A NOTE

ON

CROSS-COUNTRY DIVERGENCE IN STANDARD OF LIVING

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ABSTRACT

Convergence in 'standards of living' across countries is an important phenomenon that drew attraction of the researchers in Economics during the last two decades. These studies take into account the growth of per capita gross domestic product or labour productivity as a measure of standard of living. The present study attempts to measure the standard of living in terms of the human development index which reflect the human well-being better than income or productivity and examines whether standards of living converge across economies over a fairly long period of time, such as 35 years (1960-95). The convergence test has been attempted for the full sample as well as for three levels of human development. The study uses the convergence test introduced by Baumol. The tests indicate that in almost for all the cases divergence has been observed. Divergence is also observed for per capita real gross domestic product for all types of sample.

1. Introduction :

During the eighties and nineties a number of theoretical and empirical studies have investigate whether standards of living across different economies converge. Theoretically, the convergence hypothesis implied by the neoclassical growth models of Solow (1956) and Cass (1965) has been questioned by the 'Endogenous growth' models of Romer (1986), Lucas (1988) and Rebelo (1991). Empirically, studies by Baumol (1986), Dowrick and Nguyen (1989), Wolff (1991), Barro and Sala-i-Martin (1991, 1992) and Mankiw et al. (1992) have presented evidence in favour of convergence. All of these studies follow the same testing procedure: for a sample of economies, they examine the cross-sectional relationship between the growth rate of per capita production over some time period and the level of per capita production at the initial point. The negative relationship between the initial level of per capita production and the growth rate of the per capita production implies that the economies those start poor grow faster than economies those start rich, the conclusion is in favour of convergence.

Baumol (1986) and Baumol and Wolff (1988) were the pioneers who addressed the issues of convergence and divergence in a systematic hypothesis-testing framework. Their studies attempted to explain current gross domestic product per capita in terms of past real gross domestic product per capita (PCGDP). Baumol and Wolff expanded the analysis by taking into account the role of education in explaining convergence and growth. Barro (1991), Zind (1991) and Mankiw, Romer and Weil (1992) broadened the analysis by adding further explanatory variables.

This study proposes to consider the convergence properties of the human development index. Human development index is better measure of 'standard of living' rather than per capita gross domestic product or labour productivity. In this context, a few sentences from Sen (A.K. Sen, 1998) is worth mentioning:
"The gross domestic product per capita may be a good indicator of the average real income of the nation, but the actual incomes enjoyed by people will depend also on the distributional pattern of that national income. Also, the quality of life of a person depends not merely on his or her personal income, but also on various physical and social conditions. For example, the epidemiological atmosphere in which a person lives can have a very substantial impact on morbidity and mortality. The availability of health care and the nature of medical insurance-public as well as private - are among the important influences on life and death. So are the other social services, including basic education and the orderliness of urban living and access to modern medical knowledge. There are, thus, many factors not included in the accounting of personal incomes that can be importantly involved in the life and death of people. The point is not the irrelevance of economic variables such as personal incomes (they certainly are not irrelevant), but their severe inadequacy in capturing many of the causal influences on the quality of life and the survival chances of people" Therefore, it is more important

to observe the cross-country convergence in quality of life over a period. This study attempts to throw light on the convergence of the countries in terms of quality of life as measured by the human development index over thirty-five years 1960-95 (i.e. a generation).

The remainder of the paper is organized in the following way: section 2 describes the rationale behind the choice of human development index as an indicator of standard of standard of living, the sample and sources of data; the methodology involved in testing for convergence is presented in section 3; section 4 reports the highlights of the convergence results and section 5 concludes the paper.

2. Indicators, Sample and Data :

The origin of the critique of the use of GNP per capita for measuring the level of development of different countries could traced back to the pioneering United Nations Report (1954) in which specific recommendations were made against the use of this indicator as a measure of standard of living. This was followed by a formidable array of literature, mainly in the 1970s, in support of this proposition, which mostly concentrated on the construction and use of socioeconomic indicators for measuring development (Adelman and Morris, 1967; UNRISD, 1972; Morris, 1979; Hicks and Streeten, 1979). A number of attempts were made for constructing composite indices, which aimed to reflect the level of development more comprehensively than GNP per capita alone could reveal. The most recent attempt in this respect is the Human Development Index (HDI) published by the UNDP since 1990. Some of the arguments raised in favour of HDI are as follows: (1) HDI captures many aspects of human condition; (2) some economists (Dasgupta and Weale, 1992) considers it as a good package of indices at a very aggregate level; (3) human development is a process of enlarging people's choices and HDI is a better measure to capture the process over per capita GNP. Provoked by the arguments raised in favour of the HDI this study uses HDI to measure standard of living.

The principle followed in choosing the sample countries is wide representation of countries from various income levels and various geographical regions. The sample consists of 91 countries. These countries are from three major development levels: high human development countries, middle human development countries and low human development countries.

Data for human development indices and per capita Real gross domestic product for the sample countries have been obtained the 1998 issue of the Human Development Report.

3. Methodology : Tests of Convergence :

There are several different methods that can be used to test the convergence hypothesis. For example, one can compare a measure of cross-country inequality at various points of time, as done by De Long (1988) and Dollar and Wolff (1988). One may also formulate a regression of the inequality index on average "world" income, as done by Ram (1989). The works of Abramotiviz (1986), Baumol (1986), Baumol and Wolff (1988), Blackman and Wolff (1989) show that one straightforward approach to test inter-country convergence is to relate rate of growth of income (GDP) per capita with initial income level.

Baumol (1986), the pioneer in this respect estimated a regression of the form :

$$\ln (Y_T/Y_0) = a + b\, Y_0 \quad\text{................................}(1)$$

Where Y stands for per capita real GDP and the subscripts 0 and T stand for initial and terminal year respectively. A significantly negative value of b implies inter-country convergence in per capita real GDP. Same methodology has been followed by others. Later Baumol and Wolff (1988) generalize (1) by introducing b as a linear function of Y_0. Hence, estimating equation is of the quadratic form:

$$\ln (Y_T/Y_0) = a + b\, Y_0 - c\, Y_0^2 \quad\text{..........................}(2)$$

The interval (0, T) is refered as a "generation". Baumol and Wolff estimated (2) using Summers-Heston (1985) data set for 72 countries with 1950 as the initial period and 1980 as the terminal period. Therefore, in their estimation for each country, the left hand side (LHS) of (2) is a measure of growth rate of Y over the generation while the right hand side (RHS) is a quadratic in the initial Y.

This study uses this approach and estimates the equations of the following forms:

$$\ln (Y_t) = \alpha_0 + \alpha_1 Y_0 + \alpha_2 Y_0^2 + \varepsilon_1 \quad\text{.............................}(3)$$

$$\ln(Y_t) = \alpha_0 + \alpha_1 Y_0 + \alpha_2 Y_0^2 + \alpha_3 \ln Y_0 + \varepsilon_2 \text{...................}(4)$$

$$\ln (Y_t) = \alpha_0 + \alpha_1 \ln Y_0 + \varepsilon_3 \text{...................}(5)$$

where $\ln (Y_t/Y_0)$ is the growth rate of an indicator mentioned in section 1 and 2 during the period 1960 to 1995 and Y_0 is the HDI or PCRGDP in the initial period i.e. in 1960 and Y_t is HDI or PCRGDP in the terminal period i.e. in 1995. Convergence would be indicated by the estimates when both α_1 and α_2 are negative or when the negative effect of one dominates the positive effect of the other while divergence would be suggested when both these parameters are positive or the positive effect of one dominates that of the other. Obviously, when α_2 is zero (3) reduces to the linear form and convergence or divergence is

determined by α_1 alone i.e. negative value of α_1 indicates convergence and positive value of α_1 suggests divergence.

The study attempts to throw light on the convergence-divergence of the countries over the period of 35 years 1960 to 1995: the initial point of time is considered to be 1960 and the terminal point of time is taken as 1995. Apart from the test of convergence for the full sample, it extends the same test for three human development levels.

4. Highlights of the Convergence Tests :

The regression estimates for HDI and PCRGDP are reported in Tables 1, and 2. Each table presents results for the full sample (91 observations) as well as for the different income groups: high (41), middle (23) and low (27). Both tables report estimates of parameters for both with and without the quadratic term in initial level of the respective indicator and with and without logarithmic expressions of the initial values of the indicators. Results for full sample as well as three development groups indicate divergence of the countries in HDI and PCRGDP. The critics of the convergence hypothesis are of the view that the economies are diverging in many important respects rather than converging. Some of them argue that increasing economic output permits the economies to choose from a variety of development paths based on their unique cultural, political or environmental factors (Odum, 1971; Horowitz, 1966). Others are of the opinion that the late developers may be unable to develop all the aspects due to backwardness and tradition (Smelser, 1963), unsuccessful competition with the developed economies (Kuznets, 1971), overspecification in primary products (Galtung, 1971) or recurrent exploitation (Baran, 1956; Frank, 1966).

5. Concluding Remarks :

Recently the literature of economic growth evidenced a number of studies testing the cross-country convergences of per capita gross domestic product or labour productivity. This study employs the test procedure and extends the study for examining convergence in the quality of life across countries over 1960-1995. In addition to the full sample of 91 countries, it tests convergence of those indicators for different income groups such as the high, middle and low human development countries. The results suggest divergence for all the cases implying that the economies of the world are becoming more dissimilar over the period 1960-1995 in respect of human development index and per capita real gross domestic product.

Table 1

Results of the Convergence Test
Human Development Index

Adj.R²	Dependent Variable	Independent Variables			Constant	
	LnY_t	Y_0	$Y_0{}^2$	LnY_0		
1	2	3	4	5	6	7
(a) Full sample						
		-0.370 (-2.522)		0.709* (12.89)	0.424 (0.373)	0.87
		1.120* (3.198)	-1.327* (-4.616)	0.622* (11.720)	0.0350 (0.257)	0.90
				0.583* (24.45)	0.134 (4.466)	0.87
(b) High Human Development Countries						
		-0.032 (-0.536)	0.697* (16.540)		0.018 (0.351)	0.92
		0.653 (2.835)	-0.759 (-3.056)	0.873* (22.100)	-0.009 (-0.578)	0.94
(c) Middle Human Development Countries						
		0.928 (0.7622)	0.487 (1.217)		-0.657 (-0.762)	0.91
		-2.435 (-0.164)	2.485 (0.227)	1.027 (0.425)	0.780 (0.122)	0.91
				0.790* (15.20)	0.002 (0.03)	0.91
(d) Low Human Development Countries						
		0.172 (0.730)		0.877* (31.56)	-0.009 (-0.134)	0.97
		-0.773 (-0.690)	3.467 (0.864)	0.853* (21.260)	-0.002 (-0.036)	0.97
				0.881* (32.600)	0.024 (4.576)	0.98

Table 2

Results of the Convergence Test
Real Per Capita Gross Domestic Product

	Dependent Variable	Independent Variables			Constant	Adj.R^2
	LnY_t	Y_0	Y_0^2	LnY_0		
1	2	3	4	5	6	7

(a) Full sample

		0.000		1.0749*	0.133	0.88
		(0.088)		(15.940)	(0.329)	
		0.000	-0.000	1.020*	0.388	0.88
		(1.139)	(-1.197)	(12.630)	(0.852)	

(b) High Human Development Countries

		-0.046*	0.431*		-0.004	0.81
		(-1.772)	(12.950)		(-0.173)	
		-1.389	1.423	-0.192	0.000	0.91
		(-6.658)	(6.461)	(-1.939)	(0.004)	

(c) Middle Human Development Countries

		-0.905	1.073		0.696	0.59
		(-0.345)	(0.850)		(0.316)	
		-41.405	20.742	10.753	22.463	0.58
		(-0.887)	(0.869)	(0.959)	(0.893)	

(d) Low Human Development Countries

		0.00		0.408	4.216	0.26
		(0.271)		(0.438)	(0.877)	
		-0.020	0.000	5.379	-18.704	0.30
		(-1.530)	(1.581)	(1.644)	(-1.228)	
				0.655	2.951*	0.28
				(3.643)	(2.651)	

Notes : In the tables 1 to 5 above
  Figures in the parentheses are t-ratios .
  * indicates significance at 5% level.
  ** indicates significance at 10% level.

References :

Abramovitz, Moses (1986) :" Catching Up, Forging Ahead and Falling Behind", Journal of Economic History, Vol. 46, pp. 385-406.

Balassa, Bela (1964) : "The Purchasing Power Parity Doctrine : A Reappraisal", Journal of Political Economy, Vol. 72, pp. 584-596.

Baran, Paul (1956) : The Political Economy of Growth, New York, Monthly Review.

Barro, Robert, J. (1991) : "Economic Growth in a Cross Section of Countries", The Quarterly Journal of Economics, Vol. CVI, No.2, pp.407-444.

Baumol, William, J. (1986) : "Productivity Growth, Convergence and Welfare: What the Long-run data Show", American Economic Review, Vol. 76, No. 5, pp. 1072-1085.

Baumol, William, J. and Edward N. Wolff (1988) : "Productivity Growth, Convergence and Welfare : Reply", American Economic Review, Vol. 76, No. 5, pp. 1155-1159.

Cass, David M. (1965) : "Optimum Growth in an Aggregate Model of Capital Accumulation ", Review of Economic Studies, Vol. 32, pp. 233-240.

De Long, J.B. (1988) : "Productivity, growth, Convergence and Welfare : Comment", American Economic Review, Vol. 78, pp. 1138-1154.

Dollar, D. and E.N. Wolf (1988) : "Convergence of Industry Labour Productivity Among Advanced Economies, 1963-1982", Review of Economics and Statistics, Vol. 70, pp. 549-558.

Dowrick, Steve and Duc- Tho Nguyen (1989) :"OECD Comparative Economic Growth 1950-1985 : Catch-up and Convergence, American Economic Review, Vol. 79, pp. 1010-1030.

Evans, Paul and Georgios Karras, (1993) :"Do Standards of Living Converge ? Some Cross-Country Evidence", Economics Letters, Vol. 43, pp. 149-155.

Feldman, A.S. and Wilbert E. Moore (1969) : "Industrialization and Industrialism : Convergence and Differentiation", In Cmparative Perspectives on Industrial Society, Edited by William A. Faunce, Boston, Little Brown.

Frank, Andre Gunder (1966) : "Thew Development of Underdevelopment", Monthly Review, Vol. 18, pp. 17-31.

Galtung, John (1971) : "A Structural Theory of Imperialism", Journal of Peace Research, Vol. 8, pp. 81-117.

Horowitz, Irving L. (1966) : Three World of Development, New York, Oxford University Press.

Kerr, Clark, John Dunlop, Frederick Harbison and Charles Myers (1964) : Industrialism and Industrial man, new York, Oxford University Press.

Kuznets, Simon (1971) : Economic Growth of Nations, Cambridge, Harvard University Press.

Mankiw, N. Gregory, David Romer and David N. Well (1992) : " A Contribution to the Empiricis of Economic Growth", The Quarterly Journal of Economics, Vol. CVII, No. 2, pp. 407-438.

Meyers, John, John Boli-Bennett and Christopher Chase-Dunn (1975) : "Convergence and Divergence in Development", In Annual Review of sociology, Palo Alto, CA : Annual Review.

Moore, Wilbert E. (1963) : "Industrialization and Social Change" In Industrialization and Society, edited by B.F. Horowitz and Wilbert E. Moore, Paris, UNESCO.

Odum, H.T. (1971) : 'Environment, Power and society, New York, Wiely.

Peacock, Walter G. and Greg A. Hoover, (1988) :" Divergence and Convergence in International Development : A Decomposition Analysis of Inequality in World System", American Sociological Review, Vol. 53, pp.838-852.

Ram, Rati (1989) : "Level of Development and Income Inequality : An Extension of Kuznets Hypothesis to the World economy", Kyklos, Vol. 42, pp. 73-88.

Ram, Rati, (1990) : "Educational expansion and Schooling Inequality : International Evidence and Some Implications", Review of Economics and Statistics, Vol. 72, pp. 266-274.

Ram, Rati, (1992) : "Education and the Convergence Hypothesis : Additional Cross-Country Evidence", Kyklos, pp.244-253.

Rebelo, Sergio (1991) : "Long-run Policy Analysis and Long-run Growth, Journal of Political economy, Vol. 99, pp. 500-521.

Sen, A.K. (1998) : "Mortality as an Indicator of Economic Success and Failure", The Economic Journal, Vol. 108, pp. 1-25.

Sen, A.K. (1981) : "Public Action and the Quality of Life in Developing Countries",
Oxford Bulletin of Economics and Statistics, Vol. 43, pp. 287-319.

Smelser, Neil (1963) : "Mechanisms of Change and Adjustment to Change", In Industrialization and Society, edited by B.F. Horowitz and Wilbert E. Moore, Paris, UNESCO.

Summers, Robert and Alan Heston (1988) : "A New Set of International Comparisons of Real Product and Price Levels : Estimates for 130 countries, 1950-85", Review of Income and Wealth, Vol. 34, pp. 1-25.

United Nations Development Programme, Human Development Report, Different issues, Oxford University Press.

World Bank, The World Tables, Different issues,

World Bank, World Development Report, Different issues, Oxford University Press.

Zind, Richard G. (1991) : "Income convergence nad divergence within and between LDC groups", World Development, Vol. 19, No. 6, pp. 719-727.