

DETERMINANTS OF GROWTH AND CONVERGENCE IN TRANSITIVE ECONOMIES IN THE 1990S: EMPIRICAL EVIDENCE FROM A PANEL DATA

Menbere T. WORKIE*

Abstract:

This paper empirically examines the determinants of economic growth and convergence in transitive economies of Central and Eastern Europe in the 1990s. While the cross-section regression suggests the absence of a significant convergence across the EU15 and other transitive economies, the Visegrad four (Slovakia, the Czech Republic, Hungary and Poland) dummy being positive and significant indicates that this group of countries has done relatively better than the other group of transitive economies. Moreover, the results indicate that there was an income *per capita* convergence within Visegrad countries. Switching to a panel data approach, and controlling for macroeconomic stability, financial development, human and physical capital accumulations and other policy variables, the results seem to suggest that there was a conditional convergence across EU15 and transitive economies in the 1990s.

Keywords: transitive economies, convergence, economic growth, panel data.

JEL Classification: C13, C31, C33

1. Introduction

Once the euphoria following the collapse of communism in Central and Eastern Europe was gone in the early 1990s, it has been replaced by hard times of economic, political and social reforms. One of the most challenging questions in this regard is whether and to what extent these reforms have generated and will guarantee long-term and sustainable economic growth and push these countries towards the living standards of those in the EU15. The results so far indicate that transitive economies have not achieved similar growth paths, though most of them are on the right track. The reasons for such growth disparities across these economies range from failure to undertake serious reform programs to bad initial conditions and to unfavorable external environment.

*) City University (Bellevue, USA), European Programs, Panonska cesta 17, 851 04 Bratislava and Institute of Slovak and World Economy, Slovak Academy of Sciences, Sancova 56, 811 05, Bratislava (e-mail: menberew2000@yahoo.com).

During the 1990s, there was a tremendous fall in output throughout the transitive economies. In fact, none of the transitive countries has reached its pre-1990 gross domestic product (GDP) *per capita* level (Workie, 2004). The annual real GDP *per capita* growth of most transitive economies during the early periods of the transition (1990 – 1993) was virtually negative. One of the major reasons for this was linked to the loss of global market share as the result of the fall of the then CMEA (the Council for Mutual Economic Assistance) right after the 1989 revolution. After 1994, however, most transitive economies have resumed a relatively high income *per capita* growth. Nevertheless, despite a decade of structural adjustment programs, most transitive economies have not managed to narrow their income *per capita* level to those of the recent members of the European Union (EU15). For instance, in 1990, Slovakia's GDP *per capita* was nearly 68 percent of the average GDP *per capita* of the EU15, which dropped to 49 percent in 1993, though increased to 51 percent in 2000. In terms of this indicator, the Czech Republic seems to have done better than all the other transitive economies (included in this study), though it either did not reach its 1990 level (see Workie, 2004).

The objective of this paper is to empirically address the extent to which transitive economies have managed to narrow their real income *per capita* gap relative to other members of the EU15 during the 1990s. This will be accomplished using the augmented Solow growth framework. Moreover, this paper makes an endeavor to check whether there was any symptom of income *per capita* convergence across the transitive economies themselves and if the accession countries in general and Visegrad four (V4 countries) in particular have been different during the 1990s.

To achieve these objectives, the remainder of this paper has been divided into the following parts. The next part briefly discusses the theoretical growth framework and its specifications. This will be followed by the empirical specification of the theoretical model. The subsequent part will present data description and samples and the empirical results and discussion. Finally, the last part brings conclusion.

2. A Brief Summary of the Augmented Solow Model and its Specifications

The absence of empirical evidence for absolute convergence across a large number of heterogeneous economies and the dispute regarding the long-term determinants of growth between neoclassical economists and advocates of endogenous growth theory have contributed to the new version of the textbook Solow model (Solow, 1956), the augmented growth framework.¹⁾ The augmented Solow growth framework recognizes the role of both physical and human capital accumulations in the growth process. The theoretical model is well known and serves as a basis for most empirical works and is summarized as follows:²⁾

1) For the discussion and literature summary on convergence see Sala-i-Martin, 1994, 1996a, 1996b and Workie, 1998, 2003.

2) For the derivative of the model and other discussion see Mankiw, Romer and Weil (1992).

$$\ln\left(\frac{Y_t}{Y_0}\right) = (1 - \ell^{\lambda t}) \left[\begin{aligned} & -\left(\frac{\xi}{1-\xi}\right) \ln(n+g+\delta) \\ & +\left(\frac{\alpha}{1-\xi}\right) \ln(S_p) \\ & -\left(\frac{\beta}{1-\xi}\right) \ln(S_h) + x\theta \\ & -\ln(y_0) + gt + \ln(A_0) \end{aligned} \right] \quad (1)$$

In this model, y stands for income *per capita*, S_h and S_p stand for human capital and physical capital respectively, n stands for the growth rate of the labor force, g is the exogenous growth of the technology, α is the share of capital in the production function, $y(0)$ is added to capture the conditional convergence effect, δ represents the rate of depreciation, $x(\theta)$ is a vector of policy and other variables that affect economic growth, and finally, λ is the measure of the speed of convergence to the steady state. The model assumes that while physical and human capital accumulations (the capital deepening part) enhance growth of income *per capita*, the growth rate of the population (causing capital widening) and rate of depreciation serve in the opposite direction.

2. 1 The Empirical Specifications of the Theoretical Model

Finally, for our purpose, an empirical counterpart of equation (1) for i -th country under consideration is approximated as follows:³⁾

$$\begin{aligned} LGDPG = & \beta_0 \ln(GDPI) + \beta_1 \ln(n+g+\delta) + \beta_3 \ln(GCF) + \beta_4 \ln(LIFE) + \\ & + \beta_5(CPI) + \beta_6(GGC) + \beta_7(FDI) + \beta_8(OPEN) + \beta_9 \ln(AID) + \\ & + \beta_{10} \ln(CPS) + \beta_{11} \ln(REER) + U_i + V_t + \varepsilon_t \end{aligned} \quad (2)$$

U_i , V_t and ε_i are country-specific, time-specific and overall error terms
 $\lambda = -1 \ln(1 + T \cdot \beta_0)/T$, the speed of convergence.

3. Data Description and Samples

No researcher on empirical issues regarding developing and transitive economies can ever enjoy the luxury of choosing the number of countries he wishes to investigate. Instead, the number of countries is rather dictated by data availability. The number of countries included in the regression differs from variable to variable and year to year. The list of countries included in this analysis is in Table 1. Data for GDP *per capita*, openness, consumer price index, and population are taken from the Penn World Table mark 6.1 (PWT 6.1), an expanded set of international comparisons, ranging from 1960 – 2000 (1990 – 2000, in this case). Following the authors, “the expenditure entries are denominated in a common set of prices and in a common currency (USD) so that real quantity comparison can be made, both between countries and over time”. All the remaining variables have been taken from the World Bank, World Development Indicators (CD-ROM, 2001). In terms of samples, except

3) The definitions of the variables are in the data description part.

the fifteen member countries of the European Union, 13 transitive countries of Central and Eastern Europe have also been included. Moreover, these transitive countries have been split into accession countries (ACC – six countries for which data was available) and Visegrad four due to their distinctive positions and policy similarities throughout the transition process.

Table 1

List of Countries Included in this Study

EU15	Transitive countries	Accession countries	Visegrad 4 (V4)
Austria	Albania	Czech Republic	Czech Republic
Belgium	Bulgaria	Hungary	Hungary
Denmark	Czech Republic	Latvia	Poland
Spain	Hungary	Poland	Slovakia
Finland	Latvia	Slovakia	
France	Macedonia, FYR	Slovenia	
United Kingdom	Poland		
Germany	Romania		
Greece	Russia		
Ireland	Slovakia		
Italy	Slovenia		
Luxembourg	Turkey		
Netherlands	Ukraine		
Portugal			
Sweden			

3. 1 *Variables Included and Corresponding Theoretical Hypotheses:*

a) Initial real GDP *per capita* (LGDP): this variable is included to control for variations in the initial capital stock across countries. Moreover, it helps to control for the conditional convergence effect. The reason is that the neoclassical growth model assumes that countries with lower capital *per capita* tend to grow faster than those with higher capital *per capita*, *ceteris paribus*. If the regression results indicate a statistically significant negative relation between this variable and the growth rate of real GDP *per capita*, it is an evidence for the so-called conditional convergence.

b) Gross capital formation (LGCF): there is a widespread consensus regarding the role of capital accumulation in physical capital in economic growth. The most prevalent argument in the economic literature is that high rate of investment provokes high rates of innovation, which will ultimately lead to higher economic growth (Barro and Sala-i-Martin, 1995, among others).

c) Life expectancy at birth (LLIFE): this variable captures human capital accumulation disparities across countries. Following Sachs and Warner (1998), life expectancy is a broad indicator of the health of population, which turns out to be growth enhancing. In contrast, 'a lower life expectancy mirrors the economic costs of a high infant mortality, high morbidity in population, and a shorter time horizon for the accumulation of human capital' (Sachs and Warner, 1998, p. 341). From a different perspective, Klasen (2002) indicates that education *per se* may not help to achieve long-term growth unless the problem of gender inequality is seriously addressed. In this work, in order to minimize a possible endogeneity problem, I used the initial value instead of the average value, which is also the case in most empirical literature.

d) The growth rate of the population (*LPOPG*): the growth rate of the population, according to the neoclassical assumption, leads to lower economic growth as more people, *ceteris paribus*, would mean capital widening. However, since the growth rate of the population in this case encompasses the labor force, it may lead to higher economic growth by feeding the economy with additional labour force, controlling for education.

e) Total government consumption expenditure (*GGC*): from the perspectives of empirical economics, the impact of government consumption expenditure is unequivocal. This variable is incorporated to control for government policy. Although the budget deficit might be a better indicator, it was not possible because of missing data for transitive economies. Barro (1991) finds a negative relationship between this variable and economic growth. Grier *et al.* (1989), taking data for OECD countries, find out that government consumption expenditure is detrimental to the growth rate of GDP *per capita*. In contrast, others, for example, Levine and Renelt (1992) argue that the relationship between this variable and economic growth is non-robust under different specifications. However, theoretically, higher government consumption expenditure may lead to slower growth *via* its crowding-out effect on private investment and other distortions (high taxation, for instance).

f) Foreign direct investment (*FDI*): foreign direct investment is expected to foster economic growth *via* several channels. First, it is a non-debt creating means of financing current account deficits. Second, foreign direct investment is the major source of technological know-how and managerial skills, among other things. Third, foreign direct investment is also an indicator of the overall macro-economic and political stability of a country, which could help economic growth *via* other spillover effects (creating new jobs, improving infrastructure, and so on).

g) Openness (*OPEN*): this indicator is also a signal about the overall economic-policy direction of a country. A country that is open to international trade is assumed to benefit from international trade and should therefore have accelerated economic growth. However, there are several problems with the issue of openness. The first problem is linked to the choice of the appropriate proxies for this indicator. Second, putting aside the proxy problems, being open on its own may not guarantee faster economic growth. Nevertheless, openness may foster economic growth through innovations, increasing efficiency, and by sending signals about the overall trade liberalization of the economy.

h) Inflation (*CPIG*): low and sustainable rate of inflation is generally an indicator of macroeconomic stability. High rate of inflation, in contrast, leads to misallocation of resources and overall inefficiency and eventually leads to slower economic growth. It is, therefore, expected that inflation will be negatively related to GDP *per capita* growth.

i) Foreign aid (*AID*): foreign aid may play an enormous role in achieving accelerated growth in countries where domestic savings are insufficient to finance domestic investment. In the context of transitive economies, aid may have played a major role in allowing governments to finance the adjustment programs. However, the contribution of aid may diminish as the economy grows and there are sufficient domestic resources capable of financing domestic investment. Following McKinnen (1964), as the GDP shares of domestic savings, exports, and tax revenue rise with GDP *per capita*, the demand for foreign aid will diminish. Aid may also reduce the fiscal burden by pumping the economy with additional foreign financing (Cassel and Eichengreen, 1996). In contrast, Boone (1996) found that aid does significantly increase economic growth; instead, it increases the size of the government. Dollar and Burnside (2000) also conclude that foreign aid is effective only in countries with sound policies. Hansen and Tarp (2001), however, argue that aid turns out to be inef-

fective after controlling for investment in physical and human capital accumulation. The cardinal conclusion, according these authors, is that aid affects growth *via* capital accumulation.

j) Credit to the private sector, percentage of GDP (LCPS): there are several proxies for financial market development. The quasi-money (M2/GDP) is the one most frequently used as a proxy. It was not possible to use this variable in this study, as data are available only for a limited number of countries. Instead, I use the amount of credits from the domestic banking sector extended towards the private sector as a proxy for financial market liberalization. In general, a well-developed financial market fulfills various tasks (OECD, 2003): first, individual savings could be translated into large-scale investments. Second, it helps individual savers have access to insurance through diversification and that decreases idiosyncratic risk. Third, it reduces the cost of investment projects. Finally, a well-developed financial market reduces the costs associated with resource mismanagement.

4. Empirical Results and Discussion

Three types of regression have been run in this work. The first regression was a cross-section one, which encompasses EU15 and all transitive economies for which data was available (see Table 5 in the appendix). Data was available for 27 to 28 countries. The results indicate that while life expectancy and growth rate of population were significantly positively related to GDP *per capita* growth, all the other variables have been either insignificant or bear wrong signs (investment for instance). Although *LGDP* has the right sign, it has not been statistically significant suggesting that there was no any major improvement in the part of the transitive economies in narrowing their income *per capita* gap to those of the EU15 during the 1990s, hence the absence of absolute convergence across EU15 and transitive economies. In columns 2 to 5 of Table 2, the dummy for Visegrad 4 has been positive and significant, indicating this group of countries has made better progress than the other transitive economies included in this analysis. This result is also supported by σ -convergence results, where the standard deviation in income *per capita* between V4 and EU15, on average, was the lowest among the transitive economies and this variance has been decreasing over time (Workie, 2004).

Though the cross-section regression has some advantages, it appears that it suffers from several drawbacks, which may distort the outcomes of empirical analysis. Studies identify at least three problems linked to a single cross-section regression (see Islam, 1995; Hoeffler, 2001; among others).

The first problem is related to the so-called omitted variable bias, in which case other important variables that determine long-run economic growth might be left out from the regression and this leads to biased estimators. Because the single cross-country regression assumes that countries have identical production function, hence this strategy does not allow for heterogeneity, for example, in the initial level of technology across countries. Following Islam (1995), the country-specific aspect of the production function that is ignored could, however, be correlated with some of the covariates and this may lead to omitted variable bias. The second problem, as Hoeffler (2001) argues, is that limiting the time series to a single cross-section regression would mean that not all available information is utilized. The third problem linked to a single cross-section regression is the problem of reverse causality (endogeneity), where one or more of the explanatory variables may happen to be correlated with each other and give rise to distorted results.

One of the remedies to the above drawbacks is to use a panel data, which allows incorporating both country-specific and timing specific factors as additional

Table 2
EU15 and Transitive (Cross-section) Results

	Cross-country Regression Results (1990 – 2000) ^{a)}				
	1	2	3	4	5
<i>CONST</i>	21.89 ^{**} (2.22)	-77.62 [*] (-1.73)	-97.65 ^{***} (-2.28)	-116.66 ^{**} (-2.4)	-130.21 ^{***} (-2.56)
<i>LGDP</i>	0.105 (0.15)	-1.014 (-1.26)	-0.256 (-0.31)	-0.502 (-0.56)	-0.479 (-0.53)
<i>LGCF</i>	-7.113 ^{***} (-2.91)	-4.803 [*] (-1.94)	-4.523 [*] (-1.97)	-4.163 [*] (-1.77)	-4.433 [*] (-1.87)
<i>LPOPG</i>	1.967 ^{***} (3.21)	2.179 ^{***} (3.81)	2.101 ^{***} (3.83)	2.180 ^{***} (3.89)	2.449 ^{***} (3.89)
<i>LLIFE</i>		23.919 ^{**} (2.26)	27.687 ^{***} (2.77)	32.234 ^{***} (2.82)	35.607 ^{***} (2.97)
<i>GGC</i>			-0.231 ^{**} (-2.31)	-0.233 ^{**} (-2.32)	-0.245 ^{**} (-2.42)
<i>FDI</i>			0.258 (1.39)	0.226 (1.18)	0.171 (0.85)
<i>OPEN</i>				0.009 (0.85)	0.009 (0.8)
<i>CPIG</i>					0.028 (0.95)
Dummy for V4	2.031 [*] (1.74)	2.251 ^{**} (2.09)	2.067 [*] (2.01)	1.943 [*] (1.86)	2.229 ^{**} (2.05)
No. of obser.	28	28	27	27	27
Implied β	0.001	0.011	0.002	0.005	0.005
R^2	0.51	0.61	0.70	0.71	0.72

a) For all the regressions, dependent variable is growth rate of log of real GDP *per capita* (in log).

explanatory variables. The country-specific factors may control for differences across countries in their level of technology and productivity, and natural endowments, degree of political instability, among other things. On the other hand, the time-specific factors may help control for the impacts of changes in global macroeconomic policies as all countries may not gain or loose equally from such policy changes.

In the framework of the panel data, I have run both random effects (*RE*) and fixed effects (*FE*) models. In the random effects model (columns 1 – 4 in each table), the country-specific effects are considered as part of the overall error term, while the country-specific effects are part of the explanatory variables in the fixed effects model (columns 5 – 8 in each table). In the context of a panel data, I used two approaches. The first was to divide the entire period, which ranges from 1991 – 2000 with a three-period and three-year non-overlapping panel (1991 – 1993, 1994 – 1996, and 1997 – 1999). The justification was that the first period decline in output was generally the reflection of severe collapses in production as the result of the dramatic change in the system rather than the result of transformation, while these economies started to stabilize in the second and third periods. The second strategy

was to run a pooled annual cross-section time series regression ranging from 1990 – 2000.

Regarding the empirical strategy, I have run several combinations. First, I take EU15 and accession countries with Visegrad 4 dummy using a three period panel. Similarly, EU15 and all transitive economies for which data was available with accession dummy have been considered. The second combination was to run annual pooled cross-section time series for both groups. Finally, I have run an annual

Table 3

EU15 and Accession with V4 Dummy (panel 3)^{b)}

	Random Effects Model				Fixed Effects Model			
Variable ^b	1	2	3	4	5	6	7	8
<i>CONST</i>	7.577** (2.16)	-13.58 (-0.69)	-16.96 (-0.76)	-20.69 (-0.9)	19.91*** (4.12)	20.78 (0.52)	60.73 (1.41)	56.88 (1.3)
<i>LGDP</i>	-1.076*** (-3.3)	-1.011** (-2.49)	-1.136*** (-2.61)	-1.179*** (-2.66)	-2.288*** (-5.03)	-1.943*** (-3.53)	-2.832*** (-4.48)	-2.941*** (-4.44)
<i>LGCF</i>	1.124*** (3.26)	1.422*** (3.54)	1.506*** (3.34)	1.427*** (3.06)	0.871** (2.51)	1.192*** (2.75)	1.063** (2.25)	1.14** (2.31)
<i>LPOPG</i>	0.02 (0.13)	0.26 (1.2)	0.257 (1.08)	0.251 (1.05)	0.065 (0.35)	0.288 (1.05)	0.205 (0.75)	0.218 (0.79)
<i>LLIFE</i>		4.508 (0.92)	5.533 (1.02)	6.511 (1.16)		-1.23 (-0.13)	-8.141 (-0.85)	-7.013 (-0.71)
<i>GGC</i>			-0.007 (-0.36)	-0.008 (-0.38)			-0.061** (-2.19)	-0.060** (-2.15)
<i>FDI</i>			0.018 (0.82)	0.016 (0.7)			0.02 (0.91)	0.025 (1.06)
<i>CPIG</i>			0.007 (0.56)	0.008 (0.59)			0.003 (0.26)	0.002 (0.18)
<i>OPEN</i>				0.002 (0.73)				-0.003 (-0.65)
Dummy for V4	-1.077*** (-2.97)	-0.85** (-2.04)	-0.926* (-1.95)	-0.908* (-1.91)				
<i>PRD1</i>	-1.044*** (-6.23)	-1.096*** (-5.2)	-1.108*** (-4.19)	-1.042*** (-3.72)	-1.034*** (-6.38)	-1.182*** (-4.84)	-1.221*** (-4.3)	-1.255*** (-4.3)
<i>PRD2</i>	-0.133 (-1.33)	-0.089 (-0.74)	-0.099 (-0.67)	-0.083 (-0.55)	-0.318*** (-3.03)	-0.324* (-1.97)	-0.432** (-2.43)	-0.438** (2.43)
Groups	21	21	21	21	21	21	21	21
No. of observ.	62	56	55	55	62	56	55	55
<i>R</i> ²	0.66	0.69	0.72	0.71	0.72	0.73	0.79	0.80
Implied β	0.011	0.01	0.015	0.012	0.023	0.02	0.03	0.03
<i>Chi</i> ²	failed	failed	failed	0.00				

b) For all regressions, columns 1 – 4 are for the random effects models while columns 5 – 8 are for the fixed effects models.

pooled cross-section time series regression only for transitive economies with Visegrad 4 dummy. The results for the three-period panel for EU15 and accession countries with Visegrad 4 dummy are in Table 3. For all panel-data regression results, columns 1 – 4 stand for the random effects models while columns 5 – 8 stand for the fixed effects model. The fixed effects model is by far better relative to the RE model as it takes into account country-specific factors that have not been included in the model.

The regression results in Table 3 suggest the following: the log of initial GDP *per capita* is negatively and significantly related with real GDP *per capita* growth. From this, it implies that keeping all the other things constant, there is an evidence for conditional convergence across EU15 and accession countries, indicating that poorer countries (accession countries) included in this study have higher growth rates relative to richer ones, controlling for the other variables. Investment was positively and strongly related with GDP *per capita* growth, while life expectancy (a proxy for human capital accumulation) was insignificant in the RE model and has a wrong sign in the FE model, the case also in other empirical studies (see Hoeffler, 2001, for example). Government consumption expenditure is turned out to be growth retarding rather than growth enhancing, particularly in the FE model. This may seem to suggest that higher government consumption, by crowding out the private sector (among other disadvantages), may lead to poor subsequent growth. The dummy for Visegrad 4 was negative and significant indicating that this group of countries experienced worse growth performance relative to EU15, *ceteris paribus*. The period dummies (PRD1 and PRD2) included to control for the impact of global macroeconomic policy changes suggest that the worst growth performance was achieved during the first period (1991 – 1993) and was followed by the second period (1994 – 1996). A three-period panel regressions for EU15 and transitive economies with accession dummy indicate similar results (therefore, I have not reported the results here). A similar regression for accession countries alone would have been useful. However, this was not possible due to few numbers of countries with full data.

The next attempt was to run an annual pooled cross-section time series regression, which covers the period 1990 – 2000. This was done mainly for two reasons: first, dividing the period might cause a selection bias problem, where one *a priori* knows the first period (1991 – 1993) was the worst period and the last period (1997 – 1999) was relatively the best one. Second, the annual pooled cross-section time series approach allows one to run a separate regression for transitive countries alone. This helps to figure out the extent to which this group of countries has been experiencing a similar growth dynamics, and whether there was any sign for conditional convergence across this group. Finally, this strategy helps to increase the number of observation and leads to a gain in the degrees of freedom.

The annual pooled cross-section time series regression results for EU15 and accession countries with V4 dummy are presented in Table 4. From the results it is apparent that there was a catch-up effect controlling for other variables, which is an evidence for conditional convergence across EU15 and accession countries that are included in this study during the 1990s. Investment in physical capital is positively related to GDP *per capita* growth, while investment in human capital was insignificantly related with GDP *per capita* growth, except column 6 of the FE model. Surprisingly, government consumption expenditure (GGC) seems to have a positive impact on GDP *per capita* growth. This is, however, consistent with OECD (2003) argument, where government consumption expenditure induces growth *via* several channels including its direct impact through the accumulation of capital in urban infrastructure, transport and communications or indirectly by stimulating the private sector through various channels (see OECD, 2003). In addition, in the context of

transitive economies, the governments' role to finance the adjustment programme might be very important to sustain the reform programme. Nonetheless, this is in contrast to the findings of the cross-section regression in this paper and Barro's finding that government consumption retards growth *via* its crowding-out effect on the private sector.

Table 4

EU15 and Accession Countries with Visegrad Four Dummy (annual pooled cross-section)

	Random Effects Model				Fixed Effects Model			
Variable	1	2	3	4	5	6	7	8
<i>CONST</i>	-1.107 (-0.09)	-35.83 (-0.47)	-9.137 (-0.12)	-19.90 (-0.28)	62.35** (2.05)	-312*** (-2.28)	-249* (-1.77)	63.92 (0.47)
<i>LGDPi</i>	-1.871 (-1.58)	-2.487 (-1.6)	-6.301*** (-3.65)	-8.058*** (-4.84)	-10.4*** (-3.41)	-15.1*** (-4.33)	-13.49*** (-3.35)	-8.929*** (-2.44)
<i>LGCF</i>	6.936*** (4.93)	7.795*** (5.04)	4.958*** (3.04)	3.764** (2.42)	12.95*** (7.48)	13.52*** (7.49)	9.718*** (5.04)	6.58*** (3.67)
<i>LPOPG</i>	0.653 (1.49)	0.428 (0.84)	12.06 (0.65)	18.50 (1.05)	-0.029 (-0.05)	-0.113 (-0.16)	79.35*** (5.04)	-3.425 (-0.1)
<i>LLIFE</i>		8.666 (0.47)	0.005 (0.001)	-0.083 (-0.18)		96.73*** (2.81)	-0.166 (-0.25)	-0.288 (-0.49)
<i>GGC</i>			0.202** (2.39)	0.212*** (2.66)			0.395** (2.23)	0.412*** (2.62)
<i>FDI</i>			0.225*** (2.71)	0.116 (1.47)			0.200** (2.29)	0.047 (0.59)
<i>CPIG</i>			-0.103*** (-4.28)	-0.129*** (-5.66)			-0.061*** (-2.56)	-0.115*** (-4.99)
<i>OPEN</i>				0.064 (5.13)				0.135*** (5.99)
Dummy for <i>ACC</i>	-2.198** (-2.03)	-1.941 (-1.25)	-2.531* (-1.72)	-5.069*** (-3.42)				
Groups	21	21	20	20	21	21	20	20
No. of observ.	204	176	168	168	204	176	168	168
<i>R</i> ²	0.41	0.46	0.58	0.66	0.47	0.54	0.63	0.71
Implied β	0.018	0.025	0.065	0.084	0.11	0.16	0.144	0.09
<i>Chi</i> ²	failed	failed	failed	failed				

Foreign direct investment (*FDI*) was strongly and positively related with growth of real GDP *per capita*, indicating the importance *FDI* *via* capital inflows, and other spillover effects (innovations, know how and managerial skills). However, once openness (*OPEN*) was included in the regression, the significance of *FDI* disappears though remains to carry the right sign. The change in the consumer price index (*CPIG*) included to control for macroeconomic stability, was strongly negatively re-

lated with the growth rate of real GDP *per capita*. This seems to suggest that price instability and uncertainty about future price developments may be detrimental for long-run economic growth. This is consistent with plenty of other empirical studies. In contrast, *OPEN*, included to control for trade openness and overall liberalization, indicates that countries that are open have better growth performance than those that are less open. Nevertheless, this indicator has been problematic in other empirical studies as it is not clear which proxy is the best one. Finally, the dummy for accession countries was negative and significant, suggesting that these countries have done much worse relative to the EU15, the result that is not surprising at all. The results for the EU15 and transitive countries were almost similar (see Table 5). Since most of the coefficients for the pooled cross-section regressions have been insignificant, the results have not been reported here.

Table 5
EU15 and Transitive Countries with ACC Dummy (annual cross-section pooled time series)

Variable	Random Effects Model				Fixed Effects Model			
	1	2	3	4	5	6	7	8
<i>CONST</i>	-4.361 (-0.6)	-118*** (-2.99)	-153.1*** (-3.39)	21.27 (0.44)	120.6*** (4.69)	-486.8*** (-3.61)	-330.7** (-2.22)	-217.3 (-1.56)
<i>LGDPi</i>	0.56 (0.85)	-1.174 (-1.24)	-3.154*** (-2.91)	-6.082*** (-4.59)	-14.24*** (-5.17)	-20.38*** (-6.35)	-18.24*** (-4.82)	-24.68*** (-6.72)
<i>LGCF</i>	0.397 (0.24)	1.113 (0.63)	1.896 (1.06)	-8.251*** (-4.18)	5.509*** (2.67)	6.611*** (3.13)	6.152*** (2.94)	-3.491 (-1.3)
<i>LPOPG</i>	0.258 (0.67)	0.237 (0.58)	-0.410 (-0.93)	-0.491 (-1.37)	-0.743 (-1.55)	-0.93* (-1.93)	-1.015** (-2.03)	-0.836** (-2.14)
<i>LLIFE</i>		29.72*** (2.9)	40.43*** (3.49)	10.66 (0.92)		154.1*** (4.51)	111.5*** (2.9)	104.1*** (2.95)
<i>GGC</i>			0.078 (0.72)	0.003 (0.04)			0.147 (0.85)	-0.109 (-0.63)
<i>FDI</i>			0.211* (1.68)	0.033 (0.28)			0.209* (1.62)	0.164 (1.36)
<i>CPIG</i>			-0.028*** (-3.28)	-0.013** (-2.03)			-0.027*** (-3.32)	-0.015** (-2.35)
<i>OPEN</i>			0.042*** (2.68)	0.288* (1.88)			0.052** (1.95)	0.039 (1.41)
<i>LCPS</i>				4.24*** (6.47)				4.194*** (5.18)
Dummy for ACC	0.497 (0.5)	1.099 (1.02)	-0.439 (-0.36)	2.617** (2.1)				
Groups	28	28	27	27	28	28	27	27
No. of observ.	271	235	223	190	271	235	223	190
<i>R</i> ²	0.09	0.14	0.29	0.44	0.22	0.31	0.40	0.53
<i>Chi</i> ²	failed	failed	failed	failed				

5. Conclusion

This paper was aimed at empirically examining the extent to which transitive economies of Central and Eastern Europe have managed to narrow their income *per capita* gaps with the existing older members of the European Union during the 1990s. In addition, the paper has also dealt with whether there was a substantial convergence across the transitive economies themselves and if the accession countries in general and Visegrad 4 countries in particular have distinction positions in this process of transformation and integration. To answer these questions, several empirical regressions have been run. The first one was a simple cross-section regression, which includes the period 1990 – 2000. The results indicate that there was no any substantial income *per capita* convergence across the transitive economies of Central and Eastern Europe and the EU15 in the past decade. However, the results signal that accession countries in general and Visegrad 4 countries in particular have by far lower standard deviation of income *per capita* level with the EU15 average compared to other transitive economies.

Since the cross-section approach suffers from several problems, a panel data approach has been introduced. The results imply that controlling for macroeconomic policy variables, investment in human and physical capital accumulation, and initial conditions, there was an evidence for conditional convergence across transitive economies and the EU15 in the past decade. The results, in this case, are consistent with the theoretical predictions of the augmented Solow model. The regression results for transitive economies alone suggest that these economies have also been experiencing conditional convergence, controlling for policy variables, and investment in human and physical capital accumulation, external aid, and financial development indicators.

Finally, the regression results suggest that countries with sound macroeconomic policies, financial development, high foreign direct investment, and comprehensive structural adjustment tend to have better economic performance than those in the opposite camp. Nevertheless, it should be stressed that convergence in income *per capita* requires several decades and there is a lot left to be done in transitive economies in order to narrow their income *per capita* gaps with those of the EU15. Moreover, the experiences of the world indicate that the main mission of the early periods of the adjustment programme is stabilization and elimination of distortions, which will guarantee higher long-term economic growth. In this regard, most transitive economies seem to have been on the right track.

References

- Barro, J. R.** (1991), "Economic Growth in a Cross-Section of Economies." *The Quarterly Journal of Economics*, 106 (2), pp. 407-443.
- Barro, J. R., Sala-i-Martin, X.** (1995), *Economic Growth*. Boston: McGraw Hill.
- Boone, P.** (1996), "Politics and the Effectiveness of Foreign Aid." *European Economic Review*, 40, pp. 289-329.
- Burnside, C., Dollar, D.** (2000), "Aid, Policies and Growth." *The American Economic Review*, 90 (4), 847-867.
- Cassel, A., Aichengreen, B.** (1996), "Can Foreign Aid Accelerate Stabilization?" *The Economic Journal*, 106 (5), pp. 601-619.
- Craig, B., David, D.** (2000), "Aid, Policies and Growth." *The American Economic Review*, 90 (4), pp. 847-867.
- Grier, K., Tullock, G.** (1989), "An Empirical Analysis of Cross-National Economic Growth: 1951 – 1980." *Journal of Monetary Economics*, 24 (2), pp. 259-276.

- Hansen, H., Tarp, F.** (2001), "Aid and Growth Regressions." *Journal of Development Economics*, 64, pp. 547-570.
- Heston, A., Summers, R., Aten, B.** (2002), "Penn World Table (Mark 6.1)." Philadelphia, Center for International Comparisons at the University of Pennsylvania (<http://pwt.econ.upenn.edu/>).
- Hoefler, E. A.** (2001), "The Augmented Solow Model and the African Growth Debate." CID, Center for International Development Working Paper No. 36.
- Islam, N.** (1995), "Growth Empirics: A Panel Data Approach." *The Quarterly Journal of Economics*, 110, pp. 1127-1170.
- Klasen, S.** (2002), "Low Schooling for Girls, Slower Growth for All? Cross-Country Evidence on the Effect of Gender Inequality in Education on Economic Development." *The World Bank Economic Review*, 16 (3), pp. 345-375.
- Levine, R., Renelt, D.** (1992), "A Sensitivity Analysis of Cross-Country Growth Regression." *American Economic Review*, 82 (4), pp. 942-963.
- Mankiw, N. G., Weil, N. D., Romer, D.** (1992), "A Contribution to the Empirics of Economic Growth." *The Quarterly Journal of Economics*, 107 (2), pp. 407-437.
- McKinnen, R.** (1964), "Foreign Exchange Constraints in Economic Development and Efficient Aid Allocation." *Economic Journal*, (June), pp. 388-409.
- Obadi, S. M.** (2002), "The Export Possibilities of the Slovak Republic to Developing Countries," in Columbus, F., ed., *Central and Eastern Europe in Transition*. New York: NOVA Science Publisher, Inc., pp. 21-27.
- OECD** (2003), *The Sources of Economic Growth in OECD Countries*. Paris: Organization for Economic Cooperation and Development.
- Sachs, D. J., Warner, A. M.** (1998), "Sources of Slow Growth in African Economies." *Journal of African Economies*, 6, pp. 335-376.
- Sala-i-Martin, X.** (1994), "Cross-Sectional Regressions and the Empirics of Economic Growth." *European Economic Review*, 38 (3-4), pp. 739-747.
- _____ (1996a), "Regional Cohesion: Evidence and Theories of Regional Growth and Convergence." *European Economic Review*, 40 (6), pp. 1325-1352.
- _____ (1996b), "The Classical Approach to Convergence Analysis." *The Economic Journal*, 106 (437), pp. 1019-1036.
- Solow, M. R.** (1956), "A Contribution to Theory of Economic Growth." *The Quarterly Journal of Economics*, 70, pp. 65-94.
- World Bank** (2001), *World Development Indicators*. Washington: World Bank (CD-ROM).
- Workie, T. M.** (1998), "Convergence Hypothesis in a Cross-Section of Economies." *Central European Journal for Operations, Researches and Economics*, 6 (3-4), pp. 261-273.
- _____ (2003), "Absolute Convergence Across Time and Space: New Empirical Evidence for an Old Debate." *Journal of Economics*, SAV, 51 (10), pp. 1270-1290.
- _____ (2004), "Slovakia's Growth Performance in a Regional Context During the 1990s: An Empirical Investigation," in: Sergi, B. S., Bagatelas, W. T., eds., *The Slovak Economy and EU Membership*. Bratislava: IURA EKONOMIA, ISBN: 80-8078-006-7, pp. 214-227.