Income Convergence Hypothesis: A Regional Comparison of selected East and South Asian Economies

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Abstract:

The empirical literature on income convergence hypothesis is available for almost all developed or industrialized countries. However, regarding developing economies especially, South Asian region few studies attempted it in their convergence related empirical analysis. Therefore, the central objective of this paper is to empirically examine whether or not income convergence is occurring over time in South Asian economies. Furthermore, within Asian block, the study also compares the convergence results of South Asian economies with its parallel East Asian region. The empirical analysis test both absolute convergence hypothesis (using beta and sigma convergence methodologies as well as Theil's inequality based approach) and conditional convergence hypothesis (by taking care of relevant control variables). These convergence tests are based on conventional regression equation approach by taking real GDP per capita with some explanatory control variables. Both steps employ the pooled cross-section, time series data set, which provides new insights in the convergence tests for real GDP per capita. Although, empirical analysis of this paper is unable to finds any evidence to accept the null hypothesis of the presence of absolute income convergence. However, our results show the presence of conditional income convergence for both East and South Asian economies. It indicates that income gap between these two groups of economies has narrow down conditional based on some common characteristics but it still remains quite large.

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1. Introduction

The empirical growth literature over the past three decades deals with many key notions: (a) what is the distribution of world per capita income? (b) what explains across countries differences in total factor productivity? (TFP, hence after) and (c) how TFP look like in the future? These notions further ask two underlying questions: Do countries or group of countries (with some common characteristics) have a tendency to converge in terms of the levels of income or GDP per capita (later defined it as beta-convergence)? And related to that: If countries do not seem to converge, do they so after holding fixed variables that capture differences in cultures, institutions and policies (defined as conditional-convergence)? These are the notions that put forwarded the empirical growth literature, beginning with Abramovitz (1986) and Buamol (1986). These seminal studies come up with a broad conclusion that the richest countries in the world appear to exhibit convergence while the world as a whole does not. Subsequent empirical research tries to investigate similar hypothesis and documents the presence of conditional convergence while rejects the null hypothesis of absolute convergence, see for instance, Barro (1991), Barro and Sala-i-Martin (1991), Mankiw *et al*. (1992), Evans (1995) and Bernard and Jones (1996).

Later empirical studies on growth and income convergence hypothesis seem to be school's specific and try to interpret this finding in the context of neoclassical and endogenous growth theory and with estimating parameters related to the shape of the production function. In the long run, the neoclassical growth model, like Solow (1956) and Swan (1956), predicts convergence of growth rates for economies which have reached their steady state. This property stems from the key assumption of diminishing returns to reproducible capital. With constant returns to scale, a proportional increase in the inputs of labor and capital leads to a proportional increase in output. By increasing the capital–labor ratio an economy will experience diminishing marginal productivity of capital. Hence poor countries with low capital-to-labor ratios have high marginal products of capital and consequently high growth rates for a given rate of investment.

In contrast, rich countries have high capital-to-labor ratios, low marginal products of capital and hence low growth rates. The severity of diminishing returns depends on the relative importance of capital in the production process and hence the size of the capital share determines the curvature of the production function and the speed at which diminishing returns set. With a small capital share the average and marginal product of labor declines rapidly as capital deepening takes place and so capital accumulation has a much bigger impact on output per worker when capital per worker ratios are low compared to when they are high. Therefore the property of income convergence in neoclassical framework can presented as a tendency of poor countries to have higher rates of growth than the average and for rich countries to grow more slowly than average. The empirical studies based on this framework end up with the conclusion of non-convergence of per capita income across the world. For world economy as a whole no such tendency is found as noted by Sachs and Warner (1995). However, there is strong evidence of convergence among the OECD economies as well as among Western and European regions within the European Community Baumol (1986); DeLong (1988); Dowrick (1992); Islam (1995) and Barro and Sala-i- Martin (2004).

The conundrum of non-convergence hypothesis was first clearly articulated by Romer (1986) while presenting his endogenous growth theory. According to him, the neoclassical hypothesis that low income per capita economies will tend to grow faster than high income per capita economies appears to be inconsistent with the cross-country evidence. In his seminal paper on endogenous growth theory he raised important doubts about the preference economists display for a growth model which exhibits diminishing returns to capital accumulation, falling rates of growth over time, and convergence of per capita income levels and growth rates across countries. Evidence relating to falling rates of growth can be found by examining the historical growth record of 'leader' economies compared to other economies[1].

[1] Leader is defined in terms of the highest level of productivity.

The vast and worthwhile empirical literature on income convergence issues is available for almost all developed or industrialized countries. However, regarding developing economies especially South Asian region[2], (like Bangladesh, India, Nepal, Pakistan and Sri Lanka) few studies attempted these economies in their convergence related empirical analysis. Therefore, the central objective of this paper is to empirically examine whether or not income convergence is occurring over time in South Asian economies. Furthermore, within Asian block, the study also compare the convergence results of South Asian economies with its parallel East Asian region[3], (countries include; Indonesia, Malaysia, Philippine, Singapore, South Korea). The empirical analysis test both absolute convergence hypothesis (using beta and sigma convergence methodologies) and conditional convergence hypothesis (by taking care of relevant control variables). These convergence tests are based on conventional regression equation approach by taking real GDP per capita with some explanatory control variables. Despite this conventional approach, we also use another convergence testing approach based on Theil inequality indices. This approach indicates that if income inequality increases over time then there will be no absolute convergence. Both steps employ the pooled cross-section, time series data set, which provides new depth in the convergence tests for real GDP per capita. Furthermore, Theil inequality results will add new depth to convergence debate in terms of sensitivity analysis.[4]

Figure 1: Map of South and East Asian Regions

Rest of the paper is organized as follows: section two briefly review the relevant literature; section three discusses the methodological setup; section four carries out empirical results; section five concludes and variables construction methodologies are provided in appendix.

[2] The economies can also be characterized by emerging market economies and shown in figure 1.

[3] Growth performance in per capita terms of last two decades shows that East Asian economies are relatively batter than South Asian Economies.

[4] Few studies consider Theil inequality index based approach to test convergence hypothesis, see for example, Park (2003).

2. Literature Review

The main notion of income convergence hypothesis is not quite new. The discussion on this issue in growth literature began with the seminal contribution of Gerschenkron (1962). The author main proposition is that poor countries could benefit from the advantages of relative backwardness. Apart from this seminal work, some author listed that convergence hypothesis originally introduced by Hume (1750). Hume claimed that the growth process would eventually generate convergence because economic growth in the rich countries would exhibit a natural tendency to slow through a process of 'endogenous decay', see for instance, Elmslie and Criss, (1999). The modern research on empirical convergence issues began with Abramovitz (1986) and Buamol (1986). These studies pointed out that the richest countries in the world appear to exhibit convergence while the world as a whole does not. Subsequence research by Barro (1991), Barro and Sala-i-Martin (1991), Mankiw *et al*. (1992), Evans (1995), Bernard and Jones (1996), Marco (2009) documented the presence of conditional convergence.

Much of above mention studies consider rich economies in their sample. However, regarding developing economies few attempts have been made. Among them Svetikas and Dzemyda (2009) study considers Lithuanian Counties to test convergence related hypothesis. According to their empirical results, there is unconditional convergence among all the regions during 1995-2006. Another study by Mabunda (2008) study investigates per capita income convergence for South African provinces for the period 1995 – 2007. He tests convergence hypothesis by using beta convergence methodology. The finding provides evidence of convergence that relatively poorer provinces grew faster than rich provinces. The conclusion suggests that South African provinces are not economically homogenous.

Chowdhury and Malik (2007) paper considers eleven countries from East Asia and the Pacific region, to test convergence related hypothesis. They modeled Stochastic Unit Root process for cross-country output differences. They find that there is no convergence in the large samples of the countries but there is evidence of convergence in the small sample groups of countries.

In the case of India, Adabar (2002) study analysis convergence and economic growth by focusing on the differences in the steady state of 14 major states of India from 1977 to 2001 by employing dynamic fixed effects panel growth regression. Result of this paper shows that there exist slight differences in the empirics of absolute and conditional convergence. Absolute divergence is consistent with conditional convergence in the context of India. There has been evidence of conditional convergence at the rate of 12 per cent per five-year period. It will take around 6 years for a state to close the half way gap between the initial level of per capita real income and its steady state level.

Ahmad and Naz (2000) study provides an evidence of inter - country convergence. They follow new-classical growth model of Solow (1956), Romer's Model (1986, 1987) and Lucas's Model (1988). Solow-Swan model predicts Conditional Convergence while Romer's and Lucas's model predict no Conditional convergence. Authors use both formal and in formal statistical techniques to test the convergence hypothesis empirically. They use the sample of 54 countries from 1961to 1992 with two main variables Real GDP and Real consumption and they further divide countries into four categories (Poor countries, Lower Middle income countries, Upper Middle income countries and Rich countries). The results show the existence of β convergence but no σ convergence. For countries Korea, Singapore, Hong Kong and Taiwan there is evidence of convergence but for poor countries there is no evidence of convergence.

3. Methodological Setup

This section layouts the methodological setup. First, the concept of income convergence is elaborated in detail with two methodological notions (a) beta convergence and (b) sigma convergence. Then the philosophy of conditional and unconditional convergence is provided. Finally the econometric models are presented to empirical investigate the convergence hypothesis for South and East Asian economies.

3.1 *Beta convergence vs. Sigma convergence*

Mathematically, we can say that beta (β) convergence occurs for a given selection of countries if there is a tendency for the poor (those with low income per capita or low output per worker) to subsequently grow faster than the rich. By "grow faster" is meant that the growth rate of per capita income (or per worker output) is asymmetrically higher. Similarly, we say that sigma (σ) convergence, with respect to a given measure of dispersion, occur for a given collection of countries if this measure of dispersion, applied to income per capita or output per worker across the countries, declines systematically over time. On the other hand, σ divergence occurs, if the dispersion increases systematically over time.

The reason that sigma (σ) convergence must be considered the more appropriate concept is the following. In the end it is the question of increasing or decreasing dispersion across countries that we are interested in. from a superficial point of view one might think that β convergence implies decreasing dispersion and vice versa. So that β convergence and σ convergence are more or less equivalent concepts. But since the world is not deterministic, but stochastic, this is not true. Indeed, β convergence is only a necessary, not a sufficient condition for σ convergence. This is because over time some reshuffling among the countries is always taking place, and this implies that there will always be some extremes. In this way β convergence may be observed at the same time as there is no σ convergence; in fact, β convergence may be consistent with σ divergence, for a formal proof, see Barro and Sala-i-Martin (2004).

Hence, it is wrong to conclude from β convergence (poor countries trend to grow faster than rich ones) to σ convergence (reduced dispersion of per capita income) without any further investigation. The mistake is called "regression towards the mean or "Galton's fallacy". Francis Galton has observed that tall fathers tended to have not as tall sons and small father tended to averaging out of the differences in light in the population. Indeed, being a true aristocrat, Galton found this tendency pitiable. But since his conclusion was mistaken, he did not really have to worry. Since σ convergence comes closer to what we are ultimately looking for, from now, when we speak of just "income convergence", σ convergence is understood.

In the above definitions of σ convergence and β convergence, respectively, we were vague as to what kind of selection of countries is considered. In principle we would like it to be a representative sample of the "population" of countries that we are interested in. The population could be all countries in the world. Or it can be the countries that a century ago had obtained a certain level of development.

One should be aware that historical GDP data are constructed retrospectively. Thus, selecting for which long data series exist as our sample involves a selection bias which generates a spurious convergence. A country which was poor a century ago will only appear in the sample if it grew rapidly over the next 100 year. A country which was relatively rich a century ago will appear in the sample unconditionally. This selection bias problem was pointed out by DeLong (1988) in a criticism of false interpretations of Maddison's long data series, see, Maddison (1982).

3.2 Measure of dispersion

Our next problem is: what measure of dispersion is to be used? Here there are different possibilities. To be precise about this we need some notion. Let:

$$y \equiv \frac{Y}{L}, \quad \text{and} \quad q \equiv \frac{Y}{P},$$

where Y= real *GDP*, L=labour force and P = population. If the focus is on living standards, Y/P, is the relevant variable. But the focus is on (labour) productivity, it is Y/L, that is relevant. Since most growth models focus on Y/L rather than Y/P, let us take '*y'* as our example.

One might think that the standard deviation of '*y*' could be relevant measure of dispersion when discussing whether σ convergence is present or not. The standard deviation of '*y*' across '*n*' countries in a given year is:

$$\sigma_y \equiv \sqrt{\frac{1}{n}\sum_{i=1}^{n}(y_i - \bar{y})^2},$$

where

$$\bar{y} \equiv \frac{\sum_i y_i}{n}$$

i.e., $\bar{y}$ is the average output per worker. However, if this measure were used, it would be hard to find any group of countries for which there is income convergence. This is because '*y*' tends to grow over time for most countries, and then there is an inherent tendency for the variance also to grow; hence also the square root of the variance, σ tends to grow. Indeed, suppose that for all countries, '*y*' is doubled from time t_1 to time t_2. Then, automatically, σ_y is also doubled. But hardly anyone would interpret this as an in the income inequality across the countries.

Hence, it is more adequate to look at the standard deviation of relative income level:

$$\sigma_{y/\bar{y}} \equiv \sqrt{\frac{1}{n}\sum_i (\frac{y_i}{\bar{y}} - 1)^2}$$

This measure is the same as what is called the *coefficient of variation,* CV_y, usually defined as

$$CV_y \equiv \frac{\sigma_y}{\bar{y}},$$

That the two measures are identical can be seen in this way:

$$\frac{\sigma_y}{\bar{y}} \equiv \frac{\sqrt{\frac{1}{n}\sum_i (y_i - \bar{y})^2}}{\bar{y}} = \sqrt{\frac{1}{n}\sum_i (\frac{y_i - \bar{y}}{\bar{y}})^2} = \sqrt{\frac{1}{n}\sum_i (\frac{y_i}{\bar{y}} - 1)^2} \equiv \sigma_{y/\bar{y}}$$

The point is that the coefficient of variation is "scale free", which the standard deviation itself is not.

Instead of the coefficient of variation, another scale free measure is often used, namely the standard deviation of $\log y$, i.e.,

$$\sigma_{\log y} \equiv \sqrt{\frac{1}{n}\sum_i (\log y_i - \log y^*)^2},$$

Where

$$\log y^* \equiv \frac{\sum_i \log y_i}{n}.$$

Note that $y*$ is the geometric average, i.e., $y* \equiv \sqrt[n]{y_1 y_2 ... y_{n.}}$ Now, by a first-order Tylor approximation of log y around $y = \overline{y}$, we have

$$\log y \approx \log \overline{y} + \frac{1}{y}(y - \overline{y}).$$

Hence, as a very rough approximation we have $\sigma_{\log y} \approx \sigma_{y/\overline{y}} = CV_y$, though this approximation can be quit poor as noted by Barro and Sala-i-Martin (2004). It may be possible, however, to define the use of $\sigma_{\log y}$ in its own right to the extent that y tends to be approximately log normally distributed across countries.

3.3 Weighting by size of population

Another Important issue is whether the applied dispersion is based on a *weighting of the countries by size of population*. For the world as a whole, when no weighting size of population is used, then there is a slight tendency to income divergence according to the $\sigma_{\log q}$ Criterion Barro and Sala-i-Martin (2004), where q is per capita income ($\equiv Y/P$). It is important to note that when there is weighting by size of population, then in the last twenty years there has been a tendency to income convergence at the global level Sala-i-Martin (2006). With weighting by size of population the above dispersion formula is modified to:

$$\sigma^{w}_{\log q} \equiv \sqrt{\sum_i w_i (\log q_i - \log q*)^2},$$

Where

$$w_i = \frac{L_i}{L} \qquad \text{and} \qquad \log q* \equiv \sum_i w_i \log q_i.$$

3.4 Unconditional vs. conditional convergence

Yet another distinction in the study of income convergence is that the difference between unconditional (or absolute) and conditional convergence. We say that a large heterogeneous group of countries (say the countries in the world) show *unconditional* income convergence if income convergence occurs for the whole group without conditioning on specific characteristic of the countries. If income convergence occurs only among a subgroup of the countries, namely such countries that in advance share the same "structural characteristics"[5], then we say there is *conditional* income convergence.

This property of conditional income convergence implies that growth rates will be rapid during transitional dynamics if a country's initial output per capita is low relative to its long-run steady state value. When countries reach their respective steady states, growth rates will then equalize in line with the rate of technological progress. Clearly, if rich countries have higher steady state values of k^* than poor countries, there will be no possibility of convergence in an absolute sense. As Barro (1997) notes, 'a poor country that also has a low long-term position, possibly because its public policies are harmful or its

[5] What the precise meaning of "structural characteristics" is, will depend on what model of the countries the researcher has in mind. According to the Solow model, a set of relevant "structural characteristics" are: the aggregate production function, the initial level of technology, the rate of technical progress, the capital depreciation rate, the saving rate, and the population growth rate.

saving rate is low, would not tend to grow rapidly'. Conditional convergence therefore allows for the possibility that rich countries may grow faster than poor countries, leading to income per capita divergence! Since countries do not have the same steady state per capita income, each country will have a tendency to grow more rapidly the bigger the gap between its initial level of income per capita and its own longrun steady state per capita income.

This formulation can be presented as follows. Abstracting from technological progress, we have the intensive form of the production function written as:

$$y_t = k_t^{\alpha}$$ (Where technology parameter is equal to one)

This expressing in terms of growth rates gives:

$$\frac{\dot{y_t}}{y_t} = \frac{\alpha \dot{k_t}}{k_t}$$

Dividing both sides of Solow's fundamental equation of motion by k gives the following equation:

$$\frac{\dot{k_t}}{k_t} = \frac{sf(k_t)}{k_t} - (n + \delta)$$

Therefore, substituting it into above expression, we can derive an expression for the growth rate of output per capita given by equation:

$$\frac{\dot{y_t}}{y_t} = \alpha \left[\frac{sf(k_t)}{k_t} - (n + \delta) \right]$$

In Figure-2 the growth rate of the capital–labor ratio ($\dot{k}/k$) is shown by the vertical distance between the $sf(k)/k$ function and the effective depreciation line, $n + \delta$ (see, Barro and Sala-i-Martin, 2004). The intersection of the savings curve and effective depreciation line determines the steady state capital per worker, k^*.

Figure 2: Transitional Dynamics in Solow Growth Model

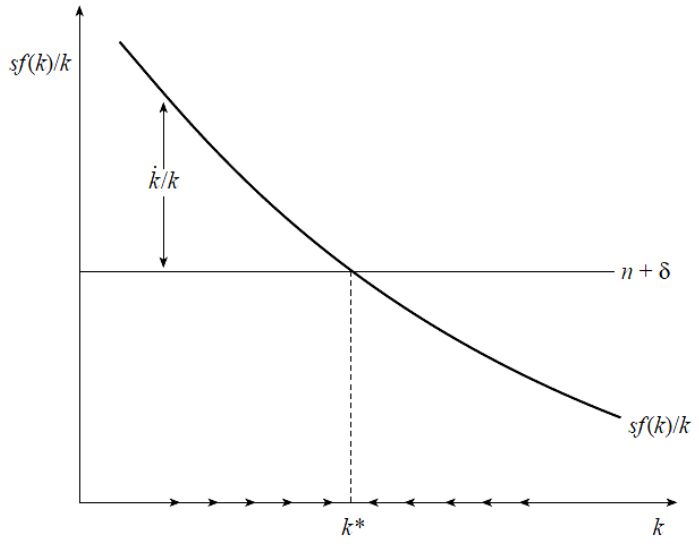
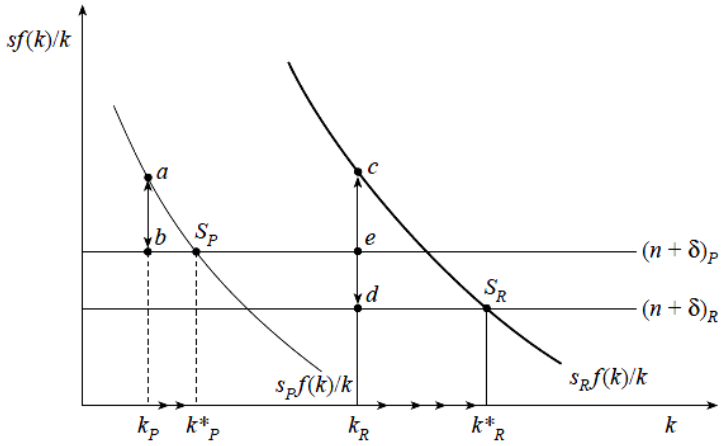


Figure 3: Conditional Convergence



In Figure 3 we compare a rich developed country with a poor developing country. Here we assume (realistically) that the developing country has a higher rate of population growth than the developed country, that is, $(n + \delta)_P > (n + \delta)_R$, and also that the developed country has a higher savings rate than the developing country. The steady state for the developing country is indicated by point *SP*, with a steady state capital–labor ratio of k_P^* . Similarly, the steady state for the developed country is indicated by points *SR* and k_R^*. Suppose the current location of these economies is given by k_P and k_R. It is clear that the developed economy will be growing faster than the developing country because the rate of growth of the capital–labor ratio is greater in the developed economy (distance *c*–*d*) than the developing country (*a*–*b*).

This figure also shows that even if the developed country had the same population growth rate as the developing country it would still have a faster rate of growth since the gap between the savings curve and the effective depreciation line is still greater than that for the developing country, that is, $a–b < c–e$.

3.5 Econometric Modeling Setup to test Absolute and Conditional Convergence

Based on above theoretical setup of absolute (unconditional) and conditional convergence hypothesis, this section formally buildup the econometric models to test the existence of absolute and conditional convergence for East and South Asian economies. Empirically, each hypothesis formally uses both beta and sigma convergence techniques. Both techniques are based on conventional approach by taking real GDP per capita and another approach based on Theil's inequality indices of each region. Each step employ the pooled cross-section, time series data set, which provides new depth in the convergence tests for real GDP per capita.

3.5.1 *Econometric Model based on Real GDP per capita approach*

Let y_{it} be the natural logarithm of per capita GDP for economy *i* (i = 1, 2, …N) during period *t* and σ_t be the standard deviation of y_{it} across *i* at time *t*.

Absolute σ convergence can be tested by estimating the following model:

$$CV_t = \alpha + \beta t + \varepsilon_t \quad \text{Where} \quad CV_t = \frac{\sigma_t}{mean} \tag{1}$$

Where, α, β are parameters and ε_t is the stochastic error term. A significant negative value for β implies absolute convergence, while $\beta \geq 0$ implies non-convergence.

Absolute β-convergence can be tested by running the following regression of growth of per capita GDP across economies:

$$\frac{1}{T}\log\left(\frac{y_{i,T}}{y_{i,0}}\right) = \alpha + \beta \log\left(y_{i,0}\right) + \varepsilon_i \tag{2}$$

Where *T* indicates the duration of time period and *0* is the beginning (initial) of the time interval and ε_t is the stochastic error term. In terms of equation (2) a significant negative value for β implies absolute beta (β) convergence, while $\beta \geq 0$ implies non-convergence.

The concept of conditional beta convergence can be derived by augmenting equation (2) by including a set of control variables xi (e.g., investment, saving, population, openness etc) that are expected to determine the steady-state growth of per capita output.

Conditional β-convergence can be tested by running the following regression of growth of per capita GDP across economies:

$$y_{it} - y_{i,t-T} = \alpha + \beta y_{i,t-T} + \gamma x_i + \varepsilon_t \tag{3}$$

Where *t* indicates the end of the time interval and (*t-T*) is the beginning (initial) of the time interval and ε_t is the stochastic error term. The vector x_i includes a set of control variables (e.g., investment, population, openness, human capital, political instability, etc). In terms of equation (3) a significant

negative value for β implies conditional beta (β) convergence holds provided that $\gamma \neq 0$, while $\beta \geq 0$ implies non-convergence.

3.5.2 *Econometric Models based on Theil Inequality Indices*

Theil (1967) developed two widely used measures of inequality. Both Theil indices satisfy all the standard ideal properties of an inequality measure and are derived from Shannon measure of entropy in information theory. The first index, the Theil entropy index T^*, assume a minimum value of 0 when there is complete inter-country income equality and a maximum value of ln(n) when there is complete inequality so that all income accrues to only one country. For our purpose, the Theil entropy index is as follows:

$$T^* = \sum_{i=1}^{n} y^*_i \ln\left(\frac{y^*_i}{p^*_i}\right) \tag{4}$$

Where y^*_i is the share of country I in the total income of all countries in the same sample and P^*_i is the share of country *i* in the total population of all countries in the sample.

The second index, which we call Theil's second measure *L**, is analogous to the Theil entropy expects that the role of income shares and population shares are reversed. The value of *L** also ranges from minimum of 0 to a maximum of ln(n). There is no reason to except the value of *T** and *L** to be the same. For our purpose, we can express Theil's second measure *L** as follows:

$$L^* = \sum_{i=1}^{n} p^*_i \ln\left(\frac{p^*_i}{y^*_i}\right) \tag{5}$$

Absolute convergence in Theil approach can be tested by running the following regressions over linear time trend as:

$$T^*_t = \alpha + \beta t + \varepsilon_t \tag{6}$$

and

$$L^*_t = \alpha + \beta t + \varepsilon_t \tag{7}$$

Where *t* indicates time and ε_t is the stochastic error term. In terms of equation (6) and (7) a significant negative value for β implies absolute convergence, while $\beta \geq 0$ implies non-convergence.

3.6 Description of Data

This study test empirically convergence hypothesis of East and South Asian economies. East Asian economies consist of countries Indonesia, Malaysia, Philippine, Singapore, South Korea whereas South Asian economies consist of Bangladesh, India, Nepal, Pakistan and Sri Lanka. To estimate the convergence regressions described in above section, data over the annual frequency from 1973 to 2009 is being used. For conditional convergence, control variables list include: per capita GDP defined by ratio of

GDP to total population adjusted by purchasing power Parity in US$ terms, secondary school enrollment of each country is used as a proxy of human capital formation, trade to GDP ratio is defined as the degree of openness, exchange rate of each country in US$ terms, political instability data for the proxy of inconsistency in government policies and consumer price index which is used to compute inflation rate for all countries. All data is taken from International Financial Statistics (IFS, CD version 2009) of the IMF and World Development Indicator (CD version 2009) of the World Bank. Further details regarding data description of all variables and its sources are provided in table 1 of appendix whereas descriptive statistics is reported in table 2.

4. Results and Discussions

This section briefly discusses all empirical results which are reported in the appendix section. In order to justify various arguments based on empirical results some graphical detail is also provided whereas graphs are provided in appendix.

4.1 *Absolute sigma convergence*

The results of absolute sigma convergence for ten Asian economies are presented in table-7 and figure 7 of appendix. These results clearly indicate that relative variation in real GDP per capita in all ten economies increases over time. The positive and significant slope coefficient associated with linear trend term verifies the existence of absolute sigma divergence over the entire sample period. This might be due to the existence of heterogeneity among Asian economies in terms of their growth performance. On average, East Asian economies are relatively growing at faster rate than South Asian economies. One can easily observe this relative growth performance from figure 1 of the appendix. The subfigures associated with figure 1 shows annual average growth rate of per capita GDP (in PPP of USD terms) of full sample period [1973 – 2009] vis-à-vis three sub-samples [1973 – 1985], [1986 – 2000] and [2001 – 2009]. All these four sample results show that South Asian economies are far behind in their average growth performance as compared with East Asian economies. However, within each regional block some heterogeneity can be observed. For example, Singapore and South Koreaian relative growth performance is visibly quite better as compared to all other countries. More recently, India shows much improved growth performance in GDP per capita terms. The existence of heterogeneity in relative growth performances leads toward absolute sigma divergence for all ten Asian countries.

Since, within each region heterogeneity exists, which is reflected in the data results. So there is need to further test the existence of absolute income convergence hypothesis for each subgroup. The regression results in order to test absolute sigma convergence hypothesis are available in figure 7B for South Asian region and in figure 7C for East Asian region. Both these results show that the slope coefficients associated with linear trend term are positive and significant. This indicates the rejection of null hypothesis and show that there is no absolute sigma convergence in both South and East Asian regions.

4.2 *Absolute Beta Convergence*

Empirical results based on absolute beta convergence are reported in table 8 and figure 8 of appendix. The full sample results show that the slope coefficient associate with log of real GDP per capita is positive and insignificant. The p-value associated with it is 48.9 percent which is very large. This presence of insignificance result indicates that there is no absolute beta convergence over the entire sample period. These results are also consistent with absolute sigma divergence among all selected Asian economies.

In Contrast to all Asian countries, one can also be interested in empirical results of each sub region. We also test the presence of absolute beta convergence for each sub region. For South Asian

region, the empirical results show that the slope coefficient is negative, which fulfill the first requirement of absolute beta convergence but it is insignificant. The p-value associated with it is 88.7 percent which strongly indicate insignificance of results. Similar results can be observed in case of East Asian economies where the slope coefficient is also insignificant. In order to accept null hypothesis about the existence of absolute beta convergence it is necessary that slope coefficient should be negative and significant. However, the first criteria is valid for both regions as the slope coefficients are negative but due to insignificant results one can easily conclude that there is no absolute convergence in output per capita in both Asian sub regions.

4.3 *Absolute Convergence based on Theil's Inequality Indices*

In order to test absolute convergence hypothesis based on Theil's inequality approach, we first estimate both T* and L* indices. The results of both indices are reported in table 5 and figure 6 of appendix. The minimum value of both indices is zero and the rising trend shows an increase in inequality. Both T* and L* indices are estimated for full sample of Asian countries as well as for two sub region. In all the cases the indices show rising trend over the sample period. This shows that in all selected Asian countries inequality increases and due to this increase in inequality absolute convergence hypothesis might not hold. The regression results based on these inequality indices are reported in table 6 of appendix. The beta coefficient associated with linear trend term is positive and significant in the cases of full sample of all ten countries also vis-à-vis sub samples of South Asian countries and East Asian countries. This shows that there is no absolute beta convergence over the sample period. These results are consistent with those of absolute sigma convergence, as discussed in previous subsection.

4.4 *Conditional Beta Convergence*

This section analyzes the empirical results to test the presence of conditional convergence among selected Asian economies. We used fixed effect panel estimation approach to estimate regressions (3) which is provided in methodology section. To test conditional convergence, control variables play a vital role. They allow us to capture the influence of business cycle and other factors on the rate of economic growth. For our study, we include six control variables (investment to GDP ratio, trade openness, exchange rate, inflation rate, human capital formation and political instability). There are many theoretical and economic justifications about the importance and influence of these control variables on the rate of economic growth. First two variables, investment to GDP ratio and trade openness are basically demand side variables, which are actually the part of aggregate demand, so have greater importance. The other two variables, exchange rate and inflation rate are economic stability variables. Political instability on the other side is considered as a policy stability variable. The last variable is human capital which captures the social condition of any country.

In order to test conditional convergence we estimate four models for full sample of all selected Asian countries. The first model considers all set of control variables. The other models drop few control variables to check the robustness of the main results. We have also reported the empirical results of all four models for both sub samples of countries in order to test the conditional convergence hypothesis for both East and South Asian Regions. Before interpreting these results, let's take a bird eye view about the trends of most of the control variables over full sample period.

The first variable is investment to GDP ratio which is the most sensitive component of aggregate demand. Data on investment to GDP ratio is provided in figure 3 of appendix. The south Asian region show quite similar trends, however East Asian region show mix trends but relative behavior is pro-cyclical. Sri Lanka in South Asian region and South Korea in East Asian region show high ratio where as India from South Asia and Indonesia from East Asia show low ratio as compared with other countries of their respective region. In general the relative trend behavior of this variable is pro-cyclical over the sample period. The second control variable is trade openness which is also a part of aggregate demand. This openness measure is also considered as a proxy of globalization. The openness data is constructed by

using the ratio of total of exports plus imports to GDP and reported in table 4 of appendix. The average trends in openness over the entire sample period show that Sri Lanka and Pakistan are more open as compared with other South Asian countries whereas Singapore and Malaysia are highly open relative to other East Asian economies.

The two main variables regarded as economic stability variables are exchange rate and inflation rate. Data on exchange rates is provided in table 3 of the appendix. The average annualized inflation over entire sample period is computed by using consumer price indices. The average inflation rate in South Asian economies vary between 8 to 11 percent whereas for East Asian economies, it varies between the ranges of 2 to 13 percent. This shows that there is little variation in inflationary trends in South Asian economies but high variation in East Asian economies. Furthermore, all Asian economies show rising trend in inflation due to recent global financial crisis from FY2007 to FY2008. Figure 2 of the appendix presents annual inflation rate over the entire sample period. The data on nominal exchange rates in USD terms show that within different sample periods both East Asian and South Asian countries face exchange rate instability. East Asian countries data also captures the trends of 1997 currency crisis.

The temporal trends in political instability over different sample periods of both South and East Asian economies are presented in figure 4 of appendix. The political instability index value varies from -10 to +10. Negative value shows autocratic regime and positive value shows a democratic regime. Many studies considered political instability variable to explore growth phenomena, see for example Ahmad and Khan (2008). It also captures the government policies consistency. The sub-graphs shows that within South Asian block India is more democratic one relative to other countries whereas Nepal and Pakistan's data shows mix autocratic and democratic results. Regarding East Asian countries Philippines and South Korea data show democratic behavior whereas Singapore and Indonesia's data shows mix trends of autocraticy and democracy.

Finally secondary school enrollment data is used as a proxy of human capital. The trends in data are provided in figure 5 of the appendix. This shows that enrollment rate is high on average in Sri Lanka from South Asian and South Korea from East Asian economies. The variable also captures the social stability conditions relative to each region.

After considering the six common (economic, political and social) characteristics, we have estimated the regressions to test the presence of conditional beta convergence hypothesis. The estimation results are reported in table 9 for full sample of countries, table 10 for South Asian region and table 11 for East Asian region respectively. For each group of countries four different regression models are estimated and results are provided within each table. Estimation results in table 9 show that for every model the slope coefficient associated with log of lagged GDP per capita is negative and significant. This shows the acceptance of null hypothesis that for all selected Asian economies conditional beta convergence hypothesis holds. The first model includes all control variables. The results show that investment to GDP ratio, openness and inflation rate are significant determinants while exchange rate, political instability and human capital are insignificant variables. However, if we drop few variables, like inflation rate especially then political instability variable becomes significant. Exchange rate and human capital remain insignificant variables in all models. Estimation results of all variables in each model shows expected sign.

Estimation results for South Asian region in table 10 and for East Asian region in table 11 of appendix also show the existence of conditional beta convergence. The slope coefficients associated with log of lagged GDP per capita are negative and significant. The estimation results of model-1 for South Asian economies, strongly suggests the presence of conditional beta convergence. However, for East Asian economies, the results are relatively weak as the slope coefficient is weakly significant. But when we drop few insignificant variables, like inflation rate, exchange rate, political instability and human capital then conditional convergence occurs significantly for East Asian economies. This also provides us with a good picture for South Asian region that common characteristics matters for conditional beta convergence. If we exclude few relevant variables then its impacts on the significance of conditional convergence goes down as t-statistics associated with main slope coefficient of log of lagged real GDP

per capita joint with adj (R^2) also goes down. But conditional beta convergence for the case of East Asian economies do not requires more control variables. It holds, even in the presence of few control variables.

5. Concluding Remarks

The main objective of this paper is to empirically examine whether or not income convergence is occurring over time in South Asian economies. Furthermore, within Asian block, the study also compares the convergence results of South Asian economies with its parallel East Asian region. The empirical analysis test both absolute convergence hypothesis (using beta and sigma convergence methodologies as well as Theil's inequality based approach) and conditional convergence hypothesis (by taking care of relevant control variables). Both steps employ the pooled cross-section, time series data set, which provides new insights in the convergence tests for real GDP per capita. Although, empirical analysis of this paper is unable to finds any evidence to accept the null hypothesis of the presence of absolute income convergence.

However, our results show the presence of conditional income convergence for both East and South Asian economies. The conditional beta convergence results also show that investment to GDP ratio, openness and inflation rate are significant determinants while exchange rate, political instability and human capital are insignificant variables. If we drop few variables, like inflation rate especially then political instability variable becomes significant. Exchange rate and human capital remain insignificant variables in all models. Estimation results of all variables in each model shows expected sign. The estimation results of full variable model for South Asian economies, strongly suggests the presence of conditional beta convergence. However, for East Asian economies, the results are relatively weak as the slope coefficient is weakly significant. But when we drop few insignificant variables, like inflation rate, exchange rate, political instability and human capital then conditional convergence occurs significantly for East Asian economies. This also provides us with a good picture for South Asian region that common characteristics matters for conditional beta convergence. If we exclude few relevant variables then its impacts on the significance of conditional convergence goes down as t-statistics associated with main slope coefficient of log of lagged real GDP per capita joint with adj (R^2) also goes down. But conditional beta convergence for the case of East Asian economies do not requires more control variables. Finally these finding indicates that income gap between these two groups of economies has narrow down conditional based on some common characteristics but it still remains quite large.

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Appendix

Table 1: Data Description and its Sources

S. No.	Variables	Description	Unit	Data Source
[1].	PCGDP_D	Per Capita Gross Domestic Product (GDP) at Purchasing Power Parity (USD)	in Million USD	IFS 2009 (IMF Online)
[2].	POP	Population	In Million	IFS 2009 (IMF Online)
[3].	OPENN	Openness [Export + Imports to GDP Ratio]	in Percentage	IFS 2009 (IMF Online)
[4].	INVGDP	Investment to GDP Ratio [Gross Fixed Capital Formation data is used as proxy for Invesmtent]	in Percentage	IFS 2009 (IMF Online)
[5].	EXRT	Exchange Rate	in USD terms	IFS 2009 (IMF Online)
[6].	CPI	Consumer Price Index [Base Year = 2000]	Index	IFS 2009 (IMF Online)
[7].	INF	Inflation Rate	in Percentage	Calculated from CPI
[8].	PI	Political Instability [Index with range from [-10 , +10] where lower value shows autocratic regime and high value shows democratic regime	Index	Polity2 Project*
[9].	SSE	Secondary School Enrollement as a proxy for Human Capital Formation	Index	WDI 2009

Table Note: IFS =: International Financial Statistics (IMF Online) and WDI =: World Development Indicators (WB Online)

*/ Polity Combined 20-pt score with mean subs for special polity conditions (Source: Monty G. Marshall and Keith Jaggers. 2002)

Table 2: Descriptive Statistics

	South Asian Region					East Asian Region				
	Mean	S.D	Max	Min	Skewness	Mean	S.D	Max	Min	Skewness
	Bangladesh					**Indonesia**				
CPI	68.13	47.08	172.60	4.32	0.52	61.89	63.86	216.08	3.82	1.16
INF	11.96	17.68	71.09	-23.87	1.90	12.25	10.31	58.39	3.72	3.29
EXRT	37.39	18.89	69.04	7.85	0.21	3879.24	3875.41	10389.90	415.00	0.74
POP	116.87	27.04	162.00	75.25	0.11	179.06	31.56	230.00	125.43	-0.07
PCGDP_D	4.78	2.25	11.91	3.06	1.85	33.90	23.43	77.54	6.57	0.49
PI	0.81	5.92	8.00	-7.00	-0.25	-2.78	6.46	7.00	-7.00	0.92
SSE	28.53	13.92	51.94	17.52	0.74	44.69	14.99	66.34	17.22	-0.26
Openn	19.04	16.91	63.12	1.53	1.14	0.01	0.00	0.01	0.00	1.01
INVGDP	12.15	9.92	29.15	0.53	0.25	2.95	3.49	11.90	0.13	1.36
	India					**Malaysia**				
CPI	62.02	45.12	162.50	10.90	0.62	77.28	25.54	122.19	33.64	0.10
INF	7.92	5.30	28.60	-7.63	1.05	3.69	3.03	17.33	0.29	2.82
EXRT	25.95	15.86	48.41	7.91	0.16	2.88	0.60	3.92	2.18	0.69
POP	884.17	189.30	1190.00	586.76	0.05	18.97	5.01	28.00	11.69	0.19
PCGDP_D	8.31	3.44	14.03	4.30	0.31	38.88	10.34	58.63	21.37	0.27
PI	8.41	0.60	9.00	7.00	-0.43	3.59	0.50	4.00	3.00	-0.40
SSE	42.57	10.85	60.56	23.54	-0.23	59.69	11.51	78.88	44.72	0.41
Openn	13.84	15.49	60.71	0.80	1.50	108.82	68.47	235.44	21.80	0.42
INVGDP	6.14	4.71	16.43	0.74	0.61	20.93	7.72	36.49	6.91	-0.08
	Pakistan					**Philippines**				
CPI	65.15	50.72	203.96	9.11	1.00	62.40	48.36	160.05	4.99	0.49
INF	9.13	5.13	26.66	2.91	1.64	10.45	9.37	50.34	0.75	2.81
EXRT	31.71	21.82	81.71	9.90	0.65	26.98	16.91	56.04	6.76	0.36
POP	119.44	34.82	179.00	67.24	0.13	64.47	15.86	90.80	39.79	0.09
PCGDP_D	10.05	4.66	18.04	3.96	0.15	25.79	19.28	59.27	8.58	0.87
PI	0.46	6.94	8.00	-7.00	0.13	2.16	7.76	8.00	-9.00	-0.63
SSE	21.47	5.29	28.86	14.00	-0.24	71.73	10.26	85.86	51.92	-0.33
Openn	20.89	21.96	95.52	1.99	1.81	43.51	42.95	117.82	1.71	0.61
INVGDP	10.67	10.48	40.87	0.79	1.55	11.05	7.58	22.77	0.78	0.09
	Sri Lanka					**Singapore**				
CPI	70.04	69.46	257.96	6.51	1.29	84.85	18.30	113.62	44.81	-0.45
INF	10.90	5.69	26.15	1.22	0.58	2.69	4.07	22.37	-1.84	3.47
EXRT	49.95	35.14	114.95	6.40	0.53	1.89	0.34	2.47	1.41	0.23
POP	17.15	2.06	20.50	13.29	-0.31	3.25	0.80	4.80	2.19	0.32
PCGDP_D	14.50	9.11	38.95	6.32	1.67	165.12	97.64	359.70	42.11	0.37
PI	5.70	1.02	8.00	5.00	1.47	-2.00	0.00	0.00	-2.00	N.A*
SSE	87.96	13.32	103.01	53.35	-1.47	67.50	9.49	80.59	48.92	-0.32
Openn	45.88	44.06	143.64	1.63	0.94	252.71	66.76	394.97	94.06	-0.09
INVGDP	18.19	18.65	70.45	0.75	1.44	28.26	6.02	38.55	15.64	-0.07
	Nepal					**South Korea**				
CPI	62.19	47.14	171.07	9.22	0.64	68.82	37.45	132.91	9.63	0.07
INF	8.55	4.85	19.81	-3.11	0.29	7.79	7.30	28.70	0.81	1.64
EXRT	40.57	26.00	77.88	10.47	0.17	839.01	270.64	1401.44	398.32	0.26
POP	20.18	5.10	29.00	12.74	0.24	42.37	4.60	48.50	33.44	-0.45
PCGDP_D	4.76	2.86	9.69	1.46	0.49	102.20	35.93	186.38	58.35	0.51
PI	-1.14	5.83	6.00	-9.00	-0.09	1.70	6.84	8.00	-8.00	-0.49
SSE	36.57	10.85	54.56	17.54	-0.23	86.96	13.32	102.01	52.35	-1.47
Openn	24.01	22.95	77.96	1.39	0.83	0.04	0.02	0.10	0.01	0.76
INVGDP	12.06	9.48	32.76	1.59	0.48	19.97	11.83	36.62	1.42	-0.16

Note: *Value not available due to divided by zero

**Author's Calculations based on IFS and WDI data

Figure 1: Average Annual Growth rate of Per Capita GDP at PPP (USD)

Figure 1A: Average Growth rates of Annual Per Capita GDP at PPP (USD) [Sample: 1973 - 2009]

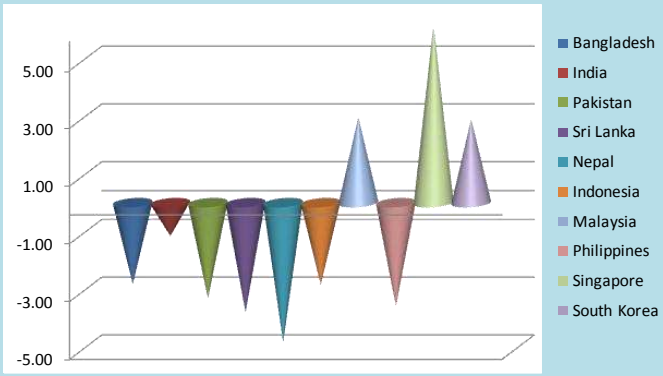


Figure 1B: Average Growth rates of Annual Per Capita GDP at PPP (USD) [Sample: 1973 1985]

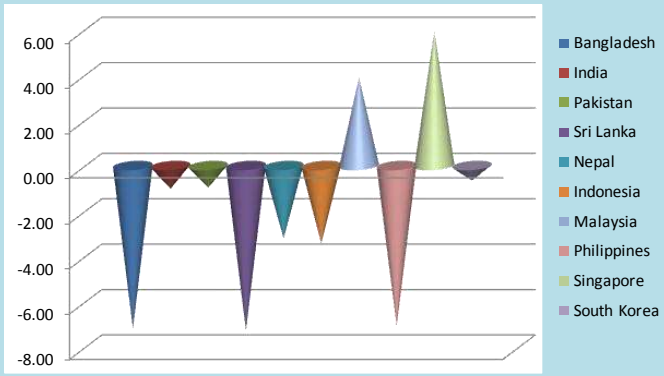


Figure 1C: Average Growth rates of Annual Per Capita GDP at PPP (USD) [Sample: 1986- 2000]

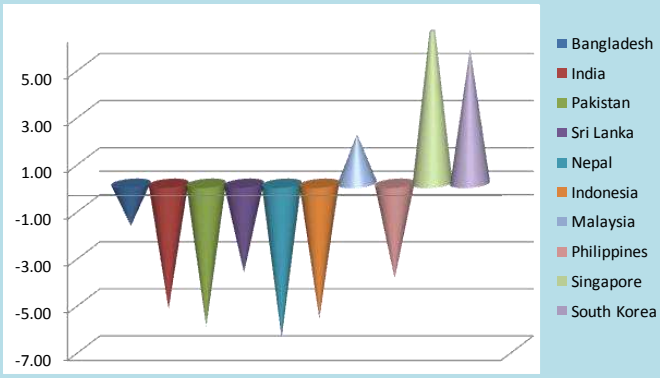


Figure 1D: Average Growth rates of Annual Per Capita GDP at PPP (USD) [Sample: 2001 - 2009]

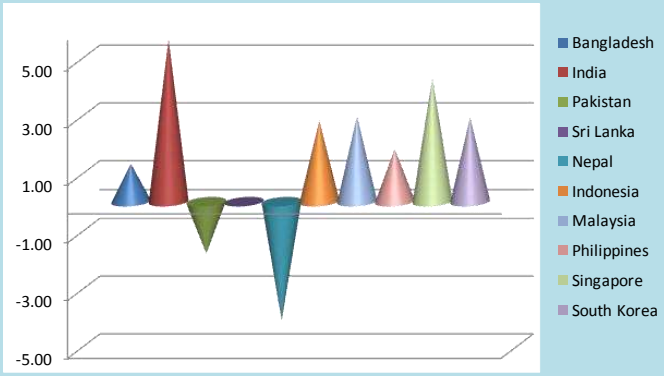


Figure 2: Annual Inflation Rates in Percent [1973 – 2009]

Fig 2A. Annual Inflation Rates in Percent [South Asian Region]

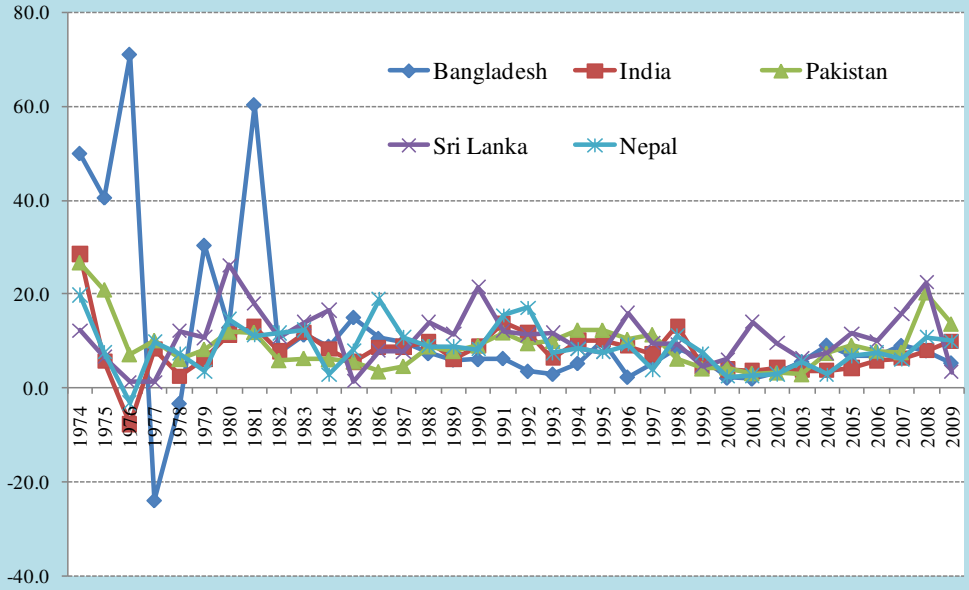


Fig 2B. Annual Inflation Rates in Percent [East Asian Region]

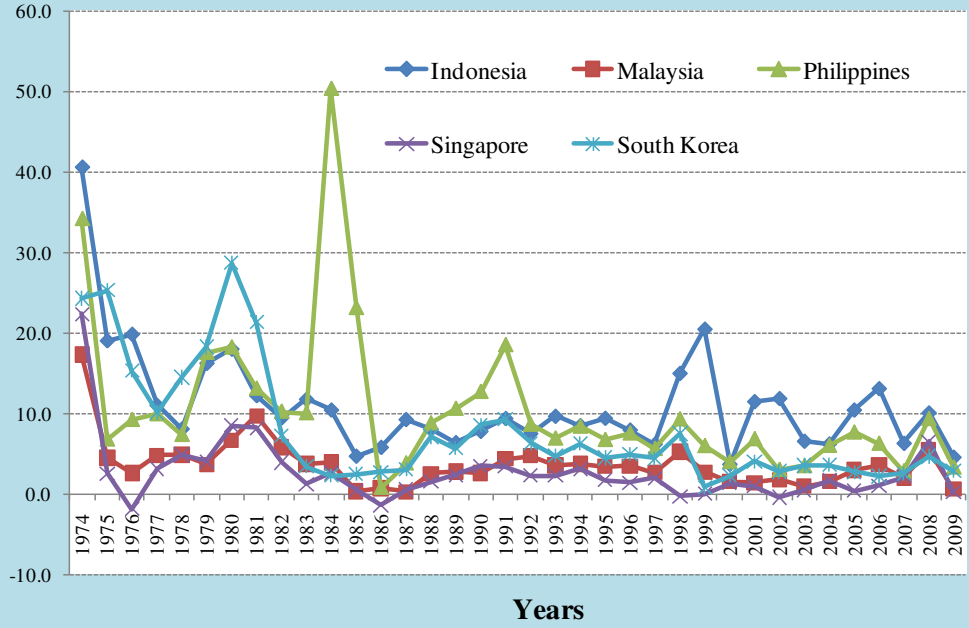


Table 3: Average Annual Exchange Rates (In term of USD)

	Bangladesh	India	Pakistan	Sri Lanka	Nepal	Indonesia	Malaysia	Philippines	Singapore	South Korea
1973	7.85	8.20	9.99	6.40	10.47	415.00	2.44	6.76	2.46	398.32
1974	8.23	8.15	9.90	6.65	10.56	415.00	2.41	6.79	2.44	404.47
1975	12.19	8.94	9.90	7.01	11.00	415.00	2.39	7.25	2.37	484.00
1976	15.40	8.88	9.90	8.41	12.50	415.00	2.54	7.44	2.47	484.00
1977	15.38	8.21	9.90	8.87	12.50	415.00	2.46	7.40	2.44	484.00
1978	15.02	8.19	9.90	15.61	12.11	442.05	2.32	7.37	2.27	484.00
1979	15.55	7.91	9.90	15.57	12.00	623.06	2.19	7.38	2.17	484.00
1980	15.45	7.93	9.90	16.53	12.00	626.99	2.18	7.51	2.14	607.43
1981	17.99	9.10	9.90	19.25	12.34	631.76	2.30	7.90	2.11	681.03
1982	22.12	9.63	11.85	20.81	13.24	661.42	2.34	8.54	2.14	731.08
1983	24.62	10.49	13.12	23.53	14.55	909.27	2.32	11.11	2.11	775.75
1984	25.35	12.45	14.05	25.44	16.46	1025.94	2.34	16.70	2.13	805.98
1985	27.99	12.17	15.93	27.16	18.25	1110.58	2.48	18.61	2.20	870.02
1986	30.41	13.12	16.65	28.02	21.23	1282.56	2.58	20.39	2.18	881.45
1987	30.95	12.88	17.40	29.44	21.82	1643.85	2.52	20.57	2.11	822.57
1988	31.73	14.95	18.00	31.81	23.29	1685.70	2.62	21.09	2.01	731.47
1989	32.27	17.04	20.54	36.05	27.19	1770.06	2.71	21.74	1.95	671.46
1990	34.57	18.07	21.71	40.06	29.37	1842.81	2.70	24.31	1.81	707.76
1991	36.60	25.83	23.80	41.37	37.26	1950.32	2.75	27.48	1.73	733.35
1992	38.95	26.20	25.08	43.83	42.72	2029.92	2.55	25.51	1.63	780.65
1993	39.57	31.38	28.11	48.32	48.61	2087.10	2.57	27.12	1.62	802.67
1994	40.21	31.38	30.57	49.42	49.40	2160.75	2.62	26.42	1.53	803.45
1995	40.28	35.18	31.64	51.25	51.89	2248.61	2.50	25.71	1.42	771.27
1996	41.79	35.93	36.08	55.27	56.69	2342.30	2.52	26.22	1.41	804.45
1997	43.89	39.28	41.11	58.99	58.01	2909.38	2.81	29.47	1.48	951.29
1998	46.91	42.48	45.05	64.45	65.98	10013.60	3.92	40.89	1.67	1401.44
1999	49.09	43.49	49.50	70.64	68.24	7855.15	3.80	39.09	1.69	1188.82
2000	52.14	46.75	53.65	77.01	71.09	8421.78	3.80	44.19	1.72	1130.96
2001	55.81	48.18	61.93	89.38	74.95	10260.90	3.80	50.99	1.79	1290.99
2002	57.89	48.03	59.72	95.66	77.88	9311.19	3.80	51.60	1.79	1251.09
2003	58.15	45.61	57.75	96.52	76.14	8577.13	3.80	54.20	1.74	1191.61
2004	59.51	43.59	58.26	101.19	73.67	8938.85	3.80	56.04	1.69	1145.32
2005	64.33	45.07	59.51	100.50	71.37	9704.74	3.79	55.09	1.66	1024.12
2006	68.93	44.25	60.27	103.91	72.76	9159.32	3.67	51.31	1.59	954.79
2007	68.87	39.42	60.74	110.62	66.42	9141.00	3.44	46.15	1.51	929.26
2008	68.60	43.51	70.41	108.33	69.76	9698.96	3.34	44.32	1.41	1102.05
2009	69.04	48.41	81.71	114.95	77.55	10389.90	3.52	47.68	1.45	1276.93

Source: IFS 2009

Table 4: Trade Openness

	Bangladesh	India	Pakistan	Sri Lanka	Nepal	Indonesia	Malaysia	Philippines	Singapore	South Korea
1973	1.54	0.80	1.99	1.63	1.39	0.00	21.80	1.71	94.06	0.01
1974	1.53	1.22	2.75	2.44	1.59	0.00	30.38	2.78	151.09	0.01
1975	2.55	1.37	2.98	2.71	2.20	0.00	26.65	2.75	134.65	0.01
1976	2.36	1.51	2.97	2.57	2.31	0.00	31.15	2.78	145.68	0.01
1977	2.83	1.59	3.10	3.28	2.14	0.00	32.61	2.99	161.92	0.02
1978	3.28	1.58	3.76	6.77	2.48	0.00	35.96	3.26	176.20	0.02
1979	4.04	2.00	4.61	8.58	2.80	0.00	44.30	4.05	209.82	0.02
1980	5.17	2.42	5.53	10.73	3.33	0.01	51.43	4.92	249.46	0.03
1981	5.88	2.52	5.53	11.17	3.81	0.01	50.04	5.04	255.00	0.03
1982	6.60	2.70	5.72	11.45	3.74	0.01	50.22	4.92	243.02	0.03
1983	6.36	2.59	6.35	12.21	4.89	0.01	52.61	6.13	220.70	0.03
1984	8.18	2.98	6.47	14.11	4.92	0.01	54.97	9.04	221.09	0.03
1985	8.18	3.13	7.01	13.72	5.79	0.00	53.17	9.32	219.47	0.03
1986	8.23	3.01	7.04	13.11	6.31	0.00	48.56	9.89	207.66	0.03
1987	8.88	3.33	7.89	15.13	7.66	0.00	56.22	12.21	234.80	0.03
1988	10.13	4.07	8.44	17.46	9.15	0.00	65.32	14.37	262.58	0.04
1989	11.49	5.06	9.77	19.21	8.70	0.00	78.20	16.77	257.63	0.04
1990	12.32	5.89	10.83	24.55	11.05	0.01	88.51	20.34	258.66	0.04
1991	12.18	6.90	13.01	26.69	14.82	0.01	99.40	23.63	252.87	0.04
1992	14.10	8.52	14.17	31.88	18.75	0.01	95.86	25.46	242.46	0.04
1993	14.74	9.81	15.03	37.98	23.09	0.01	101.49	31.49	248.64	0.04
1994	16.66	10.96	15.88	42.70	25.82	0.01	120.66	35.16	264.78	0.04
1995	21.19	13.37	18.70	46.91	29.14	0.01	134.50	41.89	276.42	0.05
1996	21.56	14.77	22.37	52.20	32.06	0.01	127.09	47.93	268.56	0.05
1997	23.13	15.69	24.20	57.51	36.70	0.01	132.69	59.86	265.58	0.05
1998	23.77	16.78	22.65	59.41	33.08	0.01	166.85	80.03	256.53	0.04
1999	25.47	17.66	25.15	62.77	38.62	0.01	174.11	83.88	269.45	0.05
2000	28.95	20.09	27.89	71.98	44.53	0.01	192.12	101.65	294.05	0.06
2001	29.44	19.99	30.84	76.96	41.67	0.01	171.70	99.33	280.16	0.05
2002	27.72	22.63	31.34	89.80	39.06	0.01	174.25	103.90	274.84	0.05
2003	31.33	24.56	34.14	93.29	45.20	0.01	172.50	106.93	294.87	0.05
2004	39.26	29.69	40.26	108.21	47.39	0.01	205.85	114.00	339.74	0.07
2005	41.90	36.35	50.50	111.68	55.21	0.01	215.15	113.16	366.12	0.07
2006	50.42	42.28	54.37	121.16	62.00	0.01	224.82	117.82	378.48	0.08
2007	54.02	44.31	55.91	134.11	66.65	0.01	219.56	105.12	348.59	0.09
2008	63.12	60.71	78.26	143.64	72.30	0.01	235.44	100.19	394.97	0.10
2009	56.06	49.37	95.52	137.82	77.96	0.01	190.27	85.06	329.60	0.08

Note: Trade Openness is calculated as: [Exports + Imports to GDP Ratio]

Figure 3: Investment to GDP Ratio [1973 – 2009]

Figure 3A: Investment to GDP Ratio [South Asian Region]

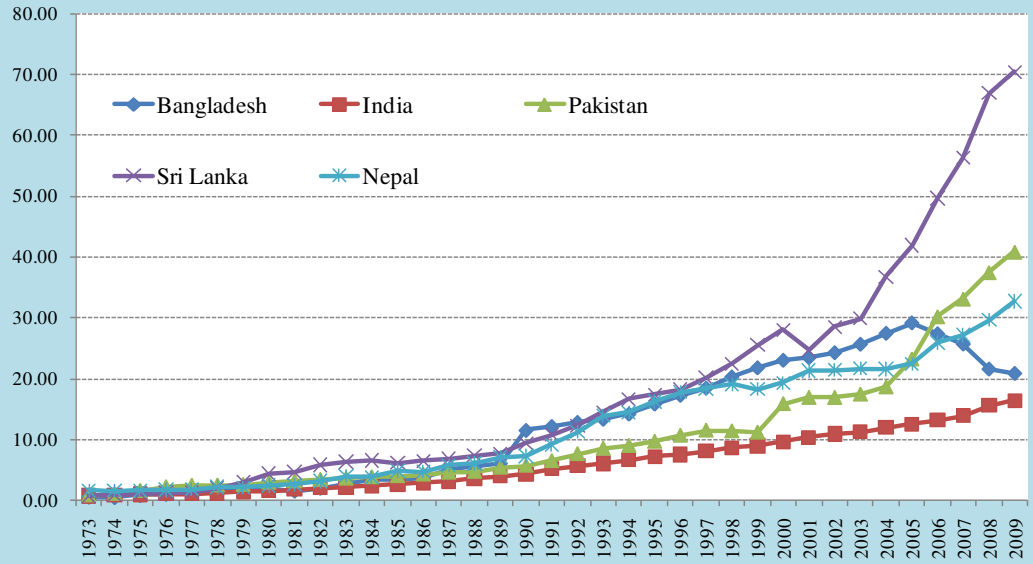


Figure 3B: Investment to GDP Ratio [East Asian Region]

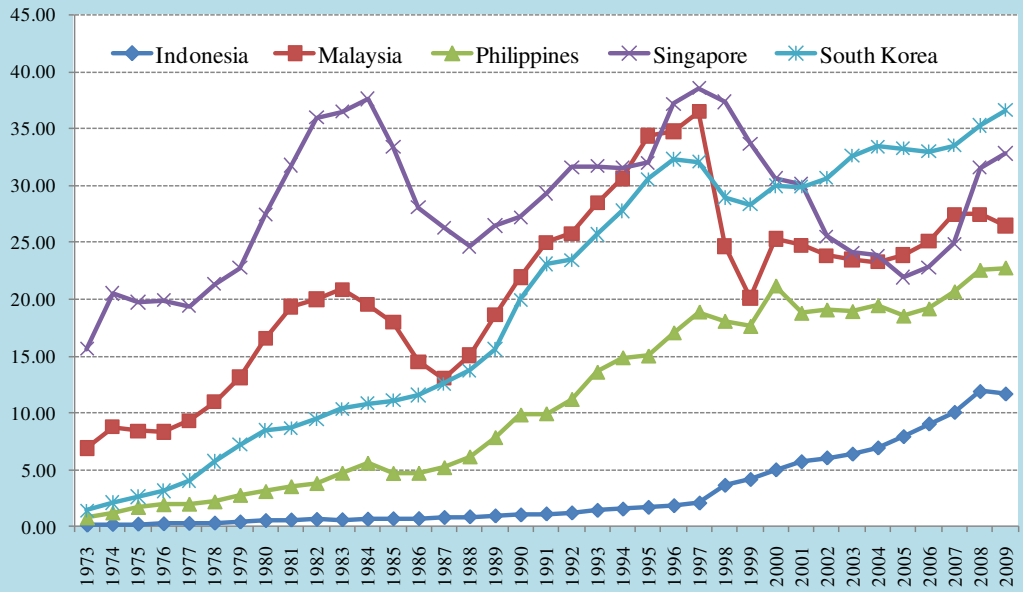


Figure 4: Average Political Instability over Different Sample Periods

Figure 4A: Average Political Instability : (Sample 1973 - 2009)
[+ve Region: Democratic and -ve Region: Autocratic]

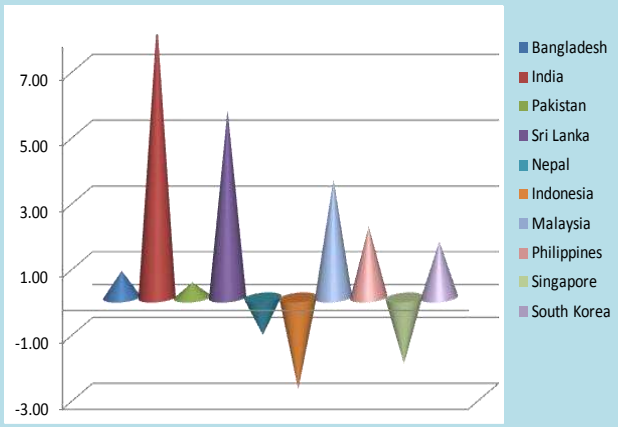


Figure 4B: Average Political Instability : (Sample 1973 - 1985)
[+ve Region: Democratic and -ve Region: Autocratic]

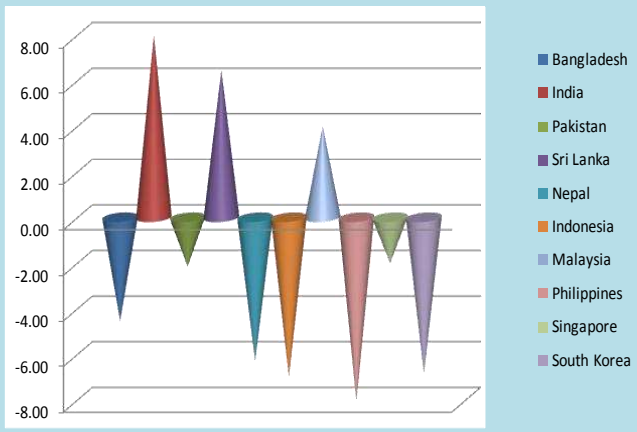


Figure 4C: Average Political Instability : (Sample 1986 - 2000)
[+ve Region: Democratic and -ve Region: Autocratic]

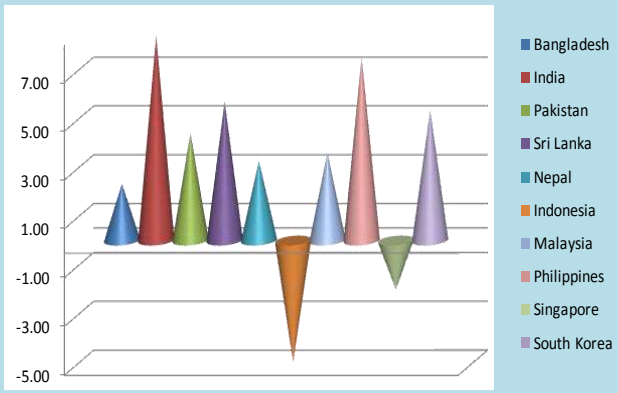


Figure 4D: Average Political Instability : (Sample 2001 - 2009)
[+ve Region: Democratic and -ve Region: Autocratic]

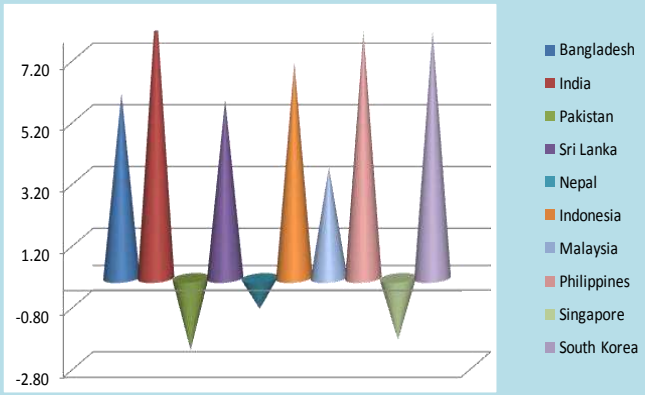


Figure 5: Trends in Human Capital [1973 – 2009]

Figure 5A: Human Capital Formation [Secondary School Enrollment] [South Asian Region]

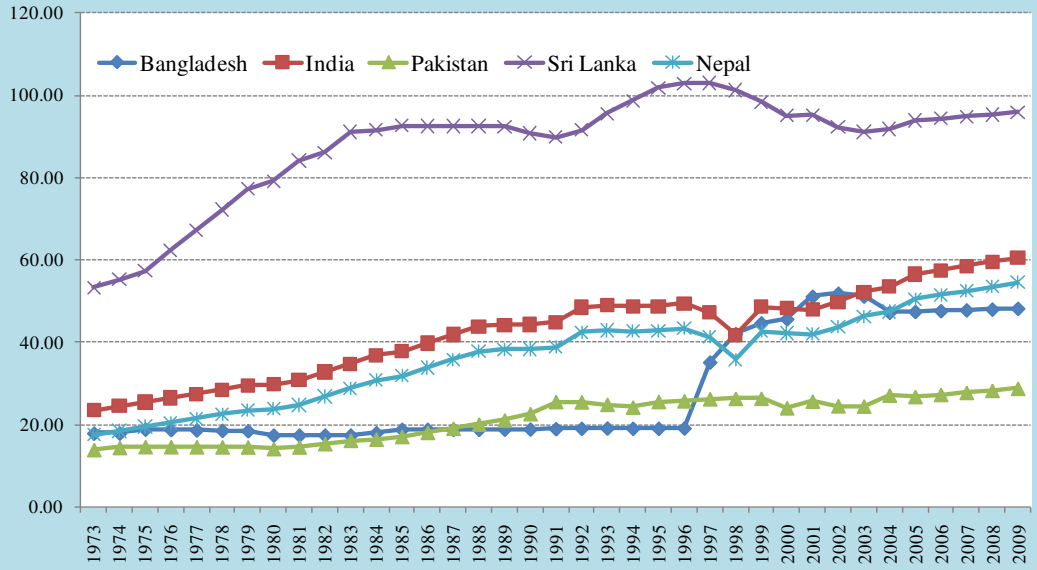


Figure 5B: Human Capital Formation [Secondary School Enrollment] [East Asian Region]

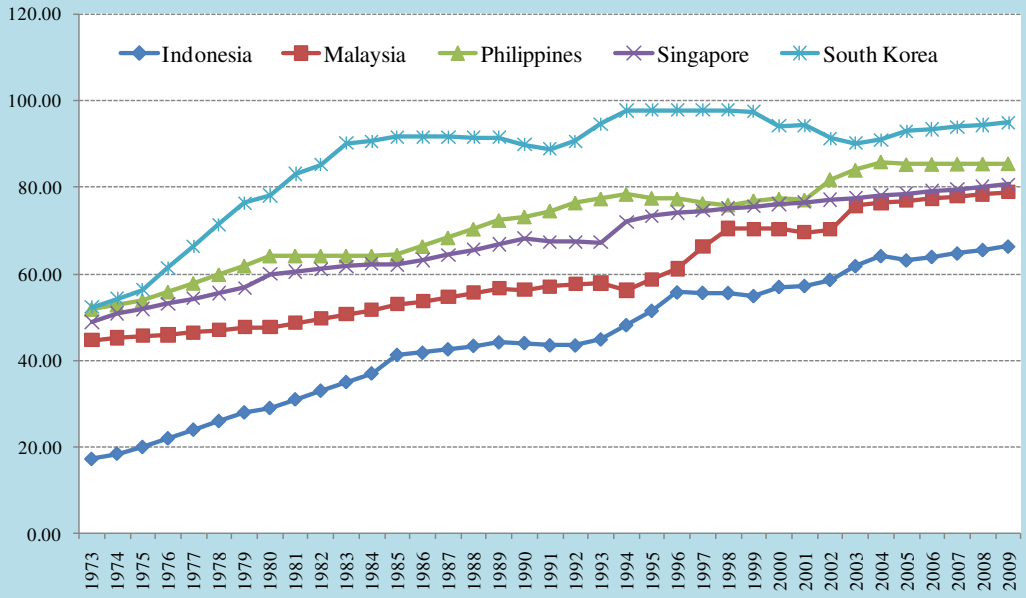


Table5: Theil Inequality Indicies for East-South Asian Regions

	Full Sample		South-Asian		East Asian	
	T-Index	L-Index	T-Index	L-Index	T-Index	L-Index
1973	0.312	0.278	0.026	0.019	0.019	0.026
1974	0.325	0.290	0.024	0.018	0.020	0.026
1975	0.344	0.311	0.032	0.026	0.022	0.028
1976	0.369	0.336	0.031	0.028	0.022	0.029
1977	0.353	0.322	0.027	0.028	0.023	0.029
1978	0.344	0.311	0.017	0.019	0.020	0.025
1979	0.291	0.262	0.017	0.020	0.018	0.019
1980	0.271	0.248	0.019	0.022	0.007	0.008
1981	0.307	0.282	0.024	0.026	0.008	0.010
1982	0.317	0.294	0.026	0.032	0.008	0.009
1983	0.256	0.238	0.028	0.035	0.013	0.012
1984	0.279	0.249	0.026	0.031	0.041	0.042
1985	0.249	0.222	0.027	0.034	0.054	0.058
1986	0.257	0.225	0.029	0.036	0.074	0.074
1987	0.251	0.207	0.029	0.037	0.126	0.111
1988	0.351	0.273	0.029	0.034	0.177	0.152
1989	0.437	0.329	0.025	0.029	0.219	0.185
1990	0.465	0.347	0.025	0.029	0.238	0.204
1991	0.631	0.477	0.035	0.033	0.271	0.238
1992	0.627	0.477	0.035	0.034	0.262	0.230
1993	0.713	0.548	0.035	0.032	0.276	0.245
1994	0.734	0.555	0.027	0.026	0.296	0.259
1995	0.823	0.622	0.030	0.027	0.331	0.286
1996	0.832	0.626	0.021	0.021	0.333	0.288
1997	0.814	0.594	0.017	0.016	0.354	0.301
1998	0.678	0.389	0.016	0.016	0.690	0.598
1999	0.768	0.448	0.013	0.013	0.681	0.591
2000	0.883	0.508	0.012	0.012	0.764	0.678
2001	0.843	0.477	0.010	0.010	0.790	0.714
2002	0.874	0.498	0.009	0.010	0.782	0.700
2003	0.846	0.481	0.012	0.014	0.777	0.691
2004	0.854	0.480	0.015	0.017	0.826	0.739
2005	0.934	0.521	0.018	0.021	0.900	0.822
2006	0.959	0.539	0.024	0.029	0.911	0.830
2007	0.912	0.516	0.033	0.041	0.916	0.833
2008	0.868	0.494	0.032	0.039	0.856	0.765
2009	0.807	0.465	0.031	0.039	0.793	0.689

Table Key:

a/ South Asian Block [Bangladesh, India, Nepal, Pakistan and Sri Lanka]

b/ East Asian Block [Indonesia, Malaysia, Philipines, Singapore and South Korea]

Figure 6: Trends in Theil Inequality Indices [1973 – 2009]

Fig. 6A: Trends in Theil-T*-Index [1973 - 2009]

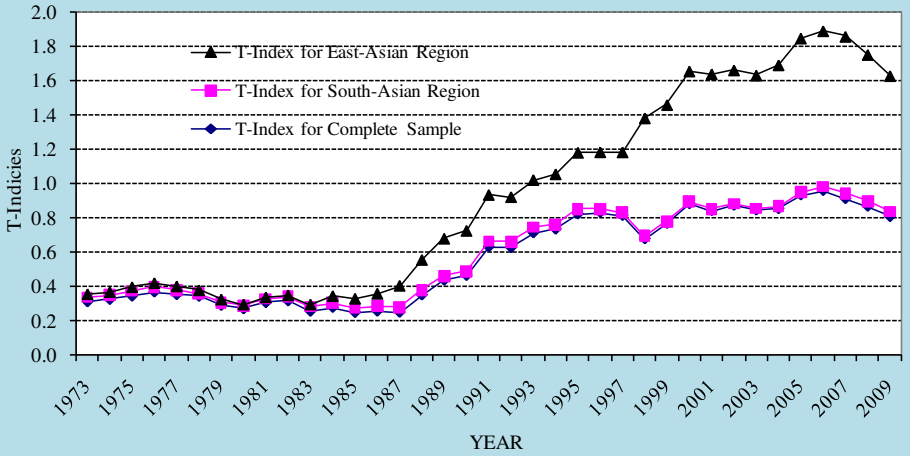


Fig. 6A: Trends in Theil-L*-Index [1973 - 2009]

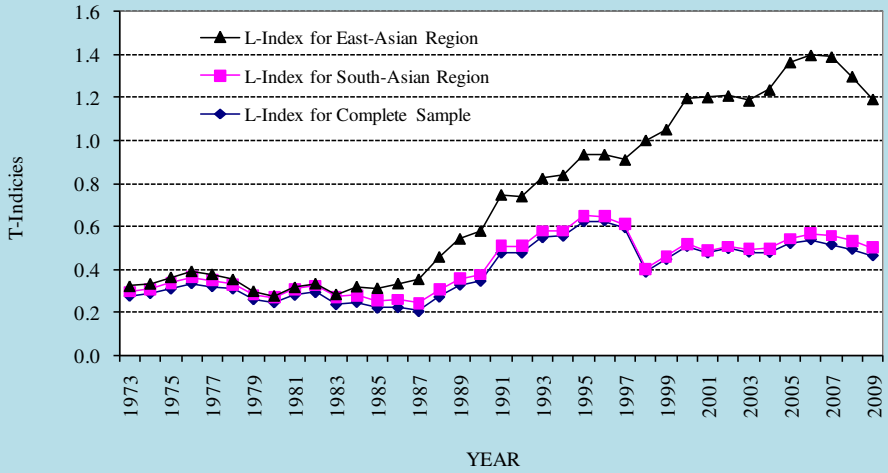


Table 6: Absolute Convergence Results based on Theil's Indices						
	Theil-T* Inequality Index			Theil-L* Inequality Index		
Full Sample [1973 - 2009] for all Asian Countries						
	estimates	t-stats	p-value	estimates	t-stats	p-value
Intercept	0.16	4.20	0.00	0.23	7.94	0.00
Beta	0.02	12.59	0.00	0.01	6.67	0.00
South Asian Region [1973 - 2009]						
	estimates	t-stats	p-value	estimates	t-stats	p-value
Intercept	0.03	10.97	0.00	0.03	8.87	0.00
Beta	0.00	-1.51	0.14	0.00	-0.35	0.73
East Asian Region [1973 - 2009]						
	estimates	t-stats	p-value	estimates	t-stats	p-value
Intercept	-0.21	-5.44	0.00	-0.19	-5.09	0.00
Beta	0.03	16.40	0.00	0.03	15.60	0.00
Note: Linear trend method is used to estimates above results						

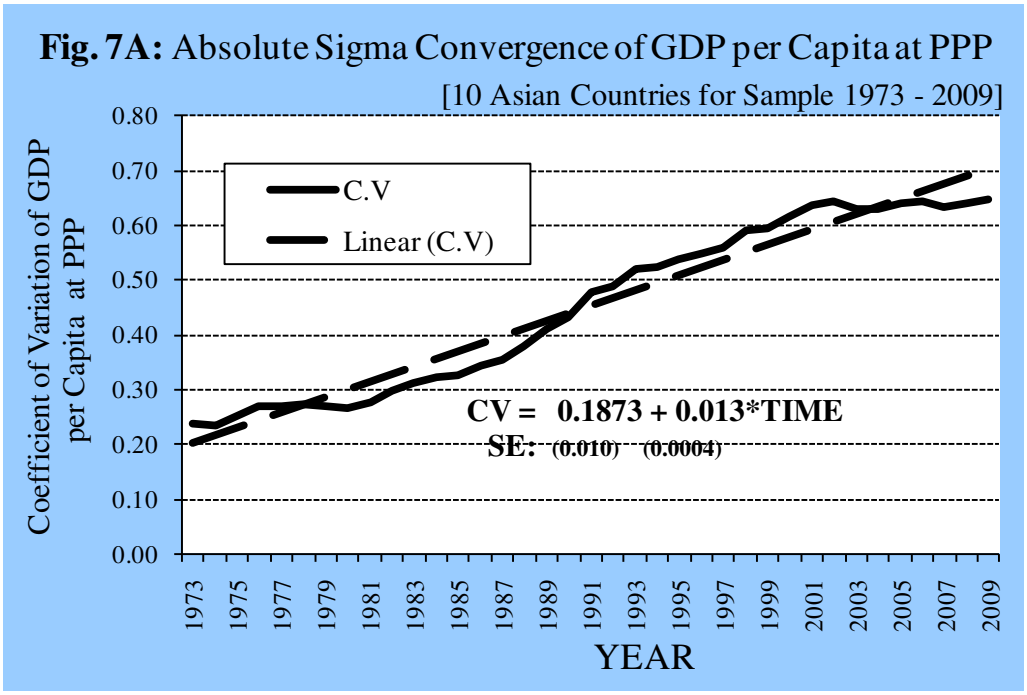
Table 7: Absolute Sigma Convergence Resutls

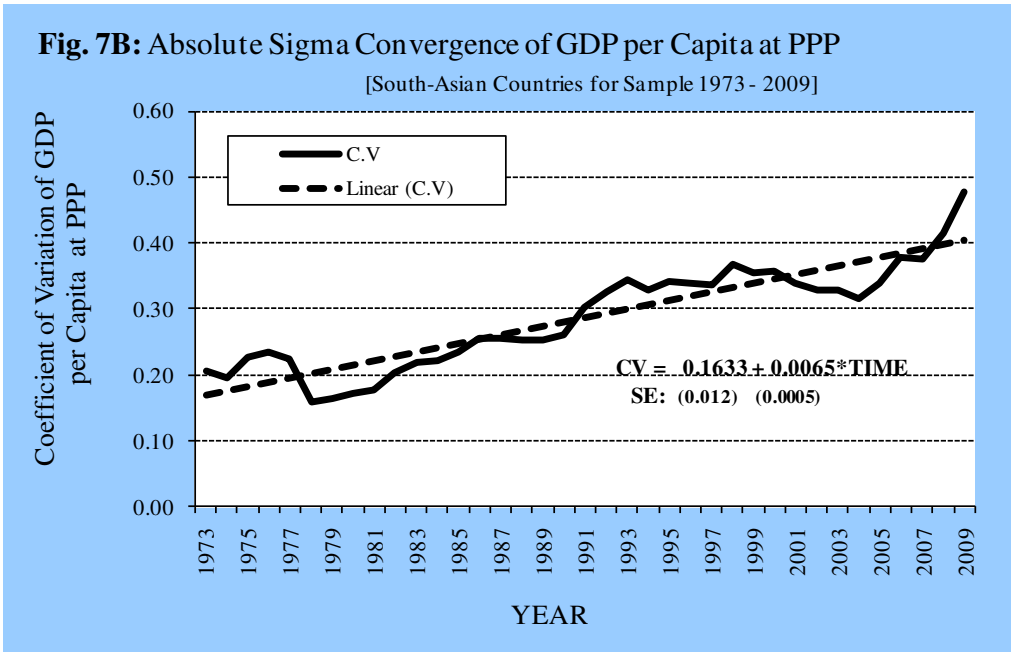
	Full Sample			South-Asian Region			East-Asian Region		
	MEAN	STD DEV	C.V	MEAN	STD DEV	C.V	MEAN	STD DEV	C.V
1973	3.271	0.772	0.236	2.703	0.558	0.206	3.839	0.473	0.123
1974	3.294	0.768	0.233	2.717	0.532	0.196	3.870	0.461	0.119
1975	3.235	0.813	0.251	2.622	0.597	0.228	3.848	0.440	0.114
1976	3.223	0.868	0.269	2.550	0.598	0.235	3.896	0.452	0.116
1977	3.262	0.882	0.270	2.565	0.578	0.225	3.960	0.445	0.112
1978	3.263	0.887	0.272	2.504	0.396	0.158	4.022	0.415	0.103
1979	3.268	0.879	0.269	2.507	0.411	0.164	4.028	0.350	0.087
1980	3.269	0.870	0.266	2.514	0.433	0.172	4.025	0.297	0.074
1981	3.243	0.898	0.277	2.463	0.439	0.178	4.023	0.317	0.079
1982	3.181	0.951	0.299	2.355	0.476	0.202	4.008	0.314	0.078
1983	3.098	0.965	0.311	2.270	0.500	0.220	3.926	0.364	0.093
1984	3.019	0.971	0.322	2.211	0.487	0.220	3.827	0.503	0.131
1985	2.948	0.963	0.327	2.167	0.507	0.234	3.728	0.553	0.148
1986	2.905	0.995	0.343	2.113	0.541	0.256	3.697	0.609	0.165
1987	2.910	1.030	0.354	2.104	0.540	0.257	3.716	0.687	0.185
1988	2.927	1.113	0.380	2.052	0.517	0.252	3.803	0.777	0.204
1989	2.911	1.196	0.411	1.958	0.494	0.252	3.863	0.841	0.218
1990	2.901	1.255	0.433	1.910	0.500	0.262	3.892	0.915	0.235
1991	2.836	1.351	0.476	1.774	0.538	0.303	3.899	0.997	0.256
1992	2.848	1.395	0.490	1.741	0.567	0.326	3.954	0.998	0.252
1993	2.819	1.463	0.519	1.655	0.568	0.343	3.984	1.049	0.263
1994	2.856	1.494	0.523	1.665	0.548	0.329	4.047	1.084	0.268
1995	2.892	1.554	0.537	1.649	0.564	0.342	4.135	1.122	0.271
1996	2.888	1.588	0.550	1.608	0.546	0.339	4.169	1.131	0.271
1997	2.815	1.574	0.559	1.559	0.524	0.336	4.071	1.162	0.285
1998	2.503	1.476	0.590	1.499	0.552	0.368	3.506	1.442	0.411
1999	2.544	1.511	0.594	1.465	0.521	0.356	3.623	1.397	0.386
2000	2.540	1.566	0.617	1.431	0.510	0.356	3.649	1.478	0.405
2001	2.451	1.558	0.636	1.358	0.459	0.338	3.544	1.505	0.425
2002	2.464	1.587	0.644	1.324	0.435	0.329	3.605	1.491	0.414
2003	2.516	1.587	0.631	1.379	0.451	0.327	3.654	1.493	0.409
2004	2.563	1.615	0.630	1.421	0.450	0.317	3.705	1.551	0.419
2005	2.596	1.658	0.638	1.434	0.488	0.340	3.759	1.602	0.426
2006	2.651	1.704	0.643	1.444	0.546	0.378	3.858	1.611	0.418
2007	2.735	1.729	0.632	1.505	0.566	0.376	3.966	1.620	0.409
2008	2.705	1.735	0.641	1.458	0.604	0.414	3.953	1.586	0.401
2009	2.650	1.714	0.647	1.418	0.679	0.479	3.882	1.536	0.396

Table Key:

a/ C.V means Coefficient of Variation across crossections

Figure 7: Absolute Sigma Convergence [1973 – 2009]





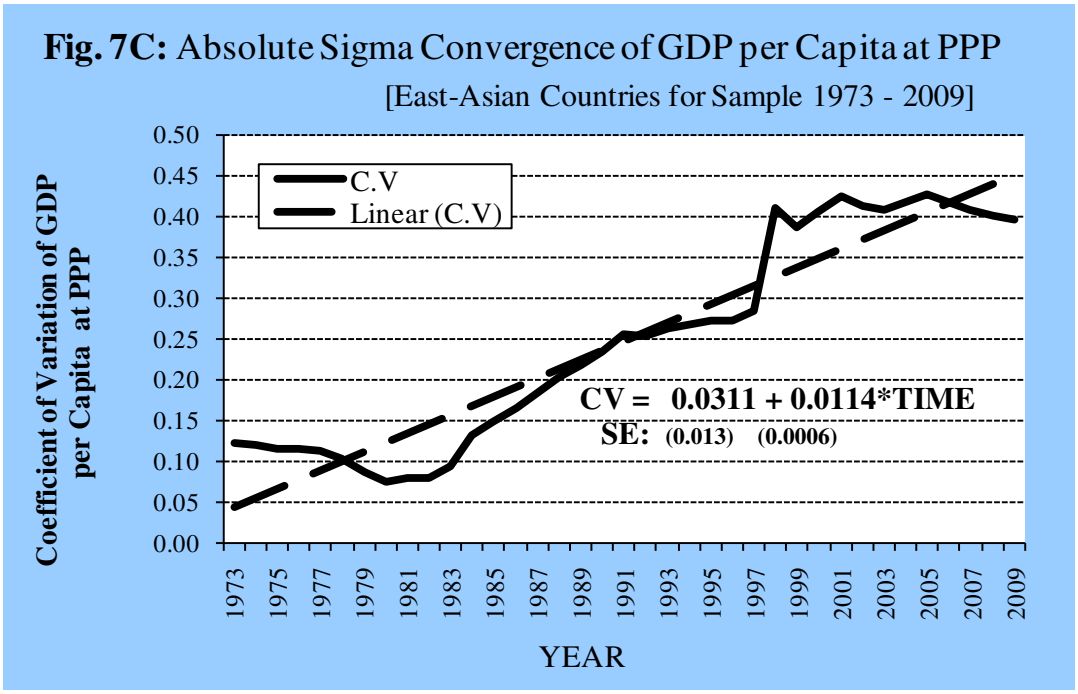
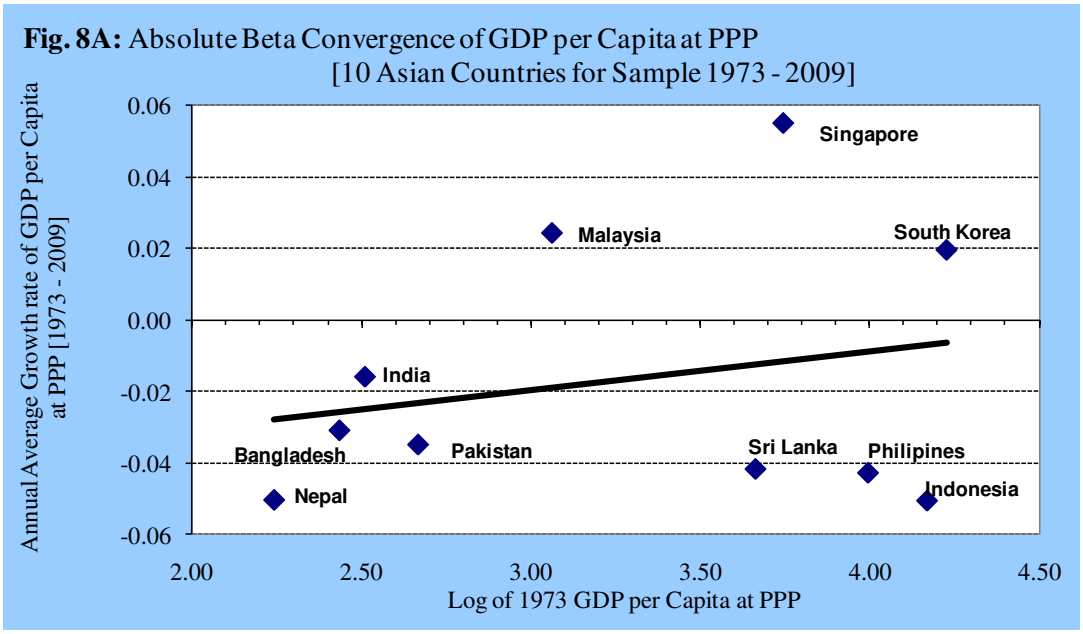


Table 8: Absolute Beta Convergence Estimation Results

Full Sample Results [10 Asain countries]			
	Parameters	t-statistics	p-value
Intercept	-0.055	-1.000	0.347
Slope	0.012	0.725	0.489
South-Asian Region			
	Parameters	t-statistics	p-value
Intercept	-0.029	-0.900	0.434
Slope	-0.002	-0.155	0.887
East Asian Region			
	Parameters	t-statistics	p-value
Intercept	0.171	0.888	0.440
Slope	-0.044	-0.888	0.440

Table Key: Negitive and Significant slope coefficient means Absolute Beta Convergence

Figure 8: Absolute Beta-Convergence [1973 – 2009]



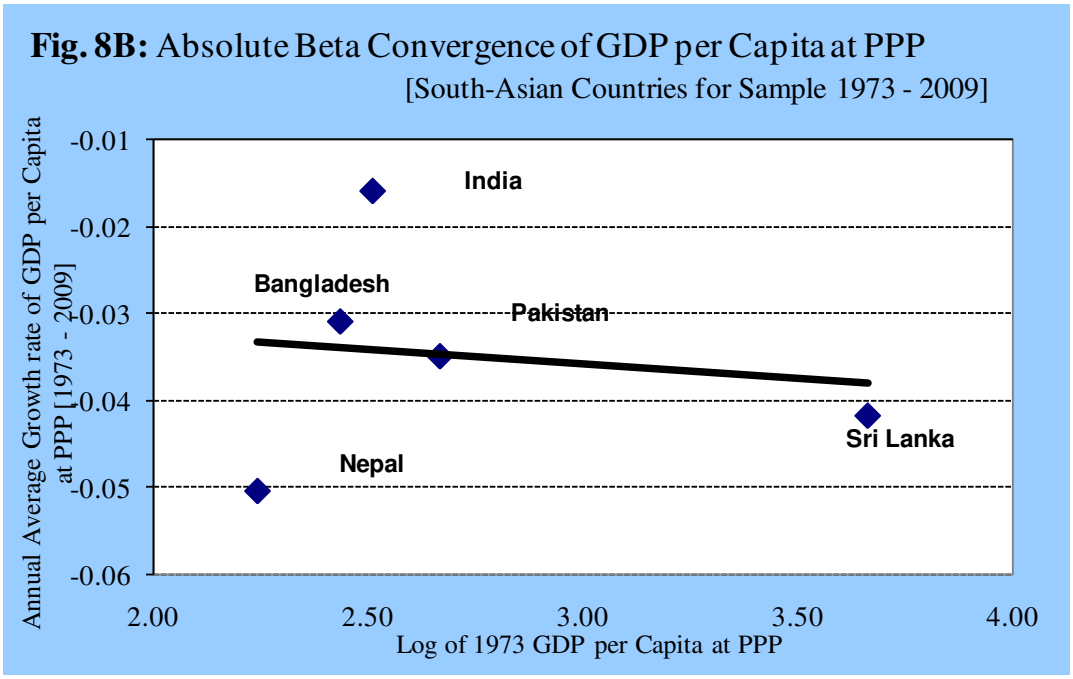


Fig. 8C: Absolute Beta Convergence of GDP per Capita at PPP
[East-Asian Countries for Sample 1973 - 2009]

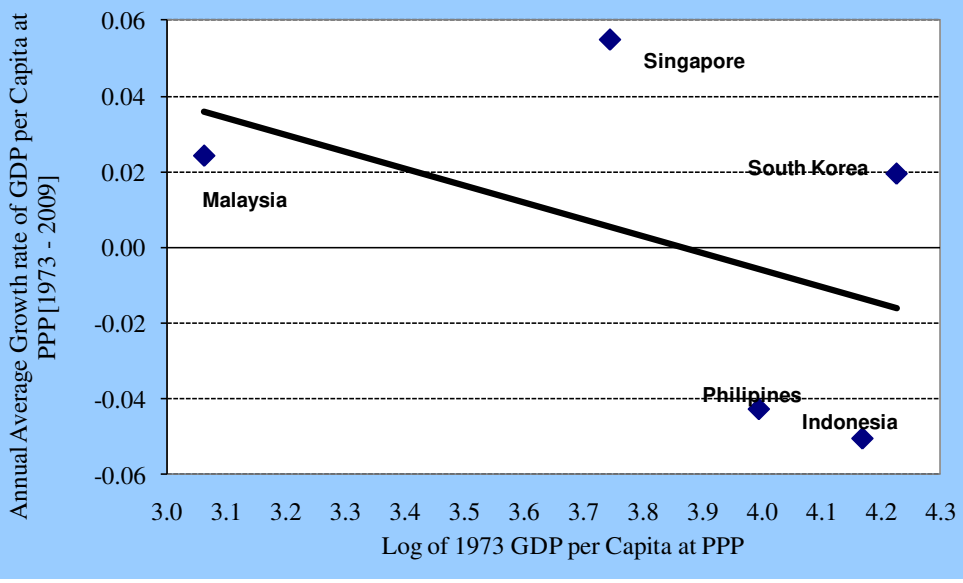


Table 9: Conditional Beta Convergence Results [Full Sample]				
Dependent Variable: growth of output per capita at PPP in USD				
	Model 1	Model 2	Model 3	Model 4
Intercept	**0.10**	**0.11**	**0.07**	**0.21**
	2.12	2.53	1.59	4.21
log(PCGDP_D$_{(t-T)}$)	**-0.04**	**-0.03**	**-0.02**	**-0.04**
	-3.06	-2.95	-1.80	-3.12
Investment to GDP Ratio	**-0.04**	**-0.02**	**0.00**	**-0.07**
	-2.39	-1.24	0.44	-4.16
Trade Openness	**0.001**	**0.001**	**--**	**0.001**
	3.18	2.99	--	4.24
Inflation rate	**-0.36**	**-0.36**	**-0.37**	**--**
	-12.89	-13.12	-13.27	--
Exchange Rate	**0.00**	**--**	**-0.01**	**--**
	0.35	--	-1.01	--
Political Instability	**0.003**	**--**	**--**	**0.006**
	1.05	--	--	1.95
Human Capital	**0.001**	**--**	**--**	**--**
	1.37	--	--	--
R^2	0.369	0.360	0.346	0.067
adj (R^2)	0.357	0.353	0.339	0.057
D.W. Statistics	1.881	1.893	1.939	1.890
S.E. of Regression	0.238	0.238	0.241	30.124
Total No. of Observations	370	370	370	370
Included Observations	369	369	369	369
Note: Bold values represent estimates of each variable and corresponding t-values are given				

Table 10: Conditional Beta Convergence Results [South Asian Region]				
Dependent Variable: growth of output per capita at PPP in USD				
	Model 1	Model 2	Model 3	Model 4
Intercept	**0.94**	**0.15**	**0.34**	**0.53**
	5.06	2.34	2.27	6.28
log(PCGDP_D$_{(t-T)}$)	**-0.16**	**-0.05**	**-0.05**	**-0.17**
	-5.24	-2.32	-2.28	-5.72
Investment to GDP Ratio	**0.04**	**-0.05**	**0.05**	**-0.17**
	1.14	-2.49	1.39	-6.44
Trade Openness	**0.002**	**0.002**	**--**	**0.004**
	3.17	2.39	--	3.97
Inflation rate	**-0.29**	**-0.33**	**-0.34**	**--**
	-12.45	-13.94	-14.49	--
Exchange Rate	**-0.25**	**--**	**-0.10**	**--**
	-4.21	--	-1.86	--
Political Instability	**0.002**	**--**	**--**	**0.008**
	1.19	--	--	3.14
Human Capital	**0.002**	**--**	**--**	**--**
	3.25	--	--	--
R^2	0.657	0.606	0.601	0.221
adj (R^2)	0.644	0.597	0.592	0.204
D.W. Statistics	1.735	2.019	2.001	1.711
S.E. of Regression	0.131	0.139	0.140	0.195
Total No. of Observations	370	370	370	370
Included Observations	369	369	369	369
Note: Bold values represent estimates of each variable and corresponding t-values are given				

Table 11: Conditional Beta Convergence Results [East Asian Region]				
Dependent Variable: growth of output per capita at PPP in USD				
	Model 1	Model 2	Model 3	Model 4
Intercept	**0.16**	**0.10**	**0.15**	**0.10**
	1.87	1.35	1.81	1.36
log(PCGDP_D$_{(t-T)}$)	**-0.04**	**-0.05**	**-0.04**	**-0.05**
	-1.68	-2.48	-2.30	-2.22
Investment to GDP Ratio	**0.03**	**0.02**	**0.02**	**0.03**
	0.99	1.61	1.77	1.18
Trade Openness	**0.000**	**0.000**	**--**	**0.000**
	0.43	1.69	--	1.42
Inflation rate	**-0.01**	**-0.02**	**-0.01**	**--**
	-0.31	-0.52	-0.24	--
Exchange Rate	**-0.01**	**--**	**-0.01**	**--**
	-0.85	--	-2.08	--
Political Instability	**0.000**	**--**	**--**	**-0.001**
	0.03	--	--	-0.28
Human Capital	**-0.001**	**--**	**--**	**--**
	-0.53	--	--	--
R^2	0.081	0.071	0.078	0.070
adj (R^2)	0.045	0.050	0.058	0.049
D.W. Statistics	1.836	1.833	1.827	1.833
S.E. of Regression	0.219	8.504	0.217	0.218
Total No. of Observations	370	370	370	370
Included Observations	369	369	369	369
Note: Bold values represent estimates of each variable and corresponding t-values are given				