Absolute And Conditional Convergence And Divergence In India And China: A Comparative Panel Data Regressions Analysis

Narender Thakur and Sonia Aggarwal

Associate Professor, Department of Economics, Dr. Bhim Rao Ambedkar College, University of Delhi. Emails: narender224jnu@gmail.com and soniaagg1970@gmail.com

Abstract

A debate on absolute and conditional convergence and divergence between the per capita GDP of the emerging economies (India and China- the global south economies) and the United States- the dominant global north economy and four global north economies (the United Kingdom, Germany, Norway, and Russian Federation) during 2010-2020 is discussed in this paper. The descriptive analysis and panel regressions are used for testing the convergence and divergence. This paper has four significant results: (i) there is no significant difference between the GDP per capita of India and China reflecting an absolute convergence among the global south economies; (ii) an absolute divergence between China and the Russian Federation; (iii) an absolute divergence between the per capita GDP of China and the GDP per capita of the US, the UK, Germany and Norway and (iv) Norway has the highest GDP per capita as compared to other six economies -empirically testing by using the panel regression of the random effect - a conditional divergence between the global south economies (India and China) and the global north economies. The results have two policy implications: (1) there is a need to expand public funding in social sectoral investment, mainly in education, health, and research and development for creating a knowledge economy in developing economies, like India and (2) there is a crucial role of the welfare by the state in the recession times of Covid-19 era as both absolute and conditional divergences are significantly tested in this paper.

Key Words: Absolute and Conditional Convergence, Panel Data, Fixed and Random Effects, India, China, US and Global North and

Global South.

I. Introduction

There has been a debate on the income convergence between the lower-middle income and high-income countries after World War II, especially in the golden age period in the Western developed economies, mainly the US and the developing economies, like India and China. In the 1950s, the Solow model of exogenous growth explained the residual factor of the growth of GDP and the GDP per capita in terms of total factor productivity (TFP) of capital and labor. In mid of the 1980s, the new or endogenous growth theory explained the residual factors of economic growth in terms of investment in human capital and technological capabilities (Romer, 1986; Lucas, 1988). They also defined the nature of human capital in terms of the public good of knowledge production and its instrumental role in the economic growth and development process, along with public knowledge and patents. However, the models of funding to produce public knowledge are not adequately elaborated, whether it is public funding or private funding. The higher role of welfare states in post-WWII in Western developed economies was crucial to expanding the technological frontiers and thereafter it led to higher labor productivity and eventually resulted in higher GDP per capita and GDP. The papers and studies on the factors of economic growth and development have been discussed below in the literature review section. In the background of this, the first objective of this paper is to examine the factors of economic growth and development of the lower-middle-income economy (India), upper-middle-income economies (China and the Russian Federation), and high-income economies (the United States, the United Kingdom, Norway, and Germany). The second objective is to empirically examine the GDP per capita and the convergence between the GDP per capita of the three lower-upper-middle economies and the four high-income economies.

II. Literature Review

In macroeconomics and development economics, there has been a debate on the role of openness to international flows of goods, technology, and both human and financial capital in the processes of economic development and growth especially in developing and poor economies. Since the 1970s, a focus on trade and financial liberalization was advised to developing countries for a

convergence of per capita income. It is claimed that economic growth is probably the most important benefit originating from it since increased trade and capital flow openness promotes supposedly the efficient allocation of resources, enhances competition in national and international markets, and allows for the diffusion of knowledge and technology across countries. While many economists asked for freer economic development by addressing the national developmental challenges in underdeveloped countries, namely the global south countries as the global north countries and their countries are more active in their developmental paths. Further, the underdevelopment of global south countries resulted from the financial capital flows originating from the global north countries, especially the US, and invested in the global south countries for the extraction of profits resulting in lower growth and development. This process of the dominance of the rich countries of the global north countries led to the developmental trap of the global south countries and a divergence of per capita income between these two sets of countries. For the detailed review of the literature on convergence and divergence, the different empirical studies are discussed below, especially from 1999 to 2021.

Sarkar (1999) examined 64 countries, 26 countries belong to the UN category, 'developed market economy' (Rich or North), and the other 38 countries belong to the category, 'developing market economy' (Poor or South) to convergence. There is some evidence of convergence but individual countries experience some diversity.

Dowrick and Golley (2004), analyzed economic growth and foreign trade and confirmed that primary exports are bad for growth. While trade openness promoted convergence in the 1960s and 1970s, benefits of trade accrued mostly to the richer economies, with little benefit to the less developed economies. Most of the dynamic benefits of trade are obtained through productivity growth, with a small contribution coming through increased investment.

Felbermayr (2004) used 108 countries for 1960-99, using the dynamic panel data model and GMM procedure proposed by Blundell and Bond (1998), to argue against the belief that international trade is less beneficial for initially poor countries than it is for more advanced ones. He is taking first differences to control country-special fixed effects for geographical or time-invariant institutional characteristics.

If there is any pattern of divergence then it is not due to trade openness and must be due to some different factor. The model shows that trade affects total factor productivity growth, and is more beneficial for countries that start with a lower level of TFP.

Prochniak et. al. (2009) examined real economic convergence among the European countries for 1992-2006. They have tested for absolute and conditional convergence from the regressions based on both cross-sectional and panel data. If regression is taken on cross-sectional data, measures the absolute convergence, but if regression is taken on the panel data, then conditional convergence is shown. The results show both types of convergence, the income gap between these countries has narrowed, although the gap was large.

Hakro and Fida (2009) examined the impact of trade liberalization on the per capita income convergence of Pakistan, India, Bangladesh, and Sri Lanka and their trade partners for the sample period 1972-2005. They adopted the convergence methodology of Ben-David (1996) and found that liberalization policies helped trading countries grow more rapidly, thus increasing their convergence rate. The convergence in per capita income can be due to other factors, but the effects of liberalization cannot be ignored.

Chandra (2009) analyzed the convergence of economic growth in India and China. The growth shows convergence but along with the rising concentration of income and wealth, the trends in poverty, employment, and unemployment worsened. This implies the benefits of economic growth since the late 1970s in China and since 1991 in India, are entirely offset by the rising income inequalities, degraded environmental conditions, and poor quality of health indicators.

Marius Brulhart (2010) surveyed the literature on trade liberalization for intra-national economic geographies and found that if regions are symmetric, then urban systems models and new economic geography models do not imply a robust prediction of the impact of trade openness on regional inequality. Regions with inherently less costly access to foreign markets, such as border or port regions, stand to reap the largest gains from trade liberalization.

Rodrik (2011) examined the high economic growth experienced by emerging and developing economies after the global financial crisis of 2008-2009, like China, Asian tigers, and Latin America. They benefitted from the pace of economic development. Africa also began to close the gap with the advanced countries. Developing countries can catch up for sustained growth if they follow economic diversification and foster structural change from low-productivity activities (such as traditional agriculture and informality) to mostly tradable higher-productivity activities.

Hye and Lau (2015) examined the impact of trade openness on economic growth in India from 1971–2009. He uses the trade openness index by using various proxies of trade openness; import divided by GDP, export divided by GDP, and export plus import divided by GDP. For estimation, it employs cointegration techniques like the Autoregressive Distributed Lag (ARDL) approach to cointegration and the rolling window regression method. The causality from trade openness and human capital to economic growth confirms trade openness-led growth and human capital-led growth in the long run and short run.

Switch (2016) analyzed the impact of liberalization on income convergence between countries, taking 19 developing countries, most of which experienced rapid growth post-liberalization. Following Ben-David's approach, the author formed two separate trading groups for import and export partners, pre-post-liberalisation for the sample countries. The results do not reflect any significant change in the rates of convergence for the developing countries pre- and post-liberalisation.

Mensah (2020) uses a panel analysis of 69 countries over 39 years from 1980 to 2018 to test for growth convergence (both absolute and conditional) among countries, divided into three regions, Europe, Asia, and Sub-Saharan Africa. There is no evidence of absolute convergence in the full sample indicating a lack of progress in closing the income gap between the developed and developing countries. The study found strong evidence of conditional convergence in the entire sample and Europe, Asia, and Sub-Saharan Africa.

Tsaurai (2021) explored the determinants of trade openness and, the impact of the complementarity between foreign direct investment (FDI) and human capital development on trade openness in transitional economies. Transitional economies are

advised to develop and implement policies to improve, FDI inflows, human capital development, economic growth, and mining sector growth if they want to benefit from trade openness.

The most of reviewed studies above showed a mix of arguments on the debate of convergence and divergence within the economy or among the economies. Some studies proved empirically that there is a possibility of convergence and another set of studies tested a divergence among the economies. This debate facilitates a research gap on the convergence and divergence with a focus on the Indian and Chinese economies- the emerging economies, especially in comparison to the US economy - the global north's most dominant economy and the other economies. Thus, this paper significantly addresses this research gap with panel data discussed further in the section on research methodology.

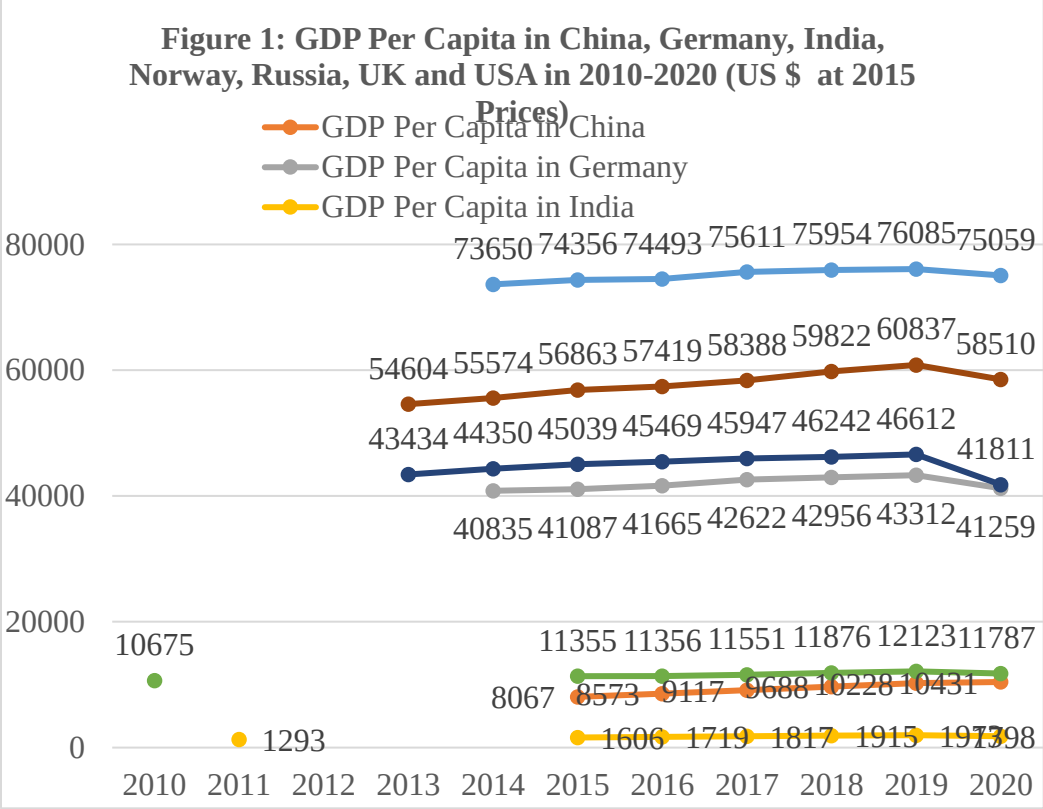
III. Research Methodology

For empirically examining the economic growth and development in these seven economies (India, China, the Russian Federation and the US, the UK, Germany, and Norway), two research questions are addressed: (1) what are the main factors of per capita GDP in these seven economies? and (2) Is there any convergence between the middle-income and high-income economies over the period (2010-2020)? Two types of analyses are undertaken to examine these two research questions: (1) descriptive analysis of all the economic growth and development parameters and (2) panel regressions of the dynamic, the fixed-effect, and the random effect to address the endogeneity problem in the econometric methodology. The dynamic panel data regression is preferred to the fixed effect and random effect however for testing the convergence of GDP per capita, the random effect is used as the dynamic panel and the fixed effect can not be used with the dummy variables for the seven countries. China has been taken as a base category to compare with the GDP per capita of the other six countries, for testing the convergence or divergence among the economies at the global level, especially in times of recession and the COVID-19 era. The data used for analyses is the World Development Indicators of the World Bank.

IV. Descriptive Analysis on Convergence and Divergence of

Gross Domestic Product (GDP) Per Capita in China, India, Germany, Norway, Russia, the UK, and the US

The purposes of taking these countries are different: the reason of Norway has the highest human development index at the global level. The highest human development determines inclusive development with growth. It is also reflected in the highest GDP per capita (at 2015 prices of US $), which was $ 73650 in 2014 and increased to $ 76085 in the pre-Covid year 2019 it is still higher than in 2014 but slightly declined to $ 75059 in the Covid year - 2020 (see Figure 1). The cause of the US, UK, and Germany is their higher economic development in terms of higher technological development and higher role of foreign capital/finance origins, mainly the US has a higher number of global top-multinational companies headquarters operated from New York. The GDP per capita in the US was $54604 in 2013 and it increased to $ 60837 in 2019 and it was $ 58510 in 2020, showing the adverse effects of the pandemic. The GDP per capita of the UK in these respective years are $ 43434, $ 46612, and $ 41811, implying a sharpest decline in the pandemic, as compared to all the other six countries, discussed in the next paragraph.



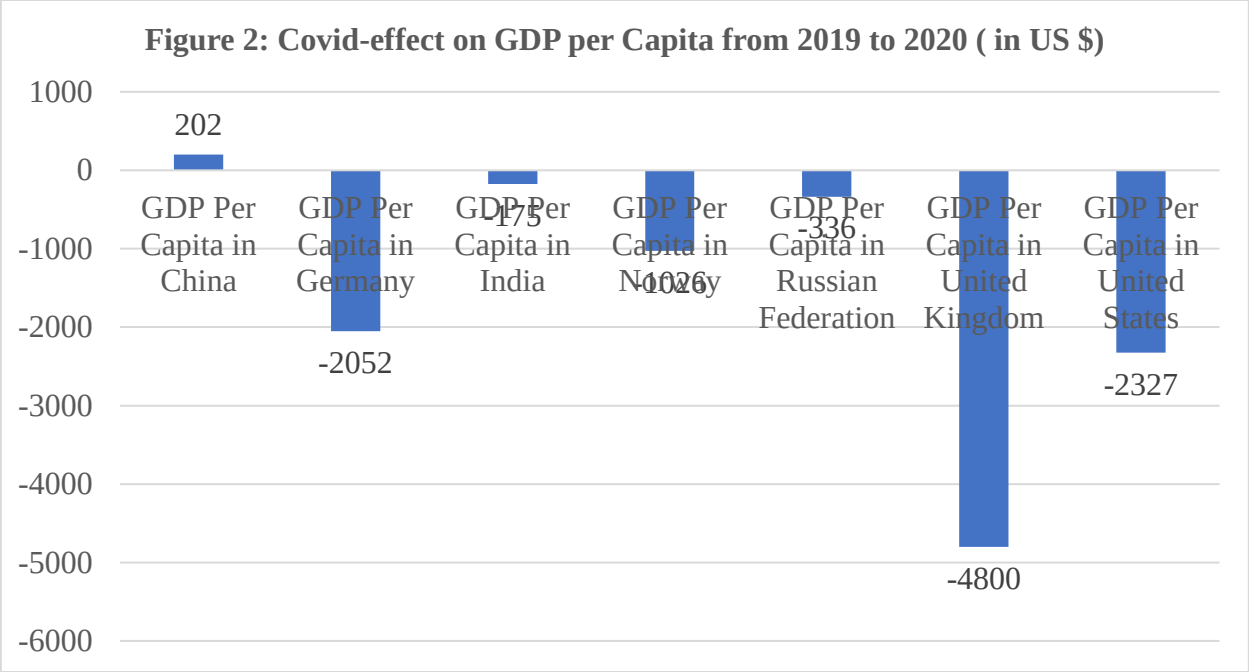
Source: Authors constructed the Figure by using WB

(2022) data.

The GDP per capita of Germany was $ 40835 in 2014, which increased to $ 43312 in 2019 and $ 41256 in 2020, showing a Covid effect. The three BRICS countries- Russia, India, and China except for Brazil and South Africa have lower GDP per capita than that of the four developed countries, the USA, the UK, and Germany. The GDP per capita in Russia was $ 10675 in 2010, it increased to $ 11355 in 2015 and further rose to $12123 in 2019 and it was $11787 in 2020. The GDP per capita of China in 2015 was $ 8067, which rose to 10228 in 2019 and 10431 in 2020, only the Chinese economy reflects a rise in GDP per capita in 2020 as compared to 2019, showing a resilience of the economy at the global level. The lowest GDP per capita of India was $ 1293 in 2011, which slightly increased to $ 1606 in 2015, further, it was higher to $1973 in 2019 but declined to $ 1798 in 2020, showing an adverse effect of the pandemic in the Indian economy. The World Bank classified the countries per capita Gross National Income (GNI) of countries on 1, July 2020 (WB, 2021): (i) income per capita is $ less than $1035-Low-income countries, income per capita between $ 1035 and $ 4045-lower-middle income countries, (iii) income per capita between $4096 and $12535-upper-middle income countries and (iv) income per capita is greater than $12535-high income countries. The chance of convergence of GDP per capita is lower between China and India, and other high-income and developed countries, the US, UK, Germany, and Norway. The Russian and Chinese economies are upper-middle-income countries and near high-income countries. The Indian economy has the lowest level of GDP per capita, is defined as a lower-medium income country as per the definition of the World Bank, and has a lower chance of convergence as compared to the developed economies, mainly the US in the present political-economic structures.

Covid-effect on GDP per Capita

Figure 2 shows that a decline in GDP per capita in terms of the effect in the UK was $ 4800 over the years from 2019 to 2020, in comparison to a decline of $ 2327 in the US, $ 2052 in Germany over the same year, $ 1026 in Norway, $ 336 in Russia, $ 175 in India and an increase in China of $ 202, showing a small recovery in the Chinese economy in the pandemic.

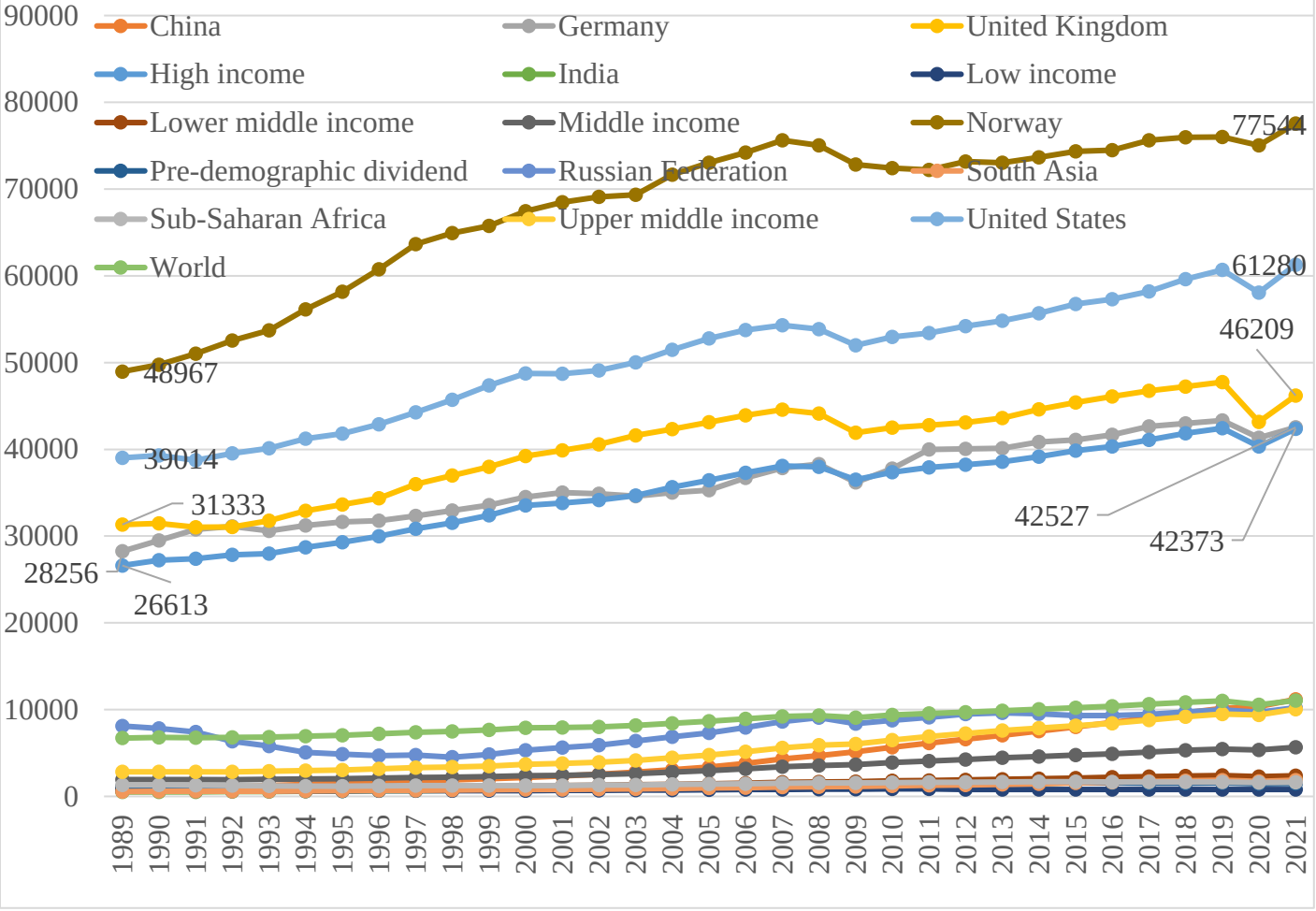


Source: Authors constructed the Figure by using WB (2022) data.

Recent GDP per Capita and Development in the Seven Countries: A Comparative Analysis

The comparative analysis of GDP per capita is undertaken to show the changes over the 32 years (1989-2021) in 7 countries and the groups of countries by their income levels and two regions (South Asia and Sub-Saharan Africa)

Figure 3: Comparative Analysis of GDP per Capita in the 7 different countries and other countries and the world level: 1989-2021

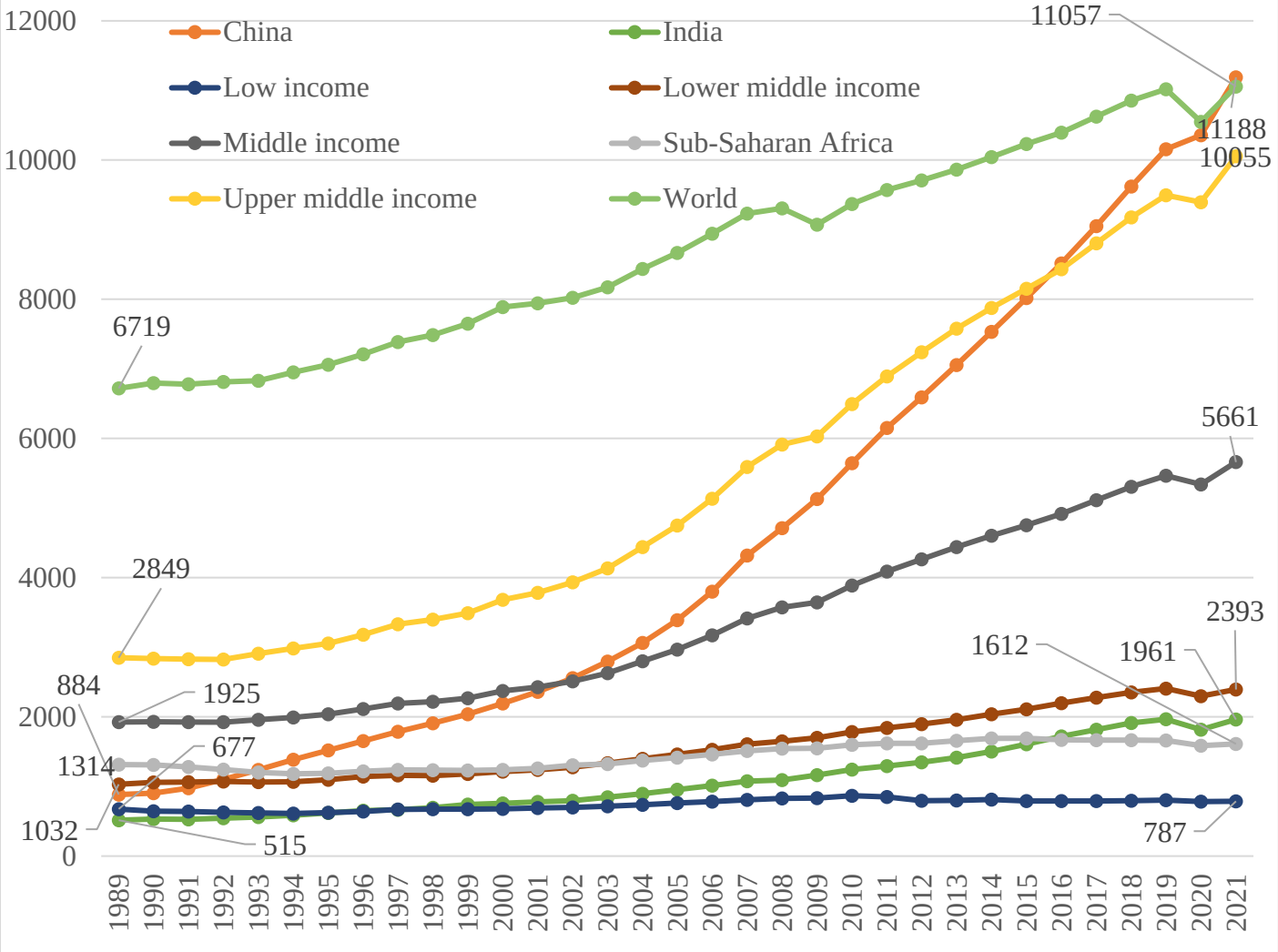


Source: Authors constructed the Figure by using WB (2022) data.

The GDP per capita of High-income countries increased from $ 26613 in 1989 to $42373 in 2021 (Figure 3), reflecting a growth rate of 59% (see Figure 5), reflecting inequalities of income among developed countries. The average GDP per capita of high-income countries is the lowest as compared to the individual top-developed countries. The level of per capita in highest ranked Norway increased from $ 48967 to $ 77544 with a growth rate of 58% (see Figure 5), the US GDP per capita increased from $ 39014 to $ 61280 with a growth rate of 57%. For the convergence analysis, the difference between the different income levels of countries is also examined further as compared to high-income countries (see Figures 6 and 7). It is important to examine the difference between GDP per capita in high and medium and low-

income countries as well as the difference between countries and regions over the years increased or decreased.

Figure 4: Comparative Analysis of GDP per Capita in India and China and other income-level countries and the World level: 1989-2021

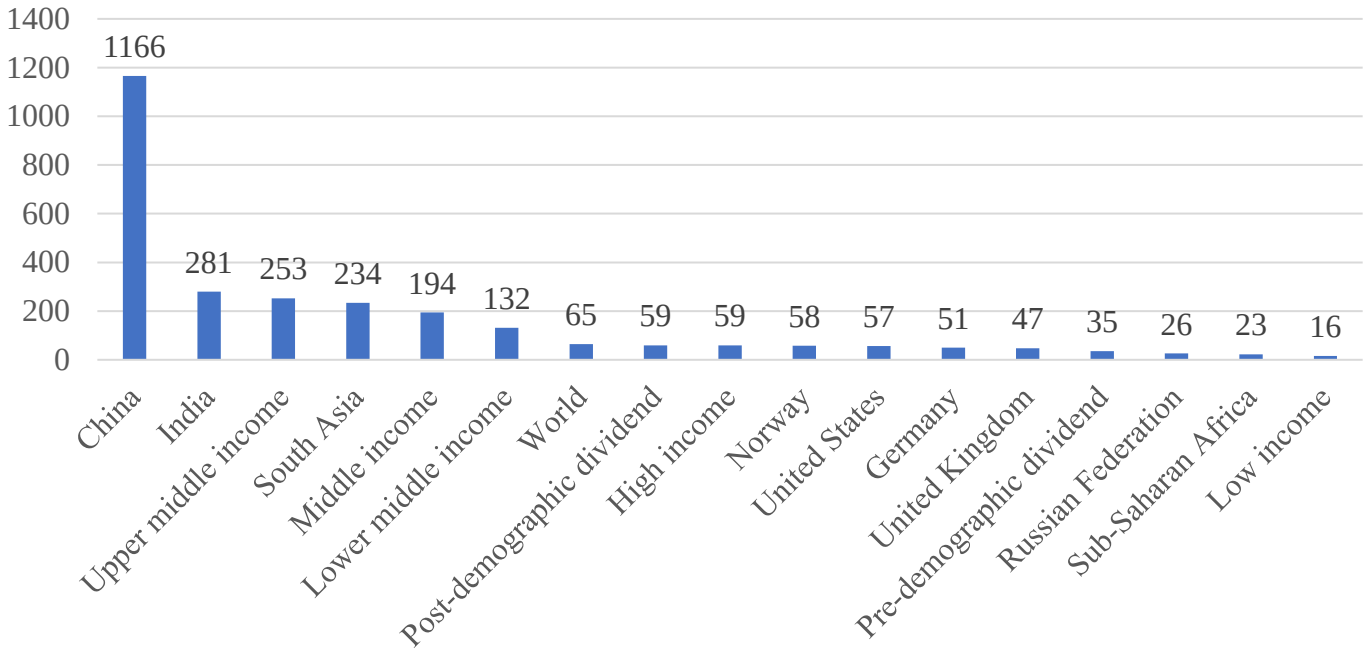


Source: Authors constructed the Figure by using WB (2022) data.

The per capita GDP in India was $ 515 in 1989, which increased to $ 1961 in 2021 after 32 years, an increase of 288% in 2021 from 1989. However, the GDP per capita of China was $ 884 in 1989, and rose to $ 11188 in 2021, an increase of 1166% (Figures 3 and 4), showing the highest increase in all the countries and regions depicted in Figures 3-5 and discussed in details further. The uneven development of the countries can be examined by the difference between the GDP per capita and the growth rates of the low-, low-

middle-, middle-, upper-middle- and high-income countries. The GDP per capita at the World level increased from $ 6719 in 1989 to $ 11057 in 2021, increasing by 65%. However, the GDP per capita of low-income countries increased from $ 677 to 787, showing a lowest increase of 16% as compared to upper middle-income countries increased by 253% from $ 2849 to $ 10055 and 194% increase in middle-income countries from $1925 to $5661 over the same years. Figure 4 shows the lower levels of GDP per capita in these countries as compared to the high-income countries as depicted in Figure 3.

Figure 5: Rate of Increase of GDP Per capita in Countries and Regions from 1989 to 2021



Source: Authors constructed the Figure by using WB (2022) data.

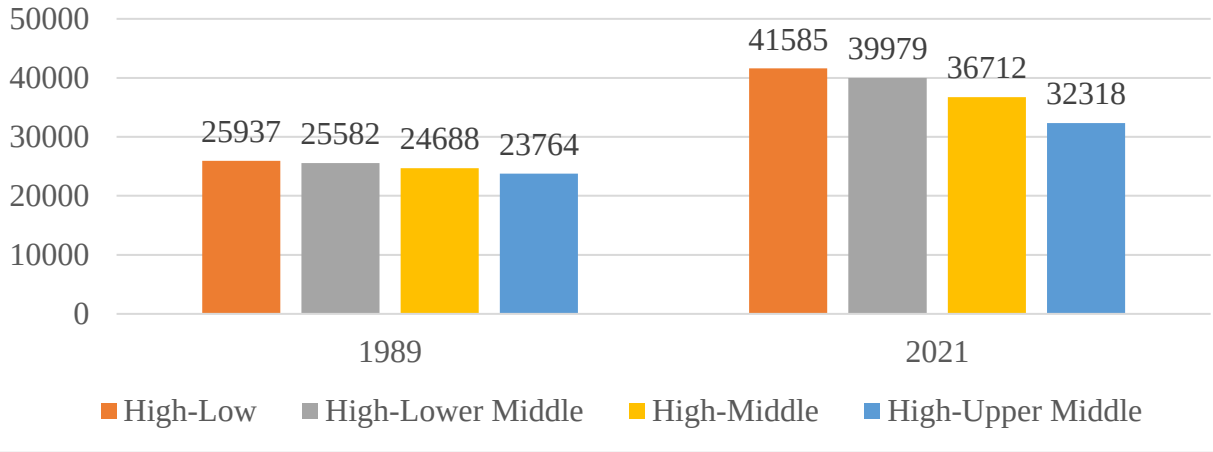
The rate of increase in Chinese GDP per capita has been the highest with 1166% from the year 1989 to 2021, in comparison to all the countries and regions. India has second rank in terms of the percentage increase with 281% over the years, which also influenced the growth rate of the South Asia region of 234%, it is near to the growth rates of the upper middle income (253%) and middle-income countries (194%). India is the lower middle-income country as per the definition of the World Bank and these countries growth rate of 132%. The average increase in the world level is lower at 65% reflecting increasing income and development inequalities as the majority of countries remained in the category

of low-income countries as depicted with the lowest growth rate of GDP per capita with 16% in comparison to the growth rate of high-income countries, that is 59%. The developed countries have a lower growth rate of 59% in comparison to the higher growth rate of upper-middle, middle, and lower-middle-income countries, the rank-order of the GDP per capita growth rate of the developed countries is Norway (58%), United States (57%), Germany (51%), United Kingdom (47%). Russian Federation's growth rate was 26% and Sub-Saharan Africa's growth rate was 23%, which is near to low-income countries' growth rate showing underdevelopment at a larger scale at the World level as well as in Sub-Saharan Africa.

Convergence or Divergence: Descriptive Analysis

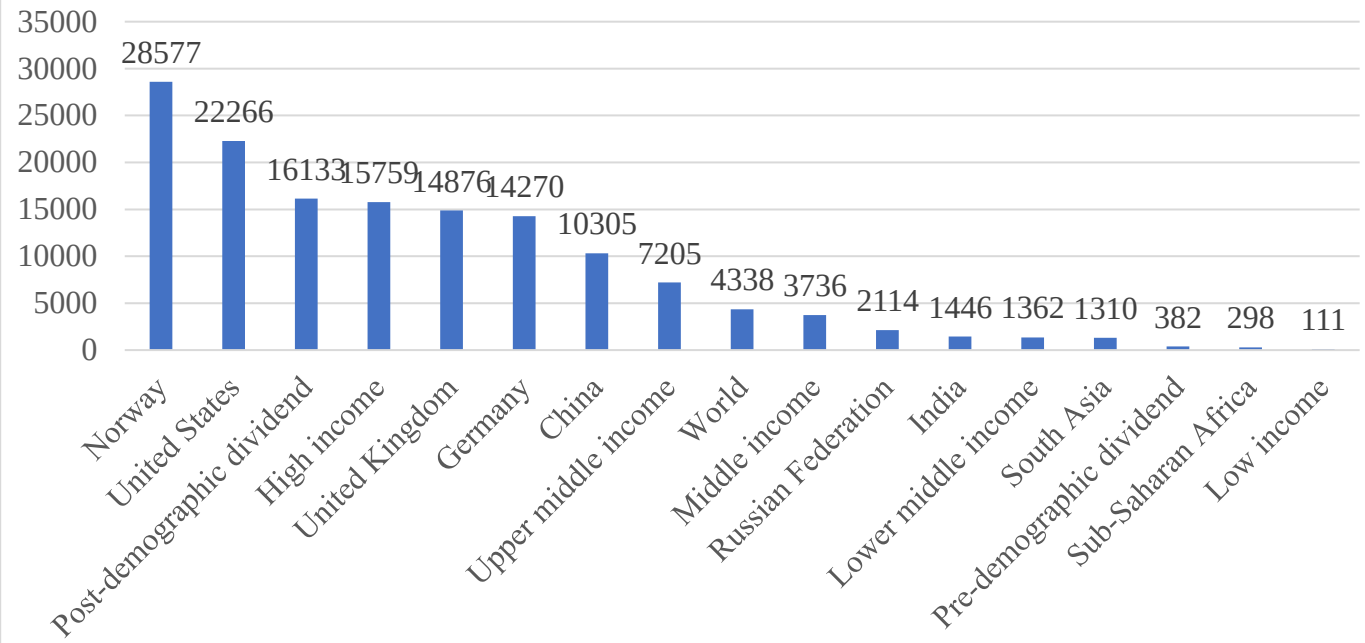
This section examines the convergence and divergence theories in the cases of countries, it is analyzed by the difference between GDP per capita of the high-income and low, lower-middle, middle, and upper-middle countries as well as the difference between the countries and regions during 1989 and 2021.

Figure 6: Difference between High income and low, lower-middle, middle, upper-middle income countries during 1989 and 2021 ($)



Source: Authors constructed the Figure by using WB (2022) data.

Figure 7: Difference between GDP per capita in the countries and regions: 1989 & 2021



Source: Authors constructed the Figure by using WB (2022) data.

The difference or gap between the high- and low-income countries/economies increased from $ 25397 in 1989 to $ 41585 in 2021, reflecting the highest divergence among the low-income countries and a case of most underdevelopment. Even the gaps between the high- and lower-middle, middle and upper-middle-income countries from 1989 to 20219 (see Figure 6). Figure 7 shows the difference between the GDP per capita of the countries and the regions, over the 32 years, the highest increases in GDP gained by high-income countries, like Norway ($ 28577) and the US ($ 22266)- the first two ranked countries in terms of the highest difference between per capita of 1989 and 2021, which are also parts of post-demographic dividend countries ($16133). The least developed countries in terms of the lowest difference between low-income countries ($ 111) and Sub-Saharan African Countries did gain their income reflecting the lower change of $ 298, these countries of underdevelopment have a scope of demographic dividend being youngest population but their underutilization of youth potential being more unemployed reflected in lower income difference of $ 382. India being a lower-middle income country had a lower difference of $ 1446, which is near to the difference between lower-middle income ($1362) and South Asia ($ 1362),

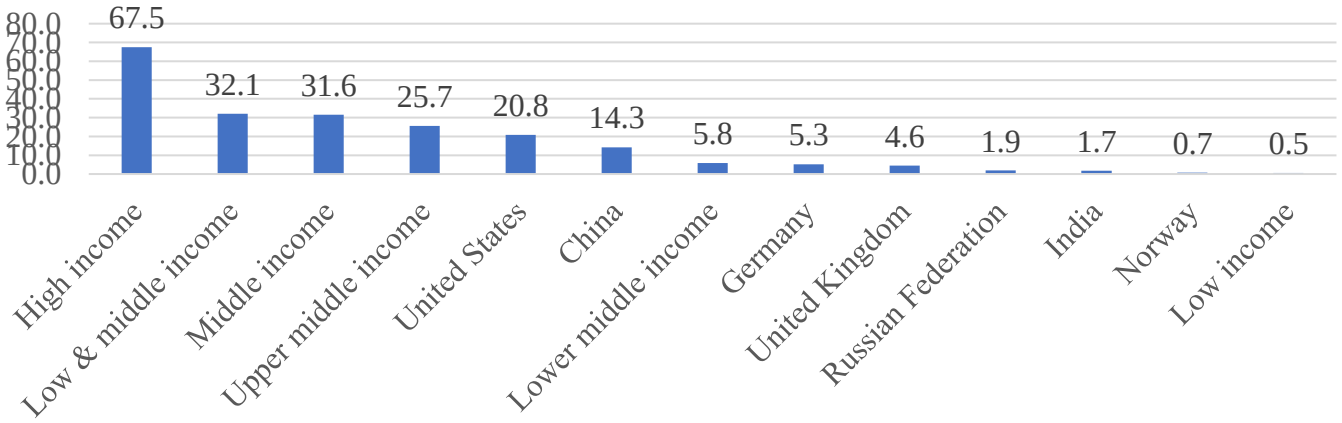
implying lower chances of convergence in the short run or the medium run until and unless there would be some bigger structural changes in the welfare of the younger population and their potential use in the productive activities with quality and inclusive education and health promoting labor productivity and well-being and eventually leading to higher economic, human and sustainable development in coming years, especially in the lower to middle-income countries. We have discussed the factors of growth and development in all these countries and regions.

Factors of Economic Growth and Development: Government Expenditure, Capital Formation, and Research and Development

1. Government Expenditure

The significant factor is instrumental to determine the GDP per capita expenditure in the countries as reflected in Figure 8, the percentage share in the high-income countries of total World government expenditure is the highest at 67.5 in 2015. The data is not available for China for the years 1989, 2020, and 2021, however, the share of other countries has not changed in these years. The share is lowest in the low-income countries, which is only 0.5%. The developed country, the US spent the highest government expenditure with 20.8% and second highest share of China with 14.3%, subsequent ranks are Germany (5.3%), the United Kingdom (4.6%), Russian Federation (1.9%), India (1.7%) and Norway (0.7%).

Figure 8: % of Government Expenditure in Countries of total World in 2015

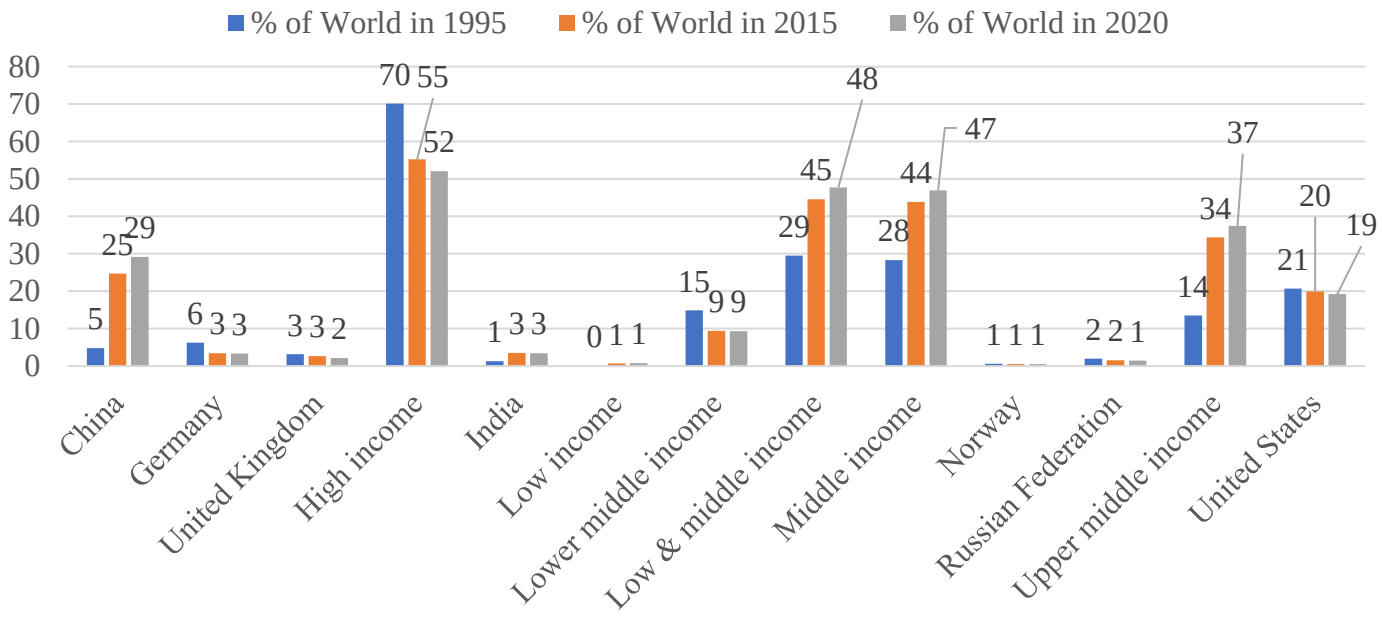


Source: Authors constructed the Figure by using WB (2022) data

2. Capital Formation

The percentage shares of high-income countries' gross capital formation (GCF) were highest over the years, 1995, 2015 and 2020 however it declined over these years, as it was 70% of total World GCF, then it declined to 55% in 2015 and 52% in 2020 (Figure 9). The share of low-income GCF is the lowest at 1% in both the years 2015 and 2020 (the data for low-income countries is not available in the year 1995), reflecting detrimental to the development. The share of the US was highest in 1995 at 21%, further, it declined to 20% in 2015 and 19% in 2020. China's share has taken over the US as it was only 5% in 1995, increased to 25% and further to 29% of the world GCF. However, its share of India was 1% in 1995 and rose to 3% each in 2015 and 2020. The share of Germany declined from 6% in 1995 to 3% each in 2015 and 2020. The United Kingdom also experienced a decline from 3% each in 1995 and 2015 to 2% in 2020.

Figure 9: Percentage Share of Gross Capital Formation (GCF) in Total World GCF during 1995, 2015 and 2020



Source: Authors constructed the Figure by using WB (2022) data.

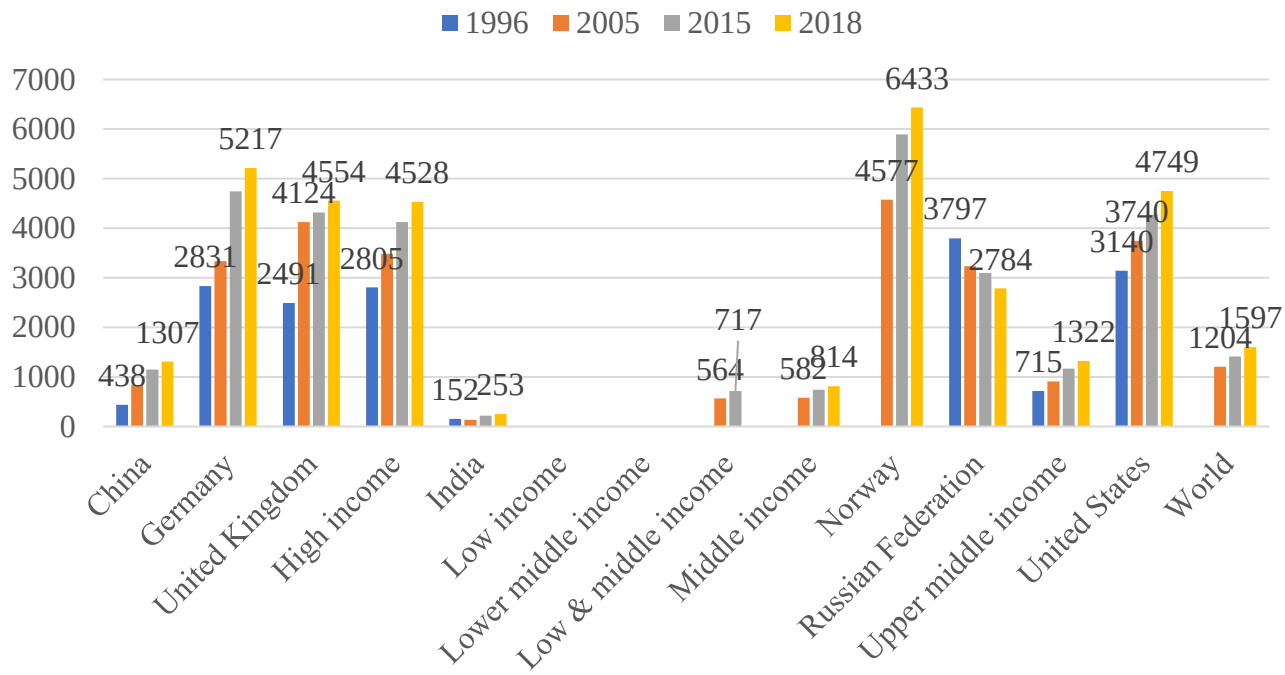
Norway's share remained constant at 1 % each in all three years. Russian Federation's share also declined from 2% in 1995 and 2015 to 1% in 2020. Thus, the dominance of the US is challenged by

China, and India also slightly increased its share as compared to other countries that experienced a decline in 2020, and one country- Norway's share remained constant.

3. Researchers in Research and Development

The number of researchers per million people is also an important factor in explaining the technological capability for economic growth and development along with the availability of domestic and foreign capital (both the GCF and Foreign Direct Investment-FDI).

Figure 10: Researchers in R&D (per million people) in Countries during 1996, 2005, 2015 and 2018



Source: Authors constructed the Figure by using WB (2022) data.

The number of researchers in R&D per million people in the high-income countries was highest with 2805 in 1996, which increased to 4124 in 2005 and 4554 in 2018. In comparison, the low- and medium-income countries had the lowest researchers with 564 in 2005 and 717 in 2015. The researchers in the upper middle-income countries were also lower with 715 in 1996 and 1322 in 2018, reflecting the dominance of the high-income countries in the 21st century. The US has increased its researchers from 3140 in 1996 to 3740 in 2005 to 4749 in 2018, the number in Norway was 4577 in 2005 and further, it has increased to the

highest 6433 in 2018. The number in Germany rose from 2831 in 1996 to 5217 in 2018, reflecting second rank after the first rank of Norway. However, the US has the main dominance in several researchers at the global level as it has a higher population in comparison to Germany, Norway, and the UK. The number of researchers in the UK increased from 2291 in 1996 to 4554 in 2018. The number of researchers has declined in Russia from 3797 in 1996 to 2784 in 2018, reflecting the loss of the comparative advantage by Russia in the global knowledge economy. China has increased its researchers from 438 in 1995 to 1307 in 2018, reflecting a lower number of researchers in comparison to the high-income countries, even though there has been a significant improvement. However, India could not increase its number of researchers and remained lowest at the global level with 152 in 1996 and 253 in 2018. The higher number of researchers with higher government expenditure in the high-income countries facilitates a comparative advantage in the 21st-century global knowledge economy and declines the possibility of the convergence of per capita income/GDP between the low- or middle-income countries and the high-income countries. These descriptive results are examined by the panel data regression further.

V. Fixed Effect and Radom Effect Panel Regressions: Empirical Testing of Conditional Convergence

The convergence between the developing economies as the emerging economies and developed economies over the 10 years (2010, 2011, 2013-2020) of the unbalanced panel years, panel data is not available for 2012. In the panel data, the number of countries is seven (codes used in the panel regressions), viz, China (0), Germany (1), India (2), Norway (3), Russian Federation (4), United Kingdom-UK (5) and United States of America-USA (6). The three income economies: are China, India, and the Russian Federation however the four developed high-income economies are: Germany, Norway, the United Kingdom, and the United States of America.

Table 1: Panel Regressions- Fixed Effect (FE) and Random Effect (RE)		
VARIABLES	Model 1: Fixed Effect	Model 2: Random Effect
	lnGDPpercapita	lnGDPpercapita
lncapital	1.2**	1.2**

lnlabor	-0.7***	-0.7***
lnExports	0.31***	0.31***
lnImports	-0.0715	-0.0715
lnpatentsresident	0.09***	0.09***
lnGovExp	0.380	0.380
education	-1.226	-1.226
edu2	-0.00333	-0.00333
edulab	0.0684**	0.0684**
capge	-0.0204	-0.0204
2.countrycode1(Germany)		1.757***
3.countrycode1(India)		-0.158
4.countrycode1(Norway)		2.950***
5.countrycode1(Russia)		1.438***
6.countrycode1(UK)		2.185***
7.countrycode1(US)		1.629***
Constant	-12.19	-13.58
Observations	48	48
R-squared	0.97	
Number of countrycode1	7	7

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 1 shows the empirical results of the panel regressions of fixed and random effects. The descriptive analysis can be examined with the empirical results of panel regressions. The independent variable, lncapital the elasticity of GDP per capita concerning the gross capital formation (GCF), the coefficient is 1.2 implying one percentage increase in GCF has a positive effect of 1.2% in GDP per capita if other variables remain constant, the coefficient is significant at 5% level. The coefficient of lnLabour is also significant at 1% and its value is -0.7 showing a negative effect of a 1% increase in the labor force on GDP per capita by a decline of 0.7%. However, there is a positive effect of educated labor on GDP per capita as the coefficient of edulab is significant at a 5% level and its value is 0.07 reflecting 1% increase in educated workers would have a positive effect of 0.07% on GDP per capita, showing a positive role of knowledge formation in the economies. The coefficient of lnExports is 0.31 which is significant at 1% and showing a 1 % increase in exports would have a 0.31% increase in GDP per capita. The coefficient of lnpatentsresident is significant and its value of 0.09 reflects 1% increase in patent applications by

residents would have a positive impact on GDP per capita by 0.09%, showing a positive impact of human capital generations through patents, corresponding to these results with the descriptive results of higher number of researchers.

There is no difference between the coefficients of the Random and Fixed Effects. To estimate the statistical difference between the log of GDP per capita in China (as a base category) and that of the six other countries. Except for India via the Random Effect, there are significant and positive differences between the log of Chinese GDP per capita and those of the other five countries (US, UK, Germany, Norway, and Russia). These five countries' significant and positive differences reflect a chance of divergence between the developing and emerging economies and the developed countries as there is no significant difference between the logs of GDP per capita in India and China. Other variables, lnImports, lnEducation, edu2, and capge are insignificant. R square is higher than 0.97 reflecting the goodness of fit of both the models as the p value of Wald test and F test are zero.

IV. Summary and Policy Implications

This paper has five descriptive and empirical results: (i) India has the lowest GDP per capita at $ 1798 in 2020 defined as a lower-income economy, (ii) there is no significant difference between the GDP per capita of India and China, proving an absolute convergence however the GDP per capita of China was $ 10431 in 2020 and India's GDP per capita was $1798 in the same year of Covid-19 showing a decline of GDP per capita in the pandemic as compared to the pre-Covid year 2019. This insignificant difference between India's and Chinese GDP per capita tests empirically a convergence, (iii) there is an absolute divergence between the GDP per capita of China and the Russian Federation, (iv) there is an absolute divergence between the GDP per capita of China and the GDP per capita of the US, the UK, Germany and Norway and (V) Norway has the highest GDP per capita as compared to other six economies showing human development of education, health and real GDP per capita at purchasing power parity ($ PPP), testing a conditional divergence between the global south countries (China and India) and the global north economies. These results have two policy implications: (1) there is a need to expand public funding in social sectoral investment, mainly in education, health, and research and development for creating a knowledge economy in

developing economies, like India and (2) there would a crucial role of the welfare state in the recession times of Covid-19 era as divergence are significantly tested in this paper.

References

ABRAMOVITZ, M. (1986). Catching up, forging ahead, and falling behind. Journal of Economic History, 46(2): 385-406.

Ahmed Nawaz Hakro* and Bashir Ahmad Fida, The Lahore Journal of Economics 14: 2 (Winter 2009): pp. 49-70 Trade and Income Convergence in Selected South Asian Countries and Their Trading Partners

AHMED, A. D. and SUARDI, S. (2007). Sources of economic growth and technology transfer in sub-Saharan Africa. South African Journal of Economics, 75(2): 159-178.

ANDRES, J., DOMENECH, R. and MOLINAS, C. (1996). Macroeconomic performance and convergence in OECD countries. European Economic Review, 40(9): 1683-1704.

Ashok Parikh*, Miyuki Shibata, Does trade liberalization accelerate convergence in per capita incomes in developing countries? Journal of Asian Economics 15 (2004) 33–48

BAIER, S. L., DWYER, G. P. and TAMURA, R. (2006). How important are capital and total factor productivity for economic Growth? Economic Inquiry, 44(1): 23-49.

BARRO, R. and LEE, J. W. (2010). A New Data Set of Educational Attainment in the World, 1950-2010. NBER Working Paper, 15,902, National Bureau of Economic Research.

BARRO, R. J. (1991). Economic growth in a cross-section of countries. Quarterly Journal of Economics, 106(2): 407-443. ——— (1998). Determinants of Economic Growth: A Cross Country Empirical Study. Cambridge, MA: MIT Press.

——— (2003). Determinants of economic growth in a panel of countries. Annals of Economics and Finance, 4: 231- 274.

——— and SALA-I-MARTIN, X. (1990). Economic Growth and Convergence across the United States. NBER Working Paper 3419.

Barro, R. J., & Sala-I-Martin, X. (1992). Convergence. Journal of Political Economy, 100(2), 223–251. Barro, R. J., & Sala-I-Martin, X. (1995). Economic growth. New York: McGraw Hill Inc.

Bernard, A. B., Jones, C. I. (1996). Comparing apples to oranges: Productivity convergence and measurement across industries and countries. American Economic Review, 1216–1238.

Ben David, D. (1993). Equalizing exchange: Trade liberalization and income convergence. Quarterly Journal of Economics, 108, 653–679.

Barro, Robert, and Xavier Sala-i Martin. (1997)"Technological Diffusion, Convergence, and Growth." Journal of Economic Growth 2(1):1-26.

BAUMOL, W. J. (1986). Productivity growth, convergence, and welfare: What the long-run data show. American Economic Review, 76(5): 1072-1085.

BENHABIB, J. and SPIEGEL, M. M. (1994). The role of human capital in economic development: Evidence from aggregate cross-country data. Journal of Monetary Economics, 34(2): 143-173.

BLUNDELL, R. and BOND, S. (1998). Initial conditions and moment restrictions in dynamic panel models. Journal of Econometrics, 87(1): 115-143.

——— and BOND, S. (2000). GMM estimation with persistent panel data: an application to production functions. Econometric Reviews, 19(3): 321-340.

BOND, S., HOEFFLER, A. and TEMPLE, J. (2001). GMM Estimation of Empirical Growth Models. Discussion Paper No. 3048, Center for Economic Policy Research (CEPR), London.

BOSWORTH, B. P. and COLLINS, S. M. (2003). The empirics of growth: An update. Brookings Papers on Economic Activity, 34(2): 113-206.

CASELLI, F., ESQUIVEL, G. and LEFORT, F. (1996). Reopening the convergence debate: A new look at cross-country growth empirics. Journal of Economic Growth, 1(3): 363-389

Dollar, D. (1992). 'Outward-oriented developing economies do grow more rapidly: evidence from 95 LDCs, 1976-1985', Economic Development and Cultural Change, vol. 40 (3), pp. 523-44.

Dollar, D. and A. Kraay. (2001). Trade, Growth and Poverty, World Bank Policy Research Department Working Paper No. 2587, Washington DC.

Dollar, D. and Kraay, A. (2003): Institutions, trade, and growth. Journal of Monetary Economics 50,133–62.

Edwards, S., (1992). Trade orientation, distortions, and growth in developing countries.Journal of Development Economics 39, 31– 57

Edwards, S. 1992. Trade orientation, distortions and growth in developing countries, Journal of Development Economics 39(1): 31–57. http://dx.doi.org/10.1016/0304-3878(92)90056-F

Engle, R. F.; Grang Wacziarg, R. 2001. Measuring the dynamic gains from trade, The World Bank Economic Review 15(1): 393–429. http://dx.doi.org/10.1093/wber/15.3.393

Frankel, J. and D. Romer (1999), “Does Trade Cause Growth?” The American Economic Review, vol.89, No. 3, pp. 1-21.

Kunofiwa Tsaurai, International Journal of Economics and Business Administration Volume IX, Issue 1, 2021 pp. 318-330 Determinants of Trade Openness in Transitional Economies:

Does the Complementarity between Foreign Direct Investment and Human Capital Development Matter

Nirmal Kumar January 24, (2009) Economic & Political Weekly EPW 41 China and India: Convergence in Economic Growth and Social Tensions?

PRITCHETT, L. (2001). Where has all the education gone? World Bank Economic Review, 15(3): 367-391.

PSACHAROPOULOS, G. and PATRINOS, H. A. (2004). Returns to investment in education: A further update. Education Economics, 12(2): 111-134.

SAB, R. and SMITH, S. C. (2002). Human capital convergence: A joint estimation approach. IMF Staff Papers, 49(2): 200-211.

SALA-I-MARTIN, X. (1996). The classical approach to convergence analysis. The Economic Journal, 106(437): 1019- 1036

Yanikkaya, H. 2003. Trade openness and economic growth: a cross country empirical investigation, Journal of Development Economics 72(1): 57–89. http://dx.doi.org/10.1016/S0304-3878(03)00068-3

Young, A. 1991. Learning by doing and the dynamic effects of international trade, Quarterly Journal of Economics 106(2): 369–406. http://dx.doi.org/10.2307/2937942