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EMPIRICAL ANALYSIS OF ECONOMIC GROWTH BETWEEN HIGH, MIDDLE, AND LOW-INCOME COUNTRIES

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ABSTRACT:

This paper empirically compares economic growth between the high, middle, and low-income countries from 1990 to 2021. The paper examines whether the growth patterns of countries before and after COVID-19 show any convergence or divergence of income. By employing descriptive analysis and panel data regressions an economic divergence in the time of the COVID-19 pandemic and ongoing global recession is detected. This paper prescribes an expansionary fiscal policy to contain the pandemic's adverse effects and expand the aggregate demand at the global level, especially in middle and low-income countries.

Keywords: Convergence, inequalities, economic crisis, divergence, growth.

INTRODUCTION:

In the COVID Era, economic inequalities have increased globally while slowing down the GDP economic growth across the global economy and it is expected to decline to 2.7% in 2023 from 3.2% in 2022 and 6.0% in 2021 (World Economic Outlook, IMF, 2022). The world growth rate would be lowest after 1970 as the average growth rate in the period of 1970-2021 was 3.6% as well as the same low rate in 2000-2021, reflecting an acute challenge of the global economic slowdown during the ongoing the economic crisis and health crisis as well. The advanced - global north economies including the US experienced a GDP growth rate of 5.2% in 2021, which declined to 2.4% in 2022 and is expected to further decline to 1.1%. The economic growth rate of the emerging market and developing economies- the global south countries was 6.6% in 2021, which declined to 3.7% in 2022 while the expected growth remains the same in 2023. The growth rates of the US in these three years were 5.7%, 1.6%, and 1.0%, however, the growth rates of China were 8.1%, 3.2%, and 4.4% during the three years and India's growth rates were 8.7%, 6.8% and 6.1%. The higher economic growth rates of the global south economies are different from their GDP per capita in comparison to those of the global north economies. The GDP per capita (current prices) in the US, China, and India during 2022 were USD 75.18 thousand, USD 12.97 thousand, and USD 2.47 thousand (IMF, 2022). The advanced economies, emerging markets developing economies, and the World GDP per capita were USD 53.1 thousand, USD 6.95 thousand, and 13.4 thousand respectively, reflecting an acute economic inequality at the global level. The inequality can be understood by the World Inequality Report (2022), the top 1% had a wealth

ISSN PRINT 2319 1775 Online 2320 7876

 UGC CARE Listed (Group -I) Journal Volume 11, Iss12 , 2022

share of 40% in India, around 30% in China, and 35% in the US in 2020 (WIR, 2022). The private wealth as a percent of national income in India increased to 560% in 2020 as compared to 290% in 1980. In these two years, China's private wealth shares in national income were 120% and 530%. The private wealth shares in the high-income countries ranged between 200% and 400% during 1970, increased to the range of 550% and 800% during 2008, and increased to double the shares of 1970 during 2020. These increasing shares of private wealth reflect an acute economic inequality rose during the pandemic. In the context of declining economic growth rates and rising inequalities, this paper has main objective to examine the chance of convergence between high, medium, and low-income countries especially.

REVIEW OF LITERATURE:

The debate on the role of openness to international flows of goods, technology, and capital in development and growth is as old as economics itself. Trade liberalization has been a prominent policy advice to developing countries during the last two decades. It is claimed that economic growth is probably the most important benefit originating from it since increased trade openness promotes 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 support that protection induces faster economic growth.

It is also being observed trading partner countries tend to exhibit a higher incidence of income convergence or divergence, therefore, the literature is also analyzed dealing with the above-stated convergence or divergence. The theory states that when a country starts with lower levels of initial capital, it is easier for that country to grow faster with openness to trade. The argument here is that trade liberalization causes a convergence in per capita income—since trade liberalization increases competition and domestic firms' absorption capacity for knowledge and ideas, knowledge levels among countries converge to a common level, leading to per capita income convergence (see Sachs and Warner (1995), Ben-David (1993, 1994a, 1994b, 1996, 2000) and Ben-David and Kimhi (2004) among others).

Siwach (2016) has taken 19 developing countries, and liberalized their economies in the 1980s and 1990s, most of them experienced rapid proposed liberalization. Ben-David's approach is followed and finds no significant change in convergence for developing countries towards their major partners of trade before liberalization. The results are robust when large country biases are taken care of as well.

Vojinovic, Acharya, and Prochniak (2009), have tested for absolute and conditional convergence based on both cross-sectional and panel data, for 10 European countries (EU-1including Central and Eastern European countries (CEE-8). They show both types of convergence, but they find that in the first half of the 1990s, the countries did not converge, the reasons were recessions during the early 1990s in some transition economies. The new EU member income gap between these countries has narrowed but remains quite large.

ISSN PRINT 2319 1775 Online 2320 7876

 UGC CARE Listed (Group -I) Journal Volume 11, Iss12 , 2022

Hakro and Fida (2009) examine 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 most trade groups exhibited income convergence, implying that liberalization policies have helped trading countries' per capita income grow more rapidly thus increasing their convergence rate.

Chandra (2009), has done a study on China and India, looking at convergence in Economic Growth. China opened its economy in 1978, and India moved from a regulatory regime to free trade in goods and services in 1991, found growth accelerated after the reform in India and China. This growth shows convergence with the rising inequality, deteriorating environmental conditions, and the quality of life declining

Marius Bru¨lhart (2010), finds that the majority of cross-country studies find no significant effect of openness on urban concentration or overall regional inequality.

Hye and Lau (2010), examine the trade openness effect on economic growth in India from 1971–2009. They find trade openness and capital increase growth in the long run and short run. India should increase expenditure in the education sector to make a labor force.

According to Rodrik (2011), the rapid economic growth after the global economic crisis of 2008-09 was experienced by emerging and developing like China, Asian tigers, and Latin America due to economic development. According to him, countries catching up is determined by their ability to absorb ideas and knowledge from the technology frontier.

Tsaurai (2021), examines trade openness in transitional economies, with panel data from 2000 to 2018, and found human capital development, economic growth, and mining sector growth significant in the impact of trade openness in transitional economies.

Dowrick and Golley (2004) study the relationship between economic growth and foreign trade, using two 20-year periods, to investigate medium-run growth to avoid the business cycle. Their results confirm that primary exports are bad for growth. They also found that if China and India were excluded from the sample, then a remaining group of 22 'more globalized' developing countries grew more slowly than the 'less globalized' over the period 1980–2000.

Felbermayr (2004) has taken 108 countries and divided them into rich and poor income groups, period 1960-99. He is using the GMM procedure proposed by Blundell and Bond (1998), his finding shows the positive effect of trade on total factor productivity growth and the results are robust. If there is any pattern of divergence, it is not due to trade openness but must be due to some different factor.

Prabirjit Sarkar (1999) has taken 64 countries to study the convergence of standards of living of the North and the South, he found that except for the 1970s, significant divergence in the standards of living of the two groups of countries for the period, 1950-92. There is evidence

ISSN PRINT 2319 1775 Online 2320 7876

 UGC CARE Listed (Group -I) Journal Volume 11, Iss12 , 2022

of convergence between less rich North and richer North and poorer South and less poor South.

Feenstra (1996), finds that without diffusion of knowledge, then trade in goods can lead to a divergence of growth rates among countries. This is in contradiction to endogenous growth models, implying convergence of growth rates is due to the flow of ideas across borders, and contradiction is due to a difference in assumptions.

Sen (2015), has taken a two-by-two-by-two H–O–S model in a dynamic setting with individuals with uncertain lifetimes, concluding that factor-price equalization is incompatible with convergence. But if new-born agents are introduced, then convergence is obtained, therefore, not ‘‘robust’’ to a small perturbation.

Detragiache (1998), gives a model of international income convergence driven by differences in technology moreover, technologically advanced firms in DCs reduce adoption costs. It predicts that LDCs more open to foreign trade with DCs have higher rates of transitional growth.

Friedt and Rodgers (2022), study the effects of natural disasters on foreign direct investment in India. They show that foreign investment shifts to more developed, less disaster-prone regions, leading to divergence in India’s economic growth. Their results suggest that multinational firms consider both local cost and region-specific disaster risk when selecting locations for production.

RESEARCH METHODOLOGY:

The main objectives of this paper are,

(i) To examine the convergence of income of the high-income and medium and low-income countries;

(ii) To test the conditional convergence between the GDP per capita and GNP per capita of the sets of countries (high countries and, medium and low-income countries.

The definitions of the Countries by the World Bank are as follows (Table 1): (i) low-income countries (LIC) are countries having less than GNI per capita of $1046, (ii) Lower-middle income countries (LMIC) have GNI per capita in the range of $1,046 – $4,095, (iii) Upper-middle income countries (UMIC) have the income in the range of $4,096 -$12,695 and (iv) the High-income countries are the countries having GNI per capita more than $ 12695. Tables 2 and 3 show the names, and numbers of the panel income-group countries- the numbers and shares of the HIC, LIC, LMIC, and UMIC are 13, 5, 12, and 9 respectively, adding to 39 total countries. The numbers and shares of the panel points of these four countries are 328 (42%), 38(5%), 247 (32%) and 163 (21%).

ISSN PRINT 2319 1775 Online 2320 7876

 UGC CARE Listed (Group -I) Journal Volume 11, Iss12 , 2022

Table 1: Income Groups of Countries as per capita Gross National Income (GNI) in US $

Income Groups	**GNI per capita on July 1, 2021 ($)**
Low income (LIC)	Less than $1046
Lower-middle income (LMIC)	$1,046 – $4,095
Upper-middle income (UMIC)	$4,096 -$12,695
High income (HIC)	More than $12,695

Table 2: Income Groups of Countries by World Bank

Income Group	Freq.	Percent	Cum.
HIC	328	42.27	42.27
LIC	38	4.90	47.16
LMIC	247	31.83	78.99
UMIC	163	21.01	100.00
Total	776	100.00	

Table 2 shows the panel income groups of countries used in the analysis. Table 3 shows 13 HIC countries: Canada, Finland, France, Germany, Japan, Korea, Kuwait, Netherlands, New Zealand, Norway, Switzerland, the United Kingdom, and the United States. The 12 lower-middle-income countries (LMIC) are Bangladesh, Bhutan, India, Indonesia, Iran, Kenya, Egypt, Pakistan, Philippines, Sri Lanka, Ukraine and Zimbabwe.

Table 3: Name of Countries by their Income-Groups

S. No.	Country Name / Income Group	HIC (13)	LIC (5)	LMIC (12)	UMIC (9)	Total (39)
1	Argentina	0	0	0	28	28
2	Bangladesh	0	0	27	0	27
3	Bhutan	0	0	4	0	4
4	Brazil	0	0	0	31	31
5	Bulgaria	0	0	0	30	30
6	Canada	23	0	0	0	23
7	China	0	0	0	1	1
8	Congo, Dem. Rep.	0	3	0	0	3
9	Egypt, Arab Rep.	0	0	28	0	28
10	Finland	25	0	0	0	25
11	France	31	0	0	0	31
12	Germany	31	0	0	0	31

ISSN PRINT 2319 1775 Online 2320 7876

 UGC CARE Listed (Group -I) Journal Volume 11, Iss12 , 2022

S. No.	Country Name / Income Group	HIC (13)	LIC (5)	LMIC (12)	UMIC (9)	Total (39)
13	India	0	0	31	0	31
14	Indonesia	0	0	9	0	9
15	Iran, Islamic Rep.	0	0	11	0	11
16	Iraq	0	0	0	5	5
17	Japan	25	0	0	0	25
18	Kenya	0	0	25	0	25
19	Korea, Rep.	31	0	0	0	31
20	Kuwait	2	0	0	0	2
21	Malaysia	0	0	0	5	5
22	Mexico	0	0	**0**	31	31
23	Mozambique	0	11	0	0	11
24	Netherlands	31	0	0	0	31
25	New Zealand	21	0	0	0	21
26	Norway	31	0	0	0	31
27	Pakistan	0	0	30	0	30
28	Philippines	0	0	28	0	28
29	Russian Federation	0	0	0	9	9
30	Rwanda	0	6	0	0	6
31	South Africa	0	0	**0**	27	27
32	Sri Lanka	0	0	23	0	23
33	Sudan	0	12	0	0	12
34	Switzerland	25	0	0	0	25
35	Uganda	0	6	0	0	6
36	Ukraine	0	0	25	0	25
37	United Kingdom	21	0	0	0	21
38	United States	31	0	0	0	31
39	Zimbabwe	0	0	2	0	2
	Total	328	38	247	163	776

The names of 5 LIC countries are Congo, Mozambique, Rwanda, Sudan, and Uganda respectively. The names of upper-middle-income countries (UMIC) are Argentina, Brazil, Bulgaria, China, Iraq, Malaysia, Mexico, the Russian Federation, and South Africa respectively.

ISSN PRINT 2319 1775 Online 2320 7876

 UGC CARE Listed (Group -I) Journal Volume 11, Iss12 , 2022

Descriptive Analysis of Absolute Convergence

This section examines the absolute convergence in the first objective on the difference between the GNP per capita and GNP per capita of the two sets of countries – Global North (High Income) countries and Global South (Middle and Low Income) countries by using the Word development indicators of the World Bank data.

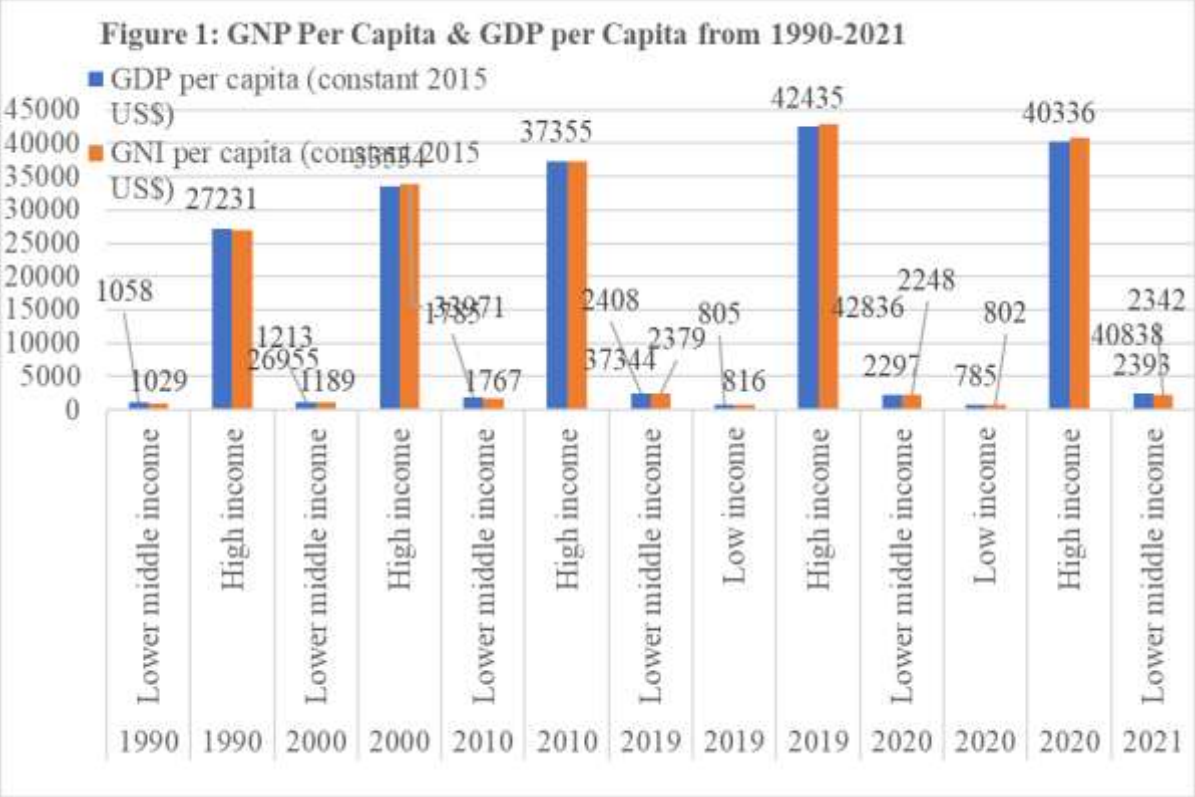

Figure 1: GNP Per Capita & GDP per Capita from 1990-2021

Source: Authors constructed this figure by using the World Bank data (WB, 2022)

Figure 1 shows the GDP per capita and GNP per capita in Low-income, Lower middle-income countries, and High-income countries during 1990, 2000, 2010, 2019, 2020, and 2021. The purpose of this analysis is to examine the difference between two indicators across countries over the years, especially decade change as well as the effects of the pandemic. The GDP and GNP per capita in the Lower middle-income countries were USD 1058 and USD 1029 respectively during 1990, reflecting slightly lower GNP per capita. These two economic indicators in the high-income countries in the same year were USD 27231 and USD 26955, showing slightly lower GNP per capita as compared to GDP per capita in the case of lower-middle-income countries. The GNP per capita in Low, Lower Middle, and High income countries were USD 816, USD 2379, and USD 42836 respectively in 2019, those declined to USD 802, USD 2248, and USD 40838 respectively in 2020., reflecting adverse effects of the pandemic in terms of lower per capita GNP. However, the difference between the GNP per

ISSN PRINT 2319 1775 Online 2320 7876

 UGC CARE Listed (Group -I) Journal Volume 11, Iss12 , 2022

capita and GDP per capita was higher in the high-income countries than that of lower-middle countries as discussed further.

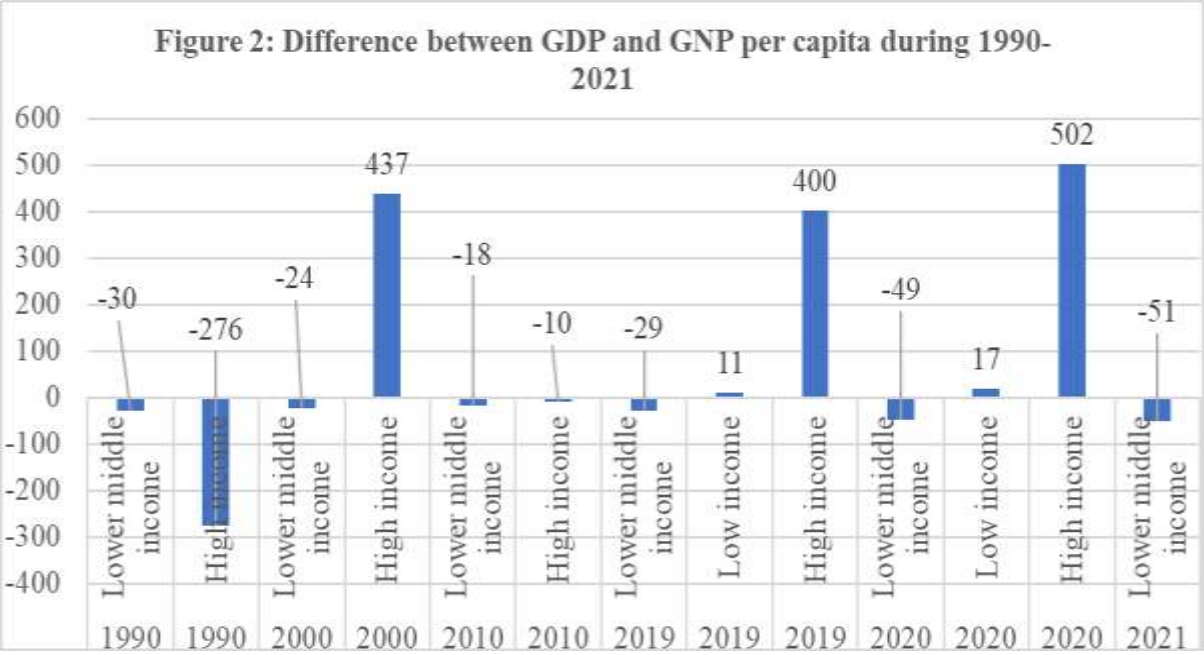

Figure 2: Difference between GDP and GNP per capita during 1990-2021

Source: Authors constructed this figure by using the World Bank data (WB, 2022)

In the later years, the difference between the GNP per capita and GDP per capita in high-income countries increased except for 2010, reflecting an adverse effect of the global financial crisis as it was USD 437 in 2000 and – USD 10 and USD 400 in 2019 and USD 502 in 2020 (Figure 2). However, the difference in the lower middle countries was, -USD 24 in 2000, -USD 18 in 2010, -USD 29 in 2019, -USD49 in 2020, and – USD 51 in 2021, reflecting lower net factor income from abroad (NFIA as the GNI=GDP-NFIA). The difference in the low-income countries was 11 and 17 in the consecutive years 2019 and 2020, in other years data are not available. This means that this data is not available for the upper middle-income countries in all the years. Thus, in comparison to GDP per capita in both the groups of countries, the high-income countries have higher GNP per capita and lower-middle-income countries have lower GNP per capita, reflecting lower NFIA for the lower-middle-income countries and the high-income countries have higher NFIA, even in the Covid-19 pandemic.

Factors of Economic Development for Convergence: Government expenditure, Consumption, capital formation, foreign trade, foreign capital, and patent applications

Figure 3 shows the shares of government final consumption expenditure of GDP and GNP. The shares of government expenditure in high-income countries were significantly higher at 20 % each (the shares in GDP and GNP) during 1990, which were only 12% of GDP and 13% of GNP in the lower middle-income countries in the same year. In 2000, the shares of

ISSN PRINT 2319 1775 Online 2320 7876

 UGC CARE Listed (Group -I) Journal Volume 11, Iss12 , 2022

the high-income declined to 18% each but were higher than those of the lower-middle-income countries (12%). In 2010, the shares of the high-income countries increased slightly to 19% and those of the lower-middle countries remained constant at 12% each. In 2019, the government expenditure shares declined to 17% and lower-middle-income countries' shares declined slightly to 11%. The pandemic pushed the shares of the high-income countries to 18% and increased to 12% in 2020 and 2021. The low-income countries' shares were 14% in 2019 and 2020, but they declined to 12% in 2021, reflecting the negligence of the governments in the low-income and lower-middle-income countries. There is a need to have the instrumental role of government expenditure in economic development especially in the Covid -19 Era, as this share of government expenditure is also an important factor for the higher GNP per capita as well as the higher GDP per capita as it is empirically tested in the panel regression analysis further.

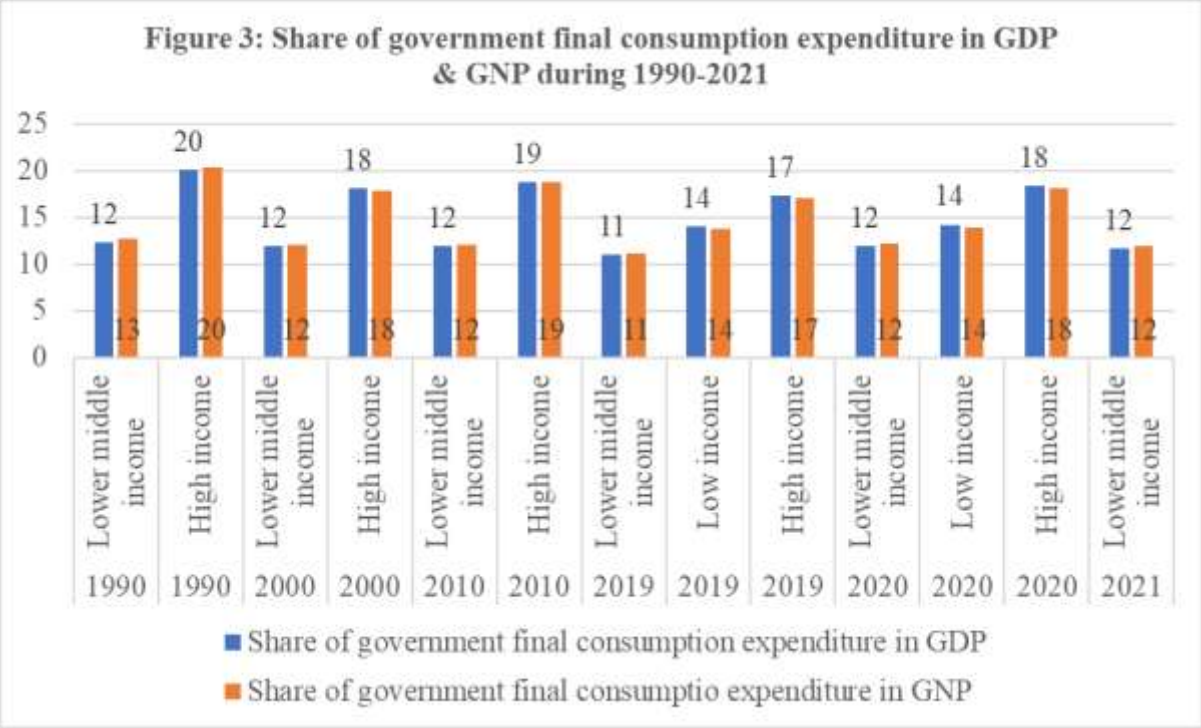

Figure 3: Share of government final consumption expenditure in GDP & GNP during 1990-2021

Source: Authors constructed this figure by using the World Bank data (WB, 2022)

Figure 4 shows the shares of gross capital formation in GNP in high-income countries 20.7% in 2010 and 32.2% in lower middle-income countries reflecting a higher share of lower middle-income countries. In the pre-COVID year 2019, these shares of both countries were 22.6% and 29.3% respectively and this share was 28.9% in low-income countries. In the Covid year, 2020, these three countries' shares were 22.2%, 27.1% and 30.6%, the lower middle countries have experienced a higher decline of capital formation of 2.2% percentage

ISSN PRINT 2319 1775 Online 2320 7876

 UGC CARE Listed (Group -I) Journal Volume 11, Iss12 , 2022

points as compared to 2019. However, it improved from 2020 to 2021 to 29%, which is still lower than that of 2019-the pre-Covid year.

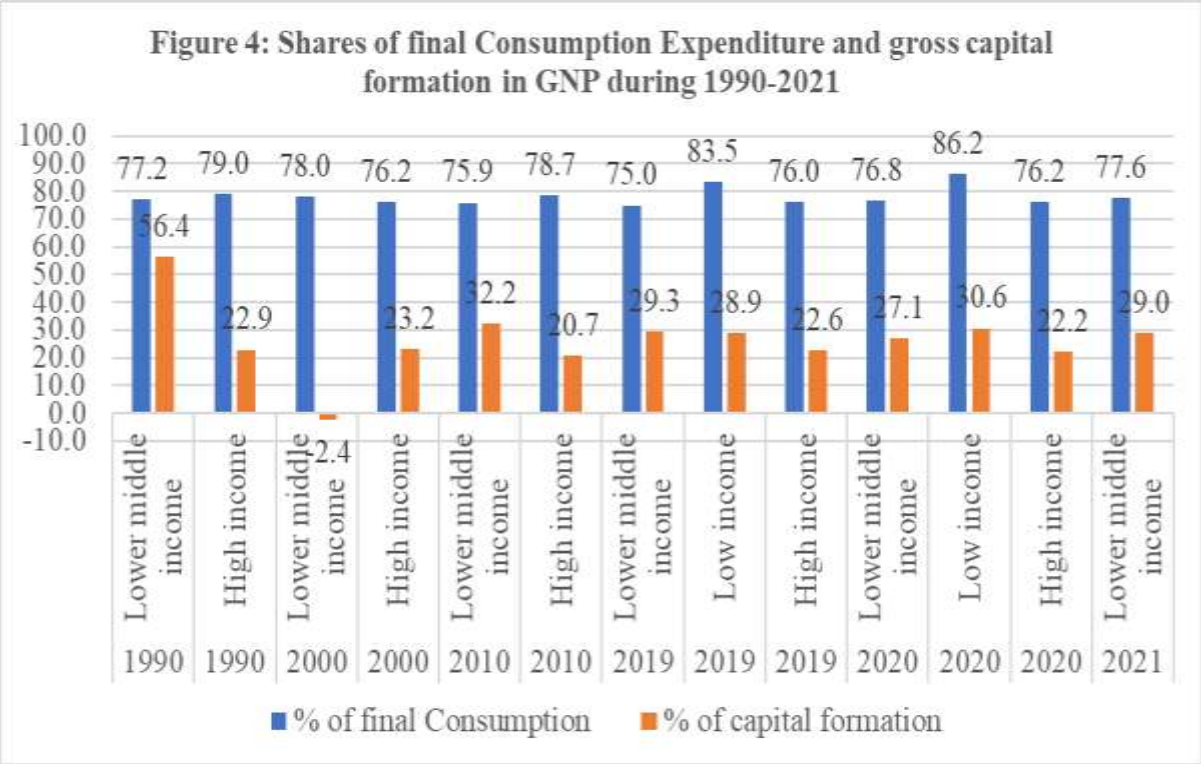

Figure 4: Shares of final Consumption Expenditure and gross capital formation in GNP during 1990-2021

Source: Authors constructed this figure by using the World Bank data (WB, 2022)

The share of final consumption expenditure was 79% of high-income countries and 77.2% of lower middle-income countries in 1990, which were 78.7% and 75.9% in 2010, reflecting higher shares for the high-income countries. The shares in 2019, were 76% and 75%, these shares in 2020, were 76.2% and 76.8% respectively. The share of low-income countries was 83.5% in 2019, this was 86.2% in 2020, the highest share in these countries due to their higher poverty lower income status, and lesser savings.

The share of exports in the high-income countries was 15% in 1990, it increased to 22% in 2000, 27.9% in 2010, and 31.9% in 2019, then there was an adverse effect in 2020, leading to a slight decline to 30.4%. The share in lower-middle-income countries was 24.6% in 1990, declined to 23.7% in 2000, it is increased to 26% in 2010, then declined to 23.5% in 2019 and 21.6% in 2020 and recovered to 23.3% in 2021, but it is still slightly lower than the share of 2019. There is more trade deficit of the lower middle and low-income countries as compared to the high-income countries as the shares of import of high-income countries were 15% in 1990, 22.0% in 2000, 27.4% in 2010, 31.2% in 2019, and 29.8% in 2020. However, the shares of imports of lower-middle-income countries were 29.4%, 25%, 32.8%, 27.8%, 24.6%, and 27.8% reflecting more than 1 % point difference between the shares of exports

ISSN PRINT 2319 1775 Online 2320 7876

 UGC CARE Listed (Group -I) Journal Volume 11, Iss12 , 2022

and imports in GNP. The difference between the exports and imports in high-income countries is less than 1 % point during all the years.

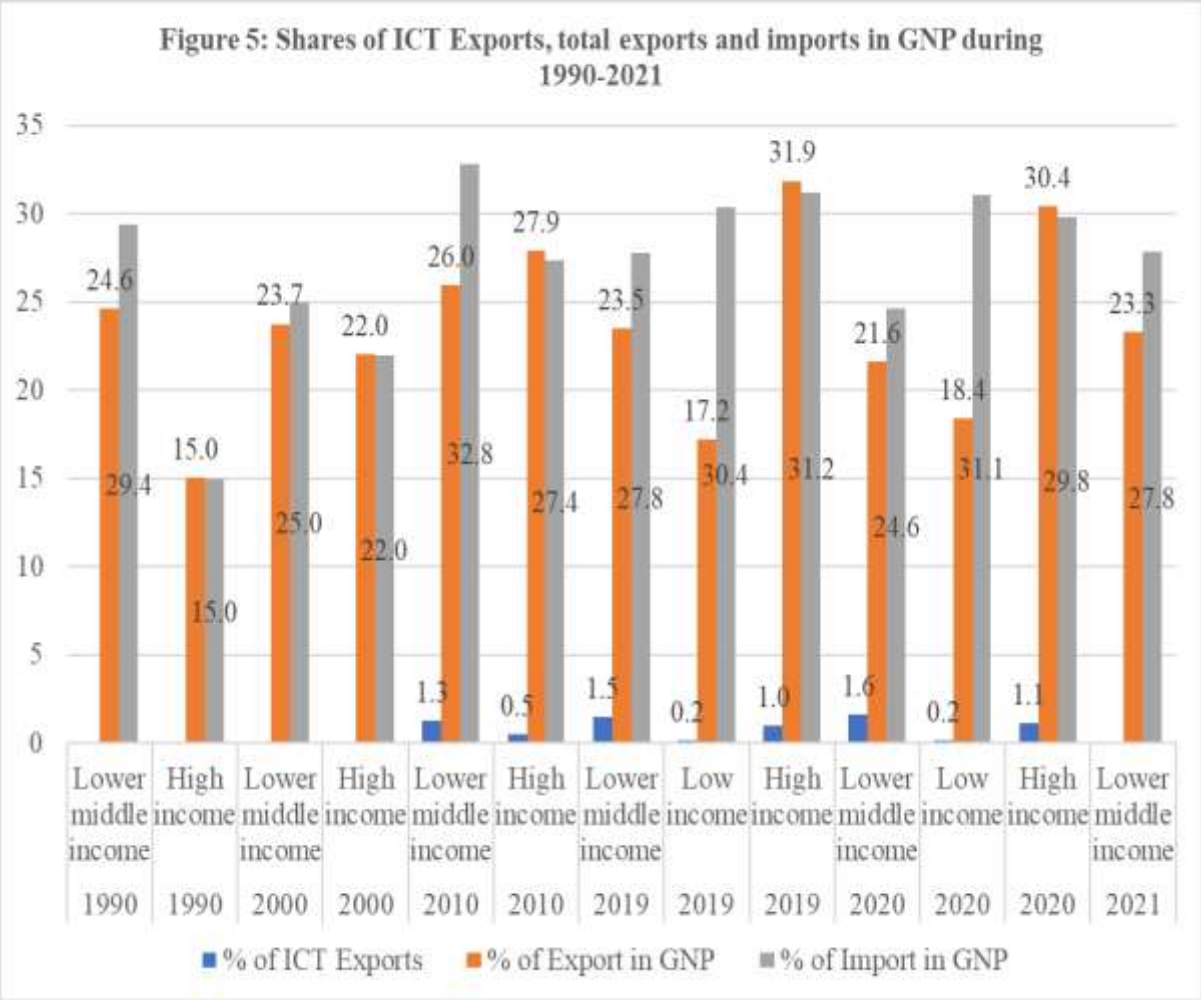

Figure 5: Shares of ICT Exports, total exports and imports in GNP during 1990-2021

Source: Authors constructed this figure by using the World Bank data (WB, 2022)

ISSN PRINT 2319 1775 Online 2320 7876

 UGC CARE Listed (Group -I) Journal Volume 11, Iss12 , 2022

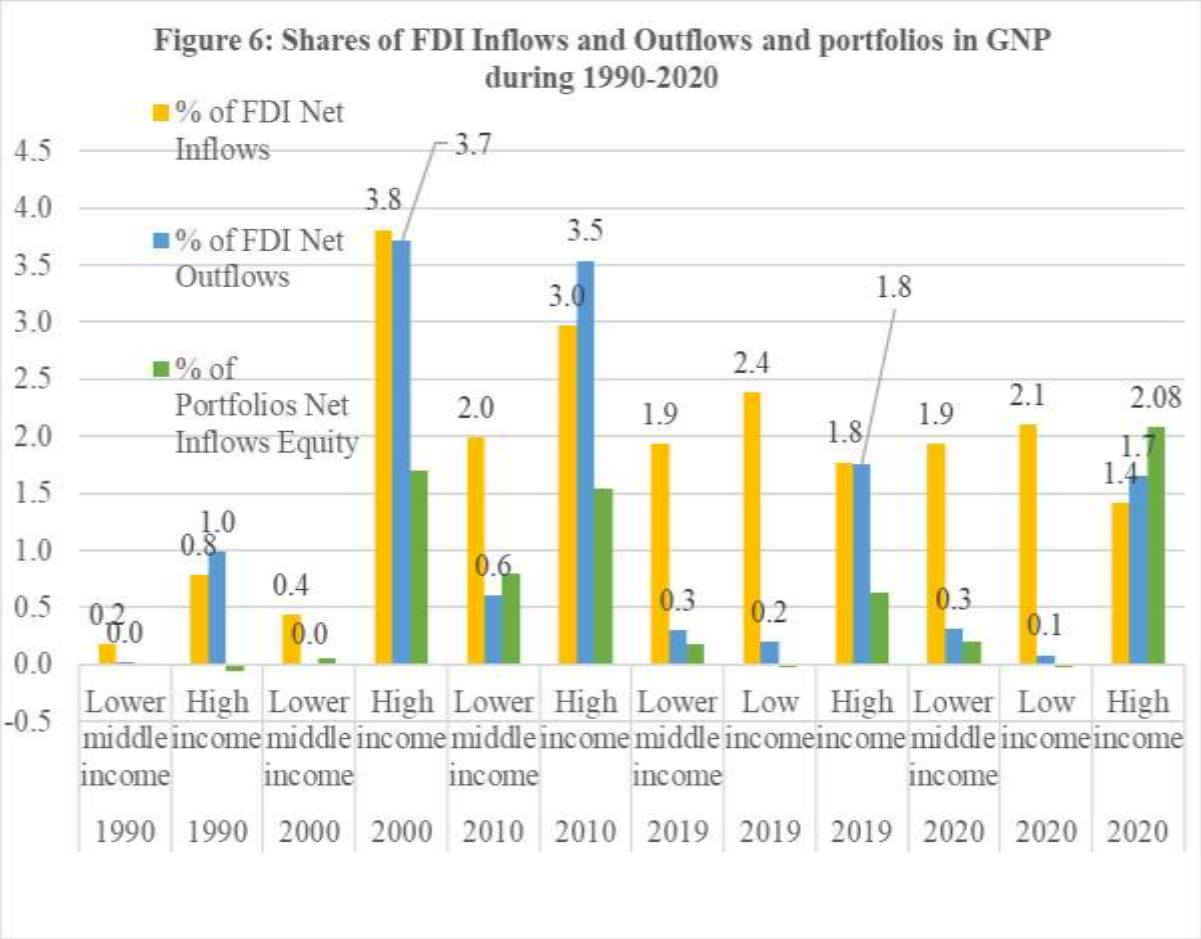

Figure 6: Shares of FDI Inflows and Outflows and portfolios in GNP during 1990-2020

Source: Authors constructed this figure by using the World Bank data (WB, 2022)

Figures 5 and 6 show the shares of foreign capital and trade, the shares of FDI Net Inflows in high-income countries were 0.8% in 1990, increased to 3.8% in 2000, declined to 3.0% in 2010 1.8% in 2019, and 1.4% in 2020. The FDI inflows in lower-middle-income countries were 0.2% in 1990, 0.4% in 2000, 2.0% in 2010, 1.9% in 2019 and 2020, this share was 2.4% in 2019 and 2.1% in 2020, reflecting increasing foreign capital in the low and lower middle countries as a declining role in the high-income countries, showing the instrumental role of global finance capital. Figure 7 shows higher roles of patents by residents in the high-income countries as compared to lower middle and low-income countries however the number of patents by nonresidents also increased reflecting emigration from the global south countries in getting patents in the high-income countries.

ISSN PRINT 2319 1775 Online 2320 7876

 UGC CARE Listed (Group -I) Journal Volume 11, Iss12 , 2022

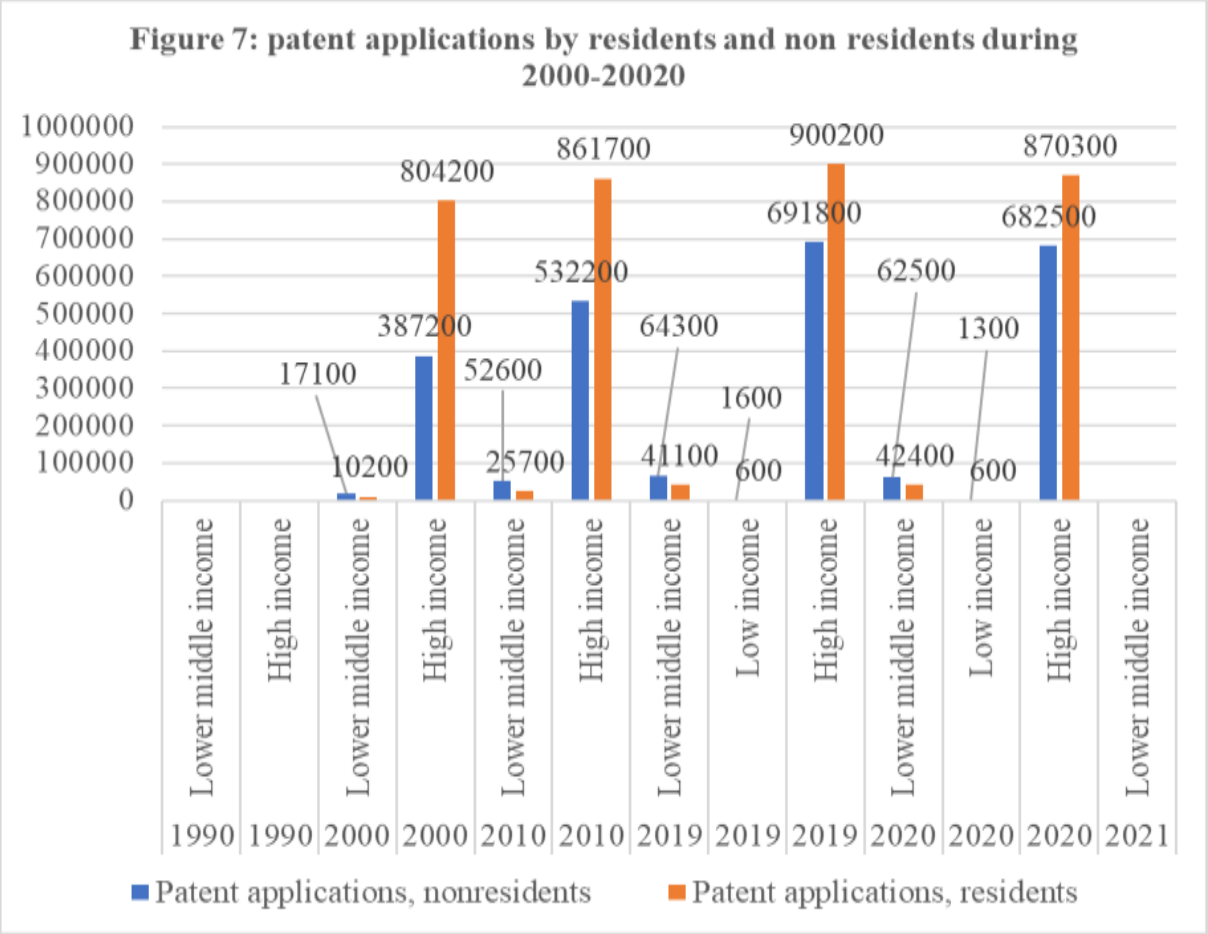

Figure 7: patent applications by residents and non residents during 2000-20020

Source: Authors constructed this figure by using the World Bank data (WB, 2022)

Figure 8 shows an absolute divergence between the GNI per capita among the countries as the values of coefficient of variation in terms of the ratio of the standard deviation and the average, are higher than one in most of the years among all the 38 countries. Moreover, the polynomial trendline shows an increasing trend after the global financial crisis years of 2009 and 2010 as the values of CVs in both years were 0.98 each after that it expanded further and it also forecasted an increase from 1.12 in 2020 to about 2.00 in 2023.

ISSN PRINT 2319 1775 Online 2320 7876

 UGC CARE Listed (Group -I) Journal Volume 11, Iss12 , 2022

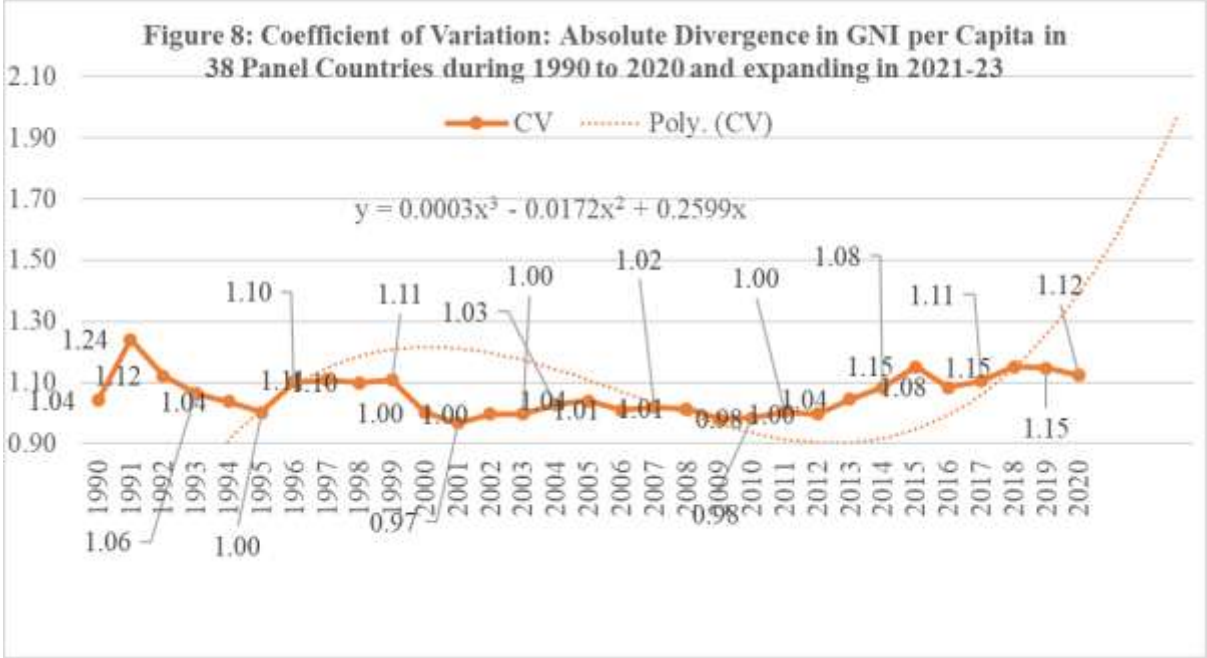

Figure 8: Coefficient of Variation: Absolute Divergence in GNI per Capita in 38 Panel Countries during 1990 to 2020 and expanding in 2021-23

Panel data regressions for Conditional Convergence and Divergence

Table 4 shows GMM estimates for addressing the endogeneity problem, as the lagged variable of the dependent (*lngnipercapita*), which is significant at 1% and its magnitudes vary between 0.27 to 0.76 in all the six models specified, reflecting a 1% increase in the previous year's GNI per capita would have a positive effect on the next year by 0.27% to 0.76%, with given other variables. The log of capital (ln*capital)* is also significant in Model 1 at 5% and 1% in Models 3-6, the values of its coefficient have the range of 0.04 to 0.14. The log of labor (*lnlabour*) is negative and significant at 1% to 10% levels , its values are in the range of -0.15 to -0.38, reflecting the negative impact of the increase in the percentage of labor on the percentage of GNI per capita as it was expected due to workers are part of population used in the denominator. The fiscal policy variable has a positive impact on the GNI per capita as the coefficient of *lngovexp* is positive and significant in the three models (Models 1, 2, and 4), the value lies between 0.07 to 0.10, showing a 1 % increase in government expenditure would increase GDP per capita by 0.07% to 0.10%. It means that fiscal policy matters in the case of an improvement of income in the economies. The role of patents (both resident or non-resident applicants) has a negative effect, showing a monopoly of public good knowledge in the economy would have negative externalities if it is privatized. As the coefficients of *lnpatentnresident* and *lnpatentnonresident* are negative and significant and their values have the range of -0.13 to -0.17. it can be verified that there would be a positive impact if the patents interact with the labor force then it would have a positive effect on GNI per capita as reflected in the significance and positive magnitude of the interaction of labor and patent applications (*lnlabourbothresinonpatents)* is 0.1. The foreign capital inflows and

ISSN PRINT 2319 1775 Online 2320 7876

 UGC CARE Listed (Group -I) Journal Volume 11, Iss12 , 2022

outflows have lower or negative effects on GNI per capita as the coefficients of lnfdiinflows are either low positive 0.001 to 0.04 the models 4 and 5 and negative 0.08 in model 6. The coefficient of *lnfdioutlows* is also negative 0.08, showing a negative effect on GNI per capita.

Table 4: Dynamic Panel Data Regression: Generalized Methods of Moments (GMM)

Dependent/ Independent Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
lngnipercapita						
L.lngnipercapita	0.76***	0.69***	0.65***	0.50***	0.29***	0.27***
lncapital	0.04**	0.03	0.14***	0.07***	0.10***	0.12***
lnlabor	-0.15*	-0.19**	-0.21***	-0.27**	-0.52***	-0.38***
lngovexp	0.07**	0.08**	0.02	0.10*	-0.01**	-0.08
lnpatentnresident	-0.13**	-0.01	-0.05	-0.15**	-0.13**	-0.05
lnpatentnonresident	-0.13**	-0.01	-0.06	-0.17***	-0.13**	-0.06
lnlabourbothresinonpatents	0.01***	0.00	0.00	0.01***	0.01**	0.00
lnfdiinflows			-0.00	0.001**	0.004*	-0.08***
lnfdioutflows			0.002	0.002	0.00	-0.08***
lnexports		0.03*	0.08***	0.03	0.09**	0.01
lnimports		0.06*	-0.02	0.03	-0.09**	-0.17***
lnfpi				-0.00	-0.00	-0.00152
lnconsumption					0.55***	0.54***
lntradefinance						0.001***
Observations	663	663	528	287	287	287
Number of CodeCountries	35	35	33	28	28	28

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

The coefficients of logs of exports are significant and positive and have a range of 0.03 to 0.09. the coefficients of imports are negative and significant with a range of -0.08 to -0.17. the coefficients of *lnconsumption* are positive and significant showing a positive impact on GNI per capita with the magnitude of 0.54 to 0.55, showing a significant and sportive impact of percentage increase in consumption on the percentage increase of GNI per capita. The coefficient of *lntradefinance* is positive with a small magnitude showing a liberalized economy has a lower positive impact in times of liberalization. The coefficients of GMM

ISSN PRINT 2319 1775 Online 2320 7876

 UGC CARE Listed (Group -I) Journal Volume 11, Iss12 , 2022

models have correspondence with the random and fixed effects panel regression examined further.

Table 5 shows a dummy variable to show a divergence between HIC and LIC/LMIC/UMIC as the coefficients of LIC, LMIC, and UMIC are significant and negative showing lower income per capita in these 26 lower- or middle-income countries as compared to 13 high-income countries. Table 6 shows the coefficients of other variables used in the GMM and random effect models.

Thus, the conditional divergence is empirically examined by using these panel data regressions with the fixed and random effects as well as the Generalized Methods of Moments (GMM).

CONCLUSIONS AND POLICY IMPLICATIONS:

This paper has three significant empirical findings: (i) there is an absolute divergence between the middle, and high-income countries, (ii) the high-income countries have high levels and shares of capital, government expenditure, and patents which are instrumental factors for their economic development, (iii) the conditional divergence hypothesis is accepted as per the panel regressions results of the random effects. The two policy implications prescribed as per the empirical results: (i) there is a need to use an expansionary fiscal policy in times of global recession as forecasted further for the year 2023 by the IMF, and (ii) the government expenditure must be increased for expanding employment opportunities in the economic crisis times, especially by the global south countries.

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APPENDIX:

Tabulation of time

Time	Freq.	Percent	Cum.
1990	16	2.06	2.06
1991	16	2.06	4.12
1992	16	2.06	6.19
1993	16	2.06	8.25
1994	16	2.06	10.31
1995	15	1.93	12.24
1996	22	2.84	15.08
1997	22	2.84	17.91
1998	24	3.09	21.01
1999	24	3.09	24.10
2000	25	3.22	27.32
2001	24	3.09	30.41
2002	25	3.22	33.63
2003	26	3.35	36.98
2004	26	3.35	40.34
2005	26	3.35	43.69
2006	25	3.22	46.91
2007	26	3.35	50.26
2008	26	3.35	53.61
2009	25	3.22	56.83
2010	25	3.22	60.05
2011	26	3.35	63.40
2012	26	3.35	66.75

ISSN PRINT 2319 1775 Online 2320 7876

 UGC CARE Listed (Group -I) Journal Volume 11, Iss12 , 2022

Time	Freq.	Percent	Cum.
2013	28	3.61	70.36
2014	29	3.74	74.10
2015	33	4.25	78.35
2016	33	4.25	82.60
2017	32	4.12	86.73
2018	36	4.64	91.37
2019	34	4.38	95.75
2020	33	4.25	100.00
Total	776	100.00	

Table 5: Panel Regression Random Effects

Dependent/Independent Variables	Model 1	Model 2	Model 3	Model 4
lngnipercapita				
lncapital	0.108***	0.111***	0.131***	0.115***
lnlabour	-0.497***	-0.712***	-0.588***	-0.794***
lngovexp	0.571***	0.647***	0.0540**	0.0830***
lnlabourbothresinonpatents	0.0192***	0.0157***	0.00169	-0.00100
lnpatentnresident	-0.331***	-0.268***	-0.0439	0.0163
Lnpatentnonresident	-0.322***	-0.263***	-0.0377	0.00413
Bangladesh	-0.693***		-0.746***	
Bhutan	0.140			
Brazil	-1.088***		-0.529***	
Bulgaria	0.275***		0.234***	
Canada	0.358***		0.283***	
China	-2.505***		-0.869***	
Congo, Dem. Rep.	-0.927***			
Egypt, Arab Rep.	-0.623***		-0.597***	
Finland	1.069***		0.776***	
France	-0.0738**		-0.0172	
Germany	-0.0807***		-0.00695	

ISSN PRINT 2319 1775 Online 2320 7876

 UGC CARE Listed (Group -I) Journal Volume 11, Iss12 , 2022

Dependent/Independent Variables	Model 1	Model 2	Model 3	Model 4
India	-2.390***		-1.392***	
Indonesia	-1.069***		-0.707***	
Iran, Islamic Rep.	-0.940***			
Iraq	-0.528***			
Japan	-0.387***		-0.00328	
Kenya	-0.613***		-0.437***	
Korea, Rep.	0.159***		0.185***	
Kuwait	0.832***			
Malaysia	0.222***		0.0824*	
Mexico	-0.496***		-0.438***	
Mozambique	-1.217***		-0.555***	
Netherlands	0.620***		0.428***	
New Zealand	1.320***		0.844***	
Norway	1.336***		0.941***	
Pakistan	-1.144***		-0.952***	
Philippines	-0.630***		-0.494***	
Russian Federation	-0.848***		-0.354***	
Rwanda	-0.557***		-0.165**	

Table 5: Panel Regression Random Effects

	Model 1	Model 2	Model 3	Model 4
South Africa	-0.488***		-0.354***	
Sri Lanka	0.0275		-0.0539	
Sudan	-1.046***			
Switzerland	1.568***		0.894***	
Uganda	-0.714***		-0.599***	
Ukraine	-0.672***		-0.293***	
United Kingdom	0.130***		0.0572**	
United States	-0.760***		-0.281***	
Zimbabwe	-0.481***		-0.107	

ISSN PRINT 2319 1775 Online 2320 7876

 UGC CARE Listed (Group -I) Journal Volume 11, Iss12 , 2022

lnfdiinflows			-0.0196*	-0.00877
lnfdioutflows			-0.0157	-0.00592
lnexports			0.153***	0.164***
lnimports			-0.147***	-0.0975***
lnfpi			0.000190	0.000110
lnconsumption			0.629***	0.621***
lntrade				
lntradefinance			0.000459**	0.000277
lnlabourpatent				
LIC		-1.026***		-0.545***
LMIC		-0.813***		-0.477***
UMIC		-0.805***		-0.412***
Constant	0.702	2.604***	-2.437***	-0.533
Observations	776	776	445	445
Number of Countries	39	39	33	33

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 6: Panel Regression Fixed Effects

VARIABLES	Model 5	Model 6
lncapital	0.108***	0.131***
lnlabour	-0.497***	-0.588***
lngovexp	0.571***	0.0540**
lnlabourbothresinonpatents	0.0192***	0.00169
lnpatentnresident	-0.331***	-0.0439
lnpatentnonresident	-0.322***	-0.0377
lnfdiinflows		-0.0196*
lnfdioutflows		-0.0157
lnexports		0.153***
lnimports		-0.147***

ISSN PRINT 2319 1775 Online 2320 7876

 UGC CARE Listed (Group -I) Journal Volume 11, Iss12 , 2022

VARIABLES	Model 5	Model 6
lnfpi		0.000190
lnconsumption		0.629***
lntrade		
lntradefinance		0.000459**
Constant	0.467	-2.580***
Observations	776	445
R-squared	0.871	0.963
Number of CodeCountries	39	33

Robust standard errors in parentheses ***