Glimpses of the Literature on International Inequality and Catch-up

K. L. Krishna

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1. Introduction

Research on inter-country inequality in living standards measured by GDP per capita in purchasing power parity (PPP) terms and the extent of catch-up to the frontier country, the US, has received considerable attention during the past three decades or so.The extant literature is quite vast and varied in scope.The purpose of this paper is to review the major contributions on the broad theme of international inequality in income levels and catch up.The phenomenon of "Great Divergence"highlighted towards the end of the 20th century has given way to a process of catch up and decline in inter-country inequality in the early 21st century.

The plan of the paper is as follows: Section 2 of the paper discusses the nature, scope, and quality of the datasets constructed since 1970 for international comparisons. These datasets are referred to as Penn World Tables (PWTs). The section describes some recent developments with regard to PWTs. Section 3 summarizes and reviews two contributions before 2010, namely, the analysis of Barro and Sala-i-Martin (2004), and the World Bank appointed Commission's Growth Report (2008).

Barro (2012) on beta-convergence and sigma-convergence, Jones (2016) on the Facts of Growth, Nayyar (2013) on Catch Up, Crafts and O'Rourke (2014) on the 20th Century Growth, Jorgenson (2016) on the New World Order, Vu (2013) on Dynamics of Economic Growth in Developing Asia, and Wolff (2014) on Productivity Convergence are summarized and reviewed in Section 4.Piketty (2014) on Wealth and Income Inequality, and Acemoglu and Robinson Why Nations Fail? Are taken up in Section 5. Concluding Remarks are offered in Section 6.

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2. Datasets for International Comparisons

2.1 The International Comparison Program

The International Comparison Program (ICP) collects data on prices for the same or similar goods in countries around the world and uses the data to calculate price index numbers or purchasing power parties (PPPs) to measure how much local currency is needed to buy as much as does the currency in the numeraire country, usually the US Dollar. The 'as much' refers to gross domestic product (GDP) or to one of its components, such as consumption or investment. PPPs can be thought of as averages of prices, or cost of living. They are used to deflate nominal currency measures to obtain "volume" measures expressed in common currency unit, such as current US dollars for the year of comparison. Adjusted for inflation in the numeraire country, the ICP yields real GDP measures in constant internationally comparable dollars.

By the late 1980s, the Penn World Table (PWT), compiled at the University of Pennsylvania, had evolved from a set of illustrative calculations begun in 1968 into a multi-country panel, particularly Mark 5, which contained up to 39 years of data on 138 countries (Summers and Heston, 1991). These data facilitated development of new growth economics, with theoretical development rooted in evidence. As highlighted by Deaton and Heston (2010), there has been a huge explosion of work since then, dealing with the explanation of growth, linking growth and politics, and an integration of macro-economics, economic development and economic history. The long-run historical statistics compiled by Angus Maddison (2003) has been extensively used for empirical analysis of economic growth and development, and in particular of inter-country disparities, Pritchett (1997) has highlighted the big divergence in income levels across countries.

The ICP is a huge undertaking requiring a vast amount of resources. A substantial proportion of the needed resources are provided by the national governments. The control and responsibility for the ICP has changed over time, and the World Bank assumed responsibility for the latest ICP 2011.The Bank published a comprehensive report on the results of ICP 2011 in 2015.

The PPP data given in the PWT, on the one hand, and the World Bank's World Development Indicators (WDIs), on the other, are the most familiar data sources used in the inter-country analyses. Eurostat and OECD compile and publish time series data back up to 1980 for countries in OECD, Europe and Commonwealth of Independent States (CIS).

Deaton and Heston (2010) provide an overview of the ICP 2005 data, and attempt an explanation of why different sources give different numbers and suggest some health warnings in their use. They pay

particular attention to PWT because it is the only source that gives long time series of national accounts for a large number of countries.

2.2 ICP 2011

ICP 2011, the latest round of the ICP is the eighth phase of the program. For the first time, it has achieved truly global coverage by including 199 Countries from all the seven geographic regions of the world. The eighth region comprised the economies that were participating in the PPP program run by Eurostat, the statistical arm of the European Union and the OECD. World Bank's (2015) comprehensive report on ICP 2011 provides details of the conceptual framework and the methodology employed by the ICP, along with detailed results of the 2011 round and a brief analysis of those results. ICP 2011 is a significant improvement over ICP 2005.

Some of the distinguishing features of ICP 2011 are:
(1) For the first time, China fully participated in ICP 2011.
(2) India and Indonesia, the two other populous economies, also covered both rural and urban areas in their collection of prices for consumption goods and services.
(3) 17 economies in Latin America participated in ICP 2011 compared to 10 in ICP 2005.
(4) The Caribbean region with 22 economies participated in ICP 2011.

From the methodology standpoint, because of the global coverage of ICP 2011, there was little need for the extrapolation of PPPs and real incomes for non-participating economies, as undertaken in the earlier ICP rounds.

Deaton and Aten (2014) and Inklar and Prasada Rao(2014) compared the ICP 2011 estimates of GDP per capita and the extrapolations for the year 2011 based on the ICP 2005 data. The conclusions are that the ICP 2011 estimates are the most accurate so far and there are other major improvements in ICP 2011.

In view of several methodological improvements and innovations, the ICP 2011 results can be considered more reliable than those for ICP 2005, especially when accounting for inconsistencies between ICP 2011 benchmark results and extrapolations from ICP 2005.

Some Major Results from ICP 2011:

(1) Distribution of World GDP

Percent share in World GDP	**PPP terms**	**Exchange rate terms**
High income economies	50.3	67.3
Middle income economies	48.2	32.0
Low income economies	1.5	0.7

(2) Ranking of economies by size in GDP:
   a. The US   17.1%
   b. China   14.9%
   c. India   6.4% (5th rank in 2005)

(3) Ranking of some major economies by per capita GDP:
   a. The US   12
   b. China   99
   c. Indonesia   107
   d. India   127

Although, China is close to the US in terms of the size of the GDP, it is very far below the US in terms of per capita GDP. India is farther. Both India and China may take long time to catch up with the US, even if their high growth rates are sustained.

(4) Intercountry inequality in income declined:

The population weighted Gini measure of intercountry inequality in real per capita income in PPP terms declined to 0.49 in ICP 2011 from 0.57 in ICP 2005. In exchange rate terms the decline was from 0.71 to 0.64. Such a sharp fall in inequality would have significant implication for the estimates of poverty incidence in the world.

2.3 An Assessment of PWTs
In a recent paper on Penn World Table (PWT) Revisions and their impact on growth estimates, Johnson et al (2013), on the basis of careful analysis highlight two problems in PWT GDP estimates. First, these estimates vary substantially across different versions of the PWT. This variability maters for cross-country growth literature; while growth studies that use low frequency data remain robust to data revisions, studies that use annual data are less robust. Second, the PWT methodology produces GDP estimates that are not valued at PPP prices. Johnson et al focus their analysis on PWT versions 6.1 and 6.2. The authors propose an alternative approach to calculating a chained growth estimate.

2.4 The Next Generation of PWT

Feenstraet al, (2015) present the theory and practice of real GDP comparison across countries and over time, based on the New Generation PWT Version 8which expands on previous versions in three respects.
(1), In addition to comparison of living standards using components of real GDP on the expenditure side, a measure of productive capacity, called real GDP on the output side is provided.

(2) Growth rates are benchmarked to multiple years to cross-country price data so they are less sensitive to new bench mark data.

(3) Data on capital stocks and productivity are (re) introduced.

Applications including the Balassa – Samuelson effect and development accounting are added.

From PWT version 8 onwards PWT development has moved to the University of California at Davis and University of Groningen, while the PWT initials are retained, and the input from Heston at the University of Pennsylvania continues.

With the incorporation of a new dataset of quality-adjusted prices of exports and imports, real GDP on the output side or real GDP, which is intended to measure the productive capacity of an economy, is now reported in PWT8.

Feenstra et al. (2009) argued that a measure of the productive capacity of countries could be obtained by combining the ICP data with prices for exports and imports. These two approaches lead to measures of real GDP on the expenditure side and real GDP on the output side, respectively, both of which are included in the PWT version 8.1.

The Second contribution of PWT8 is to improve upon the measure of growth of real GDP previously reported in PWT, which is based on national accounts data. Johnson et al (2013) criticized the growth rate estimate as being dependent on the bench mark year of the ICP data, and thereby dependent on the version of PWT being used. That problem is resolved in PWT 8 by using multiple ICP bench marks for all measures of real GDP.The growth rate will not change in between existing bench mark year and new bench mark.

Incorporating multiple ICP benchmarks also ensures that relationships such as Balassa- Samuelson effect remain apparent in the data set, rather than disappearing when going back.

Another important contribution of PWT 8 is the reintroduction a measure of capital stock and for the first time inclusion of a measure of

relative TFP across countries. It has been shown, compared to standard finding in the literature, cross-country variation in factor inputs can account for more of the cross country variation in CGDP e per capita. This is mostly because PWT 8 incorporates new estimates of the labour share in GDP that vary across countries and over time.

Taken together, these contributions show that PWT 8 breaks new ground in providing a cross country data set that is closely linked to the theoretical concepts of welfare and production, more consistent over time and more transparent in its methods.

The release of the 2011 ICP provides new prices for final expenditure which, in conjunction with updated, quality-adjusted prices for exports and imports, will be used to compute real GDP on the expenditure side and output side in PWT version 9.

Early analysis on the 2011 ICP prices suggests that they differ quite substantially from extrapolated prices using the 2005 benchmark. (Deaton and Aten 2014; Inklarand Rao 2014)

2.5 The Maddison Project

Bolt and Van Zanden (2014) introduce the Maddison project and its first set of results. The Maddison Project was initiated in 2010, the year the eminent economic historian of national accounts passed away at the age of 84. The project builds on the illustrious legacy of Maddison. His estimates of GDP and population in the world economy and different countries of the world economy between Roman times (beginning of the first millennium) and the present have been of immense value to the economic profession. The project involves cooperation between scholars who are specialists on different regions, topics and periods.

The main goal of the project is to continue Maddison's work by creating new generation of estimates of GDP, population and GDP per capita in the world economy between Roman times and the present. Maddison built on the pioneering work of scholars, such as Clark, Kuznets and Bairoch.

Most new work relates to the period before 1820, it leads to a reassessment of level of GDP per capita in Western Europe in the early modern period and to a confirmation of Maddison's previous estimates of real income for Asian economies.

The inclusion of more recent PPPs in the Maddison project data base will have major implications, mainly for rapidly growing developing countries such as China and India as more recent PPPs from ICP 2005 and ICP 2011 will change the levels of their income significantly.

3. Major Contributions to the Literature Before 2010

In this section, we review two major contributions on international inequality and catch up. The first is by Barro and Sala-i-Martin (2004) and the second is World Bank's (2008) Growth Report.

3.1 A Comprehensive Study by Barro and Sala-i-Martin for the period 1960-2000

3.1.1 Basic Facts

Barro and Sala-i-Martin or BS, for brevity, (2004)   is a major, comprehensive study of economic growth in the world economy during the 40 year period 1960-2000. The book outlines a brief history of modern growth theory, presents the Solow and endogenous growth models in different chapters, attempts an empirical analysis of economic growth in a cross section of countries for the period 1960 to 2000, using the PPP (purchasing power parity) GDP data from PWTs (PENN World Tables) version 6.1

Three informative histograms for the period 1960-2000 are presented.Histogram of per capita GDP in 1960 for a sample of 113 countries.Histogram of per capita GDP in 2000 for a sample of 150 countries; and ahistogram of growth rate of GDP from 1960 to 2000 for 112 countries.For 1960, the highest/lowest GDP per capita ratio is 39, and the Coefficient of Variation (CV) is 89 per cent.

For 2000, the highest/lowest GDP per capita ratio is 69 and the CV is 112%. Thus the gap in per capita GDP across countries widened considerably over the period 1960-2000.

The average growth rate of GDP over the period 1960-2000 is 1.8 per cent per year and the standard deviation is 1.7%. The range is from - 3.2 per cent per year in Congo to 6.4 per cent per year in Taiwan, indicating sharp divergence in long-term growth rates.

B.S (2004) identify 20 loser countries and 20 winner countries in terms of economic growth over the period 1960 to 2000. Of the losers, 18 are fromSub-Saharan Africa (SSA) and 2 are from Latin America.   The winners include 9 from East Asia, 4 from Western Europe and 2 from SSA.

The main regressions, presented in Chapter 12 of the book, for per capita growth rates apply to the three 10 year periods, 1965-75,   1975-85 and 1985-95. The correlations of growth rates across the 10-year periods are positive/but not high: 0.43 between 1975-85 and 1965-75 and 0.42 between 1985-95 and 1965-75. Thus, although there is persistence over time in which countries are slow or fast growers, there are considerable differences over time in these groupings. The correlations are much

weaker for the seven 5 year intervals, from 1960 – 65 to 1995-2000. The average correlation for one period growth rate with the previous period is only 0.17. The last 5 year period 1995-2000 is noteworthy for being unrelated to history, the correlation of growth rates in 1995-2000 with those in 1990-95 being only 0.05.

3.1.2 Analysis of the Empirical Determinants of Economic Growth and Convergence

BS attempt an econometric analysis of the determinants of economic growth using data for 87 countries (241 observations at 10-year intervals, 1965-75, 1975-85 and 1985-95) for which data are available on explanatory variables. The sample includes both developing and developed countries.For the 112 countries with the requisite data, the correlation between growth rate of per capita GDP over the period 1960-2000 and log per capita GDP in 1960 is 0.19, positive, indicating absolute divergence. However, the neoclassical growth theory predicts conditional convergence rather than absolute convergence: the theory predicts a negative partial correlation between growth and initial level of income, holding constant variables that proxy for the steady state. The regression results in the table below provide the details in regard to explanatory variables, their estimated coefficients, their signs and statistical significance.

B S use an empirical framework that relates the real per capita growth rate to two kinds of variables: first, initial levels of state variables, such as the stock of physical capital and the stock of human capital in the form of educational attainment and health; and second, controls such as the ratio of government consumption to GDP, the ratio of domestic investment to GDP, the extent of international openness, movements in the terms of trade, the fertility rate, indicators of macro-economic stability, measures of the maintenance of the rule of law and democracy and so on. Human capital is represented by average years of educational attainment.

Regression Results for the growth rate of per capita GDP

For the basic regression, data for 72 countries for 1965-75 for 86 countries, for 1975-85 and for 83 countriesfor 1985-95 are used. IV (Instrumental Variable) method of estimation is used. The regression disturbances are assumed to be uncorrelated and homoseedartic across countries. Allowance for heteroscedasticity and serial correlation of errors across time is made.The 3 SLS (three stagy least squares) regression results are presented in the table below:

Dependent Variable: Growth rate of per capita GDP

Explanatory Variable	Coefficient	Standard error
Log GDP per capita in 1960	-0.025	.003
Educational attainment (male upper schooling)	0.0036	.0016
Reciprocal life expectancy at age one log	-5.0	0.9
Log Total Fertility rate	-.012	.005
Government consumption ratio	.062	.023
Rule of law indicator	.0185	0.0059
Democracy indicator	.0079	0.028
(Democracy indicator)	-.074	0.025
International openness ratio	0.0054	0.0048
Change in terms of trade variable	0.130	0.053
Investment ratio	0.083	0.024
Inflation rate	-0.019	(.010)
Constant terms	-0.0078	0.0026
(dummy coefficients for periods)	-0.0128	0.0034

R square = 0.60, 0.049, and 0.051for the three ten year periods, 1965-75, 1975-85 and 1985-95.NOBS = 72, 86 and 83 for the three ten-year periods

The Coefficient of log GDP per capita in 1960 is significantly negative lending support to the hypothesis of conditional convergence.

BS undertake and report robustness tests of the regression results, and find the results to be robust. They discuss the issue of model selection and apply the state-of-the art procedures.

3.2 The Growth Report

World Bank – Commission on Growth and Development (2008): The Growth Report – Strategies for Sustained Growth and Inclusive Development. The Commission was chaired by Michael Spence, Nobel Laureate in Economics and Professor Emeritus, Stanford University. The mandate of the commission consisting of 19 experienced policy makers and two Nobel Laureates was to gather the best understanding about the policies and strategies for rapid economic growth and poverty reduction. The Commission's audience was the leaders of developing countries.

The Growth Report attempted to identify key insights and policy levers to help developing countries achieve high, sustainable and inclusive growth

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The Report's Salient Findings / Recommendations are:
1. Growth Dynamics and the Global Economy
   Growth rate of 7 per cent a year sustained over 25 years in 13 economies was unheard of before 1950. According to the Commission, this was possible only because the world economy was more open and integrated.
2. Leadership and Effective Government. Successful cases were associated with "capable, credible and committed" governments. Effective political leadership is required over a long planning horizon for inclusive growth.
3. Selected Policy Ingredients
   For sustained rapid growth, high rate of public investment in infrastructure, education and health are recommended.
4. Income inequality at the bottom and top ends of the income distribution should be contained.
5. Growth strategies should take into account the cost of pollution from the outset.
6. Identification of categories of countries facing special challenges
   A. African countries
   B. Very Small Countries
   C. Countries Rich in Natural Resources
   D. Middle Income Countries requiring skill upgradation as Service Sector gains in importance
7. New global challenges
   A. Global warming and climate change
   B. Changing Relative Prices of Manufacture vs. commodities
   C. Demographics
   D. Global Governance

The Report draws attention to the issue of catching up in 25 largest developing countries out of about 150 developing countries in the world. The 10 largest account for about 70 per cent of developing countries GDP and the 25 largest for about 90 per cent. The growth performance of these 25 countries has been uneven. Because industrialized (OECD) countries' secular growth rate per capita is about 2 per cent, developing countries need to grow at much higher rates to catch up. Between 1960 and 2006, only six countries grew faster than 3 per cent in per capita terms. India achieved a per capita growth rate of only 2.8 per cent during 1960-2006. However, Indian per capita growth rate was 4.1 per cent during 1980-2006. The other giant, China, was far ahead with a per capita growth rate of 8.6 per cent during 1980-2006.

In Table 1.2 of the Report for each of the 25 largest developing countries, the per capita GDP in 2006 based on purchasing power parity in 2000 international dollars, average growth rate during 1997-2006, projected growth rates needed to catch up in 2050, in 2100 and the

number of years needed to catch up with per capita GDP of OECD group are presented. India needs 50 years from 2006 to catch up, while China needs 23 years, Russia needs 17 years Pakistan needs 159 years and Bangladesh needs 163 years.

The growth report based on the informed deliberations of 21 eminent scholars and policy makers and containing authentic data with valuable policy implications for different categories of economies in the world deserves careful study.

4. Major Contributions to the Literature Since 2010

In this section, we will cover eight major contributions to the literature since 2010, those that throw light on between country income inequality and catch up. Barro (2012) revisited his original theme of Convergence/Divergence and reported new estimates for a much longer period than 1960-2000.Jones (2016) in Facts of Economic Growth, covers a variety of sub-themes under Growth at the Frontier and The Spread of Economic Growth.Nayyar (2013) analyses Divergence in the pre-1960 period, and the convergence tendency after 1960, in economic historical perspective in the countries of the developing world in Africa, Asia and Latin America. Sachs (2015) in his book The Age of Sustainable Development has a lot to say on international inequality and its mitigation. Crafts and O'Rourke (2014) analyses catch up,falling behind in economic history perspective. Jorgenson (2016) presents the New World Order, and the dominant positions China and India acquired by China, following the "Asian Model" of growth. Vu (2013) takes up Developing Asia for analysis, with focus on the factors for sustainable growth in China and India in the coming decades. Wolff (2014) analyses productivity convergence, and the contributory forces.

4.1 Barro's (2012) tests of Beta and Sigma Convergence

Barro (2012) uses data for 80 countries for the period 1960 to 2009 to investigate the issues of beta (β)-convergence and sigma (σ)-convergence. The dependent variable is the annual growth rate of real per capita GDP for 10 periods: 1960-65, 1965-70 – 2005-09. Logper capita GDP is for 1960, 1965, ..., 2005 are the respective explanatory variables.

Values for 1959, 1964, … 2004 are used as instruments. Other regressors are averages over periods, with lagged values used as instruments. The error terms are allowed to be correlated over time within countries.

The convergence rate of per capita GDP is found to be around 1.7 per cent per year. This beta-convergence is conditional on an array of explanatory variable that hold constant countries long-term characteristics. In a much longer time frame – 28 countries since 1870 – estimation with country fixed effects is more appropriate, and the estimated convergence

rate is around 2.4 per cent per year. Combining the point estimates from the post-1960s and post-1870s panels suggests that the conditional convergence rate of between 1.7% and 2.4% per year, an interval that contains the "iron-law" rate of 2.0%.

A measure of dispersion – the standard deviation of the log of per capita GDP across 25 countries is reasonably stable since 1870. This lack of "sigma convergence" is consistent with the presence of beta-convergence. For 34 countries – including China and India – observed since 1896, dispersion of per capita GDP declines since the late 1970s, especially when the country data are weighted by population, suggesting sigma-convergence.

According to the "iron law of convergence", advanced by Barro, countries eliminate gaps in levels of real per capita GDP at a rate of around 2% per year Convergence at a rate of 2% implies that it takes 35 years for half of an initial gap to vanish and 115 years for 90% to vanish. Convergence rate parameters are important because they provide guidance on how fast countries like China and India are likely to catch up to richer countries.

Different strands of the literature on inter-country inequality in economic growth have been reviewed above. Liberalization and globalization are expected to result in convergence. The overall evidence from the review is that there is lack of convergence that the rate of convergence is slow. Countries such as India and China in recent times have achieved high rates of economic growth and the catch-up in terms of growth rates is quite impressive although it will take a long time, two or three generations for the gaps in income levels to be eliminated.

4.2 Jones (2016) -The Facts of Economic Growth

Jones documents the facts that provide answers to two questions:
    A.How much richer is the world today than say 100 years ago?
    B. How large are the income gaps between countries?

As noted by Jones,Kaldor (1961) formulated a few key stylized facts that growth theory should explain, and Jones and Romer (2010) updated Kaldor's list to incorporate what was learnt since 1961. Jones in this essay draws on the "renaissance" of growth economics to present the empirical knowledge on growth. The essay is in broad parts. Part I documents the facts related to growth of the "Frontier" over time- the growth patterns experienced by the richest countries in the world.

Part II deals with the "Spread of Economic Growth" across the countries in the world: the facts regarding catching up, falling behind or

staying in place, and the characteristics of the countries in the three groups.

4.2.1 Growth at the Frontier

Jones considers both modern economic growth and growth over the very long run. With regard to the former, it is noted that for nearly 150 years GDP per person in the US (Frontier) at a remarkably steady average rate of around 2 % per year. With regard to growth over the very long term, it is noted that sustained growth in living standards is a post-1820 reality. Evidence suggests living standards were comparatively stagnant for thousands and thousands of years before the Industrial Revolution.

A variety of growth models have been proposed to explain the transition from stagnancy to modern growth. The models combine the Malthusian diminishing returns and increasing returns associated with ideas. Galor (2005) labels the new growth theory as "Unified Growth Theory".

Jones discusses the spread of economic growth in the world and the extent to which countries are catching up, falling behind or staying in place. Furthermore, he identifies the characteristics shared by countries in the three groups.

Jones first highlights the key fact about the spread of growth over the very long run, since about 1200 AD, is that it occurred at different points in time, something in the "The Great Divergence" after 1600 AD. The Maddison Project data is used to depict the GDP per person (in multiple of 300 dollars) over the period 1200-2010 is presented in a figure 210) the paper. GDP per person differs only modestly prior to the year 1600. For example, it ranges from a high of $ 1620 in the Netherlands (in 1990 dollars) to a low of $ 610 in Egypt.

4.2.2 The Spread of Economic Growth

Pritchett (1997) pointed out that the poorest countries in the World in 1950 had an income of about $ 300 - less than one dollar per day. This figure seems close to the minimum wage income likely to prevail in any economy at any point in time. In 1300, the ratio of riches country to the poorest was of the order of $1620/$300 = 5.4

The long- time trend since 1200 AD in GDP per person for a sample of six countries, the US, the UK, Japan, China, Argentina and Ghana are compared. The GreatDivergence in incomes occurs after the year 1600. The ratio of the richest to poorest rises to more than 10 by 1830 (for the UK) and then to more than 100 by 2010 (for the US). Rapid growth occurs at different points in the sample of countries.

Argentina was relatively rich by 1870 and growth took off in Japan after World War II. In 1950, China was much poorer than Ghana, by more than a factor of two. Rapid growth since 1978 raises China's living standards to more than a factor of 25 over the benchmark level of $ 300 per year.

Jones highlights the heterogeneity of growth trend across a sample of countries (the US, the UK, France, Japan, Argentina, S. Africa and China) since 1870. Some countries like the UK, Argentina, and South Africa experienced substantial declines in the income relative to the US, reflecting the fact that the growth rates over long periods of time fell short of the 2% growth rate of the frontier, the US, other countries like Japan and China witness large increases in relative incomes.

Some facts on GDP per person relative to the US during 1980-2010 period using PWT 8.0 data countries/regions: W. Europe, Russia, Brazil, China, India, Sub-Saharan Africa are as follows, as stated by Jones:

(1) W. European income has been stable, around 75% of the US level. Work hours per adult were substantially lower in W. Europe and GDP per hour was much closer to the US level.
(2) After rapid growth in the 1980s (and before) Japan peaked at an income relative to the US of 85% in 1995. Since 1995, Japan fell back to around 75% of the US level as a result of rapid growth.
(3) China, after 1980, 1990, improved its relative level from 5% in 1980 to about 20% in 2010.
(4) India, improved its relative level from 4% in 1990 to about 8% in 2011.
(5) In the case of SSA, the income relative fell from 7.5% in 1980 to 3.3% in 2001.
(6) Since 2000, several of the countries and regions display catch-up to the US level.

Next, Jones plots GDP per person relative to the US for 2011 against the relative for 1960 for a sample of 100 countries.

There are more middle-income countries above the 45 degree line than below, indicating that countries in the middle of the distribution showed a catch-up tendency. Low income countries displayed the opposite tendency.

Convergence among OECD Countries:
The plot of the growth rate of GDP per person during 1960-2011, against GDP per person in 1960 for the countries in the OECD as of 1970 shows the catch-up behaviour of the group since 1960. The countries that were relatively poor in 1960 – Japan, Portugal and Greece – grew rapidly while those that were relatively rich in 1960 – Switzerland, Norway and US

– grew more slowly. Other studies also reported convergence among OECD countries.

Lack of convergence worldwide

The plot of growth rate during 1960-2011 against the level in 1960 for the sample of 100 countries does not indicate absolute convergence.

4.2.3 Development accounting

Jones proceeds to discuss the theme of Development Accounting which has received much attention of researchers during the past 20 years or so. It can be shown, under plausible assumptions, that GDP per worker is a function capital-output ration, human capital worker and TFP measured in labour augmenting units.

The Penn World Trade (PWT), starting with version 8.0 contains all the data needed to conduct a simply of development accounting. That data set contains measures of the economy's stock of physical capital and measure of human capital that is based on educational attainment data from Barro and Lee (2013) and measures of returns to education: 13.4% for the first 4 years, 10.1% for the second 4 years and 6.8% for all additional years. The Development Accounting assuming that the share of capital in output of TFP based on the Translog index [See Feenstra et al (2015)].

Jones carries out a Development Accounting Exercise for a sample of 128 countries for the year 2010. Table 6 in the chapter gives the calculations for 18 countries including China and India, relative to the United States. Some key findings are:-

(1) The capital-output ratio is stable across countries. Its average value is very close to one.
(2) The contribution from educational attainment (human capital) is larger, but quite modern.
(3) The differences in TFP are the largest contributor to income differences.

For the sample of 128 countries for the year 2010, the correlation between GDP per worker (US=1) and TFP (factor-augmenting, US=1) is as large as 0.96. The differences in TFP are very large.

We present below Development Accounting calculations of jones for UK, South Kores, China and India, for 2010. .

Countries	TFP	GDP per Worker	Capital/GDP (K/Y)	Human Capital
United States	1.000	1.000	1.000	1.000
United Kingdom	0.925	0.733	1.015	0.780
South Korea	0.564	0.598	1.146	0.925
China	0.168	0.136	1.137	0.713
India	0.217	0.010	1.014	0.533

It may be noted that the China excelled India in regard to Human Capital per worker. But India excelled China in regard to TFP. For both countries however, their TFP was far below that of the UK and South Korea.

There is a lot to learn from the detailed exposition of Jones on the two questions posed by him at the beginning of his essay on the Facts of Economic Growth. His account of Development Accounting is particularly insightful. In his Conclusion, he mentions a number of facts not covered by him in the long essay.

4.3 Nayyar (2013) on Catch Up: Developing Countries in the World Economy
4.3.1 Basic Facts

[This following account draws heavily upon chapter 9 of Nayyar (2013)]. Much of it is admittedly a virtual reproduction of the chapter.

This highly acclaimed monograph authored by Deepak Nayyar (2013) analyses the evolution of developing countries in the world economy through long history, but with particular focus on the recent six decades 1950 to 2010. It compares the three continents, Asia excluding Japan, Africa and Latin America including Caribbean with the West comprising Europe, North America, Australia and Japan, in terms of shares of world GDP and population and GDP per capita. Various aspects of globalization such as international trade, international investment and international migration are also covered.

Part I of the monograph sketches the decline and fall of the developing countries during 1820-1950. Part II, covering the period 1950-

2010, analyses in detail the extent and nature of catch up of the developing countries.

One thousand years ago, Asia, Africa and South America or Latin America taken together, accounted for more than 80% of world population and world income. This was attributable in large part to Asia, where China and India accounted for nearly 50% of world population and world income.

The overwhelming significance of these three continents continued for five centuries until 1500.

The beginnings of changes are discernible from the early 16th to the late 18th century. The voyages of discovery and the colonization of the America were critical turning points.

In the middle of the 18th century, demography, technology and institutions were broadly comparable between Europe and Asia.

The Industrial Revolution in Britain during the late 18th century, which spread to Europe over the next 50 years profoundly, influenced the economies. Yet in 1820, less than 200 years ago, Asia, Africa and South America still accounted for almost three-fourths of world population and two-thirds of world income. The combined share of China and India was 50% even in 1820.

"Dramatic Transformation" of the World Economy between 1820 and 1950:In 1950, the share of Asia, Africa and Latin America (AALA) in world population was two-thirds and in world income about one-fourth. The decline and fall during 1820-1950 was concentrated in Asia much of it attributable to China and India, while Latin America was the exception as its shares in world population and income were not only symmetrical throughout but also rose over time.

The "Great Divergence" in per capita incomes in 130 years, during 1820-1950: As a ratio of GDP per capita in Western Europe and Western Offshoots, GDP per capita in Latin America dropped from three-fifths to two-fifths, in Africa from one third to one-seventh and in Asia from one-half to one-tenth. Between 1830 and 1913, the share of AALA in world manufacturing output fell drastically from 60% to 7.5%.

The industrialization of West Europe and the de-industrialization of Asia during the 19th century led to the great specialization, which meant that Western Europe followed by the U.S. specialized in and exported manufactured goods while AALA specialized in and exported primary products.

Progressive integration of AALA into the world economy during the century from 1850 to 1950 took place through international trade, international investment and international migration which resulted in a division of labour between countries that was unequal in its consequences for development. The outcome of this process was the decline and fall of Asia and a retrogression of Africa, although in its post-colonial era, LA fared much better except for the divergence in per capita incomes, so that by 1950 the contrast between rich industrial countries and poor under developed countries was enormous.

Welcome changes in the period 1950-2010 were witnessed in the share of developing countries in world output and in levels of per capita income relative to industrialized countries. The share of developing countries in world output stopped its continuous decline around 1960, when it was about 25% to increase rapidly after 1980, so that it was almost 50% by 2008, while divergence in GDP per capita also came to a stop in 1980 and was followed by modest convergence thereafter.

Sub Period 1950-1980: GDP growth rates in developing countries as a group were somewhat higher than in industrialized countries experiencing unprecedented rapid growth (during the Golden Age of Capitalism). For developing countries, it was a sharp contrast with their performance in the preceding hundred years.

Sub Period 1980-2008: GDP growth rates in developing countries as a group were almost double those in industrialized countries. Until 1980, growth rates of GDP per capita in developing countries were lower than in industrialized countries because of high population growth rates, but this was reversed after 1980 as their GDP growth was so much higher and population growth rates slowed down. These differences underlie the end of divergence in per capita incomes C.1980 followed by the beginning of a very modest convergence that is discernible in the 1990s and more visible in the 2000s.

4.3.2 Catch up in Industrialization since 1950:

The catch up in industrialization beginning around 1950 gathered momentum in the early 1970s with implication for structural changes in the composition of output and employment, leading to a decline in the share of agriculture and increase in the shares of industry and services. There was a dramatic transformation in four decades from 1970 to 2010. The share of developing countries in world industrial production increased from one-twelfth to one-third in constant prices and from one-eighth to two-fifths in current prices. Similarly, their share in world exports of manufactures, in current prices, rose from one-fourteenth to two-fifths.

Industrialization also led to pronounced changes in the composition of their trade as the share of primary commodities and resource-based

products fell while the share of manufactures (particularly medium and high-technology goods) rose in both exports and imports.

The role of the state in evolving trade and industrial policies, developing institutions and making strategic intervention, whether as a catalyst or a leader, was central to this process. Policies for import substitution through protection or export orientation through promotion were followed. In either case, external markets became increasingly important. Internationalization of production and the rise of global value chains since the late 1990s were also important factors.

Uneven Nature of the Distribution of the Catch up between the constituent regions of the developing world. The significant rise in the share of the world output and the modest convergence in per capita income were both attributable almost entirely to Asia, as Latin America witnessed neither, while Africa experienced a continuous decline, although the distribution of foreign investment was less unequal.

The catch up in industrialization was the most uneven between regions. Asia led the process in terms of structural change, share in industrial production, rising manufactured exports, and changing patterns of trade, while LA witnessed relatively little change and Africa made almost no progress. An overwhelming proportion of the increase in the share of developing countries in world manufacturing value added (MVA) and manufactured exports was attributable to Asia, while the share of Latin America recorded a modest rise and the share of Africa remained unchanged.

Higher Degree of catch up in Industrialization among countries within Region: The "Next - 14" Group of countries. China, India, Indonesia, Malaysia, South Korea, Taiwan, Thailand and Turkey in Asia (8 in numbers) Egypt and South Africa in Africa (2) Argentina, Brazil, Chile and Mexico in Latin America (4)

The economic significance of the "Next - 14" in the Developing World is overwhelming in terms of their size (GDP and population), their engagement with the world economy (trade, investment, migration, MVA and exports).

The determinants of the observed concentration appear to be size, growth and history. There is also enormous diversity within the "next-14" group. The emerging significance of China in the "Next - 14" is particularly striking. The success of these countries was characterized by specificities in terms of economic, social, political and historical contexts. Initial conditions, enabling institutions and supportive governments were the factors that put them on the path to industrialization.

4.3.3 Catch up, Inequality and Poverty

Nayyar highlights that the process of catch up is associated with high levels of inequality between countries and citizens. While inequality between countries is due to the wide gap between rich and poor nations. Inequality among people in the world, which increased sharply during 1820-1950 as a result of the Great Divergence, persisted at high levels during 1950 – 2000. There is an exclusion of countries and regions within countries in the developing world from the process of catch up. Massive divergence in per capita incomes between the least developed countries (LDCs) and the rest of the developing world. An exclusion of regions within the "Next - 14" countries from the convergence process was also in evidence.

Nayyar emphasizes an important fact: catch up in the terms of aggregate income has not led to a commensurate improvement in the well-being of ordinary people. During the period 1981-2008, the proportions of the population in the developing world below the specified international poverty lines ($1.25 and $ 2.00 per day PPP) declined but these proportions remain significant, and the absolute number of people below both poverty lines remains large, while the number of people between the two lines, who are vulnerable, doubled over this period.

In 2008, 75% of the poor in the world, below both poverty lines lived in Asia despite its rapid economic growth, rising share of the world income and catch up in industrialization. This is because economic inequality has been high or rising in countries, particularly the "Next - 14" that have led the catch up process. Thus catch up is not sufficient to improve the living conditions of people even in the Next – 14" group of countries.

Nayyar's painstaking and meticulous documentation of the catch-up process in the developing countries and regions of the world economy in the long-term with focus on the period 1950-2010 is most insightful and revealing. The progress in catch-up has not resulted in commensurate improvement in the living conditions of the extreme poor in South Asia and Africa which constitute a large proportion.

4.4 Sachs (2015) on the Unequal World

Jeffrey Sachs (2015) in his book, the Age of Sustainable Development, provides an insightful narrative of convergence and divergence in a long-term historical perspective using Angus Maddison's historical data series (2006) supplemented with data from the Maddison Project. The attractive feature of Sachs narrative is: the issues and processes are presented in the light of Sustainable Development Goals (SDGs) of 2015, with emphasis on the end of extreme poverty persisting in Sub Saharan Africa and parts of South Asia. In Chapter 1: Introduction to Sustained Development, Chapter 2: Unequal World, Chapter 3: A Brief History Economic Development, Chapter 4: Why Some Countries

Developed, While Other Stayed Poor.Sachs presents a variety of data and its implications for inequality.

Some of the main points made by Sachs are:
1. Modern Economic Growth during the past 250 years was a diffusion process, starting from England and gradually diffusing and evolving all over the planet.
2. Many different types of factors have been at play during the past 250 years, and the relatives importance of these factors has changed as technologies evolve

Section V: Convergence or Divergence of Chapter 2 - unequal world, states that the print phase of modern economic growth, roughly from 1750 to 1950 was characterized by divergence and since about 1960, the forces of convergence have tended to gain the upper hand.

Until the Industrial Revolution in the second half of the 18th Century most of the World was poor and rural and so the gaps between the rich and poor countries were quite narrow initially, GDP per capita took off in small parts of the World, starting in England the then spreading to great Britain, much of Western Europe, the US and Canada, Australia and New Zealand. Very few other countries experienced early industrialization.

Then came the imperialism practised by Western Europe in Africa, Asia and the Middle East, with a big political setback to the potential of convergence. The industrialization of the "West" and the de-industrialization of the rest resulted in Divergence.

After the end of imperialism during 1950-1970, newly independent countries started industrialization with domestic and foreign investment. The five decades 1960-2010 displayed a tendency towards convergence.

4.5 Economic History Perspective - Craft and O Rourke (2014) on the 20th Century Growth

Crafts and O Rourke (2014) survey the world-wide experience of economic growth during the period 1870-2007 with a focus on technological change at the frontier tighter with issues relate to successes and failure in catch-up growth. Evidence on sources of growth is revised. The key feature of the analysis of divergence in growth are "directs" technical change, intuitional quality and geography case studies of the experience of several individual countries are presented to illustrate these points.

The authors state that their work is an interpretative essay highlighting some of the ways in which economic history can contribute to the study of economic growth. The long-run implication of the industrial revolution for the world economy is traced.

The authors first look at the legacy of the industrial revolution and its 19th century aftermarket. There was a big shift in the centre of gravity of the world economy of 1900 was rarely different from that of 1700 in terms of its technological capabilities, the income levels in leading economies, the extent of globalization and the degree of international specialization in production.

The proximate sources of growth, lessons from the ICT (Information and communication Technology) revolution are presented in one section of the essay. Three sections are devoted detailed cast studies ion the nature of catch up:

Case Studies I: <u>Initial success and subsequent disappointment</u>, (a) European Golden Age (1950-73) and subsequent slowdown.

Case Studies II: <u>Success at least for now</u>, (a) The East Asian Miracle (b) China, and (c) India

Case Studies III: <u>Failures</u>, (a) Failed catch-up in USSR (b) Post-Colonial sub-Sharan Africa, and (c) The natural Resource curse
According to Crafts and O' Rourke,

The convergence of countries is a process whose roots lie in the great divergence of the 19th century. The great divergence was due to new industrial technologies implemented in some regions/countries of the world but not in other. It was magnified by the globalization of the period which, due to technological argument related a division of labour between an industrializing "West" and a deindustrializing "Rest".

Regional inequalities have been reduced as a result of the spread of modern industrializations. However, convergence has not been as smooth as simple growth model assume: the economic history of the 20th century growth points to various frictions that impede the process. Besides successes in convergent, these have been a variety of failures.

Innovation reflects the economic situation of the leading or frontier economy of the time. This was the U. K. …… the late 19th century and the U.S. thereafter. European economies and even Britain itself found themselves at a disadvantage in the 20th century in regard to the adoption of American techniques that had been developed in the context of American factor prices and the American market. Social capability matters

for growth and not all countries have it. Intuitions are path dependent, and can be an impediment to growth.

Geography is another factor for convergence. It may matter in different ways at different points in time: resource abundance may be a blessing in some time period, but a curse in others, depending on the tradability of resources and on their nature.

Economic historians emphasize the importance of Wars, technological revolutions, financial crises, and other events that are treated as exogenous shocks in economic models, but which are elements in the evolution of the World. The WWI, the Russian Revolution, or the Great Depression were not mere complications in the history of 20th Century economic growth, but a part the evolution. Even short run episodes, it handled badly, can have a long run impact on economic growth.

Crafts and O'Rourke offer a new and detailed perspective on the economic history of convergence and divergence since 1820, with a focus on the 20th century. The essay adds a different dimension to the vast literature on the subject.

4.6 Jorgenson (2016) on India and China in the New World Order

Jorgenson of Harvard University has recently analysed the sources of economic growth for the G7, the G20 and the world economy for the period 1990-2012 and projected the growth for the period 2012-22. He focuses on 14 major economies - the G7 economies including the US and seven emerging economies of the G20, including India and China.

Jorgenson notes that the US was the World's largest economy throughout the 20th century. According to this empirical growth analysis, in the 21st Century the balance of the world has shifted from industrialized economies, led by Europe, Japan and the US, to the emerging economies of Asia, especially China and India. In terms of purchasing power parity (PPP) estimates based on the World Bank's 2011 International comparison program (ICP 2011), the new economic order is China, the US, India, Japan, Germany, Russia and Brazil.

According to Jorgenson, World economy growth has accelerated during the 21st Century and rapid growth will continue. While Chinese economy growth has already slowed, Indian growth will accelerate. As China and India rise in relative importance in the 21st Century the accelerated growth of the world economy will be maintained.

In Jorgenson's informed assessment, the" Asian Model "of economic growth relies on globalization and investment in human and nonhuman capital, rather than innovation. This new growth paradigm of the "Asian Model"emphasizes skilful management by public and private authorities.

Jorgenson analyses the performance of the World economy during the period 1990-2012. With GDP as a measure of output and total factor productivity (TFP) as output per unit of a combination of capital and labour inputs, he presents output, input and TFP for the World economy and major groups like the G7, and the G20, and individual economies of the G7 - Canada, France, Germany, Italy, Japan, the UK and the US and the seven emerging economies (EEs) Brazil, China, India, Indonesia, Mexico, Russia and South Korea. He refers to the EEs as the extended BIRCs.

For his analysis of the growth of the World Economy, Jorgenson utilizes the Total Economy Database (TED), originally developed by Maddison at the University of Groningen and maintained now by the Conference Board. This was expanded in collaboration with Jorgeson and Vu (see Jorgenson and Vu, 2013)

Jorgenson proceeds to present projections of economic growth for the major groupings of economies mentioned above for the period 2012-2022. His major findings are: the future growth of the World economy will accelerate, relative to the historical period 1990 - 2012; the advanced economies of the G7, the OECD, and the European Union (EU) will grow more slowly, while the growth rates of the extended BIRICS is almost the same as during 1990 - 2012; the acceleration in world economic growth is due to the increasing importance of the more rapidly growing economies like China and India.

The driving forces in the future growth of the World Economy are demography and technology, Projections of labour productivity incorporate projections of improvements in capital and labour composition or quality and total factor productivity .

The attractive feature of the Jorgenson exercise is that it provides a panoramic view of economic growth and productivity in the world economy and a comparison between the advanced economies and the emerging economies during 1990 -2012, building projections for the period 2012 - 2022 using a suitable dataset, and leading to a statement of the New World Order, with China and India holding the first and third positions in the second decade of the 21stcentury, if not beyond.

4.7 Vu (2013) on Developing Asia in the World Economy
Vu has collaborated with Jorgensonin his research on the growth and productivity on the different country groups in the world economy for the closing decades of the 20th century and the first decade of the 21st century.

Vu's (2013) book, The Dynamics of Economic Growth: Policy Insight from Comparative Analysis of Asia, with a Foreword by Jorgenson, presents a compressive analysis of Developing Asia, comprising 16

countries, in the global dynamics of catching-up and falling behind during 1990-2010, and ends up with a catch-up policy framework for sustaining high economic growth (chapter 5 of the book). One attractive feature of the book as special attention to the comparatives analysis of the two giant economies in Asia, China and India, spanning the reform period 1990-2010.

Vu notes that Developing Asia, in spite of relatively high growth in recent decades has a long way to go before several nations in the region can escape from poverty and attain prosperity. Using the income relative to the US in purchasing power parity (PPP) terms as an indicator of development, in 2010 this indicator was at 13 percent for Developing Asia, as a whole 11 percent for ASEAN-6, 5 percent for the SAC-4 consisting of Bangladesh, Nepal, Pakistan and Sri Lanka, 16 percent for China and 8 percent for India.

With the exception of the four Asian Tiger economies and Malaysia, the developing Asian Countries, especially the South Asian nations, are much below the world's average income level. The income level relative to the world average in 2010 was only 67 percent for China, 30 percent for India and 11 percent for Nepal, the poorest country in the group. It is essential that most of the developing Asian economies have to achieve sustained high economic growth for many decades to come, for them to catch up with the world average.

Vu argues that the Asian growth model is the outcome of a strategic policy framework that focuses on fostering and sustaining high marginal product of capital, 14PK. The policy framework pays attention to enhancing the activeness of the capital investment.

Vu's empirical analysis in the book confirms that the economic growth of Developing Asia in the two decades 1990-2010 far exceeded that of industrialized countries and other developing economies. As a result many economies in Developing Asia made substantial progress towards catching up in per capita income, while the group as a whole has become a major driver of world economic growth. The growth patterns of developing Asian economics during 1999-2010 is consistent with the growth model followed by successful East Asian economies in earlier periods, which is characterized by sustained high growth driven by intensive capital accumulation. Vu infers that the impressive performance of China and India during 1990-2010 indicates that this growth model works not only for small or mid-sized economies but also for large economies, not only for East Asia but also for South Asia.

The evidence reviewed in the book also indicates that the secret of the Asian growth model lies not in achieving high TFP growth but in sustaining reasonable TFP growth despite intensive factor accumulation over extended period.

The strategic policy framework highlighted by Vu facilitates the achievement of sustained moderate TFP growth accompanied by intensive capital accumulation, focuses on the enhancement of the marginal product of capital. This framework comprises three strategic directions: (1) exploiting the backwardness' advantage; (2) upgrading the absorptive capability; and, (3) creating favourable conditions for investment structural change and efficiency improvement.

Vu presents much empirical evidence for China and some evidence for India to show that both China and India made significant progress on all the three strategic dimensions. He attributes the better catch-up performance of China to its greater efforts compared to India.

China and India face different type of challenges in sustaining their remarkable growth in the post-2010 period. The nature or specific policy initiatives for sustained economic growth in India require attention to macro-economic stability, infrastructure development and competitiveness of the manufacturing sector.

4.8 Productivity Convergence Literature

Wolff (2014) is one recent and comprehensive narrative on Convergence. In the ten chapters of the book a various issues relating to the empirical analysis of convergence of income levels and productivity levels are discussed. The essentials of modern growth theory, beginning with the 1956 Solow – Swan growth model, its modification by Mankiw, Romer and Weil (MRW model) of 1992, the Lucas (1988) and Romer (1990) growth models and Aghion – Howitt endogenous growth theory model are outlined in Chapter 2. The definitions of a convergence and P – convergence, econometric issues, early data sources and methods are also presented in this chapter. The theory and estimation of productivity growth at the industry level and country level and the associated measurement issues are the subject matter of chapter 3. Chapters 4 to 8 are devoted to various aspects of the growth and productivity performance of advanced industrial countries. Chapter 4 on the long-term record, reviews studies on convergence in per capita income, labour productivity and total factor productivity in the long term, 1870 to 1979, and in the very long term, year 1 to 2006; several of the studies reviewed including Abramovitz (1986) Baumol (1986) and Baumol, Blackman and Wolff (1989) made use of data provided in Maddison (1982) on GDP, employment and capital stock for sixteen OECD countries for the period 1870 to 1979.

Strong evidence of convergence in labour productivity levels was found among this group of 16 advanced countries. Between 1870 and 1938, the CV (coefficient of variation) fell almost by half. However, as a consequence of the destruction of capital stock during World War II, the CV in 1950 increased close to its 1890 level. A high degree of convergence

was observed in the post-war period, 1950 to 1979, with the CV falling by three-fifths. The correlation between 1870 labour productivity level and annual rate of productivity growth from 1870 to 1979 was – 0.93, pointing to unconditional convergence in the long-term.

The evidence on very long-term convergence in per capita income from year 1 to 2006 AD for sixteen OECD countries (the "Maddison 16") is not as unambiguous as for the period from 1870 to 1979. In the year 1, Italy (the Roman Empire) was the leading country. However, between the year 1 and 1000, with the break-up of the Roman Empire, there was a sharp decline in the Roman Empire's per capita income resulting in dramatic convergence in GDP per capita among the sixteen countries. By the year 1500, there was again a sharp divergence in per capita incomes led once again by Italy. Further divergence was in evidence from 1500 to 1700 with the emergence of mercantile capitalism in countries such as the Netherlands and the beginnings of Industrial Revolution in the U.K. With industrialization spreading to other countries in Western Europe and to the U.S., there was a clear convergence in per capita income from 1700 to 1820. With the progress of industrialization in selected countries, the dispersion in per capita income increased from 1820 to 1870. The pattern for the post-1870 period was similar to that for labour productivity described above. Over the very long term and the more recent long-term, no clear pattern of convergence even among this relatively small group of countries was found.

Wolff notes that several studies went back as far as 9000 B C, Galorand Weil (2000) and Galor (2012), for example, considered the long transition process from thousands of years of Malthusian stagnation through the demographic transition to modern growth. Galor (2012) presents a unified growth model to capture the transition among three regimes that historically characterized economic development. The first regime is the Malthusian regime, which is characterized by slow technological progress and high enough population growth resulting in stagnation in income per capita. The second regime is called the post Malthusian period, in which technological progress accelerates and population continues to increase. The third regime is the modern growth regime, when the positive association between income growth and population growth is reversed. This modern regime is characterized by sustained income growth and lowered population growth.

In Chapter 9 of his book, Wolff (2014) reviews the existing evidence from several studies on the convergence hypothesis for advanced and developing groups of countries for the period 1970 to 2003 and on the factors that affect the convergence process. The catch-up effect, measured by the coefficient of the initial level of per capita output in the growth

regression, acts as a strong force among wide range of countries of the world.

Three other strong forces have been identified:

1. Investment rate
2. Level of education of a country's population (particularly primary and secondary education)
3. Good institutional framework: rule of law, stable polity, "good government" and developed social infrastructure.

Many other factors have been suggested in the literature. These, however, produce mixed or weak results. There are degree of trade openness, FDI, investment in R & D, degree of financial development, foreign aid, natural resources, product market and labour market regulations.

Wolff refers to the central arguments on convergence in terms of Gerschenkron's notion of the advantage of relative backwardness. The argument is that countries that are far behind the technology frontier have the best potential to gain from technology transfer and should grow most rapidly.

Wolff notes that today's industrialized (OECD) countries provide clear evidence of the power of the catch-up effect. Between 1950 and 1980 the CV (coefficient of variation) in average LP (labour productivity) fell by half among this group of 24 countries. Some countries, namely, Greece, Ireland, Japan, Portugal and Spain, achieved high growth rates in productivity.

By 1980, the catch up effect had generally petered out. The US began to pull ahead of the EU in the 1990s and early 2000s, thanks to the IT revolution. The first Asian Tigers and later the New Asian Tigers achieved high growth rates since 1960s.

Wolff concludes that even the least developed economies have a latent potential to catch up in terms of GDP per capita, provided the above mentioned conditioning factors are created and exploited.

5. Related Contributions
5.1 Piketty (2014) on Wealth and Income Inequality

Piketty (2014) in his magnum opus, Capital In the Twenty First Century analyses a unique collection of data from 20 countries, including India, ranging as far back as 1700 to analyse between country and within country inequality of wealth and income. He shows that modern economic growth and the diffusion of technology, knowledge and skills have allowed mankind to avoid inequalities on the apocalyptic scale predicted by Karl

Marx in the 18th century. But the deep structure of capital and inequality have not been modified as expected in the optimistic decades after World War II. The main driver of inequality - the tendency of return on Capital, r, to exceed the rate of economic growth, g, - threatens to generate extreme inequalities that stir discontent and undermine democratic values.

The World Top Income Database (WTID), based on the joint work of some 30 researchers around the world, is the largest historical database available concerning the evolution of income inequality is the primary sources of data for the book. The second most important source data concerns wealth, including both the distribution of wealth and its relation to income. For this, Piketty relies on three distinct sources of data and methodology, each of which is complementary to the others.

Piketty notes on the basis of his analysis that the process by which wealth is accumulated and distributed contains powerful forces pushing towards divergence. Forces of convergence also exist, and in certain countries at certain times, these may prevail, but the forces of divergence can regain the upper hand as in 2010s.

The book relies primarily on the historical experience of five leading developed countries, namely the US, Japan, Germany, France and Great Britain,

With regard to empirical results, Piketty begins by examining the evolution of the global distribution of production. He documents that from 1900 to 1980, 70-80 per cent of global production of goods and services was concentrated in Europe and America, which dominated the rest of the world. By 2010 the European-American share had declined to roughly 50 percent approximately the same level as in 1860. Piketty remarks that it is likely to fall further to 20-30 per cent at some point in the 21st century. He further remarks that the phase of divergence in per capita output is over that a period of convergence has set in. However the resulting "Catch-up" phenomenon is far from over.

Piketty then proceeds to discuss the distribution of world GDP by region (Europe, America, Africa and Asia, including major countries in each region) in the year 2012 (Table 1.1, page 63) and sums up current global inequality:

Per capita income in PPP euros is on the order of 150-250 euros per month in sub-Saharan Africa and India. It is as high as 2500-3000 euros per month in Western Europe, North America and Japan, that is ten to twenty times higher. The global average, which is roughly equal to that China is around 600-800 euros per month.

Piketty states that historical experience suggests that the principal mechanism for convergence at the international level as well as domestic level is the diffusion of knowledge, the effectiveness of which depends on the presence or availability of enabling factors.

After a detailed and critical examination of the state of wealth and income inequality between countries and within countries in the world in 16 chapters of the book.

Piketty presents a summary evaluation at the end of the book the historical knowledge concerning the dynamics of the distribution of wealth and income since the 18th Century and has attempted draw from this knowledge lesson for the century ahead. The sources of which Piketty draws are more extensive than any previous author has used. Piketty caution that his conclusion are "tenuous".

Piketty highlights the central contradiction of capitalism in the form of the inequality r > g, where r is the private rate of return on capital and g is the rate of growth of income and output. The overall conclusion of the study is that a market economy based on private property, contains powerful forces of convergence, associated with the diffusion of knowledge and skills, but it also contains powerful forces of divergence, which are inimical to democratic societies and to the values of social justice.

The inequality r > g expresses a fundamental logical contradiction, according to Piketty's analysis. The entrepreneur inevitably tends to become a rentier, increasingly dominant over those who own nothing but their labour. The divergence in the wealth distribution is occurring on a global scale.

There is no "simple solution" to the big problem. Increase in the growth rate can be achieved by investing in education, knowledge and non-polluting technologies. But reaching a growth rate of 4 or 5 per cent a year is difficult history shows that only countries that are catching up with more advanced economies such as Europe during three decades after World War II or China and other emerging economies to day - Can grow at such rates. For countries at the World technology frontier - and ultimately for the World as a whole the growth rate is unlikely to exceed 1 - 1.5 percent in the long run no matter what economic policies are adopted.

With an average return on Capital of 4-5 per cent the inequality r > g is likely to become the norm in the 21st Century as it had been throughout history until the eve of World War I. In the 20th Century, it took two World Wars to wipe away the past and reduce the return on Capital, resulting in the illusion that the fundamental contradiction of capitalism (r > g) had been overcome.

Piketty advocates progressive annual tax on Capital, for avoiding an "inegalitarian spiral" while preserving competition and incentives for accumulation. Progressive tax on capital would contain the unlimited growth of global inequality of wealth, which is increasing at a rate that cannot be sustained in the long run.

5.2 Acemoglu and Robinson (2012) on the Importance of Inclusive Institutions

The book <u>Why Nations Fails?</u> authored by Acemoglu and Robinson has attempted to show that while economic institutions are critical for determining whether a country is poor or prosperous, it is <u>politics and political institutions</u> that determine what economic institutions a country has. The theory for world inequality advanced in the book shows how political and economic institutions interact in causing poverty or prosperity and how different parts of the world have different sets of institutions. Once a society gets organised in a particular way, this tends to persist. This persistence makes it difficult for poor countries to become prosperous.

The book argues that most of the <u>other hypothesis</u> proposed by social scientists to explain the origins of poverty and prosperity fail to convincingly explain the poverty patterns across the globe. In this connection, <u>three hypotheses</u> are mentioned:

1. The Geography Hypothesis claiming that global inequality is due to geographical differences is refuted by evidence for a number of real world examples.
2. The authors concede that to the extent that social norms related to culture matter, the culture Hypothesis is useful in understanding world inequality.
3. The Ignorance Hypothesis which states that world inequality exists because citizens or their rulers do not know how to make poor countries rich. This hypothesis attributes poverty to "market failures", which policy makers do not know how to remove. The authors argue that this hypothesis is partially valid.

The institutional view of comparative development highlighted in the book builds on a number of important earlier contribution. See for example and North, Wallis Weingast (2009).

Acemoglu and Robinson's on institutions theory of World inequality and its historical origins has been used in the book to explain the main contours of economic and political development around the world since the onset of the Neolithic Revolution some 10000 years ago. The theory makes a distinction between "extractive" and "inclusive" economic and political institutions. It also attempts an explanation for why inclusive institutions emerged in some parts of the World and not in others. Central to the theory is the link between inclusive economic and political institutions are prosperity.

The book states that nations fail economically because of extractive institutions. These institutions keep poor countries poor and present them from embarking on a path of economic growth. This is true now in Africa, in countries such as Zimbabwe and Sierra Leone, in South America in Colombia and Argentina, in Asia in North Korea and Uzbekistan and in the Middle East in Egypt. There are notable differences among these countries. Some are tropical some are in temperate latitudes. Some were colonies of Britain; other of Japan, Spain and Russia. They have very different histories, languages and cultures. What they all share is extractive institutions. I all these cases the basic of these institutions is an elite who design economic institutions in order to enrich themselves and perpetuate their power at the expense of the vast majority of people in society. Institutions that create poverty generate negative feedback loops and endure- a vicious circle.

As the various vicious circles played out in different parts of the world over the past 250 years or so, world inequality emerged and persists.

According to the authors, the solution to the economic and political failure of nations is to transform their extractive institutions to inclusive only. This is not easy. But is not impossible. Examples of cases that have managed to break the mould and transform their institutions for the better, even after a long history of extractive institutions, are Botswana in Africa, China in the post-Max period and the US South after the Civil Right Act of 1964. China broke the mould even if it did not transform its political institutions and reaped huge benefits in terms of growth and poverty reduction. The authors show in several chapters of the book how their institutional theory works and illustrate the wide range of phenomena it can account for

Acemoghu, Johnson and Robinson (2011, 2002) attempt econometric analysis of the role of institutions, geography and culture and show that institutions dominate the other two types of explanation in accounting for inter-country differences in per capita incomes.

6. Concluding Remarks

We have reviewed a wide range of literature on international inequality,catch up and related aspects.The total number of contributions reviewed is twelve.While some of the contributions reviewed are very comprehensive in terms of the issues covered or temporal coverage, all have said something new. All have provided considerable evidence on the relevant issues.

The salientfindings are that international inequality is on the decline, although intranational inequality is on the rise. A large proportion of countries are catching up in the sense of reduction in the gaps with rich

economies, the process is slow. Even high growth developing econ0mies, such as China and India will take a long time to eliminate the gap.According to Barro's "Iron Law" the rate of convergence is only 2.0 percent. This is confirmed in his recent study reviewed in Section 4.

The factors behind catch up are Investment Rate, Level of Education, especially primary and Secondary education, Infrastructure, physical and social, good governance and inclusive institutions.

Most of the empirical studies have made use of different versions of the Penn World Tables (PWTs) based on price data collected for the same or similar products in different countries across the globe in a bench mark year, for constructing purchasing power parity (PPP) cost of living index numbers.In recent assessments of the PWTs,some limitations have been highlighted. Some caution has to be exercised in the use of PWTs.

ICP 2011 is the eighth and latest exercise. It has been funded and monitored by the World Bank. Leading researchers have commented that ICP 2011 is an improvement over ICP 2005 on which PWT 8 is based. PWT 8 has expanded on previous versions in three respects,as noted by Feenstra et al.2015.PWT Version 9 will be based on ICP 2011. It should be an improvement over PWT Version 8.

The essay by Jones reviewed in this paper has covered wide ground in empirical growth economics as well as the new area of Development Accounting with a small illustration based on Jones (2016).

Nayyar's comprehensive narrative of catch up in the countries of Africa, Asia, and Latin America is profoundly insightful and informative.The study on Developing Asia has offered useful policy suggestions for sustainable growth in China, India and other developing Asian economies. In the New World Order, Jorgenson has empirically established that the ranking in terms of size of the economy is China, the US, India,Japan, Germany, Russia, and Brazil. At the same time, India's per capita income is the lowest among the seven nations.

Other works reviewed in this paper have thrown up several interesting findings. Several studies reviewed provide separate data for China and India to facilitate a comparison between the dominant economies.

In our review, because of space considerations, we have not been able to cover the recent contributions of Atkinson,Bourguignon, and Milanovic on Intra-country Inequality and Global Inequality. Some very recently published Handbooks and monographs contain valuablematerial.

The literature is too vast and diverse for a single survey of the kind attempted in this paper, to cover more than what has already been covered.

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