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FOREIGN DIRECT INVESTMENT AS A STIMULANT IN PRODUCTIVITY CONVERGENCE PROCESS BETWEEN VISEGRAD COUNTRIES AND EU-15[1]

Abstract. The explanation of reasons and degree of differentiation of wealth between countries remains an important issue in economics today. Theories of economic growth are focused principally on the identification of the long-term determinants of diversification of sources and economic growth, which in turn is associated with the notion of real convergence. Given the supply role of foreign capital that impacts on the economy, in the face of dynamic inflow of foreign direct investment (FDI) into developing countries' economies, it seems reasonable to include it in convergence process modelling, especially in the modelling of the convergence of productivity.

The productivity of the economy is in fact determined by the size of the capital accumulation (both domestic and foreign), savings rate and a number of other conditions. The author hypothesized that the presence of FDI contributes to the acceleration of pace of real convergence between Visegrad countries and EU-15. In this study we estimate interactions between FDI and productivity at both national and NACE level in the years 2000–2014. We concider, in panel data form, among others, productivity in terms of gross value added per employee, degree of penetration of FDI in the economy of the host country. Results suggest conditional β-convergence of productivity existence however they vary across countries, sectors and time. The analysis provides recommendations regarding the arguments for the sectoral policy aimed at encouraging foreign capital to increase its involvement, focusing on reducing productivity gap between the developing and developed countries belonging to European Union.

Keywords: foreign direct investment, convergence of productivity, panel model, Visegrad Group

JEL: C23, O47, F21

1. INTRODUCTION

Real economic convergence is a common concept in economic literature. One of the most important tasks in economics concerns identifying mechanisms that predetermine economic growth of countries and thus determine the long

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term development of individuals. The hypothesis of convergence in its base meaning explains the dynamics of an economy on the path to its steady state equilibrium as a consequence of neoclassical Solow–Swan's model of growth[2]. Initial studies on convergence conducted among others by Meguire (1985), Baumol (1986), Barro (1991), Barro, Sala-i-Martin (1992), Mankiw, Romer and Wail (1992) focused on estimation of cross section regression of growth.

Another meaning concerns the process of convergence between groups of economies endeavoring to achieve the same level of development in terms of other factors, like for instance rate of savings (Baumol 1986). The literature on convergence is continuing its expansion. In Polish literature a few recent papers should be mentioned (Ciołek 2003; Gawlikowska-Hueckel 2002; Markowska-Przybyła 2010; Próchniak 2013).

2. REAL CONVERGENCE IN THEORY

The primary issue to be explored in connection with the convergence hypothesis is whether the level of income per capita in poorer countries is getting closer to the level of income per capita in richer countries, which would in consequence equalize income distribution in the long term. Literature concerning this issue is vast, starting from classical works to the most contemporary research articles. There are, for example, Barro and Sala-i-Martin, based on the neoclassical model of Ramsey–Cass–Koopmans and Mankiw, Romer and Weil's paper, where the authors use the neoclassical model Solow–Swan. In both cases, authors used the equation which shows the relationship between the GDP per capita growth rate, and initial level of GDP per capita as follows:

$$r_{i,t,t+T} = \beta_0 - \beta \times lny_{it} + \beta \times lny_i^* + \varepsilon_{it} \quad (1)$$

where:

$r_{i,t,t+T}$ – rate of growth of GDP per capita in *i*-country between *t* and *t*+*T* period,

[2] From conceptual point of view, literature gives distinction between conditional and unconditional β convergence. Relying on Solow-Swan model that assumes Cobb–Douglas production function in following form: $Y_t = C_t^{\alpha}(A_t \times L_t)^{1-\alpha}$, where *Y* is GDP, *C* – capital, *L* – labor force, *A* – TFP, α – elasticity of production on capital, 1–α elasticity of production on labor force, thus GDP per capita in steady state equilibrium is expressed by following formula $y^* = A\left[\frac{s}{n+g+\delta}\right]^{\frac{\alpha}{1-\alpha}}$, where A is TFP, s is savings rate, g and n are exponential growth rates of *A* and L respectively δ is rate of capital depreciation. This formula illustrates that GDP per capita value in steady state equilibrium of each country depends on six elements respectively *A*, *s*, *g*, *n*, δ and α which could be determined as a vector θ. Unconditional convergence assumes that all variables from vector θ are the same for economies that are considered, and all of them converge to the same stationary equilibrium.

y_{it} – GDP per capita level in *i*-country in *t*-period,
y_i^* – GDP per capita level in *i*-country in steady-state,
ε_{it} – error term.

In case of positive and significant parameter β it can be assumed that initially poorer countries experience higher GDP per capita growth rate than richer ones. Classical concepts, most commonly found in literature include concepts β type convergence (including unconditional and conditional convergence) and concepts of σ type convergence. In this study unconditional β type convergence is tested on a group of four developing economies namely Czech Republic, Hungary, Poland and Slovakia that have been EU Member States since 2004 and developed EU-15. In contrast to the unconditional convergence the concept of conditional convergence emphasizes the existence of possible differences in a stationary equilibrium, which requires the modification of the equation as follows:

$$r_{i,t,t+T} = \beta_0 - \beta \times lny_{it} + \beta \times ln\theta + \omega_{it}, \quad (2)$$

where θ is a vector of variables characterizing the heterogeneity of the individual stationary equilibrium. If the estimation of θ parameter in regression is statistically significant and positive in its sign, it may be treated as a possibility of conditional convergence existence. The most important issue in question is what variables should be included in the vector θ. In literature authors usually utilize variables connected to education level, fiscal policy and employment structure indices (i.e. Ramajo et al. 2008). In recent literature we observe increasing number of studies analyzing convergence processes, taking into account spatial auto-correlations (among others Modranka 2012; Górna, Górna 2013)

3. REAL CONVERGENCE: SECTORIAL APPROACH

The new Member States of EU have recorded in last decade substantial development gains. Taking into account progressive catching-up process, development gap between old EU Members and the new ones still remains significant. Gains in productivity have been observed parallel with huge foreign direct investment inflows to new Member States, mainly from developed EU countries. Moreover FDI inflows are accompanied by many types of government supportive policies. Efficiency of utilizing measures such as tax preferences for foreign investors should always be concerned in terms of measurable positive changes connected directly or indirectly to foreign capital in the host country. Foreign capital is generally considered not only as a supportive tool for shortages in capital but also know-how, managerial skills and knowledge improvements. Depending on the type of FDI and host country's characteristics,

different effects, varying from positive to negative may be observed. The most important issue is how important FDI is in accelerating convergence process in general and for productivity gains in particular. If FDI has a consistent positive impact on productivity, this would imply that countries should continue to pursue policies aimed at attracting FDI. A lot of research on productivity growth has emphasized the importance of absorptive capacity of the economy hosting the investment, and tacit knowledge in particular, which may enhance the transfer of technology and thereby strengthen the impact of FDI on productivity growth. Absorptive capacity is based on the idea that the potentially positive impact of FDI on the host economy may fail or not, depending on adaptive skills of firms, their resources, as well as general investment climate and economy performance including institutions quality (European Central Bank 2009).

Productivity of an economy plays an extremely important role as a driver for development, in particular in terms of the theory of economic growth. After the literature review, we can conclude that the occurrence of convergence on the aggregate level (national economy) can obscure a lot of information concerning differences on the sectorial level (Bernard, Jones 2001: 1217; Puziak 2009). Therefore it is reasonable to examine in detail which sectors of the economy are subjected to the convergence processes and what is the contribution of individual sectors convergence to the entire economy. The paper by Dollar and Wolf (1988), based among others on Baumol, found that convergence processes within OECD economies occurred on the aggregated level. Acknowledgment of the convergence of productivity levels was a starting point to open the debate on the size of the convergence levels of productivity in particular sectors. In the 1980s there was a lack of literature concerning this issue until Bernard and Jones (1996) work showed that the key to understand the differences in growth rates between different countries is to observe whether technology flows between sectors within one country, or rather between sectors of various countries. In most papers by Bernard and Jones one can find a similar theme of justification for undertaking the sectorial convergence issue. The authors' idea was to fill the gap in research on convergence at micro and macroeconomic level.

An important contribution to the understanding of the convergence processes was Paci (1997) paper, undertaking sectorial convergence on regional level. He drew attention to the importance of sectorial studies because of their ability to show items such as structural changes and productivity changes in sectors that are not observable directly on the aggregated level. One can also find some issues concerning productivity convergence in Carree et al. (1999) paper, nevertheless the biggest impact was put there on GDP per capita convergence. Another study of Gouyette and Perelman (1997), focusing on manufacturing and services sectors, puts emphasis on catching-up processes and interactions between changes in productivity and changes in capital accumulation.

The research on convergence is affected by justified criticism. Accepting sectorial analysis, a selection of appropriate countries for analysis remains an important issue, as a badly performed selection might be a potential cause of biased results. In a pioneering paper, encouraged by the lack of studies concerning EU countries (economists were mostly focusing on national-level analysis within OECD countries only), Doyle and O'Leary (1999) hypothesized that structural changes, which may facilitate convergence, are some of the determinants causing the process on the sector level and to a lesser extent on the level of entire economies. Pascual and Westermann (2002) focused in their study on manufacturing and revealed that convergence analysis should be considered among the sectors which are using similar technologies. They proved that analyzing sectors using different technology may lead to inadequate comparisons and misleading statements about a lack of convergence. Muller (2000), attempted, by utilizing statistical tools, to determine a mechanism which explains why one sector experiences productivity convergence and another doesn't. Wong (2006) presents another interesting approach to sectorial convergence in OECD countries, offering innovative technique of decomposition of β convergence because of the impact of sectorial productivity growth and changes of structure of employment in economy. He assumed that even the lack of convergence in each sector does not make it impossible for the convergence process to take place in the entire economy, which is due to the labor force migrating from lower productivity sector to another more productive one.

To summarize, an overview of the empirical research of sectorial convergence of labor productivity does not allow for clear assessment. It should be mentioned that, at the same time, many researchers carried out studies on labor productivity convergence and others on technological changes and their implications. Approaches concerning labor and capital or even TFP convergence processes should be treaded complementary.

4. DATA AND METHODS

The lack of in-depth research concerning the effect of FDI inflows on productivity convergence in developing countries such as the Visegrad Group, based on industry-level data was the motivation behind this study. This paper provides empirical evidence of the overall effects of stock inward FDI on the productivity convergence in Visegrad Countries, using NACE rev. 1.1. and rev. 2 data in the period 2000–2014. The data were obtained from Eurostat database as well as national banks of each individual country. An important feature of the paper is that it explores whether the size of benefits associated with FDI depends on the absorptive capacity in terms of business enterprise

expenditure on R&D and human capital of the recipient country. Detailed information about the data used in the study is presented in table 1.

Initial studies devoted to economic convergence utilized cross-sectional regressions. This resulted in loss of information of variability of economies and factors describing them. Omission of these features in the model meant that they became components of the random error, which led in turn to the non-fulfillment of the condition of lack of explanatory variables correlated with the random component. The use of such tests or derivatives as? the OLS method involves the problem of consistency and bias. Another problem in studies utilizing time series or cross-section data was connected to a low number of degrees of freedom. To some extent panel data techniques solve the problem, by increasing the available degrees of freedom, and taking into account the individual effects.

In this study we consider the following model:

$$\gamma_{i,t} = \alpha - \beta \times ln\gamma_{i,t-1} + \theta \times X_{i,t} + \eta_i + v_t + u_{it}, \tag{3}$$

$$y_{i,t} = \alpha - (1-\beta) \times y_{i,t-1} + \theta \times X_{i,t} + \eta_i + v_t + u_{it}(y_{i,t} = lnP_{i,t}), \tag{4}$$

where $\gamma_{i,t} = \ln(\frac{P_{i,t}}{P_{i,t-1}})$ is the rate of growth of productivity in a country (sector), $X_{i,t}$ is the matrix of observations, representing country specification, η_i is the individual effect for *i*-country (sector), v_t is the time effect for *t*-period, and u_{it} is the random error term. In the context of conditional β-convergence hypothesis verification, the estimated value of the β parameter is most interesting, and is defined as follows:

$$\beta = (1 - e^{-\beta T})\frac{1}{T}, \tag{5}$$

where T is the number of time observations and β is the estimated parameter. Because the model (3) has got a period dependent variable delayed by 1 among its explanatory variables, it means that we are dealing with an autoregressive model[3].

[3] We set of assumptions regarding the random component and the properties of individual and time effects:
$E(u_{i,t}) = 0\ for\ i = 1, \dots, N\ and\ t = 1, \dots T; E(u_{i,t}u_{i,s}) = 0\ for\ i = 1, \dots N, and\ t \neq s; E(u_{i,t}u_{i,t}) = \delta_u^2; E(u_{i,t}\eta_i) = 0\ for\ i = 1, \dots N\ and\ t = 1, \dots T; E(u_{i,t}, v_t) = 0, for\ i = 1, \dots N, and\ t = 1, \dots T$

Table 1. List of variables used in the study

No	Name of variable	Description	Formula	Shortcut	Unit	Sources
1	2	3	4	5	6	7
1	FDI_pos_ mEUR_i, j, t	Stock of FDI in host *i*-country j-sector in *t*-period	–	FDI	millions euro	National Polish Bank, Czech National Bank, National Bank of Slovakia, Central Bank of Hungary Eurostat
	Capacity_Utilisation _i_t	Capacity utilization of *i*-economy in *t*-period	–	CAP	%	Eurostat
3	Gross_Value_Added_in _previous_ yearprices _i_j_t	Gross Value Added in *i*-economy, *j*-sector in *t*-period	–	GVA	millions euro	Eurostat (a lot of missing data for Poland)
4	Total employment _i_j_t	Total employment 15–74 in *i*-economy, *j*-sector in *t*-period	–	EMP	ths	Eurostat
5	GVA_per_employee _i_j_t	Gross Value Added per employee in *i*-economy, *j*-sector in *t*-period	(3)/ (4)	PROD	millions euro	–
6	GAP_i_j_t (GAP in terms of GVA per employee between EU-15 and i-V4 country)	Gross Value Added per employee in *i*-economy, *j*-sector in *t*-period in EU-15 divided by same measure in each V4 country	$(5^{UE})/$ $(5^{\text{each of V4}})$	GAP	–	–
7	GFCF_i_j_t	Gross Fixed Capital Formation (Assets in current prices) in *i*-economy, *j*-sector and *t*-period	–	GFCF	millions euro	Eurostat

Table 1 (cont.)

1	2	3	4	5	6	7
8	FDI_GVA_i_j_t	FDI to GVA ratio in *i*-economy, *j*-sector and *t*-period	(3)/ (5)	PENETR	%	–
9	HRST_i_j_t	Scientists and engineers 25–64 as percentage of total employment in *i*-economy, *j*-sector and *t*-period	–	HRST	%	Eurostat (2008–2014)
10	BERD_i_j_t	Business enterprise R&D expenditure in *i*-economy, *j*-sector and *t*-period	–	BERD	millions euro	Eurostat (2005–2014)
11	BERDGVA_i_j_t	Business enterprise R&D expenditure ratio to GVA in *i*-economy, *j*-sector and *t*-period	(10)/ (5)	BERDGVA	%	– (2005–2014)
12	INVESTMENT_i_j_t	Gross fixed capital formation as a share of value added in *i*-economy, *j*-sector and *t*-period	(7)/ (3)	INV	%	Eurostat (a lot of missing data for Poland)

i = {Poland, Czech Republic, Hungary, Slovakia,UE-15}, *j* = NACE rev.2 {A, B, C, D35, E, F, GTU, G, H, I, J, K, L, M, N, P85, Q, R, S and TOTAL}, *t*: 2000–2014.

Source: own study.

Growth regressions taking into account the hypothesis of β-convergence models are dynamic and therefore appropriate methods of estimation should be used. The use of classic estimators for panel models, such as OLS (GLS) or the within estimator, results in biased parameters. Application of OLS for the estimation of the model is equivalent to the adoption of restrictive assumptions that individual or periodic effects do not occur within the model. It is empirically proven that the value of the autoregressive parameter (1-β) is overestimated, which implies underestimated speed of convergence. Using the within estimator avoids the issue to do with omitted variables and individual effects but it does not solve the problem of endogenous variables causing biased results. In case of the within estimator autoregressive parameter value is underestimated thus speed of convergence is overestimated (Blundell et al. 2000).

In the estimation of dynamic panel models many methods which take into account the endogenity of dependent variables (Baltagi 1995) were proposed. The majority are estimates based on GMM and instrumental variables method. GMM was developed by Arellano and Bond (1991) and earlier by Holtz-Eakin, Newey and Rosen in 1988. In 1996 this method has been used for the first time by Caselli, Esquivel and Lefort to estimate the regression of growth.

$$y_{i,t} = \alpha + (1-\beta) \times y_{i,t-1} + \theta \times X_{i,t} + \eta_i + v_t + u_{it}\,, \tag{6}$$

$$y_{i,t-1} = \alpha + (1-\beta) \times y_{i,t-2} + \theta \times X_{i,t-1} + \eta_i + v_{t-1} + u_{it-1}\,, \tag{7}$$

$$\Delta y_{i,t} = (1-\beta) \times \Delta y_{i,t-1} + \theta \times \Delta X_{i,t} + \Delta v_t + \Delta u_{it}\,, \tag{8}$$

The idea of this approach is to use in the estimation appropriate instruments for the explanatory variables that are correlated with the random component. In the model for the first differences (7) there are no individual effects, which makes the assumption that the individual effects are uncorrelated with the explanatory variables no longer necessary. Consequently, for GMM for the first differences for each unit matrix of instruments Z_i is needed. The result of estimation is minimal squared measure:

$$y_{i,t} = \alpha + (1-\beta) \times y_{i,t-1} + \theta \times X_{i,t} + \eta_i + v_t + u_{it}\,, \tag{9}$$

$$y_{i,t-1} = \alpha + (1-\beta) \times y_{i,t-2} + \theta \times X_{i,t-1} + \eta_i + v_{t-1} + u_{it-1}\,, \tag{10}$$

$$\Delta y_{i,t} = (1-\beta) \times \Delta y_{i,t-1} + \theta \times \Delta X_{i,t} + \Delta v_t + \Delta u_{it}\,, \tag{11}$$

$$\Delta u' Z^D W_N Z^{D\prime} \Delta u, \tag{12}$$

where:

$$\Delta u' = (\Delta u_1', u_2', \dots, u_N'), \tag{13}$$

$$Z^D = (\Delta Z_1^D, Z_2^D, \dots, Z_N^D), \tag{14}$$

W_N is weight matrix. (15)

The result of mineralization is estimator of parameters:

$$\widehat{\alpha_D} = (\Delta\widetilde{X'}Z^D W_N Z^{D\prime}\Delta\widetilde{X'})^{-1}\Delta\widetilde{X'}Z^D W_N Z^{D\prime}\Delta y \text{ , where } \widehat{\alpha_D} = \begin{bmatrix} 1-\beta \\ \delta \end{bmatrix}. \quad (16)$$

Nevertheless, there are cases in which the GMM estimator for the initial differences is biased. It occurs when the value of the autoregressive parameter is close to 1 or when the variance of the individual effects is significantly higher than the variance of the random component. Another estimator proposed by Blundell and Bond (1988), so called sys-GMM is more adequate in such circumstances. The general idea behind sys-GMM is the estimation system of *T*-2 equations for initial differences and *T*-2 equations for the levels. Due to the fact, that in level equations we face individual effects, additional restrictions are needed.

5. RESULTS

In this paragraph the results of the conducted study are presented. First we estimated a set of simple regressions explaining productivity level in terms of gross value added per employee in V4 countries, using variables such as productivity gap?, investment level, economy utilization capacity, foreign direct investment in economy (PENETR) and its interactions with business enterprises expenditures on research and development ratio, as well as the mentioned GAP. Taking into account results from table 2, only in case of Poland we observe statistically significant and negative impact of the gap in productivity. Except Slovakia, positive interaction between productivity and FDI intensity with BERD GVA ratio was observed. The negative values of parameters for PENETR*GAP, as in case of Slovakia and Hungary, mean that bigger productivity gap connected to high FDI intensity negatively affected productivity.

In further tables (3–5) we present detailed results of estimated panel models explaining rate of change of productivity in the entire economy and in each sector[4]. By using different approaches (pooled panel model, fixed effects and dynamic panel model) we checked the robustness of obtained results. In all cases we noticed significant and negative parameter β, which means that convergence in productivity occurs. Y-o-y productivity rate of growth was higher in the economies with lower lagged productivity level. We also considered a set of

[4] Taking into account the fact that investment in manufacturing and services (in particular financial and insurance activities and professional scientific and technical activities) in V4 countries contributed commonly more than 90% of the total FDI stock, it was decided to present only selected results that are consistent with the study objective.

variables including productivity gap and its square, which suggested that in envisaged example productivity rate was the greatest for individuals characterized by medium levels of productivity gap.

Table 2. Estimates for PROD (V4 in the years 2000–2014) average productivity in economy

explained variable	Poland	Czech Republic	Hungary	Slovakia
PROD				
const	33 312,37 ***	21 620,41 ***	16 556,55 ***	16 372,80 ***
GAP	–5 302,75 ***			
PENETR			25 569,69 ***	33 203,90 ***
*PENETR*BERDGVA*	1 764 850,81 ***	1 592 101,94 ***	328 183,22 *	
*PENETR*GAP*		24 599,03 ***	–8 217,44 ***	–9 256,51 ***
CAPACITY				234,93 ***
INV				–61 988,80 ***
Adjusted Rsquared	0,99	0,98	0,97	0,99
DW	2,37	1,73	1,85	2,43
N	15	15	15	15

Source: own study.

In case of the manufacturing, apart from the estimator used, statistically significant and negative values of β are observed. The set of additional variables included in conditional β convergence equation contributes significantly to the explanation of changes in productivity. Taking into account models 4 FE and 5 DPM we have to notice that higher expenses on research and development increase productivity changes by improving the absorbing abilities of a sector. When productivity gap squared was included in the equation, the results showed that productivity rate was the greatest for individuals characterized by medium levels of productivity gap. Considering the results for the services sector convergence process, it was also observed that it took place at a speed comparable to the whole economy and to manufacturing. Detailed analysis of GAP levels and dynamics is also a useful tool for the less productive sectors to become more productive thanks to higher rates of growth.

In table 5 we find the results for financial and insurance activities (NACE rev.2: K) and professional, scientific and technical activities (NACE rev.2: M). Comparing them to obtained for manufacturing and services β parameters are almost two times higher. Additional set of variables is fulfilling its role by improving explanation level of considered models and providing useful information that higher investment level, rather medium productivity gap between V4's and UE-15 sectors results in higher productivity growth rates.

Table 3. Estimates for ld_PROD (V4 + UE-15 in the years 2000–2014) average productivity in economy

Explained variable	Model 1 pooled	Model 2 pooled	Model 3 FE	Model 4 FE	Model 5 Dynamic panel model 1-step	Model 6 Dynamic panel model 1-step	Model 7 Dynamic panel model 1-step
ld_ *PROD*	***ld_PROD***						
const	,642 ***	5,811 ***	6,116 ***	4,303 ***	6,727 ***	4,964 ***	,009 ***
ld_PROD_(–1)					–,169 ***	–,156 **	–,150 ***
l_PROD_1	–0,058 ***	–,524 ***	–,553 ***	–,411 ***		–,472 ***	–,644 ***
GAP		–,192 ***	–,210 ***				
GAP_squared						–,027 ***	–,031 ***
PENETRGAP		–,015		–,022 ***			
Adjusted Rsquared	0,27	0,71					
LSDV Rquared			0,79	0,68			
Within Rsquared			0,78	0,65			
DW	1,71	1,04	1,37	1,61			
N	5	4	4	4	4	4	4
T	14	14	14	14	13	13	12
Number of instruments					47	57	45
Diagnostic tests		B-P (LM=14,5949, p=0,000)			Test AR(1) [0,5394]. TestAR(2) [0,2040]. Sargam Test [0,0293], Wald Test [0,000]	Test AR(1) [0,1100]. TestAR(2) [0,4462]. Sargam Test [0,0285], Wald Test [0,000]	Test AR(1) [0,1005]. TestAR(2) [0,5548]. Sargam Test [0,0007], Wald Test [0,000]

Source: own study.

Table 4. Estimates for ld_PROD (V4 + UE-15 in the years 2000–2014) NACE GTU & C

Explained variable	Model 1 pooled	Model 2 pooled	Model 3 pooled	Model 4 FE	Model 5 FE	Model 6 pooled	Model 7 pooled	Model 8 FE
ld_ *PROD*	***C-MANUFCTURING.***					***GTU-SERVICES***		
const	,627 ***	5,375 ***	5,563 ***	5,924 ***	4,944 ***	,627 ***	6,378 ***	6,557 ***
ld_PROD_(–1)								
l_ PROD _1	–,0571 ***	–,477 ***	–,471 ***	–,525 ***	–,469 ***	–,0573 ***	–,574 ***	–,0589 ***
GAP		–,193 ***	–,292 ***	–,247 ***			–,249 ***	–,256 ***
GAP_squared					–0,032 ***			
BERDGVA		,350 **	1,243 **	,425 **	,587 ***		,839 ***	,622 **
INV		–,224 *	–,422 *					
PENETR			–0,402 **					
*PENETR*BERDGVA*			–1,130 *					
*PENETR*GAP*			,142 **					
Adjusted Rsquared	0,17	0,66	0,68			,19	,71	
LSDV Rquared				0,75				0,79
Within Rsquared				0,74		0,19	0,71	0,77
DW	2,38	2	2,08	2,33		1,66	1,15	1,34
N	5	4	4	4	4	5	4	4
T	14	14	14	14	14	14	14	14
Diagnostic tests					Joint test on named regressors 2,40e-13, Test for differing group of intercepts 0,009		Variance Test [0,006] B-P (LM=4,95432 , [0,026]	Joint test on named regressors 9,77e-16 Test for differing group intercepts 0,000

Source: own study.

Table 5. Estimates for ld_PROD (V4+UE-15in the years 2000–2014) NACE K & M

Explained variable	Model 1 pooled	Model 2 pooled	Model 3 FE	Model 4 FE	Model 5 pooled	Model 6 pooled	Model 7 FE
ld_ *PROD*	***K FINANCIAL AND INSURANCE ACTIVITIES***				***M PROFESSIONAL, SCIENTIFIC AND TECHNICAL ACTIVITIES***		
const	1,160 ***	11,565 ***	5,296 ***	3,754 ***	1,065 ***	9,796 ***	4,307 ***
ld_ PROD _(–1)							
l_ PROD _1	–0,102 ***	–,995 ***	–,457 ***	–,332 ***	–,097 ***	–,851 ***	–,404 ***
GAP		–4,9 ***	,123 ***			,559 ***	
GAP_squared				–,005 **		,034 ***	–,019 ***
BERDGVA		51,536 *					
INV		,085 ***	,101 *	,145 **		,453 ***	
PENETR		,057 **					
*PENETR*BERDGVA*		–14,394 *					
*PENETR*GAP*							
Adjusted Rsquared	0,19	0,94			0,24	0,89	0,57
LSDV Rquared			0,59	0,46			
Within Rsquared			0,55	0,41		1,28	1,70
DW	2,04	1,91			1,72		
N	5	4	4	4	4		
T	14	(1–10)	14	14	14		
Diagnostic tests			Joint test on named regressors 0,000; Test for differing group intercepts 0,000	Joint test on named regressors 0,000; Test for differing group intercepts 0,031			Joint test on named regressors 0,000; Test for differing group intercepts 0,004

Source: own study.

6. CONCLUSIONS

The results in this paper point to the following conclusions. First, there is a significant convergence effect in productivity on the country as well as the industry levels. Moreover the productivity growth depends negatively on the gap between the EU-15 and the V4 countries, or rather shows non-linear relation (Wojciechowski 2016b). At the country as well as industry level, this effect is clearly visible in Slovakia. At the industry level, the convergence effect is particularly strong in the manufacturing and services sector. Second, FDI plays an important role in accounting for productivity. Third, the impact of FDI on productivity highly depends on the absorbing capacity of the recipient economy. More precisely, the effect of FDI on productivity seems to be increasing with a rising productivity gap between V4 countries and UE-15 but only to some extent. The results suggest an existence of an optimal level of productivity gap providing high productivity growth rate. This finding is not common in literature and further in-depth empirical studies are needed. There is also evidence that the level of business enterprise research and development expenditures is significantly, positively associated with a higher impact of foreign direct investment. The assumed types of interaction between absorptive capacity and the beneficial impact from intensity of FDI seem to be surprisingly negative in the models for sectors. The policy implication of the obtained results is that creating mechanisms for favorable conditions for FDI is needed in order to support productivity convergence, in particular in sectors with higher productivity gap. Absorptive capacity of the V4s economies can be increased by investing more in research and development, for example via raising the level of human capital (see European Central Bank, 2009). Focusing on the example of Poland, according to study of Gradzewicz et al. (2013), during the entire transformation period, the share of more productive employees in total employment was increasing each year, however improvement in quality of labor force was counter-cyclical. The decomposition of the sources of change in average productivity indicates that, while the main factor causing labor productivity growth in the previous periods was the improvement of the employees' education levels, in recent years this factor contributed to a decline in performance. Another important issue is the fact that changes in the structure of employment, and therefore in productivity, are highly determined by demographic processes.

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BEZPOŚREDNIE INWESTYCJE ZAGRANICZNE JAKO STYMULANTA KONWERGENCJI PRODUKTYWNOŚCI POMIĘDZY KRAJAMI GRUPY WYSZEHRADZKIEJ A UE-15

Streszczenie. Wyjaśnienie przyczyn i stopnia zróżnicowania zamożności krajów pozostaje wciąż ważnym tematem w ekonomii. Teorie wzrostu gospodarczego skupiają się zasadniczo na identyfikacji długookresowych determinant oraz źródeł zróżnicowania tempa wzrostu gospodarczego, co z kolei wiąże się z pojęciem konwergencji realnej. Biorąc pod uwagę zasilające oddziaływanie kapitału zagranicznego na gospodarkę, w obliczu dynamicznego napływu bezpośrednich inwestycji zagranicznych (BIZ) do gospodarek krajów rozwijających się, zasadne wydaje się włączenie tej kategorii makroekonomicznej w modelowaniu procesów konwergencji, w szczególności konwergencji produktywności. Produktywność gospodarki zdeterminowana jest bowiem rozmiarami akumulacji kapitału (krajowego i zagranicznego), stopą oszczędności oraz szeregiem innych uwarunkowań. Autor stawia hipotezę, ze obecność BIZ przyczyniała się do przyspieszenia tempa konwergencji realnej pomiędzy krajami Grupy Wyszehradzkiej a krajami UE-15. W badaniu na poziomie krajowym zdezagregowanym zgodnie z klasyfikacją NACE za lata 2000–2014 wykorzystano dane panelowe określające m.in. produktywność oraz stopień penetracji BIZ w gospodarce (sekcji) w kraju goszczącym. Badanie wskazuje na występowanie warunkowej β-konwergencji o zróżnicowanym tempie w przekroju krajów, sektorów i czasu. Przeprowadzona analiza dostarcza informacji w zakresie zasadności prowadzenia sektorowej polityki sprzyjającej wzrostowi zaangażowania kapitału zagranicznego ukierunkowania na zmniejszenie luki produktywności pomiędzy krajami rozwijającymi się, a rozwiniętymi należącymi do wspólnego ugrupowania, jakim jest Unia Europejska.

Słowa kluczowe: bezpośrednie inwestycje zagraniczne, konwergencja produktywności, modele panelowe, Grupa Wyszehradzka.

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