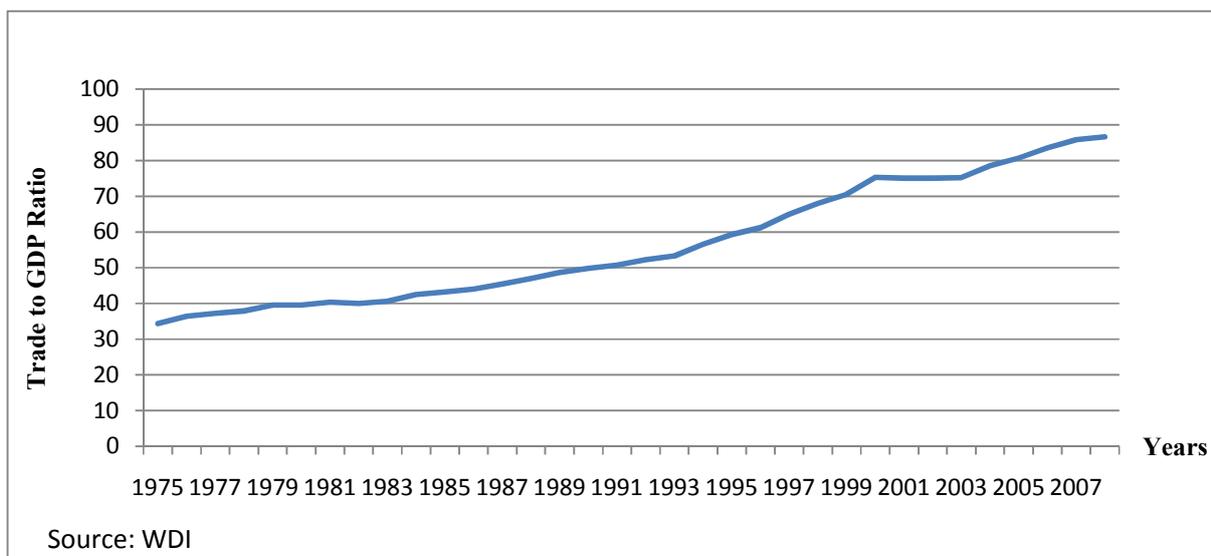
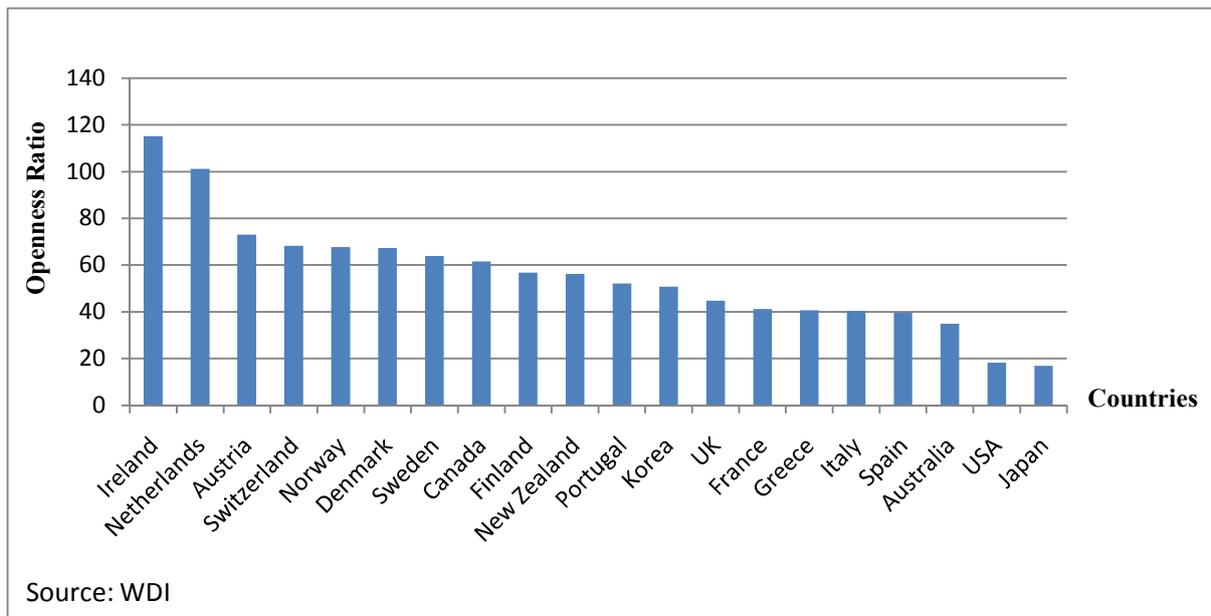


Figure 5 presents the openness ratio, average trade to GDP ratio, from 1975 to 2007. It is clear that through time, openness ratio is gradually increasing. Still in some periods, we can see that the rise in the growth of openness is ceased. To illustrate, between 1981 and 1983, and 2001 and 2003 openness ratio stayed constant. However, this stagnation is altered in the following years.

Figure 6 shows the country-specific average of the openness ratio between 1975 to 2007. Again, Ireland has the highest and Japan has the lowest openness ratio among all countries. It is seen that Netherlands and Austria are the main followers of the Ireland. On the other hand, United States appear to have a lower rate of openness relatively to other countries.

Figure 6. Country-Specific Average of the Openness Ratio Between 1975-2007



We will move on as follows; first, all the variables in all samples will be tested for stationarity by panel unit tests. Then, the cointegration tests will be conducted with non-stationary variables. Finally, trade and FDI effects on wages will be estimated.

5. PANEL UNIT ROOT AND COINTEGRATION TEST ANALYSIS

In this section, first, stationarity of the variables are analyzed by using the Breitung (2000) panel unit root test. Then, the Kao (1999) panel cointegration test is employed with the variables that are integrated of order one, I(1).

5.1 Panel Unit Root Test

A stationary series is expected to return to its mean value. Therefore, mean and variance do not vary over time. However, in non-stationary series the mean and variance change in different points and the variance is increasing with the sample size.¹⁰ As a result, a non-stationary series is not expected to return its mean value over time. By employing unit root tests, we can determine if the series are stationary or not. If the non-stationary series become stationary after taking the first difference, these series are called integrated of order one, I(1). They are called integrated of order two, I(2) if they become stationary after taking the second difference. (See Hamilton, 1994, p. 437)

To test the stationarity of the variables, the Breitung (2000) panel unit root test is used which assumes a common unit root process across countries. The null hypothesis of the Breitung test indicates a unit root process and assumes the series are non-stationary. On the other hand, the alternative hypothesis rejects unit root process and confirms stationarity. In order to estimate the Breitung t-values, the equation (4) is used:

$$\Delta y_{it} = a_{it-1} + \sum_{j=1}^{p_i} \beta_{ij} \Delta y_{it-j} + X'_{it} \delta + \epsilon_{it} \quad (4)$$

The null and alternative hypothesis of the Breitung test can be expressed as:

$H_0: \alpha = 0$ (Panel series has a common unit root)

$H_1: \alpha < 0$ (Panel series does not have a common unit root)

The panel unit root tests are conducted with intercept and trend. A summary of the results is presented in Table 4.¹¹ For Sample 1 and Sample 2 at the 5% significance level, it is found that W, LP, FDI and OPEN are I(1), whereas U is stationary, I(0). In particular, the test results of FDI

¹⁰ For further information see Harris and Sollis (2005, p.26.)

¹¹ During the estimations the maximum number of lags is chosen by Schwarz Info Criterion.

for Sample 1 shows that at the 5% significance level, panel unit root test statistic, which is 4.16, is not statistically significant. Therefore, we accept the null hypothesis and say that the panel series of FDI contains a unit root. After taking the first difference, it becomes stationary with a t-value of -3.245 is significant at 5% significance level. Thus, the variables are integrated of order one.

In Sample 3, U, LP, and OPEN are found I(1), while W is I(2) and FDI is non-stationary for the tests with the first and second differences, where it is I(3). To cross-check the unit root results of W and FDI variables alternative methods are employed. The alternative methods used are Levin, Lin and Chu test, Im, Pesaran and Shin test, ADF-Fisher test, and PP-Fisher test. According to these test results, both W and FDI are found I(1). (See Table 12 in the Appendix part) In Sample 4, all the variables are found I(1). We reach similar test results for Sample 5 as for Sample 3 that U, LP and OPEN are I(1), while W is I(2) and FDI is I(3). Alternative tests are employed for both variables, W and FDI, and they are found I(1). In Sample 6, all the variables except FDI, which is I(3), are found I(1). Therefore, FDI is tested with alternative methods and it is found I(1).¹²

Table 4. Breitung Panel Unit Root Test Results

Breitung Panel Unit Root Test Results						
Variable	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Sample 6
W	I(1)	I(1)	I(2)*	I(1)	I(2)*	I(1)
LP	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)
FDI	I(1)	I(1)	I(3)*	I(1)	I(3)*	I(3)*
U	I(0)	I(0)	I(1)	I(1)	I(1)	I(1)
OPEN	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)

Notes: i) I(0) indicates stationarity, while I(1) stands for integrated of order one. ii) I(2) stands for integrated of order two and I(3) is for integrated of order three. iii) Variables with (*) are found I(1) with alternative tests.

Since the non-stationary W and FDI data are found I(1) with alternative tests, although Breitung test can not reject the unit root for the first difference, we are going to accept the results of the

¹² See Table 12, Table 15 and Table 17 for the alternative test results in the Appendix part

alternative tests and assume that they are I(1) to enable further analysis.¹³ The alternative tests we have used not only include common unit processes but also individual unit processes. Since all alternative method results confirm that the variables are I(1), we can ignore the Breitung test results and accept the alternative test results for these variables.

5.2 Panel Cointegration Tests

Having done the stationary tests, now we can look for the long-run relations between wages and the explanatory variables. In order to perform the cointegration tests, the variables have to be integrated of order one, I(1). Therefore, the stationary variables are excluded from the cointegration tests. To estimate the long-run relationships between variables, we have used the Kao residual based cointegration test which was developed by Chihwa Kao in 1999. In the Kao panel cointegration test, which is an extension of the Engle-Granger two-stage approach, the slope of the coefficient β does not vary across cross-sections that Kao assumes the coefficient β homogenous.¹⁴

Briefly, Kao panel cointegration test is done by:

If there is bivariate case:

$$y_{it} = \alpha_i + \beta x_{it} + e_{it} \quad (5)$$

$$y_{it} = y_{it-1} + u_{i,t} \quad (6)$$

$$x_{it} = x_{it-1} + \epsilon_{i,t} \quad (7)$$

$$e_{it} = \rho e_{it-1} + v_{it} \quad (8)$$

More generally, if there is more than one explanatory variable:

$$y_{it} = \alpha_i + \delta_i t + \beta_{1i} x_{1i,t} + \beta_{2i} x_{2i,t} + \dots + \beta_{Ni} x_{Ni,t} + e_{it} \quad (9)$$

$$e_{it} = \rho e_{it-1} + v_{it} \quad (10)$$

As in the Engle-Granger (1987) two-stage approach, the dependent variable is regressed with explanatory variables. Then, the residual term from this regression is checked for stationarity. If this term is stationary, I(0), the variables will be cointegrated. In other words, the value of the

¹³ For detailed results for panel unit root tests please see Appendix part.

¹⁴ See Harris and Sollis (2005, p.201)

“ ρ ” from the Kao panel cointegration test determines the result of the cointegration. The null hypothesis of the Kao test says that there is no cointegration relation between the variables, whereas the alternative rejects the null and confirms that the series are cointegrated.

$H_0: \rho = 1$ (There is no cointegration)

$H_1: \rho < 1$ (There is cointegration)

Moreover, Kao (1999) claims that the null hypothesis of the cointegration test also confirms the case of the spurious regression. Therefore, if the null hypothesis can be rejected, then the problem of spurious regression is avoided that we do not need to take difference for the non-stationary terms in the panel estimation process.

The results of the cointegration tests are presented in Table 5. The Kao test is conducted by assuming that all the variables have individual intercept. The maximum number of lags is chosen by Schwarz Info Criterion and the spectral estimation method used is the Bartlett Kernel method with the Newey-West automatic bandwidth selection. The tests are done for two different specifications. In the first specification, the cointegration relation between wage and openness is estimated. In the second specification, unemployment, labor productivity and inward FDI stock are included in the cointegration test.¹⁵

Table 5. Kao Panel Cointegration Test Results

Kao Residual Cointegration Test Results				
	First Specification		Second Specification	
	ADF t-statistics	Prob.	ADF t-statistics	Prob.
Sample 1	-0.786858	0.2157	0.872395	0.1915
Sample 2	1.463646*	0.0716	1.555095*	0.06
Sample 3	-2.442183***	0.0073	-1.374961*	0.0846
Sample 4	-1.530685*	0.0629	-2.842244***	0.0022
Sample 5	-0.619978	0.2676	-2.757819***	0.0029
Sample 6	-2.174772**	0.0148	-3.054541***	0.0011

Note: i) Values with (*) indicates significance at 10% level. ii) Values with (**) indicates significance at 5% level. iii) Values with (***) are significant at 1% level.

¹⁵ For Sample 1 and Sample 2 unemployment is excluded since it is stationary in both samples.

The results show that, for the first specification, which is with only real wages and openness ratio, there is no cointegration relation found for Sample 1 and Sample 5, while for the remaining samples the variables are cointegrated. For instance, in Sample 3 we reject the null hypothesis since the Kao test result is -2.44 with a probability of 0.007 which indicates significance at 5% level. As a result, we can conclude that real wages and openness ratio exhibit a long-run relationship. In the second specification, except Sample 1, all the samples have cointegration relation. To illustrate, for Sample 4, the test result is -2.84 with a probability of 0.002 that ensures the rejection of the null hypothesis where we can confirm the cointegration relation. As a result, except sample 1, we find a long-run relationship between real wages and openness ratio, FDI stock, labor productivity and unemployment in all samples.¹⁶

For the non-cointegration samples 1 and 5, an alternative panel cointegration method, Pedroni panel cointegration test, is used to control the results. Although both Pedroni and Kao panel cointegration tests are based on the Engle-Granger two-stage approach, the Pedroni test differs from the Kao test by allowing the slope of the coefficient β to vary across cross-sections. Thus, Pedroni assumes the coefficient β heterogeneous. Table 6 shows the cointegration test results for the second specification of the Sample 1 and the first specification of Sample 5.¹⁷ The Pedroni test is conducted by assuming that the variables have an individual intercept. The maximum number of lags is chosen by Schwarz Info Criterion (SIC) and the spectral estimation method used is the Bartlett Kernel method with the Newey-West automatic bandwidth selection. The null hypothesis of the Pedroni test accepts no cointegration relation, while the alternative confirms that the series are cointegrated. There are two alternative hypotheses in the Pedroni test. The first one is the homogenous alternative, where $\rho = \rho_i < 1$ for all i . This is also called *within-dimension* test or panel statistic test. On the other hand, the second alternative hypothesis is the heterogeneous alternative, which assumes $\rho_i < 1$ for all i . Pedroni refers this as *between-dimension* test or group statistics test.

¹⁶ Since unemployment is $I(0)$, it is excluded in Sample 1 and Sample 2 in cointegration analysis.

¹⁷ Since the Pedroni cointegration test gives insignificant results for the first specification of the Sample 1, panel cointegration test results are not presented.

Null and alternative hypotheses of Pedroni Test:

$H_0: \rho_i = 1$ for all i (No cointegration)

$H_1: \rho = \rho_i < 1$ for all i (Within-dimension test) (Series are cointegrated)

$H_1: \rho_i < 1$ for all i (Between-dimension test) (Series are cointegrated)

Since the between-dimension test does not assume ρ_i same for all countries, it allows for potential heterogeneity across every country in the model. Eviews 7 gives four within-dimension and three between-dimension test results, where panel v-statistic, panel-rho statistic and panel PP-statistic are non-parametric tests. On the other hand, ADF-statistic is a parametric test result.¹⁸

Table 6. Pedroni Panel Cointegration Test Results

Pedroni Panel Cointegration Test			Pedroni Panel Cointegration Test		
Sample 1			Sample 5		
Within Dimension	Statistic	Prob.	Within Dimension	Statistic	Prob.
Panel v-Statistic	-2006.349	1	Panel v-Statistic	0.622778	0.2667
Panel rho-Statistic	-0.573382	0.2832	Panel rho-Statistic	-0.593818	0.2763
Panel PP-Statistic	-2.211963**	0.0135	Panel PP-Statistic	-1.828098**	0.0338
Panel ADF-Statistic	-2.57644*	0.005	Panel ADF-Statistic	-1.687882**	0.0457
Between Dimension	Statistic	Prob.	Between Dimension	Statistic	Prob.
Group rho-Statistic	0.59794	0.7251	Group rho-Statistic	-0.038105	0.4848
Group PP-Statistic	-2.369591*	0.0089	Group PP-Statistic	-1.845523**	0.0325
Group ADF-Statistic	-6.514375*	0.0000	Group ADF-Statistic	-1.79308**	0.0365

Note: i) Values with (*) reject the null hypothesis at 1% significance level, while (**) rejects at 5%. ii) Sample 1 results refer to the second specification of Sample 1, while Sample 5 stands for the first specification of Sample 5.

According to Pedroni test results, the null hypothesis can only be rejected in both within dimension and between dimension analysis for the PP-statistics and ADF-statistics. However, v-statistics and rho-statistics are not significant enough to confirm cointegration relation in these samples. Still, we can not certainly say whether there is a long-run relationship between variables

¹⁸ For further information about the Pedroni Test, see Pedroni (1999).

in these samples or not since the test results of the Pedroni test are conflicting with each other. Nevertheless, to continue our analysis by making long-run estimations of trade and FDI effect on wages, we will assume that these samples are cointegrated.

6. PANEL ESTIMATION RESULTS

After we have found the cointegration relation, which proves the long run relation between openness and FDI, and wages, now we can estimate the magnitude and sign of the trade and FDI effects on wages. Since we find cointegration relation between variables, we disregard the problem of spurious regression. First of all, we will estimate our first specification, where the effect of the openness on wages is tested. Then, we move on to test with the second specification, where all the explanatory variables are included to our model that we have estimated the size of the effects of FDI and openness on wages. Furthermore, the second specification also allows us to check the robustness of the openness effect on the first specification. The estimations are performed by using Panel OLS method.

6.1 Estimation Results of the First Specification

In Table 7 the estimation results of our first specification is presented. It is found that openness has a positive and significant effect of on wages for all sample groups except sample 5 where the effect is insignificant.

Table 7. Panel Estimation Results of the First Specification

Dependent Variable W						
	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Sample 6
C	0.7624* (4.919)	0.5245* (27.187)	3.6058* (36.229)	2.7743* (16.965)	3.6007* (12.919)	5.4072* (23.777)
OPEN	0.2546** (1.805)	0.4880* (22.247)	3.2794* (16.492)	2.5102* (11.722)	0.1948 (1.316)	3.8998* (9.109)
R²	0.9997	0.9976	0.9966	0.842455	0.9993	0.9393

Note: i) t-values are presented in parenthesis. ii) Values with (*) are significant at 5% significance level, while values with (**) are significant at 10% level. iii) Estimations are performed by selecting cross-section fixed effects iv) No-GLS effects with White cross-section covariance method are chosen.

Among the samples, there are differences in the size of the effect. For instance, a 10% unit increase in the openness ratio raises the wages 2.5% in sample 1, while the same size of effect results in 39% rise in sample 6. These results are controversial with the findings of Majid (2004) where he finds negative relationship for his first specification, which covers only the trade effect on wages. However, he finds the positive effect of the three-lagged of the openness on wages for developed countries where a 10% unit increase in the openness ratio raises the wages 5.8%, which is also very close to our results for sample 2 that is 4.8%.

6.2 Estimation Results of the Second Specification

Table 8 illustrates the estimation results of the second specification. It is again found that for all samples except Sample 5, openness has significant effect on wages. However, this time for Sample 1, the impact of openness appears negative. In particular, a 10% unit increase in the openness ratio decreases wages 0.8%. This result is consistent with Majid's (2004) estimation results where he estimated that a 10% unit increase in the openness ratio leads to a 2% decrease in wages in his first specification and 0.05% in second specification for the developed countries. Furthermore, only in Sample 6 the size of the effect remained almost same, which has changed from 3.9 to 3.6. But, for Sample 2, Sample 3 and Sample 4, the effect of openness has decreased considerably although they are still significant and positive.

On the other hand, labor productivity is found significant and positively related with wages in all samples. For instance, a 1% increase in the labor productivity results in 0.49% increase in wages for Sample 2, which is the lowest impact among the samples, while the rise in wages is 1.97% for Sample 6 where LP has the highest impact among the samples. Moreover, except Sample 1 and Sample 2, it is observed that the rise in the wages will be more than rise in the productivity. Although Onaran and Stockhammer (2006) found positive impact of productivity on wages in all their specifications, the size of the effect, where the coefficient of productivity around 0.125, is smaller than what we have found in our samples. The divergence in the effect can be explained by the selection of countries. Since Onaran and Stockhammer (2006) have chosen developing countries, it is expected to see lower effect of productivity than the developed countries. For instance, Goh (2009) estimates the relation between labor productivity and wages and concludes that 1% increase in the productivity yields 0.7% in the wages, which is closer what is estimated in our model.

Table 8. Panel Estimation Results of the Second Specification

Dependent Variable W						
	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Sample 6
C	-1.7869* (-17.293)	-0.997* (-10.305)	-0.2917 (-1.008)	-3.1751* (-8.962)	-3.5305* (-8.435)	-1.0982 (-0.855)
OPEN	-0.0849* (-2.605)	0.0516* (2.225)	1.1059* (7.222)	1.1175* (6.623)	0.0496 (0.294)	3.5556* (5.482)
LP	0.7318* (21.642)	0.4905* (16.288)	1.3466* (16.084)	1.8867* (17.265)	1.7341* (15.240)	1.973* (4.273)
FDI	0.0008* (3.015)	0.0012* (5.124)	0.0052* (2.603)	-0.0088* (-6.623)	0.0019 (1.275)	-0.0266* (-6.220)
U			0.0132* (2.263)	-0.0076 (-1.535)	-0.0030 (-0.519)	0.0402* (2.087)
R²	0.9985	0.9979	0.9985	0.9506	0.9929	0.9697

Note: i) t-values are presented in parenthesis ii) Values with (*) are significant at 5% significance level, while values with (**) are significant at 10% level. iii) Estimations are performed by selecting cross-section fixed effects iv) No-GLS effects with White cross-section covariance method are chosen.

Inward FDI stock appears to be significant in all samples except Sample 5. However, the size of the effect is quite small and there are differences in the sign of the effects among samples. In particular, it is seen that FDI stock is positively related with wages in samples 1-3, while it has negative influence in Sample 4 and 5. For instance, a 10% increase in the FDI ratio increases wages 0.01% in Sample 2 and decreases wages 0.27% in Sample 6. Even though the results are conflicting with each other, as indicated in the literature part, the recent studies show that there is not a consensus in the FDI effect on wages. There are evidence which supports that some scholars have found a positive effect of FDI on wages, whereas the others found negative effect. To illustrate, Majid (2004) estimated the coefficient as -0.042 for FDI effect on wages for developed countries, which is close to our results for Sample 6, while Onaran and Stockhammer (2006) found the coefficient 0.12 for Central and Eastern Europe Countries. Furthermore, Gopinath and Chen (2003) claim that a 10% unit increase in the inward FDI raises wages 0.005% in fifteen developed countries. This result assures that even our findings for FDI, are

quite low, they still have empirical support. As a result, the FDI effect varies not only between developed and developing countries but also within the developed country groups.

Finally, the unemployment effect is found significant only in Sample 3 and Sample 6.¹⁹ However, the sign of the effects are the opposite of what we expected. Since our main purpose to investigate the FDI and openness effect, we can leave this problem out of our interest.

7. SUMMARY AND CONCLUSIONS

The aim of this thesis is to analyze the trade and FDI effect on wages in the twenty developed OECD countries with panel data approach. During the estimations, we divided countries into six different sample groups according to their geographical location. As explanatory variables openness ratio, inward FDI stock, labour productivity and unemployment rate are used to explain the effects on wages. The methodology introduced by Onaran and Stockhammer (2006) is followed in the estimation procedure, where we replaced the ratio of export and imports to GDP with openness ratio as in Majid (2004). Moreover, two estimation equations are introduced, where in the first specification the effect of the openness on the wages are measured. In the second specification, all the explanatory variables are included to the estimation.

The relationships between wages and explanatory variables are investigated with empirical research. The main contribution of this research is to analyzing the wage and trade relation with cointegration analysis since cointegration and thereby unit root analyses are missing in the analyses of both Onaran and Stockhammer (2006) and Majid (2004). First of all, stationarity of the variables in every sample are tested with Breitung panel unit root tests. For the variables that are not integrated order 1, $I(1)$, alternative test methods are performed. Except the unemployment rate for Sample 1 and Sample 2, all the panel series of variables are found non-stationary. Then, cointegration between wages and explanatory variables, which are found non-stationary, are tested with Kao panel cointegration test according to the specified models. For the non-cointegrating samples, we have performed Pedroni panel cointegration test. The results indicate that except the first specification of Sample 1, a long-run relationship exists between wages and

¹⁹ Since unemployment is stationary in Sample 1 and Sample 2, it is not included in the estimations for these two groups.

explanatory variables. Moreover, this cointegration relation removes the spurious regression problem in the estimation process.

The results from the first specification indicate that openness has a significant and positive effect on the wages in all samples except Sample 5. Moreover, the greatest effect occurs in the groups of the Mediterranean countries. In the second specification, all the explanatory variables are included to the model. The estimation results show that except Sample 1, openness still has a positive and significant effect on wages, while in Sample 5 the effect is again insignificant. On the other hand, labour productivity has a positive and significant impact on wages in all samples.

Although inward FDI stock is significant in all samples except in Sample 5, the sign of the effect differs among samples. Moreover, the size of the effect is quite small which shows that although it is significant FDI do not play a high role in the wages. On the other hand, for unemployment we have found a surprising effect, where it is only significant in Sample 3 and Sample 6. However, the effects are negative that is not promising since any increase in the unemployment is expected to lower the bargaining power of the labours, which decreases the wages.

To sum up, trade and FDI movements have significant effects on wages. However, the effect of trade appears more effective than FDI on wages. The rapid increase in the FDI does not influence the wages as expected. Since the developed countries prefer to operate in developing countries due to low cost of production, it is better to analyze the developing countries in order to see the direct effect of FDI. Moreover, working with the sector-specific data differentiated according to skilled-unskilled or capital-labour intensity may give more promising results. Due to lack of adequate data, we will leave this analysis to the future.

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APPENDIX

1. Data Conversion and Creation of Wages

Country	Method	Years, Missing Data in ILO
Australia	Manufacturing wage index	1997, 1999, 2001, 2003 and 2005
	Men to Total	1977-1981
Austria	Manufacturing wage index	2004, 2005 and 2006
	Men to Total	1996-2003
Canada	-	-
Denmark	Interpolation	1993, 1994
Finland	Monthly to hourly	1995-2006
France	Manufacturing wage index	1998-2006
Greece	Manufacturing wage index	1998-2006
Ireland	Exchange Rate	1996-2006
Italy	Manufacturing wage index	1988-1990
Japan	Monthly to hourly	1994-2006
Korea	-	-
Netherlands	Exchange Rate	2001-2005
	Manufacturing wage index	2006
New Zealand	-	-
Norway	Monthly to hourly	1999-2006
Portugal	Monthly to hourly	1998, 1999
	Manufacturing wage index	2003-2006
Spain	Exchange Rate	2001-2006
Sweden	-	-
Switzerland	Interpolation	1995, 1997, 1999, 2001, 2003 and 2005
UK	Men to Total	1975-1981
USA	Manufacturing wage index	2003-2006

Since Canada, Korea, New Zealand and Sweden have the complete data for the given period, there is no conversion or change made in the data.

2. Panel Unit Root Test Results

Table 9. Panel Unit Root Results of Sample 1

Sample 1				
series	test	t-value	p-value	Ho= There is Unit Root A=Accept Null, R=Reject Null, at 5%
W	ct	-0.43082	0.3333	A
	ct,1	-8.57114	0.0000	R
U	ct	-2.59673	0.0047	R
	ct,1	-6.39327	0.0000	R
LP	ct	2.98337	0.9986	A
	ct,1	-6.65515	0.0000	R
FDI	ct	4.16341	1.0000	A
	ct,1	-3.24530	0.0006	R
OPEN	ct	1.23769	0.8921	A
	ct,1	-7.88076	0.0000	R

Table 10. Panel Unit Root Results of Sample 2

Sample 2				
series	test	t-value	p-value	Ho= There is Unit Root A=Accept Null, R=Reject Null, at 5%
W	ct	-1.52814	0.0632	A
	ct,1	-9.06902	0.0000	R
U	ct	-1.75659	0.0395	R
	ct,1	-5.13043	0.0000	R
LP	ct	2.71957	0.9967	A
	ct,1	-5.01794	0.0000	R
FDI	ct	4.57484	1.0000	A
	ct,1	-1.95625	0.0252	R
OPEN	ct	0.51617	0.6971	A
	ct,1	-6.58374	0.0000	R

Table 11. Panel Unit Root Results of Sample 3

Sample 3				
series	test	t-value	p-value	Ho= There is Unit Root A=Accept Null, R=Reject Null, at 5%
W	ct	2.66872	0.9962	A
	ct,1	-0.79581	0.2131	A
	ct,2	-2.74726	0.0030	R
U	ct	-0.22301	0.4118	A
	ct,1	-4.79477	0.0000	R
LP	ct	-0.44232	0.3291	A
	ct,1	-5.74916	0.0000	R
FDI	ct	1.59311	0.9444	A
	ct,1	-1.09493	0.1368	A
	ct,2	0.05026	0.5200	A
OPEN	ct	2.09586	0.982	A
	ct,1	-5.97766	0.000	R

Wages are found I(2) and FDI is found non-stationary for tests with first and second difference for Sample 3. By employing alternative tests, these variables are found I(1).

Table 12. Alternative Panel Unit Root Test Results For Wages and FDI in Sample 3

Alternative Panel Unit Root Test Results For The First Difference of Wages			
Method	t-value	p-value	Ho= There is Unit Root A=Accept Null, R=Reject Null, at 5%
Levin, Lin & Chu t*	-4.84029	0.000	R
Im, Pesaran and Shin W-stat	-5.42423	0.000	R
ADF - Fisher Chi-square	33.9657	0.000	R
PP - Fisher Chi-square	43.354	0.000	R

Alternative Panel Unit Root Test Results For The First Difference of FDI			
Method	t-value	p-value	Ho= There is Unit Root A=Accept Null, R=Reject Null, at 5%
Levin, Lin & Chu t*	-5.46272	0.000	R
Im, Pesaran and Shin W-stat	-5.78752	0.000	R
ADF - Fisher Chi-square	53.7954	0.000	R
PP - Fisher Chi-square	75.7614	0.000	R

Table 13. Panel Unit Root Results of Sample 4

Sample 4				
series	test	t-value	p-value	Ho= There is Unit Root A=Accept Null, R=Reject Null, at 5%
W	ct	1.82515	0.9660	A
	ct,1	-2.85445	0.0022	R
U	ct	-1.23382	0.1086	A
	ct,1	-2.09240	0.0182	R
LP	ct	3.29811	0.9995	A
	ct,1	-2.81988	0.0024	R
FDI	ct	2.26151	0.9881	A
	ct,1	-1.90947	0.0281	R
OPEN	ct	1.60686	0.946	A
	ct,1	-2.45918	0.007	R

Table 14. Panel Unit Root Results of Sample 5

Sample 5				
series	test	t-value	p-value	Ho= There is Unit Root A=Accept Null, R=Reject Null, at 5%
W	ct	2.31609	0.9897	A
	ct,1	-1.02439	0.1528	A
	ct,2	-8.93254	0.0000	R
U	ct	-1.45506	0.0728	A
	ct,1	-1.94744	0.0257	R
LP	ct	0.34537	0.6351	A
	ct,1	-4.90251	0.0000	R
FDI	ct	3.13722	0.9991	A
	ct,1	-1.07896	0.1403	A
	ct,2	-0.55502	0.2894	A
OPEN	ct	1.15718	0.8764	A
	ct,1	-2.75725	0.0029	R

Wages are found integrated order 2, I(2) and FDI is found non-stationary for tests with first difference and second difference for Sample 5 as for Sample 3. By employing alternative tests, these variables are found I(1).

Table 15. Alternative Panel Unit Root Test Results For Wages and FDI in Sample 5

Alternative Panel Unit Root Test Results For The First Difference of Wages			
Method	t-value	p-value	Ho= There is Unit Root A=Accept Null, R=Reject Null, at 5%
Levin, Lin & Chu t*	-2.14983	0.0158	R
Im, Pesaran and Shin W-stat	-2.57195	0.0051	R
ADF - Fisher Chi-square	16.5493	0.0111	R
PP - Fisher Chi-square	20.3002	0.0024	R

Alternative Panel Unit Root Test Results For The First Difference of FDI			
Method	t-value	p-value	Ho= There is Unit Root A=Accept Null, R=Reject Null, at 5%
Im, Pesaran and Shin W-stat	-3.51945	0.0002	R
ADF - Fisher Chi-square	21.4556	0.0015	R
PP - Fisher Chi-square	22.2299	0.0011	R

Table 16. Panel Unit Root Results of Sample 6

Sample 6				
series	test	t-value	p-value	Ho= There is Unit Root A=Accept Null, R=Reject Null, at 5%
W	ct	4.95484	1.0000	A
	ct,1	-2.58437	0.0049	R
U	ct	1.59851	0.9450	A
	ct,1	-5.04724	0.0000	R
LP	ct	2.83846	0.9977	A
	ct,1	-2.83385	0.0023	R
FDI	ct	1.10208	0.8648	A
	ct,1	-0.89275	0.1860	A
	ct,2	-0.82155	0.2057	A
OPEN	ct	-0.25817	0.3981	A
	ct,1	-5.13754	0.0000	R

For Sample 6, only FDI is found non-stationary for tests with first difference and second difference. However, after testing with alternative methods, FDI is found I(1), too.

Table 17. Alternative Panel Unit Root Test Results For FDI in Sample 6

Alternative Panel Unit Root Test Results For The First Difference of FDI			
Method	t-value	p-value	Ho= There is Unit Root A=Accept Null, R=Reject Null, at 5%
Levin, Lin & Chu t*	-4.34505	0.000	R
Im, Pesaran and Shin W-stat	-5.14048	0.000	R
ADF - Fisher Chi-square	32.0307	0.000	R
PP - Fisher Chi-square	40.9465	0.000	R