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Speed of convergence. CEE and Western Balkans countries

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Abstract — The implications of neoclassical model in growth theory are still dominant. One of the implications is convergence hypothesis which means that in the long run income per capita will converge in the steady state level. With regards it is suggesting a natural methodology for finding support of convergence hypothesis. Different researches found the speed of convergence for different "convergence club" countries and regions around the world. Regarded to this it is suggested" convergence club" countries for Albania which is composed by Central, Eastern Europe (CEE) and Western Balkans countries because of same similar characteristics. The observed period for this study is 2000-2010 and the explanatory variable is GNI per capita. In this study, after testing the convergence hypothesis in cross-sectional data set through regression analyses, it is estimated the speed of convergence around 2% per year between this "convergence club" country.

Index Terms— "Convergence club" for Albania, Convergence of income per capita, GNI, Mathematical neoclassical model of growth, Speed of convergence.

1. INTRODUCTION

Albania and other similar countries are in the process of European integration, process of which determines an achievement of certain requirement. There are different countries with similar historical facts, countries. Countries like Estonia, Latvia, Lithuania, Poland, Czech Republic, Slovakia, Hungary and Slovenia in May 2004, and in January 2007 Romania and Bulgaria, are now part of EU. Other countries like Albania, Macedonia, Serbia, etc are trying to make possible this participation. Being part of the EU required obligation of achieving determinant objectives in different spheres of life and one of them are economic criteria. Candidate and potential candidate countries need to converge in common objectives. For this reason it is looking for convergence of income per capita between these countries.

First part of this study illustrated the concept of convergence which will be tested. Literature review about pro and cons convergence hypothesis is suggested in the second part. Then, in the third part, mathematical model of convergence explain how to pose the convergence problem and how to quantify the response of them. The fourth part of the study trying to constructs "convergence club" countries for Albania according similarities between them. The last part represents an empirical finding by cross-sectional regression analyses in SPSS 17.

2. THE CONCEPT OF CONVERGENCE

Beyond the history neoclassical model was mostly considered by the researchers to predict convergence in term of income per capita. The pioneers of neoclassical model are Solow [16], [17] and Swan [20]. Considering diminishing return of physical capital in production, which is the crucial assumption in contest of convergence, they conclude that a closed economy will converge in its steady state in term of income per capita, or more detailed, in the presence of exogenous technological progress income per capita will grow only by the rate of technological progress. In the neoclassical model steady state level depends on the depreciation rate of physical capital, the growth rate of population and the rate of saving. Differences in these country indicators, which are considered constant in time, saving rate, population growth and depreciation, make the differences in steady state level. On the basis of the neoclassical assumptions endogenous saving rate taking in consideration optimal consumption choice by individual in time and the result is the same, in the long run an economy will converge in steady state level of income per capita [3], [7], [19]. This means that each country, in the long run, will converge at its steady state level. So, lower the level of income per capita, compared to steady state level, higher should be rate of growth for achieving long run equilibrium.

Researches considering these theoretically frameworks have constructed a convergence terminology. *Absolute* convergence refers to the process by which relatively poor countries grow faster that rich ones. The notion of absolute convergence maybe implies that county indicators are the same for all, or more exactly, these indicators are dynamically related to the economic growth and evolve together. Countries may have a common steady state and, in the long run, they can grow at the same rate, rate of exogenous technological change. Reasons for absolute convergence should be: (i) lower level of capital means higher marginal returns which push increasing investments and, in the same time, income to steady state level, (ii) the contagion of poor economies from successful economic model of richer can push them towards steady state level. *Conditional* convergence implies that a given country converges to its steady state and this level depends on the individual county indicators. By this definition it is not necessary to argue that poor counties grow faster than rich ones. How largest is the rate of growth of a given country depends by the distance of its own steady state. This mean that poor countries can have a lower growth rate even that they level of income per capita is lower than rich counties. Reasons for conditional convergence should be: (i) Even though a higher return of capital in poor countries, they cannot increase investment because of higher necessity to consume and, in the open economy, be-

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cause of higher risk and uncertainty that characterize these countries which is called "poverty trap" in literature, (ii) even though successful model are available poor countries do not have "the capacities" to adopt them. However, conditional convergence permits to analyze, after controlling for steady state differences, a negative relation between growth and initial level of income per capita in the same way of absolute convergence.

3. LITERATURE REVIEW OF CONVERGENCE

The most important assumption that makes possible a presence of convergence in theory is diminishing return of capital. If this condition is not held than income per capita for a given economy do not converge and consequently even the world. In fact, for better explanation of growth emerged new theory of endogenous growth. Romer [11], [12] and Lucas [15] use an excellent theoretical framework to explain that diminishing return of capital is not held in general. Based in AK model, through external effect of knowledge, R&D and innovation, Romer explains that a given country will not converge in term of GDP per capita. Lucas, considering human capital performance and learning by doing in the production process which leads in increasing returns to scale, interprets the same conclusion of non convergence.

The sustention of convergence comes at firs by Abramovitz [10] who explains the negative relation between initial level of productivity and growth rate of productivity in the long run. He defines "catch up" the process which make possible that poor can catch rich in term of productivity. Baumol [21] using Maddison data [1], introduced the term of "convergence clubs". The idea of clubs is that if a homogenous sample of countries can be founded, than according to neoclassical model absolute convergence should be observed. He found a negative relation between average rate of growth and initial level GDP per work hour during the period 1870-1979 by the equation g= 5.25- 0.75ln(Y1870) R2=0.88 for 16 countries called them clubs. Making attention of the ratio of standard deviation from the mean of GDP per work-hour, Baumol concluded that it is fallen quite steadily. Mankiw, Romer and Veil using augmented Solow model by human capital, founded a significant tendency toward convergence for OECD sample [8]. After controlling for rate of saving, population growth and human capital they explained that convergence hypothesis is relevant. One of the regression results offered by them is the speed of convergence around 2% per year. The contribute in convergence hypothesis is offered by Barro and Sala-I-Martin where they have investigated the US data set for 48 states and have suggested a 2% annum as a speed of convergence between them [13]. The same rate of convergence was suggested by Sala-I-Martin from Japanese prefectures [23]. However, absolute convergence it is not present in the world. Mankiw, Romer and Veil conclude that unconditional convergence is not present in their data. Sala-I-Martin did not find absolute convergence between 110 countries for the period 1960-1990 [23]. The set of countries in the world did not converge in the sense of beta convergence1. Barro and Sala-I-Martin suggested that growth rate from 1960 to 2000 is not related with the Log of GDP per capita in 1960 using cross-country data for 112 countries; even more they found a positive relation intending a presence of divergence [14].

This literature review suggests that, with more probability, the hypothesis of conditional convergence is more present in the world. Conditional convergence into the world or absolute convergence between "convergence club" and regions make reasonable the agreement of similarities of them. The diffusion of technology, the influence of social mentality and their behavior, the political condition and decision, the representation of democracy by institutions, openness of economy, and all of that unexplored in growth theories, tend to be more similar in these kind of "convergence club" or regions.

4. MATHEMATICAL NEOCLASSICAL MODEL OF GROWTH WITH CONSTANT SAVING RATE

Assuming Cobb Douglas production function with labor augmenting technological progress [2]. Technological progress transforms the labor input in effective labor input Y= F(K;AL). In the Cobb Douglas function production by labor and capital inputs is given

$$Y = K^{\alpha}(AL)^{1-\alpha} \quad (1)$$

Where technology and labor input are supposed to be

$$\left.\begin{aligned} A(t) &= e^{gt} \\ L(t) &= L_0 e^{nt} \end{aligned}\right\} \Rightarrow AL = e^{gt} L_0 e^{nt} = L_0 e^{(n+g)t}$$

This means that this factor grows constantly in time by n+g. In terms of capital per effective worker we have

$$\tilde{k} = K(t)/L_0 e^{(n+g)t} \Rightarrow K(t) = \tilde{k} L_0 e^{(n+g)t}$$

Where the first derivate per time (t) should be equal to saving in a closed economy

$$\dot{K} = \dot{\tilde{k}} L_0 e^{(n+g)t} + \tilde{k}(n+g) L_0 e^{(n+g)t} = sF\left[\tilde{k}; L_0 e^{(n+g)t}\right] \quad (2)$$

Divided per effective worker we have $\dot{\tilde{k}} + \tilde{k}(n+g) = sf(\tilde{k})$. If we take in consideration depreciation rate by (σ) than we take

$$\dot{\tilde{k}} = sf(\tilde{k}) - (n+g+\delta)\tilde{k} \quad (3)$$

In the Cobb Douglas case we have

$$\dot{\tilde{k}} = s\tilde{k}^{\alpha} - (n+g+\delta)\tilde{k} \quad (4)$$

At steady state capital per effective worker will not change, so $\dot{k} = 0$. If we consider output per effective worker equal to $\tilde{y} = \tilde{k}^{\alpha}$ in the steady state physical capital per effective worker will be taken by $sk^{\alpha} = (n+\alpha+g)k$. By transformations we get steady state level of capital per effective worker which is

$$\tilde{k}^* = \left(\frac{s}{n+\delta+g}\right)^{\frac{1}{1-\alpha}} \quad (5)$$

And output per effective worker converges in

$$\tilde{y}^* = \left(\left(\frac{s}{n+\delta+g} \right)^{\frac{1}{1-\alpha}} \right)^{\alpha} \quad (6)$$

The right side of the expression is composed by constants. We have assumed population, technology and depreciation are changed constantly in time. This formulation explains why steady state level should be different for different countries. Output per capita (effective worker) in steady state depends on saving rate, population growth, technological change and depreciation. To consider growth rate of output we can write

$$\tilde{y}^* = \left[\frac{Y(t}{A(t)L(t)} \right] = \left(\left(\frac{s}{n+\delta} \right)^{\frac{1}{1-\alpha}} \right)^{\alpha} \Rightarrow Y(t) = \left(\left(\frac{s}{n+\delta} \right)^{\frac{1}{1-\alpha}} \right)^{\alpha} A(t)L(t)$$

If we like to have growth rate of per capita output we can follow

$$\left[\frac{Y(t}{A(t)L(t)} \right] = \left(\left(\frac{s}{n+\delta} \right)^{\frac{1}{1-\alpha}} \right)^{\alpha} \Rightarrow y = \frac{Y(t)}{L(t)} = \left(\left(\frac{s}{n+\delta} \right)^{\frac{1}{1-\alpha}} \right)^{\alpha} A(t)$$

For facilities we consider

$$\phi = \left(\left(\frac{s}{n+\delta+g} \right)^{\frac{1}{1-\alpha}} \right)^{\alpha}$$

Growth rate of output will be equal to

$$\dot{Y} = \frac{\dot{A}(t)L(t) + \dot{L}A(t)}{A(t)L(t)} = \frac{\dot{A}L(t) + \dot{L}A(t)}{A(t)L(t)} = \frac{\dot{A}}{A(t)} + \frac{\dot{L}}{L(t)} = g + n \quad (7)$$

And growth rate of per capita output will be

$$\dot{y} = \frac{\dot{\phi}A(t) + \phi\dot{A}(t)}{\phi A(t)} = g \quad (8)$$

This formulation demonstrates what we have mentioned before. For a given country growth rate in steady state converges in population growth plus technological change or, growth rate of output per capita converges in technological change. These are the conclusions of neoclassical model.

4.1. SPEED OF CONVERGENCE

Consider equation (4) we can find rate of change of capital per effective worker in any time by

$$\dot{\tilde{k}} / \tilde{k} = s\left(\tilde{k}^{\alpha} / \tilde{k} \right) - (n+\delta+g) \quad (9)$$

This may be written as

$$\dot{\tilde{k}} / \tilde{k} = s\tilde{k}^{-(1-\alpha)} - (n+\delta+g) = se^{-(1-\alpha)\ln \tilde{k}} - (n+\delta+g) \quad (10)$$

So, the rate of change of capital per effective worker declines as its value converges to steady state. Here we can introduce the concept of speed of convergence. It measure how much the rate of change decreases as its level increases in proportional sense (i.e. by 1%). By formulas it can be written

$$\beta \equiv -\frac{\partial\left(\dot{\tilde{k}} / \tilde{k} \right)}{\partial \ln \tilde{k}} \quad (11)$$

This term is called beta convergence. The negative sing is justified by the fact that does not make sense negative speed of convergence if the capital per effective worker does not achieve steady state. The rapport of the formula is negative because of the opposite movement of the components multiplied per minus makes β positive. We can obtain them by considering absolute value of the first derivate of the right side of 1.10 by $\ln \tilde{k}$

$$\beta = \left| -(1-\alpha)s\tilde{k}^{-(1-\alpha)} \right| \quad (12)$$

Speed of convergence is negatively related to the level of capital per effective worker. This means that, when we are at lower level of steady state, speed declines as we approach to the steady state, so β is not constant. In the equation (12) we can substitute the value of capital per effective worker in steady state given by equation (5) and then, after simple transformations, we have

$$\beta^* = (1-\alpha)(n+\delta+g) \quad (13)$$

This is the steady state for β. Speed of convergence, in this equation, represents how rapidly capital per effective worker approaches to the neighborhood of steady state level. So, we can write

$$\dot{\tilde{k}} / \tilde{k} \approx -\beta^* \left[\ln\left(\tilde{k} / \tilde{k}^* \right) \right] \quad (14)$$

Consider Cobb Douglas of (1) we can be written

$$\dot{\tilde{y}} / \tilde{y} = \alpha\left(\dot{\tilde{k}} / \tilde{k} \right) \quad \text{or} \quad \ln\left(\dot{\tilde{y}} / \tilde{y} \right) = \ln\left(\alpha\left(\dot{\tilde{k}} / \tilde{k} \right) \right)$$

Using (11) and (14) it can be written

$$\dot{\tilde{y}} / \tilde{y} \approx -\beta^* \left[\ln\left(\tilde{y} / \tilde{y}^* \right) \right] \quad (15)$$

Equation (15) says that growth rate of output per effective worker to the neighborhood of steady state, is equal to the speed of convergence multiplied by the gap between steady state and actual level. Again, if countries have the same steady state level poor country will grow faster than rich by the catch up process. The solution of this differential equation can give the equation of testing convergence hypothesis. Equation (15) can be written

$$(\ln \tilde{y})'_t = -\beta[\ln \tilde{y} - \ln \tilde{y}^*] \quad (16)$$

Substituting $\ln \tilde{y} = z$ we have $\dot{z} = -\beta(z(t) - z^*)$. Here z_0=z(0) and z* is steady state. For more we have

$$\dot{z} + \phi z(t) = \lambda z^* \quad (17)$$

Considering integrating factor $\mu(t) = e^{\int \beta t dt} = e^{\beta t}$ and multiplying both sides

$$e^{\beta t}\dot{z} + e^{\beta t}\beta z(t) = e^{\beta t}\beta z^* \quad (18)$$

Integration of (18) gives

$$z(t) = z^* + Ce^{-\beta t} \quad (19)$$

Initial condition of starting point will have that $z_0=z(0)$ and $z(0) = z* + C$ where $C = z(0) - z*$

Differential solution will be

$$z(t) = z* + [z(0) - z*]e^{-\beta t} \quad (20)$$

Substitution of Ln(y)=z(t) give

$$\ln \tilde{y} = [1 - e^{-\beta t}] \ln \tilde{y}* + e^{-\beta t} \ln \tilde{y}_0 \quad (21)$$

Here $\ln \tilde{y}_0$ is the natural logarithm of initial level of output per effective worker. Subtract in both parts of (21) by $\ln \tilde{y}_0$ we have

$$\ln [\tilde{y}/\tilde{y}_0] = -[1 - e^{-\beta t}] \ln \tilde{y}_0 + [1 - e^{-\beta t}] \ln \tilde{y}* \quad (22)$$

In this equation we can see that growth rate is explained by initial level of income per capita and by steady state level of income per capita, all in term of effective worker. If we assume that technology is exogenous and growth by constant rate g, the equation (22) can be formulated in the same way in term of income per capita adding the constant g. Also $[1 - e^{-\beta t}] \ln \tilde{y}*$ is no longer an explanatory variable if we consider the absolute convergence. Passing from the deterministic definition of hypothesis to the stochastic process we have to consider a normal distribution of the random disturbance in the process by the term ui. For the given interval of time [0;T] we can write

$$\frac{1}{T} \ln [y_{i;T}/y_{i;0}] = a - \frac{[1 - e^{-\beta T}]}{T} \ln y_{i;0} + u_{i;o,T} \quad (23)$$

Here $a = g + [1 - e^{-\beta * T}] \ln \tilde{y}*$ is supposed to be the same for all the economies and $u_{i;o,T}$ is the random disturbance of the data. Now we have a regression form of absolute convergence hypothesis.

5. Convergence club countries for Albania

It is not a simple way to define a "convergence club" because of the heterogeneity of social aspect of Europe countries. Countries with millennium history and culture are significantly non similar between them. Even thought, there are same characteristics which can make possible candidate countries for building "convergence club" for Albania. CEE and Western Balkans countries can construct a given "convergence club" for Albania. During 1989-1990 all these countries passed from a planned to a free market economy. After that, all of these countries have been evolved in the integration process in EU. Some of them are now part of EU realizing at least nominal convergence stipulated in the Treaty of Maastricht called nominal convergence. The fulfillment of these criteria's is assessing the possibilities of sustainable economic growth under the conditions of promoting the public policies of achieving the convergence process in real term. Real convergence is defined as incomes convergence, prices convergence, productivity convergence, educational standards convergence, infrastructure development, economic and social cohesion, structural convergence with EU economies, etc. One of most important indicator of real convergence remains income per capita (PPP).

Kornai [9] suggested different characteristics that make similar CEE countries during 1990-2004 in the convergence process. He called "great transformation" the process of transition of these countries because of: direction of market economy and democracy: parallel complete transformation in all spheres, the transformation was not violent and peaceful in sense of no use of military intervention, the incredible speed of transformation. Marelli and Signorelli [5] believe that the core of "great transformation" was the institutional change, which interacts with additional spheres: economic growth and development, structural change and economic performance, inequality and labor market, relations and shocks in global shocks in the global economy. These countries can be defined as a vanguard of "convergence club".

TABLE 1
NOMINAL CONVERGENCE CRITERIA FOR EU MEMBER STATES

Indicators	Maastricht criteria
Inflation rate (%, annual average)	Under 1.5 pp over the average of the most successful 3 EU Member States
Long-term interest rate (% per year)	Under 2 pp over the average of the most successful 3 EU Member States
The exchange rate as compared to euro (maximum appreciation/depreciation in percentage compared to two years average***)	± 15 %
General government balance (% of GDP)	Under 3%
General government gross debt (% of GDP)	Under 60%

One of the most structural factors, which make possible the convergence, is the adoption acquis communautaire. Continued work in structural convergence along the lines of the acquis communautaire is crucial also in candidates like Macedonia, Montenegro and Croatia, and potential candidate countries like Albania, Bosnia Herzegovina, Serbia and Kosovo.

For Balkan countries the characteristics of convergence club are stronger. Central European Free Trade Agreement (CEFTA) have positive impacts in the regional integration process expanding trades and eliminating barriers between countries, providing protection of intellectual property rights, harmonizing policy and competition strategies facilitating sustainable growth and development in Balkan. This second group of countries completes the "convergence club" for Albania, which is evidently the last position in terms of Income per capita (PPP).

6. Data analyses of absolute convergence

We are going to test for absolute beta convergence hypothesis using data for CEE and Western Balkans countries because of the "convergence club" characteristics. Log linear Regression between average of per capita income growth and log of initial income per capita is to be tested for absolute convergence hypothesis. The period observed in the cross-sectional data, due to particular conditions, is 2000-2010. The crisis of '97 in Albania and the war of Ex-Yugoslavian countries in 1999 may cause problems in the normal trend of data. By this facts, initial level of income per capita starts from 2000. In the data analyses is considered GNI per capita. In fact migration factor is present in different countries in the sample. Romania, Bulgaria, Estonia, Albania, Montenegro, Bosnia Herzegovina and others, showed a migratory movement towards western countries after 1990. GNI maybe reflect better the technological level, human and social capital and preferences embodied in national population. All this factors are considered significant in growth literature. Turning to the data analyses SPSS program is used to test the convergence hypothesis by OLS method and the regression is given by the equation

$$\sum_{t=0}^{11} g_t \Big/ T = b_0 - b_1 \ln y_{i;0} + u_{i;o,T} \qquad (24)$$

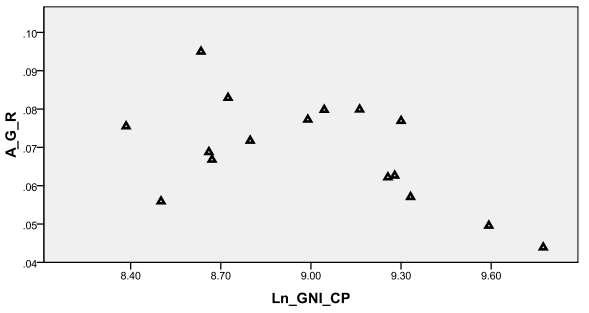

Fig. 1. Average growth rate for the 2000-2010 and Ln of GNI per capita 2000. It is easy to understand the trend of data given in this graph. Anyway, we can see that the dispersion is considerable regarding to the trend. Source WB 2012 and own calculation.

Regression results are in support of the theoretically framework. It is found negative coefficient of Ln y0 (b1=-0.018) and it is statistically significant at 5%. The model can explain 30.2% of the variation in average of income per capita growth rate (R square =0.302) and residuals seems to have normal distribution. By calculation of the speed of convergence, the rate of which Gross national income per capita tends to steady state level, is around 2% per year by this calculation $-0.018=-(1-e^{-\beta*11})/11$. Barro and Sala-I-Martin suggested that the time for which Ln(y(t)) is in the halfway between Ln(y0) and Ln(y*) is given by Lucas rule 70/β. Lucas explain that considering y as a income per capita at time t and let y0 be some initial value of per capita income. Then y=y0egt.The time it takes per capita income to double is given by the time t* at which y=2y.Therefore, 2y0=y0egt implies t*=Ln2/g. Regarding to Barro and Sala-I-Martin (2004) is suggested that halfway convergence is the time for which equation $\ln \tilde{y} = [1-e^{-\beta t}]\ln \tilde{y}^* + e^{-\beta t} \ln \tilde{y}_0$ satisfies the condition $e^{-\beta t}=1/2$. The halfway in time is therefore [Ln(2)/β]=0.69/0.02. If we consider the result for β=0.02 we can establish the time t=34.4 years. This means that starting from the initial condition of income per capita only after 34 years will be in halfway of achieving the steady state level.

7. Conclusion

Absolute convergence hypothesis, implied by neoclassical model, consists in the process by which poor countries can thatch up rich ones. This hypothesis is not supported by empirical studies for the world. It is more acceptable conditional convergence hypothesis which means that counties with similar characteristics can converge in the term of income per capita creating "convergence club". For Albania "convergence club" can be represented by CEE and Western Balkans countries because of, the similar characteristics in changing from commanded to free market economic system, facing to the European integration process in achieving nominal convergence postulated by Treaty of Maastricht and the adoption of acquis communautaire, the common economic agreement like CEFTA, etc. Considering cross-sectional data set for the period 200-2010 and using OLS method is estimated that speed of absolute convergence (β convergence) toward steady state level is around 2% per wear. Anyway, the model can explain 30 % of the variation in average of income per capita growth rate.

References

[1] A. Maddison,"Phases of Capitalist Development" *Oxford, Oxford University Press*, 1982.

[2] D. Acemoglu, "Labor- and Capital-Augmenting Technical Change" http://web.mit.edu/daron/www/lab-cap5.pdf , Jan. 2000.

[3] D. Cass, "Optimum growth in an aggregative model of capital accumulation," *Review of Economic Studies,* pp.32, 233–240, 1965.

[4] D. Raluca and C. Mirela, "Romania between real and nominal convergence," *University of Craiova, Faculty of Economy and Business Administration, 2007*
http://steconomice.uoradea.ro/anale/volume/2007/v2-finances-accounting-and-banks/62.pdf.

[5] E. Marelli and M. Signorelli, "Economic Growth and structural features of transition" pp. 11-56. PALGRAVE MACMILLAN Basingstoke, Hampshire RG21 6XS, 2010.

[6] European Commission http://www.cefta2006.com/

[7] F. P. Ramsey, "A Mathematical Theory of Saving", *the Economic Journal, Vol. 38, No. 152*. (Dec), pp. 543-559, Dec. 1928.

[8] G. Mankiw, D. Romer, D. Weil , "A Contribution to the Empirics of Economic Growth," *The Quarterly Journal of Economics,* Volume 107, issue 2, pp. 407 – 437, May 1992.

[9] J. Kornai, "The great transformation of Central Eastern Europe: Success and Disappointment, "*Economics of Transition*, pp. 2, 14, 207-244, Apr. 2006.

[10] M. Abramovitz, "Catching Up, Forging Ahead and Falling Behind." *Journal of Economic History*: 385-406. Jun. 1986.

[11] P. Romer, "Endogenous Technological Change," *The Journal of Political Economy,* Vol. 98, No. 5, Part 2, pp. S71-S102, Oct.1990.
[12] P. Romer, "Increasing Return and Long-Run Growth," *The Journal of Political Economy,* Vol. 94, Issue 5, pp. 1002 – 1037, Oct. 1986.
[13] R. Barro and X. Sala-I-Martin, "Convergence", journal of Political Economy, 100 (May): 223-252, May 1992.
[14] R. Barro X. and Sala-I-Martin, "Economic Growth", 2nd edition, pp. 23-71, 462-496. The MIT Press Cambridge, Massachusetts, 2004.
[15] R. E. Lucas, "On the mechanics of Economic Development," *Journal of Monetary Economics* 22, pp. 3-42, Feb. 1988.
[16] R. M. Solow, "A Contribution to the Theory of Economic Growth," *the Quarterly Journal of Economics*, Vol. 70, No. 1, pp. 65-94, Feb. 1956.
[17] R. M. Solow, "Technical Change and the Aggregate Production Function," *the Review of Economics and Statistics*, Vol. 39, No. 3, pp. 312-320, Aug. 1957.
[18] R. Martin and A. Winkler, "Real Convergence in Central, Eastern and South-Eastern Europe" pp. 68-88, 124-152. PALGRAVE MACMILLAN Basingstoke, Hampshire RG21 6XS, 2009.
[19] T. Koopmans, "On the concept of optimal economic growth," *Econometric Approach to Development Planning,* chap. 4, pp. 225–87, 1965.
[20] T. Swan, "Economic Growth and Capital Accumulation," *Economic Record* 32.63, pp. 334-361, 1965.
[21] W. J. Baumol, "Productivity Growth, Convergence, and Welfare: What the Long Run Data Show," *IU American Economic Review* 75, 1072-85, Aug. 1985.
[22] World Bank http://data.worldbank.org/topic/economic-policy-and-external-debt
[23] X. Sala-I-Martin, "The classical approach to convergence analysis" *Economics working paper* 117, Yale University and Universitat Pompeu Fabra, Jun. 1995.

ANNEX

TABLE 2
REGRESSION INPUT DATA

Country Name	Average GNI growth rate 2000-2010	GNI per capita 2010, PPP (current international $)
Albania	0.075497	4380
Bosnia Herzegovina	0.055917	4920
Croatia	0.062631	10710
Czech Republic	0.049575	14650
Estonia	0.079887	9530
Hungary	0.057055	11290
Latvia	0.07725	8020
Lithuania	0.079804	8470
Macedonia, FYR	0.066803	5830
Montenegro	0.071743	6620
Romania	0.094989	5620
Slovenia	0.043893	17560
Slovak Republic	0.076913	10940
Poland	0.062195	10470
Serbia	0.068773	5770

Bulgaria	0.082936	6150

TABLE. 3

REGRESSION OUTPUTS

Unstandardized Coefficients		Standardized Coefficients		
B	Std. Error	Beta	t	Sig.
.234	.067		3.490	.004
-.018	.007	-.550	-2.464	.027

a. Dependent Variable: A_G_R

TABLE. 4

MODEL SUMMARY

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.550a	.302	.253	.01160

a. Predictors: (Constant), Ln_GNI_PC

b. Dependent Variable: Av_G_R