

## **The 'Poorest might catch up': Convergence vs. Pseudo-convergence**

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## **Abstract**

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**Keywords:** Convergence, Pseudo-convergence, Sigma-convergence, Beta-convergence, Rawls, Welfare

**JEL Code:** C40, D63, E0, F00

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Public welfare policies in developing countries have a Rawlsian perspective; they seek to uplift the poor, the poorest of the poor in particular. Policies to enable the poor to catch up with the rich are generally two-fold, viz., inclusive growth, and redistributive (transfer) programmes. This paper proposes twin concepts and measures of convergence ( $\kappa^*$ ) and pseudo-convergence (pseudo- $\kappa^*$ ) to characterize such outcomes. Unlike the conventional measures of convergence, they can contra-distinguish outcomes during economic growth as against decay. Illustrations based on estimates of per capita GDP and consumption across countries in the world show divergence and pseudo-divergence between 1993 and 2011.

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## **1. Introduction**

Divergent/convergent growth experience of individual citizens/ administrative districts has become a matter of policy concern in almost all the states in India or for that matter in countries across the globe in recent years.<sup>1</sup> In an era of globalization and increasing income inequalities, a primary policy focus to begin with could be on the income disparity between the poorest and the richest, be it at the level of citizens or administrative units or countries. One finds a similar concern in the global context too when the World Bank rank-orders countries in terms of per capita income in PPP\$ or the UNDP in terms of Human Development Index.

The New Millennium has witnessed a different profile of change in the growth experience of countries like India. Calling it ‘*Bimaru Lessons*’<sup>2</sup>, the Indian Express editorial states “Few outside the government would have been surprised that the clutch of states in north India plagued by a combination of relatively high illiteracy, high population growth rate and poor income generation potential, have shown brisk growth rates. Bihar, Rajasthan and Madhya Pradesh are no longer laggards. They have logged an average of 9.4 per cent growth since 2006-07, way above the national average. Their growth had picked up pace before the big ticket redistributive programmes launched by this government had time to make an impact. Except in Bihar and Uttar Pradesh, the distance between the worst performing district in each state and the best has actually declined in the last ten years. This means growth has worked to reduce income inequality among the country’s regions.” (*The Indian Express*, 28 December,

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<sup>1</sup>For instance, successive State Human Development Reports in India have focused on inter-district disparities in per capita income and other dimensions of human development.

<sup>2</sup>Bimaru is an acronym formed by taking the initial letters of four north Indian states: Bihar, Madhya Pradesh, Rajasthan and Uttar Pradesh. The term ‘bimaru’ means ‘sick’ in Hindi; ‘Bimaru’ was used as an adjective by demographer Ashish Bose to describe the backward condition of these states.

2012). Thus, there is a public concern about the different dimensions of the convergence process, namely, improvement in the economic status of the poorest, decline in the disparity between the poorest and the richest, improvement in the status of the population in general and also the pace of change in the status of the poorest relative to that of richest/ mainstream population.

A moot question in the context of the advocacy for ‘Inclusive Growth’ pertains to provision of opportunities and promotion of the incomes (primary economic status) of the poorest of the poor along with that of the mainstream (see, for instance, Suryanarayana, 2008). At the same time, governments in developing countries in particular have sought to achieve the different Millennium Development Goals like those on poverty and food insecurity by direct transfers in cash/kind to promote their consumption (secondary economic status).<sup>3</sup> In such a context, some relevant questions would be as follows:

1. Is there any change in the extent of disparity in income between the poorest and the richest during the reference period? This would be a subset of the concerns under ‘inclusive growth’, and ‘convergence’ in the conventional literature.
2. If there is no change in income disparity between the poorest and the richest, one would be interested in ascertaining if transfers in cash/kind have reduced disparity at least in their respective consumption levels. Verification of this question would involve determining the rank order positions of individuals/geographic units in terms of income but measuring disparity in their consumption. We term this particular issue as one of ‘*pseudo-convergence*’.

We have coined the term pseudo-convergence *a la* pseudo-Lorenz ratio, which is based on a distinction between variables to (i) determine the rank-order weights; and (ii) measure inequality respectively. In a similar way, we define the concept of pseudo-convergence by distinguishing between income to determine the primary economic status (poorest/richest) and some welfare measure like consumption to define the secondary economic status and hence, determine the post-redistributive welfare outcome.<sup>4</sup>

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<sup>3</sup> For instance, Antyodaya Anna Yojana of the Government of India which provides ten million poorest families food grains at highly subsidised prices.

<sup>4</sup> However, given the dual time reference in our problem, an additional distinction could be made between base and current year income status depending upon the policy question under review.

This paper proposes indices,  $\kappa^*(\text{max})$  and  $\kappa^*(\text{median})$ , to measure convergence/pseudo-convergence from a Rawlsian perspective and call it  $\kappa^*$ -convergence/pseudo- $\kappa^*$ -convergence in growth experience taking into account the qualitative dimensions emphasised in the public discourse on uplifting the poorest of the poor. This study would also provide an empirical illustration using the estimates of per capita GDP at 2000 PPP\$ across countries in the world for the years 1993 and 2011. The paper is organised as follows: Section 2 proposes measures of convergence from the Rawlsian perspective. Section 3 provides an illustration and a comparison of the different convergence measures. The final section summarises the paper.

## **2. Need for a convergence measure from the Rawlsian Perspective.**

The concept of convergence in the growth process essentially refers to the potential of the developing countries to catch up with the developed ones due to two major reasons: (i) diminishing returns to capital; and (ii) saving in terms of costs of technological innovations since they could simply replicate the innovations in the developed countries. Thus the issue is closely bound up with growth theory. From an economic welfare perspective, actual as well as potential scope for the poor to catch up with the rich has considerable policy appeal.

The literature on analyzing convergence of income based on the neoclassical growth model across countries is vast, pioneered by Sala-i-Martin (1990) and Barro (1991). The concept of convergence has been examined from different perspectives: (a) Convergence within vs. across countries;(b) Convergence in terms of growth rate vs. income level;(c)  $\beta$ -convergence vs.  $\sigma$ -convergence;(d) Absolute vs. conditional convergence;(e) Global vs. local convergence;(f) Income vs. total factor productivity-convergence; and (g) Deterministic vs. stochastic convergence.

Depending upon the perspective, empirical verifications have been carried out in terms of cross-section, time series, panel and distributional information.<sup>5</sup> As pointed out by Islam (2003), research on convergence has proliferated in multifarious dimensions involving different concepts and methodologies. They converge in terms of results from a broad perspective. However the focus has been primarily in the growth-theoretic context.

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<sup>5</sup>For a comprehensive review of literature, see Durlauf and Quah (1999) Islam (2003) and Temple (1999).

As regards methodology, there are two distinct approaches to measure “convergence”: (i)  $\beta$ -convergence; and (ii)  $\sigma$ -convergence. Beta convergence refers to a growth process wherein poor countries grow faster than the rich; thus, it verifies if there is any catching up process. Sigma-convergence refers to a reduction in the spread or dispersion in the levels /logarithm of income across countries around the average (mean); thus, its focus is on reduction in disparities over time. This approach can also be carried out in terms of inequality measures like the Gini coefficient, the Atkinson index and the Theil index. Beta convergence is a necessary but not sufficient condition for sigma convergence. These are measures based on the entire sample/population and seek to measure the general patterns and trends.

The regression specification for verifying  $\beta$ -convergence is:

$$\ln\left(\frac{y_{it}}{y_{it-1}}\right) = \alpha + \beta \ln(y_{it-1}) + u_{it} \quad (1)$$

A value of  $\beta < 0$  implies ‘unconditional  $\beta$ -convergence’ and a declining dispersion in per capita income (viz.,  $y_{it}$ ) implies  $\sigma$ -convergence.

The literature based on these two methods generally does not touch upon the dynamics of convergence as emphasized in the current public policy debates in developing countries where the concern is not only with the uplift of the poorest by their inclusion in the mainstream growth process along with reduction in income disparities but also with the relative pace of progress of different sections of the society and their standard of living. Contemporary methods on convergence in general (including Atkinson Index for different specifications of the inequality aversion parameter as illustrated below) neither make nor could capture such distinctions in the convergence process. Hence, this paper makes an attempt to fill up this gap in a modest way.

### **3. Motivation and measure**

Given the contemporary Rawlsian emphasis on economic growth providing opportunities for the poorest and reducing disparity between the extremes in the country, this section proposes to develop a measure of convergence based on observed extreme values and changes therein.

The policy focus could be on either administrative units like countries, states and districts or citizens.

Let subscript ‘i’ denote the administrative unit or citizen under review, where  $i = 1, \dots, n$ . Let  $Y_{it}$  denote the income corresponding to unit ‘i’ in time ‘t’. Let us consider range as a measure of disparity and denote it by  $R_t$  where

$$R_t = \max(Y_{it}) - \min(Y_{it})$$

Similarly from the inclusive growth perspective, one may measure the gap ( $G_t$ ) between the population in general ( $\text{median}(Y_{it})$ )<sup>6</sup> and the poorest of the poor ( $\min(Y_{it})$ ), that is,

$$G_t = \text{median}(Y_{it}) - \min(Y_{it})$$

Now  $R_t$  or  $G_t$  can change for better/worse because of different combinations of qualitative changes in the following dimensions: (i)  $\max(Y_{it})$  or  $\text{median}(Y_{it})$ ; (ii)  $\min(Y_{it})$ ; (iii) range/gap; and (iv) rate of change in  $\min(Y_{it})$  relative to that in  $\max(Y_{it})$ . That is, outcomes of the convergence process could differ because of increase/decrease/no-change in  $\max(Y_{it})$  or  $\text{median}(Y_{it})$ ,  $\min(Y_{it})$  and relative rates of changes in them. Each of these components would count from a welfare perspective. We propose a ternary variable  $T_i$  to denote the qualitative changes in each of these dimensions. Each of these dimensions is qualitatively different in terms of its welfare implications for the poor and for the society. From a social welfare perspective, a reduction in range/gap is desirable; it is a positive outcome. Let ternary variable  $T_1$  denote this outcome; it takes the value 1 when the range/gap declines, 0 for no change and (-) 1 for an increase. Similar is the case with increases (positive outcomes), decreases (negative outcomes) and no change in  $\max(Y_{it})$  or  $\text{median}(Y_{it})$  and  $\min(Y_{it})$ . Let ternary variable  $T_2$  denote changes in  $\max(Y_{it})$  or  $\text{median}(Y_{it})$  and  $T_3$  represent changes in  $\min(Y_{it})$ . Further, one may also consider the rate of change in these variables. It would always be a desirable outcome to have the poorest of the poor experience a higher rate of

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<sup>6</sup> Median is a robust measure of average for positively skewed distributions like income. For further details on measures of inclusive growth, see Suryanarayana (2008).

increase in his/her income than the average / the richest. Let  $T_4$  denote this dimension (Table 1).<sup>7</sup>

**Table 1: Convergence: Components of changes from the Rawlsian perspective**

Ternary Variable values	Components of change			
	Range (or Gap)	Max( $Y_{it}$ ) (or median( $Y_{it}$ ))	Min( $Y_{it}$ )	Rate of change in min( $Y_{it}$ ) vis a vis max( $Y_{it}$ ) (or median( $Y_{it}$ ))
	$T_1$	$T_2$	$T_3$	$T_4$
-1	Increase	Decrease	Decrease	Lower
0	No change	No change	No change	No change
1	Decrease	Increase	Increase	Higher

Let us denote the outcome state by  $\kappa(T_1, T_2, T_3, T_4)$  where the values of  $T_i$  denote the outcome scenario. For instance  $\kappa(1, 1, 1, 1)$  would denote a situation involving a decrease in disparity (range / gap), increase in the income of the richest as well as the poorest, and the rate of increase (decrease) in income of the poorest is higher (lower) than that of the richest or the median income. In fact, the index can be generalised by increasing the number of dimensions ( $T_i$ ) to take into account even changes like movement of the poorest/richest across decile/quartile groups.<sup>8</sup>

To begin with, we propose measures of convergence based on the qualitative changes of the dimensions under review using the ternary variable approach at some select levels of disaggregation of components of changes.

The proposed index  $\kappa = \frac{i^T}{n}$

<sup>7</sup>It may appear that these four dimensions are not independent since  $T_1 = \psi(T_2, T_3, T_4)$ . In fact, it is not really so since individual welfare also depends upon her/his relative income and extent of disparity as implied in the welfare function underlying the Gini ratio.

<sup>8</sup>One finds such shifts in the rank ordering of districts across quartile groups in the state of Maharashtra (Suryanarayana, 2011).

Where  $i' = (1 \dots 1)$ ,  $T' = (T_1 \dots T_n)$ , and  $\kappa \in [-1, 1]$ .

Corresponding to Table 1, we have  $i' = (1 \ 1 \ 1 \ 1)$ ,  $T' = (T_1 \ T_2 \ T_3 \ T_4)$ ,  $n = 4$  and  $\kappa \in [-1, 1]$ . Depending upon the reference measure (maximum or median income), one may distinguish between  $\kappa$ -max and  $\kappa$ -median.  $\kappa(T_1, T_2, T_3, T_4)$  would provide a measure of what may be called  $\kappa$ -convergence.

### 3.1 Evaluation:

1. The index has the merit that it maintains the principle of anonymity while examining disparity and its welfare dimensions. However, it has the limitation that the individual welfare functions are implicitly assumed to be independent, and depend on their respective incomes only. In consequence, it would not take into account welfare losses/gains due to interchange of ranks in the society. For instance, there may be all round progress in terms of numerical measures of the different dimensions of convergence. Still there could be a welfare loss/gain only because of a change in the permutation as countries undergo changes in their relative status. This index would not take into account such losses/gains unless all households have identical welfare functions.
2. The index  $\kappa$  has a limitation that it is an unweighted measure and hence, may not facilitate subtle distinctions between qualitative changes of dimensions of convergence.

The second limitation mentioned above could be addressed by appropriate weighting of outcomes. An index obtained by weighting outcomes would permit rank-ordering of convergence states in ascending order of values. Towards this end, we would define  $\kappa^*$  given by

$$\kappa^* = \omega' T$$

where  $\omega' = (\omega_1 \ \omega_2 \ \dots \ \omega_n)$  where  $\omega'$  is a weighting diagram reflecting policy priorities across 'n' outcome dimensions. One option for deriving the weighting diagram could be to rank order the outcome dimensions as per policy priorities and weight by the ranks themselves. For instance, if  $T_1 < T_2 < T_3 < \dots < T_n$ , then  $\omega_i = \frac{2i}{n(n+1)}$  where 'i' is the rank of the order of the outcome specified and 'n' is the total number of outcome dimensions under review (Table

2). Depending upon the reference measure (maximum or median), one may distinguish between  $\kappa^*$ -max and  $\kappa^*$ -median.  $\kappa^*(T_1, T_2, T_3, T_4)$  would provide a measure of  $\kappa^*$ -convergence, that is, convergence as desired by policy priorities.

**Table 2: Convergence: Weighted Components of changes from the Rawlsian perspective**

Ternary Variable values	Components of change			
	Range (or Gap)	Max( $Y_{it}$ ) (or median( $Y_{it}$ ))	Min( $Y_{it}$ )	Rate of change in min( $Y_{it}$ ) vis a vis max( $Y_{it}$ ) (or median( $Y_{it}$ ))
Dimension →	$T_1$	$T_2$	$T_3$	$T_4$
Weight ( $\omega$ ) →	0.3	0.1	0.4	0.2
▼ -1	Increase	Decrease	Decrease	Lower
0	No change	No change	No change	No change
1	Decrease	Increase	Increase	Higher

In sum, there will be  $3^n$  alternative combinations of outcomes. However, not all of these combinations will be consistent and hence, not feasible. Select consistent and hence, feasible combinations are listed in Table 3. Some salient features are as follows:

1.  $\kappa^*$  takes only discrete values in the interval  $[(-) 1, 1]$ .
  - a. When there is both growth and convergence, it will be represented by  $\kappa^*(1,1,1,1)$  which will be equal to 1. This is an ideal Rawlsian scenario.
  - b. Growth with divergence between the poorest and the richest will mean  $\kappa^*((-1), 1, 1, (-1)) = 0$ .
  - c. A stagnant economy without any change in the income distributional status would imply  $\kappa^*(0,0,0,0) = 0$ .
  - d. When the economy declines involving convergence between the poorest and the richest, that is,  $\kappa^*(1, (-)1, (-)1, 1) = 0$ .
  - e. Finally, when there is decay and divergence,  $\kappa^*((-1), (-)1, (-)1, (-)1) = (-)1$ .
2. Ranking of outcome states based on the values of  $\kappa^*$  tallies with those based on qualitative perception of welfare changes specified.
3. Consistent desirable combinations, that are convergence from the Rawlsian perspective, would involve values of the index greater than or equal to 0.8.

4. The values of  $\kappa^*$  are always positive for increases in the welfare of the poorest.
5. The value of the index is greater than or equal to 0.6 for combinations of changes involving both a decrease in the range and increase in the income of the poorest.

**Table 3: Outcome States and the Index  $\kappa^*$**

Scenario	$T_1$	$T_2$	$T_3$	$T_4$	$\kappa^*$
1	1	1	1	1	1
2	1	0	1	1	0.9
3	1	(-1)	1	1	0.8
4	0	1	1	1	0.7
5	(-1)	1	1	1	0.4
6	(-1)	1	1	(-1)	0
7	(-1)	1	0	(-1)	(-0.4)
8	(-1)	1	(-1)	(-1)	(-0.8)
9	(-1)	(-1)	(-1)	(-1)	(-1)

*Note:* In total  $3^n$  (that is,  $3^4 = 81$ ) combinations of the three different values of the four dimensions are possible. In this table we show 8 such cases, which are consistent and feasible for illustration.

In sum, (i) when there is no well-defined policy priority across dimensions, one would not distinguish between their qualitative aspects and use  $\kappa$  measure for ranking different states of outcomes; and (ii) when the policy maker has definite preferences across states of convergence outcome dimensions, one would use the weighted  $\kappa^*$  measure of convergence. Such a preferred convergence scenario may be called  $\kappa^*$ -convergence.

### 3.2 Pseudo-convergence:

The convergence measure defined above is with reference to the primary economic status, that is, income. It would only measure inclusiveness of the growth strategy. There may/may not be any convergence in income. However, the poorest might have caught up with the richest in terms of her/his secondary economic status, that is, consumption due to public policy intervention in terms of transfers and subsidies. To verify if such programmes have been effective, one may estimate the  $\kappa^*$  measure for the consumption estimates of the poorest and richest identified in terms of their income status, which may be called pseudo- $\kappa^*$ . A

comparison between measures of convergence and pseudo-convergence in an era of growth would provide useful policy insights (Table 4). They are as follows:

1. Both ‘ $\kappa^*$ -convergence’ and ‘pseudo- $\kappa^*$ -convergence’: This would imply that the government policies have been effective in enabling the poorest to catch up with the richest in terms of their capability to earn income and realise the benefits from such growth. Hence, it would suggest ‘Inclusive Development’.
2. ‘ $\kappa^*$ -convergence’ but ‘pseudo- $\kappa^*$ -divergence’: As happened in the Indian states like Maharashtra, growth in income *per se* would not ensure rational consumer choice and the poorest may end up wasting their precious little income. This would call for proper household education on consumer choice to promote welfare. Thus, there is only inclusive growth and not development.
3.  $\kappa^*$ -divergence but pseudo- $\kappa^*$ -convergence. Pursuit of well implemented transfers would generate such a scenario.
4. Both  $\kappa^*$ -divergence and pseudo- $\kappa^*$ -divergence: Ideally this would call for an inclusive development strategy to promote both income and consumption.

**Table 4: Convergence and pseudo-convergence during growth: Policy Implications**

GDP Consumption expenditure	→	$\kappa^*$ -convergence	$\kappa^*$ -divergence
↓		Inclusive development	Evidence of effectiveness of targeted policies
Pseudo- $\kappa^*$ -convergence		Inclusive growth; need for consumer education	Need for inclusive/redistributive policies
Pseudo- $\kappa^*$ -divergence			

One can also conceive of a similar profile of  $\kappa^*$ - and pseudo- $\kappa^*$ -convergence for an era of decay and their policy implications for growth and redistributive policies.

One limitation of this measure, if and when applied to verify pseudo-convergence among individual citizens, is that the fourth dimension ( $T_4$ ) would generally turn out to be positive and unity. This is because slope of the consumption function of the poorest is greater than that corresponding to the richest. However, this may not be a serious limitation in poor developing countries where the general level of income itself is abysmally low so much so

that India has a Food Security Act providing food subsidies for two-thirds of the population as against the demand from the activists for its universalization.

## 4. Illustration

### 4.1 Convergence

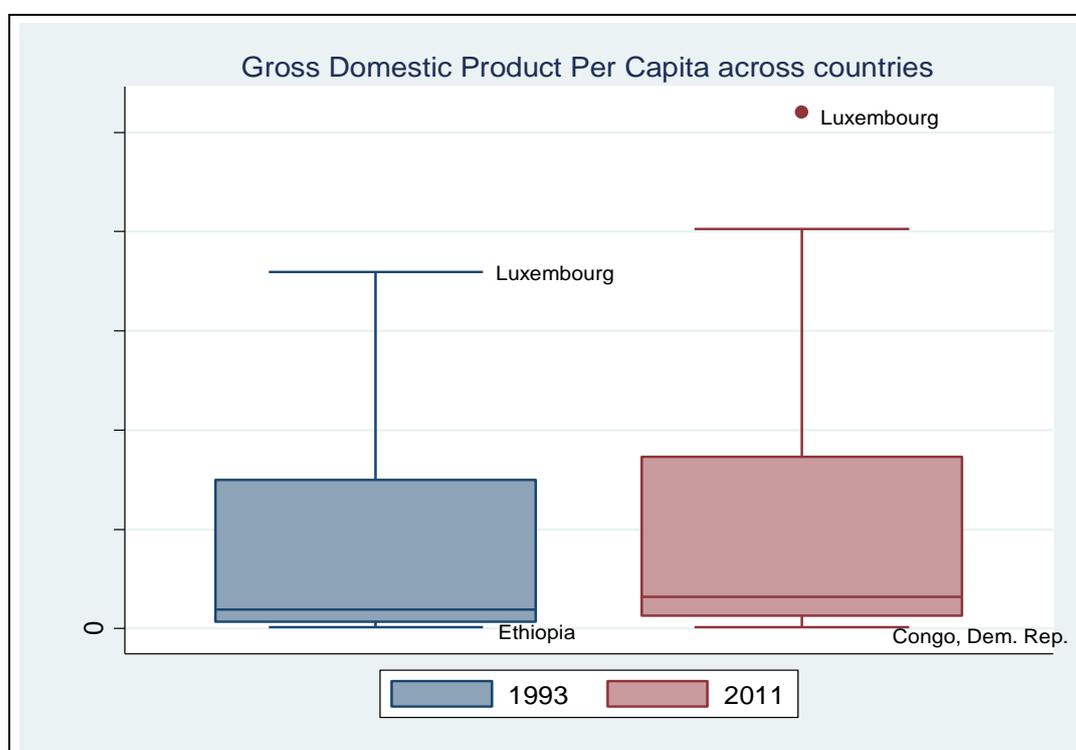
As an illustration, we examine the profile of per capita gross domestic product (GDP) at 2000 PPP\$ published by the World Bank (<http://data.worldbank.org/indicator>) for 94 countries for the years 1993 and 2011. Estimates for the year 1993 show that while Ethiopia was at the lower end, Luxembourg was at the upper end. The income disparity (range) between the two was PPP\$ 35,850. By the year 2011, the range increased to PPP\$ 51,946 involving the Democratic Republic of Congo (PPP\$ 111) and Luxembourg (PPP\$ 52,056) at the extreme ends (Figure 1). Between these two years, per capita income of the richest country increased while that of the poorest decreased. As a result, the disparity (range) widened. Thus, from a welfare perspective, we have negative scores for three dimensions: range, min ( $Y_{it}$ ) and rate of change in the income of the poorest of the poor, that is,  $\kappa^*((-1, +1, (-)1, (-)1)$ . Consistent with this profile,  $\kappa^*(\max)$  takes the value -0.8 (Table 5). As the box-plots in the Figure 1 show, range between the extremes had increased in the second scenario. A similar pattern also holds for the second case when the income of the poorest country is compared with that of the median income of all countries. Belize and Thailand had the median level of income in 1993 and 2011 respectively. We find the value of  $\kappa^*(\text{median})$  to be the same as that of  $\kappa^*(\max)$ , i.e. -0.8 (Table 5). Thus, we have a scenario of economic growth with divergence of income between the poorest and the richest. From a Rawlsian perspective, this is an unacceptable scenario since the divergence is caused by a decline in the income of the poorest and increase in that of the richest country.

**Table 5: Rawlsian Convergence: Global context - 2011 vis a vis 1993**

$\kappa^*(\max)$										
Year	Min( $Y_{it}$ )	Max( $Y_{it}$ )	Range	Rate of change of min( $Y_{i0}$ )	Rate of change of max( $Y_{i0}$ )	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>	$\kappa^*(\max)$
1993	110.86 (Ethiopia)	35960.62 (Luxembourg)	35960.62	-	-	-	-	-	-	-
2011	109.81 (Congo, Dem. Rep.)	52056.02 (Luxembourg)	52056.02	(-) 0.01	0.45	(-)1	1	(-)1	(-)1	-0.8
$\kappa^*(\text{median})$										
Year	Min( $Y_{it}$ )	Median( $Y_{it}$ )	Gap	Rate of change of min( $Y_{i0}$ )	Rate of change of median( $Y_{i0}$ )	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>	$\kappa^*(\text{median})$
1993	110.86 (Ethiopia)	1907.54	1796.68	-	-	-	-	-	-	-
2011	109.81 (Congo, Dem. Rep.)	3207.12	3097.31	(-) 0.01	0.68	(-)1	1	(-)1	(-)1	-0.8

Note: Sample size = 94

**Figure 1: Box Plot of Global Income Profiles: 1993-2011**



## 4.2 Pseudo-convergence

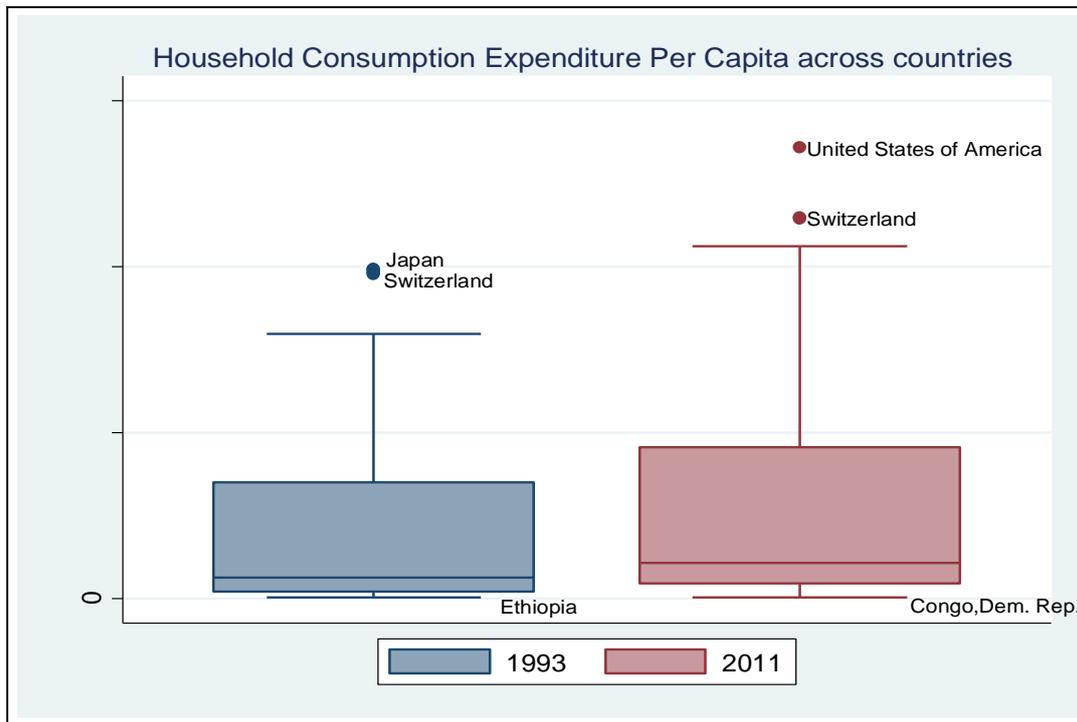
What is the profile if the same issue is examined in terms of estimates of consumer expenditure? There was an increase in both median or maximum and minimum consumer expenditure (Figure 2). However, the gap widened and the growth rate was not favourable for the poorest. As a result, the weighted indices, with their respective values at zero, show growth with pseudo-divergence (Table 6).

**Table 6: Rawlsian Pseudo-convergence: Global context - 2011 vis a vis 1993**

Pseudo $\kappa^*(\max)$										
Year	Min( $C_{it}$ )	Max( $C_{it}$ )	Range	Rate of change of min( $C_{i0}$ )	Rate of change of max( $C_{i0}$ )	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>	Pseudo $\kappa^*(\max)$
1993	90.11 (Ethiopia)	15938.19 (Luxembourg)	15848.08	-	-	-	-	-	-	-
2011	92.23 (Congo, Dem. Rep.)	18766.78	18674.55	0.02	0.18	(-1)	1	1	(-1)	0
Pseudo $\kappa^*(\text{median})$										
Year	Min( $Y_{it}$ )	Median( $Y_{it}$ )	Gap	Rate of change of min( $Y_{i0}$ )	Rate of change of median( $Y_{i0}$ )	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>	Pseudo $\kappa^*(\text{median})$
1993	90.11 (Ethiopia)	1261.51	1171.4	-	-	-	-	-	-	-
2011	92.23 (Congo, Dem. Rep.)	2167.56	2075.32	0.02	0.72	(-1)	1	1	(-1)	0

Note: Sample size = 94

**Figure 2: Box Plot of Global Consumption Profiles: 1993-2011**



### 4.3 Conventional measures

How do our  $\kappa^*(\max)$  and  $\kappa^*(\text{median})$  measures compare with the conventional  $\beta$ - and  $\sigma$ -convergence approaches? OLS estimates show the  $\beta$ -convergence rate to be negative and significant (Table 7). This implies that there was  $\beta$ -convergence. Table 7 shows that there had been a rise in the mean level of income but a fall in standard deviation from 1993 to 2011. However, the coefficient of variation of the logarithm of per capita GDP (PPP\$) decreased over time. Thus there was  $\sigma$ -convergence. The Atkinson measure also confirms convergence for select specifications of the inequality aversion parameter in the range [0.5, 1.00]. Thus while the conventional measures confirm convergence, our  $\kappa^*$  measure for income reveals divergence. In other words,  $\kappa^*$  is a more robust measure for analysing convergence/divergence from a Rawlsian perspective than  $\beta$ - or  $\sigma$ -convergence.

**Table 7: Convergence: Conventional Measures: 1993-2011**

OLS estimate of $\beta$ -convergence			
Regressand	Regressor	Intercept	Slope
$\ln\left(\frac{Y_{it}}{Y_{i0}}\right)$	$\ln(Y_{i0})$	0.752*** (0.142)	(-) 0.042*** (0.018)
$\ln\left(\frac{C_{it}}{C_{i0}}\right)$	$\ln(C_{i0})$	0.897*** (0.148)	(-) 0.063*** (0.02)
$\sigma$ -convergence			
Year	Mean	Standard Deviation	Coefficient of variation
$\ln(Y_{it})$			
1993	7.84	1.61	0.205
2011	8.26	1.57	0.19
$\ln(C_{it})$			
1993	7.37	1.52	0.206
2011	7.79	1.45	0.186
Atkinson Index			
$\varepsilon=0.5(W_1)$	$\varepsilon=0.8(W_2)$	$\varepsilon=0.9(W_3)$	$\varepsilon=1(W_4)$
$Y_{1993}$			
0.364(4671.73)	0.553(3282.07)	0.606(2892.01)	0.653(2544.25)
$Y_{2011}$			
0.345(6815.74)	0.529(4905.94)	0.581(4358.11)	0.629(3862.67)
$C_{1993}$			
0.345(2734.93)	0.525(1984.57)	0.576(1771.67)	0.622(1580.06)
$C_{2011}$			
0.307(3934.64)	0.476(2976.84)	0.526(2691.39)	0.573(2426.93)

Notes:

1. Standard errors of regression parameter estimates are reported in parenthesis
2. \*\*\* refers to 1 % level of significance
3.  $\varepsilon$  refers to the inequality aversion parameter of the Atkinson index; numbers in parentheses represent the corresponding welfare level.

## 5. Conclusion

In this era of globalization and strategies for inclusive growth and Millennium Development Goals, public policy concern is with not only economic growth but also reducing disparities in income and standard of living among countries in the world, regions within countries and citizens within regions/countries by direct transfers to the poorest (the Rawlsian concern). In response to this popular concern and urge to verify changes in these parameters, this paper develops a ternary variable index  $\kappa^*$  to measure convergence/pseudo-convergence in growth experience taking into account its different dimensions from the Rawlsian perspective. The index  $\kappa^*(\max)$  is based on observed extreme values, disparities and relative rates of changes

in them while  $\kappa^*$ (median) compares the economic status of the poorest with that of the average, their relative rates of changes and emerging disparities. The index is based on a weighting diagram reflecting policy priorities across different dimensions of convergence and maintains the principle of anonymity. The index can contra-distinguish outcomes as between contexts of economic growth/stagnation and decay. Empirical illustrations of applications of  $\kappa^*$  and pseudo- $\kappa^*$  based on per capita GDP and consumption across countries in the world provide evidence of a divergence in terms of both income and standard of living between 1993 and 2011.

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