

Human Capital vs. Rule of Law: What Matters for the Income Convergence of Poor Countries

by
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Abstract:

The paper analyzes the conditional β -convergence among the low income countries using the panel data framework covering the period 1960-2008. The estimation of conditional convergence is based on the augmented Solow model with system GMM technique for the dynamic panel data. The paper assesses the role of initial human capital stock and rule of law in the income convergence of poor countries by considering further categorizations of the poor countries based on these two variables. This is the first study on the comparative analysis of human capital and rule of law in the income convergence of poor countries utilizing the dynamic panel framework. The full sample of low income countries has not shown any evidence of conditional income convergence. The categorizations on the basis of initial human capital stock have not altered the conclusions of no income convergence. However, the subsample of low income countries with better rule of law has shown positive evidence of convergence towards the steady states. The paper concludes greater role of rule of law than initial human capital stock in the income convergence of poor countries and vice versa for the high and middle income countries.

Keywords: Initial human capital; Rule of law; dynamic system GMM; augmented Solow model

JEL Classification: O47; O50

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Introduction

The subject of *poor becoming the rich* or β -convergence has been discussed in the literature for quite a long period. The initial empirics were based on a simple concept of *absolute β -convergence* entailing the identical levels of per capita income for all the countries in the long-run [Baumol (1986); Barro and Sala-i-Martin (1990)]. However, the evidence of absolute divergence for the world countries resulted in the idea of *conditional β -convergence* entailing the convergence of countries towards their respective steady states [Barro (1991)]. The conditional β -convergence equation was based on the neo-classical growth model, which is the foundation for the development of the topic of convergence [Mankiw et al. (1992)]. Following Mankiw et al. (1992), some studies on the conditional β -convergence have utilized augmented Solow model of estimation using the cross-sectional data framework [Murthy and Ukpolo (1999); Dobson and Ramlogan (2002)]. However, a greater number of studies on the conditional β -convergence for various groups of countries have utilized the panel data techniques for the estimation of augmented Solow model [Islam (1995); Caselli et al. (1996); Bond et al. (2001)].

Another notable development in the growth and convergence empirics has been the inclusion of additional regressors in the economic/income growth models [Barro (1991)]. Such growth regressions also known as Barro's style growth regressions have been an important part of convergence literature [Sala-i-Martin (1996a); Barro (2003)]. As far as additional regressors are concerned, many socio-economic, demographic and policy variables have been considered for these regressions. The initial level of human capital, rule of law, government consumption, fertility rate and trade openness are some of the explanatory variables in these income growth regressions and many such Barro's style studies have

endorsed the conditional income convergence [Barro (1998); Caselli *et al.* (1996); Tsangarides (2001)].

Given the vast convergence empirics, there are few studies on the β -convergence of low income/poor countries. One of the early papers on convergence has confirmed absolute β -divergence among the poor countries [Baumol (1986)]. Conversely, Temple (1998) has confirmed conditional β -convergence among the poorest quartile of countries for the period 1960-85 utilizing the augmented Solow model. More importantly, a study has specifically discussed the role of rule of law and institutional variables in explaining the income convergence among the poor countries [Knack and Keefer (1997)]. The method utilized in the paper by Knack and Keefer (1997) is the same as used in Barro's style growth framework; that is to incorporate the rule of law as a right hand side variable in the convergence regression [Barro (2003)]. The resulting conclusions of the paper by Knack and Keefer (1997) are endorsing the conditional income convergence; nonetheless, the paper was based on the cross-sectional data estimations. Another important study on the income convergence of poor countries with reference to the economic policies is contributed by Sachs and Warner (1995). These authors concluded that prevalence of *efficient economic policies* is a crucial determinant of income convergence of poor countries.

This paper analyses the conditional β -convergence among the low income countries using the dynamic panel data framework for the period 1960-2008. The particular focus in this paper is on the role of rule of law and/or initial level of human capital in the income convergence of these low income countries. Instead of the usual method of regressing the income growth on the rule of law, this paper is utilizing a different approach. The low income countries are separately divided into two further categories, each, based on the median level of initial human capital stock and median value of the rule of law. Subsequently, conditional income convergence is analyzed in each of the four clusters of low income countries. This

approach is expected to furnish comprehensive insight on the income convergence of low income countries in relation to the human capital stock and the rule of law. The important contribution of this paper is that it is the first study on the comparative analysis of rule of law and initial human capital in income convergence of the poor countries. The paper proceeds with a brief literature review on the role of human capital and rule of law in income growth and convergence in the first section. The second section explains the methodology of the paper while the third section discusses the results. The conclusions are presented in the fourth section.

1. Literature Review

The role of human capital in economic growth has been emphasized primarily by the endogenous growth theory. Lucas (1988) incorporated human capital as one of the variables in the growth model that is expected to help yield increasing returns. The major source of the increasing returns is spillover effects associated with both learning by doing and investment in education and training.¹ Considering the importance of human capital in economic growth, Mankiw et al. (1992) have also augmented the neoclassical growth model by adding the variable of human capital and have empirically validated its significance as well. Moreover, Mankiw et al. (1992) have also analyzed conditional β -convergence with the augmented Solow model. More importantly, Barro (1991) has explicitly emphasized the role of human capital stock in the income convergence of countries. According to Barro (1991), the convergence of a poor country towards the rich is conditional on the initial level of human capital stocks and these results are confirmed for a sample of 98 world countries. Similarly,

¹ The significance of human capital had also been highlighted earlier by Uzawa (1965), in the discussion on the relationship between education and economic growth.

in the words of Kyriacou (1991), “*the convergence hypothesis holds true only if sufficient levels of per capita human capital stock have been accumulated*”.

In the context of endogenous growth models, Tamura (1991) has developed a model incorporating spillover effects of human capital in investment technology resulting in income convergence both in levels and growth rates. In this model, human capital convergence is the main source for the income convergence. In an empirical investigation of Tamura’s proposition using cross-country data, Stamatakis and Petrakis (2006) asserted the importance of convergence in higher education as a source for the income growth convergence.

Another important explanation for the relationship between human capital and income growth is through the channel of *technological diffusion*, because human capital is considered necessary for the technological innovations and imitations [Nelson and Phelps (1966); Apergis (2009)]. In other words, the role of research and development towards the total factor productivity (TFP) growth in a country depends on the threshold level of human capital [Xu (2000)]. Alternatively, human capital is an important determinant of technological spillovers. Aiyar and Feyrer (2002) have not only confirmed that the TFP differences are explaining a key part of income differences across countries but have also validated the vital role of human capital in TFP growth. According to these authors “*international technology spillovers from countries at the frontier to developing countries are facilitated by human capital stocks*”.

The literature on the rule of law usually has mainly focused on its relationship with the economic growth and development and also on various indicators and measurements of the rule of law [see Haggard et al. (2008)]. As already mentioned, Barro (1991) introduced rule of law as one of the determinants of income growth in cross-country regressions. According to Barro (1998), better regulation and the security of property rights is conducive to economic growth of a country through facilitating its investment and trade. Many

following studies on cross-country growth and conditional convergence (already mentioned in introduction) have confirmed the significance of the rule of law and or quality of institutions. Similarly, Knack and Keefer (1995) concluded that '*security of property rights affects not only the magnitude of investment, but also the efficiency with which inputs are allocated*'. According to the results of a study on the estimation of wealth of nations by the World Bank (2006), the rule of law has the largest component in the *intangible capital* of the countries.²

2. Methodology

The first step of analysis is based on the categorizations of world countries into four income groups. The world sample consisting of 98 countries over the period 1960-2008 has been considered for the study. This sample of 98 countries is categorized into four income groups of high, upper middle, lower middle and low income using the cluster analysis on the data of real per capita income in 1960.³ The agglomerative form of the Hierarchical cluster method is used which is based on the Ward's linkage method. Out of a total of 98 countries, 58 countries fall in the category of low income in 1960.⁴ The initial year of the sample, 1960, is chosen for classification to avoid the possibility of the *ex-post sample bias* in the income convergence analysis. The primary focus of the convergence analysis in the following is the low income cluster which also has the highest number of countries.

² Intangible capital includes human capital, social capital and governance.

³ It is worth mentioning that utilizing the gross national income (GNI) per capita based on the *Atlas method*, the World Bank database categorizes the countries into four income groups namely low, lower middle, upper middle and the high income groups. However, there is no information available related to this grouping prior to the 1970s either in the World Bank database or in any of the studies pertaining to economic growth and/or income convergence.

⁴ Data availability for real per capita GDP and other key variables determine the size of total sample equal to 98.

The analysis is based on the estimation of conditional β -convergence for low income group and among its various categorizations using the data of per capita income. The conditional income convergence is analyzed utilizing the panel data framework for the augmented Solow model given by Islam (1995). This can also be written as:

$$Gy_{it\tau} = f(s_{kit\tau}, h_{\tau}^*, (n_{it\tau} + g + \delta), y_{it}) \quad (1)$$

This formulation originally is based on the convergence equation of augmented Solow model developed by Mankiw et al. (1992). In the above equation $Gy_{it\tau}$ denote the growth rate of per capita income for a panel interval between τ to t . y_{it} is the initial level of income in the interval. s_k is the accumulation of physical capital, h^* is the steady state level of human capital and n denotes the population growth. g and δ are the technological growth rate and depreciation rate respectively; both of which are assumed to be constant for all the countries with a value of 5% following Mankiw et al. (1992) and Islam (1995). This equation additionally includes both the cross-section fixed effects and time fixed effects. The right hand side variables are measured in the natural log form and their respective coefficients are non-linear. The specific form of the equation (1) as in Islam (1995) is written as

$$\ln \left[\frac{y_{it\tau}}{y_{it}} \right] = \mu_i + (1 - e^{-\beta\xi}) \left(\frac{\alpha}{1 - \alpha} \right) \ln(s_{kit\tau}) + (1 - e^{-\beta\xi}) \left(\frac{\eta}{1 - \alpha} \right) \ln(h_{\tau}^*) - (1 - e^{-\beta\xi}) \left(\frac{\alpha}{1 - \alpha} \right) \ln(n_{it\tau} + g + \delta) - (1 - e^{-\beta\xi}) \ln(y_{it}) + \delta_t \quad (2)$$

μ_i and δ_t denote the cross-section fixed effects and time fixed effects respectively. β is the conditional convergence coefficient.

The panel data over the period 1960-2008 have been considered for the analysis of conditional β -convergence within specific income groups. The data for the real per capita GDP, population and investment share of GDP (s_k) is taken from Penn World Table (PWT)

7.0. This panel data is based on five-yearly intervals. Growth rates of GDP per capita are calculated over the five years' periods. The variables of population growth and accumulation of physical capital are non-overlapping averages over each five years interval. Since, the income growth rate is function of the steady state level of human capital in the augmented Solow model; the value of human capital in period τ is used in the estimations. However, instead of considering the series of human capital stock, the variable of human capital per worker is constructed utilizing the Mincerian earnings function: $h_i = e^{\phi(E_i)}$ with ϕ denoting the returns to the education, E . The country specific estimates for returns to educations are taken from Psacharopoulos and Patrinos (2004) while the data for average years of schooling of the population age 15 and above, E , is taken from Barro and Lee (2010). The particular reason for utilizing his method is that it makes use of micro-economic literature on Mincerian earnings function and considers a log-linear relationship between human capital and growth [Cohen and Soto (2007) and Bergheim (2008)]. It is worth noting that the human capital per worker is typically considered a regressor against GDP per worker growth; therefore, the human capital per person is calculated for the per capita growth regressions.

In addition to the above mentioned variables, human capital stock and rule of law index are also utilized for the further categorizations of income groups. As mentioned earlier, the human capital stock data, average years of education, E , is taken from Barro and Lee (2010). The data for the rule of law index is sourced from the *Economic Freedom of the World data* by the Fraser Institute. This measure encompasses legal structure and security of property rights. Data for this variable is only available with five-yearly frequency.

The income growth regressions in equation (1) and equation (2) can alternatively be written as:

$$y_{it} = \gamma y_{it-1} + \sum_{j=1}^k \beta_j x_{it}^j + \delta_t + \mu_i + v_{it} \quad (3)$$

In this equation, y_{it} and y_{it-1} are the dependent and lagged dependent variables while, explanatory variables and their coefficients are denoted by x_{it}^j and β_j respectively. u_i represents the cross-sectional fixed effects and δ_t denotes the time effects. Thus, the augmented Solow model based conditional convergence equation is a dynamic panel framework and is estimated using the system GMM technique. Because, it is a better estimator for the persistent data e.g. GDP per capita and is also preferred in case of small T of the sample such as T=10 in this paper [Bond et al. (2001)]. In their separate studies on the bias properties of dynamic panel data estimators, Hayakawa (2007) and Soto (2009) concluded system GMM method to be least biased and highly efficient compared to the differenced and level GMM.

3. Results

Initially, the augmented Solow model based conditional β -convergence is estimated for the full sample of low income countries. The augmented Solow model based results on the income convergence of low income cluster are reported in Table 1. According to the results, the coefficient on accumulation of physical capital is positive and significant confirming the already established positive relationship between investment and income growth. However, the variable of population growth, depreciation and technological growth, $n_{it} + g + \delta$, is positive and insignificant. Contrary to the positive impact of physical capital accumulation, human capital per person is having an insignificant impact on income growth of low income countries in both of the estimations. A number of studies have confirmed the insignificant impact of human capital on income growth [Kumar (2006), Temple (1999); Benhabib and Spiegel (1994)]. One plausible explanation for the lower size and insignificant coefficient on

Table 1: Conditional Income Convergence in Low income Countries (1960-2008)	
No. of Observations/No. of countries	580/58
$\ln(Y_{i,t})$	-0.0034 (-0.12)
$\ln(s_{kit\tau-1})$	0.168** (3.45)
$\ln(n_{it} + g + \delta)$	0.152 (0.94)
$\ln(h^*_{pit\tau})$	0.084 (1.14)
Implied β (annual)	0.001 (0.12)
AR(2) test (H_0 =no autocorrelation)	0.244
Hansen test (H_0 =all instruments are valid)	0.587
Difference in Hansen Test (GMM for levels) (H_0 =exogenous instruments)	0.610
(.) denotes the t statistics of the respective coefficients. * indicates significance at 5% level, ** indicates significance at 1% level. p values are reported for the tests of AR(2), Hansen and Difference in Hansen. Panel data with five yearly intervals over the period 1960-2008 is utilized for the analysis. Implied rate of convergence (β) is estimated using the Delta Method.	

human capital is the relationship between two forms of the capital in the growth regressions as put forth by De la Fuente and Domenech (2006), Soto (2002) and Krueger and Lindahl (2001). According to Pritchett (2001), the insignificant impact of human capital on income growth is because of the low quality of education, low returns and/or poor quality of institutions in a country. This explanation may be more relevant for the low income countries.

There is no evidence of conditional income convergence for the low income countries with the augmented Solow model as the coefficient on the initial income is negative but insignificant. This result implies that even after controlling for the differences in human capital, physical capital and population growth, the low income countries are not converging towards their steady states. In other words, these variables may not be explaining the income convergence among the low income countries. Though on average all the low income countries have not indicated any evidence of convergence but an important question at this point is whether any specific sub-sample of low income countries is converging or not. In this

context, two important determinants of income growth and convergence are considered, namely the initial human capital and the rule of law index. Accordingly, an insight into the income convergence of low income countries in relation to the human capital and rule of law is furnished by further categorizations.

The low income countries are categorized separately on the basis of human capital stock in 1960 and average value of rule of law index over the period 1970-2008 (the period for which this data is available). Both of the categorizations are performed independently to assess the relative significance of initial level of human capital and/or average rule of law in income convergence of low income countries. Instead of considering the arbitrary threshold values of initial human capital and average rule of law, the thresholds for this division are the median value of these two variables for the sample. The list of countries in each of the clusters is given in Table A-1 in appendix together with average real per capita income growth of each country over the period 1960-2008. It is evident from the Table A-1 that both the low human capital and poor rule of law countries are having weak average income growth over the last half century. The overall average income growth for these two overlapping groups is around 1%. Moreover, 5 and 6 countries among the low initial human capital cluster and poor rule of law cluster respectively are characterized with negative average income growth over the study period. It can be inferred from the Table A-1, that high initial human capital countries have performed better than the low initial human capital countries, but the highest average income growth pertains to the better rule of law cluster with the value of 2.5%. In this group, the only exception with its negative average income growth is Niger.

Subsequent to the categorizations, conditional income convergence is estimated among each of these four groupings of low income countries namely, low initial human capital, high initial human capital, poor rule of law and better rule of law countries. These results on conditional income convergence of all these categories are reported in Table 2.

Again, the coefficient on the physical capital is positive and significant in all the estimations while, population growth is insignificant in its impact on income growth for all the four clusters. An interesting finding in Table 2 is the relationship between human capital and income growth, which is positive and insignificant for the two categories based on the initial human capital. However, it is negative and insignificant for the poor rule of law countries but positive and significant for the countries with better rule of law. Further, in the results of the better rule of law group, the coefficient on human capital is approximately equal to that of physical capital; confirming the role of both forms of capital in the income growth of these countries. This may indicate that better rule of law helps enhancing the impact of human capital on income growth.

As far as income convergence within these groups is concerned, none of the groups of low income countries in Table 2 are converging except the better rule of law cluster. The coefficients on initial income are insignificant in the former but negative and significant in the latter implying the annual rate of conditional convergence, β , of 2%. This convergence figure results in a half-life of 35 years. It is worth noting from Table A-1 that there are many countries which are part of both the high initial human capital and better rule of law categories. These also include some of the consistently high growing economies in the study sample, like, China (4.4%), Malaysia (4.4%), South Korea (5.5%), Thailand (4.4%), Taiwan (5.8%). Still, the high initial human capital category has not shown any evidence of conditional β -convergence. This may indicate that better rule of law has a significant role in the income convergence of the low income countries and only countries with good rule of law are able to attain the higher income growth and the convergence towards the steady states.

Category	Low initial human capital	High initial human capital	Poor rule of law	Better rule of law
No. of Observations/No. of countries	290/29	290/29	280/28	300/30
$\ln(Y_{i,t})$	-0.0191 (-0.40)	0.013 (0.22)	-0.012 (-0.26)	-0.097* (2.26)
$\ln(s_{k_{it\tau-1}})$	0.149** (2.76)	0.212** (4.0)	0.168* (2.55)	0.257** (5.16)
$\ln(n_{it} + g + \delta)$	-0.039 (-0.14)	0.008 (0.04)	0.195 (0.75)	-0.377 (-1.54)
$\ln(h_{pit}^*)$	0.055 (0.38)	0.13 (1.14)	-0.129 (-0.80)	0.238* (2.62)
Implied β (annual)	0.004 (0.39)	-0.003 (-0.22)	0.002 (0.26)	0.02* (2.15)
Half-life (years)	-	-	-	35
AR(2) test (H_0 =no autocorrelation)	0.311	0.916	0.547	0.425
Hansen test (H_0 =all instruments are valid)	0.873	0.499	0.640	0.819
Difference in Hansen Test (GMM for levels) (H_0 =exogenous instruments)	0.901	0.240	0.538	0.765
(.) denotes the t statistics of the respective coefficients. * indicates significance at 5% level, ** indicates significance at 1% level. p values are reported for the tests of AR(2), Hansen and Difference in Hansen. Panel data with five yearly intervals over the period 1960-2008 is utilized for the analysis. Implied rate of convergence (β) is estimated using the Delta Method. The half-life is calculated by the formula, H.L.= $\ln 2/\beta$.				

At this point an interesting comparison of the above results for low income group can be with the convergence results for the remaining sample of 40 countries consisting of high and middle income countries, also based on the same four categories namely, low initial human capital, high initial human capital, poor rule of law and better rule of law. The methodology for the categorizations and analysis of conditional β -convergence is similar to the one reported earlier. The list of countries within their four categorizations along with their average income growth is reported in Table A-2 in appendix. The results of the augmented Solow model based convergence equation for these four categorizations are reported in Table 3. Focusing on the results for the income convergence in this Table, the low initial human capital group is converging at a slower rate of 1.8% per annum compared to the 3.2% annual rate for the high initial human capital countries. This implies that initial human capital has a significant role towards the income convergence of high and middle income countries. On the

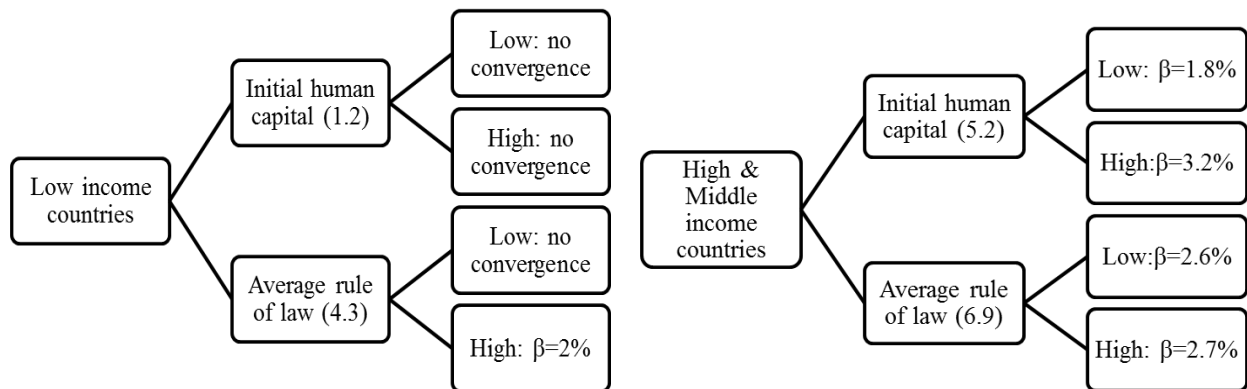
contrary, the rule of law is not making any difference towards the income convergence of high and upper middle income countries. Because both the poor rule of law and better rule of law clusters in Table 3 have almost similar annual rate of conditional β -convergence equalling 2.6% and 2.7% respectively.

Table 3: Conditional Income Convergence: Augmented Solow Model Categories of High and Middle Income Countries (1960-2008)				
Category	Low initial human capital	High initial human capital	Poor rule of law	Better rule of law
No. of Observations/No. of countries	200/20	200/20	200/20	200/20
$\ln(Y_{i,t})$	-0.084** (3.13)	-0.147* (-2.71)	-0.120** (-3.05)	-0.127* (-2.74)
$\ln(s_{kit\tau-1})$	0.148 (2.01)	0.283** (3.51)	0.0439 (0.71)	0.244** (3.68)
$\ln(n_{it} + g + \delta)$	-0.154 (-1.58)	-0.244 (-1.24)	-0.383** (-2.89)	-0.223 (-1.85)
$\ln(h_{pit}^*)$	0.015 (0.38)	0.10 (0.96)	-0.012 (-0.32)	0.089 (0.71)
Implied β (annual)	0.018** (3.00)	0.032* (2.50)	0.026** (2.86)	0.027* (2.55)
Half-life (years)	39	22	27	26
AR(2) test (H_0 =no autocorrelation)	0.119	0.201	0.113	0.476
Hansen test (H_0 =all instruments are valid)	0.939	0.194	0.190	0.168
Difference in Hansen Test (GMM for levels) (H_0 =exogenous instruments)	0.994	0.942	0.937	0.530
(.) denotes the t statistics of the respective coefficients. * indicates significance at 5% level, ** indicates significance at 1% level. p values are reported for the tests of AR(2), Hansen and Difference in Hansen. Panel data with five yearly intervals over the period 1960-2008 is utilized for the analysis. Implied rate of convergence (β) is estimated using the Delta Method. The half-life is calculated by the formula, $H.L.=\ln 2/\beta$.				

Finally, all the results on income convergence for the four categorizations of each, the low income cluster and high and middle income cluster are summarized in Figure 1. The values in parentheses with each indicator, initial human capital and average rule of law, are the median values which are used to divide the respective sample. It is evident that initial levels of human capital stock and average values of rule of law index are quite different between low income and high and middle income groups. However, the impact of human capital on income convergence is more significant for the latter than the former. On the

contrary, rule of law is an important ingredient for the income convergence of poor countries. Further finding in support of key role of rule of law is the considerable rate of income convergence among those low income countries which have both lower initial human capital and better rule of law [see Figure A-1 in appendix].⁵

Figure 1: Summary of Results



The reported results on income convergence for various categorizations of low income countries are based on Table 2, while that for the high and middle income countries are part of Table 3. The categorizations in each case are based on the median values of the two indicators namely, initial human capital stock and average rule of law. These median values are reported in parentheses.

4. Conclusions

The paper has contributed to the literature of income convergence by studying the role of initial level of human capital stock and rule of law towards the catching up of poor countries. The low income countries are not conditionally converging, however only the countries with better rule of law have converged over the last fifty years. Moreover, initial levels of human capital stock are not contributing towards the income convergence of poor countries. This contradicts with the existing literature on the direct and indirect role of human capital in

⁵ This sample consists of Benin, Botswana, Cameroon, Cote d'Ivoire, Gambia, Ghana, India, India, Morocco, Niger, Papua New Guinea and Tunisia [see Table A-1]

income growth and convergence. The study concludes that at initial levels of development, rule of law has a higher role than the initial human capital stock. Even the impact of human capital on the growth is strong only with the better rule of law. Conversely, the high and upper middle income countries have strong convergence with higher initial levels of human capital and for this group; rule of law is not making significant difference towards the income convergence. The determinants of income convergence can vary depending on the level of development of country/countries. Therefore, initial human capital stock is only effective for income convergence once the countries have the better rule of law. In other words, factor inputs like human capital are effectively contributing towards the income convergence only after maintaining a certain level of rule of law.

References

- Aiyar, S.S. and Feyrer, J. (2002) A Contribution to the Empirics of Total Factor Productivity. *Dartmouth College Working Paper*, No. 02-09.
- Apergis, N. (2009). Technology, Human Capital and Growth: Further Evidence from Threshold Cointegration. *Open Economics Journal*, 2, pp. 80-86.
- Barro, R. and Lee, J.W. (2010). A New Data Set of Educational Attainment in the World, 1950-2010. *NBER Working Paper*, 15902. National Bureau of Economic Research.
- Barro, R. J. (1991). Economic Growth in a Cross Section of Countries. *Quarterly Journal of Economics*, 106 (2), pp. 407–443.
- Barro, R. J. (1998). *Determinants of Economic Growth: A Cross Country Empirical Study*. United States of America: MIT Press.
- Barro, R. J. (2003). Determinants of Economic Growth in a Panel of Countries. *Annals of Economics and Finance*, 4, pp. 231–274.
- Barro, R. J. and Sala-i-Martin X. (1990). Economic Growth and Convergence across the United States. *NBER Working Paper*, 3419.
- Baumol, W. J. (1986). Productivity Growth, Convergence, and Welfare: What the Long-Run Data Show. *American Economic Review*, 76 (5), pp. 1072–1085.

- Benhabib, J. and Spiegel, M. M. (1994). The Role of Human Capital in Economic Development: Evidence from Aggregate Cross-Country Data. *Journal of Monetary Economics*, 34(2), pp. 143-173.
- Bergheim, S. (2008). *Long-run Growth Forecasting*. Berlin: Springer-Verlag.
- Bond, S., Hoeffler, A. and Temple, J. (2001). GMM Estimation of Empirical Growth Models. *Discussion Paper No. 3048*, Center for Economic Policy Research (CEPR), London.
- Caselli, F., Esquivel, G. and Lefort, F. (1996). Reopening the Convergence Debate: A New Look at Cross-Country Growth Empirics. *Journal of Economic Growth*, 1(3), pp.363-89.
- Cohen, D. and Soto, M. (2007). Growth and Human Capital: Good Data, Good Results. *Journal of Economic Growth*, 12(1), pp. 51-76.
- De la Fuente, A. and Domenech, R. (2006), Human Capital in Growth Regression: How Much Difference Does Quality Data Make? *Journal of the European Economic Association*, 4(1), pp. 1-36.
- Dobson, S. and Ramlogan, C. (2002). Convergence and Divergence in Latin America, 1970-1998. *Applied Economics*, 34(4), pp. 465-470.
- Hayakawa, K. (2007). Small Sample Bias Properties of the System GMM Estimators in Dynamic Panel Data Models. *Economics Letters*, 95(1), pp. 32-38.
- Haggard, M.S., MacIntyre, M. and Tiede, B. L. (2008). The Rule of Law and Economic Development. *Annual Review of Political Science*, 11, pp. 205-234.
- Islam, N. (1995). Growth Empirics: A Panel Data Approach. *Quarterly Journal of Economics*, 110 (4), pp.1127-70.
- Keefer, P. and Knack, S. (1997). Why Don't Poor Countries Catch Up? A Cross National Test of an Institutional Explanation. *Economic Inquiry*, 35 (3), pp. 590-602.
- Knack, S. and Keefer, P. (1995). Institutions and Economic Performance: Cross-country Tests Using Alternative Institutional Measures. *Economics and Politics*, 7(3), pp. 207-227.
- Krueger, A. B. and Lindahl, M. (2001). Education for Growth: Why and for Whom? *Journal of Economic Literature*, 39(4), pp. 1101-1136.
- Kumar, C.S. (2006). Human Capital and Growth Empirics. *Journal of Developing Areas*, 40(1), pp. 153-179.
- Kyriacou, G. (1991), Level and Growth Effects of Human Capital, *C. V. Starr Center Working Paper, No. 91-26*, C.V. Starr Center for Applied Economics, University of New York.

- Lucas, R. E., Jr. (1988). On the Mechanics of Economic Development. *Journal of Monetary Economics*, 22 (1), pp.3–42.
- Mankiw, N. G., Romer, D. and Weil, D. N. (1992). A Contribution to the Empirics of Economic Growth. *Quarterly Journal of Economics*, 107 (2), pp.407–437.
- Murthy, V. N. R. and Ukpolo, V. (1999). A Test of the Conditional Convergence Hypothesis: Econometric Evidence from African Countries. *Economic Letters*, 65 (2), pp.249-53.
- Nelson, R. and Phelps, E. (1966). Investment in Humans, Technological Diffusion, and Economic Growth. *American Economics Review*, 56 (1-2), pp. 69-75.
- Pritchett, L. (2001). Where Has All the Education Gone? *World Bank Economic Review*, 15(3), pp. 367-391.
- Psacharopoulos, G. and Patrinos, H. A. (2004). Returns to Investment in Education: A Further Update. *Education Economics*, 12(2), pp. 111-134.
- Sachs, J.D. and Warner, A. M. (1995). Economic Convergence and Economic Policies. *NBER Working Paper*, No. 5039, National Bureau of Economic Research.
- Sala-i-Martin, X. (1996a). The Classical Approach to Convergence Analysis. *The Economic Journal*, 106 (437), pp.1019-36.
- Soto M. (2009). System GMM Estimation with a Small Sample, *UFAE and IAE Working Papers*, 780, Unitat de Fonaments de l'Anàlisi Econòmica (UAB) and Institut d'Anàlisi Econòmica (CSIC), Barcelona.
- Soto, M. (2002), Rediscovering Education in Growth Regressions, *OECD Development Centre Working Paper*, 202, OECD Development Centre.
- Stamatakis D., Petrakis, P. (2006). The Human Capital Convergence Fallacy: A Cross Country Empirical Investigation. *Journal of Educational Research and Review*, 1(3), pp. 98-107.
- Tamura, R. (1991). Income Convergence in an Endogenous Growth Model. *The Journal of Political Economy*, 99 (3), pp. 522-540.
- Temple, J. (1999). A Positive Effect of Human Capital on Growth. *Economics Letters*, 65(1), pp. 131-134.
- Temple, J. R. W. (1998). Robustness Tests of the Augmented Solow Model. *Journal of Applied Econometrics*, 13(4), pp.361-75.
- Tsangarides, C. G. (2001). On Cross-Country Growth and Convergence: Evidence from African and OECD Countries. *Journal of African Economies*, 10(4), pp. 355-389.

Uzawa, H. (1965). Optimal Technical Change in an Aggregative Model of Economic Growth. *International Economic Review*, 6(1), pp.8–31.

Xu J. (2000). Multinational Enterprises, Technology Diffusion and Host Country Productivity Growth. *Journal of Development Economics*, 62 (2), pp. 477-93.

World Bank (2006). *Where is the Wealth of Nations? Measuring Capital for the 21st Century*. Washington DC: World Bank

Appendix

Initial Low Human capital countries		Initial High human capital countries		Countries with poor rule of law		Countries with better rule of law	
Bangladesh	1.1	Bolivia	0.7	Bangladesh	1.1	Benin	0.6
Benin	0.6	Brazil	2.4	Bolivia	0.7	Botswana	6.1
Botswana	6.1	China	4.4	Burundi	0.7	Brazil	2.4
Burundi	0.7	Colombia	2.3	Central African Rep.	-1.1	Cameroon	0.8
Cameroon	0.8	Dominican Rep.	3.0	Colombia	2.3	China	4.4
Central African Rep.	-1.1	Ecuador	1.7	Congo, Dem. Rep.	-3.2	Cote d'Ivoire	0.6
Congo, Dem. Rep.	-3.2	Fiji	1.7	Congo, Republic	1.9	Dominican Republic	3.0
Congo, Republic	1.9	Guatemala	1.5	Ecuador	1.7	Fiji	1.7
Cote d'Ivoire	0.6	Honduras	1.0	Egypt	3.2	Gambia, The	0.8
Egypt	3.2	Jordan	1.1	Guatemala	1.5	Ghana	1.5
Gambia, The	0.8	Kenya	0.3	Haiti	-0.6	India	3.1
Ghana	1.5	Korea, Republic	5.5	Honduras	1.0	Jordan	1.1
Haiti	-0.6	Lesotho	2.5	Indonesia	3.6	Kenya	0.3
India	3.1	Malaysia	4.4	Mali	1.2	Korea, Republic of	5.5
Indonesia	3.6	Mauritania	2.1	Mozambique	1.5	Lesotho	2.5
Malawi	1.2	Mauritius	3.0	Nepal	1.2	Malawi	1.2
Mali	1.2	Namibia	1.4	Nicaragua	-0.3	Malaysia	4.4
Morocco	3.3	Nicaragua	-0.3	Pakistan	2.4	Mauritania	2.1
Mozambique	1.5	Panama	3.2	Paraguay	1.6	Mauritius	3.0
Nepal	1.2	Paraguay	1.6	Philippines	1.7	Morocco	3.3
Niger	-0.3	Philippines	1.7	Rwanda	0.3	Namibia	1.4
Pakistan	2.4	Romania	4.0	Senegal	0.1	Niger	-0.3
Papua New Guinea	2.3	Senegal	0.1	Sierra Leone	0.6	Panama	3.2
Rwanda	0.3	Sri Lanka	3.4	Sri Lanka	3.4	Papua New Guinea	2.3
Sierra Leone	0.6	Taiwan	5.8	Syria	1.9	Romania	4.0
Syria	1.9	Tanzania	1.8	Togo	-0.1	Taiwan	5.8
Togo	-0.1	Thailand	4.4	Uganda	1.1	Tanzania	1.8
Tunisia	2.9	Zambia	0.1	Zimbabwe	-1.5	Thailand	4.4
Uganda	1.1	Zimbabwe	-1.5			Tunisia	2.9
						Zambia	0.1

The two human capital classifications are based on the initial level of human capital stock, 1960. The average value of rule of law index for the period 1960-2008 is considered for the rule of law based groupings of low income countries. The median value of each of the indicator is used as a benchmark for the divisions. The number in front of each country is the percentage income growth rate over the period 1960-2008.

Initial Low Human capital countries		Initial High human capital countries		Countries with poor rule of law		Countries with better rule of law	
Algeria	0.9	Argentina	1.3	Algeria	0.9	Australia	2.4
Austria	2.7	Australia	2.4	Argentina	1.3	Austria	2.7
Chile	2.5	Barbados	2.4	Barbados	2.4	Belgium	2.6
Costa Rica	1.7	Belgium	2.6	Chile	2.5	Canada	2.2
Cyprus	3.7	Canada	2.2	Costa Rica	1.7	Denmark	2.3
El Salvador	1.4	Denmark	2.3	Cyprus	3.7	Finland	2.8
France	2.4	Finland	2.8	El Salvador	1.4	France	2.4
Hong Kong	5.1	Greece	3.2	Greece	3.2	Hong Kong	5.1
Italy	2.5	Iceland	2.9	Israel	2.7	Iceland	2.9
Jamaica	1.0	Ireland	3.5	Italy	2.5	Ireland	3.5
Mexico	2.1	Israel	2.7	Jamaica	1.0	Japan	3.5
Peru	1.4	Japan	3.5	Mexico	2.1	Luxembourg	3.4
Portugal	3.4	Luxembourg	3.4	Peru	1.4	Netherlands	2.3
Singapore	5.1	Netherlands	2.3	Portugal	3.4	New Zealand	1.5
South Africa	1.5	New Zealand	1.5	South Africa	1.5	Norway	3.0
Spain	3.2	Norway	3.0	Spain	3.2	Singapore	5.1
Trinidad & Tobago	3.3	Sweden	2.1	Trinidad & Tobago	3.3	Sweden	2.1
Turkey	2.4	Switzerland	1.6	Turkey	2.4	Switzerland	1.6
Uruguay	1.7	United Kingdom	2.1	Uruguay	1.7	United Kingdom	2.1
Venezuela	0.8	United States	2.1	Venezuela	0.8	United States	2.1

The two human capital classifications are based on the initial level of human capital stock, 1960. The average value of rule of law index for the period 1960-2008 is considered for the rule of law based groupings of high and middle income countries. The median value of each of the indicator is used as a benchmark for the divisions. The number in front of each country is the percentage income growth rate over the period 1960-2008.

