

# Evaluation of the impact of economic openness on labour productivity in EU countries

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**Abstract:** With the growing economic integration, globalization, international openness and regionalization, more and more significance is given to competitiveness improvements not only of individual countries but also of groups of countries as a unit. Ability to identify issues of competitiveness improvement in a country or group of countries, approaches of solving such issues and a level of settlement of these issues contribute in the social and economic rate of a region and living standards of its population. One of the most relevant indicators reflecting competitiveness of national or regional economy is productivity. However, labour productivity is among those quantities that have a negative impact on the competitiveness of the EU as a group of countries. To ensure the growth of average labour productivity in EU, it is essential to look for methods and tools helping to prompt productivity in the countries demonstrating low labour productivity. In the light of globalization, one of the factors causing changes in labour productivity of both EU and other countries could be economic openness. Therefore, the aim of the study is to evaluate the impact of economic openness on labour productivity of EU-28 countries.

To achieve the objective, this article reveals the concept of economic openness, identifies indices reflecting economic openness at the theoretical level, and presents the theoretical model of the impact of economic openness on productivity. Having analysed the existing approaches to economic openness, the study is conducted from the perspective of the most popular one stating that economic openness involves trade openness and financial openness. If the presumption that the impact of economic openness on labour productivity may differ in countries of different productivity is accepted, then EU countries can be distributed into two clusters: relatively high and relatively low labour productivity. Afterwards, EU countries are divided into clusters based on indices of trade intensity and FDI intensity. The comparison of the countries falling into the clusters revealed denies the presumption that the countries with higher economic openness are more open. This theory also fails when the countries are ranked according to indicators of labour productivity and economic openness; however, after composing the multiple regression model and introducing pseudo variables, it is established that the impact of FDI intensity on labour productivity is statistically significant, and is observed both in the cluster of relatively high labour productivity and in the cluster of relatively low labour productivity. The impact of trade openness on labour productivity of EU countries has not been confirmed; thus, to achieve growth of labour productivity, financial openness shall be prompted in EU countries.

*Keywords: labour productivity, economic openness, trade openness, financial openness*

JEL: F40, J24

## 1. Introduction

With the growing economic integration, globalization, international openness and regionalization, more and more significance is given to competitiveness improvements not only of individual countries but also of groups of countries as a unit. Ability to identify issues of competitiveness improvement in a country or group of countries, approaches of solving such issues and a level of settlement of these issues contribute in the social and economic rate of a region and living standards of its population (Mačiulytė-Šniukienė and Paliulis 2011). One of the most relevant indicators reflecting competitiveness of national or regional economy is productivity. According to Blinder and Baumol (1993), nothing can reduce poverty rates, increase leisure quality and ability of a country (and/or region) to finance its education system, health care, environmental safety and art better than the growth of productivity. Other authors (Saari 2006; Gomez-Salvador 2006; Bagley 2006; Frankel et al. 2008) also agree that ability of a country or region to improve living standard depends on its ability to prompt productivity and efficiency growth. It should be noted that the total factor – land, labour and capital – productivity or individual factor productivity may be calculated. According to Bagley (2010), a number of authors suggest using labour productivity as the quantity reflecting wellness of the economy. As observed by Rilley (2012), higher labour productivity can lead to lower average costs, higher profits, higher wages, improved competitiveness, and trade performance and economic growth.

According to Parham (n.s.), the benefits of labour productivity growth can be distributed in a number of different ways: to the workforce through better wages and conditions; to shareholders and superannuation funds through increased profits and dividend distributions; to customers through lower prices; to the environment through more stringent environmental protection; and to governments through increases in tax payments (which can be used to fund social and environmental programs). This verifies the significance of labour productivity in order to secure competitiveness of a region or group of countries and life quality improvement. Namely, labour productivity, however, is among those quantities that have a negative impact on the competitiveness of the European Union (EU) as a group of countries. In 2012, the average of labour productivity of EU member-states, expressed in the added value per employee, was 32,1 EUR per hour worked, with 44,5 EUR per hour worked in the USA, meanwhile. To ensure the growth of average labour productivity in EU, it is essential to look for methods and tools helping

to prompt productivity in the countries demonstrating low labour productivity. It is notable that in Bulgaria, one of the countries of the lowest productivity, labour productivity in 2012 was 12 times lower than in Luxemburg, the country of the highest labour productivity; although, the comparison of the data in 2000 shows that labour productivity in Bulgaria has grown to 2.4 EUR per hour worked. Achievement of productivity growth requires, first, identification of factors effecting labour productivity in EU member-states.

In the light of globalization, one of the factors causing changes in labour productivity of both EU and other countries could be economic openness. As marked in Document of UK Department for Business, Innovation and Skills (BIS) “Economic Openness and Economic prosperity” (2011), economic openness is an important driver of economic prosperity. Interrelations between productivity (most often total factor productivity or/and labour productivity) and economic openness has been investigated by a number of authors (Liu et al. 2000; Kimura and Kiyota 2006; Anderson and Babula 2008; Damijan, de Sousa and Lamotte 2009; Driffield, Love and Taylor 2009; Wang 2010; Arisoy 2012; Sacha 2012; Yasin 2012; Harris and Moffat 2013.), but their results are controversial. They depend on the country situation, study level (micro, sectoral, macro), data sample and studied period, as well as on indicators of economic openness employed in the study and its methods. Therefore, the generalization that the degree of economic openness determines the level of labour productivity is not possible if based on the results of retrospective studies – case studies of a certain country or group of countries are necessary. Considering the above, there have been interrelations between labour and economic openness of EU-28 member-states chosen as the study object.

The aim of the study is to evaluate the impact of economic openness on labour productivity of EU-28 countries. Objectives of the study:

1. To ground the impact of economic openness on labour productivity in the theoretical level;
2. To establish a measurement model for the impact of economic openness on labour productivity based on retrospective researches;
3. To analyse the interrelation between economic openness and labour productivity in EU-28 countries taking the period 2001 to 2010.

The study methods: scientific literature review, comparison and interpretation; data classification and grouping, ranking, comparative analysis; statistical methods: average calculation, clustering, correlation and regression analysis.

## 2. The theoretical grounds for the impact of economic openness on labour productivity

To ground the impact of economic openness on labour productivity of countries at the theoretical level, it is essential, first, to define the concept of economic openness and to identify indicators reflecting economic openness. As described by Whitman (1969), the concept of economic openness is closely associated with the concept of economic integration and, in the author's opinion, with economic globalization. The major features of economic globalization include the growing integration of goods, labour and capital markets and strengthening role of business (DFI, mergers and acquisitions, and etc.) Thus, it could be stated that the concept of economic openness does also interact with the concept of economic liberalization.

Having studied the definitions of open economy given in scientific publications and dictionaries of economic terms, the following three main approaches to the phenomenon of economic openness could be highlighted (see Table 1).

**Table 1. Main approaches to economic openness**

Approach	Description	Followers
1. Economic openness = on the international trade scale	Economic openness degree is judged according to export and import flows, their part in GDP or according to other indicators reflecting international trade	Pearce (1992), Rodriguez (2000), Andersen and Babula (2008), Debroy (2009).
2. Economic openness = on the international trade and capital movement scales	Economic openness is associated with not only international trade but also with international capital flow	Whitman (1969), Combes et al. (n.s.), Wolf et al. (1999), Gregory (2007), Andersen and Babula (2008), Yasin (2012).
3. Economic openness = on the international trade, capital movement and labour movement scales	Economic openness is associated with international trade, international capital flow and free labour flow crossing borders of the national economy.	Blanchard (2006), Debroy (2009)

Source: authors' own elaboration

Pearce (1992), a representative of Approach One, states in Macmillan Dictionary of Modern Economics that open economy is an economy participating in international trade. According to this author, the degree of economic openness is approximately equal to the part of foreign trade sector in the Gross Domestic Product (GDP). Another follower of the same approach Debroy (2009) notes that "open economy: Economy where international trade is fairly large when compared to national income." Nevertheless, he also points into the fact that the term

“open economy” is also used for an economy where international trade and payment and cross-border movements of labour and capital are free from restrictions. Therefore, it partially represents Approach Three, too.

The representatives of Approach Two, Combes et al. (n.s.) and Wolf et al. (1999), agree that the openness of an economy divides in to two main parts: Trade openness and Financial openness (or openness to foreign investment). According to Muzaparova (2005), financial openness is the degree of international mobility of capital, i.e., financial openness is reflected by the degree of the integration of financial markets into the global financial system. Financial openness is usually valued based on common financial flows. As marked by Gregory (2007), an open economy is an economy in which there are economic activities between domestic community and outside, e.g., people, including businesses, can trade in goods and services with other people and businesses in the international community (Trade openness), and flow of funds as investment across the border (Financial openness).

As alleged by the advocates of Approach Three, economics openness covers not only mobility of goods, services and capital but also mobility of labour force. For instance, Blanchard (2006) states that an open economy is “an economy that places few restrictions on the movement of capital, labour, foreign trade, and payments into and out of the country.” He also supports the approach that economic openness includes three different fields: goods market openness, financial market openness and production resource (labour and capital) market openness. He explains that goods market openness means that consumers and enterprises may choose from goods manufactured in their country or abroad; financial market openness indicates that financial investors are provided with possibilities to choose from national financial assets or foreign financial assets, and labour resource market openness signifies that enterprises are able to decide on a production place, and employees – on a working place. However, Blanchard notes in addition that the role of production market openness in short-term and medium term perspective is much significant to compare with the role of goods or financial market openness. Taking this into account, economic openness in the present study is treated as goods market openness (also known as Trade openness) and financial market openness (also known as Financial openness). Accepting this attitude, a further goal is to set out the most proper indices to measure Trade Openness and Financial openness.

According to Combes et al. (n.s.), trade openness is generally calculated by the ratio of the sum of export and import to GDP  $(X+M)/GDP$ . It is often the case that the ratio of exports only to GDP is preferred: indeed, the ratio of imports to GDP is less sure in the interpretation as it can be reduced by protectionist policy as well as by increased competitiveness. According to these authors, observed financial openness can be defined in many ways. The most comparable to the indicator of commercial openness is the ratio of capital flows to GDP, either using only the entries, that is, gross flows (in a similar way to the rate of exports), or the sum of entries and outgoings (similar to the sum of the rates of exports and imports), but naturally not the net flows which mean nothing with respect to openness. In their research, as the financial openness index, the authors use the ratio of the sum of annual flows (both assets and liabilities) of capital as direct investments and portfolio investments to GDP.

Yasin (2012) measures economic openness differently: 1) by the sum of import and exports as per cent of GDP, and 2) by the sum of import, export, and capital inflows expressed as per cent of GDP. The author found that the results are invariant with the type of trade openness measure. In other words, there is no statistical difference between the results obtained when trade openness is measured by the sum of exports plus imports, or when it is measured by the sum of exports, imports and capital inflows. Rodriguez (2009), in the article “On the Degree of Openness of an Open Economy”, measure economic openness by the ratio of international trade turnover and GDP, i.e.,  $(E+I)/GDP$ . Wolf et al. (1999) divide Economic Openness into Openness in Trade and Openness in Investment (FI). The authors rank five studied countries (country groups – the United States, European Union, Japan, China, and South Korea) according to 10 dimension of Trade Openness and 10 dimension of Investment Openness. The dimension of Trade openness includes: (1) import control, (2) technical and environmental standards, (3) testing and certification, (4) product licensing, (5) entry, (6) distribution network, (7) ownership requirements for bidding on government contracts, (8) openness in bidding on non-defense contracts, (9) openness in bidding on defense-related contracts, (10) protection of intellectual property rights. The dimension of Foreign investment is attributed the following: (1) investment climate, (2) transparency of FI regulations, (3) legal protection of FI, (4) control on merges and acquisitions, (5) approval of FI, (6) foreign ownership of local firms, (7) board participation and voting rights of foreign investors, (8) performance requirements for FI, (9) remittance of dividends and profits, (10) foreign ownership of land.

Having analysed retrospective researches, Yanikkaya (2002), discusses several methods of measuring economic openness in his article. When studying interrelations of economic openness and economic growth, however, he measures trade intensity, as a number of other authors, by the ratio of trade turnover (X+M) and GDP. Still, as additional variables reflecting economic openness, he employs import penetration ratios, exports shares in GDP. To assess whether the growth effects of trade with developed and with developing countries are different from one another, authors used two more measures of trade intensity ratios—trade with OECD countries and trade with non-OECD countries. OECD in Science, Technology and Industry Scoreboard 2011, Trade openness is also measured as exports and imports as a percentage of Gross Domestic Product (GDP).

Analysis of other sources leads to the conclusion that the most common measurement for Trade openness is the ratio of exports plus imports to GDP (Frankel and Romer 1996; Easterly and Levine 2001; Alcalá and Ciccone 2004, Dollar and Kraay 2004; Lee et al. 2004; Loko et al. 2009). Other authors employ other indicators: Export, Import, jointly or individually (Bonelli 1992; Bodman 1996; Riezman et al. 1996; Awokuse 2007), Ratio of export to GDP or/and Ratio of import to GDP (Austria 1998; Miller and Upadhyay 2000). The authors claim that the later indices reflect export and import flows or their intensity, but fail to demonstrate Trade openness in full. On this account, the authors of the present study will measure Trade openness by the index of international trade intensity: the ratio of export plus import to GDP.

In scientific publications, Financial openness is mostly measured using the FDI flows indicators (Inward FDI and/or Outward FDI, or Inward FDI plus Outward FDI (Kimura and Kiyota 2006; Bijsterbosch and Kolasa 2010; Liu et al. 2010; Wang 2010; Yasin 2012, Sannasee et al. 2013). But, to follow the study consistency and seeking for compatibility of trade openness and financial openness indices, the study will employ FDI intensity index (Ratio of Inward FDI plus Outward FDI to GDP) to measure financial openness in the study.

When the concept of economic openness is defined and indices for its measurement are identified, it is further sought to theoretically base the impact of economic openness on labour productivity. Since it has been established that economic openness encompasses trade openness and financial openness, there will be those channels namely discussed through which the impact of foreign trade and financial capital flows on productivity is actualized. The links of trade openness and productivity are discussed first.

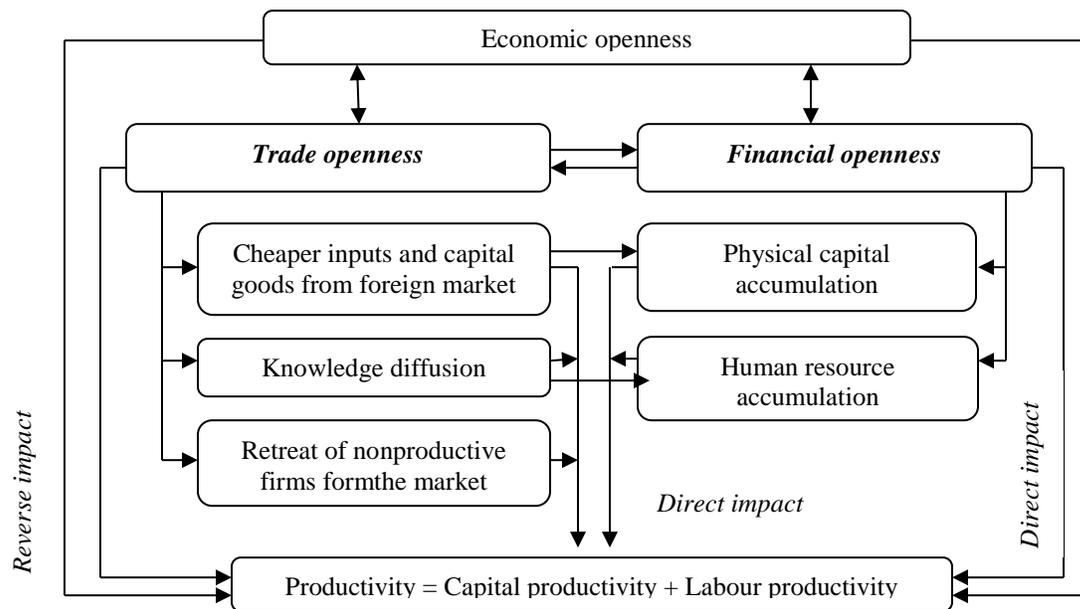
Muendler (2004) in his study has talked about three channels through which trade breeds productivity. Firstly, trade intensifies competition in the product market which compels the producers to innovate for surviving from which productivity gain is also expected. It is termed as “competitive push”. Secondly, through trade an economy can avail cheap inputs and capital goods from foreign markets which allows it to adopt new methods of production and substitute the factors which relatively more expensive. It leads to the creation of capital, destruction of jobs and increase in productivity, known as ‘foreign input push’. Thirdly, observed only at the industry and/or sector level, termed as ‘competitive elimination’ where increased foreign competition forces the least efficient firms to close down while the more efficient ones gain market share, hence raising average productivity.

As indicated by Parteka and Wolszczak-Derlacz (2013), firm-level analysis focusing on exporters reveals that exporters’ higher productivity can show up through different channels: 1) “self-selection”—exporters already had higher productivity before they entered foreign markets, and consequently their higher post-entry productivity is observed and often misinterpreted as the causal effect between exporting activity and productivity; 2) “learning by exporting”—exporters’ performance is improved over time through the learning process because firms that enter into export markets gain new knowledge and expertise, which allows them to improve their efficiency level; 3) intra-industry (or inter-firm) reallocation toward exporting firms; or 4) the shutdown of lower-productivity firms due to enhanced competition in the market.

Andersen and Babula (2008), when discussing the impact of openness on the growth of economy, states that there exist two main sources for economic growth, such as capital accumulation (physical and human) and productivity growth. According to the authors, openness may affect both. First, openness to international flows of capital may raise the speed at which physical capital and human capital are accumulated locally (at least temporarily). Second, openness, expressed by capital flows, may speed up productivity growth through faster technological progress.

Additionally, Andersen and Babula (2008) highlight that International trade may affect the growth rate of productivity through three channels: 1) it gives access to foreign intermediate inputs or, implicitly, technologies; 2) it expands the market size for new product varieties; and 3) it facilitates the international diffusion of general knowledge.

In quite a similar way, correlations of trade openness and productivity are described by other authors (Borensztein et al. 1998; Djankov and Hoekman 2000, Liu et al. 2000; Kimura and Kiyota 2006; He Ng 2007; Driffield et al. 2009; Wang 2010). Links between financial openness and productivity have also been discussed at the theoretical level by a number of authors (Nowbutsing n.s.; Borensztein et al. 1998; Liu et al. 2000; Bosco 2001; Galiniene 2007; Wang 2010). As observed by Liu et al. (2000), the impact of FDI on productivity can either be direct or indirect. As noted authors, inward FDI is associated with the introduction of additional capital and new production and managerial skills that have a direct effect on productive efficiency. FDI also provides indirect effects by knowledge diffusion. It might be said that similar impact channels are also specified by Bosco (2001). She claims that FDI contributes to economic growth through capital accumulation in the recipient economies and, through knowledge transfer, through labour training and skill acquisition. Wang (2010) points out that when foreign-owned affiliates operate in a host economy, those affiliates interact with other firms in the same industry through imitation and competition, with firms in upstream industries through purchasing intermediate inputs, and with firms in downstream industries through selling products to them. Through these intra- and inter-industry economic linkages, FDI generates spillover effects to the local economy.



**Figure 1. Channels of economic openness contribution to productivity**

Source: authors' own elaboration

It is worth noting, in addition, that there exists a bilateral link between two constituents of economic openness – trade openness and financial openness. From the point of view of Galiniene et al. (2007), direct foreign investments found the basement for trade. The authors established that in evaluations the theoretical connection model where the following four elements of the connection between trade and direct foreign investments are defined is acceptable: Replaceability, Complementarity, Market expansion and Trade generating. Considering the presented approaches, it is possible to create the theoretical model of the impact of economic openness on productivity (see Fig. 1).

The model shows that economic openness, including trade and financial openness, effects productivity (common, capital and labour), directly and indirectly, through the channels above; however, the reverse impact is observed when changes in productivity influence economic openness.

### 3. Review of results of retrospective researches and the measurement model for the impact of economic openness on labour productivity

The theoretical grounds of the impact of economic openness on productivity are further followed by the review of retrospective researches on correlations of economic openness and labour productivity, employed methods and their results. Such analysis enables a partial empirical basis for the impact of economic openness and identification of key indicators that could be used to measure economic openness and form the measurement model for the impact of economic openness on labour. By virtue of the fact that it is agreed to follow the approach that economic openness involves financial openness and trade openness, researches on capital movement scale and productivity, goods and service movement scale and productivity are discussed separately. Sannassee et al. (2013) investigate relationships between financial openness (expressed by FDI flows) and labour productivity using “productivity spillover model”:  $VAL = F(FDI, HC, TG, RD, OPNS, CI)$ . The authors converted all the variables in logarithmic terms and expressed regression equation as:  $LVAL = \alpha_0 + \beta_1 LFDI_{xt} + \beta_2 LH C_{xt} + \beta_3 LTG_{xt} + \beta_4 LRD_{xt} + \beta_5 LOPNS_{xt} + \beta_6 LCI_{xt} + U_{xt}V$ , Where, LVAL: Log of Value Added per Labour; LFDI: Log of FDI; LHC: Log of Human Capital; LTG: Log of Technology Gap; LRD: Log of Research & Development; LOPNS: Log of Trade Openness; LCI: Log of Capital Intensity;  $\beta_1$  to  $\beta_6$ : Parameter estimates and;  $U_{xt}$ : The error term. As dependent variable authors used labour productivity expressed by value added in the country to the total labour force. In this investigation author used 1981-2009 period dates.

As for the sample selection, the 20 countries selected were disaggregated into 2 samples: one sample of 10 developed/emerging countries (USA, China, France, UK, Germany, India, Brazil, Canada, Spain and Mexico) and a second sample of 10 developing/least developed. The findings of this study give evidence of positive and significant spillovers from FDI only for the sample of developed/emerging countries in the short run. But same could not be sustained in the long run. Furthermore, as a spin-off from the model, human capital and trade openness are seen to be important determinants of FDI for both developed/emerging countries and developing/least developed countries. Results of other authors studying relations between financial openness and productivity are structured in Table 2.

The connections between trade openness studied many researchers. Yesin (2012) examined the relationship between trade openness and labour productivity in manufacturing industries in the United States. An empirical model was developed to estimate the effect of trade openness on the aggregate productivity of labour using time-series data. The regression results suggest that trade openness has a positive and significant effect on labour productivity in manufacturing. The results of researches on trade openness and productivity found by other authors are given in Table 3.

As given in Tables 2 and 3, the results of researches on trade openness and productivity, financial openness and productivity are controversial. They depend on the situation a particular country is in, the research level (micro, sectoral, macro), data sample and studied period, as well as on economic openness indicators and methods used in a research. It should be noted that when investigating correlation between trade openness and financial openness, the authors mainly employed the following methods: linear regression, cross section regression, and panel date model. Considering that one of the aims of the paper is to identify the impact of economic openness on labour productivity in two clusters of EU countries (relatively low labour productivity and relatively high labour productivity), in this case the most proper model - multiple regression analysis, introducing pseudo variables – shall be used.

**Table 2. Review of retrospective researches on correlations of financial openness and labour productivity**

Authors	Study period	Research sample / level	The main results
Liu et al. (2000)	1996, 1997	Chinese electronic industry, 41 sub-sectors	FDI has a positive impact on labour productivity in the Chinese electronics industry. In terms of the relative magnitude of the impact on labour productivity, the human capital variable was the most important determinant, followed by firm size and then foreign presence (FDI) in 1996. However, because of a significant drop in the number of engineers, the human capital variable was not statistically significant.
Van Pottelsberghe et al. (2001)	1971–1990	13 developed countries, macro level	They find a positive long-run relationship between the foreign R&D capital stock weighted by outward FDI and domestic total factor productivity, implying that outward FDI into R&D-intensive countries indeed has beneficial effects upon home-country productivity by transferring technological knowledge from the host country.

Authors	Study period	Research sample / level	The main results
Kimura and Kiyota (2006)	1994–2000	Japanese, firm-level	Outward FDI increases firm productivity. More specifically, their results suggest that firms engaging in outward FDI experience, on average, productivity growth 1.8% higher than domestic firms not engaging in outward FDI.
Bitzer and Kerekes (2008)	1973 and 2000	17 OECD countries	The interaction between foreign R&D capital and outward FDI is negatively associated with domestic productivity in non-G7 countries; for the G7 the evidence of R&D spillovers through outward FDI is not significant.
Driffield et al. (2009)	1978–1994	UK, industry level	They find that FDI generate productivity growth in the UK, suggesting that technology-sourcing and efficiency-seeking FDI increase domestic productivity.
Wang (2010)	1973-1997	Canadian manufacturing industries	FDI generates strong effects on total factor productivity (TFP) growth through both forward and backward inter-industry linkages, and increase in an industry's absorptive capacity raises the effects of FDI on TFP growth through forward inter-industry linkages.
Herzer (2012)	1980-2008	Germany, macro level	The evidence presented here suggests that outward investing firms combine home production with foreign production to reduce costs and to increase their competitiveness both internationally and domestically. This benefits the entire domestic economy due to the increased productivity of the investing firms and the associated productivity spillovers to local firms.
Huang et al. (2013)	2000-2005	Taiwan firms (electronic and non-electronics)	The empirical finding suggests that productivity effect caused by investing in developing countries remains significantly positive. A lagged productivity-enhancing effect is also found after FDI in developed countries for both electronics and non-electronics firms.
Harris and Moffat (2013)	1997-2008	Britain, sectoral level	Foreign-owned plants contributed relatively more to aggregate productivity growth than UK-owned plants over the period. This strong performance is mostly the result of reallocations of output shares towards high productivity continuing plants and the opening of high productivity plants.

Source: authors' own elaboration

**Table 3. Results of retrospective researches on trade openness and labour productivity**

Authors	Study period	Research sample / level	The main results
Bonelli (1992)	1980–1985, 1975–1985	22 Brazilian manufacturing industries	The study shows positive association between export expansion and TFP growth. TFP growth is explained by variables related to export expansion and import change.
Frankel and Romer (1996)	1985	150 countries and a subsample of 98 countries	The results suggest that trade has a quantitatively large, significant, and robust positive effect on income.
Rodrik (1998)	1980–1989	23 OECD countries / macro level	Economic openness has influence on Governmental expenditures, and further causes changes in GDP.
Easterly and Lavine (2001)	1960–1995	73 countries, macro level	TFP residual, rather than factor accumulation, accounts for most of the cross-time variation in income and growth. Openness and back market exchange rate premium significantly correlated with economic growth.
Awokuse (2007)	1960–2000	Canada, macro level	The empirical results suggest that trade stimulates economic growth.
Alcala and Ciccome (2004).	n.s.	138 countries, industry level	International trade has an economically significant and statistically robust positive effect on productivity.
Damijan et al. (2009)	1995–2002	Firm-level data for six transition economies	Main findings: (i) foreign ownership has helped restructure and enhance the productivity of local firms in four out of six countries; (ii) exporting to advanced markets has a larger impact on productivity growth in four countries, especially when the firm's absorptive capacity is taken into account; (iii) in contrast, exporting to the less competitive markets of the former Yugoslavia seems to negatively affect productivity growth in three countries; and (iv) learning effects from importing are similar to those from exporting.
Yasin (2012)	1987–2010	US manufacturing industries	Trade openness has significant and positive impact on labor productivity in manufacturing at least at 1% significance level.
Saha (2012)	1961–2008	India / macro level	The econometric analysis reveals that trade openness as captured by the three measures - Trade-GDP, Export-GDP and Import-GDP ratio in India has affected TFP growth positively and significantly.

Source: authors' own elaboration

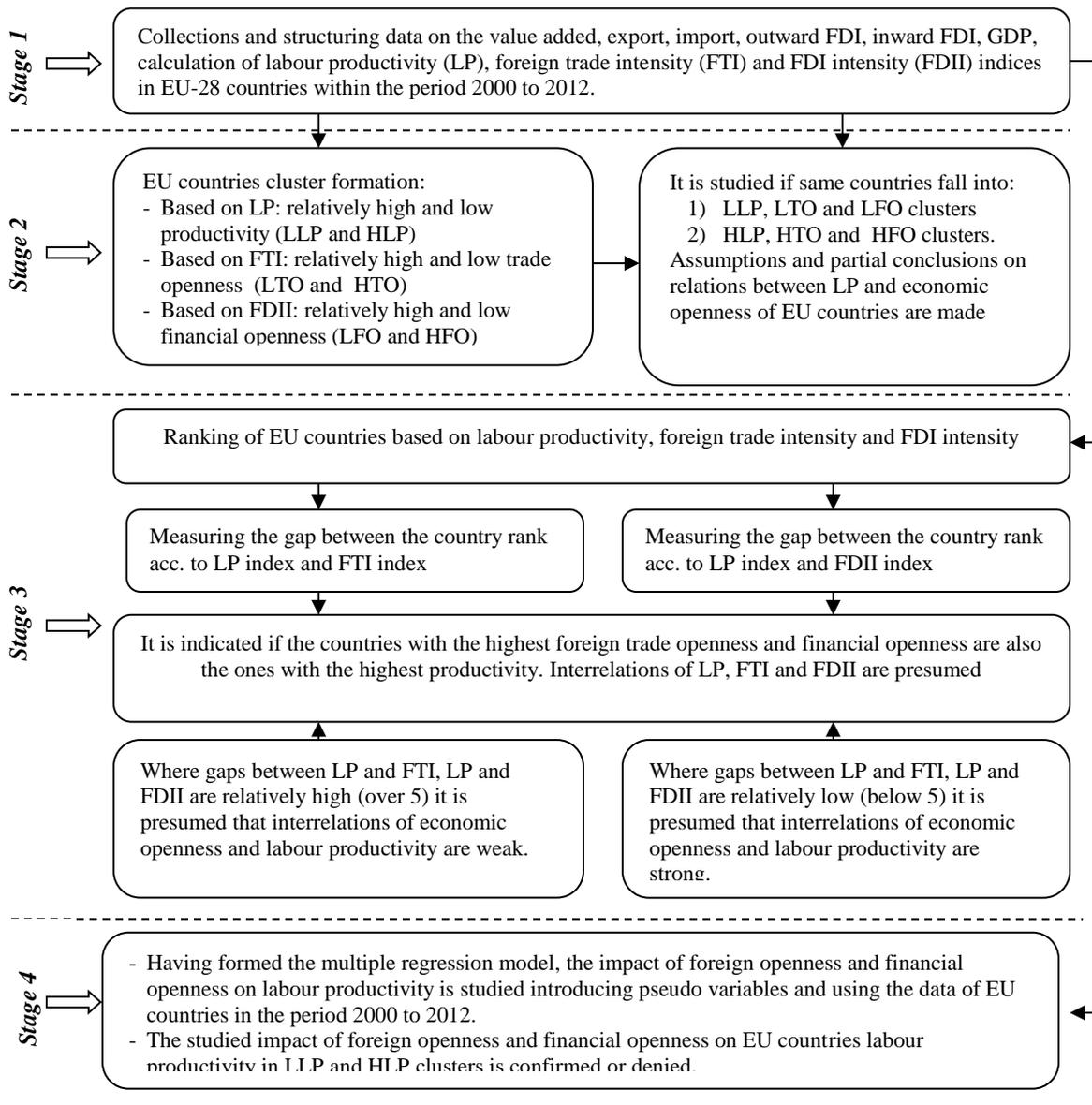
Having revealed the conception of economic openness and analysed of retrospective researches on interrelations between economic openness, incorporating trade openness and financial openness, and labour productivity, it was decided, in the present study, to use the Trade Intensity Index  $((\text{Export} + \text{Import})/\text{GDP}$  i.e.  $(E+M)/\text{GDP}$ ) to measure trade openness, and for financial openness FDI intensity index  $((\text{Inward FDI} + \text{Outward FDI})/\text{GDP})$  was employed.

Labour productivity at the national level is usually measured in four ways: 1) as the total value added (TVA) per one employee, 2) as the total value added (TVA) per one hour, 3) as the gross domestic product (GDP) per one employee and 4) as the gross domestic product (GDP) per one hour worked. The analysis of correlations between the mentioned indicators using the data of 2012 in EU countries led to the conclusion that there exist no essential difference in using TVA per employee or GDP per employee, since the correlation coefficient  $R$  in this case will be 0.98. Moreover, the use of either TVA per one hour worked or GDP per one hour worked makes no significant difference ( $R=0,99$ ).  $R$  reliability was validated using the sample  $t$  statistics with the reliability level of 95 per cent ( $\alpha=0.05$ ). Considering that, it was decided to measure labour productivity using TVA per one hour worked given that expressing productivity per hour worked will eliminate differences in the full-time/part-time composition of the workforce.

The first stage of the study (see Fig. 2) deals with data collection and structuring, calculation of indexes of labour productivity, international trade intensity and FDI intensity in EU-28 countries.

In the second stage, there are two clusters of EU-28 countries first distinguished, namely: clusters of EU countries with relatively high labour productivity (HLP cluster) and with relatively low labour productivity (LLP cluster). The countries are attached to a particular cluster using the cluster analysis, i.e. based on similarities in the sense of labour productivity. As remarked by Čekanavičius and Murauskas (2008), the aim of the cluster analysis is to distribute the object so that differences are as trifle as possible within the clusters and as big as possible between them. The object similarity is indicated with the metric distance unit – Chebyshev distance: The EU countries are divided into clusters, as it is presumed that labour productivity in countries with different productivity may be determined by different factors.

In the same (second) stage and in the same way, EU-28 countries are also grouped in clusters according to the FDI intensity index (FDII). Grouping results in clusters of EU countries with the relatively low trade openness (LTO cluster), with the relatively high trade openness (HTO cluster), with the relatively low financial openness (LFO cluster) and relatively high financial openness (HFO cluster). Distribution of EU countries into clusters separately according to labour productivity, foreign trade intensity (FTI) and FDI intensity (FDII) enables assumptions or partial conclusions on relations among these three indices.



**Figure 2. Measurement model for interrelations of economic openness and labour productivity in EU countries**

Source: authors' own elaboration.

In the third stage of the study, EU countries are ranked based on the aforementioned indices: LP, FTI and FDII; gaps between the rank of a country according to LP and the rank of a country according to FTI and FDII are measured. This enables identification if the countries with the highest foreign trade openness and financial openness are also the ones with the highest productivity. The fourth stage of the study is devoted to the analysis of the impact foreign

openness and financial openness on labour productivity of EU countries. Here the multi regression is employed choosing labour productivity as a dependent variable and trade intensity (X1) and FDI intensity (X2) – as independent variables. Since the goal is to establish if the independent variables determine labour productivity in the clusters of relatively low and high labour productivity, the following pseudo variables are introduced: market openness in countries of different labour productivity (X2) and direct foreign investment intensity in countries of different labour productivity (X4).

#### **4. Estimation of the influence of economic openness indices on the labour productivity in EU countries**

In the first stage of the study, the data of all 28 member-states of the European Union required to measure the studied indices - labour productivity per one hour worked (LP), foreign trade intensity (FTI) and FDI intensity (FDII), were collected and structured. The second stage is devoted to distinguishing clusters according to LP, FTI and FDII of EU-28 in 2000-2012, using the previously described methods. The clusters are arranged based on labour productivity, foreign trade openness and financial openness (see Table 4).

The cluster analysis of EU countries according to all three indices eliminated Croatia and Luxemburg from the further research. The reasons for such elimination were as follows: Croatia – not all data received were required for the research, Luxemburg – indices were much higher to compare with the rest countries. Thus, 26 EU remain in the study.

The cluster analysis results show that only three same countries - Belgium, Ireland and Netherlands – fall into HLP, HTO and HFO clusters; and only these three same countries - Poland, Portugal and Romania – fall into LLP, LTO and LFO clusters. Estonia stands out as it is attributed to the cluster of lower labour productivity based on labour productivity only, but economic openness indices move this country to the clusters of high trade openness and financial openness. This demonstrates economic openness of Estonia that influence on the growth of labour productivity is not significant.

**Table 4. Clusters of EU countries based on labour productivity, trade openness and financial openness**

Cluster	Attributed countries	Index value limits
<i>Based on labour productivity</i>		
LLP cluster	Bulgaria, Czech Republic, Estonia, Latvia, Lithuania, Hungary, Malta, Poland, Portugal, Romania, Slovenia, Slovakia	4.1 – 18.6
HLP cluster	Belgium, Denmark, Germany, Ireland, Greece, Spain, France, Italy, Cyprus, Netherlands, Austria, Finland, Sweden, United Kingdom	20.1 – 50.58
<i>Based on foreign trade intensity</i>		
LTO cluster	Denmark, Germany, Greece, Spain, France, Italy, Cyprus, Poland, Romania, Portugal, Finland, Sweden, United Kingdom	0.53 – 0.99
HTO cluster	Belgium, Bulgaria, Czech Republic, Estonia, Ireland, Latvia, Lithuania, Hungary, Malta, Netherlands, Austria, Slovenia, Slovakia	1.01 – 1.57
<i>Based on FDI intensity</i>		
LFO cluster	Czech Republic, Denmark, Germany, Greece, France, Italy, Latvia, Lithuania, Hungary, Austria, Poland, Portugal, Romania, Slovenia, Slovakia, Finland	0.79 – 3.3
HFO cluster	Belgium, Bulgaria, Estonia, Ireland, Spain, Cyprus, Malta, Netherlands, Sweden, United Kingdom	3.8 – 11.9

Source: composed by the authors according to Eurostat data of 2012

The results of the country distribution to clusters according to labour productivity, when countries are compared according to trade openness and financial openness, are completely opposite: the majority of countries distributed to HLP cluster according to labour productivity fall into LTO and LFO clusters based on other two indices. This indicates that trade openness and partially financial in the countries of high labour productivity are much lower. HTO cluster mainly includes the countries that belonged to LLP cluster based on LP, as the foreign trade intensity of the majority of countries is higher than 1, i.e., the sum of export and import in such countries is higher than their GDP. The preliminary conclusion is possible here that a minor impact of trade openness and financial openness on labour productivity is likely in the groups of countries with different levels of labour productivity.

To establish correlations of economic openness and labour productivity, in the third stage of the study, EU countries are ranked according to the studied indices: labour productivity and economic openness indices (trade openness and financial openness), and gaps between the country rank based on LP and the country rank based on FTI and FDII are calculated. Ranking is performed using indices of EU 26 countries in 2012 reflecting labour productivity and trade openness and financial openness (see Table 5).

**Table 5. Labour productivity, foreign trade intensity, direct foreign investment intensity and ranks of ES-26 countries according to these indices**

Country	LP	Rank acc. to LP	FTI	Rank acc. to FTI	Ranking gaps (LP and FTI)	FDII	Rank acc. to FDII	Ranking gaps (LP and FDII)	Ranking gaps (FTI and FDII)
<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>6</i>	<i>7</i>	<i>8</i>	<i>9</i>	<i>10</i>
Belgium	45.7	3	1.71	5	-2	4.8	4	-1	1
Bulgaria	4.8	26	1.38	11	15	2.2	10	16	1
Czech Republic	13.2	18	1.63	7	11	3	6	12	1
Denmark	52.6	1	1.08	14	-13	1.7	14	-13	0
Germany	42.6	7	0.96	17	-10	1.1	18	-11	-1
Estonia	11.2	21	1.94	2	19	5.5	3	18	-1
Ireland	50.4	2	1.68	6	-4	13.5	1	1	5
Greece	20.3	15	0.54	26	-11	0.5	23	-8	3
Spain	31.5	12	0.60	22	-10	0.9	20	-8	2
France	45.4	5	0.57	24	-19	1.2	17	-12	7
Italy	32.1	11	0.56	25	-14	0.2	24	-13	1
Cyprus	21.5	13	0.94	18	-5	2.1	12	1	6
Latvia	8.2	24	1.37	12	12	2.3	8	16	4
Lithuania	10.3	23	1.62	8	15	1.3	16	7	-8
Hungary	11.3	20	2.01	1	19	10.1	2	18	-1
Malta	14.5	17	1.86	3	14	-0.7	26	-9	-23
Netherlands	45.6	4	1.58	9	-5	1	19	-15	-10
Austria	39.5	8	1.09	13	-5	2.7	7	1	6
Poland	10.4	22	0.86	19	3	0.7	22	0	-3
Portugal	17	16	0.74	21	-5	2.3	8	8	13
Romania	5.4	25	1.01	15	10	0.8	21	4	-6
Slovenia	21.3	14	1.46	10	4	-0.4	25	-11	-15
Slovakia	12.8	19	1.85	4	15	1.5	15	4	-11
Finland	39.4	9	0.85	20	-13	2.2	10	-1	10
Sweden	44.9	6	0.97	16	-10	4.4	5	1	9
United Kingdom	39.4	10	0.59	23	-13	2	13	-3	10

Marking in Table 5:

<i>Colour</i>	<i>Meaning</i>
	Column 2 – low productivity country, 4 column – low trade openness country, 7 column – low financial openness country.
	Column 2 – medium productivity country, 4 column – medium trade openness country, 7 column – medium financial openness country
	Column 2 – high productivity country, 4 column – high trade openness country, 7 column – high financial openness country

Source: composed by the authors according to Eurostat data of 2012

Ranking of EU-26 countries according to the indices of trade openness and financial openness in 2012 and labour productivity observed in the country in the same year shows that high economic openness is not characteristic to all the countries of high labour productivity. Denmark is ranked on the top based on labour productivity, but its indices of economic openness position it into 14th only. Meanwhile, other countries of high productivity level, such as Netherlands (4th position), France (5th position), Germany (7th position), Austria (8th position), Finland (9th position) and United Kingdom (10th position), appear among those of medium and low trade and financial openness according to economic openness. Italy, according to its labour productivity results, is placed among the countries of high productivity (11th position); however, ranking based on trade openness and financial openness moves it 25th and 24th positions, respectively (attributed to the countries of low economic openness). Belgium and Ireland only maintain their high ranking according to all studies indices, i.e. they are treated as the countries of high productivity and economic openness. What concerns Poland and Romania, these countries belong to the group of low productivity and low or medium economic openness.

Nevertheless, the ranking results also show other tendencies, including: low labour productivity countries demonstrate high economic openness, for instance, Latvia that is ranked 24th according to labour productivity, Lithuania – 23rd, and Bulgaria that remains in the very last 26th position, and when studying their economic openness, these three are attributed to the countries of high and medium openness group. At this point, it could be concluded that the countries of higher economic openness shall not necessarily show the highest results of labour productivity and trade openness and financial openness either has no impact on labour productivity in different country groups or openness negatively influences labour productivity in the countries.

The fourth stage of the study involves the analysis of interrelations of labour productivity and economic openness reflected by foreign trade intensity and FDI intensity indices. The study method – the multiple regression, including the pseudo variables. The dependent variable (Y) is labour productivity per one hour worked. Foreign trade intensity (X1) and direct foreign investment intensity (X1) are distinguished as independent variables. The model also involves the two following pseudo variables: foreign trade intensity in the countries of different labour productivity (X2) and direct foreign investment intensity in the countries of different labour productivity (X4).

Regression function may depend on data outliers (see Table 6). They are set out considering the following parameters: 1. According to the Cook's distance, an observation is considered as outliers, if  $D > F_{0.5}(k+1; n-k-1)$ ; 2. Based on the value of the observation impact index, an observation is considered as outliers, if  $h > 2(k+1)/n$ ; 3. Standardized errors are applied the rule that an observation is considered as outliers, if  $|e| > 3$ .

**Table 6. Validation of outliers of the data of the regression model**

Cook's distance	Comparison	Centered leverage value	Comparison	Standard. error	Comparison	Country
0.06246	No	0.25368	No	-0.732	No	<i>Belgium</i>
0.06719	No	0.06662	No	1.600	No	<i>Denmark</i>
0.00788	No	0.06033	No	0.569	No	<i>Germany</i>
0.35025	No	0.83072	Yes	-0.186	No	<i>Ireland</i>
0.05845	No	0.08072	No	-1.379	No	<i>Greece</i>
0.00008	No	0.06564	No	-0.055	No	<i>Spain</i>
0.09398	No	0.07292	No	1.825	No	<i>France</i>
0.00031	No	0.07823	No	0.102	No	<i>Italy</i>
0.07489	No	0.03224	No	-2.139	No	<i>Cyprus</i>
0.04358	No	0.34966	No	-0.396	No	<i>Netherlands</i>
0.00031	No	0.04199	No	-0.128	No	<i>Austria</i>
0.00276	No	0.03114	No	0.414	No	<i>Finland</i>
0.01596	No	0.05862	No	0.819	No	<i>Sweden</i>
0.02655	No	0.07457	No	0.961	No	<i>United Kingdom</i>
0.02049	No	0.0358	No	-1.087	No	<i>Bulgaria</i>
0.00112	No	0.05661	No	0.220	No	<i>Czech Republic</i>
0.00399	No	0.16815	No	0.246	No	<i>Estonia</i>
0.00725	No	0.03547	No	-0.648	No	<i>Latvia</i>
0.00126	No	0.0825	No	-0.200	No	<i>Lithuania</i>
0.24865	No	0.66043	Yes	0.402	No	<i>Hungary</i>
0.03747	No	0.29824	No	0.495	No	<i>Malta</i>
0.01705	No	0.07109	No	-0.786	No	<i>Poland</i>
0.00001	No	0.11457	No	0.016	No	<i>Portugal</i>
0.03951	No	0.05457	No	-1.322	No	<i>Romania</i>
0.06325	No	0.14286	No	1.081	No	<i>Slovenia</i>
0.00472	No	0.13263	No	0.308	No	<i>Slovakia</i>
<b><math>D = 0.899</math></b>		<b><math>h = 0.385</math></b>		<b><math> e  = 3</math></b>		

Source: authors' own elaboration.

Having analysed standardized errors, it could be stated that there are no outliers, as values of standardized errors in their absolute majority are below 3. Using the Cook measure, outliers are not found, too. Two observations may be treated as outliers based on the values of the centered leverage value, since the calculated critical value is exceeded  $\approx 0.385$ . Outliers are not eliminated due to the fact that one model only confirmed them.

Evaluation of the autocorrelation between variables is performed using the Durbin-Watson test. The delivered  $d$  value is 2.051, so having the significance level of 99 %, no autocorrelation is established, as  $dU (1.517) < d (2.051) < 4-dU (2.483)$ . Further, the collinearity diagnostic takes place. To clarify if no correlation between independent variables exists, pair correlation matrix and VIF statistics are calculated.

**Table 7. Matrix of pair correlations between variables**

		<b>X1</b>	<b>X2</b>	<b>X3</b>	<b>X4</b>
<b>Market openness (X1)</b>	$\rho$	1	.435*	-.128	.085
	<i>Value</i>		.026	.534	.681
	<i>n</i>		26	26	26
<b>Market openness pseudo variable (X2)</b>	$\rho$		1	.307	.709**
	<i>Value</i>			.127	.000
	<i>n</i>			26	26
<b>FDI intensity (X3)</b>	$\rho$			1	.710**
	<i>Value</i>				.000
	<i>n</i>				26
<b>FDI intensity pseudo variable (X4)</b>	$\rho$				1
	<i>Value</i>				
	<i>n</i>				

Source: authors' own elaboration.

The results of the pair correlation matrix (see Table 7) shows that no strong correlation between all model variables, since pair correlation coefficients are below 0.8; therefore, all variables may be employed in the further analysis. VIF statistics is used to calculate the value of dispersion reduction multiplier at all independent variables and it does not significantly exceed 4 (X1 – 1.415; X2 – 3.107; X3 – 2.402; X4 – 4.051); thus, it could be stated that multicollinearity is not characteristic to the model. The Fisher's distribution allows providing the following

conclusions: the model is incompatible with the data; the regression model is partially applicable for forecasting. Hypothesis testing. The following hypotheses are tested:

$H_0: b_1 = b_2 = \dots = b_k = 0$ ;  $H_1: b_j \neq 0$ . The study results are as follow:

$F=22.31$
$F_{crit.} = F_{1-\alpha}(k; n-k-1) = 2.84$

Since  $F > F_{crit.}$ , with the significance level of 95 %, the hypothesis  $H_0$  is denied.

Heteroskedasticity diagnostic applies the Goldfield – Quandt (GQ) test. After sorting the data according to each independent variable descending and eliminating the middle observations, calculations of regression sums of squares (RSS) of the following expanded data lines are made. It is established that the heteroskedasticity problem does not exist.

**Table 8. Regression model results**

Model Dependent variable: DP_Y	Nonstand. coef.		Stand. coef.	t	Residuals
	$\beta$	Stand. error	$\beta$		
Constant	21.586	4.757	-	4.538	.000
TO_X <sub>1</sub>	-5.900	3.772	-0.177	-1.564	.133
TO_D_X <sub>2</sub>	-0.150	0.867	-0.029	-.173	.865
<b>FDI_X<sub>3</sub></b>	22.942	4.068	0.834	<b>5.639</b>	<b>.000</b>
FDI_D_X <sub>4</sub>	0.269	1.161	0.047	.231	.819

Source: authors' own elaboration.

The delivered results show that direct foreign investment intensity (X3) only, as finance market openness index, has an essential impact on labour productivity (i.e. it is a statistically significant model variable). However, differences of the impact according to labour productivity level in two country groups are not found.

## 5. Concluding remarks

There exist three approaches to economic openness: 1) economic openness is associated with goods market openness, i.e., trade openness; 2) economic openness is associated with not only goods market but also with financial market openness, i.e. financial openness; 3) economic openness is associated with not only goods and financial market openness but also with labour market openness. Given that the role of labour market openness in short and medium term is less significant to compare with goods or financial market openness, the second approach prevails in the study.

The analysis of the retrospective researches on interrelations of trade openness and productivity and financial openness and productivity allows concluding that foreign trade intensity ( $X+M/GDP$ ) is the most appropriate index to measure trade openness, and FDI flow intensity ( $FDI_{Out}+FDI_{In}/GDP$ ) is such for financial openness.

Productivity is basically influenced by trade openness through the following three channels: attracts lower-cost production resources from foreign markets; non-productive firms are closed due to competition, increasing this way macro level productivity; and through knowledge diffusion. The impact of financial openness on productivity is made through two channels, such as accumulation of physical capital and human capital. Additionally, there has been established a theoretical interrelation between trade and FDI flows and concluded that usually companies accepting FDI increase export scale. Moreover, reversion impact is displayed – upon prompted productivity, economic openness may grow or lessen (depending on the state politics).

The results of clustering provide a means of concluding that a weak impact of trade openness and financial openness on labour productivity is likely in groups of countries demonstrating different levels of labour productivity. Ranking of EU-26 countries based on their indices of trade openness and financial openness in 2012 and labour productivity of these countries in the same year disclosed that not all countries of high labour productivity feature high economic openness.

The conclusion that only direct foreign investment intensity (FDII), as an index of financial openness, demonstrates an essential impact on labour productivity in EU 26 countries is based on the results of the multiple regression analysis; differences in the impact of economic

openness on labour productivity in two groups of countries based on the level of labour productivity has not been established though.

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## ***Ewaluacja wpływu ekonomicznego otwarcia na wydajność pracy w krajach Unii Europejskiej***

### ***Streszczenie***

Wraz ze wzrostem integracji gospodarczej, globalizacji, międzynarodowej otwartości ekonomicznej i regionalizacji, coraz większej znaczenia nabiera nie tylko poprawa konkurencyjności poszczególnych krajów, ale także grup krajów. Umiejętność identyfikowania kwestii związanych z poprawą konkurencyjności w poszczególnych krajach bądź też w grupach krajów przyczynia się poprawy społeczno-ekonomicznych wskaźników regionu i poziomu życia ludności. Jednym z najbardziej istotnych wskaźników odzwierciedlających konkurencyjność krajowej lub regionalnej gospodarki jest wydajność pracy. Niemniej jednak wydajność pracy jest wśród tych wielkości, które niekorzystnie oddziałują na konkurencyjność Unii Europejskiej jako całości. Aby zapewnić wzrost średniej wydajności pracy w UE, konieczne jest poszukiwanie metod i narzędzi wspomagających podniesienie produktywności w krajach charakteryzujących się niską wydajnością pracy. W obliczu globalizacji, jednym z czynników powodujących zmiany w wydajności pracy państw członkowskich UE może być otwartość gospodarcza. W związku z tym, celem badania jest ocena wpływu otwartości gospodarczej na produktywność pracy w 28 krajach członkowskich UE. Aby osiągnąć cel, ten artykuł ukazuje koncepcję otwartości gospodarczej, określa wskaźniki odzwierciedlające otwartość gospodarczą na poziomie teoretycznym, i przedstawia model teoretycznego wpływu otwartości gospodarczej na produktywność. Po przeanalizowaniu istniejących podejść do otwartości gospodarczej, przeprowadzono analizę z perspektywy najbardziej popularnego stwierdzenia, że otwartość gospodarcza polega na otwartości handlowej i otwartości finansowej. Jeżeli domniemanie, że wpływ otwartości gospodarczej na wydajności pracy może różnić się w krajach o różnej wydajności pracy można przyjąć, że kraje UE mogą być podzielone na dwa klastry: o stosunkowo wysokiej i o stosunkowo niskiej wydajności pracy. Kraje UE mogą zostać również podzielone na klastry na podstawie wskaźników intensywności handlu i intensywności BIZ. Okazuje się, że porównanie krajów należących do klastrów zaprzecza domniemaniu, że kraje z większej otwartości gospodarczej są bardziej otwarte. Teoria ta nie potwierdza się również wtedy, gdy kraje te uszereguje się pod względem wskaźników wydajności pracy i otwartości gospodarczej, niemniej jednak po utworzeniu modelu regresji wielokrotnej i wprowadzeniu pseudo zmiennych ustalono, że wpływ natężenia BIZ na produktywność pracy jest istotna statystycznie i jest obserwowany zarówno w klastrze o stosunkowo wysokiej wydajności pracy oraz w klastrze o stosunkowo niskiej wydajności pracy. Wpływ otwartości handlu na wydajność

pracy z krajów UE nie została potwierdzona w ten sposób, aczkolwiek aby osiągnąć wzrost wydajności pracy, powinna zostać wprowadzona otwartość finansowa w krajach UE.

**Słowa kluczowe:** wydajność pracy, otwartość gospodarcza, otwartość handlowa, otwartość finansowe