Absolute and Conditional Convergence: Its Speed for Selected Countries for 1961--2001

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Abstract

The study gives the theoretical justification for the per capita growth equations using Solovian model(1956) and its factor accumulation assumptions. The different forms of the per capita growth equation is used to test for 'absolute convergence' and 'conditional convergence' hypotheses and also work out the speed of absolute and conditional convergence for selected countries from 1961-2001.We use cross sectional data of GDP per capita levels and growth rates of European countries EU16(EU15 +United Kingdom), South Asian Countries (5), some East Asian (8) and CIS Countries (15) to test for 'absolute convergence' hypothesis for four different periods 1961-2001,1970-2001,1980-2001,1990-2001.Only EU and East Asian countries together have shown uniform evidence of absolute convergence in all periods. While EU as a region has shown significant evidence of absolute convergence in two periods, 1961-2001 and 1970-2001, there is no convincing statistical evidence in favor of absolute convergence in the last two periods: 1980-2001 and 1990-2001.This latter evidence with declining rate of economic growth for EU since 1961 points to a challenge for designing EUs regional policies which also have to cope up with many East European and Baltic nations who joined EU recently. The speed of absolute convergence in the four periods range between 0.99-2.56 % p.a. (2% for the EU was worked out by Barro and Xavier Sala-i-Martin, 1995, for European regions) for EU while it ranges between 0.57-1.16 % p.a. for the countries in East Asia and EU regions together. However, there is no evidence of convergence among the South Asian countries in all periods and some major CIS republics since 1966.There is however tendency for absolute convergence among countries of South Asia, East Asia and European Union together particularly after the 1980s.

Conditional convergence is prevalent among almost all pairs of regions in our sample except East Asian and South Asian nations together.Speed of conditional convergence ranges from 0.2 % in an year to 22%.In the European nations, the speed of conditional convergence works out be nearly 20 % unlike the speed of absolute convergence which hovered around 2 %.Such results would mean that countries in Europe are converging very quickly to their own potential level of incomes per capita but not so quickly to a common potential level of income per capita.The elasticity of output which is also estimated ranges from 0.54 to 0.91 implying that capital is to be interpreted as broad capital inclusive of human capital stock.It seems that human capital not only affects technological progress but affects output levels directly by increasing capital stock levels implying that the assumption of including human capital stock in the production function were appropriate in Mankiw,Romer and Weil(1992).

The results for the speed of conditional convergence favors use of an extended Solovian model inclusive of human capital.Conditional beta convergence seems to be a better empirical exercise(as evident from our theoretical model and empirical results) because it reflects the convergence of countries after we control for differences in steady states .Conditional convergence is simply a confirmation of a result predicted by the neoclassical growth model:that

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countries with similar steady states exhibit convergence.It does not mean that all countries in the world are converging to the same steady state,only that they are converging to their own steady states

Introduction

There has been considerable research inquiry into the causes and nature of differences in growth rates across countries and regions over time. Even small differences in these growth rates, if cumulated over a long period of time, may have substantial impact on the standards of living of people. Despite considerable research on the subject, cross-country and cross-regional income disparities are on rise over time. Understanding the causes behind such inequalities is essential to formulate appropriate policies and bring about required institutional changes in order to spread the benefits of growth processes across regions.

Convergence refers to the process by which relatively poorer regions or countries grow faster than their rich counterparts. Few subjects in applied economic research have been studied as extensively as the convergence hypothesis advanced by Solow (1956) and documented by Baumol (1986) and Barro and Xavier-Sala-i-Martin (1995). In its strongest version (known as absolute convergence), an implication of this hypothesis is that, in the long run, countries or regions should not only grow at the same rate, but also reach the same income per capita. The present study tests the 'convergence' of GDP per-capita within and across four regions-South & East Asian, European Union (15) and the United Kingdom from 1961-2001, some countries from the Commonwealth of Independent States (CIS) since 1966 till 2001 and other CIS nations from mid 1980s[2] to 2001. Convergence can be conditional (conditional beta convergence) or unconditional (absolute beta convergence). Conditional convergence implies that a country or a region is converging to its own steady state while the unconditional convergence implies that all countries or regions are converging to a common steady state.

One of the stylized facts of economic growth today is that the levels of GDP per capita and growth rates have differed across countries and regions of the world. This is indeed the case for some of the regions included in our study (see Table I below). While EU region (industrialized economies) has relatively the highest GDP per capita income levels in 2001, East Asian region has shown relatively higher growth rates in all periods from 1961 to 2001. Decadal growth rates, however, do show that the performance of EU and East Asian region show a declining trend in economic growth rates while South Asian region show an upward trend.

Table I: Per Capita Income Levels and Growth Rates Across Regions

	AVERAGE GDP PER CAPITA (IN Current US $) IN 2001	Average Annual Per Capita GDP Growth Rate 1961-2001	Average Annual Per Capita GDP Growth Rate 1970-2001	Average Annual Per Capita GDP Growth Rate 1980-2001	Average Annual Per Capita GDP Growth Rate 1990-2001
South Asia(5)	447.72	2.16	2.23	2.82	2.81
East Asia(8)	3348.70	4.34	4.31	3.90	3.51
European Union(16)	21050.75	2.88	2.49	2.28	2.27
CIS (15)	1523.83	1.46(Latvia, Russia and Georgia (1966-2001)		-1.05 (Estonia & Moldova) 1981-2001	-0.22(1986-2001) 10 CIScountries

[2] Please see Appendix Table I for the list of countries included in the four regions included in our study.

					excluding Latvia,Russia, Georgia, Estonia and Moldova

Source: Author's calculations using data on GDP Per Capita (constant 1995 US$), GDP (CURRENT US $) and Population from World Bank, World Development Indicators on CDROM, 2003.

Note: The second column shows weighted average with population as weights. The growth rates are for GDP Per Capita (in constant 1995 US $).

As is evident from the above data, economic growth varies tremendously across different regions. With the new era of free market philosophy, countries are competing with each other for resources. How are the countries doing relative to one another? Have they been diverging away from one another? These are critical questions for three reasons: (1) Central planning in Soviet Union(Now Russian federation and CIS countries),China & India has explicitly sought to reduce regional disparities. Also, with 10 new East European and Baltic states joining the EU on May,1 2004[3], reducing regional inequalities within the EU would be the explicit goal of the EU enlargement policies (2) Rising regional disparities cause regional tensions & 3) poor regions should not remain poor for generations to come?

The absolute and conditional convergence hypotheses has been tested by many researchers using different methodologies and data sets and appears to be strongly rejected by some data sets and accepted by others. In view of these results, this study tests for absolute convergence and conditional across and within regions ,work out speed of absolute and conditional convergence & identify policies which may reduce differential levels of per-capita income levels and growth rates of regions. Neoclassical growth models (Cass 1965; Koopmans 1965; Solow 1956, Swan 1957) have been used as a framework to study convergence across regions within countries. The main variable in use will be GDP per-capita income prevailing in different countries/ regions included in our study.

The paper is organized as follows: Section II provides the definition of absolute convergence and conditional convergence within the neoclassical framework. Section III presents a review of the empirical literature on convergence analysis, Section IV gives the theoretical foundation for the growth equation Section V gives the objectives,hypotheses, methodology,data and data sources with variable description , Section VI discusses the regression results of absolute convergence analysis.Section VII discusses the conditional convergence results. Section VIII gives conclusion and policy implications, points out the limitations of the study and makes some suggestions for future research. Appendix tables are at the end.

II. Convergence Analysis: Neoclassical Approach

The major focus of recent work on growth empirics has been the issue of convergence.The basic paradigm for this discussion by the Solow(1956) model.The crucial assumption in the Solow model of diminishing marginal returns to capital leads the growth

[3] Poland - along with Hungary, Lithuania, Estonia, Latvia, Slovakia, Slovenia, Cyprus, Malta and the Czech Republic are new entrants to EU.In practice, according to Eurostat figures, average per capita GDP in the 10 new entrant East European countries now stands at around 40 percent of the EU average, indeed, the gap between the average EU income level and that of the new entrant countries has widened considerably since 1989. The EU's real GDP grew by 30 percent between 1989 and 2002, whereas for the 10 East European accession countries the increase amounted to only 8 percent during the same period. **Lowering the gap has not diminished appreciably among the East European nations since** the mid-1990s, in part because of macroeconomic mismanagement in some countries; slowing structural change in others; and the impact of external shocks, such as the 1998 Russian financial crisis.

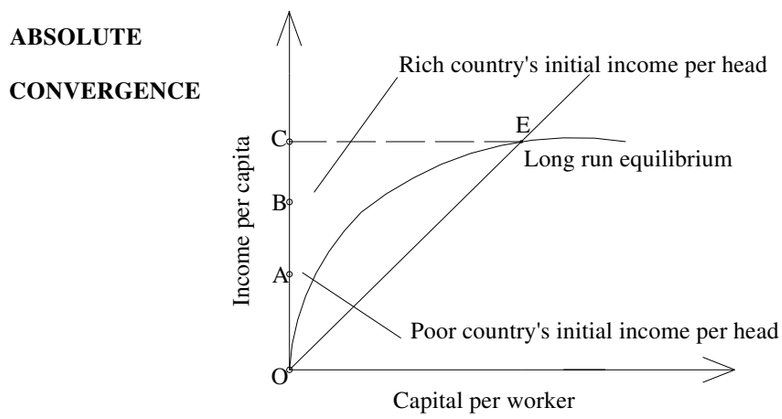
process within an economy to eventually reach the steady state where per capita output,capital stock and consumption grow at a common constant rate equaling the exogenously given rate of technological progress.This lead to the notion of convergence,which can be understood in two different ways.The first is in terms of level of income.If countries are similar in terms of preferences and technology,then the steady state income levels for them will be the same and with time they will ten to reach that level of income per capita.The second is convergence in terms of the growth rates.Since in Solow model the steady state growth rate is determined by the exogenous rate of technological progress,then provided that technology is a public good to be equally shared ,all countries will eventually attain the same steady state rate of growth.

In the last decade,a vast amount of research has gone into investigating the so-called convergence hypothesis(Barro and Sala-I-Martin,1992,Mankiw Romer and Weil,1992,among others).Do poorer regions remain poor for many generations or do they catch up with the rich ones?

Barro in his first empirical work(1991) on growth showed that if differences in the initial level of human capital(along with some other pertinent variables) are controlled for,then the correlation between the initial level of income and subsequent growth rate turn out be negative even in wider sample of countries.This concept of conditional convergence found its more explicit formulation in Barro and Sala--Martin(1992) and Mankiw,Romer and Weil(1992).Both these papers emphasized the fact that the neoclassical growth model did not imply that the all countries are converging to the same steady state per capita income.Instead what it implied is that countries would reach their respective steady states.

An early hypothesis proposed by economic historians such as Aleksander Gershenkron(1952) and Moses Abramovitz(1986) was that at least under certain circumstances "backward' country would tend to grow faster than the rich ones,in order to close gap between the two groups.Baumal(1986) for example reported finding convergence among a group of countries included in Maddison(1982) sample.The convergence hypothesis is central to the neoclassical growth model particularly Solow model(1956).The model predicts that that if two countries are exactly same except for their initial per capita income,they will both end at the long run equilibrium point E in the figure I given below-

Figure I



Therefore, if the poor country's initial income per head is OA,which is below the rich country's income per head OB,then the poor country must grow more rapidly(higher marginal productivity and inviting capital from abroad) than the rich country for both of them ultimately to achieve the

common level of income per head OC(assuming same technology, production, population, preferences)[4]. This is called absolute beta convergence (also called unconditional convergence because it implies that all countries/regions are converging to common steady state level of income)..However, these structural parameters differ across countries and regions and countries may not converge to a common level of income per -capita but to their own steady state level(long run potential level of income).Therefore,economies with lower levels of per capita income(expressed relative to their steady state levels of per capita income) tend to grow faster.Such convergence is called conditional convergence.

Sigma convergence concerns cross -sectional dispersion. In this context, convergence occurs if the dispersion-measured by standard deviation of log per capita income or wages across regions decline over time. Absolute convergence (poor countries tend to grow faster than rich ones) tends to generate convergence of the second kind (reduced dispersion of per capita income). However, beta convergence is a necessary but not sufficient condition for sigma convergence. Yet a better measure of the evolution of personal inequality is the population weighted variance of the log of income per capita (as opposed to simple variance of the log of income per capita, which gives the same weight to all regions, regardless of population). In this study we propose to measure indirect convergence through two measures-absolute convergence and conditional convergence

III: Review of Literature: Previous Studies on Economic Growth and Convergence Across Regions

The bulk of their empirical writings, exemplified by Barro (1991) and Mankiw, Romer and Weil (1992), have found evidence that economies with low initial incomes tend to grow faster than economies with high initial incomes, after controlling for rates savings and population growth. This finding has been treated as evidence of convergence, and has generally been taken as evidence that the neo - classical growth model pioneered by Solow (1956) ' is consistent with observed growth patterns. Barro and Sala - 1 - Martin (1992) have investigated the question of convergence within regions as well by using 48 states of the United States.Boldrin and Canova (2001) using a similar methodology severely criticized the previous results. Using a different data set, which includes 185 EU regions during the period 1980 - 1986, they concluded that the results are mixed and not supportive of convergence of regional per capita income. Canova and Marcet (1995) also, basing the analysis on per capita incomes for 144 EU regions, found only limited signals of convergence during the period 1980 - 1982. Others have studied different regions of now developed countries: Keller (1994) for Austria and Germany, Cashin (1995) for Australia and Coulombe and Lee (1993) for regions in Canada, Kangasharju (1999) for Finland and Sala-i-Martin (1996) for Japanese Prefectures. The evidence seems to be unequivocal: different regions in different countries are converging. Most rates of convergence hover around 2% per annum. However, the same cannot be said about the whole world. With data of the past 30 years for 110 countries, the evidence shows that the world is not converging. They are diverging. Poor countries are getting relatively poorer and the rich countries getting richer. The argument put forth to reconcile these two facts is that there is no diffusion of technology across different countries. However, within a country, regions are more closely related.Hence the result.There have been very few studies that look at convergence in the developing countries. This paper tries to fulfil such a gap by including countries from CIS federation,South Asia and East Asia.

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[4] More than that when capital is scarce it is very productive,so national income will be large in relation to the capital stock,and this will induce people to save more than enough to set the wear and tear on existing capital.Thus capital deepening process will take place till the steady state level of capital per worker is reached. This study assumes that growth and bipolar international divergence in labour productivity are driven primarily by capital deepening and less attributable to differences in technological changes and technological catch up(result confirmed by Kumar and Russel,2002)

The cross-country regression literature is enormous: a large number of papers have claimed to have found one or more variables that are partially correlated with the growth rate: from human capital to investment in R&D, to policy variables such as inflation or the fiscal deficit, to the degree of openness, democracy, financial variables or measures of political instability. In fact, the number of variables claimed to be correlated with growth is so large that the question arises as to which of these variables is actually robust in explaining differential growth performance across countries and regions. Edward Leamers(1985) Extreme Bound Tests approach to identify 'robust' empirical relations in the economic growth literature and Xavier Sala-I-Martin(1997) method of looking at the entire distribution of regression coefficients are some methodologies to identify some significant factors affecting growth.

In recent times, cross country analysis has come under criticism from the"Twin-Peaks" literature led by Danny Quah (1996, 1997). The researcher is interested in the evolution of the distribution of the world distribution of income and the variance is only one aspect of this distribution. Quah noticed that, in 1960, the world distribution of income was uni-modal whereas, in the 1990s, the distribution became bi-modal. He then used Markov transitional matrices & non-parametric method to estimate the probabilities that countries improve their position in the world distribution. Using these matrices, he then forecasted the evolution of this distribution overtime. His conclusion was that, in the long run, the distribution would remain bi-modal, although the lower mode will include a lot fewer countries than the upper mode.

Even though Quah's papers triggered a large body of research, his conclusion does not appear to be very robust. Jones (1997) and Kremer, Onatski and Stock (2001) have recently shown that a lot of these results depend crucially on whether the data set includes oil-producers (for example, the exclusion of Trinidad and Tobago or Venezuela from the sample changes the prediction of a bi-modal steady state distribution to a uni-modal distribution; the reason is that these are two examples of countries that were relatively rich but have become poor so if they are excluded from the sample, the probability of "failure" -that is, the probability of a country moving down in the distribution- lowers substantially).

The present study uses cross country regression approach and not the time series approach to the study of convergence. The appropriateness of the cross-country regression approach is challenged by, for example, Quah (1993), Bernard and Durlauf (1996) and Evans (1996). Quah(1993) shows that negative correlation between output growth and initial output is consistent with a stable variance in cross country output.Bernard and Durlauf(1996) argue that the initial output regression approach tends to reject the null hypothesis of no convergence too often in the presence of multiple output equilibria as countries converge to their own steady state levels of per capita income**.**Evans (1996) points out that the cross sectional approach may generate inconsistent convergence rate estimates, which may lead to incorrect inferences. Under the time series framework, output convergence requires real per capita cross country output differentials to be stationarity; that is, the levels of per capita national output are not diverging over time. Quah (1992) examines the unit root property of per capita output **of the US**. Using a panel unit root test, Evans (1998) shows that convergence occurs within a group of developed countries and different growth patterns are observed among countries with different literacy rates.

Compared with cross country analysis, the time series approach yields less convincing findings for the convergence hypothesis (Cheung and Pascual, 2004) One possible reason for the non convergence outcome is related to the empirical procedures used in these studies. The typical time series test has no convergence (presence of unit root) under the null hypothesis. Since it is commonly known that unit root tests tend to have low power against persistent but stationarity alternatives, the inability of these studies to reveal evidence of convergence is not surprising. Cheung and Pascual (2004),however, use panel time series procedures for cross sectionally correlated panels because their ability to reject a false null hypothesis is higher than the corresponding univariate procedures. The results from procedures with different

specifications of the null hypothesis help determine the usefulness of the data in terms of their ability to identify the convergence property. Nahar and Inder (2002) illustrate that there is an inconsistency in the convergence definitions proposed by Bernard and Durlauf (1995). The notion of convergence is linked to stationarity of output differences, but Nahar and Inder provide counter-examples to show that certain non-stationarity differences can satisfy this definition of stochastic convergence. Consequently, Nahar and Inder propose a new procedure for testing for convergence, either towards a single "leading" economy, or towards the mean of a group of economies.

Some important lessons from growth literature are:

(i) There is no simple determinant of growth.

(ii) The initial level of income is the most important and robust variable (so conditional convergence is the most robust empirical fact in the data)

(iii) The size of the government does not appear to matter much. What is important is the“quality of government” (governments that produce hyperinflation's, distortions in foreign exchange markets, extreme deficits, inefficient bureaucracies, etc., are governments that are detrimental to an economy).

(iv) The empirical relation between most measures of human capital and growth is weak. Some measures of health, however, (such as life expectancy) are robustly correlated with growth..

(v) Institutions (such as free markets, property rights and the rule of law) are important for growth.

(vi) More open economies tend to grow faster.

(vii) Geography(landlocked countries and distance of the countries from equator) and climatic conditions(tropical vs temperate) do effect growth through its impact on efficiency and technology parameters.

(viii) Financial development do effect growth rates primarily through its impact on savings and investment rate.

(ix) Religious variables: The proportion of public Confucian, Buddhist, Muslim, among others do have impact on growth rates.

The most likely way institutions and quality of governments affect the long term growth rates of per capita GDP is through its impact on share of investment in GDP.

The differential performances across regions has begun to raise important policy questions within these countries.To what extent are the differences a manifestation of global economic forces acting upon these countries,especially during process of economic liberalization for countries like India and CIS Countries .Will market reforms tend to make rich states richer in relative terms,with poor states lagging ever farther behind,or will market reforms lead to economic convergence across states?Why is that the U.S states displayed convergence in most decades of U.S. history and similarly for Japanese prefectures,but India and China do not show signs of convergence.These are difficult questions to answer given that a large number of papers have claimed to have found one or more variables that are partially correlated with the economic growth rate. However,it is heartening to note that one of the empirical facts of economic growth is that a country's relative position in the world distribution of per capita income is not immutable.Countries can move from being "poor" to being "rich" and vice-versa(Jones,2002 ,fact no 4,page 13)[5].It clearly suggests that there are actions which the governments of India and China can take such that these economies grow similarly to what East Asian Economies did

[5] At the end of the nineteenth century,Argentina was one of the richest countries in the world.With a tremendous natural base and a rapidly developing infrastructure,it attracted foreign investment and immigration on a large scale.By 1990,however,Argentina's per capita income was only about one third of per capita income in the U.S.Carlos Diaz-Alejandro(1970) provides a classic discussion of the economic history of Argentina.

from 1960-97[6].One of the objectives of this study is to suggest policy measures that can fulfil such a goal.We would also test for absolute and conditional convergence for countries included in our sample.

III.Objectives of the Study , Methodology, Hypotheses ,Data Sources & Variable Description

III.1The objectives of the present study are:

- Provide theoretical foundation to the per-capita growth equation. Identify some common and major determinants of economic growth rates across regions.
- To know whether the selected 8East Asian,5 South Asian, Commonwealth of Independent States(15) and 16 European Union countries EU16(EU15+UK) are converging in absolute beta sense independently and jointly .

- To test for conditional convergence across regions and countries
- To measure the speed of absolute and conditional convergence

III.2Methodology

We shall test for the absolute convergence hypothesis using the data from the East Asian, South Asian, CIS and European Union countries. Bangladesh, India, Nepal, Pakistan and Sri Lanka from South Asian region. China, Hong Kong, Japan, Malaysia , Singapore,Thailand,Phillipines,Indonesia, from East Asian region and 16 European Union countries (Austria, Belgium Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden,Norway and UnitedKingdom) and fifteen CISnations(Azerbaijan,Belarus,Estonia,Latvia,Lithunia,Moldova,Russia,Tajakistan,Turkmenistan,Ukraine,Uzbekistan,Kazakistan,Krygistan,Armenia and Georgia) are considered. Test will be done jointly as well as independently, that is, first on 5 South Asian countries then on 8 East Asian countries, then on 16 European Union countries, 15 CIS nations and then on total 44 countries.

Linear and Non linear Regression between per capita average annual growth rate and initial level of per capita GDP is estimated to test and estimate the speed of absolute beta convergence respectively.

The following regression equation will be used to test the absolute convergence-

$$Yi.t, t+T = a + b \log (yi.t) + ei.t \quad \text{----------(1)}$$

Where, Yi.t, t+T be economy i's average of yearly annual growth rates of GDP[4] between t and t+T(dependent variable) and log (yi.t) is the *natural* log of economy i's GDP per capita at time t(independent variable).

If $b < 0$ and is significantly different from 0 ,then, we say that data set exhibits absolute beta convergence and we would reject the null hypothesis (Ho) of b=0. If the null hypothesis (b= 0) were rejected, we would conclude that not only do poor countries grow faster than rich countries, but also that they all converge to the same level of GDP per capita. Left tailed test has been used to work out the critical point beyond which the value of beta coefficient will imply rejection of the null hypothesis of non convergence.

[6] Most of the East Asian Economies including Hong Kong,South Korea,Thailand,Singapore and Malaysia grew at 5.6 per annum from 1960 to 1997 till they faced currency and banking crisis in 1997.It is said that these economies are already on the path of recovery.

To measure the speed of absolute convergence (in terms of percentage per year), non-linear least squares is used to estimate equation (1a)

$\gamma_{it,t+T} = a - (1-e^{-\lambda})*\log y_{it} + U_t$ ----------(1a)

where $\gamma_{it,t+T}$ is the average annual growth rate of gross domestic product per capita between time period t and t+T.log y_{it} is the log(*natural*) of per capita gross domestic product at time period t.U_{it} is the error term. λ is the speed of convergence implying the speed at the which actual income is reaching its common steady state level of income (potential level of income) in an year.[7]In particular,if the production function is Cobb-Douglas with a capital share given by α the, the parameter λ is given by $(1-\alpha)(n+g+\delta)$where g is the growth rate of technology, δ is the depreciation rate and n is the rate of population growth.

Conditional convergence across countries and regions will be tested by estimating the below given equation

Yi.t, t+T = a +b1* log (initial)+b2 *log saving(s)+b3 *log(n+g+δ)+b4*log Life(H) +b5*log Trade(T) +b6*log industry(I)+ ei.t,where ----------(v a)

Yi.t, t+T is average annual growth rate of GDP per capita and log (initial) is log of initial level of GDP per capita,log savings(s) is log of average annual gross domestic savings to GDP ratio,log(n+g+δ) is log of(population growth(n)+rate of growth of technology(g:which is assumed to be constant at 3%)+rate of depreciation(δ:assumed to be constant at 2%)),log of Life(H) is log of life expectancy in initial year.This is proxy for healthy labor force(Human Capital),log of trade openness(T) is log of average annual trade openness to GDP ratio.Trade openness is measured as (nominal exports+nominal imports)/GDP.,Log of industry(I) is log of average annual share of industry value added in GDP.The last three factors are assumed to determine technology levels.

If b1 < 0 and significantly different from zero. then we say that data set exhibits conditional beta convergence and we would reject the null hypothesis (Ho) of b1=0.This will imply that countries which are further away from steady state will grow at a faster rate than countries which are nearer to it.The further an economy is 'above' its steady state,the slower the economy should grow.

To measure the speed of convergence λ(in terms of percentage per year), non-linear least squares is used to estimate equation (v) below

$$\frac{\log y_t - \log y_0}{t} = D - \frac{(1-e^{-\lambda t})}{t}\log y_0 \quad +(\alpha/1-\alpha)/t(1-e^{-\lambda t})\log \quad s$$

$$-(1-e^{-\lambda t})/t(\frac{\alpha}{1-\alpha})\log(n+g+\delta) + g + \beta'_6 \log I + \beta'_5 \log H \qquad (v)$$

$$+\beta'_4 \log T + \varepsilon .$$

Where the variables are as described above,The left hand side is measured as average annual GDP per capita, Log y_0 is log of initial level of GDP per capita,α is the elasticity of

4. Strictly, one must use the exponential or continuous compound growth rate (1/T log)(Y_{it+T}/Y_{it}) since equation (1) is obtained from solovian growth model (with its standard assumptions) for the exponential growth rates. However, as the exponential growth rates are determined only by the end-points and would be influenced for example, by the global recession of 2001 we have in stand proxied (indeed approximated) the same by the average of yearly growth rates. Of course, if one is finding the growth rate for every year and averaging it for the sample period, it will be affected by all events in the sample period, including events taking place at the end years.

[7] Equations (1) and (1a) are derived from solving the Solovian model(1956) in its transitional dynamics phase .Please refer to Barro and Xavier-Sala-I-Martin(1995) and our subsequent sections for further clarification .In this phase ,the model assumes that all economies have not reached their potential level of income(steady state level).

output with respect to the capital. This can be estimated from the above equation V as well.λ is the speed of convergence implying the speed at the which actual income is reaching its steady state level of income(potential level of income) in an year.In particular, if the production function is Cobb-Douglas with a capital share given by α the, the parameter λ is given by (1-α)(n+g+δ)where g is the growth rate of technology, δ is the depreciation rate and n is the rate of population growth as discussed above. The value of t is one in equation V as all the variables used in the study are average annual figures.

III.3Conditional Convergence Hypotheses

1) Conditional beta convergence will hold for countries/regions against that they will not hold for the time period 1961-2001 within and across regions. We would test whether b1 <0 in equation (v a) will hold against the Null hypothesis:b1=0.We would fit a multiple regression model given below

Yi.t, t+T = a +b1* log (initial GDP per capita)+b2 *log saving(s)+b3 (v a)
*log(n+g+δ)+b4*log Life(H) +b5*log Trade(T) +b6*log industry(I)+ ei,t

Where, the variables are as described in the section on methodology. Negative and significant value of the initial level of log of GDP per capita would corroborate evidence in favor of conditional convergence.

2)

i) Domestic Savings rate is hypothesized to have positive impact on the GDP per capita growth rate. We would test whether b2=0 holds against the alternative that b2> 0 in equation (v a).Higher savings rate imply more resources for investment and growth.

ii) Population growth rate is hypothesized to have a negative impact on GDP per capita growth rate. We would test whether b3=0 against the alternative b3<0 in equation (v a). Higher population would mean less resources for savings and more consumption. Less resources for savings in turn would mean lower investment and growth.

iii) Higher life expectancy in the initial year means economies which have healthy labour force(higher human capital) at the initiation of the growth process would grow at a faster rate. We would test whether b4=0 holds against the alternative b4> 0 in equation (v a) .

iv) Higher trade openness means larger foreign investment and new ideas, new managerial skills, new technologies which in turn will augment the growth process. It is hypothesized that b5 in equation (v a) is =0 against the alternative it is b5>0.

v) Lastly, new technology levels are more prevalent in industry. Therefore, higher the value added share of industry in GDP, larger will be the growth of GDP per capita. It is hypothesized that b6 =0 against the alternative b6 >0 in equation (v a)

4) It is hypothesized that the speed of conditional convergence(non convergence) will be positive(negative) for the , East Asian, South Asian regions separately and jointly (λ>0 in equation (v) below would mean convergence of GDP per capita income to its own potential level of GDP per capita(conditional convergence) ,respectively, while negative value for λ would imply non convergence.

$$\frac{\log y_t - \log y_0}{t} = D - \frac{(1-e^{-\lambda t})}{t}\log y_0 \quad +(\alpha/1-\alpha)/t(1-e^{-\lambda t})\log \quad s$$

$$-(1-e^{-\lambda t})/t(\frac{\alpha}{1-\alpha})\log(n+g+\delta)+g+\beta'_6 \log I+\beta'_5 \log H \quad \text{---} \quad (v)$$

$$+\beta'_4 \log T+\varepsilon .$$

Where, the variables are as described the chapter on methodology.

III.4Data & Data Sources with Variable Description

Data set comprises 13 Asian (8 East and 5 South) countries,15 Commonwealth of Independent States and 15 European Union countries and UK. Country names are given in the Appendix Table I. Log of initial level of GDP per capita(independent variable),initial per capita GDP and GDP per capita average annual growth rates(dependent variable), for the four time periods 1961-2001,1970-2001,1980-2001 are given in Appendix Tables II,III,IV and V.This data set is from the data sample as described in-World Development Indicators on CDROM,various years. Different number of countries is included in CIS in different sub-periods because most of the CIS nations were formed at different intervals after the disintegration of the erstwhile Soviet Union in the late 1980s. For Latvia, Russia and Georgia the data is available from 1966-2001,while for Estonia and Moldova data is available from 1981-2001.

For the conditional convergence analysis the variable description and data description is described below:-

Dependent Variable: GDP per capita average annual growth(1961-2001).Worked out by the author from World Bank World Development Indicators on CDROM ,various years

Independent Variables:

1) Initial Level of GDP per capita(constant 1995 US $),World Bank World Development Indicators on CDROM,Various Years
2) Savings (s) is log of (weighted)average annual Gross Domestic savings to GDP ratio, weights being the GDP of each country. Definition: Gross domestic savings are calculated as GDP less final consumption expenditure (total consumption). Source: World Bank national accounts data, and OECD National Accounts data files.
3) Average Annual Population growth,(n): Population is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship--except for refugees not permanently settled in the country of asylum, who are generally considered part of the population of the country of origin. Source: World Bank staff estimates from various sources including the United Nations Statistics Division's Population and Vital Statistics Report, country statistical offices, and Demographic and Health Surveys from national sources and Macro International.
4) Life Expectancy:Definition:

Life expectancy at birth indicates the number of years a newborn infant would live if prevailing patterns of mortality at the time of its birth were to stay the same throughout its life. Source: World Bank staff estimates from various sources including the United Nations Statistics Division's Population and Vital Statistics Report, country statistical offices, and Demographic and Health Surveys from national sources and Macro International.

5) Trade Openness as % of GDP:

Definition: Trade is the sum of exports and imports of goods and services measured as a share of gross domestic product. Source: World Bank national accounts data, and OECD National Accounts data files.

6) Average(Weighted) Annual Industry Value Added as % of GDP:

Definition: Industry corresponds to ISIC divisions 10-45 and includes manufacturing (ISIC divisions 15-37). It comprises value added in mining, manufacturing (also reported as a separate subgroup), construction, electricity, water, and gas. Value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs. It is calculated without making deductions for depreciation of fabricated assets or depletion and degradation of natural resources. The origin of value added is determined by the International Standard Industrial Classification (ISIC), revision 3. Source: World Bank national accounts data, and OECD National Accounts data files.

Appendix Tables VI and VII gives data for conditional convergence analysis.

IV.Growth Model:Providing Theoretical Justification for Per Capita Growth Equation

We follow variant of the Jones(2002) model in general by endogenizing technology. Assuming Cobb-Douglas Production function with labor augmenting technological progress (A)

$$Y_t = K_t^{\alpha}\left(A_t L_t\right)^{1-\alpha} \quad 0<\alpha<1 \qquad \ldots(i)$$

where Y is output, K is capital and L is labor .L is assumed to grow exogenously at rate n and A_t grows endogenously at rate g.

$$\frac{\dot{L}}{L} = n$$

$$\Rightarrow L_t = L_0 e^{nt}.$$

Technology is endogenized. Technology levels are explained by trade openness (T) Human Capital (H) and share of industry in GDP of the country (I).Trade openness and Human capital are known to be major vehicles for international knowledge and technology spillovers. Industrial sector is one major sector where technology plays a major role in increasing productivity and growth.

$$A_t = A_o e^{gt}.T^{\beta_4}.H^{\beta_5}I^{\beta_6}$$

Capital grows at $\dot{K} = sY - \delta K$, δ is the depreciation rate. Assuming that s is saved and invested, and defining output and stock of capital per unit of effective labor as $\tilde{y} = \frac{Y}{AL}$ and $\tilde{k} = \frac{K}{AL}$, respectively, the dynamic equation for $\tilde{k}$ is given by

$$\dot{\tilde{k}} = s\tilde{y}_t - (n+g+\delta)\tilde{k}_t$$

$$\Rightarrow \dot{\tilde{k}} = s\tilde{k}_t^{\alpha} - (n+g+\delta)\tilde{k}_t$$

where δ is the constant rate of depreciation. It is evident that $\tilde{k}$ converges to its steady state value $\left(\dot{\tilde{k}} = 0\right)$.

$$\tilde{k}^* = \left(\frac{s}{n+g+\delta} \right)^{\frac{1}{1-\alpha}}$$

upon substitution the steady state output per effective labor is

$$\tilde{y}^* = \left(\frac{s}{n+g+s} \right)^{\frac{\alpha}{1-\alpha}}$$

and steady state output per labour as

$$y^* = \left(\frac{s}{n+g+\delta} \right)^{\frac{\alpha}{1-\alpha}} A_t \qquad \ldots(ii)$$

The formulation in (ii) can explain why steady state per capita income levels differ among countries. They differ because countries have different savings rate, technology levels, rate of growth of population, among others. Good quality governance leads to higher savings rate and create right environment for technological spillovers.

IV.1Dynamism around the steady state

It is possible to utilize a more general framework that examines the predictions of the Solow model for behaviour of per capita income out of steady state. Such a framework allows estimation of the effect of various explanatory variables on per-capita growth rates as well as the speed at which actual income per capita reaches the steady state level of income per-capita. Expansion of by log $\tilde{y}$ around log $\tilde{y}^*$. Using Taylor's expansion (assuming other terms to be zero).

$$\log_e \tilde{y} = \log \tilde{y}^* + \frac{\tilde{y} - \tilde{y}^*}{\tilde{y}^*}$$

$$\Rightarrow e^{\log \tilde{y}^* + \frac{\tilde{y} - \tilde{y}^*}{\tilde{y}^*}} = \tilde{y}$$

$$\Rightarrow e^{\left(\frac{\tilde{y} - \tilde{y}^*}{\tilde{y}^*} \right)} = \frac{\tilde{y}}{\tilde{y}^*}$$

Similarly $\frac{\tilde{k}}{\tilde{k}^*} = e^{\left(\frac{\tilde{k} - \tilde{k}^*}{\tilde{k}^*} \right)}$

Also, the rate of growth of income per effective labour is α times the rate of growth of capital per effective labour.

$$\frac{\dot{\tilde{y}}}{\tilde{y}} = \alpha \frac{\dot{\tilde{k}}}{\tilde{k}}$$

$$\frac{\dot{\tilde{y}}}{\tilde{y}} = \alpha \left[\frac{\dot{K}}{K} - \frac{\dot{L}}{L} - \frac{\dot{A}}{A} \right]$$

$$\Rightarrow \frac{\dot{\tilde{y}}}{\tilde{y}} = \alpha\left[s\frac{\tilde{y}_t}{\tilde{k}_t} - (n+g+\delta) \right]$$

$$\Rightarrow \frac{\dot{\tilde{y}}}{\tilde{y}} = \alpha\left[s\frac{e^{\frac{\tilde{y}-\tilde{y}^*}{\tilde{y}^*}}.\tilde{y}_t^{\,*}}{e^{\frac{\tilde{k}-\tilde{k}^*}{\tilde{k}^*}}.\tilde{k}^*} - (n+g+\delta) \right]$$

In steady state $s\tilde{y}^* = (n+g+\delta)\tilde{k}^*$

So

$$\Rightarrow \frac{\dot{\tilde{y}}}{\tilde{y}} = \alpha\left[\frac{(n+g+\delta)e^{\frac{\tilde{y}-\tilde{y}^*}{\tilde{y}^*}}}{e^{\frac{\tilde{k}-\tilde{k}^*}{\tilde{k}^*}}} - (n+g+\delta) \right]$$

$$\Rightarrow \frac{\dot{\tilde{y}}}{\tilde{y}} = \alpha\left[(n+g+\delta)\left\{ \frac{e^{\frac{\tilde{y}-\tilde{y}^*}{\tilde{y}^*}}}{e^{\frac{\tilde{k}-\tilde{k}^*}{\tilde{k}^*}}} - 1 \right\} \right]$$

$$\Rightarrow \frac{\dot{\tilde{y}}}{\tilde{y}} = \alpha\left[(n+g+\delta)\left\{ \frac{e^{\frac{\tilde{y}-\tilde{y}^*}{\tilde{y}^*}} - e^{\frac{\tilde{k}-\tilde{k}^*}{\tilde{k}^*}}}{e^{\frac{\tilde{k}-\tilde{k}^*}{\tilde{k}^*}}} \right\} \right]$$

As

$$\log_e m = \log n + \frac{m-n}{n} \text{ (Taylors expansion)}$$

$$e^{\frac{m-n}{n}} \approx \frac{m}{n}$$

$$\Rightarrow \frac{m-n}{n} \approx \log\frac{m}{n}$$

Using the above we get

$$\Rightarrow \frac{\dot{\tilde{y}}}{\tilde{y}} = \alpha\left[(n+g+\delta)\left\{ \frac{\frac{\tilde{y}}{\tilde{y}^*} - \frac{\tilde{k}}{\tilde{k}^*}}{\frac{\tilde{k}}{\tilde{k}^*}} \right\} \right]$$

$$\Rightarrow \frac{\dot{\tilde{y}}}{\tilde{y}} = \alpha\left[(n+g+\delta)\left(\log\left\{ \frac{\tilde{y}}{\tilde{y}^*} / \frac{\tilde{k}}{\tilde{k}^*} \right\} \right) \right]$$

$$\Rightarrow \frac{\dot{\tilde{y}}}{\tilde{y}} = \alpha\left[(n+g+\delta)\left\{ \log\tilde{y} - \log\tilde{y}^* - \log\tilde{k} + \log\tilde{k}^* \right\} \right]$$

Using $\log \tilde{y} = \alpha \log \tilde{k}$ and $\log \tilde{y}^* = \alpha \log \tilde{k}^*$

$$\frac{\dot{\tilde{y}}}{\tilde{y}} = (1-\alpha)(n+g+\delta)\left[\log \tilde{y}^* - \log \tilde{y}\right]$$

$$\Rightarrow \frac{\dot{\tilde{y}}}{\tilde{y}} = \lambda\left[\log \tilde{y}^* - \log \tilde{y}\right] \qquad \ldots(iii)$$

Where $\lambda = (1-\alpha)(n+g+\delta)$ is the speed of convergence. Barro and Xavier-Sala-i-Martin (1995) define speed of convergence(rate at which the level of income per effective worker approaches its steady state)

$$-\frac{d\left(\frac{\dot{\tilde{y}}}{\tilde{y}}\right)}{d(\log \tilde{y})} = \lambda$$

i.e.,speed of convergence coefficient λ is the proportionate change in growth rate caused by change in initial income per effective labour.

Equation (iii) says that growth rate of income per effective labour is equal to the speed of convergence multiplied by the gap between steady state and actual level of incomes. Higher the gap, higher would be the growth rates. If the countries or regions have the same steady state growth & level of incomes, country or regions which are far away from its steady state will grow at faster rate and catch up with the relatively rich partner (absolute convergence).

Solving the differential equation (iii) we get

$$\log \tilde{y}_t = \log \tilde{y}_0 e^{-\lambda t} + \left(1-e^{-\lambda t}\right)\log \tilde{y}^*$$

Where $\log \tilde{y}_0$ is log of initial level of income per effective labour.

$$\Rightarrow \log \tilde{y}_t - \log \tilde{y}_0 = -\left(1-e^{-\lambda t}\right)\log \tilde{y}_0 + \left(1-e^{-\lambda t}\right)\log \tilde{y}^*$$

To find growth of income per capital we substitute the value of log A_t which is $= \log A_0 + + gt + \beta_4 \log T + \beta_5 \log H + \beta_6 \log I$

and noting $\tilde{y} = \frac{Y}{AL}$

$$\Rightarrow \tilde{y} = \frac{y}{A}$$

We get

$$\log y_t - \log y_0 = \left(1-e^{-\lambda t}\right)\left(\log y^* - \log y_0\right)$$
$$+e^{-\lambda t}\left[gt + \beta_4 \log T + \beta_6 \log I + \beta_5 \log H\right]$$

$$\Rightarrow \log y_t - \log y_0 = -\left(1-e^{-\lambda t}\right)\log y_0 + \text{Constant}_I \qquad \ldots(iv)$$

Where $C_i = \left(1-e^{-\lambda t}\right)\log y^* + e^{-\lambda t}\left[gt + \beta_4 \log T + \beta_6 \log I + \beta_5 \log H\right]$

.In Equation (iv) average per capita growth is found by dividing by time period t on both sides. Non linear least squares can be used to estimate equation (iv) using cross sectional data.It is to be noted that if we assume that all economies here have the same steady state level of per capita income(in turn implying same structural parameters of the economy) and steady state growth, then Constant$_i$ = Constant, equation (iv) would then imply absolute convergence, if the coefficient $(1-e^{-\lambda t})=\beta$ of $\log y_0$ is >0(implying negative relationship between average growth rate and initial level of GDP per capita).

In this study, we would estimate the variant of equation (iv) by the below given linear equation by OLS assuming Constant$_i$ = Constant(a in the below given equation)

Yi.t, t+T = a + b log (yi.t)+ ei.t ----------(1)

whereYi.t, t+T be economy i's average annual growth rate of GDP between t and t+T,Log (yi.t) be the log of economy i's GDP per capita at time t

If b < 0 and is significantly different from zero, it would imply absolute convergence.

λ measures speed at which the per capita income approaches the common steady state(potential level) of income Speed of convergence(λ) in an year is found by estimating equation (iv) directly by using Non Linear Least Squares taking average annual GDP per capita growth as dependent variable and log of initial level of GDP per capita as independent variable.

However, the diversities among the economies are quite apparent ,conditional convergence is the likely proposition. To test for conditional convergence we derive growth rate of per capital income after substituting values of steady state income from (ii).We get

$$\log y_t - \log y_0 = -(1-e^{-\lambda t})\log y_0 + \frac{\alpha}{1-\alpha}(1-e^{-\lambda t})\log s$$

$$-(1-e^{-\lambda t})\frac{\alpha}{1-\alpha}\log(n+g+\delta) + gt + \beta_6 \log I + \beta_5 \log H$$

$$+\beta_4 \log T + (1-e^{-\lambda t})\log A_0 .$$

For cross-sectional study average growth can be found by dividing by time period t

$$\frac{\log y_t - \log y_0}{t} = D - \frac{(1-e^{-\lambda t})}{t}\log y_0 \quad +(\alpha/1-\alpha)/t(1-e^{-\lambda t})\log s$$

$$-(1-e^{-\lambda t})/t(\frac{\alpha}{1-\alpha})\log(n+g+\delta) + g + \beta'_6 \log I + \beta'_5 \log H \qquad (v)$$

$$+\beta'_4 \log T + \varepsilon .$$

Where $\log A_0 = D + \varepsilon$ where D is a constant and ε is the country specific shift or shock term. Since the endogenous rate of technological progress, g is thought to be same for all countries and for cross-section regression t is just a fixed number, g in equation is a constant. The above equation can be estimated using Non linear least squares. If the coefficient of log y_0 is > 0 we have conditional beta convergence. However, we would fit the below given linear equation for testing conditional convergence.

Yi.t, t+T = a +b1* log (initial)+b2 *log saving(s)+b3 *log(n+g+δ)+b4*log Life(H) +b5*log Trade(T) +b6*log industry(I)+ ei.t,where ----------(v a)

Yi.t, t+T is average annual growth rate of GDP per capita and log (initial) is log of initial level of GDP per capita,log savings(s) is log of average annual gross domestic savings to GDP ratio,log(n+g+δ) is log of(population growth(n)+rate of growth of technology(g:which is assumed to be constant at 3%)+rate of depreciation(δ:assumed to be constant at 2%)),log of Life(H) is log of life expectancy in initial year.This is proxy for healthy labor force(Human Capital),log of trade openness(T) is log of average annual trade openness to GDP ratio.Trade openness is measured as (nominal exports+nominal imports)/GDP.,Log of industry(I) is log of average annual share of industry value added in GDP.The last three factors are assumed to determine technology levels.

If b1 < 0 and is significantly different from zero, then we say that the data set exhibits conditional beta convergence and we reject the null hypothesis (Ho) of b1=0.

Our theoretical results imply average rate of growth of per capita income levels is a function of initial levels of per capita income levels (negatively related with growth), average saving rate, rate of growth of population (negative impact), human capital(proxied by years of schooling for adult or weighted average of primary,secondary and tertiary enrollment rates or life expectancy as in this study), average share of industry in aggregate income(proxy for technology levels) and average trade openness. The last three factors in the above equation (v) show the impact of technology on growth.The above model is a variant of Mankiw ,Romer Weil(1992) augmented version(with human capital stock) of the Solow model. Mankiw,Romer and Weil (1992) do not however endogenize the technological progress.

In the present study, we would test for absolute convergence and work out the speed for absolute convergence using equations (1) and(iv), respectively **.**We would test for conditional convergence and work out the speed of conditional convergence using equations (v a) and (v) above, respectively.

VI. Discussion of the Results:Absolute Convergence

The Regression results(using 1961-2001 data) show that coefficient of initial level of GDP per capita b is <0(negative) and **significant** for countries in the EU and the EU and EA(East Asia) together(see all results of absolute convergence in Table II).Such results seem to suggest that absolute convergence hypothesis tends to hold for the EU region(all industrialized countries) and for the countries in the EU and East Asian regions together only.The EU countries including UK seem to have same steady state level of incomes implying that convergence hypothesis holds.For the industrialized countries of EU,the assumption that their economies have similar technology levels,investment rates and population growth may not be a bad one.The neoclassical model then would predict convergence,the same as the results confirm.

The rapid growth rates observed from 1960 onwards by most of the countries in East Asian region including China has led such countries to catch up with their richer and industrialized counterparts.Sachs et. al(1997) spell out three major reasons why these countries did better than others(atleast from 1960-1997 till they faced currency and banking crisis in 1997).Such countries tend to have relatively higher share of investment to GDP ratio,greater trade openness and better quality of public institutions .However,more than that is that their labor force participation rates have increased from 1960s and along with relatively high economic growth rates tend to imply higher labour productivity for the whole region(see Table III below).The first column of the Table-III shows that Japan has the highest income per-capita among all the South Asian and East Asian countries. It is followed by Singapore and Hong-Kong. Sri Lanka has the highest per-capita income among all the countries in the South Asian region.The second column of Table III reports a related measure, income per worker in 1997. The difference between the two columns lies in the denominator; the first column divides total GNP by a country's entire population, while the second column divides GNP by only the labor force. The third column reports the 1997 labor force participation rate – the ratio of the labor force to the population. Thailand has

the highest labor force participation rate followed by China and then Japan. Nepal has the highest labor force participation rate among the South Asian countries included in our study. The labor participation rate for Bangladesh, India and Nepal has come down in 1997 from what in was in 1960. For example, India's labor participation rate has come down from 0.45 in 1960 to 0.44 in 1997. While Pakistan and Sri-lanka's labor participation rate have increased.

For all the East Asian countries included in our study the labor participation rates have increased substantially. For example, one may find from the table that China's labor force participation rates have increased from 0.53 in 1960 to 0.59 and so have the economic growth(5.94 from 1960-1997) implying higher labour productivity . Hong-Kong's labor participation rate has increased from 0.39 in 1960 to 0.52 in 1997 ,while for Thailand it has increased from 0.51 to 0.60. It is quite revealing from the Table – III that despite substantial increase in labor force rates for all the East Asian economies included in our study GNP per worker has also increased substantially in the period 1960-1997. This may also indicate the higher efficiency levels of the East Asian economies labor force. We also see from Table – III (column 6) that the bulk of the world's population lives in only two countries : China and India. China with 21.7% of world population had a GNP per capita of 1.5% of that of Japan (column 7) in 1997 and Indian with 17% of the world population had a GNP per capita of 0.9% of that of Japan. Together, these countries account for nearly 38.7% of the world population. In contrast, the 12 countries that make up the rest of the South Asian and East Asian countries account for 14.3% of the total population. Table(III) also shows how the distribution has changed from 1960. In 1960, China and India's share in the world population was 22.1% and 14.4% respectively, while in 1997, China's share has gone down marginally from 22.1% in 1960 to 21.7% in 1997,India share has gone up to 17 % in 1997. While China's GNP per-capita constituted 1.1% of that of Japan in 1960, it is 1.5% in 1997. The corresponding figure for India was 2.2% in 1960, it is only 0.9% in 1997. Such figures for population and GNP per capita indicates that the increase in share of population for India since 1960 has led to its fall in its relative position in terms of GNP per-capita vis-à-vis Japan.

Surprisingly, the empirical results(using data from 1960-2001) show that countries within East Asia do not show absolute convergence(column 4 in Table II).The beta coefficient of initial level of GDP per capita is positive though insignificant.

The regression coefficient for initial level of GDP per capita is negative but insignificant for regions SA+CIS,SA+EU+EA,EU+EA+CIS and SA+EU+EA+CIS implying that no conclusive evidence can be found in favor of absolute convergence of GDP per capita levels across most of the regions.For other regions within and across regions one finds no evidence of convergence of per capita income levels.For example the countries within South Asian(SA) region show no evidence of convergence(positive beta though insignificant).Divergence is certainly present in case of the three CIS countries Russia,Latvia and Georgia.The lack of absolute convergence within and across most of the regions except in EU and EU and EA together may be due to the fact that steady state level of income are not same across such regions.This may be due to the fact that all countries do not have the same investment rates,population growth rates,or technology levels,they are not generally expected to grow towards the same steady state target.Conditional beta convergence would be a better empirical exercise because it reflects the convergence of countries after we control for differences in steady states.It may be not out of place to confirm that conditional convergence is simply a confirmation of a result predicted by the neoclassical growth model:that countries with similar steady states exhibit convergence.It does not mean that all countries in the world are converging to the same steady state,only that they are converging to their own steady states .

The speed of convergence(the rate at which actual GDP per capita reaches common steady state levels) for EU region works out to be 2.56 % in an year[8].These result are in conformity with Barro and Xavier Sala- Martin(1995) who found speed of convergence to be approximately 2 % across EU regions. Kaitila (2004) using panel regression finds speed of convergence of 2.6 %for EU 15 countries using data from 1961-2001(although without differentiating between speed of convergence and beta regression coefficient of the initial level of GDP per capita)[9].The speed of convergence for EUand EA region together works out to be only 0.57% in an year only.Depending on the speed of convergence, the half life of convergence[10] for the EU region worked out to be 26.9 years while for all countries in the EU and the East Asian region worked out to be 121 years. Mankiw Romer and Weil(1992) argue that in the textbook Solow growth model,convergence takes place at a rate of 4%,which would imply that the economy moves half way to its steady state in 17 years.On the other hand,if the textbook model is augmented by human capital,the convergence rate declines to 2% and the economy moves to its steady state in 35 years[11].Higher education makes it easier to adopt new technology.

A useful way to interpret growth rates of different regions from 1961-2001 was provided by Lucas(1988).A convenient rule of thumb used by Lucas is that country growing at g percent per year will double its per capita income every 70/g years.[12]According to this rule,GDP per capita in East Asian region will double approximately in 16 years(70/4.34=16.12),GDP per capita in South Asian region will double in 32 years(70/2.16),GDP per capita in EU region will double in 24 years(70/2.88) and GDP per capita in CIS(3) will double in 48 years(70/1.46).

Table II :Absolute Convergence Results

[8] Non linear least squares have been used to estimate the speed of convergence. SPSS software has been used for some of the regression results .Starting values of zero are given to the parameters involved.

[9] Solving the simple Solovian model(1956) around the steady state under the factor accumulation assumptions of the model gives us the growth equation which relates per capita growth rates nonlinearly to log of initial level of GDP per capita. Equation (Ia) above is the final derived result. It is clear from this equation that speed of convergence parameter λ is different from the beta coefficient of initial level of GDP per capita of equation 1 above.It seems that Kaitila(2004) has missed the point.

[10] Half life of convergence is the time that it takes for half the initial gap between steady state(potential level of GDP per capita) and actual GDP per capita to be eliminated. In the equation $\log \tilde{y}_t = \log \tilde{y}_0 e^{-\lambda t} + (1-e^{-\lambda t}) \log \tilde{y}^*$ (equestion needs to be written clearly) the time t for which log $y^{\sim}$ (actual income)is half way between log $y^{\sim}_0$ (initial income)and log $y^{\sim *}$ (potential level or steady state level of income)satisfies the condition $e^{-\lambda t}$=.5. The half life is therefore log (2)/λ= 0.69/λ (fraction), where .λ denotes speed of convergence. The above equation is derived by solving the Solovian model(1956) around the steady state.

[11] The speed of convergence works out to be$(1-\alpha-\beta)(n+g+\delta)$ in an extended Solovian model(Cobb Douglas production function with human capital - as in Mankiw,Romer and Weil,1992).If α is interpreted to be the elasticity of output with respect to capital and β as elasticity of output with respect to human capital,assuming $\alpha+\beta=0.7$,n=.01 per year(1%),g=.02(2%) and δ=.05(5%) speed of convergence works out to be(0.3*8=2.4% which is approximately similar to the speed of convergence results we have got for EU.

[12] Let y be per capita income at time t and let y0 be some initial value of per capita income.Then $y=y0e^{gt}$.The time it takes per capita income to double is given by the time t^* at which y=2y0.Therefore,$2yo=y0e^{gt}$ implies $t^*=\log 2/g$

					1961-2001							1970-2001			
	Regions	Log of Initial level**	T Value	R2	F Value	Implied Speed#	No.of Obser-vations	Half life of Conver-gence23 (Years)	Log of Initial level**	T Value	R2	F Value	Implied Speed#	No.of Obser-vations	Half life of Conver-gence23 (Years)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
1	EU16	-0.92*	-4.28	0.57	18.33	2.56	16	26.9	-0.82*	-2.24	0.26	0.78	1.72	16	40.1
2	SA(5)	1.29	1.14	0.3	1.3	-0.83	5		1.16	1.39	0.39	1.93	-0.77	5	
3	EA (8)	0.01	0.03	0.01(R)	0.001	-0.01	8		-0.37	-0.88	0.12	0.78	0.46	8	
4	CIS*	2.27	3.51	0.92	12.34	-1.18	3								
5	SA+EU+EA	-0.07	-0.5	0.01	0.25	0.06	29		-0.2	-1.41	0.07	2.01	0.22	29	
6	SA+EU+EA+CIS3	-0.01	-0.07	.01(R)	0.005	0.0096	32								
7	SA(5)+EU(16)	0.12	1.31	0.08	1.72	-0.11	21		0.004	0.45	0.01	0.21	-0.04	21	
8	SA(5)+EA(8)	0.44	1.38	0.15	1.91	-0.36	13		0.14	0.43	0.02	0.19	-0.13	13	
9	SA(5)+CIS(3)	-0.13	-0.36	0.021	0.13	0.14	8								
10	EU(16)+EA(8)	-0.44*	-2.9	0.28	8.46	0.57	24	121	-0.63*	-3.85	0.4	14.81	0.99	24	69.6
11	SA5+EU(16)+CIS(3)	0.19	1.88	0.14	3.51	-0.17	24								
12	EU(16)+EA(8)+CIS(3)	-0.25	-1.39	0.072	1.94	0.28	27								
13	EU(16)+CIS(3)	0.3	1.41	0.11	1.98	-0.26	19								
14	EA(8)+CIS(3)	0.02	0.04	0.012(R)	0.002	-0.02	11								
					1980-2001							1990-2001			
	Regions	Log of Initial level**	T Value	R2	F Value	Implied Speed#	No.of Obser-vations	Half life of Conver-gence23 (Years)	Log of Initial level**	T Value	R2	F Value	Implied Speed#	No.of Obser-vations	Half life of Conver-gence23 (Years)
	(1)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)	(29)
1	EU16	-0.63	-1.03	0.07	1.07	0.99	16		-0.72	-0.84	0.05	0.7	1.27	16	
2	SA(5)	0.34	0.94	0.23	0.88	-0.29	5		0.06	0.06	0.001	0.003	-0.062	5	
3	EA (8)	-0.55	-1.14	0.18	1.31	0.8	8		-0.64	-1.33	0.23	1.76	1.02	8	
4	CIS*								-0.54	-0.57	0.04	0.33	0.77	10	
5	SA+EU+EA	-0.32*	-2.17	0.15	4.72	0.38	29	181.6	-0.31	-1.9	0.12	3.61	0.36	29	
6	SA+EU+EA+CIS3	-0.24	-1.33	0.06	1.77	0.28	31		0.24	0.94	0.023	0.88	-0.22	39	
7	SA(5)+EU(16)	-0.66	-1.41	0.1	2	1.07	21		-0.15	-0.99	0.05	0.99	0.15	21	
8	SA(5)+EA(8)	-0.11	-0.34	0.01	0.12	0.11	13		-0.21	-0.68	0.04	0.47	0.24	13	
9	SA(5)+CIS(3)	-1.18	-1.76	0.38	3.1	23.17	7		-2.36*	-3.67	0.51	13.51	18.14	15	3.8
10	EU(16)+EA(8)	-0.69*	-3.31	0.33	10.94	1.16	24	59.5	-0.66*	-2.72	0.25	7.39	1.08	24	63.8
11	SA5+EU(16)+CIS(3)	-0.03	-0.18	0.002	0.033	0.03	23		0.48	1.84	0.11	3.4	-0.39	31	
12	EU(16)+EA(8)+CIS(3)	-0.41	-1.46	0.08	2.13	0.52	26		0.62	1.97	0.11	3.89	-0.48	34	
13	EU(16)+CIS(3)	1.25	3.1	0.38	9.64	-0.81	18		1.4	5.74	0.58	32.9	-0.87	26	
14	EA(8)+CIS(3)	-0.47	-0.7	0.06	0.48	0.63	10		0.34	0.5	0.02	0.25	-0.29	18	

* CIS = 3 countries in 1961-2001

* CIS = 2 countries in 1980-2001

* CIS = 10 countries in 1990-2001

**log of initial level of GDP per capita negative and significant value(*) imply absolute convergence.

Implied Speed of Convergence (+)/Divergence(-) In a year (%)

Source:Authors Calculations

TABLE III: Growth and Development among Selected South and East Asian Economies

	GNPPC(Constant 1995 us $) in 1997 & GDPPC(Constant 1995 US$) IN 2002	GNPPW(Constant 1995 us $) in 1997 (1960) & GDPPW(Constant 1995 US$) IN 2002	Labor force participation rate in 1997 (2002)	Labor force participation rate in 1960	years to double[13]	Population/ world population in 1997 (1960) (2002)	GNPCC/ GNPPC Of Japan In 1997 & GDPPC/ GDPPC of Japan(2002)	GNPPC/GNPCC of Japan in 1960	Average annual growth rates of PCGNP (1960-1997) & PCGDP(1960-2002)
Bangladesh	351.622 396.20	689.456 (396.58) 742.51	0.51 (0.533	0.54	47.803	0.022 (.017) 0.0219	0.008 0.008	0.026	1.45 (1.300)
China	667.858 944.12	1113.097 (172.84) 1571.4	0.59 0.600	0.53	11.669	0.217 (.221) 0.2071	0.015 0.020	0.011	5.94 (5.932)
Hong Kong,	23646.947 25455	45474.174 (7747.34) 48120.	0.52 0.529	0.39	11.950	0.001 (.001) 0.0010	0.543 0.565	0.368	5.8 (5.256)
India	391.7436 493.27	890.337 (399.87) 1100	0.44 0.448	0.450	27.615	0.170 (.144) 0.1696	0.009 0.010	0.022	2.51 (2.469)
Indonesia	1095.591 1059.8	2331.089 (641.50) 2154.1	0.47 0.492	0.39	16.823	0.035 (.031) 0.0342	0.025 0.023	0.030	4.12 (3.592)
Japan	43574.383 45029	80692.75 (17097.94 84182	0.539 0.534	0.48	14.810	0.022 (.031) 0.0205	1 1	1	4.68 (4.147)
Korea, Rep.	11027.925 14279	22056.05 (3713.90) 27684	0.5 0.515	0.33	11.215	0.008 (.008) 0.0077	0.254 0.317	0.149	6.18 (5.889)
Malaysia	4468.503 4806.4	11171.251 (2741.08) 11368	0.4 0.422	0.35	16.195	0.004 (.003) 0.00393	0.103 0.106	0.117	4.28 (3.932)
Nepal	215.851 240.67	469.2467 (277.57) 515.03	0.460 0.467	0.54	67.295	0.004 (.003) 0.0039	0.005 0.005	0.0183	1.03 (1.350)
Pakistan	501.99 518.40	1356.724 (500.94) 1358.8	0.369 0.381	0.36	24.406	0.023 (.015) 0.0234	0.012 0.011	0.022	2.84 (2.567)
Philippines	1170.460 1208.9	2786.796 (1845.16) 2826.6	0.42 0.427	0.38	47.803	0.0130 (.009) 0.0129	0.027 0.026	0.085	1.45 (1.272)
Singapore	32486.066 27254	64971.806 (10038.18 55383	0.5 0.492	0.33	10.779	0.001 (.0004) 0.0006	0.746 0.605	0.404	6.43 (5.709)
Sri Lanka	770.176 898.81	1791.069 (772.60) 2027.1	0.43 0.443	0.36	24.667	0.003 (.003) 0.0030	0.018 0.019	0.034	2.81 (2.793)
Thailand	2821.170 3000.3	4701.990 (883.98) 4934.	0.6 0.6081	0.51	13.538	0.011 (.009) 0.0099	0.065 0.066	0.055	5.12 (4.607)

Source:Authors calculations from the World Bank,World Development Indicators,1999 and 2004

Using data from 1970-2001 ,beta coefficient for log of initial level of GDP per capita is negative and significant for two regions,the EU and EU and EastAsia(EA) together implying absolute convergence exist for such regions(See Table II).The speed of convergence works out to

[13] please look at footnote no.12 for calculating years to double.

be is 1.72%(the speed at which the actual GDP per capita approaches the steady state level of GDP per capita) for countries in the EU while it is 0.99% for countries of the EU and EA regions together.Depending on the speed of convergence, the half life of convergence for the EU region worked out to be 40.1 years while for all countries in the EU and the East Asian region worked out to be 69.6 years.The speed of convergence figures are lower for EU and higher for EU+EA together as compared to the corresponding figures for the period 1961-2001.Beta coefficient for the initial level of GDP per capita is negative but insignificant for EA only and SA,EU and EA together.There is no evidence of absolute convergence among countries in the South Asian region,South Asian and East Asian region together and South Asian and EU region together.

Using data from 1980-2001 we find negative and significant beta coefficient for initial level of GDP per capita for the countries in the EU and East Asian(EA) regions together and also for the countries in the South Asian(SA),EU and EA regions together implying absolute convergence for such regions(see Table II).This phenomenon may be due to faster growth of SA region since 1980s.There is no evidence of convergence of GDP per capita levels of the nations in the EU and two CIS republics of Moldova and Estonia together.The beta coefficients for all other regions except South Asian region show negative but insignificant beat coefficient for initial level of GDP per capita implying tendency for convergence of the regions from 1980 onwards.South Asian region show no evidence of convergence in the periods 1961-2001 and 1970-2001. The speed of convergence in the EU and EA region together worked out to be 1.16 % showing increasing trend from earlier periods 1961-2001 and 1970-2001.This feature shows that the East Asian economies are quickly (relatively) catching up with the European nations. The speed of convergence for all countries in the SA, EU and EA worked out to be 0.385% in an year. Depending on the speed of convergence, the half life of convergence for all the countries in the EU and EA region together worked out to be 59.5 years while for all countries in the SA, EU and the East Asian region together worked out to be 181.6 years.

Using data from 1990-2001,we find negative and significant coefficients for initial level of GDP per capita for the countries in the EU and East Asian regions together(speed of convergence of more than 1 % with half life of convergence to be 63.8 years) and also for the countries in the South Asian and CIS regions together implying absolute convergence(with half life of convergence to be 3.8 years) for such regions(see Table II).The South Asian countries it seems are catching up in terms of GDP per capita with the newly formed republics of erstwhile Soviet Union since 1990s.The South Asian regions have shown relatively higher growth rates in 1990s while the newly formed CIS nations had difficult period of negative growth rates.However,there is no evidence of absolute convergence in terms of reaching the common GDP per capita levels for countries in the South Asian regions(as in earlier periods), the EU,EA and CIS together, the SA,EU,EA and CIS together,EA and CIS together and SA,EU and CIS together. For all other groups (which do no have CIS) we see negative but insignificant beta coefficient implying tendency towards convergence.

In summary, only countries in the EU and East Asian regions together have shown uniform evidence of absolute convergence in all periods 1961-2001,1970-2001,1980-2001 and 1990-2001. The speed of absolute convergence for such region had shown an increasing trend till1990.While countries in the EU has shown significant evidence of absolute convergence in two periods ,1961-2001 and 1970-2001, there is no convincing case for absolute convergence in the last two periods of 1980-2001 and 1990-2001.This later evidence with declining rate of economic growth for the EU since 1961(see Table I) may be a worrying sign for designing EUs regional policies which also have to cope up with many East European and Baltic nations who joined the EU on May 1,2004 .The South Asian regions in all periods have shown no evidence of convergence in their GDP per capita levels.Since 1980s,however, we do see some evidence of absolute convergence for all countries in South Asia,EU and East Asia.

VII.Conditional Convergence Results

Conditional convergence is defined as the existence of an inverse relationship between initial level of per capita GDP and its subsequent growth once one controls for the determinants of the steady state level of GDP per capita. Countries that are poor relative to their own steady state do tend to grow more rapidly. It does not mean that all countries in the world are converging to the same steady state state , only that they are converging to their own steady states according to a common theoretical model. The prediction of the above model can explain differences in growth rates across countries/regions.

Equation (v a) has been estimated to examine the effect of initial level of GDP per capita along with other factors on GDP per capita growth rate(1961-2001).Table IV give the regression results.Table IV includes data on all the three regions,EU,EA and SA which comprises of 29 countries in all.Speed of convergence(λ) and elasticity of output with respect to capital(α) is found by estimating equation (v) by nonlinear least squares.Starting values of zero are given for the parameters involved.

We find that from Table IV that coefficient of initial level of log GDP per capita is negative and significant across almost all regression equations from column 2 through column 6 and column 8 signifying inverse relationship between growth rate of per capita GDP and initial level of GDP per capita.Such results suggest conditional convergence among EU,EA and South Asian regions together.Each country in the sample is converging to its own steady state level (potential) level of GDP per capita.The F values for all estimated regression equation in Table IV are significant implying overall significance for all regression coefficients. However,average annual domestic savings rate(log of savings) is another factor which is positive and significantly affects growth rate across all the estimated regression equations.The regression coefficients for log($n+g+\delta$) , log trade openness and log of life expectancy have the right signs but are insignificant in most of the regression equations .Regression equations in columns 7 and 8 depict that trade openness becomes an insignificant factor once domestic savings rate are included in the regression equation.This may mean that trade openness affects growth via the savings rate channel as well.This result is in conformity with the study by Levine and Renelt(1992).The coefficient for log of industry value added as % of GDP does not show the usual sign.It is negative and insignificant.It seems to capture the importance and increase of service sector value added in GDP.

The speed of conditional convergence ranges from 0.26 %-1.82 % in an year.Speed of convergence is maximum(1.82%) when all the variables are included in the regression equation(Column 6).The elasticity of output which is also estimated directly by equation V ranges from 0.77 to 0.91 implying that capital is to be interpreted as broad capital inclusive of human capital stock[14].It seems that human capital not only affects technological progress(as in the theoretical model spelt out earlier) but affects output levels directly by increasing capital stock levels(assumption of including human capital stock in the production function is appropriate;as in Mankiw,Romer and Weil,1992).

Half life of convergence is the least when all variables are included(column 6).

Table IV:Test for Conditional Convergence:European Union,East Asia,& South Asia

Independent Variables	Dependent Variable: Average Annual GDP Per Capita(1961-2001) Regions Included:East Asia(8)+South Asia(5)+ EU(16)=29 observations						
	Column2	Column3	Column4	Column5	Column6	Column7	Column8
Constant	-3.618a	0.846	-11.272	-7.567	-3.904	1.033	-3.741a

[14] The Solow model generally assumes $\alpha = 1/3$.Higher values of α implies interpreting capital inclusive of physical,human and knowledge capital.

	(-2.827)	(.199)	(-1.511)	(-.887)	(-0.437)	(0.741)	(-2.862)
Ln initial level of GDP per capita(negative and significant value imply Conditional convergence) (t value)	-0.235* (-2.748)	-0.374* (-2.451)	-0.765* (-3.074)	-0.789* (-3.140)	-0.86* (-3.378)	-0.175 (-1.383)	-0.247* (-2.797)
Ln average savings(as % of GDP) (t value)	2.747* (6.63)	2.879* (6.704)	2.759* (6.690)	2.600* (5.784)	3.202* (4.887)		2.593* (5.417)
Ln(n+g+δ) (t value)		-2.091 (-1.098)	-1.837 (-1.014)	-2.840 (-1.334)	-3.642 (-1.656)		
Ln life Expectancy 1961 (t value)			3.678* (1.93)	3.121 (1.555)	3.325 (1.671)		
Ln Average trade openess(as % of GDP) (t value)				0.259 (0.905)	0.168 (0.577)	0.833* (2.606)	0.167 (0.662)
Ln Average Industry Value added(as % of GDP) (t value)					-1.168 (-1.250)		
R^2	0.632	0.649	0.696	0.707	0.726	0.214	0.639
F	22.355a	15.424a	13.768a	11.095a	9.732a	3.549a	14.728a
No.of Observations	29	29	29	29	29	29	29
Implied Speed of Conditional Convergence(+) in an year(in %)	0.26	0.55	1.71	1.50	1.82	0.1917	0.28
Implied Elasticity of Output with respect to capital(α)	0.92	0.87	0.77	0.77039	0.7928		0.91
Half Life of Convergence(in years)	265	125	40	46	38	363	246

* significant at 5 % level of significance(one tailed)
** significant at 6 % level of significance(one tailed)
a:significant at 5 % level of significance

Table V includes data on only one region :EU.It has 16 countries of Europe.We find that from Table V that coefficient of initial level of log GDP per capita is negative and significant across all regression equations i.e., from column 2 through column 8 signifying inverse relationship between growth rate of per capita GDP and initial level of GDP per capita.Such results suggest conditional convergence within the EU.Each country in the sample is converging to its own steady state level (potential) level of GDP per capita.The F values for all estimated regression equation in Table V are significant implying overall significance for all regression coefficients.Average annual domestic savings rate(log of savings) is also another factor which positively and significantly affects growth rate across all the estimated regression equations .The regression coefficient for log of trade openness has the right sign and is significant in most of the regression equations(column 5,7 and 8).Regression equations in columns 7 and 8 depict that trade openness and domestic savings rate are both significant factors affecting growth rate of GDP per capita.The regression coefficients for log of life expectancy have the reverse sign(negative) and it is insignificant(for right tailed test), therefore, we accept the null hypothesis of b4=0.The latter result suggest that those European countries which had lower life expectancy at the initiation of the growth process, grew at a faster rates.The regression

coefficient for log of (n+g+δ) also has a reverse sign to what was hypothesized.It comes with a positive sign and is insignificant(left tailed test).More labour resources would mean more newer ideas and therefore higher growth in industrialized economies(Romer,1986).The coefficient for log of industry value added as % of GDP does not show the usual sign.It is negative and insignificant(right tailed test).It seems to capture the importance and increase of service sector value added in GDP and decline of secondary and primary sectors value added in GDP.

The speed of conditional convergence ranges from 18.008 %-21.335 % in an year for the EU nations.Speed of conditional convergence is maximum(21.335 % in an year) when explanatory variables like average domestic savings rate,trade openness as % of GDP and initial level of GDP per capita are included in the growth equation(column 8).Government policies that may focus on increasing savings rate and increase trade with all countries tend to have maximum advantage in Europe[15].The elasticity of output which is also estimated directly by equation V ranges from 0.564 to 0.679 implying that capital is to be interpreted as broad capital inclusive of human capital stock.Half life of convergence is the least(3.23 years) when the speed of conditional convergence is maximum(column 8)

Table V:Test for Conditional Convergence:European Union

Independent Variables	Dependent Variable: Average Annual GDP Per Capita(1961-2001) Regions Included: EU(16)=16 observations						
	Column2	Column3	Column4	Column5	Column6	Column7	Column8
Constant	7.642a (5.948)	6.078 (1.738)	24.595a (3.092)	21.525a (2.901)	22.195a (2.563)	9.968a (6.733)	7.807a (7.136)
Ln initial level of GDP per capita (negative and significant value imply conditional convergence) (t value)	-1.319* (-9.423)	-1.296* (-8.558)	-1.027* (-6.195)	-1.092* (-7.057)	-1.095* (-6.697)	-1.087* (-6.669)	-1.311* (-11.02)
Ln average savings (as % of GDP) (t value)	2.319* (5.613)	2.201* (4.481)	1.982* (4.733)	1.696* (4.120)	1.712* (3.869)		1.776* (4.275)
Ln(n+g+δ) (t value)		1.016 (0.483)	3.121 (1.604)	2.115 (1.142)	2.031 (1.013)		
Ln life Expectancy 1961 (t value)			-5.615 (-2.502)	-4.392 (-2.047)	-4.444 (-1.952)		
Ln Average trade openess(% of GDP) (t value)				0.253* (1.825)	0.252 (1.724)	0.667* (3.668)	0.345* (2.449)
Ln Average Industry Value added (% of GDP) (t value)					-0.0946 (-0.179)		
R^2	0.874	0.876	0.921	0.941	0.942	0.787	0.916
F	44.894a	28.241a	32.028a	31.718a	23.878a	24.052a	43.433a
No.of Observations	16	16	16	16	16	16	16
Implied Speed of Conditional Convergence(+) in an year(in %)	20.464	20.853	19.813	21.0351	17.892	18.008	21.335
Implied Elasticity of Output with respect to capital(α)	0.648	0.65	0.679	0.6047	0.603		0.564
Half Life of Convergence(in years)	3.37	3.30	3.48	3.28	3.85	3.831	3.23

* significant at 5 % level of significance(one tailed)
** significant at 6 % level of significance(one tailed)
***significant at 10 % level of significance(one tailed)
a:significant at 5 % level of significance

[15] In general, multilateral trade liberalization under the WTO seems to a better policy than the sectoral and regional trade liberalization efforts of countries (Mathur,2002).

Table VI includes data on TWO regions :EU and EA.There are 24 countries in the sample.We find that from Table VI that coefficient of initial level of log GDP per capita is negative and significant across all regression equations i.e., from column 2 through column 8 signifying inverse relationship between growth rate of per capita GDP and initial level of GDP per capita.Such results suggest conditional convergence within the EU and EA regions together.Each country in the sample is converging to its own steady state level (potential) level of GDP per capita.The F values for all estimated regression equation in Table VI are significant implying overall significance for all regression coefficients. Average annual domestic savings rate(log of savings),log of (n+g+δ) and log of life expectancy are some factors which come with the usual sign and significantly affects growth rate across almost all the estimated regression equations .The regression coefficient for log of trade openness has the right sign and is significant in the regression equation shown in column 7 only .Regression equations in columns 7 and 8 depict that trade openness becomes an insignificant factor once domestic savings rate are included in the regression equation.The coefficient for log of industry value added as % of GDP does not show the usual sign.It is negative and insignificant(right tailed test).It seems to capture the importance and increase of service sector value added in GDP and decline of secondary and primary sectors value added in GDP.

The speed of conditional convergence ranges from 0.287 %-22.689 % in an year for the EU and EA nations together.Speed of conditional convergence is maximum(22.689 % in an year) when all explanatory variables are included in the growth equation(column 6).Government policies that may focus on increasing savings rate , trade openness, increasing life expectancy, favoring the services sector and reducing population growth tend to have maximum advantage in terms of increasing growth rates and speed of convergence when European and East Asian nations are included. The elasticity of output which is also estimated directly by equation V ranges from 0.781 to 0.91. Half life of convergence is the least(3.04 years) when the speed of conditional convergence is maximum(column 6)

TABLE VI: Test for Conditional Convergence:European Union and East Asia

Independent Variables	Dependent Variable: Average Annual GDP Per Capita(1961-2001) Regions Included: EU(16)+East Asia(8)= 24observations						
	Column2	Column3	Column4	Column5	Column6	Column7	Column8
Constant	-3.833 (1.353)	1.720 (0.376)	-30.215a (-3.309)	-26.649a (-2.677)	-18.713 (-1.541)	4.713a (2.676)	-3.737 (-1.280)
Ln initial level of GDP per capita(negative and significant value imply conditional convergence) (t value)	-0.250* (-2.018)	-0.424* (-2.552)	-1.573* (-4.782)	-1.597* (-4.820)	-1.572* (-4.769)	-0.455* (-3.173)	-0.260* (-1.975)
Ln average savings(as % of GDP) (t value)	2.856* (4.085)	3.438* (4.411)	3.977* (6.418)	3.793* (5.802)	4.014* (5.919)		2.743* (3.334)
Ln(n+g+δ) (t value)		-3.366 (-1.517)	-4.787* (-2.723)	-5.730* (-2.807)	-6.073* (-2.963)		
Ln life Expectancy 1961 (t value)			10.156* (3.795)	9.644* (3.514)	8.719* (3.064)		
Ln Average trade openess(as % of GDP) (t value)				0.242 (0.92)	0.16 (0.591)	0.570* (1.822)	0.0821 (0.278)
Ln Average Industry Value added(as % of GDP) (t value)					-1.161 (-1.124)		

R^2	0.598	0.639	0.795	0.804	0.817	0.376	0.599
F	15.591a	11.805a	18.385a	14.759a	12.689a	6.336a	9.963a
No.of Observations	24	24	24	24	24	24	24
Implied Speed of Conditional Convergence(+) in an year(in %)	0.287	0.559	19.456	20.143	22.689	0.6075	0.301
Implied Elasticity of Output with respect to capital(α)	0.91	0.889	0.788	0.781	0.792		0.91
Half Life of Convergence(in years)	246.42	123	3.54	3.425	3.041	113	229

* significant at 5 % level of significance(one tailed)
** significant at 6 % level of significance(one tailed)
***significant at 10 % level of significance(one tailed)
a:significant at 5 % level of significance

Table VII includes data on the two regions,EU and SA which comprises of 21 countries in all. Table VII give the regression results.

We find that from Table VII that coefficient of initial level of log GDP per capita is negative and significant across for regression equations in column 3 through column 6 signifying inverse relationship between growth rate of per capita GDP and initial level of GDP per capita.Such results suggest conditional convergence among EU and South Asian regions together.Each country in the sample is converging to its own steady state level (potential) level of GDP per capita.The F values for all estimated regression equation in Table VII are significant(except regression equation in column 7) implying overall significance for all regression coefficients. However,average annual domestic savings rate(log of savings) is one factor which is positive and significantly affects growth rate almost across all the estimated regression equations(except in column 6).The regression coefficients for log($n+g+\delta$) have the right sign but are insignificant in most of the regression equations.Log of life expectancy,log of trade openness and log of industry value added have the right signs but are insignificant in most of the regression equation.Regression equations in columns 7 and 8 depict that trade openness is an insignificant factor if we include domestic savings rate or do without it in the regression equation.

The speed of conditional convergence ranges from 0.79 %-0.88 % in an year.Speed of convergence is maximum(0.88%) when four variables are included in the regression equation(Column 4).The elasticity of output which is also estimated directly by equation V ranges from 0.64 to 0.71 .Half life of convergence is the least when four variables are included in the growth per capita regression equation(column 4).

TABLE VII: Test for Conditional Convergence:European Union and South Asia

Independent Variables	Dependent Variable: Average Annual GDP Per Capita(1961-2001) Regions Included: EU(16)+South Asia(5)= 21observations						
	Column2	Column3	Column4	Column5	Column6	Column7	Column8
Constant	-1.272 (-.835)	9.622 (1.525)	-5.169 (-.507)	-2.920 (-.282)	-6.242 (-.587)	0.417 (0.380)	-1.692 (-1.080)
Ln initial level of GDP per capita(negative and	-0.138 (-0.985)	-0.487* (-2.052)	-0.634* (-2.672)	-0.665* (-2.799)	-.600* (-2.485)	.01456 (0.137)	-0.167 (-1.171)

significant value imply conditional convergence) (t value)							
Ln average savings(as % of GDP) (t value)	1.702* (2.215)	1.892* (2.576)	1.467* (2.008)	1.291** (1.735)	.990 (1.268)		1.439* (1.792)
Ln(n+g+δ) (t value)		-4.884* (1.773)	-2.650 (-.92)	-3.272 (-1.121)	-2.247 (-.744)		
Ln life Expectancy 1961 (t value)			3.221* (1.786)	2.810 (1.534)	2.083 (1.086)		
Ln Average trade opennes(as % of GDP) (t value)				0.327 (1.095)	0.384 (1.282)	0.530 (1.605)	0.352 (1.075)
Ln Average Industry Value added(as % of GDP) (t value)					1.386 (1.150)		
R^2	0.279	0.392	0.493	0.531	0.571	0.198	0.325
F	3.491a	3.652a	3.890a	3.390a	3.106a	2.221	2.7333***
No.of Observations	21	21	21	21	21	21	21
Implied Speed of Conditional Convergence(+)/divergence(-) in an year(in %)		-.0375 (insignificant)	0.885	0.8849	0.7944		
Implied Elasticity of Output with respect to capital(α)			0.713	0.6910	0.6410		
Half Life of Convergence(in years)			78	77	86		

* significant at 5 % level of significance(one tailed)
** significant at 6 % level of significance(one tailed)
a:significant at 5 % level of significance
***significant at 10 % level of significance

Table VIII below includes in the sample countries from East Asia and South Asia.There is no convincing evidence of conditional convergence in all the regression equations.The coefficient for log of initial level of GDP per capita is negative but is insignificant.Only regression coefficient of domestic savings as % of GDP is positive and significant across regression equations All other variables except log of average industry share in GDP comes with the usual sign. All variables besides domestic savings rate are insignificant. However, the F values are almost all significant in all regression equations.It seems that there are more important factors in this region,particularly in South Asian Region, besides the ones taken in the study which can have impact on the degree of convergence .These may be higher infrastructure spending,efficient bureaucracy ,less corruption, less restrictive labor regulations,policy stability,rule of law,understanding institutions,among others.It is upto future research that could quantify such factors and generate time series data on such factors over long time period.

TABLE VIII:Test for Conditional Convergence:East Asia and South Asia

Independent Variables	Dependent Variable: Average Annual GDP Per Capita(1961-2001) Regions Included: EA(8)+South Asia(5)= 13 observations						
	Column2	Column3	Column4	Column5	Column6	Column7	Column8
Constant	-4.894a (-3.016)	2.257 (0.295)	-2.719 (-.221)	13.340 (0.735)	8.635 (0.466)	-.913 (-.393)	-4.990a (-2.892)

Ln initial level of GDP per capita(negative and significant value imply conditional convergence) (t value)	-.0674 (-.324)	-0.121 (-.557)	-.301 (-.736)	-0.222 (-.548)	-.402 (-.922)	.232 (0.672)	-.0861 (-.382)
Ln average savings(as % of GDP) (t value)	2.817* (4.950)	2.745* (4.761)	2.697* (4.436)	2.185* (2.976)	3.526* (2.406)		2.732* (4.194)
Ln(n+g+δ) (t value)		-3.385 (-.957)	-3.230 (-.873)	-7.974 (-1.477)	-5.673 (-.981)		
Ln life Expectancy 1961 (t value)			1.515 (0.529)	-0.631 (-.189)	0.692 (0.196)		
Ln Average Trade openness (as % of GDP) (t value)				0.661 (1.182)	0.233 (.339)	0.722 (1.348)	0.117 (0.326)
Ln Average Industry Value added(as % of GDP) (t value)					-1.855 (-1.055)		
R^2	0.753	0.776	0.783	0.820	0.848	0.279	0.756
F	15.251a	10.387a	7.237a	6.357a	5.567a	1.937	9.294a
No.of Observations	13	13	13	13	13	13	13
Implied Speed of Conditional Convergence(+)/divergence(-) in an year(in %)							
Implied Elasticity of Output with respect to capital(α)							
Half Life of Convergence(in years)							

* significant at 5 % level of significance
** significant at 6 % level of significance
***significant at 10 % level of significance
a:significant at 5% level of significance

In summary ,conditional convergence is prevalent among almost all pairs of regions in our sample except East Asian and South Asian nations together.Domestic savings rate as % of GDP is one robust factor across all regression equations and samples.Average trade openness as % of GDP, and average annual rate of growth of population have positive and negative influence on growth rates respectively.Life expectancy in the initial years tend to have positive impact on growth per capita GDP.In Europe,however rate of growth of population has positive influence on growth per capita GDP while life expectancy in the initial year have negative influence on GDP per capita.Average industry value added as % of GDP most of times enters negatively in the regression equation signifying the rise of services sector value added in GDP across regions.

Speed of conditional convergence ranges from 0.2 % in an year to 22%.In the European nations the speed of conditional convergence works out be nearly 20 % unlike the speed of absolute convergence which hovered around 2 %.Such results would mean that countries in Europe are converging very quickly to their own potential level of incomes per capita but not to a common potential level of income per capita.The elasticity of output which is also estimated directly by equation V ranges from 0.54 to 0.91 implying that capital is to be interpreted as broad capital inclusive of human capital stock.It seems that human capital not only affects technological

progress(as in the theoretical model spelt out earlier) but affects output levels directly by increasing capital stock levels(assumption of including human capital stock in the production function is appropriate;as in Mankiw,Romer and Weil,1992).

VIII. Conclusion,Policy Implications and Limitations of the Study

The study is an attempt to understand and re-examine the convergence process (relatively poorer states catching up with richer counterparts)in the four regions included in our study from 1961 to 2001. Only EU and East Asian countries together have shown uniform evidence of absolute convergence in all periods 1961-2001,1970-2001,1980-2001 and 1990-2001. East Asian nations are catching up with their richer counterparts despite the setback in their economic growth performance in the late 1990s due to the currency and banking crises in the region.This(resilience) of the most of the East Asian economies like South Korea,Thailand, Indonesia, among others may be due to their higher labour productivity, quality of institutions, higher trade openness and relatively higher savings rate. While EU as a region has shown significant evidence of absolute convergence in two periods ,1961-2001 and 1970-2001, there is no convincing statistical evidence in favor of absolute convergence in the last two periods : 1980-2001 and 1990-2001.This latter evidence with declining rate of economic growth for EU since 1961(see Table I) points to a challenge for designing EUs regional policies which also have to cope up new entrants- East European and Baltic nations(ten in all at this stage) who joined EU on May 1,2004.Low growth is linked to high unemployment and the failure of the labor market as well to the unsolved problems in the systems of social security. This may require good governance and institutional changes.

Under current EU rules, regions with a per capita GDP of less than 75 percent of the EU average automatically qualify for EU regional aid under the so-called Objective 1 facility. With the accession of the East Europeans, average EU GDP will drop by about 10 percentage points. This means that many of the regions that currently have GDP per head less than 75 percent of the EU average, and so qualify for regional support, will no longer do so. As a result, all Germany's new states, all but two Spanish legions, and all but one region in Italy will no longer qualify for Objective I funding. In addition, GDP pet head in Spain will move above 90 percent of the EU average, which means that it will no longer qualify for cohesion fund money.

The speed of absolute convergence in the four periods range between 0.99-2.56 % in an year(2% for the EU as worked out by Barro and Xavier Sala-i-Martin,1995 for European regions) for EU while it ranges between 0.57-1.16 % in an year for the countries in East Asia and EU regions together. There is no evidence of convergence of GDP per capita incomes among the South Asian countries in all periods and some major CIS republics since 1966.Divergence in GDP per capita incomes among the South Asian nations over a period of time will be challenge

for the policy makers who are keen on forming the South Asian Free Trade Association. Unless efforts are made to legalize trade channels and promote trade based on comparative advantage, there may not be much gain in regional liberalization efforts. However, statistical evidence shows that there is tendency for absolute convergence between countries of South Asia,East Asia and European Union particularly after the 1980s. The relatively inferior economic growth performances of some of the CIS republics particularly Russia have shown why socialism did not prosper in such countries .Most of the Eastern block nations and Russian federation are now keen to join the EU as they are eager to raise their living standards and catch up with their richer counterparts.

Conditional convergence is prevalent among almost all pairs of regions in our sample except East Asian and South Asian nations together.It seems that there are more important factors particularly in South Asian Region, besides the one taken in the study namely the initial level of GDP per capita, which can have deeper impact on convergence of incomes. These may be policies directed towards higher infrastructure spending, making bureaucracy efficient, reducing corruption, more open economies, less restrictive labor regulations, achieving political stability, implementing rule of law,understanding institutions,among others.It is upto future research to quantify such factors and generate time series data on such factors over long time period.The Global Competitive Report(2003-04) is one such attempt.

Domestic savings rate as % of GDP is one robust factor across all regression equations and samples.Average trade openness as % of GDP, and average annual rate of growth of population have positive and negative influence on growth rates respectively.Life expectancy in the initial years tend to have positive impact on growth per capita GDP.In Europe,however rate of growth of population has positive influence on growth per capita GDP while life expectancy in the initial year have negative influence on GDP per capita.Average industry value added as % of GDP most of times enters negatively in the regression equation signifying the rise of services sector value added in GDP across regions and its impact on growth of per capita incomes.

Speed of conditional convergence ranges from 0.2 % in an year to 22%.In the European nations, the speed of conditional convergence works out be nearly 20 % unlike the speed of absolute convergence which hovered around 2 %.Such results would mean that countries in Europe are converging very quickly to their own potential level of incomes per capita but not so quickly to a common potential level of income per capita.The elasticity of output which is also estimated directly by estimating equation V ranges from 0.54 to 0.91 implying that capital is to be interpreted as broad capital inclusive of human capital stock.It seems that human capital not only affects technological progress(as in the theoretical model spelt out earlier) but affects output levels directly by increasing capital stock levels(assumption of including human capital stock in the production function is appropriate;as in Mankiw,Romer and Weil,1992).

The results for the speed of convergence favors use of an extended Solovian model inclusive of human capital.Conditional beta convergence seems to be a better empirical exercise(as evident from our theoretical model and empirical results) because it reflects the convergence of countries after we control for differences in steady states .Conditional convergence is simply a confirmation of a result predicted by the neoclassical growth model:that countries with similar steady states exhibit convergence.It does not mean that all countries in the world are converging to the same steady state,only that they are converging to their own steady states

For research in future,conditional convergence can be tested using cross sectional average data on pertinent growth factors like corruption perception indices, rule of law index, social capital and trust variables, formal and informal rules governing the society, among others. It will be interesting to find out the speed of conditional convergence by including such variables in the per capita growth equation .

This study does not test for cluster convergence (Giles, 2001,Stroomer and Giles, 2003). This methodology uses 'fuzzy sets' to cluster the data (for one series) for the different countries in the sample, with the purpose of measuring the distance between the centers of these clusters at each point in time. If the centers of the fuzzy clusters move towards each other over time, this represents a particular type of convergence in the variable in question (e.g. in output, or in life expectancy, gini coefficient, among other indicators of quality of life). However, we have not attempted this approach in the present paper. The fuzzy regression could be used, for example, if the objective was to see whether countries which have had higher trade openness have a higher speed of convergence - countries could then be clustered in to open, partially open and other possibilities, by using fuzzy logic. The future research can take up this type of study for gaining insights into the growth process.

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Appendix Table I

Countries(44)/Regions(4)
South Asia(5)
Bangladesh
India
Nepal
Pakistan
Sri-Lanka
European Union(16includingUK)
Austria
Belgium
Denmark
Finland
France
Germany
Greece
Ireland
Italy
Luxembourg
Netherlands
Norway
Portugal
Spain
Sweden
United Kingdom
EAST ASIA(8)
China
Hong Kong
Indonesia
Japan
Malaysia
Phillipines
Singapore
Thailand
CIS(15)
Armenia
Azerbaijan
Belarus
Estonia
Georgia
Kazakistan
Krygistan
Latvia
Lithunaia
Moldova
Russia
Tajakistan
Turkmenistn
Ukraine
Uzbekistan

Appendix Table II:Growth Performance of Selected South Asian, EU, East Asian and CIS Countries:1961-2001

Countries	Intial Per Capita GDP(1961)	Average Annual GDP Per-capita Growth(DEPENDENT VARIABLE)	Log of Initial Per Capita GDP(1961)(INDEPENEDENT Variable)
Bangladesh	223.63	1.52	5.41
India	186.79	2.40	5.23
Nepal	139.77	1.45	4.94
Pakistan	186.79	2.62	5.23
Sri-Lanka	290.03	2.80	5.67
Belgium	10829.18	2.75	9.29
Austria	11047.95	2.85	9.31
Denmark	17154.23	2.16	9.75
Finland	10404.57	3.00	9.25
France	11047.95	2.62	9.31
Germany*	18398.05	1.96	9.82
Greece	4188.09	3.25	8.34
Ireland	5767.53	4.23	8.66
Italy	7115.28	2.90	8.87
Luxembourg	15994.50	3.23	9.68
Netherlands	11731.12	2.40	9.37
Portugal	2864.07	3.98	7.96
Spain	5064.45	3.38	8.53
Sweden	13904.95	2.16	9.54
United Kingdom	9701.15	2.16	9.18
Norway	11849.01	3.04	9.38
Malaysia	1012.32	3.98	6.92
China	69.41	5.89	4.24
Indonesia	259.82	3.62	5.56
Japan	9320.77	4.21	9.14
Phillipines	742.48	1.21	6.61
Singapore	2921.93	5.91	7.98
Thailand	478.19	4.59	6.17
Hong Kong	3294.47	5.35	8.10
Latvia**	1380.22	2.35	7.23
Russia**	1436.55	1.83	7.27
Georgia**	620.17	0.21	6.43

Source: Average Annual Growth Rate of Per Capita GDP is calculated on the basis of the data for per capita GDP (constant 1995 US $) from the World Bank World Development Indicators on CDROM.Initial Level of per capita GDP is initial level of per capita GDP at constant 1995 US $.Based on Author's calculations.

Note:* data is from 1972-2001

* *data is from 1966-2001

APPENDIX Table III:Growth Performance of Some South Asian,EU and Eat Asian Countries:1970-2001

Countries	Initial GDP Per Capita(1970)	Average Annual GDP Per-capita Growth(Dependent Variable)	Log of Initial Per Capita GDP(1970) (Independent Variable)
Bangladesh	248.69	1.58	5.516218
India	213.02	2.62	5.361379
Nepal	147.67	1.69	4.995011
Pakistan	274.72	2.27	5.615742
Sri-Lanka	351.04	2.98	5.860901
Belgium	15611.00	2.40	9.655731
Austria	15860.99	2.55	9.671618
Denmark	23463.70	1.63	10.06321
Finland	14979.62	2.70	9.614446
France	16412.28	2.11	9.705785
Germany*	18398.05	1.96	9.82
Greece	7486.96	2.20	8.920918
Ireland	7908.03	4.29	8.975634
Italy	10730.14	2.31	9.280812
Luxembourg	20457.26	3.31	9.926093
Netherlands	17188.61	2.04	9.752002
Portugal	4979.56	3.45	8.513096
Spain	8417.07	2.45	9.038017
Sweden	19268.58	1.75	9.866231
United Kingdom	11858.32	2.13	9.380785
Norway	15677.16	2.89	9.65996
Malaysia	1370.66	4.11	7.223045
China	109.37	7.30	4.69476
Indonesia	297.61	4.23	5.695771

Japan	20464.99	2.77	9.926471
Phillipines	867.39	1.01	6.765491
Singapore	5404.14	5.60	8.59492
Thailand	751.68	4.60	6.622305
Hong Kong	5946.57	4.91	8.69057

Source: Average Annual Growth Rate of Per Capita GDP is calculated on the basis of the data for per capita GDP (constant 1995 US $) from the World Bank World Development Indicators on CDROM.Initial Level of per capita GDP is initial level of per capita GDP at constant 1995 US $.Based on Author's calculations.

Note:* Data is from 1972-2001

APPENDIX TABLE IV:Growth Performance of Some South Asian,EU,East Asian and CIS Countries:1980-2001

Countries	Initial Level of GDP per Capita(1980)	Average Annual GDP Per-capita Growth(Dependent Variable)	Log of Initial Per Capita GDP(1980) (Independent Variable)
Bangladesh	225.19	2.45	5.416951
India	227.98	3.63	5.429276
Nepal	148.01	2.21	4.997257
Pakistan	318.05	2.57	5.76221
Sri-Lanka	455.07	3.24	6.12046
Belgium	21285.02	1.96	9.965759
Austria	22231.38	1.94	10.00926
Denmark	27308.41	1.58	10.21495
Finland	20604.11	2.30	9.933246
France	21418.24	1.68	9.971998
Germany	23354.38	1.60	10.05854
Greece	10701.64	1.13	9.278152
Ireland	10894.39	4.77	9.296003
Italy	14591.92	1.86	9.588223
Luxembourg	24594.79	3.90	10.11029
Netherlands	21122.67	1.84	9.958102
Portugal	7327.91	2.87	8.899446
Spain	10858.55	2.30	9.292708
Sweden	22634.71	1.62	10.02724
United Kingdom	14189.21	2.07	9.560237
Norway	23594.53	2.45	10.06877
Malaysia	2297.11	3.63	7.739409
China	166.75	8.19	5.116471
Indonesia	503.01	3.74	6.220614
Japan	28296.12	2.18	10.25048
Phillipines	1172.86	0.14	7.067197
Singapore	11002.84	4.64	9.305909
Thailand	1116.28	4.60	7.017753
Hong Kong	11289.26	4.08	9.331607
Estonia*	4064.31	0.94	8.31
Moldova*	1480.3	-3.04	7.30

Source: Average Annual Growth Rate of Per Capita GDP is calculated on the basis of the data for per capita GDP (constant 1995 US $) from the World Bank World Development Indicators on CDROM.Initial Level of per capita GDP is initial level of per capita GDP at constant 1995 US $.Based on Author's calculations.

Note:* Data is from 1981-2001

APPENDIX TABLE V:Growth Performance of Some South Asian,EU,East Asian and CIS Countries:1990-2001

Countries	Initial Level of GDP per Capita(1990)	Average Annual GDP Per-capita Growth(Dependent Variable)	Log of Initial Per Capita GDP(1990) Independent Variable
Bangladesh	278.16	3.12	5.628197
India	323.93	3.61	5.780542
Nepal	188.03	2.52	5.236584
Pakistan	448.19	1.37	6.105219
Sri-Lanka	615.87	3.45	6.423031
Belgium	25658.50	1.89	10.15263
Austria	27501.89	1.87	10.22201
Denmark	31806.95	1.73	10.36744
Finland	26820.99	1.55	10.19694
France	25966.69	1.53	10.16457
Germany	28580.79	1.36	10.26049
Greece	10874.99	1.88	9.294221
Ireland	15084.70	6.49	9.621436
Italy	18160.61	1.44	9.80701
Luxembourg	36335.12	3.84	10.50054
Netherlands	24977.98	2.19	10.12575
Portugal	9958.64	2.70	9.206196
Spain	13958.61	2.26	9.543852
Sweden	27251.67	1.30	10.21287
United Kingdom	18072.07	1.97	9.802123
Norway	28840.33	2.54	10.26953
Malaysia	3104.03	4.14	8.040458
China	350.28	8.20	5.85874
Indonesia	776.67	3.18	6.65501
Japan	39955.04	1.32	10.59551
Phillipines	1090.87	0.63	6.994728
Singapore	17620.37	4.15	9.776811
Thailand	1997.12	3.93	7.599459
Hong Kong	18812.54	2.55	9.842279
Azerbaijan*	601.85	-2.02	6.40
Belarus**	1587.63	-0.21	7.37
Lithunaia**	3010.92	-1.88	8.01
Tajakistan***	1261.43	-5.87	7.14
Turkmenistan****	2591.52	-2.77	7.86
Ukraine****	1998.20	-4.53	7.60
Uzbekistan****	578.25	-0.73	6.36
Kazakistan	2100.65	-1.33	7.65
Krygistan*****	566.80	-1.61	6.34
Armenia**	1540.71	-1.88	7.34

Source: Average Annual Growth Rate of Per Capita GDP is calculated on the basis of the data for per capita GDP (constant 1995 US $) from the World Bank World Development Indicators on CDROM.Initial Level of per capita GDP is initial level of per capita GDP at constant 1995 US $.Based on Author's calculations.

Note:* Data is from 1993-2001
** data is from 1991-2001
*** data is from 1986-2001
**** data is from 1988-2001
***** data is from 1987-2001

Appendix TABLE VI:DATA FOR CONDITIONAL CONVERGENCE ANALYSIS[16]

Countries	years	Average annual trade open	years	Average annual share of industry in GDP	life expectancy1961	years	Aaverage annual share of savings in GDP	years	Pop. growth (n)	g+n+δ
Bangladesh	1965-2001	25.75	1965-2001	19.47	40.22	1965-2001	9.33067	1960-2001	2.302	7.3019
India	1965-2001	19.95	1960-2001	25.78	44.89	1960-2001	19.519	1960-2001	2.095	7.095
Nepal	1965-2001	40.77	1965-2001	17.55	38.81	1965-2001	11.5404	1960-2001	2.135	7.1352
Pakistan	1960-	34.41	1960-	23.51	44.43	1960-	12.292	1960-	2.74	7.7397

[16] CIS Countries have been left out from the conditional convergence analysis due to lack of uniform data across variables from 1966-2001.

	2001		2001			2001		2001		
SriLanka	1960-2001	73.62	1960-2001	26.25	60.64	1965-2001	14.99	1960-2001	1.597	6.5965
Belgium	1960-2001	134.1	1971-2001	31.63	70.59	1965-2001	23.172	1960-2001	0.295	5.2947
Austria	1960-2001	77.37	1971-2001	34.501	69.011	1965-2001	24.0092	1960-2001	0.34	5.3402
Denmark	1960-2001	67.61	1966-2001	26.867	72.23	1966-2001	23.6362	1960-2001	0.38	5.3798
Finland	1960-2001	59.17	1960-2001	34.232	68.69	1960-2001	26.333	1960-2001	0.381	5.3811
France	1960-2001	43.87	1971-2001	29.670	70.82	1965-2001	21.6989	1960-2001	0.627	5.6268
Germany	1971-2001	53.09	1971-2001	35.907	69.73	1971-2001	23.523	1960-2001	0.302	5.3018
Greece	1960-2000	44.97	1960-2000	26.591	69.17	1960-2000	16.0304	1960-2001	0.582	5.5815
Ireland	1960-2001	133.6	1971-2000	37.358	69.953	1965-2000	27.1455	1960-2001	0.748	5.7481
Italy	1960-2001	45.67	1971-2001	33.241	69.8	1965-2001	22.7858	1960-2001	0.341	5.3405
Luxembourg	1960-2000	220	1971-2000	28.454	68.87	1965-2000	29.9505	1960-2001	0.815	5.8153
Netherland	1960-2001	107.4	1971-2001	30.471	73.65	1965-2001	25.7665	1960-2001	0.81	5.8103
Portugal	1960-2001	65.57	1971-2001	31.487	63.81	1965-2001	18.8293	1960-2001	0.273	5.2735
Spain	1960-2001	42.83	1971-2001	33.552	69.94	1965-2001	22.7668	1960-2001	0.718	5.7183
Sweden	1960-2001	65.95	1971-2001	31.336	73.47	1965-2001	22.3593	1960-2001	0.42	5.42
UK	1960-2001	53.06	1960-2001	34.507	70.76	1960-2001	17.1551	1960-2001	0.278	5.2779
Norway	1960-2000	73.54	1971-2000	26.849	73.42	1960-2000	31.0489	1960-2001	0.564	5.5643
Malaysia	1960-2001	161.7	1960-2001	41.843	55.03	1960-2001	38.2855	1960-2001	2.604	7.6045
China	1960-2001	33.46	1960-2001	46.856	40.54	1960-2001	37.7851	1960-2001	1.554	6.5536
Indonesia	1967-2001	54	1967-2001	39.324	42.005	1967-2001	29.7782	1960-2001	1.933	6.933
Japan	1960-2001	19.52	1960-2000	36.536	68.31	1960-2001	30.7404	1960-2001	0.717	5.7167
Philippines	1960-2001	71.43	1960-2001	33.419	54.06	1960-2001	19.1256	1960-2001	2.58	7.5797
Singapore	1960-2001	342	1960-2001	34.3	64.09	1960-2001	46.6764	1960-2001	2.21	7.2098
Thailand	1960-2001	81.19	1960-2000	36.424	53.29	1960-2001	31.9141	1960-2001	2.019	7.0186
Hong Kong	1960-2001	259.7	1960-2001	20.435	66.99	1960-2001	32.222	1960-2001	1.889	6.8886

SOURCE:AUTHORS CALCULATION FROM WORLD BANK WORLD DEVELOPMENT INDICATORS ON CDROM,VARIOUS YEARS,Averages are weighted averages.Weights are GDP of countries.

APPENDIX TABLE VII:DATA FOR CONDITIONAL CONVERGENCE ANALYSIS(CONTINUED)

Lntradeopen	Lnindustry	Lnlifeepectancy(1961)	Lnsavings	Ln(g+n+δ)	Average Annual GDP Per-capita Growth(1961-2001)	Log of Initial Per Capita GDP(1961)
3.248532	2.968875	3.694364	2.233307	1.988136506	1.52	5.41
2.993354	3.249599	3.804215	2.971388	1.959392002	2.40	5.23
3.708064	2.865054	3.658678	2.445852	1.965040001	1.45	4.94
3.538434	3.157426	3.793915	2.508949	2.046358922	2.62	5.23
4.298917	3.267666	4.104955	2.707383	1.886545724	2.80	5.67

4.898735	3.454106	4.256888	3.142945	1.666706698	2.75	9.29
4.348602	3.540988	4.234266	3.178437	1.675271532	2.85	9.31
4.213726	3.290899	4.279855	3.162779	1.682651199	2.16	9.75
4.080448	3.533184	4.229604	3.270823	1.682892814	3.00	9.25
3.781276	3.39014	4.260141	3.077262	1.727535743	2.62	9.31
3.971951	3.580957	4.244631	3.157979	1.668046008	1.96	9.82
3.805889	3.280573	4.236567	2.774489	1.719463112	3.25	8.34
4.89515	3.620547	4.247824	3.301211	1.748876846	4.23	8.66
3.821464	3.503796	4.245634	3.126138	1.675319282	2.90	8.87
5.393487	3.348313	4.232221	3.399546	1.760497534	3.23	9.68
4.676532	3.416775	4.299324	3.249075	1.759635819	2.40	9.37
4.183097	3.449575	4.15591	2.935414	1.662692382	3.98	7.96
3.757215	3.513096	4.247638	3.125303	1.743678553	3.38	8.53
4.188836	3.444768	4.296877	3.107242	1.690095815	2.16	9.54
3.971499	3.541162	4.259294	2.842297	1.66353587	2.16	9.18
4.297829	3.290229	4.296196	3.435563	1.716369393	3.04	9.38
5.085675	3.733927	4.007878	3.645071	2.028737021	3.98	6.92
3.510351	3.84709	3.702289	3.631915	1.880014212	5.89	4.24
3.989067	3.671835	3.737789	3.393777	1.93629262	3.62	5.56
2.971183	3.598298	4.224056	3.425579	1.743391716	4.21	9.14
4.26877	3.509125	3.990095	2.951029	2.025468344	1.21	6.61
5.834811	3.535145	4.160288	3.843239	1.975445511	5.91	7.98
4.396804	3.595228	3.975749	3.463049	1.948562343	4.59	6.17
5.559658	3.017288	4.204543	3.472649	1.92987092	5.35	8.10