Is There a Club of Former Centrally Planned Economies, Given the Empirical Evidence for Their Growth and Convergence Patterns?

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Summary:

Our analysis[1] provides evidence in support of the following assumptions: i) poorer Central and Eastern Europe (CEE) and Caucasus and Central Asia (CCA) countries are growing faster than relatively richer ones; hence there is absolute β convergence; ii) when control variables are included into our model, larger (negative) β coefficients are displayed, supporting the phenomenon of conditional convergence; iii) we estimate the speed of unconditional convergence to the (club's) steady state lies within the range of 1.6 to 3.4 per cent, whereas the speed of conditional convergence remains within the range of 2.9 to 5.1 per cent; iv) there is no evidence of sigma (σ) convergence, in fact there is significant increase in the dispersion of the levels of income across the economies under consideration; v) high resource abundance (within the setting of this club of countries) is associated with high economic growth; vi) high resource abundance within a broader background (including the CEE and CCA, plus OECD countries) is associated with overall negative impact on economic growth (Sachs and Warner, 1995), however a net negative effect obtains only in countries with poor institutional settings (Mehlum et al, 2006); vii) location matters for growth – the nearer a country is located to Berlin or Stockholm (whichever nearer), the higher the rate of economic growth; viii) high quality of governance has strong positive effect on economic growth; ix) the higher the educational attainment (proxy for quality of human capital), the higher the real GDP growth; and, x) these countries are expected to reach half the distance to their (unconditional) non-growth steady state in around 50 years, though this may not guarantee catch-up with the industrialised countries.

Key words: Growth differences – increasing v. decreasing returns to scale; Beta convergence – absolute and conditional; Sigma convergence (distribution approach);Speed of convergence; Club's convergence; Impact and net effect of resource abundance; Dutch disease

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1. Introduction

Currently there is a strong revival of interest in both the theoretical and the practical aspects of the processes of economic growth, and the factors determining

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[1] This paper is based on a part of the first chapter of my PhD dissertation with University of Birmingham.

countries' income levels. The fast growing literature identifies a range of ways through which convergence or divergence may occur. Relatively recently the research has extended to a more comprehensive examination of the potential causes determining the growth of income per capita including: cultural; historic; geographical; natural endowments; and institutional factors. While there is a lot of research to be done into the subtleties of the above-mentioned broad factors, various (important, though not unanimously accepted) assumptions have been launched by the literature so far. The modern intensive development in this area started with Baumol (1986) about 30 years ago, when he apparently found evidence pointing to absolute or conditional convergence (in line with the neoclassical economics tradition) -- depending on the interpretation -- among 16 OECD countries. However, his elucidations were very tentative, introducing the idea of "convergence clubs" and emphasizing the importance of the "path dependent processes" whereby the final outcome of a process is not just a unique equilibrium, but depends on the initial conditions and the random events on the path of development (a rather different approach from neoclassical economics). On this basis, Barro (1991), Sala-i-Martin (1994) and Barro and Sala-i-Martin (1995) went further and are popularly credited with "a mnemonic rule: *economies converge at a speed of about two percent per year* (Sala-i-Martin1994)." On theoretical (and empirical) grounds Sala-i-Martin was not able to "distinguish the neoclassical hypothesis of diminishing returns to capital from the hypothesis of positive (but slow) rates of technological diffusion".

There are important debates stemming from the empirics of economic convergence to wider economics and policy issues. In an influential paper Sachs and Warner (1995) articulate Dutch disease features by documenting "[a] statistically significant, inverse and robust association between natural resource intensity and growth over the past twenty years." Conversely, Mehlum et al. (2006) claim that they "[h]ave shown that the quality of institutions determines whether countries avoid the resource curse or not. The combination of grabber friendly institutions and resource abundance leads to low growth. Producer-friendly institutions, however, help countries to take full advantage of their natural resources." Beckmann et al (2014) further extend the connection between the institutional framework and government activities by arguing that "[t]he institutional framework has to be included in any analysis of the impact of government activity on economic growth. [...] the impact of overall government activity on growth is conditional on the quality of the institutions and differs between clusters of countries characterized by different economic systems."

Moreno and Trehan (1997) emphasize the importance of location for economic activity and growth. Using a sample of ninety-three countries over the period of 1965 to 1989 they "[c]ould not find evidence that the level of income (per worker) in a region matters. In other words, a country's per-worker income does not appear to converge to those of other countries in the region. However, proximity to large markets does matter, as countries that are near large markets appear to have grown faster."Moving beyond location Spolaore and Wacziarg (2013) focus their analysis on historic roots, culture and genetic and epigenetic transmission. They provide an excellent review of the relevant literature and present several important conclusions and suggestive answers to pertinent questions: i) "[t]echnology and productivity tend to be highly persistent even at very long horizons; ii) "[l]ong-term persistence holds at the level of populations rather than locations"; iii) "[l]ong-term genealogical links across populations play an important role in explaining the transmission of technological and institutional knowledge and the diffusion of economic development; iv) "If current development is a function of a very long-term historical factors, are development policies hopeless? Not necessarily."

Desmet et al (2011) are the first to quantitatively analyze what determines the likelihood of secessions and unions of nations. Finally, another important contribution questions directly the relevance of the apparatus of the β and σ -- convergence[2]. Quah (1995) "[c]onclude that, as with β-convergence, the empirics of σ-convergence cannot deliver, even in theory, a useful convincing answer. For convergence one is interested in how one part of the distribution behaves relatively to another: that is, after all, what "catch-up" means". Applying his arguably better suited techniques (stochastic kernel) his key finding is that "[t]he rich are becoming richer; the poor, poorer; with the middle-class vanishing."

Most of the existing literature is focused on large samples of diverse countries or subsamples (clubs) of the rich industrialised economies (OECD). Our study is the first to explore the convergence hypothesis in the setting of the 28 (former centrally planned) economies covering the CEE and CCA countries. We use both a cross-section and a panel approach in examining evidence about convergence.

2. Methodology and econometric estimates

The scatter diagram below depicts the interrelation between the annual average

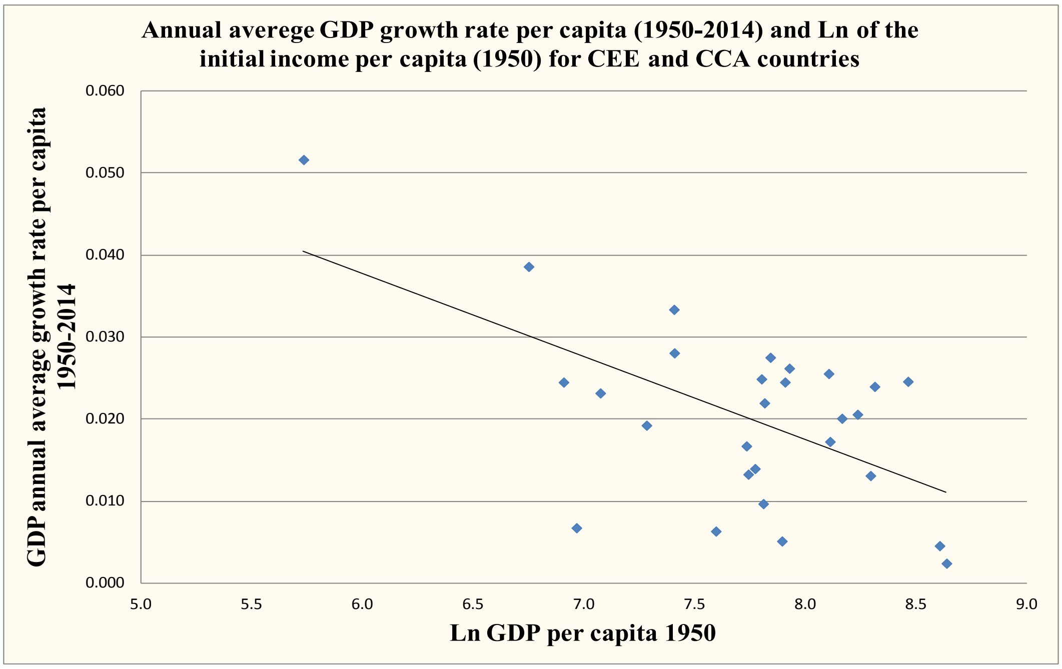

Fig. 1. Annual average GDP growth rate per capita (1950-2014) and Ln of the initial income per capita (1950) for CEE and CCA countries

Source: James et al. Population Health Metrics 2012, Maddison time-series in International GK Dollars

[1] σ -- convergence signifies reduction in the dispersion of levels of income across economies; β-- convergence means that poor economies grow faster

growth rate per capita (1950-2014) and the Ln of the initial income per capita for the former centrally planned economies. On observation it is obviously negative.

To investigate further, we apply the following general model:

$$\left(\frac{1}{T}\right)Ln\left(\frac{Y_{i,T}}{Y_{i,0}}\right)=\alpha_i+\beta LnY_{i,o}+\gamma X_{i,0}+\varepsilon_{i,t} \quad (1)$$

This model represents an expansion of Solow's growth equation which relates GDP per capita growth rates nonlinearly to *Ln* of initial level of GDP per capita $LnY_{i,0}$ and also includes the control (explanatory) variables term $X_{i,0}$, and $\varepsilon_{i,t}$ is normally distributed (0, σ).

T – Time period

$Y_{i,0}$ –Initial level of GDP per capita

$Y_{i,T}$ – GDP per capita growth rates

$X_{i,0}$ – Control explanatory variables

We estimate four different models, both in conditional and unconditional forms.

i) First we run a cross-section regression on growth -- using 65 year averages (1950-2014) for the 28 (CEE and CCA) countries; Assuming constant initial state and growth level of the technology across countries we estimate the following equation:

GDPAG = α +β*LGDP50 + ε (2)

and obtain the following results, as shown in table 1 below:

or substituting coefficients:

GDPAG = 0.0984 - 0.0101*LGDP50 (3)

Where,

GDPAG – Annual average GDP growth rate per capita 1950-2014

INPT – Intercept (constant)

LGDP50 – Ln GDP per capita 1950

The coefficient (β) in front of the variable Ln of the initial GDP per capita in 1950 is negative and significantly different from zero (-0.0101) this provides evidence of absolute convergence; this is to say that poor economies tend to grow faster than rich ones.

Using the (re-parameterised) relation between the speed of convergence (decay rate) λ[1] and the estimated coefficient β

$$\beta=-(1-e^{\lambda\tau}) \quad (4)$$

$$\lambda=-\frac{Ln(1+\tau\beta)}{\tau} \quad (5)$$

we estimate speed of convergence of 0.016 or about 1.6 per cent per year, which would imply a half-life of convergence to steady state of about 68 years. This brings us to the issue of statistical versus substantive (economic) significance. For instance, our findings are not not-inconsistent with the results of a seminal paper by Barro (1991), corroborated by another influential paper by Alesina *et al* (1996). These authors report β coefficients of conditional convergence for 98 countries for the period 1960-85, with sizes twice as low as the estimate presented above, though they do not dwell too much on the consequential effect on the half-life to their respective steady states.

But differences across countries must have certain (important) effects on the dependent variable GDPAG. Hence, we add control variables on the right-hand side of our model by including distance and resource abundance.

GDPAG = αINPT +βLGDP50 +γDISTANCE + + δRESOURCE +ε (6)

Table 1: Results from Equation 2 estimation

Dependent variable: GDPAG Included observations: 28		
Variable	Coefficient	t-Statistic
INPT	0.0984	4.602
LGDP50	-0.0101	-3.6652
Adjusted R-squared	0.3153	
Durbin-Watson statistic	1.1187	

Table 2: Results from Equation 6 estimation

Dependent variable: GDPAG Included observations: 28		
Variable	Coefficient	t-Statistic
INPT	0.2106	4.602
LGDP50	-0.0148	-6.4064
Distance	-1.0106	-4.7208
Resource	0.0103	2.6470
Adjusted R-squared	0.6161	
Durbin-Watson statistic	1.0146	

obtaining the following results:

or substituting coefficients:

GDPAG = 0.2106 - 0.0148*LGDP50 - 0.0106*DISTANCE + 0.01030*RESOURCE (7)

Where,

GDPAG – Annual average GDP growth rate per capita 1950-2014

INPT – intercept (constant)

LGDP50 – Ln GDP per capita 1950

DISTANCE -- Distance to Berlin or Stockholm, whichever is the nearer

RESOURCE – Resource abundance dummy

As the coefficient (β) in front of the variable Ln of the initial GDP per capita in 1950 is negative and significantly different from zero (-0.0148) it would imply β – (conditional) convergence; this is to say that poor economies tend to grow faster than rich ones, *ceteris paribus* (holding constant the proxies for the respective steady states). Furthermore, higher economic growth is associated with a shorter distance to Berlin or Stockholm and higher resource abundance.

The speed of convergence is estimated at 0.051 or 5.1 per cent, which would imply a half-life of convergence to steady state of around 46 years.

ii) Next we estimate stacked by date panel for two (13 years averages) periods (1989-2001 and 2002-2014)

GDPAG = α + β LGDPI + ε (8)

and obtain the following results:

Substituting coefficients:

GDPAG = 0.0987 - 0.0101*LGDPI (9)

Table 3: Results from Equation 8 estimation

Dependent variable: GDPAG Total panel (balanced) observations: 56		
Variable	Coefficient	t-Statistic
INPT	0.0987	1.05819
LGDPI	-0.0100	-0.9401
Adjusted R-squared	-0.0021	
Durbin-Watson statistic	3.0047	

Where,

GDPAG – Annual average GDP growth rate per capita for the two periods stacked panel data

C – Constant (intercept)

LGDPI – Ln of the initial GDP per capita for the first year of the respective periods

The coefficient β is with negative sign (as expected) but turns out to be insignificant. Hence, we continue by adding relevant control variables and estimate the respective equation 10:

$$GDPAG = \alpha + \beta LGDPI + \gamma GOVQ + \delta RES + \varsigma DIST + \varepsilon \quad (10)$$

The estimation results are presented below:

Substituting coefficients:

$$GDPAG = 0.3657 - 0.0386*LDPI + 0.0303*GOVQ + 0.0288*RES - 0.0126*DIST \quad (11)$$

C – Constant (intercept)

LGDPI – Ln of the initial GDP per capita for the first year of the respective periods

GOVQ – Quality of governance (EBRD Governance and Enterprise Restructuring Indicator)

RES – Resource abundance dummy

Table 4: Results from Equation 10 estimation

Dependent variable: GDPAG Total panel (balanced) observations: 56		
Variable	Coefficient	t-Statistic
C	0.3657	2.0637
LGDPI	-0.0386	-3.0620
GOVQ	0.0303	3.9392
RES	0.0288	2.0205
DIST	-0.0126	-1.1021
Adjusted R-squared		0.3133
Durbin-Watson statistic		1.9805

Where,

GDPAG – Annual average GDP growth rate per capita for the two periods stacked panel data

DISTANCE – Distance to Berlin or Stockholm, whichever is nearer

The coefficient β is negative and strongly significant, providing support for conditional

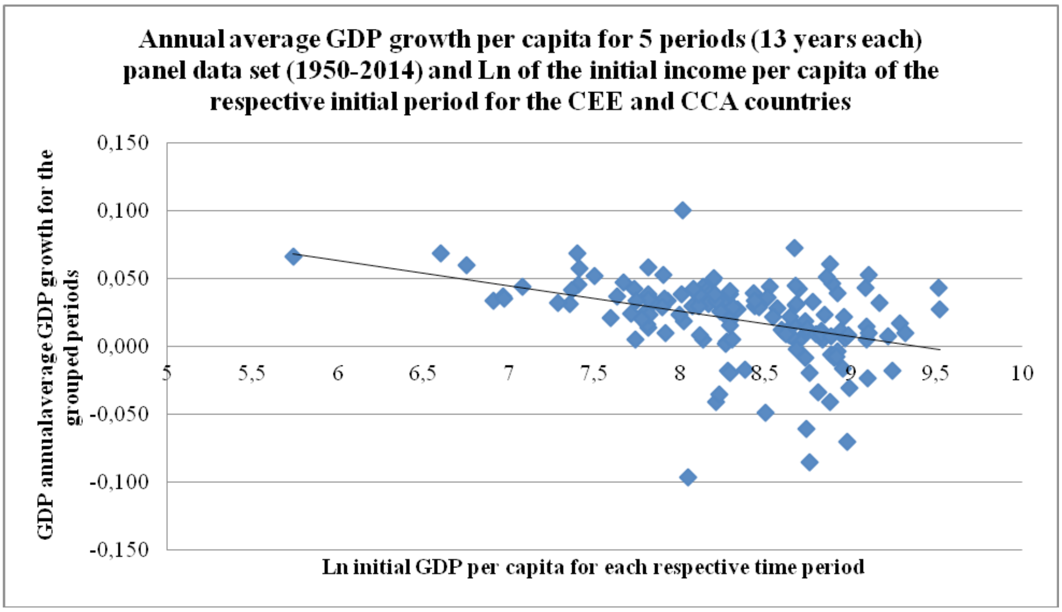

Fig. 2. Annual average GDP growth rate per capita for 5 periods (13 years each) panel data set (1950-2014) and Ln of the initial income per capita of the respective initial period for CEE and CCA countries

Table 5: Results from Equation 12 estimation

Dependent variable: GDPAG Total panel (balanced) observations: 140		
Variable	Coefficient	t-Statistic
C	0.1761	5.6552
LGDPI	-0.0187	-5.0166
Adjusted R-squared	0.1481	
Durbin-Watson statistic	2.2469	

convergence; the regression coefficient in front of GOVQ is positive and strongly significant, suggesting a strongly positive effect on the rate of economic growth from the quality of government; the coefficient on RES is positive and significant (i.e., resource abundance seems to be good for growth); and, the regression coefficient on DIST is with the expected sign and with similar magnitude of the previous estimate (see eq. 2a), though this time it is insignificant.

Re-calculating the speed of convergence it appears to be around 4 per cent with a half-life of around 18 years.

iii) We continue by utilising stacked by date panel for five (13 years averages) periods (1950-2014)

Note the location of points plotted below the abscissa signifying the negative growth rate experienced by many of the countries under consideration during the period (1989-2001) of the initial severe shock of transition from central planning/ communism to new economic and political structures.

We estimate eq. 12, below

$$GDPC = \alpha + \beta LGDPI + \varepsilon \quad (12)$$

and get the following results:

Substituting coefficients:

$$GDPC = 0.1761 - 0.01870 * LGDPI \quad (13)$$

Where:

GDPC – Annual average GDP growth rate per capita for the five periods stacked panel data

C – Constant (intercept)

LGDPI – Ln of the initial GDP per capita for the first year of the respective periods

Looking at the coefficient in front of LGDPI (negative, significantly different from zero, and strongly significant) we again observe strong support for the unconditional convergence hypothesis.

We continue by estimating a conditional convergence version of the same model, i.e., (eq. 14)

$$GDPC = \alpha + \beta LGDPI + \gamma LDIST + \delta RES + \varepsilon \quad (14)$$

The results are as follows:

Substituting coefficients we get:

Table 6: Results from Equation 14 estimation

Dependent variable: GDPC Total panel (balanced) observations: 140		
Variable	Coefficient	t-Statistic
C	0.3660	6.8815
LGDPI	-0.0269	-6.6880
LDIST	-0.0170	-4.3091
RES	0.0151	2.2446
Adjusted R-squared	0.2394	
Durbin-Watson statistic	2.3867	

GDPC = 0.3660 - 0.0269*LGDPI - 0.0170*LDIST + 0.0151*RES (eq. 6a)

Where:

GDPC – Annual average GDP growth rate per capita for the five periods stacked panel data

C – Constant (intercept)

LGDPI – Ln of the initial GDP per capita for the first year of the respective periods

LDIST – Distance to Berlin or Stockholm, whichever the nearer

RES – Resource abundance dummy

Once again our main results – strong conditional convergence effect (2.9 per cent speed of convergence with 25 years half-life to steady state; the nearer to Berlin /Stockholm, the higher the rate of economic growth and the more affluent the country on natural resources the higher the rate of economic growth -- are confirmed.

3. Resource abundance – is it good or is it bad for economic growth?

Before continuing our estimations we will make a short digression to discuss the important issue of the interrelations between resource abundance and economic growth. So far our analysis has shown that, within our -- club of – countries, high resource abundance is associated with high annual average real GDP growth. While we explore in detail the intricacies and controversy surrounding the hypothetical "blessing" or a "curse" of the natural resource abundance in general (world background) in Petkov (2016), here we formulate a small empirical exploration by broadening our sample (of so far, just CEE and CCA countries) by adding the group of the OECD countries. As six of the member countries of both clubs overlap they are included just once as members of the club to which they have had longer-lasting membership so far (FCPE). Using the same time period (1950-2014) we estimate the following equation:

$$GDPAG = \alpha INPT + \beta LGDP50 + \gamma RES\_P + \delta RES\_H + \varepsilon \quad (15)$$

obtaining the following results:

Substituting coefficients:

GDPAG = 0.0781 - 0.0067*LGDP50 - 0.0081*RES_P + 0.0004*RES_H (16)

Where:

GDPAG – Annual average GDP growth rate per capita 1950-2014

INPT – intercept (constant)

LGDP50 – Ln GDP per capita 1950

RES_P – Resource abundance dummy for countries with underdeveloped/poor institutional structure[2]

RES_H – Resource abundance dummy only for countries with high quality institutional structure[3]

We assume that the intuitional structure of the OECD countries is more advanced, characterised with high effectiveness and efficiency, while for the CEE and CCA countries it is considered to be in general of poor quality. On this basis the results again

Table 6: Results from Equation 15 estimation

Dependent variable: GDPC Total panel (balanced) observations: 56		
Variable	Coefficient	t-Statistic
C	0.0781	5.7319
LGDP50	-0.0067	-3.9998
RES_P	-0.0081	-2.2488
RES_H	0.0003	0.0861
Adjusted R-squared	0.2129	
Durbin-Watson statistic	1.2125	

display conditional convergence, though the process is characterised by a lower speed (just about 0.9 per cent) per year and with half-life time to a steady state of around 103 years. It is worth noting that the coefficient in front of the RES_P is now negative (and significant), suggesting that resource abundance is having a negative effect on economic growth under the conditions of poor institutional structure; whereas, the regression coefficient in front of RES_H is positive, suggesting the opposite relation, though it turns out to be insignificant.

To investigate further we put into use the (World Bank) data on total natural resource rents as per cent of GDP (NRRENT12). We take averages of the time-series (available just for the period 2004-2012) and estimate the equation below:

$$GDPAG = \alpha C + \beta LGDP50 + \gamma NRENT12 + \varepsilon \quad (17)$$

Our estimate of β is again negative and strongly significant. The negative coefficient γ suggests that the higher the natural resource rate the lower the growth rate of GDP per capita in all of the countries under consideration (CEE, CCA, and OECD), however it's not significant.

As a next step, we add a dummy for the OECD member countries in equation 17 and find these results:

This time both the size and the significance of the coefficient β are strengthened, the regression coefficient γ (in front of NRRENT12) is again with negative sign and insignificant, while the coefficient on the OECD (dummy variable) is positive and strongly significant. The coefficient of mutual determination corrected for degrees of freedom almost triples in size.

This is suggestive of an interesting conclusion: some form of the resource "curse" is expected to be observed in any country that extracts natural resource rent. However, a substantial net negative effect would obtain with certainty only in (underdeveloped) countries with poor institutional structures.

Table 7: Results from Equation 17 estimation

Dependent variable: GDPC Included observations: 56		
Variable	**Coefficient**	**t-Statistic**
C	**0.0734**	**5.2684**
LGDP50	**-0.0061**	**-3.6147**
NRRENT12	**-0.0001**	**-1.0235**
Adjusted R-squared	**0.1681**	
Durbin-Watson statistic	**0.9719**	

Table 8: Results from Equation 17a estimation

Dependent variable: GDPC Included observations: 56		
Variable	Coefficient	t-Statistic
C	0.0945	7.9141
LGDP50	-0.0096	-6.3092
NRRENT12	-1.03E-05	-0.1240
OECD	0.0119	5.3707
Adjusted R-squared	0.4546	
Durbin-Watson statistic	1.2815	

We are then in a position to suggest a reconciliation between the seminal works of both Mehlum et al (2006) and Sachs and Warner (1995). While their works cover different set of countries and different time periods, the nexus is unchanged.

iv) Finally we base our estimation on a pooled panel data for the period 1989-2014. Here we are using a real panel data and this allows us to control in general for individual heterogeneity of the countries involved. As we are interested in analysing the effect of the lagged value of the Ln of the GDP per capita on the dependent variable we use fixed effects model.

$$DLGDPC = \alpha_i + \beta LGDPC(-1) + \varepsilon_i \qquad (18)$$

Table 9: Results from Equation 18 estimation

Dependent variable: DLGDPC Total panel (balanced) observations: 480		
Variable	**Coefficient**	**t-Statistic**
C	**0.2120**	**1.8550**
LGDPC(-1)	**-0.0231**	**-1.7563**
Adjusted R-squared	**0.0050**	
Durbin-Watson statistic	**0.8411**	

Substituting coefficients:

$$DLGDPC = 0.2120 - 0.0231*LGDPC(-1) + [CX=F] \qquad (19)$$

Where,

DGDPAG – Annual GDP growth rate per capita 1989-2013

C – Intercept (constant)

LGDPC(-1) – Lagged value of Ln GDP per capita

Here again our coefficient β is negative but at best weakly significant. This may suggest that if we take the time-invariant characteristics of the countries under investigation as indeed unalterable, convergence may never occur. But if we suppose that one cannot change human nature, but still could manage it realistically to some extent, we can add two important control variables, remove the fixed effects dummies and estimate the altered equation (eq.20) below

$$DLGDPC = \alpha + \beta LGDPC(-1) + \gamma EDU + \delta GOVERNANCE + \varepsilon \qquad (20)$$

We estimate this equation using panel least squares, using White cross-section standard errors and covariance (d.f. corrected) and obtain the following results:

After substitution of the coefficients we attain:

$$DLGDPC = 0.0441 - 0.0279*LGDPC(-1) + 0.0105*EDU + 0.0416*GOVERNANCE \qquad (21)$$

Where,

DGDPC – GDP growth rate per capita for the 1989-2013 period

Table 10: Results from Equation 20 estimation

Dependent variable: DLGDPC Total panel (balanced) observations: 480		
Variable	Coefficient	t-Statistic
C	0.0441	0.8686
LGDPC(-1)	-0.0279	-2.7482
EDU	0.0105	2.2217
GOVERNANCE	0.0416	3.8540
Adjusted R-squared	0.2094	
Durbin-Watson statistic	1.0395	

C – Constant (intercept)

LGDPC(-1) – Ln of the level of GDP per capita lagged one period

EDU – Barro-Lee Average years of total schooling, age 25+, total

GOVERNANCE – EBRD transition indicator: Governance and enterprise restructuring

Now the coefficient β is of the same magnitude (as the previous equation) but strongly significant, and EDU and GOVERNANCE have significant positive effects on the GDP growth rate per capita.

Now we can compose together all our results into the table below:

While we obtain broad-spectrum supportive results for unconditional and conditional β convergence, this is just necessary, but not sufficient condition to detect σ convergence. Therefore, we directly calculate σ convergence for our sample of countries below.

v) σ-- Convergence:

In fact we calculate the standard deviation of GDP per capita across the former centrally-planned economies for the periods of 1950-1962, 1963-1975, 1976-1988, 1989-2001, and 2002-2014. The results expressed in per cent are depicted in the chart below.

We observe that coefficient of variation started a declining trend from the period 1950-1962, displaying a reduction from 46.5 per cent to 41.4 per cent in 1963-1975, and then declining further to 35.5 per cent for the 1976-1988 episode. This trend may be associated with the reconstruction period after the World War II and continued

Table 3. Convergence of GDP per capita in the CEE and CCA countries (former centrally planned economies) 1950-2014, various estimations of both conditional and unconditional models

	Cross-section regression		*Panel stacked by date*		*Panel stacked by date*		*Pooled panel*	
			1989-2014		1950-2014			
	1950-2014		2 by 13 years periods		5 by 13 years periods		1989-2014	
	Unconditional Model	Conditional Model	Unconditional Model	Conditional Model	Unconditional Model	Conditional Model	Unconditional Model	Conditional Model
β	**-0.010**	**-0.015**	**-0.010**	**-0.0386**	**-0.0187**	**-0.0269**	**-0.0231**	**-0.0279**
t-statistics	*[-3.6652]*	*[-6.4064]*	*[-0.9401]*	*[-3.0620]*	*[-5.0166]*	*[-6.6880]*	*[-1.7563]*	*[-2.7482]*
Distance to Berlin /Stockholm	--	**-0.0106**	--	**-0.0126**	--	**-0.0170**	--	--
t-statistics		*[-4.7208]*		*[-1.1021]*		*[-4.3091]*		
Reourse abundance	--	**0.0103**	--	**0.0288**	--	**0.0151**	--	--
t-statistics		*[2.6470]*		*[2.0205]*		*[2.2444]*		
Quality of governence	--	--	--	**0.0303**	--	--	--	**0.0416**
t-statistics				*[7.1298]*				*[3.8540]*
Educational Attainment	--	--	--	--	--	--	--	**0.0105**
t-statistics								*[2.2217]*
Adjsted R-squared	0.3153	0.6161	-0.0021	0.3133	0.01481	0.2394	0.005	0.2094
λ	**1.6%**	**5.1%**	**1.0%**	**4.0%**	**2.0%**	**2.9%**	**3.4%**	**4.6%**
t half-life	**68**	**46**	**69**	**18**	**37**	**25**	**30**	**24**
Jarque-Bera*	1.7916	1.4772	4.1456	0.4137	110.47	61.93	1961.2	1475
	(0.4082)	(0.4777)	(0.1258)	(0.8131)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Observations	28	28	56	56	140	140	500	500

**Hence, for half of the estimated models the OLS error can be taken to be normally distributed.*

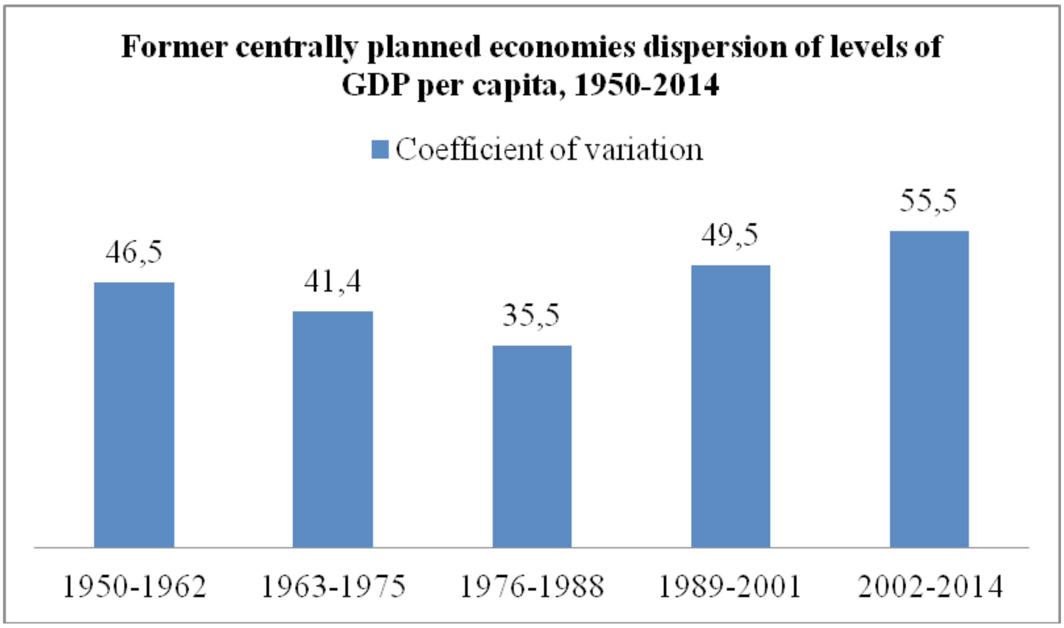

Fig. 3. Former centrally planned economies dispersion of levels of GDP per capita, 1950-2014

extensive catch-up growth purposely supported by the former Soviet Union. This all changed in the next period (1989 -2001) with the beginning of the disintegration of the former Soviet Union, former Yugoslavia, and the entire structure of centrally-planned

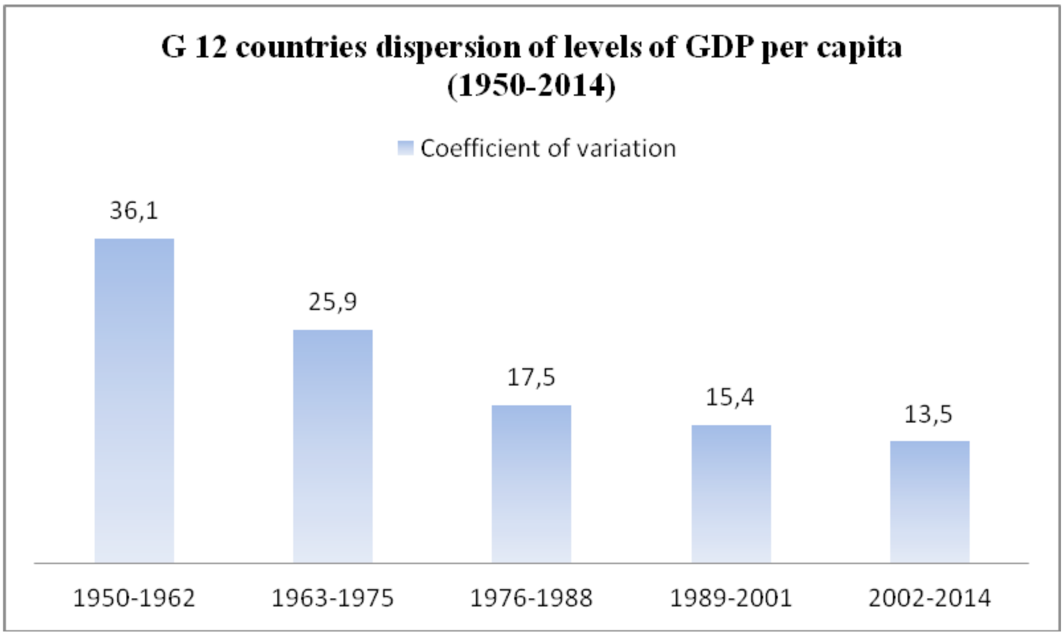

Fig. 4. G12 countries dispersion of levels of GDP per capita (1950-2014)

(socialist) economies. This shock and the transition process brought about significant increase in the coefficient of variation up to 49.5 per cent (from the low point of 35.5); the increase in dispersion of the levels of GDP per capita continued during the next (most recent) period (2002-2014) though with a smaller magnitude (55.5 per cent).

For comparison purposes we present G 12 coefficients of variation over the same period:

Conclusions

Our analysis provides evidence supporting the following assumptions: i) poorer CEE and CCA countries are growing faster than relatively richer ones; hence there is absolute β convergence; ii) when control variables are included into our model larger (negative) β coefficients are displayed, supporting the phenomenon of conditional convergence.; iii) we estimate the speed of unconditional convergence to the (club's) steady state to lie in-between 1.6 to 3.4 per cent, whereas the speed of conditional convergence stays in the range of 2.9 to 5.1 per cent; iv) there is no evidence of sigma (σ) convergence, in fact there is a significant increase in the dispersion of the levels of income across the economies under consideration; v) high resource abundance (within the setting of this club of countries) is associated with high economic growth; vi) high resource abundance within a broader background (including the CEE and CCA, plus OECD countries) is associated with an overall negative impact on economic growth (Sachs and Warner, 1995), however a net negative effect is registered only in countries with poor institutional settings (Mehlum et al, 2006); vii) location matters for growth – the nearer a country happened to be to Berlin or Stockholm (whichever nearer) the higher the rate of economic growth; viii) high quality of governance has a strongly positive effect on economic growth, and ix) the higher the educational attainment (proxy for quality of human capital), the higher the real GDP growth.

Still, it is not clear what exactly finding support for β convergence means. Does this support the hypothesis for decreasing returns to capital or is it simply to sustain the proposition that poor countries have strong propensities to catch up through the appropriation of technology?

Will these countries (with former centrally planned economic systems) be approaching half the distance to their (own club) non-growth steady state around 2064? Even if they do, wouldn't the rich nations of 2064 still be those that are rich at present?

While we cannot be completely certain about providing a positive answer to the first question; the answer to the second one -- after considering the self-reinforcing properties of the growth process -- may be somewhat more definite and in accord with the views of Baumol (1986) and Spolaore (2013):

> "The long run does matter. [...] [i] mportant current issues are, I believe, the product of path dependent processes whose mathematical expression must take the form of functionals rather than mere functions, meaning that we cannot understand current phenomena such as the relative productive capacities of different economies without systematic examination of earlier events which affect the present and will continue to exercise profound effects tomorrow." (Baumol, 1986)

> "[I]ong-term persistence holds at the level of populations rather than locations. A focus on populations rather than locations helps us understand both persistence and the reversal of fortune, and sheds light on the spread of economic development."(Spolaore and Wacziarg, 2013)

What factors may potentially help alleviate this predicament? The most promising (time-variant) factors would seem to be quality of governance and educational attainment (quality of human capital). The effect from enhancing any of these variables would lead to stronger growth and apparently faster convergence to the steady state. The problem of course is that this is much more easily said than possibly done.

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Annex 1:

1	ALB	Albania
2	BGR	Bulgaria
3	HUN	Hungary
4	POL	Poland
5	ROM	Romania
6	CEZ	Czech Republic
7	SVK	Slovakia
8	BIH	Bosnia and Herzegovina
9	CRO	Croatia
10	MKD	Macedonia
11	MNE	Montenegro
12	SRB	Serbia
13	SVN	Slovenia
14	ARM	Armenia
15	AZR	Azerbaijan
16	BLR	Belarus
17	EST	Estonia
18	LVA	Latvia
19	LTU	Lithuania
20	GEO	Georgia
21	KAZ	Kazakhstan
22	KGZ	Kyrgyzstan
23	MDA	Moldova
24	RUS	Russia
25	TJK	Tajikistan
26	TKM	Turkmenistan
27	UKR	Ukraine
28	UZB	Uzbekistan

Endnotes:

[i] Nuclear physics: "Decay constant, proportionality between the size of a population of radioactive atoms and the rate at which the population decreases because of radioactive decay. Suppose N is the size of a population of radioactive atoms at a given time t, and dN is the amount by which the population decreases in time dt; then the rate of change is given by the equation $dN/dt = -\lambda N$, where λ is the decay constant. Integration of this equation yields $N = N_0 e^{-\lambda t}$, where N_0 is the size of an initial population of radioactive atoms at time t = 0. This shows that the population decays exponentially at a rate that depends on the decay constant. The time required for half of the original population of radioactive atoms to decay is called the half-life. The relationship between the half-life, $T_{1/2}$, and the decay constant is given by $T_{1/2} = 0.693/\lambda$ (http://www.britannica.com/science/decay-constant)."

[ii] RES_P is dummy variable for a set of countries with poor institutional structure and takes the value of "0" when we observe a country with share of its resource value added in GDP of less than 15%, whereas it takes the value of "1" when a given country has a share of resource value added in GDP higher than 15%.

[iii] RES_H is dummy variable for a set of countries with good institutional structure and takes the value of "0" when we observe a country with share of its resource value added in GDP of less than 15%, whereas it takes the value of "1" when a given country has a share of resource value added in GDP higher than 15%.