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THE NEXUS BETWEEN FOREIGN DIRECT INVESTMENTS AND LABOUR PRODUCTIVITY – PANEL DATA APPROACH

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ABSTRACT

This research uses country-level data to examine if foreign direct investments affected labour productivity in selected Emerging European Economies in the more extended period 1997-2017. The panel data analysis includes the comparison of macro panel estimations on the total sample and the estimations with robust micro-panel methods and dummy variables in the two analysed sub-periods. Robust estimations support the evidence of a significantly positive link between foreign direct investments and labour productivity in the Western Balkans, Visegrad Group and the Baltic States after the Global Financial Crisis. Furthermore, there is evidence that foreign direct investments positively affected labour productivity growth on the total sample level. Based on the empirical evidence, the authors suggest that policymakers in the Western Balkans should establish measures to promote more significant foreign investments to boost labour productivity and real economic growth.

Keywords: *FDI, labour productivity, panel data models*

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INTRODUCTION

Foreign direct investments (FDI) are frequently investigated in relation to the economic growth in emerging and less developed economies, e.g., [1], [2], [3]. The FDI inflows are linked to several positive effects, which result in growing gross domestic product (GDP) and reduced unemployment rate in the host country [4]. The development of the Emerging European Economies (EEEs) greatly relies on the volume and motivation of received FDI inflows. However, the Western Balkan countries need more domestic capital accumulation and a total level of investments that would further accelerate the economic progress. On the other hand, [5] alerts that relying on the significant foreign capital parallel to the current account deficit problem could induce higher vulnerability of emerging economies to external shocks and abrupt capital escape, with consequent restrictive adjustments of the real economy. New EU member states (Poland, Slovakia, and the Baltic States) had the fastest improvement in economic development, while the Western Balkan countries had a very slow development. The catching up process was faster before the global financial crisis (GFC) and has slowed down, given the low total factor productivity growth rates and insufficient capital accumulation [6]. Western Balkan countries need to enhance the quality of institutions, create a more favourable investment environment, implement innovative technology and attract more investments to ensure faster sustainable development. Also, differences in economic development level and government policy have affected the possibility of gaining benefits from FDI inflows. This is in line with [7], who finds that the stage of economic development, local companies' absorptive capacity, and workforce capabilities influence the impact of FDI on labour productivity and further adjustments of the economic policy.

The goal of this paper is to test whether FDI net inflows, together with selected macroeconomic parameters, can impact labour productivity growth. Therefore, this paper contributes to the literature by revealing the link between FDI and labour productivity by employing panel data analysis in the case of EEEs. This research also tested the relations of labour productivity with significant macroeconomic indicators like inflation, economic growth, external balance, real effective exchange rate, government budget, government debt, tertiary education and total factor productivity. Moreover, there is not enough focus in the existing literature concerning labour productivity growth as the dependent variable with an investigation on the macro level data. Previous research focuses on competition or productivity spill-overs in smaller country samples with intrafirm data and different methodologies. Also, this research issue was a relevant question in the transition era of Central and Eastern Europe and after the European Union's submission, so it is helpful to give an actualization of this hypothesis. The mentioned research problem is relevant to many researchers interested in FDI and its spill-over effects. This research is also significant for the policymakers in EEEs and other emerging economies since FDI can boost their real growth and simultaneously serve as a less volatile way to finance current account deficits [8] and [9]. Relevant literature connected with the examined relations between FDI and productivity is presented in the following section.

LITERATURE REVIEW

The contemporary literature mainly analyses the determinants of FDI inflows [10], [11], [12] or the link between FDI and economic growth [13], [14], [15], [16]. Emerging economies try to attract more FDI inflows because of potential positive transmission effects on the rise in productivity and the transfer of contemporary technology [17], reduction of unemployment [4] and higher wages [18]. FDI inflows are connected with [19] technology transfer and labour productivity growth, contributing to higher economic growth. On the other hand, foreign companies focus on locations offering high-quality human capital and a skilled workforce [11]. There are a small number of recent papers that investigate the direct link between FDI and labour productivity growth. Most research has mainly focused on the FDI productivity spill-overs using the intrafirm level data in limited county samples.

There are two FDI transmission channels into economic growth [14]: the direct channel through input accumulation (capital inflow and employment growth) and the indirect channel through the productivity growth of total production factors (growth of labour productivity, new technologies, managerial skills and know-how). Similarly, [20] argues that two FDI transmission channels lead towards higher productivity in the host country: the competition channel and the technology and knowledge transfer channel. According

to the panel data study [21], FDI positively triggers labour productivity with a long-run link. However, the magnitude of the impact differs across developed and developing countries with the conclusion that the positive influence of FDI on productivity level could be improved with a higher quality workforce. Exploring the FDI effects by the type of investments, [22] concludes that Greenfield investments affect more significant capital accumulation and productivity. In contrast, Brownfield investments could positively affect economic growth by transferring new technology and knowledge. Compatible empirical findings that support the thesis of positive effects of Greenfield investments on the real economy can be found in [23], [24], [25]. However, the FDI effects on economic growth rely on the absorption capacity of the host economy. Minimal human capital is required to gain positive effects of Greenfield investments. At the same time, a developed financial sector is requisite to achieve a positive impact of Brownfield investments on economic growth [13].

The indirect effect of FDI on economic growth is present through total factors productivity growth, implementation of contemporary technology and the application of better managerial skills and human capital [26]. According to [27], FDIs are statistically significant channels of technology transfer and total factor productivity growth stimulation. However, these findings depend on the institution's quality and the absorption capacity of national companies. The research results of [2] and [16] imply that FDI impact on the total factor productivity is statistically insignificant. Moreover, [28] finds that Brownfield investments positively impacted the total factor productivity, while Greenfield investments did not significantly impact the productivity. According to [29], multinational enterprises (MNEs) significantly affected domestic companies by changing the level of competition and improving productivity in the analysed sample of 30 European countries. However, the impact of FDI is not always beneficial due to the crowding-out effect on domestic suppliers and the intensification of competition. The level to which domestic companies may benefit from FDI spill-overs depends on their absorptive capacity, which can potentially increase employment opportunities and output levels for domestic firms [30]. The quantitative synthesis of the substantial literature observing the effect of FDI on the productivity of locally owned firms in the Czech Republic can be found in [31] with the conclusion that as of 2018, a 10% increase in foreign investments is probably going to increase the productivity of domestic firms by 11%, with even more significant effect for joint ventures, reaching 19%. The research [32] analyses FDI productivity spill-overs across industries based on firm-level data from Lithuania with the conclusion of positive productivity spill-overs from projects with joint ownership, both domestic and foreign, but not in projects with full foreign ownership.

Great attention in the literature is given to the FDI's positive transmission effects on the real economy of the host country. However, FDI could also generate adverse transmission effects, like a decrease in employment [13], crowding-out of national companies [33], negative impact on the living environment, exploitation of scarce resources, an absence of long-term technology and knowledge transfer [34] and a rise in income inequality [35]. However, an overall literature review suggests that FDI could impact labour productivity via technology and know-how, new employment and economic development.

METHODOLOGY AND DATA

Empirical model

In the last two decades, a growing number of research studies have used panel data techniques because of the significant advantages of the simultaneous combination of cross-section data with time series [9]. The panel data models give more possibilities to identify and measure the effects of examined phenomena [36] and model different causes of heterogeneity of regression parameters [37]. There are macro and micro panel models, where [38] highlights their differences and appropriate application by time and cross-section dimensions. The main difference between macro and micro panels lies in the time dimension, where macro panels rely on a longer time dimension. In contrast, micro panels are based on a shorter time dimension and the assumption of $T<N$. In contemporary econometric literature researchers often use macro-panel models with longer time series and extensive cross-section data due to availability of international online databases. Also, macro panels neutralize potentially unfulfilled assumptions of micro panels like nonstationary variables, Cross-Section Dependence (CSD), autocorrelation and heteroscedasticity of the standard errors.

The authors implement micro and macro panel models in this paper to provide extensive research and relevant findings. Authors implement a heterogeneous macro-panel estimation model, *Common Correlated Effects Mean Group (CCEMG)*, appropriate for heterogeneous samples of countries with longer time dimension, nonstationary variables and cross-section dependent errors in the model. Together with the macro panel model, authors implement micro panel models with corrected standard errors in the two sub-periods in order to test the following general hypotheses:

H_1: The FDI net inflows contribute to the labour productivity growth in Emerging European Economies.

H_2: The selected macroeconomic indicators and total factor productivity are linked with labour productivity growth in Emerging European Economies.

The *CCEMG* model was presented in [39] and is broadly used, especially in recent research, e.g. [40], [37], [41]. The *CCEMG* parameter estimator accounts for one or more unobserved common factor(s), time trends and CSD in the panel by including time averages of all observable variables in the regression equation. This relatively new approach is robust to the unobserved common factor being nonstationary I (1) and allows heterogeneous impact across panel members [39]. The *CCEMG* approach is robust to the presence of a limited number of strong factors like global crisis, and vast number of weak factors, for instance, local spill-over effects [42]. The *CCEMG* model equation is as follows [39]:

$$y_{it} = \beta_i + \beta_i' x_{it} + c_{1i}\bar{y}_t + c_{2i}'\bar{x}_t + e_{it}, \quad (1)$$

$$\hat{\beta}_{CCEMG} = N^{-1}\sum_i \hat{\beta}_i,$$

where y_{it} is the dependent variable for individual i at time point t, $\bar{y}_t$ and x_t are time averages of the dependent and independent variables. Augmentation of the model with the combination of time averages of all variables can account for the unobserved common factor f_t [39]. The parameter β'_i ($\beta'_i=\beta+v_i$) is a vector of heterogeneous regression coefficients, c_{1i} is the coefficient with time averages of the dependent variable, c'_{21} is the coefficient with time averages of independent variables, e_{it} is standard error [39]. Estimating regression parameters is an averaged estimation of individual slope coefficients that is an unbiased estimation of parameter β [39].

In order to give a detailed estimation, the authors use micro panel models with corrected standard errors for the two sub-periods concerning the global financial crisis: 1997-2007 and 2008-2017, with estimation for three country groups - Western Balkans, Visegrad Group and the Baltic States. The sub-periods are distinguished to assess the potential differences of regression parameters concerning the mentioned global crisis, but also because of the assumption of shorter time dimension in micro panel models. Micro panel estimation results presented in this research are *fixed individual effects (FE) and random individual effects models (RE)*, the *Driscoll-Kraay estimation model of robust standard errors for coefficients estimated with FE* [43], *fixed effects with White corrected standard errors (CSE*), and *Panel-Corrected Standard Error (PCSE) estimation model* [44].

The regression equation for the *fixed individual effects model - FE* is as follows [3, 9]:

$$y_{it} = \beta_{1i} + \sum_{k=2}^{K} \beta_k x_{kit} + u_{it}, \quad (2)$$

where y_{it} is the dependent variable for individual i at time point t, β_{1i} is a heterogeneous free member that varies across individual units, β_k represents constant regression coefficients of independent variables $x_{kit,}$ and u_{it} is the standard error. The model involves the heterogeneity of free member across individual units - individual effects μ_i [3, 9]. A *fixed individual effects model* with the dummy variables for country groups was used to estimate individual effects on a dependent variable across cross-section data [3, 9]. The heterogeneity of the sample points toward the estimation of the specified model with *fixed individual effects* [3, 9]. The consistent estimation of β in *FE* is connected with the supposition of a non-correlation between the components of standard error u_{it} and the regressor x_{it} observed at any time [3, 9]. *Driscoll-Kraay's* [45] standard errors for coefficients estimated by *Pooled Ordinary Least Squares* (*OLS)/Weighted Least Squares (WLS)* or *fixed effects* are well calibrated in larger time span panels when autocorrelation, CSD, and residuals heteroscedasticity are found. If residuals are heteroscedastic, alternative covariance matrix estimators like the *White* version with robust standard errors are broadly used [3, 9]. *Panel Corrected Standard Errors* (*PCSE*) [44] relies on *pooled OLS* coefficient estimates and includes large *T* asymptotic-based standard errors, which correct the contemporaneous correlation between the subjects, with well-performed estimation in smaller panels.

This research contributes to the literature on the link between FDI and labour productivity in emerging economies. The authors test with panel data models whether FDI net inflows have contributed to labour productivity growth and provide relevant insight to policymakers to bring more foreign investors and speed up the development progress. The dependent variable is the growth rate of labour productivity by employees (output per person employed, per cent change) obtained from The Conference Board Total Economy Database. Independent variables are selected to support the hypothesis that FDI, total factor productivity, tertiary education, and macroeconomic stability indicators impact labour productivity growth in EEEs. Given that this paper addresses selected EEEs that went through the government stabilization and transition process in the focused period 1997-2017, the model also provides an estimation of the link with macroeconomic factors like inflation, government budget, government debt, GDP growth rate, real effective exchange rate (REER), and external balance. According to [7], the stage of economic development and workforce capabilities influence the impact of FDI on labour productivity. Also, [21] stated that a higher-quality workforce could improve productivity. Therefore, this study includes the factors of macroeconomic stability and tertiary education as a proxy of labour quality.

The estimated regression equation for *CCEMG* is[4]:

$$LP_{it} = \beta_i + \beta'_{1i}FDI_{it} + \beta'_{2i}GDPgr_{it} + \beta'_{3i}INF_{it} + \beta'_{4i}GB_{it} + \beta'_{5i}GD_{it} + \beta'_{6i}EB_{it} + \beta'_{7i}REER_{it} + \beta'_{8i}TFP_{it} + \beta'_{9i}SET_{it} + c_{1i}\overline{LP}_t + c'_{2i}\overline{FDI}_t + c'_{3i}\overline{GDPgr}_t + c'_{4i}\overline{INF}_t + c'_{5i}\overline{GB}_t + c'_{6i}\overline{GD}_t + c'_{7i}\overline{EB}_t + c'_{8i}\overline{REER}_t + c'_{9i}\overline{TFP}_t + c'_{10i}\overline{SET}_t + e_{it} \quad (3)$$

Estimated regression equation for *FE* is:

$$LP_{it} = \beta_{1i} + \beta_1 FDI_{it} + \beta_2 GDPgr_{it} + \beta_3 INF_{it} + \beta_4 GB_{it} + \beta_5 GD_{it} + \beta_6 EB_{it} + \beta_7 REER_{it} + \beta_8 TFP_{it} + \beta_9 SET_{it} + u_{it} \quad (4)$$

Data

The research sample focuses on the selected EEEs that become EU members (Poland, Czech Republic, Slovakia, Hungary, Lithuania, Latvia, Estonia, Slovenia, Bulgaria, Romania and Croatia), together with Western Balkan countries that converge towards the EU5. The total sample (N=16) accumulates data for 1997-2017 (T=21). Macro panel models require a longer time dimension T>20, and our total sample aligns with this requirement. Hence, it is interesting to implement a heterogeneous panel estimation model to assess the impact of FDI inflows, total factor productivity, tertiary education, and macroeconomic stability factors on labour productivity growth as the indicator of real development. On the other hand, classical micro-panel models require cross-section data that is larger than the time dimension. Hence, the estimation includes two sub-samples concerning GFC to achieve the assumption (T<N). The vast differences between the countries in this sample also imply the use of dummy variables in micro panel data specification for the Visegrad Group (Hungary, Poland, Czech Republic and Slovakia), Western Balkans (Serbia, Bosnia and Herzegovina, Montenegro, North Macedonia and Albania), and Baltic States (Estonia, Lithuania and Latvia). Data [3, 9] for the mentioned broad range of independent variables are collected from The International Monetary Fund Database (per cent share of general government debt in GDP), The World Development Indicators Database (per cent share of FDI net inflows in GDP; annual GDP growth rate; annual inflation rate; per cent share of external balance on goods and services in GDP; gross per cent of school enrolment tertiary), The Country Economy Database (per cent share of government budget balance in GDP), The Conference Board Total Economy Database (labour productivity growth rate per employee; total factor productivity growth rate), and The Bruegel Datasets (real effective exchange rate).

The Stata/SE 12.0 software program was used for all specification tests and model estimations. The results of the Jochmans Portmanteau test and Born-Breitung Bias corrected HR test (presented in the Appendix, Table A1) show an absence of standard error autocorrelation in both sub-periods. The results of modified Wald statistics for the group heteroscedasticity (presented in the Appendix, Table A2) confirm the heteroscedasticity of standard errors in both sub-periods. Hausman specification test indicates that FE is better suited than RE with consistent estimations in both sub-periods (Table 1). The F test results (Table 1) indicate significant individual effects in the FE in both sub-periods. The results of the Pesaran CD (Cross-sectional Dependence-CSD) test (Table A3) were Ho is independence of cross-section data, and

[4] The independent variables in the model are the share of FDI net inflows in GDP (FDI), GDP growth rate (GDPgr), annual inflation rate (INF), government budget balance in GDP (GB), general government debt in GDP (GD), external balance on goods and services in GDP (EB), real effective exchange rate (REER), total factor productivity growth rate (TFP) and school enrolment tertiary (SET). Other research by authors [9] uses similar variables to test the link with external balance in this sample.

[5] Other research by authors [3, 9] uses the same data and sample to estimate the link between FDI and macroeconomic factors with economic growth and external balance.

results with a p-value of 0.00 suggest that cross-sectional dependence is evident for all variables in the model. The presence of CSD in the model is expected, bearing in mind that selected EEEs are EU members or countries that converge towards the EU. The high correlation between the countries in the sample reflects the harmonization of their economic policies and institutional frames.

According to the results of stationarity tests of the second generation - Pesaran CADF and CIPS statistics (presented in Table A4), some variables are stationary with p-values less than 0.05 (GDP growth, inflation, REER and total factor productivity) with potential nonstationary series. Therefore, it is obligatory to investigate the stationarity of the first difference (presented in Table A4a) to test the hypothesis of I(1) order of integration. The results of the first difference indicate that labour productivity, GDP growth, FDI, inflation, government budget, trading balance, REER and total factor productivity are stationary in the first difference in the three lags. Specification tests indicate heteroscedasticity of standard errors, CSD, and potential nonstationary in a minor number of variables in the labour productivity model. Therefore, heterogeneous panel models and robust standard error models are appropriate for testing the research hypotheses.

PANEL DATA RESULTS AND DISCUSSION

There is no consensus in the literature concerning FDI spill-over effects on the host economy. The authors present the findings that support the supposition of beneficial FDI impact on the rise in labour productivity. Table 1 summarizes the panel estimation results concerning GFC and identified country groups. Based on the presented results, the link between FDI and labour productivity was not statistically significant in the period prior to the crisis. Before the crisis, the most of the FDI inflows took the form of privatization or acquisition, so an insignificant link to the productivity in this sub-sample is expected. However, in the period after the crisis, where most FDI took the form of G*reenfield* FDI or reinvested profits, the *PCSE* method gives evidence of a positive FDI impact on labour productivity growth, significant at 1%. *PCSE* estimation results imply that labour productivity growth after the crisis is connected with more significant FDI inflows, total factor productivity growth, inflation overheating, government budget deficit, and decrease of government indebtedness, which are significant at 1%.

Table 1. The panel data estimation results by sub-periods and country groups6

The effect of FDI net inflows on the labour productivity growth								
Model	**Before GFC (1997-2007)**				**After GFC (2008-2017)**			
	FE - White CSE		**PCSE method**		**FE - White CSE**		**PCSE method**	
Variables	**Coeff.**	***P* - values**	**Coeff.**	***P* - values**	**Coeff.**	***P* - values**	**Coeff.**	***P* - values**
FDI	-0,0330	0,175	0,0181	0,419	0,0250	0,116	0,0318***	0,010
FDI - WB0	-0,0417**	0,025	-0,0144	0,432	0,0126	0,184	0,0146	0,194
FDI - WB1	0,0408	0,551	0,0602	0,232	0,1276**	0,013	0,0323	0,659
FDI - VS0	-0,0484	0,335	0,0541	0,218	0,1229***	0,001	0,1349***	0,000
FDI - VS1	-0,0089	0,660	0,0013	0,950	0,0087***	0,004	0,0112	0,237
FDI - BS0	-0,0320	0,244	0,0131	0,553	0,0252	0,118	0,0336**	0,014
FDI - BS1	-0,0777***	0,000	-0,0839	0,392	0,1679**	0,027	0,1503	0,127
GDP gr	0,0805	0,349	0,0900	0,119	-0,2464***	0,006	-0,1139	0,132
INF	-0,0020	0,146	-0,0009	0,637	0,1541	0,187	0,1888***	0,001
GB	0,0170	0,723	-0,0412	0,302	-0,2145**	0,021	-0,2482***	0,001
GD	-0,0056***	0,003	-0,0028	0,329	-0,0507**	0,016	-0,0293***	0,002
EB	-0,0439**	0,035	-0,0230	0,143	-0,0432	0,637	0,0185	0,295
REER	0,0140	0,204	-0,0046	0,728	-0,0411	0,337	-0,0393*	0,097
TFP	0,8801***	0,000	0,8544***	0,000	1,3105***	0,000	1,1741***	0,000
SET	0,0044	0,770	0,0131	0,383	-0,0213	0,397	-0,0022	0,896
$R^{2\ within}$	0,8498		0,8264		0,8316		0,7686	
F test FE / Wald chi^2 test RE	778,640	0,000	789,000	0,000	78,810	0,000	389,180	0,000
	p<0,05 FE		p<0,05 RE		p<0,05 FE		p<0,05 RE	
Hausman test 18,390 0,031 Choice of FE					16,940 0,050 Choice of FE			
Dependent variable: *LP* - labour productivity growth rate per employee (output per employed person growth); Independent variables [3, 9]:								

[6] If interested in the connection of FDI and macroeconomic variables with economic growth and external balance in the same sample of EEEs, see previous work of authors [3, 9].

FDI - FDI net inflows in GDP; *GDP gr* - annual GDP growth rate; INF - annual inflation rate; *GB* - government budget balance in GDP; *GD* - general government debt in GDP; *EB* - external balance on goods and services in GDP; *REER* - real effective exchange rate; *TFP* - total factor productivity growth rate; *SET* - school enrolment tertiary.
Dummy variables for FDI:
WB1 - Western Balkans; *WB0* – sample without Western Balkans;
VS1 - Visegrad Group; *VS0* – sample without Visegrad Group;
BS1 - Baltic States; *BS0* – sample without Baltic States.
***P*-values**: * significant at 10%, ** significant at 5%, *** significant at 1%.

Source: by the Authors.

Estimation of the *FE with White corrected standard errors* suggests a significantly negative connection with government debt and external balance before the GFC. In contrast, after the GFC, a significantly negative connection was confirmed with the GDP growth rate, government budget, and general government debt. Negative relation to the government debt is in line with large FDI inflows directed in the EEEs in both sub-samples. Also, the negative relation to external balance before the crisis is related to FDI inflows affecting the external deficits. The negative connection between GDP growth rate and labour productivity implies that emerging economies with a slower growth pace had greater labour productivity.

The variable total factor productivity growth is positively related to labour productivity by all estimation methods in both sub-periods and the total sample. Labour productivity is strongly connected with total factors productivity. Based on the panel estimation results, it could be emphasized that after the crisis, emerging economies with slower economic growth, more substantial inflation, unstable government budgets, decreased public debt, and depreciated real exchange rates have better indicators of labour productivity growth. This is reasonable because less developed economies tend to raise labour productivity, stabilize macroeconomic conditions, fasten economic progress and attract more FDI.

Table 1 also contains panel estimation results with the dummy variables for FDI net inflows in three country groups. In the Western Balkan group, there is a positive but insignificant link between FDI and labour productivity prior to the crisis, while after the crisis, *FE* estimations show the presence of a positive nexus at a 5% significance level. For the Visegrad Group, *FE* estimations point to a negative and insignificant connection between FDI and labour productivity prior to the crisis, while after the crisis, there was a positive nexus, significant at 1%. *FE* estimation results for the Baltic States indicate that the link between the FDI and labour productivity was negative prior to the crisis, significant at 1%, while after the crisis, there was a positive nexus, significant at 5%. The panel estimation results with corrected standard errors show that after the GFC, FDI net inflows positively affected labour productivity in selected EEEs. Moreover, panel analysis by country groups again proves a positive FDI impact on labour productivity in the post-crisis period.

In order to provide a complete examination of the research assumption, Table 2 presents the estimation results of heterogeneous macro-panel models (CCEMG and Mean Group - MG) with Driscoll-Kraay FE estimations. According to the CCEMG and MG estimations, FDI positively but insignificantly affected labour productivity growth in selected EEEs. On the other hand, Driscoll-Kraay7 FE estimation method gives relevant findings of significant positive FDI impact on labour productivity on the total sample of selected EEEs. It is interesting to highlight a significant negative link between the GDP growth rate and labour productivity growth by CCEMG estimation, which points out the conclusion that emerging economies with slower economic progress have a more favourable indicator of labour productivity.

Also, according to the Driscoll-Kraay FE estimation, external balance is negatively related to labour productivity, meaning that emerging economies with worse external positions (deficit) have better labour productivity. Total sample estimation and estimation after the crisis imply an insignificant negative nexus between labour productivity and the tertiary educated population as a proxy of labour quality. This indicates that countries with a lesser ratio of the highly educated population have greater productivity with the restriction that this link is not statistically significant. These findings are connected with the aspiration of less developed countries with lower labour quality to achieve greater labour productivity with interest to attract more foreign investors and stimulate competitiveness, economic growth and stabilized external balance.

Robustness checks of the estimated model are presented in Tables A5 and A6. Namely, the model has been estimated with the initial sample and research period changes. In the first phase, the time dimension was broadened with the additional year (2018), while in the second phase, the authors excluded one country from the initial sample (Croatia). The results of the robustness checks imply that the model is robust to the sample alteration since estimated coefficients of independent variables detain the same sign with approximate values and statistical significance.

[7] This model generates reliable results in samples with CSD and longer time dimension.

The robustness checks confirm the original results, suggesting that the presented results are reliable. CD test on the residuals of the CCEMG estimator (presented in Table A7) implies their independence, while in the case of the MG estimation method, the model residuals are CSD. CADF and CIPS tests on the residuals of CCEMG and MG estimation methods (presented in Table A8) point out that model residuals are stationary. Given that the results suggest that residuals of the MG estimation method are CSD, the authors emphasize the results of the CCEMG method, which offers valid estimation results with independent and stationary residuals. Therefore, residual testing results indicate that the CCEMG method successfully captures the presence of common unidentified factors that cause cross-section dependence in the original model specification.

Table 2. Heterogeneous models and Driscoll-Kraay FE estimation results

The effect of FDI net inflows on the labour productivity growth						
Model	**CCEMG**		**MG**		**Driscoll-Kraay FE**	
Variables	**Coeff.**	***P* - values**	**Coeff.**	***P* - values**	**Coeff.**	***P* - values**
FDI	0,1902	0,484	0,0057	0,896	0,0288**	0,051
GDP gr	-0,7626**	0,041	-0,0891	0,389	-0,0813	0,393
INF	-0,2763	0,549	-0,0293	0,395	0,0009	0,676
GB	-1,1625	0,232	-0,1726	0,045	-0,0219	0,645
GD	-0,1704	0,103	-0,0630	0,027	0,0009	0,723
EB	0,9477	0,291	-0,0637*	0,093	-0,0850***	0,002
REER	0,2425	0,185	0,0117	0,650	-0,0011	0,912
TFP	0,8244**	0,049	1,0441***	0,000	1,0694***	0,000
SET	-0,0402	0,911	0,0029	0,883	-0,0086	0,504
RMSE	0,2388		1,0015		-	-
Wald chi² / F test	207,900	0,000	593,340	0,000	1409,750	0,000
$R^{2\ within}$	-		-		0,8323	

Dependent variable:
LP - labour productivity growth rate per employee;
Independent variables [3, 9]:
FDI - FDI net inflows in GDP; *GDP gr* - annual GDP growth rate; INF - annual inflation rate; *GB* - government budget balance in GDP; *GD* - general government debt in GDP; *EB* - external balance on goods and services in GDP; *REER* - real effective exchange rate; *TFP* - total factor productivity growth rate; *SET* - school enrolment tertiary.
***P*-values**: * significant at 10%, ** significant at 5%, *** significant at 1%.

Source: by the Authors.

The panel data results show that more significant FDI inflows positively influenced labour productivity growth rate in the total sample of selected EEEs and in-country groups of the Western Balkans, Visegrad Group and Baltic States in the period after the GFC. Also, this research suggests that the labour productivity rate is related to slower economic growth, more substantial inflation, unstable government positions (budget and external balance), decreased government debt, depreciated real exchange rate and total factor productivity growth. The focused link between the FDI and labour productivity and related empirical evidence is in line with the conclusions of [19], [22] and [29]. Moreover, a panel data study [21] concludes that FDI triggers the growth of labour productivity with the support of higher labour quality and efficiency.

CONCLUSION

This study provides evidence on the macro level data supporting the assumption that FDI inflows positively affect labour productivity growth in selected EEEs. The results and conclusions contribute to the literature on the FDI transmission effects and are relevant to economic policy creators and researchers. The targeted link between FDI and labour productivity has not been examined as much recently, especially with the panel data approach on the country-level data. Also, research showed that increased labour productivity is linked with slower economic growth, more substantial inflation, unstable government positions, decreased government debt, depreciated real exchange rate and total factor productivity growth. The empirical findings are obtained via macro heterogeneous panel estimator CCEMG and micro-panel estimation methods with robust standard errors. The comparative analysis of the mentioned panel estimators for selected EEEs in the more extended period (21 years), three country groups, and the sub-periods before and after the GFC gives a strong background for economic policy recommendations. The positive effects of higher FDI inflows on the labour productivity of the host economy provide helpful guidance to policymakers in emerging economies, who should formulate measures to ensure more FDI inflows, improve the labour productivity level, and thus boost further real development. The authors'

findings are directed towards the Western Balkan countries that should put more effort into creating sustainable growth policy with more significant improvements concerning institutions, investment environment and work force education. Consistent macroeconomic conditions, strong human capital, and favourable business regulations are prerequisites for establishing an attractive investment environment.

The limitation of this research is the lack of a comparative outlook of FDI labour productivity spill-overs via different types (Greenfield vs Brownfield) or specific industries and diversity in other indirect FDI effects like new technology and knowledge transfer. Also, this research specification did not test potential endogeneity between variables and cointegration. Considering this, further research on the nexus between FDI and labour productivity in selected EEEs could be directed towards GMM or Dynamic Common Correlated Effects Model, involving potential endogeneity problem in the FE estimation method and their bi-directional connection. It would also be interesting to examine FDI spill-over effects in other aspects of real convergence to provide more relevant implications for policymakers in the EEEs. A deeper analysis of the mentioned relations in the case of EEEs (EU members and candidates) in a longer time implies the possible implementation of heterogeneous panels with adjustment parameters (like Pooled Mean Group and Augmented Mean Group estimators) as the indicators of converging or diverging trends towards the developed European economies.

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INTERNET DATABASES:

1. Conference Board Total Economy Database:
   https://www.conference-board.org/data/economydatabase/
2. World Bank – The World Development Indicators Database:
   https://datacatalog.worldbank.org/dataset/sustainable-development-goals,
   https://data.worldbank.org/country/
3. UNCTAD, World Investment Report 2020:
   https://unctad.org/topic/investment/investment-statistics-and-trends
4. International Monetary Fund Database:
   https://www.imf.org/external/datamapper/DEBT1@DEBT/OEMDC/ADVEC/WEOWORLD/
5. Country Economy Database:
   https://countryeconomy.com/deficit/
6. Bruegel Datasets:
   http://bruegel.org/publications/datasets/real-effective-exchange-rates-for-178-countries-a-new-database/

APPENDIX[8]

Table A1. Jochmans Portmanteau and Born and Breitung test - Autocorrelation tests

H_0: Absence of autocorrelation	Jochmans Portmanteau test		Born and Breitung HR-test	
	Chi-sq	Prob > Chi-sq	HR-statistics	*P*-value
Before GFC (1997-2007)	16,000	1,000	0,080	0,940
After GFC (2008-2017)	15,000	1,000	1,510	0,130

Table A2. The Wald statistics - Heteroscedasticity test

Modified Wald test for the group heteroscedasticity in FE model	
Before GFC (1997-2007)	chi2 (16) = 679,24
	Prob>chi2 = 0,0000
After GFC (2008-2017)	chi2 (15) = 243,83
	Prob>chi2 = 0,0000

Table A3. Pesaran CD test for cross-section dependence

Pesaran CD test for cross-section dependence				
Ho: ρij = ρji = 0, i≠j H1: ρij = ρji ≠ 0, i≠j	CD test	*P* - values	Correlation	Absolute (correlation)
LP	16,880	0,000	0,336	0,387
FDI	12,230	0,000	0,244	0,320
GDP gr	21,790	0,000	0,434	0,471
INF	20,300	0,000	0,404	0,518
GB	13,120	0,000	0,261	0,329
GD	16,470	0,000	0,328	0,561
EB	25,210	0,000	0,502	0,551
REER	33,570	0,000	0,669	0,711
TFP	15,890	0,000	0,317	0,369
SET	38,770	0,000	0,772	0,772

Table A4. Pesaran second generation unit root tests for stationarity

H_0: I(1) H_1: I(0)	Lags	Model with constant			Model with constant and trend		
		CADF	CIPS	*P* - values	CADF	CIPS	*P* - values
LP	0	-4,396	-10,912	0,000	-4,495	-9,400	0,000
	1	-2,728	-4,032	0,000	-2,639	-1,413	0,079
	2	-2,711	-3,961	0,000	**-2,599**	**-1,245**	**0,107**
FDI	0	-3,305	-6,414	0,000	-3,702	-5,987	0,000
	1	-2,364	-2,532	0,006	-2,992	-2,933	0,002
	2	**-1,713**	**0,154**	**0,561**	**-2,208**	**0,440**	**0,670**
GDP gr	0	-3,686	-7,983	0,000	-3,761	-6,242	0,000
	1	-2,858	-4,569	0,000	-3,038	-3,133	0,001
	2	-3,001	-5,160	0,000	-3,009	-3,007	0,001
INF	0	-4,402	-10,938	0,000	-4,195	-8,108	0,000
	1	-2,636	-3,652	0,000	-2,666	-1,530	0,063
	2	-2,862	-4,584	0,000	-2,833	-2,248	0,012
GB	0	-2,746	-4,107	0,000	-3,037	-3,127	0,001
	1	-2,212	-1,906	0,028	**-2,535**	**-0,967**	**0,167**
	2	**-1,537**	**0,878**	**0,810**	**-2,079**	**0,994**	**0,840**
GD	0	-3,458	-7,043	0,000	**-2,143**	**0,717**	**0,763**
	1	-2,952	-4,957	0,000	**-2,547**	**-1,020**	**0,154**
	2	-2,868	-4,612	0,000	**-2,581**	**-1,166**	**0,122**
EB	0	-2,411	-2,724	0,003	-3,282	-4,181	0,000
	1	-2,273	-2,156	0,016	-3,377	-4,590	0,000
	2	**-2,016**	**-1,096**	**0,137**	-2,645	-1,440	0,075
REER	0	-2,924	-4,840	0,000	-3,316	-4,328	0,000
	1	-2,199	-1,851	0,032	-2,992	-2,935	0,002
	2	-2,314	-2,325	0,010	-2,897	-2,523	0,006
TFP	0	-4,205	-10,122	0,000	-4,413	-9,044	0,000
	1	-2,665	-3,771	0,000	-2,616	-1,316	0,094
	2	-2,863	-4,590	0,000	-2,722	-1,774	0,038
SET	0	**-1,185**	**2,331**	**0,990**	**-1,405**	**3,892**	**1,000**
	1	-2,147	-1,639	0,051	**-2,489**	**-0,768**	**0,221**
	2	**-2,012**	**-1,082**	**0,140**	**-2,176**	**0,576**	**0,718**

[8] Authors calculations in the Stata program for the following tests: autocorrelation, heteroscedasticity, CSD, stationarity, robustness check, CD and CADF test on the model residuals.

Table A4a. Pesaran second generation unit root tests for stationarity on first difference of variables

H_o: I(1) H_1: I(0)	Lags	Model with constant (first difference)			Model with constant and trend (first difference)		
		CADF	CIPS	*P* - values	CADF	CIPS	*P* - values
dLP	0	-5,766	-15,828	0,000	-5,840	-14,101	0,000
	1	-3,687	-7,676	0,000	-3,649	-5,423	0,000
	2	-2,659	-3,642	0,000	**-2,563**	**-1,120**	**0,131**
dFDI	0	-5,297	-13,989	0,000	-5,281	-11,884	0,000
	1	-4,071	-9,180	0,000	-4,026	-6,914	0,000
	2	-2,706	-3,829	0,000	-2,727	-1,771	0,038
dGDP gr	0	-5,119	-13,288	0,000	-5,057	-10,998	0,000
	1	-4,046	-9,083	0,000	-4,079	-7,123	0,000
	2	-3,088	-5,324	0,000	-3,066	-3,114	0,001
dINF	0	-5,368	-14,265	0,000	-5,658	-13,379	0,000
	1	-3,799	-8,112	0,000	-4,055	-7,031	0,000
	2	-3,078	-5,287	0,000	-3,685	-5,565	0,000
dGB	0	-4,607	-11,281	0,000	-4,558	-9,021	0,000
	1	-3,668	-7,601	0,000	-3,674	-5,519	0,000
	2	-2,512	-3,065	0,001	-2,737	-1,809	0,035
dGD	0	-3,228	-5,873	0,000	-3,208	-3,674	0,000
	1	-2,433	-2,756	0,003	**-2,310**	**-0,117**	**0,453**
	2	**-2,034**	**-1,191**	**0,117**	**-1,944**	**1,329**	**0,908**
dEB	0	-4,480	-10,786	0,000	-4,433	-8,529	0,000
	1	-3,814	-8,174	0,000	-3,647	-5,415	0,000
	2	-2,831	-4,317	0,000	-2,713	-1,713	0,043
dREER	0	-4,848	-12,229	0,000	-4,974	-10,671	0,000
	1	-3,435	-6,687	0,000	-3,635	-5,366	0,000
	2	-2,900	-4,587	0,000	-2,992	-2,821	0,002
dTFP	0	-5,862	-16,204	0,000	-5,955	-14,555	0,000
	1	-3,781	-8,041	0,000	-3,811	-6,064	0,000
	2	-2,753	-4,013	0,000	-2,701	-1,667	0,048
dSET	0	-2,215	-1,902	0,029	**-2,568**	**-1,142**	**0,127**
	1	-2,149	-1,644	0,050	-2,737	-1,809	0,035
	2	**-1,971**	**-0,943**	**0,173**	**-2,332**	**-0,207**	**0,418**

Table A5. Robustness check 19

Robustness check of the model: The effect of FDI net inflows on the labour productivity growth (1997-2018)						
Model	**CCEMG**		**MG**		**Driscoll-Kraay FE**	
Variables	**Coeff.**	***P* - values**	**Coeff.**	***P* - values**	**Coeff.**	***P* - values**
FDI	0,0451	0,882	0,0036	0,934	0,0245*	0,063
GDP gr	-0,7808*	0,084	-0,0775	0,445	-0,0721	0,437
INF	-0,4761	0,268	-0,0208	0,577	0,0007	0,741
GB	-1,3485	0,223	-0,1523*	0,081	-0,0270	0,564
GD	0,0602	0,724	-0,0516**	0,016	0,0004	0,842
EB	1,0349	0,281	-0,0532	0,130	-0,0841***	0,001
REER	0,0054	0,951	0,0157	0,513	-0,0017	0,864
TFP	0,9015**	0,018	1,0272***	0,000	1,0557***	0,000
SET	-0,2075	0,523	0,0053	0,754	-0,0096	0,450
RMSE	0,3505		1,0131		-	-
Wald chi² / F test	370,920	0,000	750,100	0,000	1481,280	0,000
$R^{2\ within}$	-		-		0,8305	
***P*-values**: * significant at 10%, ** significant at 5%, *** significant at 1%.						

Table A6. Robustness check 210

Robustness check of the model: The effect of FDI net inflows on the labour productivity growth without Croatia (1997-2017)						
Model	**CCEMG**		**MG**		**Driscoll-Kraay FE**	
Variables	**Coeff.**	***P* - values**	**Coeff.**	***P* - values**	**Coeff.**	***P* - values**
FDI	0,1666	0,540	0,0155	0,735	0,0288*	0,056
GDP gr	-0,7952**	0,008	-0,0939	0,395	-0,0841	0,385
INF	-0,5035	0,347	-0,0405	0,246	0,0009	0,677
GB	-0,7019	0,415	-0,1734*	0,060	-0,0168	0,719
GD	-0,1919	0,292	-0,0633**	0,037	0,0012	0,657
EB	0,7396	0,394	-0,0731*	0,063	-0,0855***	0,002
REER	0,2240	0,217	0,0063	0,815	-0,0029	0,785
TFP	0,9382**	0,021	1,0399***	0,000	1,0735***	0,000
SET	-0,3192	0,314	0,0023	0,911	-0,0057	0,667
RMSE	0,2720		1,0210		-	-
Wald chi² / F test	88,470	0,000	588,750	0,000	1283,610	0,000
$R^{2\ within}$	-		-		0,8307	
***P*-values**: * significant at 10%, ** significant at 5%, *** significant at 1%.						

[9] The model has been estimated on the total sample of EEEs, but with an additional year (2018) for all variables included in the model. The authors chose to add mentioned one year data because there is available newer data relevant to this estimation (*N*=16, *T*=22).

[10] The authors estimated the model at the initial research period (1997-2017), but excluding one country from the sample (Croatia) (*N*=15, *T*=21). The authors chose Croatia due to the low average of labor productivity growth rate.

Table A7. CD test on the residuals of CCEMG and MG methods

CD test for cross-section dependence of residuals				
Estimation method	**CD test**	***P* - values**	**Correlation**	**Absolute (correlation)**
CCEMG	-1,530	0,126	-0,030	0,284
MG	3,690	0,000	0,073	0,190

Table A8. CADF test on the residuals of CCEMG and MG methods

Estimation method	**Lags**	**Model with constant**		
		CADF	**CIPS**	***P* - values**
CCEMG	0	-5,629	-15,997	0,000
	1	-4,889	-12,943	0,000
	2	-3,470	-7,092	0,000
MG	0	-4,853	-12,795	0,000
	1	-3,845	-8,640	0,000
	2	-3,083	-5,495	0,000

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