Chapter 10
Divergences of Health Expenditures and Role of the Government in Response to COVID-19 Pandemic in Selected Nations—An Investigation

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10.1 Introduction

It has often been argued that public investment in social sectors, like health and education generally contributes to the enhancement of human capital, skill formation and knowledge development and thereby increasing productivity and higher returns which stimulates economic growth. Thus, according to this approach, the justification of the role of public policy in the social sector is accepted on the ground that human capital has a positive spill-over effect on economic growth as well as development. So public provisioning of social services is an instrument of human development that has a larger role to play. If we compare the public provisioning of health care services in terms of health expenditure (as a percentage of GDP) in a few selected countries (both developed and emerging market economies) we will find that India's health expenditure (as a percentage of GDP) is the lowest among them all (accounting for 3.54% of its GDP) in 2018 (Fig. 10.1). Even countries like Nigeria have a greater percentage contribution than India.

As per the latest OECD Indicators of Health at a Glance, 2021, before the COVID-19 pandemic, the average health expenditure was approximately 8.8% of their GDP which more or less remained constant since 2013. The United States tops the list by spending 16.8% of GDP. Together a group of the top ten including the US, France, Canada, Japan and the United Kingdom spent more than 10% of their GDP in health (Fig. 10.1). Countries like Brazil and South Africa and a further dozen countries in the next group spent 8–10% of GDP. The next set of countries that spent

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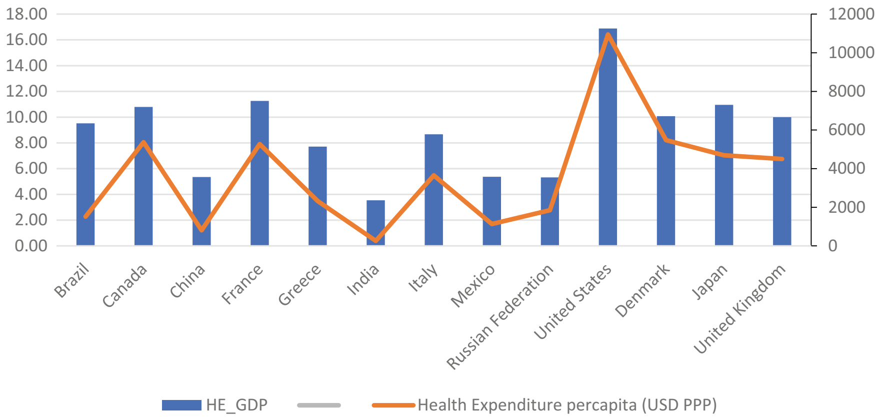

Fig. 10.1 Comparison of health Expenditure (as percentage of GDP) and Health Expenditure per-capita (USD PPP) in selected Countries in 2019. (*Source* Author's Construction based on World Development Indicator (2020) and Global Health Expenditure Database, OECD, 2021)

6–8% of their GDP includes many central and eastern European OECD countries, as well as the newer members from the Latin America region—Colombia and Costa Rica. The expenditure made by Mexico and Turkey along with China and India on health is less than 6% of GDP. So, it is quite clear from the above discussion that there existed a wide range of variation in health expenditure across the globe prior to the pandemic.

But there has been a significant increase in the ratio of health expenditure to GDP for many of the list of countries (already mentioned above). Primary estimates suggest that average health expenditure jumped from 8.8% in 2019 to 9.7% in 2020. Also, countries that were severely affected by the pandemic experienced an appreciable rise owing to combating health disasters and the further spread of the pandemic (for e.g., in the UK it increased from 10.2% in 2019 to 12.8% in the initial part of 2020).

The figure also shows a wide amount of disparity in health Expenditure per capita (USD PPP) across the same set of countries mentioned earlier. India holds the lowest position on both health Expenditure (as a percentage of GDP) and Health Expenditure per capita (USD PPP). The average per capita health spending in OECD countries (USD PPP) was more than USD 4 000, with the US occupying the highest position USD 10,948. But for the next set of countries (Canada, France, Denmark) it is almost half the amount of the US and for Japan and the United Kingdom, it was around the OECD average. China and India are the lowest among the set.

Usually, a variety of financing arrangements are available for individuals or groups of the population to access healthcare facilities. Generally, government financing schemes (at national or subnational levels), compulsory health insurance (managed through public or private entities), out-of-pocket spending (Spending by households both on a fully discretionary basis and as part of some co-payment arrangement), voluntary health insurance—are the most common forms of financing available in many countries.

Denmark and the United Kingdom accounted for 80% or more of national health spending. In Germany, Japan and France more than 75% of spending was covered through a type of compulsory health insurance scheme. While Japan relies on a comprehensive social health insurance, France supplements the public health insurance coverage with a system of private health insurance arrangements, which became compulsory under certain employment conditions in 2016. In the United States, federal and state programmes, such as Medicaid, covered around one-quarter of all US healthcare spending in 2019. Although almost 60% of expenditure was classified under compulsory insurance schemes, these cover very different arrangements. Out-of-pocket payments financed one-fifth of all health spending in 2019 in OECD countries, with the share broadly decreasing as GDP increases. Households accounted for one-third or more of all spending in Mexico (42%), Greece (36%), Russia and China (greater than 35%), India (above 60%), while in France out-of-pocket spending was below 10% (Fig. 10.2). With moves towards universal health coverage, a number of OECD countries have increased spending by government or compulsory insurance schemes in recent decades.

The vast majority of funding for government schemes comes from general government revenues (such as taxation and levies), which are then channelled through budgetary and allocation processes. However, governments might also contribute to social health insurance, for example, by covering the contributions of particular population groups or providing general budget support to insurance funds. Individuals purchase private health insurance through the payment of regular premiums.

Overall public funding can be defined as the sum of government transfers and all social contributions. Private sources consist of the premiums for voluntary and compulsory insurance schemes, as well as any other funds coming from households or corporations. In Denmark, public sources funded more than 80% of health care

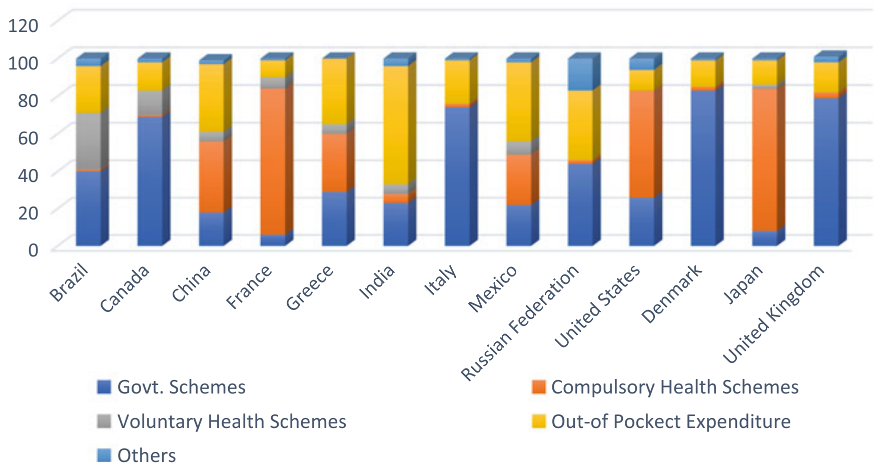

Fig. 10.2 Health Expenditure by Financing Schemes. (*Source* Author's Construction based on World Development Indicator (2020) and Global Health Expenditure Database, OECD, 2021)

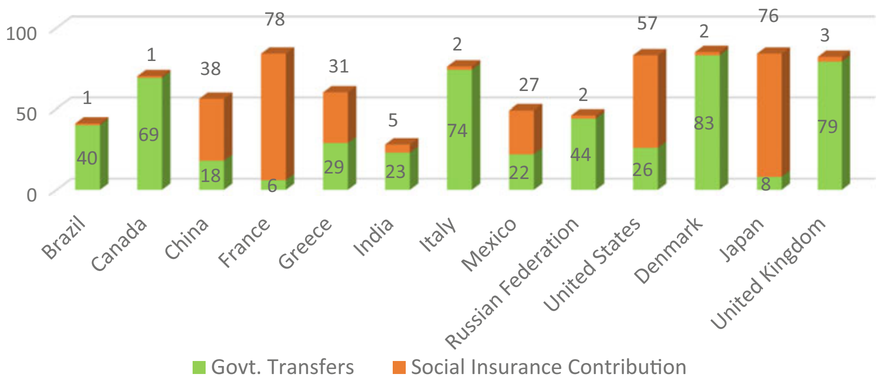

Fig. 10.3 Health expenditure from public sources as a share of total, 2019. (*Source* Author's Construction based on World Development Indicator (2020) and Global Health Expenditure Database, OECD, 2021)

expenditure (Fig. 10.3). In other countries, governments may not pay directly for the majority of health services, but they provide transfers and subsidies [16]. Governments fund a range of public services, and health care competes with other sectors such as education, defense and housing. The level of public funding of health is determined by factors such as the type of health system in place, the demographic composition of the population and government policy. Budget priorities can also shift from year to year due to political decision-making and economic effects. Public funding of health spending (via government transfers and social insurance contributions) accounted for an average of 15% of total government expenditure across OECD countries in 2019. Around 20% or more of public spending was linked to health care spending in Japan, and the United States. At the other end of the scale, Mexico and Greece, allocated around 10% of government spending to health care. All OECD countries expanded and revised their budget allocations in 2020 as part of government responses to tackle the impact of COVID-19. While the public resources allocated to health rose, the extent of these increases was generally smaller than the subsidies provided to businesses that suffered from the economic standstill. India occupies the lowest position on health expenditure from public sources as a share of the total.

10.2 Global Health Security (GHS) Index

The GHS, 2021, published by Johns Hopkins Bloomberg School of Public Health states.

> *Countries continue to suffer harm from the COVID-19 pandemic as a result of insufficient health security capacity. This lack of capacity comes at a time when political and security risks have increased in nearly all countries, and enduring financial investment necessary*

to sustain capacities has yet to be demonstrated. Such weaknesses leave a world acutely vulnerable to future health emergencies, including those potentially more devastating than COVID-19.

It stressed the importance of developing stronger public health coupled with policies and programs that may help people to have universal health coverage, paid sick leave, subsidized childcare, income assistance, food and housing assistance, etc. along with protective public health measures to fight the COVID-19 pandemic.

The GHS Index is based on six pillars with the objective of assessing a country's capability to ***prevent, detect***, and ***respond*** to biological threats along with factors that can be an obstacle to building such capability like ***health systems, norms,*** and ***risks***.

It is clear from the GHS Index that in order to strengthen the preparedness to fight epidemic or pandemic majority of countries, including high-income nations, have not made adequate financial investments. In case of most countries, no improvement has been observed in maintaining a capable and accessible health system. Countries which are exposed to greater political and security risks have also shown greater preparedness deficit. One interesting point to note is that emerging economies like China and India lag behind the other set of countries in all kinds of preparedness required to fight the COVID-19 pandemic (Table 10.1).

Table 10.1 Global Health Security (GHS) Index, 2021

Country	Prevention score	Detection score	Response score	Heath system score	Norms score	Risks score	Overall score
US	79.4	80.1	65.7	75.2	81.9	73.3	75.9
Canada	70.4	70.8	49.2	67.3	79.2	81.8	69.8
UK	63.5	70.8	64.8	68.3	62.5	73.0	67.2
Denmark	64.3	64.6	51.8	64.5	61.1	79.9	64.4
France	59.4	45.7	47.7	70.4	65.3	82.9	61.9
Japan	43.1	71.1	59.5	51.6	66.7	70.9	60.5
Mexico	41.9	54.3	64.8	54.7	68.1	57.9	57.0
Italy	47.2	49.7	43.2	40.2	65.3	65.9	51.9
Greece	44.8	48.9	46.7	46.2	63.9	58.3	51.5
Brazil	49.7	53.6	56.3	50.3	41.7	55.9	51.2
Russia	45.5	43.6	44.7	58.9	51.4	50.5	49.1
China	43.9	48.5	38.5	51.8	38.9	63.4	47.5
India	29.7	43.5	30.3	46.1	47.2	60.2	42.8

Source Hopkins Bloomberg School of Public Health States.

10.3 Divergences in Fiscal Support in Response to COVID-19

There has been a significant difference in fiscal support measures in response to the COVID-19 pandemic which has failed to arrest the quick spread of the pandemic. The strong recovery from the last two years is not only due to the vaccination programmes but also due to the massive and quick monetary and fiscal of the government. Figure 10.4 shows to what extent the fiscal support in the US widely diverged from other strong economies of the world.

In order to fight the deep recession caused by disruptions in supply chain and lockdown measures, developed advanced countries have been able to mobilize a considerable amount to support and stimulate their domestic economies. But in contrast, developing countries with limited resource bases could not provide financial support and stimulus packages adequately given the size of most developing economies and their limited fiscal space, the per capita amount of such packages is limited in comparison with both their needs and the magnitudes mobilized by developed countries (Fig. 10.4a). If we analyze the fiscal stimulus package (as a % of GDP) of these sets of countries we will observe that Japan, Italy, the US, the UK and Canada are heading the list. But compared to them the other developing countries a way lagging behind. So, from the point of view of government support, there exists a huge divergence between them (Fig. 10.4b).

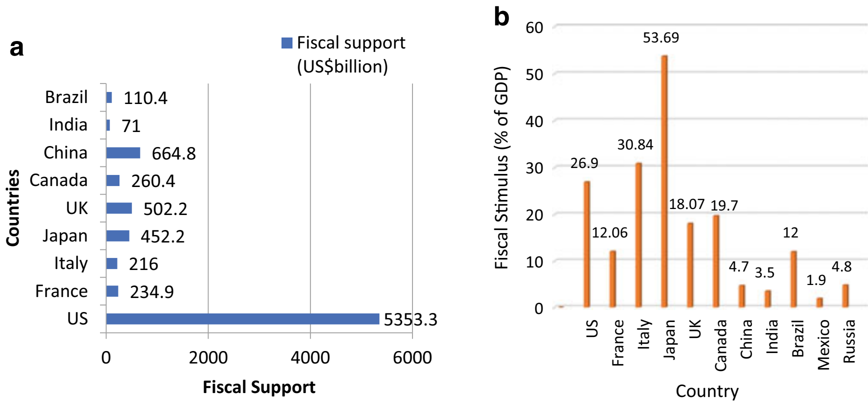

Fig. 10.4 **a** Fiscal Support in Nations (US $ billion). **b** Fiscal Stimulus (as % of GDP). (*Source* Moody's Analytics—Global Fiscal Policy in the Pandemic, February, 2022 and https://www.statista.com/statistics/1107572/covid-19-value-g20-stimulus-packages-share-gdp)

10.4 Literature Survey

An enormous body of literature has developed with the objective of explaining the issue of convergence/divergence of health expenditure, the development of public health infrastructure and the role of government in pursuing policies to mitigate the negative impact of the COVID-19 pandemic. However the problem of testing a hypothesis lies in the fact that only two years of scattered and non-uniform data sets are available. Here we cite a few good works of literature that are available along with their major findings. OECD [17], Health at a Glance 2021, compares key indicators for population health and health system performance across OECD member countries and key emerging economies. They have tried to focus on health status, risk factors for health, access to health care, quality of health care, health system capacity and resources. García et al. [9] explore some of the key drivers of efficiency and find that lower income inequality, less corruption, and health interventions oriented at expanding population access to basic health services are associated with greater efficiency. Balakrishnan and Namboodhiry [1] in their study tried to emphasize the need for developing a strong public health system, with evidence on health expenditures across the states of India. They found that the average level of expenditure on health is found to be low both in itself and in relation to spending by governments in South and Southeast Asia. They arrived at two important conclusions: (a) some of the mortality from COVID-19 is policy-induced and (b) assume that assuring health security to the Indian population would require a radical restructuring of the spending priorities of the states Fallahi [8] tried to examine the issue of convergence in the ratio of total health expenditures to GDP for a sample of OECD countries over the period 1960–2006. Stochastic convergence is tested using unit root tests, without and with a structural break. Moreover, β convergence is examined by applying a method that allows for a structural break and is robust to the presence of unit roots and serial correlation in the errors. The results support the existence of stochastic convergence for all countries. β Convergence, however, is supported for some countries only before the break points (regime 1). In regime 2 (the period after the break points) all countries are experiencing divergence. Barro and Martin [2, 3] talk about an important economic question is whether poor countries or regions tend to converge toward rich ones. They based their main analysis on a growth equation that derives, as a log-linear approximation, from the transition path of the neoclassical growth model for closed economies. Assuming $x_i{}^*$ to be the steady-state per capita growth rate, $\widehat{y_{it}}$ is output per effective worker, $\hat{y}^*_{it}$ is the steady-state level of output per effective worker, T is the length of the observation interval, the coefficient β is the rate of convergence, and u_i, is an error term. They found that the process of convergence within the European countries is in many respects similar to that of the United States. In particular, the rate of convergence is again about 2% a year. In a 1992 paper, they considered the neoclassical growth model as a framework to study the convergence of per capita income and product across 48 contiguous US States. They found clear evidence of convergence across the US States. Moreover, the book on Economic Growth [4, 2nd edition] has a separate chapter relating the empirical analysis of convergence, discussing in detail about *both the* β *and* σ convergence criteria. Hembram & Halder [14] attempted to re-examine the standard debate of β, σ, and club convergence empirically in India with respect to per capita net state domestic product (PCNSDP) across 22 states over time (viz. 1980–1981 to 2015–2016). They went beyond the σ convergence, and the distribution-sensitive inequality measure such as generalized entropy is used to explore the pattern of distribution of PCNSDP among states over time. They found σ divergence, a rising trend of inequality of PCNSDP with a higher sensitivity to the right tail of the distribution. The results show that there exists absolute β divergence but conditional β convergence. Hembram & Halder [13] made a comprehensive study on the global convergence of income based on β, σ inequality across 187 countries over a period from 1990 to 2018 at a disaggregated level. Most of the recent studies have found the absence of absolute convergence but the presence of conditional convergence [6, 18]. Cherodian and Thirlwall [6] have found the presence of absolute divergence but weak conditional convergence across 32 Indian states for the period, 1999–2000 to 2010–2011. Chakraborty and Chakraborty [5] have considered a dynamic panel of 28 states and 14 years (viz. 2001–2014); the conditioning variables are public capital spending, gross fixed capital formation, credit deposit ratio, commercial credit by the banking sector, literacy rate, infant mortality rate (IMR), and total fertility rate (TFR). They have argued that public investment in health plays a crucial role in conditional and club convergence.

10.5 Objective of the Study, Data and Methodology

We consider panel data which includes a total of fourteen major Covid-affected countries and twenty-two time points (2000–2021). The countries can be subdivided into two major categories viz. low-income group and high-income group. The former group consists of six countries and the latter group consists of eight countries. Moreover, the time span can be sub-divided into two sub-spans. Since Covid hit in the last quarter of 2019 we consider the time span 2000–2019 to be the pre-Covid period and the time period 2020 is the Covid shock period. Our main indicator is the health expenditure of the countries. Therefore, we consider the Current Health Expenditure per Capita in PPP (Che_pc_ppp) and two main determinants, viz., Domestic general government health expenditure per capita, PPP (dgghe_pc_ppp) and Domestic private health expenditure per capita, PPP (dpghe_pc_ppp). We do the convergence exercise for the pre-covid time span. Using the convergence outcome and analyzing the Covid shock period individually try to predict what happened to the convergence of health expenditure after the covid era.

In the case of the convergence exercise, we have used *both the* β *and* σ convergence criteria. The σ convergence of any indicator depends on the dispersion of the value of that indicator between different countries over time. If the dispersion over time decreases, we say that sigma convergence occurs among the group of countries

Table 10.2 Explaining Different GE Measures (where $A_L = \{i|x_i \leq \overline{x}\}$ and $A_H = \{i|x_i \geq \overline{x}\}$)

Value of α	Formula of $GE(\alpha)$	Name of $GE(\alpha)$	Tail of the distribution received a larger weight
0	$\frac{1}{n}\sum_{i \in A_L} ln\left(\frac{\overline{x}}{x_i}\right)$	Mean log deviation	Lower-tail
1	$\frac{1}{n}\sum_{i \in A_H} \left(\frac{x_i}{\overline{x}}\right) ln\left(\frac{x_i}{\overline{x}}\right)$	Theil measure of Inequality	Both the tails received equal weights
2	$\frac{sd(x)}{2\overline{x}}$	Half of the Coefficient of Variation	Upper-tail

Source Authors own construction based on the knowledge from relevant papers

in case of long-run occurrence of that particular indicator. Since standard deviation is very much dependent on the unit of measurement and the Gini-measure of inequality is very much distribution insensitive along with not perfectly sub-group decomposable, therefore we consider the Generalized Entropy (GE) measures. The GE measure of inequality is

$$GE(\alpha) = \frac{1}{n\alpha(\alpha - 1)} \sum_{i=1}^{n} \left[\left(\frac{x_i}{\overline{x}}\right)^{\alpha} - 1\right]$$

where α is the distribution sensitivity parameter, x_i be the value of the indicator (x), n be the number of countries and $\overline{x}$ be the mean of the indicator x. If α is low enough then $GE(\alpha)$ put more weight to the lower tail of the distribution and vice-versa. We consider three main distributional weights in terms of values of α viz. $(\alpha \in \{0, 1, 2\})$. Table 10.2 describes these particular GE measures corresponding to the value of α.

Following Barro and Sala-i-Martin [2], we have also used the fixed effect model to check the β convergence of the per capita health expenditure and its two major components namely per capita domestic general government health expenditure and domestic private health expenditure at PPP.

10.6 Empirical Analysis

10.6.1 Analysis of σ Convergence

We will do the σ convergence analysis for the current per capita health expenditure, domestic general government per capita health expenditure and domestic private per capita health expenditure respectively one after another. Table 10.3 in the Annexure shows the values of different measures of σ convergence for the current health expenditure per capita and correspondingly Fig. 10.5a, b and c, respectively, depict the plot

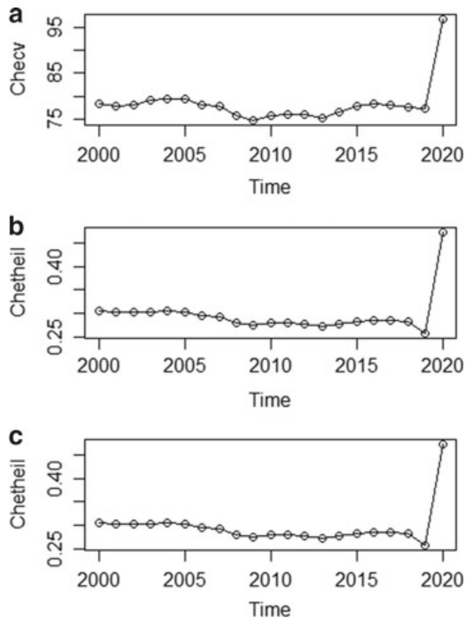

Fig. 10.5 **a** Coefficient of variation of Che_pc_ppp across countries for the period 2000–2020. **b** Theil's measure of Che_pc_ppp across countries for the period 2000–2020. **c** Mean log deviation of Che_pc_ppp across countries for the period 2000–2020. *Source* Generated by the authors

of coefficient of variation, Theil measure and mean log deviation for the current per capita health expenditure over the year 2000 to 2020.

In the case of all the three measures, we can observe a downward move up to the year 2013 but then there is an increasing trend after 2013 in particular for the cv measure and Theil measure. Hence, our conclusion is there may be a tendency of convergence before 2013 but after that, the situation became worse in terms of current health expenditure per capita. Therefore, we are unable to conclude any about the σ convergence of current per capita health expenditure.

Table 10.4 in the Annexure show the values of different measure of σ convergence for the domestic general government per capita health expenditure and correspondingly Fig. 10.6a, b and c are, respectively, the plot of coefficient of variation, Theil measure and mean log deviation for the domestic general government per capita health expenditure over the year 2000–2019.

In case of all the three measures, one can observe a downward move up to the year 2013 but then there is an increasing trend after 2013 in particular for cv measure and Theil measure. Hence, our conclusion is there may be a tendency of convergence before 2013 but after that, the situation became worse in terms of current health expenditure per capita. Therefore, we are unable to conclude any about the σ convergence of domestic general government per capita health expenditure. It should be noted that in case of both indicators, the mean log deviation tells us a different story. Therefore, when we put larger weight to the lower part of the distribution,

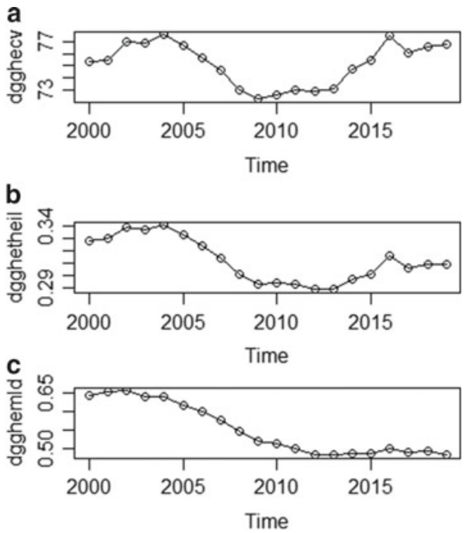

Fig. 10.6 **a** Coefficient of variation of dgghe_pc_ppp across countries for the period 2000–2019. **b** Theil measure of dgghe_pc_ppp across countries for the period 2000–2019. **c** Mean log deviation of dgghe_pc_ppp across countries for the period 2000–2019. *Source* Generated by the authors

we may get sigma convergence across these countries. Hence, there may be an incidence of σ convergence among the low-income group but in generally the outcome is inconclusive.

Table 10.5 in the Annexure show the values of different measures of σ convergence for the domestic private per capita health expenditure and correspondingly Fig. 10.7a, b and c, respectively, represent the plot of coefficient of variation, Theil measure and mean log deviation of the domestic private per capita health expenditure over the period 2000–2019. It is clearly visible that all three measures of σ convergence for the domestic private per capita health expenditure are falling over the period 2000–2019. Hence, we can conclude that for the domestic private per capita health expenditure we have the incidence of σ convergence.

10.7 Shock Period Analysis

The shock period analysis is shown in the Table in Annexure. Before the Covid shock period the range value of the coefficient of variation, Theil measure and mean log deviation of current per capita health expenditure were, respectively, (75–81)%, 0.26–0.3 and 0.36–0.45. However, During the Covid shock period the value of coefficient of variation, Theil measure and mean log deviation of current per capita health expenditure are, respectively, increased to 96%, 0.46 and 0.73. Hence, during the Covid shock period all the indicator of the σ convergence indicates that the gap between the counties increases in term of current per capita health expenditure. If this gap increase will have a significant effect on the process of the stock of Health capital formation, then the observed divergence tendency after 2013 for current per

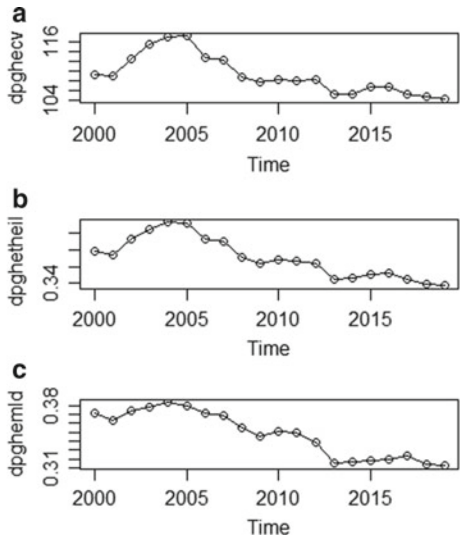

Fig. 10.7 **a** Coefficient of variation of dpghe_pc_ppp across countries for the period 2000–2019. **b**: Theil measure of dpghe_pc_ppp across different countries for the period 2000–2019. **c**: Mean log deviation of dpghe_pc_ppp across countries for the period 2000–2019. *Source* Generated by the authors

capita health expenditure will lead to the divergence of current per capita health expenditure.

10.8 Analysis of β Convergence

Following Barro and Sala-i-Martin [2], we now use the fixed effect model to check the β convergence of the per capita health expenditure and its two major components namely per capita domestic general government health expenditure and domestic private health expenditure. Then, we estimate the following model using our panel data

$$\gamma_{it} = \alpha + \beta ln\left(x_{i(t-1)}\right) + \mu_i + \epsilon_t + u_{it} \tag{10.1}$$

where $\gamma_{it} = ln\left(x_{it} / x_{i(t-1)}\right)$ is the log value of the growth ratio of any indicator x of country i at time point t, μ_i is the country-specific error component and ϵ_t is time specific error component.

In Annexure, we present the estimation result of the Fixed effect model separately for the current per capita health expenditure, the domestic general government per capita health expenditure and the domestic private per capita health expenditure. Since our analysis requires only the value of the estimated β coefficient and whether it is significant or not. Therefore, let us concentrate on the Table 10.6 only.

It is observed that the estimated β coefficient for the estimated fixed effect model for all three variables are negative, significant and absolute value lies between zero and unity. A negative value of the estimated β coefficient confirms that there is a

Table 10.6 Panel Fixed Effect Model outcome *(for detail see appendix table 10.7)*

Variable under fixed effect model		Estimated β coefficient	Significant status
Without shock effect	Che_pc_ppp	−0.060956	Significant at 1% level
	dgghe_pc_ppp	−0.047236	Significant at 1% level
	dpghe_pc_ppp	−0.157344	Significant at 1% level
With shock effect	Che_pc_ppp	−0.048940	Not significant

Source Authors

negative relation between the growth ratio of any time point to the previous year's value of the indicator. Hence, we have the β convergence for all the three indicators. Further, the absolute value of the estimated β coefficient for domestic general government per capita health expenditure is less than the estimated β coefficient for domestic private per capita health expenditure. Therefore, domestic private per capita health expenditure converges at a faster rate than the domestic general government per capita health expenditure. However, when we include the shock period the beta coefficient gets insignificant. Hence, the trend of convergence is not confirmed due to Covid shock.

10.9 Conclusion

Though there were clear trends of divergence in social sector expenditure in the pre-COVID-19 era between low-income and high-income countries, it became more prominent with the outbreak of the COVID-19 pandemic. In case of the development of public health infrastructure, there exist significant variations across countries which was a major constraint to fight against this kind of pandemic globally. The evidences from COVID-19 clearly demonstrates the need for investing in the public health care system in order to mitigate the devastations from these kinds of pandemics. China and India, being two fastest growing emerging nations of the world, are lagging way behind in public health care provisioning. In terms of health expenditure (as a percentage of GDP), health Expenditure per capita (USD PPP), variety of financing arrangements are available for individuals or groups of the population to access healthcare facilities, health expenditure from public sources as a share of the total—it demonstrates the significant gap between rich and poor nations and there is no tendency for these gaps to narrow down in the long term. Empirical analysis to examine the trends in expenditure on health care facilities (current health expenditure per capita in PPP and its two main determinants viz., domestic general government health expenditure per capita, PPP and domestic private health expenditure per capita, PPP) in selected 14 low and high-income countries, confirms that there is no case for convergence in health divergences between these sets of countries. Moreover, if we include the shock period (2020) the spikes of divergences are even more significant. Using the coefficient of variation, Theil's measure and mean log deviation for σ

convergence and panel fixed effect model for β convergence, the study does not find any trends of convergence in health expenditure. Hence, the authorities like WHO should take care of the issues to minimize the differences in the per capita health expenses in the low and high income earning countries by means of global policy packages.

Annexture

See Tables 10.3, 10.4 and 10.5
Table 10.7 Panel data analysis (fixed effect model)

Table 10.3 Different measures of σ convergence for Che_pc_ppp

	Year	cv	mld	Theil
1	2000	77.61258	0.444887	0.294547
2	2001	77.63307	0.444332	0.294725
3	2002	79.6869	0.451684	0.305661
4	2003	80.69132	0.447904	0.307543
5	2004	81.06987	0.447634	0.309322
6	2005	80.56804	0.437425	0.303882
7	2006	79.15489	0.42917	0.295837
8	2007	78.55282	0.419609	0.290232
9	2008	76.24088	0.404494	0.277549
10	2009	75.13194	0.391942	0.270825
11	2010	75.81109	0.395302	0.274728
12	2011	75.70547	0.38984	0.273482
13	2012	75.64985	0.375537	0.269758
14	2013	74.92272	0.360328	0.264183
15	2014	76.52376	0.364993	0.270939
16	2015	77.53538	0.366833	0.274935
17	2016	78.76225	0.375077	0.282991
18	2017	77.16671	0.375042	0.274278
19	2018	77.45255	0.371224	0.274908
20	2019	77.55016	0.365124	0.273826

R Outcome of Fixed Effect Model for Che_pc_ppp for Pre Shock Period

Two ways effects Within Model

Call:

plm(formula = gche ~ log(lag(che, 1L)), data = PanelFinal, effect = "twoways", model = "within").

Balanced Panel: $n = 14$, $T = 19$, $N = 266$.

Residuals:

Min	1st Qu	Median	3rd Qu	Max
−0.26849541	−0.01815846	−0.00048993	0.01771452	0.26103531

Table 10.4 Different measures of σ convergence for dgghe_pc_ppp

	Year	cv	mld	Theil
1	2000	75.38344	0.642937	0.327252
2	2001	75.45889	0.652194	0.329513
3	2002	76.95094	0.655783	0.338902
4	2003	76.84399	0.640234	0.336479
5	2004	77.54218	0.640261	0.340295
6	2005	76.63863	0.617558	0.332692
7	2006	75.67681	0.599301	0.323292
8	2007	74.64878	0.577026	0.313718
9	2008	73.02976	0.547201	0.300579
10	2009	72.25629	0.519509	0.292381
11	2010	72.65838	0.514525	0.293447
12	2011	72.96607	0.498849	0.292583
13	2012	72.90769	0.483769	0.288964
14	2013	73.09539	0.481307	0.288167
15	2014	74.69603	0.486819	0.296479
16	2015	75.42856	0.484902	0.300296
17	2016	77.49199	0.500281	0.315394
18	2017	76.00564	0.488632	0.30554
19	2018	76.55121	0.493075	0.308675
20	2019	76.75024	0.482275	0.308409

Table 10.5 Different measures of σ convergence for dpghe_pc_ppp

	Year	cv	mld	Theil
1	2000	109.3779	0.370815	0.377456
2	2001	109.0118	0.36313	0.373808
3	2002	112.7306	0.374714	0.393087
4	2003	115.5491	0.378806	0.404291
5	2004	117.015	0.383345	0.412057
6	2005	117.2981	0.379526	0.410891
7	2006	112.9123	0.371456	0.392681
8	2007	112.4642	0.36806	0.38893
9	2008	108.9633	0.354581	0.370858
10	2009	107.8315	0.34545	0.363909
11	2010	108.4257	0.350864	0.368475
12	2011	108.1966	0.349444	0.366967
13	2012	108.2509	0.338288	0.363218
14	2013	105.2566	0.315054	0.345252
15	2014	105.4434	0.317492	0.346697
16	2015	106.8115	0.318222	0.350544
17	2016	106.9596	0.319832	0.352128
18	2017	105.2451	0.324068	0.344387
19	2018	104.7455	0.314447	0.33942
20	2019	104.2379	0.312039	0.337018

Coefficients:

	Estimate	Std. Error	*t*-Value	Pr(>|*t*|)
log(lag(dpghe, 1))	−0.060956	0.022536	−2.7049	0.007338**

Signif. codes:

'***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 '' 1

Total Sum of Squares: 0.54594.

Residual Sum of Squares: 0.52932.

R-Squared: 0.030444.

Adj. *R*-Squared: −0.10271.

F-statistic: 7.31623 on 1 and 233 DF, *p*-value: 0.007338.

R Outcome of Fixed Effect Model for Dgghe_pc_ppp for Pre Shock

Two ways effects Within Model

Call:

plm(formula = gdgghe ~ log(lag(dgghe, 1L)), data = PanelFinal, effect = "twoways", model = "within").

Balanced Panel: $n = 14$, $T = 19$, $N = 266$.

Residuals:

Min	1st Qu	Median	3rd Qu	Max
−0.2781945	−0.0238835	−0.0012419	0.0250152	0.2693519

Coefficients:

	Estimate	Std. Error	*t*-Value	Pr(>|*t*|)
log(lag(dgghe, 1))	−0.047236	0.016775	−2.8159	0.005281**

Signif. codes:

'***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 '' 1

Total Sum of Squares: 0.77151.

Residual Sum of Squares: 0.74612.

R-Squared: 0.032911.

Adj. *R*-Squared: −0.099908.

F-statistic: 7.92921 on 1 and 233 DF, *p*-value: 0.005281.

R Outcome of Fixed Effect Model for Dpghe_pc_ppp for Pre Shock Period

Two ways effects Within Model.

Call:

plm(formula = gdpghe ~ log(lag(dpghe, 1L)), data = PanelFinal, effect = “twoways”, model = “within”).

Balanced Panel: $n = 14$, $T = 19$, $N = 266$.

Residuals:

Min	1st Qu	Median	3rd Qu	Max
−0.27541533	−0.02728384	−0.00048104	0.02276403	0.22126890

Coefficients:

	Estimate	Std. Error	*t*-Value	Pr(>|*t*|)
log(lag(dpghe, 1))	−0.157344	0.033029	−4.7639	3.341e−06 ***

Signif. codes:

‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘’ 1

Total Sum of Squares: 0.75069.

Residual Sum of Squares: 0.68406.

R-Squared: 0.088756.

Adj. R-Squared: −0.036394.

F-statistic: 22.6944 on 1 and 233 DF, p-value: 3.3411e-06.

R Outcome of Fixed Effect Model for Che_pc_ppp with Shock Period

Two ways effects Within Model

Call:

plm(formula = gche ~ log(lag(che, 1L)), data = PanelFinal, effect = “twoways”, model = “within”).

Balanced Panel: $n = 13$, $T = 20$, $N = 260$.

Residuals:

Min	1st Qu	Median	3rd Qu	Max
−1.6000521	−0.0285992	−0.0081296	0.0261584	0.4985668

Coefficients:

	Estimate	Std. Error	t-Value	Pr(>|t|)
log(lag(che, 1))	−0.048940	0.068573	−0.7137	0.4761

Total Sum of Squares: 4.9891.

Residual Sum of Squares: 4.9779.

R-Squared: 0.0022389.

Adj. R-Squared: –0.13841.

F-statistic: 0.509359 on 1 and 227 DF, p-Value: 0.47615.

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