JOURNAL OF ECONOMIC DEVELOPMENT 1
Volume 47, Number 4, December 2022

WHAT DETERMINES THE HEALTH STATUS IN DEVELOPING COUNTRIES? EVIDENCE FROM A DYNAMIC PANEL [*]

TONMOY CHATTERJEE [a] AND SOUMYANANDA DINDA [b]

[a] *Bhairab Ganguly College, India*
[b] *University of Burdwan, India*

Many studies have investigated the association between health status and economic growth, between health status and international trade. Advancing on earlier work, this paper incorporates unemployment rate, population growth rate, income inequality, institutional indicators and indicators related to infrastructure along with growth and trade indicators, and uses dynamic panel technique in order to find the behavior of population health status in developing nations. The present study aims to provide new evidence regarding health status determinants and how they are related to the population health status in developing countries. This study is provided new evidence on this relationship for 51 developing countries during the period 1980–2018. Apart from this, we have tested the sensitivity of the estimates in our empirical analysis using three clusters of countries, namely, Asia, Africa and Latin America. Overall, our results suggest that improvement of health status can be achieved from either an increase in per capita income or from the perspective of international trade or in the presence of strong institution and better health infrastructure.

Keywords: Health status, Unemployment, Population Growth, Corruption, Inequality, Infrastructure, Trade, Panel Data
JEL Classification: I15, B52, C23, F14, F21, J11, J21

1. INTRODUCTION

Economic development presumes many dimensions of socio-economic activities. History suggests that several elements of socio-economic development have relatively

[*] We would like to thank the Editor and an anonymous referee of this journal for their extremely useful and constructive comments. However, the usual disclaimer applies.

unfolded from the blanket, in the post second world war period. In fact, the issue of sustainable development was almost untouched in an overwhelming atmosphere of rapid industrialization. However, sustainability creates immense space to some major social factor like health in order to maintain the sustainable path of economic development. Issues of development are quietly attached with the aspects of social phenomenon like health in developing countries.

Broadly, health of a nation is explained in terms of three different arguments, namely, health status, quality of life and health care. Among these three, quality of life is related to the condition affects the person's normal life. Again, in terms of health care, we can exercise the way of prevention, treatment, and management of sickness through the goods and services offered by health care organisations and professionals. Whereas, the health status is not only related to the individual's body structure and function, moreover, it relates to the macro identities of health, including, life expectancy at birth, morbidity rate, mortality rate etc. Hence, quality of life is attached with person's life, implies related to microeconomic arguments and health care is the way through which we can prevent illness, indicates the step with which we can get better health outcomes. Therefore, at macro level for a country, where one wants to suspect the main determinants of health, it is rational to start with health status.

Notwithstanding, evidences suggest that issues related to health status were relatively less discussed in the last century; however, it has generated lots of attention of the researchers and has been prominently discussed in the last one and a half decades of the present century. Moreover, only in recent past, researchers have agreed to claim health status as an economic phenomenon, since, its presence with good numbers justify health as a crucial component of human capital formation in order to realize sustainable economic growth. Acceptable economic growth creates immense space to health status to grow and in return raises the levels of human capital formation (Cole and Neumayer, 2006). Hence, better health has a positive effect on individual productivity and returns to human capital. Better health increases nutritional efficiency of the labour by increasing productivity. Moreover, nutritionally efficient workers can earn benefits by two different ways. First, higher nutrition generates higher productivity among the workers, which in turn makes them capable to earn more wages. Secondly, the workers with more nutrition will be able to attend more working days in their job compared to earlier and hence, employment in terms of nutritional efficiency shall go up. This increase in employment along with higher wages should facilitate positive effect on health status of a country (Martikainen and Valkonen, 1996; 1998).

In spite of the presence of influence of employment on health status, income can also be considered as another component which influences health status in a positive way. Good health leads to higher human capital formation and generates the capability to work more and earn more. Good earnings lead to an increase in the demand of health-related goods and services, which provide better population health status (Mushkin, 1962; Grossman, 1972; Wilkinson and Pickett, 2006; Wilkinson, 1996). However, in developing countries health is not equally distributed and income inequality, population growth and poor infrastructure can be treated as the responsible factors behind the same. Adverse effects of income disparity on health are well acknowledged by the health economists (Herzer and Nunnenkemp, 2015). Again, population explosion in developing countries creates the supply bottlenecks scenario in health-related goods and services, facilitating poor health. Such supply side bottlenecks generate either from unemployment or population explosion, however, this can be eliminated by incorporating significant infrastructural development. Improvement of infrastructure of both types, that is, overall infrastructure and also infrastructure related to health are crucial in order to generate better health outcomes (Mushkin, 1962; Grossman, 1972). Again, infrastructure development is significantly associated with capital abundance of the corresponding country. Moreover, developing nations suffer from the scarcity of capital and thereby may face certain constraints to deliver better infrastructure. Adverse effects of such constraints can be narrowed by introducing non-dubious trade policies (Herzer and Nunnenkemp, 2012). Higher external flows of capital can eliminate the scarcity of capital in developing nations and hence, pursue better infrastructure for health and can influence the population health status in a positive manner (Stevens, Urbach and Wills, 2013).

So far, the point of departure of this paper goes back to Angus Deaton's inquiries into the question on how the health status is related to economic growth and other factors. The basic question that Deaton asked was: Does economic growth or economic conditions in general improve health of a country, or does the health contribute to economic growth? After many years of painstaking work, he comes to terms in his book, The Great Escape, that health in general evolves through an interaction of many factors including institutions and innovations in medical and scientific knowledge that can cure many deadly diseases and/or help prevent the contraction of such diseases. Starting with Douglas North, Tabelini and Acemoglu and his colleagues, more recently, have been arguing, through a careful inquiry into the historical course of development, that institutions do matter in terms of raising productivity and creating wealth. One of the most serious problems plaguing the developing countries is the lack of well-functioning institutions including social capital, which are causing serious problems of dual inequalities in income/wealth and opportunities to receive medical services and broadly health status. From this short introduction we can feel that health status can't be measured within a single dimension. These problems need to be addressed in more serious terms instead of drawing any simplistic conclusion. To be more specific, health status for developing economies may be associated with several macroeconomic, socio-economic, demographic, international trade and most significantly institution related dimensions. Hence, our main task is to conceptualize that what determines the population health status for the developing countries? This is an important question that lies at the centre of our study.

In this paper, we adopt a robust panel data covering a period of 1980-2015 and scrutinize which are the significant determinants of health status in developing nations. This paper is original in four ways. First, this is the first of its kind in studying the drivers of population health status in developing nations of Asian, African and Latin American continents using a large panel data framework. Aforementioned set up gives us the opportunity to throw some lights in the way of policymaking by mitigating argument that unique policy measure can't optimize the health status of all developing countries, rather, policy measures should be continent or region specific. Second, this study tests the hitherto commonly untested variables such as institution related measure, unemployment rate and population growth rate of countries in understanding the determinants of health status. Third, the role of infrastructure (overall and health specific) behind the potentiality of population health has not been researched yet. However, its impact on health in developing countries can't be ignored and hence it makes the third contribution of our study. Fourth, it explores the association between trade measure in terms of simultaneous presence of openness and foreign direct investment, and health status in countries of our concern. In fact, such relationship has been established theoretically, however, its empirical validation has not been judged yet. Therefore, such interaction between openness and foreign direct investment make a clear space to the policymakers to think again before juggling in favour of liberalization.

The remainder of the paper is organised as follows. In Section 2, we review the related literature and offer a number of plausible explanations of the relationship between health status and the possible determinants of health that lead us to the data to statistically identify the appropriate endogenous variables, control variables and the specification that can best describe these links. Section 3 describes the sources of data set and the definitions of the data variables. Section 4 describes the estimation strategy. In Section 5, we provide a detailed discussion on the results and conclude in Section 6.

2. LITERATURE REVIEW

Before going to the main stream discussions of our empirical study, we shall also critically analyse the existing literature based on health care status and several major socio-economic variables. A developing economy is always characterized by low per capita income and hence we shall start with per capita income and its impact on population health status. Simply speaking, life expectancy and economic growth are positively associated with each other (Barro, 1996). As per absolute income hypothesis, Life expectancy and average per capita incomes are also positively related across different cross-sections. More importantly, they are associated with each other non-linearly due to the existence of diminishing returns to increases in income (Preston, 1975). Increases in income would have larger positive effects on health outcomes among poor people than on health outcomes among rich people (Preston, 1975). In support of this Mushkin (1962) have emphasized more on human capital formation and try to explain the relationship between economic growth and health status. Similarly, Bryant (1969) has explained the improvement of health status due to social and economic changes within a region. Slightly different way, Bhargava et al., (2001) have incorporated adult survival rate as an indicator of health status and examined the relationship between per capita GDP and health in terms of adult survival rate and they have claimed that health is positively associated with per capita GDP. Again, this result has also been challenged in the presence of poverty (Deaton, 2003). Supporting results, that is, the diminishing return to personal income leads to a negative relation between income inequality and health status has also been claimed in the literature (Gravelle, 1998). On balancing these forces, Sorkin (1977) have explained that population health is positively attached with per capita during the early twentieth century. However, this study has also claimed that increases in the population health status of the developed nations is less sensitive to Per capita GDP and more sensitive in developing nations.

From another angle we can relate population health with per capita income and we are revealing them in the following manner. It can be suggested that the survival rate contributes to per capita GDP for across countries (Jamison et al., 1998). Again, more malaria prone areas contribute less to per capita GDP growth (Gallup and Sachs, 2000). Similarly, HIV epidemic has reduced the per capita GDP growth rate by reducing human capital and savings of per capita GDP specifically in African countries (Ainsworth and Over, 1994). Interestingly, for the African countries, a positive associationship between per capita GDP growth rate growth and the share of government budget allocated to health care is experienced (Gyimah-Brempong, 1998). Similarly, an optimistic result between economic growth and health care status has been found for the Latin American countries (Mayer, 2001). In fact, different health programs can improve the standard of living of the poor and it can also influence the events on their everyday activities (Malenbaum, 1970) and moreover, healthy individuals are more efficient at assimilating knowledge and, in consequence, obtain higher productivity levels (Grossman et al., 1972; Alsan, Bloom and Canning, 2006).

Another line of research through which the effects of social deprivation and social status on population health can be capitalized is as follows. It may be noted that the transformation in health diseases from epidemiological to infectious leads to more absolute deprivation, relative disadvantages and from the same channel the scope of psychosocial stress and relative deprivation are also emerged (Wilkinson, 1996; Wilkinson, 1997; Wilkinson, 2000). Again, it can be shown that chronic stress disappears health status as per as human biology is concerned (Sapolsky, 2004).

Another channel, namely, international trade, through which we can expect that population health status, shall be affected. It is to be noted that quality of life such as health conditions and FDI are associated with each other’s and not only that, health care quality is positively affected by the inflow of FDI for a given cross-section (Blonigen & O’Fallon, 2011). Moreover, the link between FDI inflow and health care status is basically depending upon by the existence of healthy workforce of a certain country (Alsan et al., 2006; Azémar and Desbordes, 2009; Chatterjee and Dinda, 2016). However, higher expenditure in health care through inflow of FDI or openness has been questioned in the presence of poverty and income inequality (Deaton; 2003). However, Stevens, Urbach and Wills (2013) have answered the above mentioned question with optimism, but Herzer and Nunnenkamp (2012) have claimed that FDI affects health care status adversely in the long run at least in case of developed economies.

We observe several loopholes in existing literature on health, more specifically, with reference to the developing countries. Most of the literature on health in developing regions has ignored the significance of institution, infrastructure, employment and demographic indicators as prominent dimensions of the health status. The extant literature has also ignored the simultaneous interaction between several trade dimensions, eventually, which becomes a good measure of international trade in understanding the features of health care in developing countries. We fill these gaps in this paper by adopting a more holistic specification involving economic factors, institutional factors, trade factors and demographic factors, as the main determinants of health in developing countries across the world.

3. DATA

In this section primarily we describe the data set with which we shall proceed and also try to describe the significance lies behind the selection of the said variables. We consider an unbalanced panel of 38 years from 1980 to 2018 for 51 developing economies around the world[1]. The main source of our data is the World Development indicators (hereafter, WDI). As our main focus of this study is to explain the major determinants of health care status and also how variables of different domains affect it for only developing economies. Here, by the term different domain, we actually wish to explain that health indicators or health care status of any country not solely depends upon a certain variable or rather a type of variable. In fact socio-economic variables like health status are generally related with different categorical variables, such as, economic growth related variables, financial variables and also on some socio-economic variables[2]. It is to be noted that per capita income and wage rate have some positive influences on health and medical care (Grossman, 1972; Leigh and Jencks, 2007). Here, we have used log per capita GDP ($\ln PCGDP$) as a representative of economic betterment. In order to smooth the data of $PCGDP$, a logarithmic transformation of this variable is performed. In fact, the logarithmic transformation often reduces the problem of heteroscedasticity. This is described by the fact that the log transformation compresses the scales in which variables are measured, thus reducing a tenfold difference between several values in double difference. Apart from this we have also incorporated a variable DM, which may help us to trigger up the scope of analytical perspective of $\ln PCGDP$ more precisely. Here we use D^*M as an exogenous variable, where $M = (\ln PCGDP_{it} - \ln PCGDP^*) =$

[1] See Table A.1 in Appendix A.

[2] For further details one can go through Table 1.

$\ln(PCGDP_{it}/PCGDP^{*})$. The implication of insertion of M in the estimation of LER and IMR is to explain the impact of the gap between $\ln PCGDP$ and mean $\ln PCGDP$ on the health indicators. More precisely, here we want to capture in which way relatively rich developing economies (rich implies where $M > 0$) are enjoying some extra benefit due to the richness of the economy. To justify this we have used a dummy variable D^{*} and we assume that $D^{*} = 0$ for poor economies (poor implies where $M < 0$) and $D^{*} = 1$ for rich economies. The categorization of poor and rich developing economies has been done by calculating the average $\ln PCGDP$ for 51 selected countries for the period 1980-2018 (we call it the grand average $\ln PCGDP$). If average $\ln PCGDP$ of the country concerned (i.e., the average $\ln PCGDP$ of the country for the period 1980-2018) is greater than the grand average $\ln PCGDP$ we refer to the country as rich, otherwise it is poor in the opposite case. Accidentally if the two are same then also we consider the country as a poor one. It is to be noted that separately the sign of $D^{*}M$ has no special economic interpretation. It is to be combined / compared with the sign of $\ln PCGDP$ to interpret it in economic terms. From the point of view of international trade, to represent the trade environment one can use Openness and per capita FDI (hereafter, $PCFDI$) inflow as two prominent variables. However, in this study we have used the interaction between Openness and $PCFDI$ as a new representative of international trade. Through this we are not only explaining the sole effect of either Openness or $PCFDI$ rather, we can explain the impact of inflow of $PCFDI$ in an open environment. More specifically, it has already been tested at the theoretical level that openness and $PCFDI$ are playing their role simultaneously on health indicators (Chatterjee and Gupta, 2014; Chaudhuri and Mukhapadhyay, 2014; Chatterjee and Gupta, 2015). However, its empirical testing remains untouched in the literature. In this respect this variable is a new addition to the literature on health and trade. Apart from these, here we have used unemployment rate (hereafter, UR), population growth (hereafter $POPGR$), income inequality in terms of gini index (GI) as variables to justify the socio-economic behavior for the developing economies throughout the world. To say seriously anything regarding the status of health care for any poor economy, the role of consumers' preferences can't be ignored and the said preferences can be distorted by the volume of heterogeneous unemployment (Grossman, 1972). Again, developing economies specifically suffering from the problem of population explosion and thereby affects their health and education through the same channel. Therefore, proper descriptions of health status for developing economies will remain unfold unless the entry of $POPGR$ has been granted. Again, GI can be obtained from several sources. For instance, many researchers use Luxembourg Income Study database or the World Income Inequality Database (WIID) to get the data on GI. However, due to the lack of continuous and consistent data of inequality over time, Firebaugh (2003) advocates to choose some alternative. In this respect following Solt (2009) here we use the Standardized World Income Inequality Database (SWIID). It is to be noted that as far as the Gini is concerned one can use both gross income Gini coefficient and the net income Gini coefficient, however, here we use the Gini index of gross income inequality (GI) (Herzer and Nunnenkemp, 2015). Apart from these to encounter institutional aspect of developing countries we consider corruption index (CI). To measure CI we have used International Country Risk Guide's ($ICRG$) index for bureaucratic corruption. Corruption is measured on a 0–6 scale with higher values denoting lower corruption. Note, for easier explanation, we rescaled the measure such that higher values of the index represent greater corruption.

Table 1. Description of variables and data sources

Variable	Description	Data Source
LER	Life expectancy at birth indicates the number of years a newborn infant would live if prevailing patterns of mortality at the time of its birth were to stay the same throughout its life.	World Development Indicators (WDI) of World Bank Data
IMR	Infant mortality rate is the number of infants dying before reaching one year of age, per 1,000 live births in a given year.	WDI
$\ln PCGDP$	logarithm GDP per capita	WDI
$Openness$	imports of goods and services (% of GDP)+Exports of goods and services (% of GDP))	WDI
$PCFDI$	Per capita foreign direct investment, net inflows (% of GDP)	WDI
$OPPCFDI$	$Openness \times PCFDI$	Developed by the authors
DM	$M = (\ln PCGDP_{it} - \ln PCGDP^{*})$ and $D^{*} = 0$ for poor economies (poor implies where $M < 0$) and $D^{*} = 1$ for rich economies	Developed by the authors
$POPGR$	Population growth (annual %)	Developed by the authors based on WDI data source
UR	Unemployment rate derived on the basis of given total unemployment, total (as % total labour force)	Developed by the authors based on WDI data source
CI	Corruption is measured on a 0–6 scale with higher values denoting greater corruption	International Country Risk Guide's (ICRG) index for bureaucratic corruption
GI	Gini coefficient based on net income	Standardized World Income Inequality Database (SWIID)
$INFRAI$	The ranking of the level of infrastructure in developing countries as detailed in Annexure 1.	Developed by the authors based on WDI data source
HII	The ranking of the level of health infrastructure in developing countries as detailed in Annexure 1.	Developed by the authors based on WDI data source

Table 2. Summary Statistics of Major Variables of our Panel Data Set

		Mean	Std. Dev.	Min	Max	Observations
Life Expectancy at Birth (LER)	Overall	67.232	7.488	45.548	82.346	N = 1898
	Between		5.946	47.531	77.159	n = 51
	Within		2.953	53.717	77.286	T = 38
Infant Mortality Rate (IMR)	Overall	37.999	29.405	2.200	133.700	N = 1931
	Between		26.292	4.937	109.671	n = 51
	Within		12.614	-6.921	101.439	T-ba r= 37.98
Log of per capita GDP (ln$PCGDP$)	Overall	7.781	1.253	4.935	11.480	N = 1837
	Between		1.718	5.897	10.402	n = 51
	Within		1	6	10	T-bar = 36.17
FDI	Overall	4,900 mil	18,900 mil	-20,900 mil	291,000 mil	N = 1858
	Between		11,800 mil	69.5 mil	78,300 mil	n = 51
	Within		14,900 mil	-73,000 mil	217,000 mil	T-bar = 36.36
Openness (op)	Overall	0.000	0.000	0.000	0.000	N = 1791
	Between		0.000	0.000	0.000	n = 51
	Within		0.000	0.000	0.000	T-bar = 35.4
Unemployment Rate (UR)	Overall	7.592	4.807	0.200	29.800	N = 1624
	Between		4.396	0.584	23.988	n = 51
	Within		2.034	-1.908	18.392	T-bar = 27.98
Population Growth Rate ($POPGR$)	Overall	0.173	4.512	-1.000	179.081	N = 1888
	Between		0.733	-0.245	5.000	n = 51
	Within		4.475	-4.867	174.254	T-bar = 37.07
Corruption Index (CI)	Overall	4.036	1.752	1.000	6.000	N = 1138
	Between		1.732	1.370	6.000	n = 51
	Within		0.386	3.480	5.665	T-bar = 27.13
GINI Index (GI)	Overall	40.290	8.807	15.370	75.260	N = 1535
	Between		3.311			n = 51
	Within		2.000			T-bar = 36.03
Infrastructure Index ($INFRAI$)	Overall	121.740	15.150	64.280	168.520	N = 1531
	Between		5.230			n = 51
	Within		11.310			T-bar = 33.31
Health Infrastructure Index (HII)	Overall	89.010	3.970	42.053	135.611	N = 1377
	Between		0.432			n = 51
	Within		4.572			T-bar = 34.12

Moreover, to capture the infrastructure issue, we have incorporated both overall infrastructure index ($INFRAI$) and health infrastructure index (HII)[3]. To describe the real health care scenarios for the developing economies, we use Life expectancy at birth and Infant mortality rate as two most suitable health indicators. Life expectancy at birth indicates the number of years a newborn infant would live if prevailing patterns of mortality at the time of its birth were to stay the same throughout its life. Life expectancy is the most widely used measure of population health care and has also several advantages over other indicators of health status, including the following: (i) it depends on both infant mortality and other mortality rates, thus incorporating mortality rates at all stages in life; (ii) it is not biased by age structure; and (iii) data on life expectancy at birth are available for a reasonably large number of countries and time periods (Herzer and Nunnenkamp, 2015). However, the use of life expectancy (hereafter, LER) as an indicator of health can be criticized on the following grounds: (i) longer life expectancy does not necessarily translate into better health; (ii) second limitation is that average life expectancy does not reveal the variation of health conditions within countries. To overlook this we have also used Infant mortality rate (hereafter, IMR) as a second best measure of population health status for developing economies in our question.

One of the originalities of this study lies in the use of several unique variables (specifically in case of health care related studies) that are perceived to be significant determinants of health care status: interaction between Openness and PCFDI (hereafter, $OPPCFDI$), DM, $POPGR$, UR, CI, $INFRAI$ and HII of these economies. Table 2 provides the description of the variables and data sources. Table 3 provides the summary statistics of the variables.

4. ESTIMATION STRATEGY

In this section, we precisely want to analyse the general way to look at a panel data and thereafter we shall try to proceed with our present estimation strategy. The data used in this study cover 51 developing economies between 1980 and 2015 which represent 35 years of observations for each economy. The purpose of this choice is to enlarge the study to all the developing countries for which we have an acceptable data length. Moreover, to overcome the shortcomings of both cross-sectional and time series analysis, here we have used this panel data set as this type of data enable us to combine time series and cross-sectional features and offer a variety of estimation approaches (Dawson, 2010). It is to be noted that the usual panel data estimation procedures such as random-effect or fixed-effects methods average the data per cross-section to recognize the trend effects which in fact conceal the dynamic association among the variables of

[3] For details see Appendix B.

study (Pesaran and Smith, 1995). Apart from this, the static panel data models are also suffering from several shortcomings. For instance, pooled OLS is highly restrictive as it imposes a common intercept and slope coefficients for all countries disregarding individual heterogeneity. Again, the fixed-effects model considers that the estimator has common slopes and variance but country-specific intercepts. More precisely, this estimator faces severe problems due to the loss of degrees of freedom and also it cannot take care about the issue of endogeneity (Baltagi, 2008) and these estimates are biased when some of the regressors are endogenous and correlated with the error terms (Campos and Kinoshita, 2008). On the other hand, researchers are often using the technique of panel co-integration to examine the long run relationship between the variables of interest. However, the panel-co-integration analysis has some its own limitation. Actually, the panel co-integration has the disadvantage that the evidence of long-term relationships can be obtained only when variables of the interest are integrated at the same level (Pesaran and Smith, 1995; Pesaran, 1997; Pesaran and Shin, 1999). In our case, as we use a data set which comprises an acceptable time and country specific dimensions for more than fifty developing economies, the inherent dynamics of the variables of interest should be examined and properly analysed. Therefore, the static panel approaches are unsuitable for capturing the dynamic nature of our data and the usual techniques of static panel estimation are no longer valid (fixed-effect model and random-effects model). Thus, we proceed to a dynamic panel estimation with General Method of Moments (hereafter, GMM). In literature, we find two types of GMM. One is linear or difference GMM estimation and the other is system GMM estimation. However, the linear GMM estimator has asymptotic weaknesses of its precision and its instruments that cause considerable bias in finite samples (Roodman, 2009). Further, the system GMM estimator is more powerful than the linear GMM because it allows the simultaneous estimation of the equation in level and the equation in first difference and so generates consistent estimators even for finite samples (Blundell and Bond, 1998). Indeed, this estimation, although robust in theory, tends to produce standard errors that are biased in finite samples. Similar cases have prompted Arellano and Bond (1991) to recommend the one step method for inference. In fact, derived estimators from dynamic panel model base on GMM of first differenced values are consistent (Arellano and Bond, 1991). However, GMM of first differenced values are suffering from the weak instrument problem and thereby system GMM provides more improved estimates (Blundell and Bond, 1998). Moreover, the two-step system GMM is more efficient than the one step (Windmeijer, 2005). Therefore, in a fairly large sample in our case 108 countries observed over 25 years, the two-step system GMM estimation procedure will be best suited given its greater asymptotic efficiency (Allegret and Azzabi, 2012).

However, before going to the main course of panel GMM estimation, we shall also focus on the issue of presence of panel unit roots. More use of non-stationary data may create the problem of spurious regression. Further, it may be noted that, Student statistics associated with the converging estimators will diverge and create several problems in statistical inference in the presence of non-stationary macroeconomic data

(Hurlin and Mignon, 2007). With an unbalanced panel, as in our case, we stand only with the IPS test (Im and Pesaran, 2003), PP-Fisher chi-square (Maddala and Wu, 1999) and Fisher-type ADF unit root test on our panel data. If the selected data series shows a p-value less than five percent and therefore we reject the presence of unit root. Again, rejection of unit root exhibits the absence of panel co-integration. From another angle multicollinearity may exhibits crucial bar to get appropriate estimators. In this regard we have introduced the variance inflation factor (VIF hereafter) for each variable. By calculating VIF for representative variables, we find that VIFs are moving around the range of 1.02 to 1.39. However, we find relatively higher VIF, that is, 2.09 for POPGR. In fact, the conventional value of VIF is around 1 and must be wary of values exceeding 2.5 (O'Brien, 2007). Thus, we can ignore the existence of multicollinearity. Further, the issue of endogeneity can't be ignored in anyway. Therefore, to tackle this we have calculated Durbin–Wu–Hausman (DWH hereafter) test. The null hypothesis of the DWH test tells us that an ordinary least squares (OLS) estimator of the same equation (for LER) would yield consistent estimates. In our case, we have found the p-value of DWH is greater than five percent, that is, 12.09% (11.89% for the estimation of IMR). Thus, we can also eliminate the endogeneity issue. Apart from these, we have also used Breusch and Pagan's (1980) LM test to check cross-sectional dependency within the panel. In fact, we have found some trace of significant cross-sectional dependence. Further, we have used Breusch-Godfrey and woolridge tests to explain the fact that regression error terms among countries also influence each other, that is, presence of Serial correlation. For the data featuring a large cross-country and long period, the GMM system estimator by Arellano and Bover (1995) and Blundell and Bond (1998) work well to tackle the issues of both Serial correlation and cross-sectional dependence (Roodman, 2009).

5. ESTIMATION SPECIFICATION

5.1. Estimation

Thus, our proposed model, which is consisting with the broader literature on the determinants of population health status cited earlier and also based on our presumption regarding the determinants of the same, takes the following functional form:

$$Health_t^i = f(Health_{t-1}^i, Marco_t^i, Socioeconomic_t^i, International_t^i, Trade_t^i).$$

More specifically, the above-mentioned function can be written as:

$$Health_t^i = \alpha_0 + \alpha_1 Health_{t-1}^i + \beta_i X_t^i + \varepsilon_{it}. \quad (1)$$

Here, $Health_t^i$ represents the health indicator and ε_{it}. is the error term. More specifically, ε_{it} can be further explored in the following manner:

$$\varepsilon_{it} = \mu_i + v_t + e_{it}. \tag{1.1}$$

Insertion of equation (1.1) in Equation (1) we can get,

$$Health_t^i = \alpha_0 + \alpha_1 Health_{t-1}^i + \beta_i X_t^i + \mu_i + v_t + e_{it}. \tag{2}$$

where, X_t^i represents the j^{th} variable for the cross-section i at time t and here μ_i is country-specific fixed effects. Note, v_t represents time fixed effects and e_{it} represents the unobservable error term.

If we consider LER as an indicator of population health status, Equation (1) can be rewritten as below:

$$LER_t^i = \alpha_0 + \alpha_1 LER_{t-1}^i + \beta_1 \ln PCGDP_t^i + \beta_2 DM + \beta_3 UR_t^i + \beta_4 POPGR_t^i + \beta_5 OPPCFDI_t^i + \beta_6 CI_t^i + \beta_7 GI_t^i + \beta_8 INFRAI_t^i + \beta_9 HII_t^i + \mu_i + v_t + e_{it}. \tag{3}$$

Consideration of IMR in the place of LER gives us the following specification:

$$IMR_t^i = \alpha_0 + \alpha_1 IMR_{t-1}^i + \beta_1 \ln PCGDP_t^i + \beta_2 DM + \beta_3 UR_t^i + \beta_4 POPGR_t^i + \beta_5 OPPCFDI_t^i + \beta_6 CI_t^i + \beta_7 GI_t^i + \beta_8 INFRAI_t^i + \beta_9 HII_t^i + \mu_i + v_t + e_{it}. \tag{4}$$

In this study we shall estimate equations (3) and (4) by using system GMM technique. In fact, one can use the usual ordinary least squares to our panel for the estimation, however, in such case the estimates will be less efficient due to the existence of cross-sectional dependency. Moreover, we can also use the conventional 2SLS estimation technique to categories the simultaneity bias (Hiebert, 2002). It is to be noted that use of system GMM technique to our panel, not only incorporates the inherent dynamics of the said panel but also provides to reasons to arrest the possible heteroscedasticity, cross-sectional dependence and autocorrelation lies in the error vector. Therefore, we can claim that the system GMM provides more efficiency over the traditional least squares and 2SLS estimators and we shall use this to get the most efficient estimator among the available estimation techniques.

5.2. Robustness Checks

In this section we shall check the robustness of our main models and to perform this here we have considered several ways to look at this. First, we incorporate the square of $\ln PCGDP$ as a new regressor and by doing so we would like to check not only the robustness of the findings even under the presence of square of $\ln PCGDP$ but also want to examine the impact of the new variable on the health status to support the several existing literature (Preston, 1975; Deaton, 2003; Leigh and Jencks, 2007). To describe this we run the following:

$$\begin{aligned} LER_t^i = {} & \alpha_0 + \alpha_1 LER_{t-1}^i + \beta_1 \ln PCGDP_t^i + \beta_2 (\ln PCGDP_t^i)^2 + \beta_3 DM + \beta_4 UR_t^i \\ & + \beta_5 POPGR_t^i + \beta_6 OPPCFDI_t^i + \beta_7 CI_t^i + \beta_8 GI_t^i + \beta_9 INFRAI_t^i \\ & + \beta_{10} HII_t^i + \mu_i + v_t + e_{it}. \end{aligned} \tag{5}$$

$$\begin{aligned} IMR_t^i = {} & \alpha_0 + \alpha_1 IMR_{t-1}^i + \beta_1 \ln PCGDP_t^i + \beta_2 (\ln PCGDP_t^i)^2 + \beta_3 DM + \beta_4 UR_t^i \\ & + \beta_5 POPGR_t^i + \beta_6 OPPCFDI_t^i + \beta_7 CI_t^i + \beta_8 GI_t^i + \beta_9 INFRAI_t^i \\ & + \beta_{10} HII_t^i + \mu_i + v_t + e_{it}. \end{aligned} \tag{6}$$

Second, we consider strength of Legal Rights Index (LRI) as a new regressor in the place of CI to capture the presence institutional effects on health. Legal right is measured on a 0-12 scale with higher values denoting higher strength of legal rights. To illustrate this we estimate the following specifications:

$$\begin{aligned} LER_t^i = {} & \alpha_0 + \alpha_1 LER_{t-1}^i + \beta_1 \ln PCGDP_t^i + \beta_2 (\ln PCGDP_t^i)^2 + \beta_3 DM + \beta_4 UR_t^i \\ & + \beta_5 POPGR_t^i + \beta_6 OPPCFDI_t^i + \beta_7 LRI_t^i + \beta_8 GI_t^i + \beta_9 INFRAI_t^i \\ & + \beta_{10} HII_t^i + \mu_i + v_t + e_{it}. \end{aligned} \tag{7}$$

$$\begin{aligned} IMR_t^i = {} & \alpha_0 + \alpha_1 IMR_{t-1}^i + \beta_1 \ln PCGDP_t^i + \beta_2 (\ln PCGDP_t^i)^2 + \beta_3 DM + \beta_4 UR_t^i \\ & + \beta_5 POPGR_t^i + \beta_6 OPPCFDI_t^i + \beta_7 LRI_t^i + \beta_8 GI_t^i + \beta_9 INFRAI_t^i \\ & + \beta_{10} HII_t^i + \mu_i + v_t + e_{it}. \end{aligned} \tag{8}$$

Third, we consider morbidity rate (MBR hereafter) as new health indicator and replace it in the place of LER and IMR and perform the same exercise. As both LER and IMR are measured in terms of mortality, these measures of health status only reflects the mortality aspect not the morbidity aspect. Hence, incorporation of morbidity rate as a measure of health status may help us to understand the behavior of different determinants from another angel. In fact, morbidity rate is a better measure of the health status to income and trade than mortality (Soobader and LeClere, 1999). Here we have used the tuberculosis incidence rate to cater MBR. The data on MBR collected from the WDI of World Bank for selected 51 developing countries for the period of 1990-2018. By performing the same model (like models (3) and (4)) with new dependent variable we want to check that whether our results remain unchanged or not. To perform this, we consider the following specification:

$$MBR_t^i = \alpha_0 + \alpha_1 MBR_{t-1}^i + \beta_1 \ln PCGDP_t^i + \beta_2 DM + \beta_3 UR_t^i + \beta_4 POPGR_t^i + \beta_5 OPPCFDI_t^i + \beta_6 CI_t^i + \beta_7 GI_t^i + \beta_8 INFRAI_t^i + \beta_9 HII_t^i + \mu_i + v_t + e_{it}. \quad (9)$$

Fourth, we separate the whole panel in three different parts depending upon three broad regions, namely, Asia, Africa and Latin America. We perform the same estimation process (i.e., we have used equations (3) and (4)) to check that whether the robustness of regional panel estimations is insensitive to regions or these are varying from one region to other.

6. RESULTS AND DISCUSSION

We begin our analysis with panel unit root tests and thereafter we proceed towards the results and discussions of the GMM estimation of the baseline model. Finally, we examine the robustness of our base line estimation.

6.1. Panel Unit Root Tests

In panel unit root test analysis, three different panel unit root tests are used to claim the variables of our interest are stationary or not.

For that purpose, we use IPS test (Im and Pesaran, 2003), PP-Fisher chi-square (Maddala and Wu, 1999) and Fisher-type ADF test. As far the test statistics are concerned, the alternative hypothesis implies there exist no unit root and obviously the null implies there exist unit root and it is valid for IPS, PP-Fisher chi-square and Fisher-type ADF test statistics. Table 3 reports the results of panel unit root tests-IPS test, PP-Fisher chi-square and Fisher-type ADF. Moreover, Table 3 exposes that the all the variables of our interest, at level are statistically significant under the above-mentioned tests, implies that all variables are integrated of order zero, I(0).

6.2. Interactions of Health Status

Graphically we can examine the interaction health care status with other relevant variables. The lower panel is divided in two parts. Panel 1 represents interactions of LER with other variable and Panel 2 expresses the interaction for IMR. Health care status in terms of LER is improving as the economy is moving towards higher per capita income. Again, the figure with interactions between LER and UR shows a declining health status of a developing economy as the UR of that economy increases. LER tend to rise as the open economy has grown indicating that market growth induces FDI inflows with proper openness, i.e., higher OPPCFDI. Figure with interactions between LER and POPGR represents a mixed trend. From Panel 2, interactions between IMR with lnPCGDP and OPPCFDI give us negative trend. Unlike LER, here in case of IMR we find mixed trend for both POGR and UR. It may be noted that a country with lower level of unemployment rate experiences positive relationship.

Table 3. Panel Unit Root Test

	At level			At first difference		
Variable	IPS test	ADF test	PP test	IPS test	ADF test	PP test
LER	-5.14 (0.00)	-19.11 (0.00)	-19.11 (0.00)			
IMR	-15.94 (0.00)	-28.37 (0.00)	-28.25 (0.00)			
ln$PCGDP$	-8.70 (0.05)	-8.10 (0.07)	-8.10 (0.07)	-19.06 (0.00)	-26.06 (0.00)	-26.01 (0.00)
UR	-2.89 (0.00)	-2.97 (0.00)	-2.95 (0.00)			
$POPGR$	-8.29 (0.00)	-17.51 (0.00)	-17.51 (0.00)			
$OPPCFDI$	-5.06 (0.00)	-10.63 (0.00)	-10.63 (0.00)			
DM	-3.74 (0.09)	-8.14 (0.05)	8.10 (0.05)	-7.78 (0.00)	-20.54 (0.00)	-20.54 (0.00)
CI	-4.68 (0.00)	40.21 (0.00)	39.79 (0.00)			
GI	-3.73 (0.00)	26.13 (0.00)	25.73 (0.00)			
$INFRAI$	-3.86 (0.00)	30.42 (0.00)	28.25 (0.01)			
HII	-3.55 (0.00)	36.54 (0.00)	31.27 (0.01)			

Notes: This table reports the test statistic followed by the probability values in parentheses for the three tests performed in ascertaining the stationarity of the variables. The first panel reports the test results in the level form and the second panel reports the results at the first difference. IPS test: The Im, Pesaran and Shin (IPS) test; ADF test: The augmented Dickey-Fuller (ADF) test; PP test: the Phillips-Perron -Fisher chi-square.

Panel-1

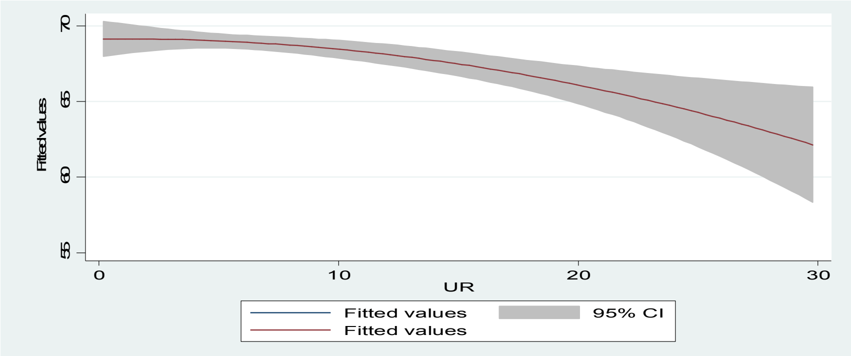

Figure 1(a). LER and UR

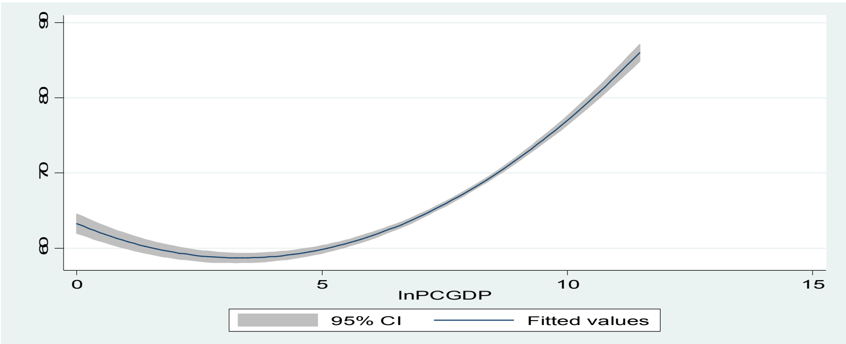

Figure 1(b). LER and $\ln PCGDP$

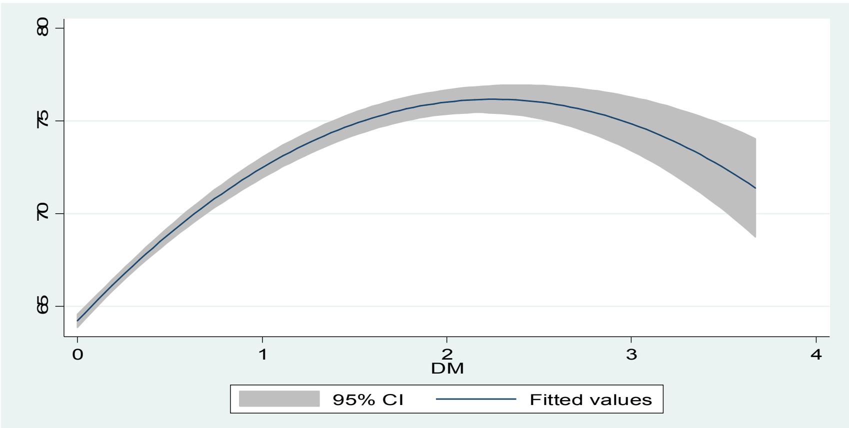

Figure 1(c). LER and DM

Figure 1. Interactions of LER - UR, $\ln PCGDP$, $POPGR$, DM, $OPPCFDI$, CI, GI

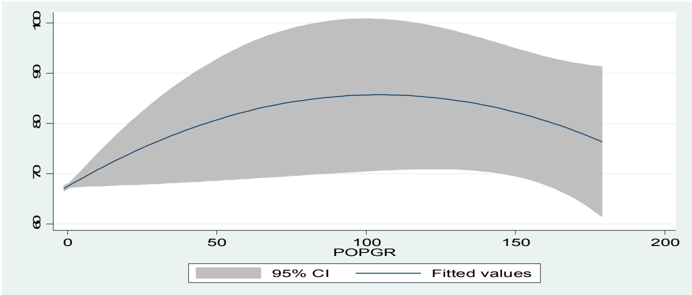

Figure 1(d). LER and $POPGR$

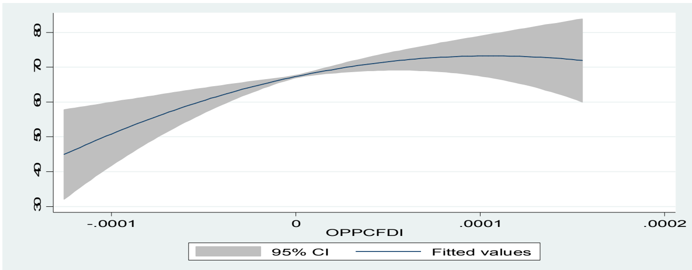

Figure 1(e). LER and $OPPCFDI$

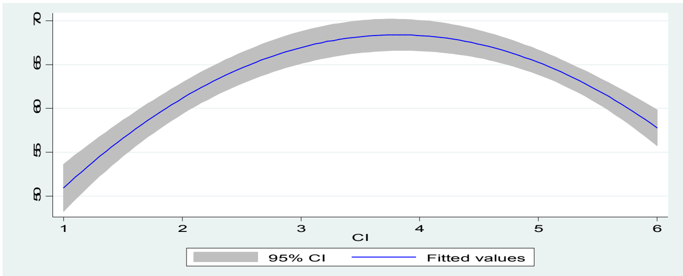

Figure 1(f). LER and CI

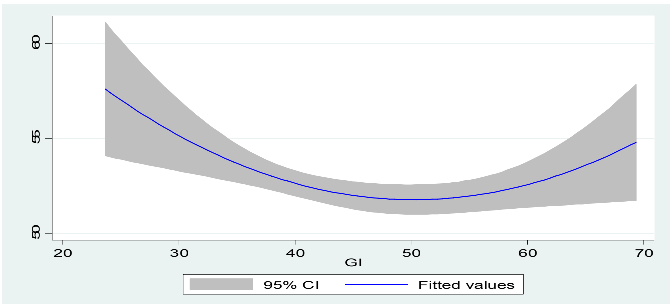

Figure 1(g). LER and GI

Figure 1. Interactions of LER-UR, ln$PCGDP$, $POPGR$, DM, $OPPCFDI$, CI, GI (con't)

Panel-2

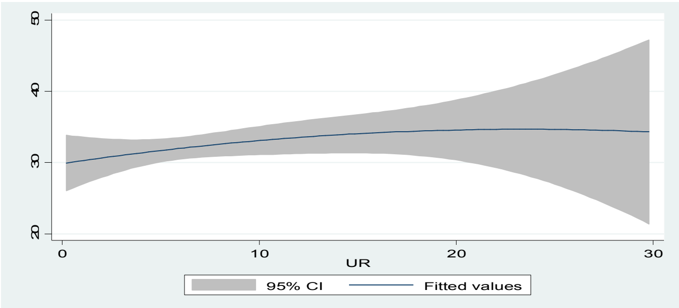

Figure 2(a). IMR and UR

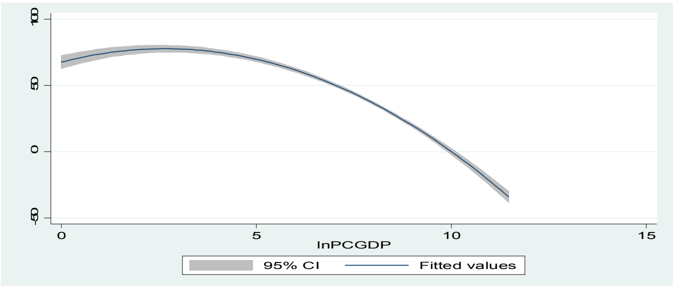

Figure 2(b). IMR and $\ln PCGDP$

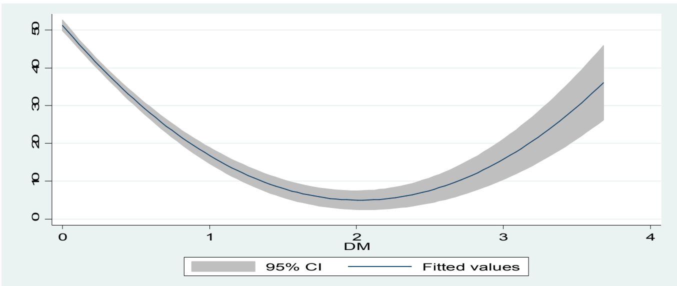

Figure 2(c). IMR and DM

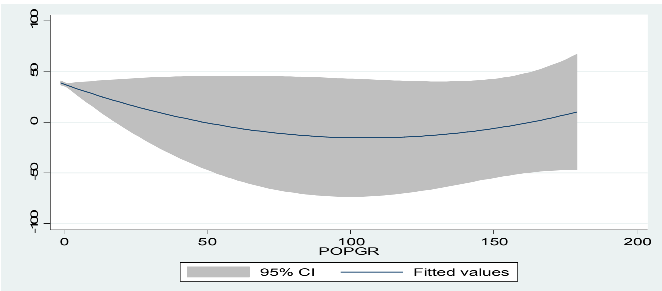

Figure 2(d). IMR and $POPGR$

Figure 2. Interactions of IMR - UR, $\ln PCGDP$, $POPGR$, DM, $OPPCFDI$, CI, GI

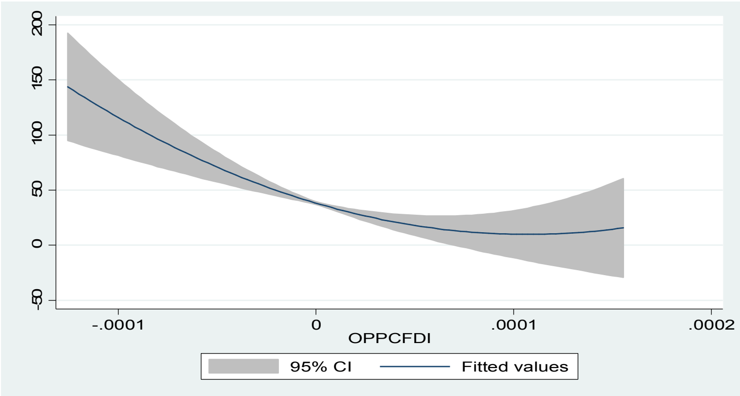

Figure 2(e). IMR and $OPPCFDI$

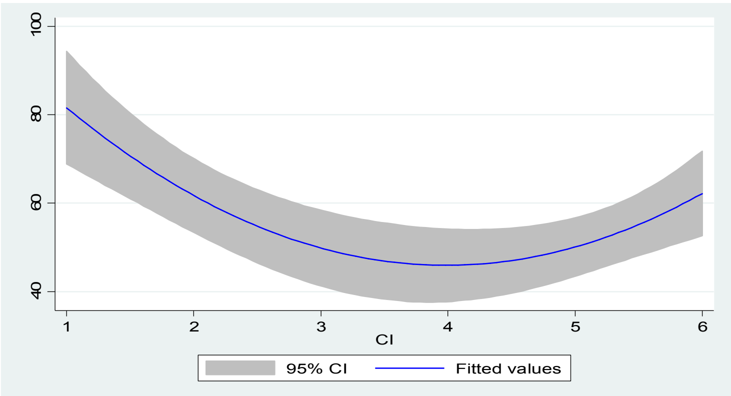

Figure 2(f). IMR and CI

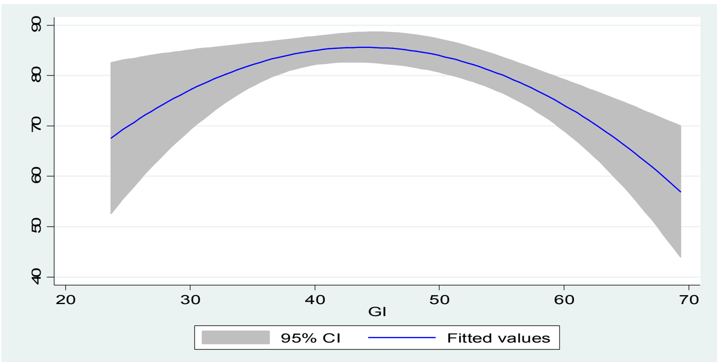

Figure 2(g). IMR and GI

Figure 2. Interactions of IMR-UR, ln$PCGDP$, $POPGR$, DM, $OPPCFDI$, CI, GI (con't)

6.3. Results of Panel GMM Estimation

Here we shall represent the empirical results of our base line model. The empirical results of equations (3) and (4) have been computed by using system-GMM dynamic panel estimation and the corresponding outcomes are presented in Table 4[4].

Table 4 gives us the empirical results of equations (3) and (4) based on System-GMM method. Overall, we find that coefficients of independent variables have the expected sign and are statistically significant in both regression equations.

6.3.1. Per Capita GDP and Health Status

From Table 4 we find that the coefficient of $\ln PCGDP$is positively and significant for LER and the coefficient of the same is negative and significant. In fact, both coefficients of $\ln PCGDP$ are explain expected sign and are significant. It shows that one percentage point increase in $\ln PCGDP$ variable is associated with a 40 basis point increase in LER. Panel 1 of figure 1 confirms this. On the other hand, the estimate suggests that one percent increase in $\ln PCGDP$ is associated with 32 to 33 basis point decline in IMR. Panel 2 of figure 1 confirms this. More specifically, our study suggests that population health care status is positively associated with $\ln PCGDP$. Higher per capita GDP for developing economy implies better potentiality of health care infrastructure through formation of health care capital and hence, it enhances the supply of health care infrastructure. Again, higher per capita GDP implies higher ability to consumption and thereby, creates high demand for health care. This is also true even in the presence of higher health care prices, as the demand elasticity for health care services are more price inelastic. Interestingly, better health status is associated with increases in per capita GDP and this result is consistent with the findings of Preston (1975), Deaton (2003), and Leigh and Jencks (2007). Apart from these, we contribute to the literature on health to examine the pace of movement of LER and IMR due to changes in per capita income. In fact, the pace of movement of LER and IMR depend upon the value of the coefficient of DM. From tables 4 and 5 we can claim that countries with $\ln PCGDP$ lower than mean $\ln PCGDP$, that is, poor nations have improved their LER more rapidly than the relatively rich nations, that is, countries for which $\ln PCGDP$ is higher than mean $\ln PCGDP$.

[4] It is to be noted that as we have used a data set for long 39 years, a structural break or structural change is quite natural. To neutralize this issue, here we have divided whole time period into two separate periods, say one from 1980-2000 and the other one from 2001-2018 and the logic behind this separation is lying on the fact that most of the developing countries were liberalized very after 2000. We have performed the same empirical exercise for the said durations and find no significant divergence from the outcomes depicted in Table 4. We insert the results in Table A2 in Appendix A.

Table 4. Results of Panel Regressions - Baseline Model

Variable	GMM for LER	GMM for IMR
LER lag 1	1.15* (0.001)	
IMR lag 1		1.09* (0.003)
ln$PCGDP$	0.40* (0.09)	-0.32* (-0.09)
UR	-0.77* (0.003)	0.59* (0.01)
$POPGR$	0.65 (0.99)	0.35* (0.003)
$OPPCFDI$	27.17** (11.31)	-7.14** (3.24)
DM	-0.25** (0.13)	3.19* (0.15)
CI	-0.09** (-0.04)	0.26** (0.11)
GI	0.36* (4.69)	-1.08* (2.93)
$INFRAI$	1.05** (0.51)	-2.79 (3.16)
HII	-2.11* (0.35)	0.67* (0.02)
Intercept	-2.99* (0.32)	-0.89 (0.86)
R^2 within	0.63	0.71
R^2 between	0.58	0.69
Over all R^2	0.55	0.71
No. of Countries	51	51
Observations	1414	1437

Notes: We represent estimation results of the specification (3) in the second column and of equation (4) in the last column. We report the results system-GMM with the coefficient values marked with significance levels in the first row followed by the standard errors (in the parentheses) in the second row. Asterisks ***, **, and * indicate levels of significance at 10%, 5%, and 1%, respectively.

6.3.2. Unemployment Rate and Health Status

With our interest to know how UR is impacting on health status in developing countries, we introduce UR as one of the explanatory variables in Equations (3) and (4) and run the panel regressions. Table 4 displays that UR is negatively associated with LER and positive correlated with IMR. Panel 1 and Panel 2 of Figure 1 confirm these. In both the cases we find the corresponding coefficients as significant. In short, our study claims that population health status is adversely affected by UR and it is quite obvious. It is quite natural that developing countries are characterized by high UR. Low employment or high unemployment leads to less purchasing power, creates lower effective demand. In fact, low quality or public subsidized health services are available in developing economies and they remain relatively less unaffected due to UR. However, lower effective demand generates lower demand for high quality health services. To build better health status, a proper high quality producible health care system is needed. With higher UR, the state may be unable to maintain good quality health treatment and thereby we experience some negative impact of UR on population health status. Though this association between UR and health status is still untouched in the empirical literature of health, however, our results are providing some sort of similarities with Grossman (1972).

6.3.3. Population Growth and Health Status

We pursue further to know how population explosion influences the population health status in developing countries and hence we incorporate the $POPGR$ in both the equations (3) and (4). Table 4 suggests that the rising $POPGR$ of the countries have a positive and insignificant impact on LER. This result is quite unusual to interpret and as it is insignificant, we are avoiding this part. On the other hand, we find that rising $POPGR$ of the countries has a positive and significant impact on IMR. The estimates suggest that a unit increment in the $POPGR$ is associated with a thirty-five to thirty-six basis point increase in IMR in developing countries. It is quite reasonable to assume that population explosion creates inequality in the distribution of state funded health services, which in turn affects population health status adversely.

6.3.4. International Trade and Health Status

We introduce a new international trade variable, $OPPCFDI$ in both equations (3) and (4) for assessing the impact of international trade on population health status in developing nations. In general, we find that to trace the international trade we often choose either $PCFDI$ or Openness. However, here we have used the interaction of Openness and $PCFDI$ and refer it as $OPPCFDI$. Table 4 reports the results of the dynamic panel regressions involving the interaction trade variable. Results suggest that an improvement in $OPPCFDI$ is positively and significantly associated with population health status. Table 4 also shows that $POPGR$ is positively associated with LER and negatively correlated with IMR. Panel 1 and Panel 2 of Figure 1 confirm these. In fact, improvement in openness for any developing economy indicates better environment to liberalise the economy and hence it should attract more FDI. More FDI implies higher $PCFDI$ and higher potentiality for capital formation. This creates better environment to build up proper infrastructure and hence it will help the health status indirectly (Stevens, Urbach and Wills, 2013). Again, it is to be noted that a fraction of this FDI will also flow to health sector directly and create direct impact to the health status (Alsan et al., 2006; Azémar and Desbordes, 2009; Chatterjee and Dinda, 2016). This results is also consistent with the findings of Chatterjee and Gupta (2014), Chatterjee and Gupta (2015) and Chaudhuri and Mukhopadhyay (2014).

6.3.5. Institution and Health Status

With our interest to know how institution is impacting on population health in developing countries, we introduce CI in the equations (3) and (4) and run the panel regressions. The results in Table 4 suggest that the panel of selected developing economies displays a significant negative correlation between CI and health status. Panel 1 and Panel 2 of Figure 1 confirm this. In short, our study claims that population health status is adversely affected by CI and it is quite obvious. It is quite natural that developing countries are characterized by high CI. Higher corruption actually portrays the inability of institutional measures of any nation. Again, inefficient institution generates poor supplement to the way of formation of human capital development and hence may deteriorate the health status of the economy. Apart from this simple argument, we can pursue the same by means of trade. If the degree of corruption is substantially differ between labour-rich and capital-rich nations, then corruption-ridden developing economies may face different terms of trade (Marjit, Mandal and Roy, 2014). The main reason behind such changes in relative prices or trade is that the intermediation-related corrupt activities are labour-intensive. Corruption lowers the effective supply of labour in the labour-rich or developing nations, and the reduced effective labor endowment has a bearing on the population health status.

6.3.6. Income Inequality and Health Status

We introduce the GI in equations (3) and (4) for assessing the impact of income inequality on population health status in developing countries. Table 4 reports the results of the panel regressions involving the GI. Interestingly, in spite of adverse effect of institutional measures in developing corruption-ridden economies, here the results suggest a significant positive relationship of GI with health status. Though these findings are unconventional, however, proper justifications are made in the literature (Zheng, 2012; Torre and Myrskylä, 2011; Herzer and Nunnenkamp, 2015).

6.3.7. Infrastructure and Health Status

We incorporate both $INFRAI$ and HII in baseline equations to assess the effect of overall infrastructure and also of health specific infrastructure on health status in developing countries. Table 4 illustrates the outcomes of the panel regressions involving the infrastructure indices. It shows that the coefficient of $INFRAI$ is positive and significant. However, as the nations are ranked based on the index, so we can say, the lesser the number of the rank, the better is the level of infrastructure. Hence, as the $INFRAI$ rank decreases, there is an adverse impact on the health status. Again, by using similar argument from Table 4 we can expose the positive effect of health infrastructure in terms of HII on health for the same panel.

6.4. Robustness Tests

Here we have started with the panel GMM estimation of equations (5) and (6). Table 5 reports the findings of equation (5) and (6). Results reported in columns (1) and (3) of Table 5 suggest that the sign of the coefficients are remain unchanged compared with Table (4). Moreover, we can say that an increase in per capita GDP leads to an increase in LER and a decrease in IMR, but the effects adverse as per capita GDP rises. More specifically, Square of per capita GDP is negatively associated with LER and positively associated with IMR, this is consistent with the results of Preston (1975) and Leigh and Jencks (2007). Again, columns (2) and (4) of Table 5 represent the outcomes of equations (7) and (8). Results reported in columns (2) and (4) validate the robustness of the outcomes illustrated in Table (4) even under presence of LRI in the place of CI.

To check the robustness of our results derived from baseline models (Table 4), we have also performed panel estimation of equation (9). Interestingly, here we have used MBR as a health status indicator instead of LER or IMR. Results of estimation of equation (9) are reported in Table 6. Table 6 suggests that all the coefficients of independent variables except of GI, have the expected sign and are statistically significant in both regression equations. Interestingly, unlike the baseline regression, here we find that health status is negatively associated with GI in developing economies; this is consistent with the results of Herzer and Nunnenkemp (2015).

To check the robustness of our baseline model, we consider the fourth and last trick among the four. We are discussing the continental health status one by one and try to compare the regional panel estimates with the overall panel estimates. To perform this, we have introduced the same system-GMM dynamic panel technique to our baseline equations.

Table 5. Robustness Test in the Presence of Squared $\ln PCGDP$ under Institutional Surveillance

Variable	GMM for LER with CI (1)	GMM for LER with LRI (2)	GMM for IMR with CI (3)	GMM for IMR with LRI (4)
LER lag 1	1.13* (0.01)	1.13* (0.01)		
IMR lag 1			1.08* (0.014)	1.08* (0.014)
$\ln PCGDP$	0.67** (0.32)	0.67** (0.32)	-0.47* (0.13)	-0.47* (0.13)
$\ln PCGDP^2$	-0.156** (0.07)	-0.156** (0.07)	0.038*** (0.023)	0.038*** (0.023)
UR	-0.43* (0.15)	-0.43* (0.15)	0.73** (0.32)	0.73** (0.32)
$POPGR$	0.35 (2.17)	0.35 (2.17)	0.49** (0.21)	0.49** (0.21)
$OPPCFDI$	23.33** (9.45)	23.33** (9.45)	-10.39** (4.38)	-10.39** (4.38)
DM	-1.35*** (0.71)	-1.35*** (0.71)	2.79* (0.58)	2.79* (0.58)
CI	-0.15* (0.04)		0.51* (0.11)	
LRI		-0.08** (0.04)		0.43** (0.21)
GI	0.31* (0.12)	0.31* (0.05)	-1.13** (0.53)	-2.08** (1.02)
$INFRAI$	1.23** (0.59)	0.35* (0.01)	-1.25 (3.76)	-1.01** (0.41)
HII	-0.31** (0.15)	-2.11* (0.33)	0.59* (0.02)	1.03** (0.43)
Intercept	-2.21*** (1.19)	-2.21*** (1.19)	-1.05 (0.92)	-1.05 (0.92)
R^2 within	0.70	0.67	0.73	0.75
R^2 between	0.54	0.54	0.61	0.61
Over all R^2	0.61	0.61	0.69	0.69
No. of Countries	51	51	51	51
Observations	1414	1414	1437	1437

Notes: We represent estimation results of the specification (5) in the second column and of equation (6) in the last column. We report the results system-GMM with the coefficient values marked with significance levels in the first row followed by the standard errors (in the parentheses) in the second row. Asterisks ***, ** and * indicate levels of significance at 10%, 5%, and 1%, respectively.

Table 6. Robustness Test in the Presence of MBR

Variable	GMM for MBR
MBR lag 1	1.79**
	(0.82)
ln$PCGDP$	-0.42**
	(0.19)
UR	0.61***
	(0.35)
$POPGR$	0.88*
	(0.27)
$OPPCFDI$	-4.19**
	(1.95)
DM	7.17**
	(3.15)
CI	0.34**
	(0.16)
LRI	0.78**
	(0.35)
GI	1.39*
	(0.36)
$INFRAI$	0.61*
	(0.02)
Intercept	0.38***
	(0.21)
R^2 within	0.68
R^2 between	0.61
Over all R^2	0.59
No. of Countries	51
Observations	735

Notes: We represent estimation results of the specification (7) in the second column. We report the results system-GMM with the coefficient values marked with significance levels in the first row followed by the standard errors (in the parentheses) in the second row. Asterisks ***, **, and * indicate levels of significance at 10%, 5%, and 1%, respectively.

6.4.1. Health Status in Asian Developing Economies

The data used in this section cover 20 Asian developing economies between 1980 and 2015. Here, we estimate the equations (3) and (4) by using the above-mentioned data set. Table (7) reports the results of the estimations. Second and third columns of Table (7) report the GMM estimation results of the specification (3) and (4) respectively. The results are also coming with expected sign and more or less significant in Asian developing economies. More precisely, Table (7) suggests that except the DM all the relevant independent variables are significantly associated with health status. Reason for this may be the selection of countries. We mean, most of the Asian developing economies are well distributed regarding PCGDP. Apart from this, here we can claim that POPGR is negatively associated with LER and this finding is also departed from the baseline findings. Irrespective of these, rests of the exogenous variables are endorsed same sign as we find in case of our overall panel estimation. In a more comparative manner, we can argue that health status of Asian economies is less affected by UR and INFRAI, and more sensitive to OPPCFDI and HII relative to our overall panel.

Table 7. Robustness Test (Results of Panel Regressions for Asian Countries)

Variable	GMM For LER	GMM For IMR
LER lag 1	0.94* (0.005)	
IMR lag 1		0.96* (0.008)
ln$PCGDP$	0.22* (0.06)	-0.092* (0.021)
UR	-0.15* (0.006)	0.36* (0.04)
$POPGR$	-3.04** (1.26)	-0.08 (1.09)
$OPPCFDI$	79.33* (16.97)	-19.63** (8.918)
DM	0.90 (1.15)	-0.68 (0.92)
CI	-0.08** (0.04)	0.25** (0.11)
LRI	0.46** (0.19)	-0.78* (0.06)
GI	1.25** (0.51)	-0.59*** (0.31)
$INFRAI$	1.01* (0.38)	-0.39*** (0.22)
Intercept	1.26* (0.34)	2.33*** (1.37)
R^2 within	0.65	0.63
R^2 between	0.54	0.52
Over all R^2	0.67	0.60
No. of Countries	20	20
Observations	500	507

Notes: We represent estimation results of the specification (3) for the Asian countries in the second column and of equation (4) in the last column. We report the results system-GMM with the coefficient values marked with significance levels in the first row followed by the standard errors (in the parentheses) in the second row. Asterisks ***, **, and * indicate levels of significance at 10%, 5%, and 1%, respectively.

6.4.2. Health Status in African Developing Economies

The data used in this section cover 14 African developing economies between 1980 and 2015. Again, we estimate the equations (3) and (4) by using the above-mentioned data set. Table (8) reports the results of the estimations.

Table 8. Robustness Test (Results of panel regressions for African Countries)

Variable	GMM for LER	GMM for IMR
LER lag 1	1.15*	
	(0.005)	
IMR_lag 1		0.95*
		(0.013)
ln$PCGDP$	0.22*	-1.44*
	(0.06)	(0.32)
UR	-0.05**	0.21*
	(0.021)	(0.02)
$POPGR$	-46.81*	1.01**
	(4.61)	(0.49)
$OPPCFDI$	72.81*	-65.23
	(11.08)	(52.95)
DM	-1.28	1.42***
	(0.81)	(0.79)
CI	-2.03*	1.34*
	(0.44)	(0.16)
LRI	-1.31*	0.78**
	(0.15)	(0.32)
GI	-1.35	3.01
	(3.01)	(7.41)
$INFRAI$	-2.11*	1.03**
	(0.33)	(0.43)
Intercept	-12.01**	9.18*
	(4.97)	(3.04)
R^2 within	0.59	0.76
R^2 between	0.46	0.52
Over all R^2	0.46	0.53
No. of Countries	14	14
Observations	442	442

Notes: We represent estimation results of the specification (3) for the African countries in the second column and of equation (4) in the last column. We report the results system-GMM with the coefficient values marked with significance levels in the first row followed by the standard errors (in the parentheses) in the second row. Asterisks ***, **, and * indicate levels of significance at 10%, 5%, and 1%, respectively.

Table (8) gives us more or less similar sign of the estimated coefficients except GI and HII as we get in the case of Asian economies. Precise investigation gives us the following results: one, health status is adversely and severely affected by $POPGR$, GI and CI, and the intensity of these adverse effects are quite high in African economies compared to rest of the cases; second, population health status is less sensitive to the growth related variable; third, IMR is more sensitive to UR rather than LER; fourth, we find that coefficients of trade variable are getting expected sign, however, coefficient corresponding to IMR becomes insignificant; finally and most unlikely the health status of African countries are adversely affected by HII.

6.4.3. Health Status in Latin American Countries

Here, we have considered a panel data set for 17 Latin American developing economies for the period 1980 to 2015.

Table 9. Robustness Test (Results of Panel Regressions for Latin American Countries)

Variable	GMM for LER	GMM for IMR
LER lag 1	1.23**	
	(0.61)	
IMR_lag 1		0.94*
		(0.003)
ln$PCGDP$	0.04**	-0.24**
	(0.019)	(0.12)
UR	-0.03*	0.02***
	(0.002)	(0.011)
$POPGR$	0.11	0.21
	(0.07)	(0.17)
$OPPCFDI$	33.81*	-54.53**
	(7.31)	(21.93)
DM	-1.28	0.44**
	(0.935)	(0.19)
CI	0.08**	-0.31**
	(0.05)	(0.11)
LRI	0.46**	-0.78*
	(0.19)	(0.06)
GI	0.75**	-0.59***
	(0.31)	(0.31)
$INFRAI$	2.31*	-1.39*
	(0.45)	(0.32)
Intercept	0.86***	2.64**
	(0.47)	(1.26)
R^2 within	0.59	0.66
R^2 between	0.46	0.56
Over all R^2	0.46	0.58
No. of Countries	17	17
Observations	462	488

Notes: We represent estimation results of the specification (3) for the Latin American countries in the second column and of equation (4) in the last column. We report the results system-GMM with the coefficient values marked with significance levels in the first row followed by the standard errors (in the parentheses) in the second row. Asterisks ***, **, and * indicate levels of significance at 10%, 5%, and 1%, respectively.

We describe our observations in the following manner: one, similar to the earlier findings, we get negative relationship between health status and UR; second and most striking, health status of economies of our concern are positively affected by CI and not affected significantly by $POPGR$; third, health status of South American countries are more affected by trade variables than the African economies; finally we find positive impact of HII on health and interestingly its effectiveness is highest among the three continents.

7. CONCLUSION AND POLICY IMPLICATIONS

The widely used concept is that more economically growing economies are healthier (Preston, 1975; Leigh and Jencks, 2007). Again, trade liberalization can produce some detrimental effects in the process of reshaping the health status (Herzer and Nunnenkamp, 2012). Thus, interactions of several variables are very crucial in order to determine the main determinants of health status in developing countries. These aspects motivated us to reassess the existing results as well as to categories the involvements of several new policy variables in order to tackle the health status. Present empirical study addressed these issues. In addition, we attempted to overcome several limitations of previous research by incorporating corruption, infrastructure, unemployment rate, population growth and interaction between $PCFDI$ and Openness as new determinants of population health status for the developing countries. This study generates a holistic way to understand about the drivers of population health status in developing economies across the world. The data sources are authentic and worldwide well accepted. We are not claiming that our results are the best but what we are suggesting that they are based on widely accepted econometric tools and techniques besides sound economic logic. Using an unbalanced panel data for more than 50 developing countries over the period 1980–2015, we find few important conclusions from our empirical analysis. Here, we express our findings with appropriate policy recommendations for collective countries and also for individual regions. First, we find that population health status is significantly associated with $PCGDP$ both in terms of linear or non-linear specifications, institutional variables in terms of both CI and LRI, GI, $POPGR$, UR and $OPPCFDI$. Second, we showed that health status for individual regions and also for collective countries are positively associated with per capita GDP and negatively associated with its square value. Government of these countries should emphasize more economic growth accelerated policies. More, growth provides more revenue to the government and thereby state can spend more on public health infrastructure. Again, high $PCGDP$ leads to more demand for the health care services and in both ways betterment of population health status can be achieved. Third and most important, here we found an almost unexplored part of this literature in the form of significant relationship between institution and health status in developing nations. Moreover, the intensity of institutional factors is found highest in Africa followed by Asian developing economies. Fourth, here we examined an unfolded relationship of this literature in the form of significant association between health status and UR in developing countries. Specifically, we can say that population health is sensitive to UR in overall panel. However, the sensitivity is quite high in Asian developing countries and the intensity of the same is quite low in case of Latina American developing nations, though the effects are significant. Fourth, we showed another relatively less analysed relationship, association between population health status and $POPGR$. We claimed that health status is adversely affected by $POPGR$ of any developing nation. In fact, we found that health status in African developing countries is more affected by the population explosion among the three regions. Our empirical results also suggest that consistent with the earlier theoretical predictions (Chatterjee and Gupta, 2014; Chaudhuri and Mukhopadhyay, 2014), ceteris paribus, trade has positive effect on health status among developing countries. Moreover, we found that impact of trade indicators on the way of betterment of health status is more effective in Asian and African developing nations among the three regions. Our results thus contribute to explanations on the stylized fact of OPN and FDI related measures in the developing of countries. The results remain robust to the inclusion of relevant control variables as well as using alternate geographical regions.

Our outcomes suggest adopting region-wise set of policies rather than any common policy path. Policy makers of Asian developing countries should adopt, i) employment generating programs; ii) proper measures to control institutional indicators like corruption; iii) liberalized trade policy and policy to accumulate health specific investment along with expansion of overall nation’s infrastructure. In case of African developing countries, it is obligatory for the policymakers to build, i) proper employment generating and poverty alleviation programs and policies to protect a sustainability of social resources; ii) proper family planning programs or some kind of awareness programs on population control to get better health scenario; iii) strict institutions and make a provision for better health infrastructure. Interestingly, policymakers of Latin American developing countries are to be less worried compared to the other two regions and they can enrich health status only by implementing correct policies to generate health specific investment along with liberal trade measures.

APPENDIX A

Table A1. List of Selected Developing Countries

Asia		Africa		Latin America	
India	Malaysia	South Africa	Egypt	Ecuador	Hungary
China	United Arab Emirates	Nigeria	Uganda	Papua New Guinea	Chile
Qatar	Philippines	Cote d'Ivoire	Ghana	Trinidad and Tobago	Cuba
Indonesia	Singapore	Cameroon	Sudan	Venezuela RB	Paraguay
Kazakhstan	Pakistan	Congo, Rep		Colombia	Uruguay
Kuwait	Bangladesh	Mauritius		Costa Rica	Jamaica
Uzbekistan	Korea, Rep.	Zimbabwe		Argentina	Mexico
Maldives	Saudi Arabia	Morocco		Brazil	
Myanmar	Thailand	Senegal		Fiji	
Jordan		Algeria		Guyana	

Table A2. Results of Panel Regressions for the Periods (1980-2000) and (2001-2018)

Variable	GMM for LER (1980-2000)	GMM for LER (2001-2018)	GMM for IMR (1980-2000)	GMM for IMR (2001-2018)
LER lag 1	1.25*	1.21**		
	(0.001)	(0.61)		
IMR_lag 1			0.97*	0.98*
			(0.013)	(0.008)
ln$PCGDP$	0.43*	0.04**	-1.44*	-0.092*
	(0.09)	(0.019)	(0.32)	(0.021)
UR	-0.81*	-0.03*	0.21*	0.36*
	(0.003)	(0.002)	(0.02)	(0.04)
$POPGR$	0.89*	0.65	1.01**	-0.08
	(0.27)	(0.99)	(0.49)	(1.09)
$OPPCFDI$	4.19**	27.17**	-7.15**	-11.08*
	(1.95)	(11.31)	(3.23)	(3.78)
DM	-0.25**	7.17**	3.19*	1.42***
	(0.13)	(3.15)	(0.15)	(0.79)
CI	-0.08**	-0.09**	0.26**	1.34*
	(0.04)	(-0.04)	(0.11)	(0.16)
LRI	0.46**	0.36*	-1.08*	-0.78**
	(0.19)	(4.69)	(2.93)	(0.32)
GI	0.74**	1.05**	3.01	-0.59***
	(0.31)	(0.51)	(7.41)	(0.31)
$INFRAI$	-2.11*	-2.11*	1.03**	-1.39*
	(0.35)	(0.33)	(0.43)	(0.32)
Intercept	-3.09*	-12.01**	9.18*	2.64**
	(0.32)	(4.97)	(3.04)	(1.26)
R^2 within	0.69	0.71	0.76	0.63
R^2 between	0.61	0.69	0.52	0.58
Over all R^2	0.59	0.71	0.53	0.55
No. of Countries	51	51	51	51
Observations	713	701	730	707

Notes: We represent estimation results of the specification (3) in the second and third columns, and of equation (4) in the last two columns. We report the results of system-GMM with the coefficient values marked with significance levels in the first row followed by the standard errors (in the parentheses) in the second row. Asterisks ***, **, and * indicate levels of significance at 10%, 5%, and 1%, respectively.

APPENDIX B

Construction of Infrastructure Index (INFRAI) for Developing Countries

The $INFRAI$ has been constructed by indexing 10 related indicators and they are, air transport, freight (million ton-km), air transport, passengers carried, electric power consumption (kWh per capita), energy use (kg of oil equivalent per capita), fixed telephone subscriptions (per 100 people), Internet users (per 100 people), mobile cellular subscriptions (per 100 people), rail lines (total route-km) and railways, goods transported (million ton-km) for the selected countries. The $INFRAI$ is composed for the developing countries in the following manner (Swamy and Narayanamurthy, 2018):

$$I_{jt} = \frac{Z_{jt}}{Z_{jt-1}} \times 100, \tag{A.1}$$

where, Z_{jt} is the value of the j^{th} indicator at time t for each cross-section and following (A.1) we derive the transformed value (index in percent) of the jth indicator at time t for each country I_{jt}. Therefore, the $INFRAI$ for each cross-section can be represented as

$$INFRAI_{it} = \sum_{j=0}^{10} \frac{I_{jt}}{10}. \tag{A.2}$$

Note, greater the value of $INFRAI_{it}$ implies greater level of infrastructure for i^{th} cross section.

Construction of Health Infrastructure Index (HII) for Developing Countries

The HII has been constructed by indexing 5 related indicators and they are, pregnant women receiving prenatal care (per 100 pregnant women), birth attended by skilled health staff (percentage of total), number of surgical procedures (per 1,00,000 population), specialist surgical workforce (per 1,00,000 population), investment in water and sanitation with private participation, improved sanitation facilities (% of population with access), improved water source (% of population with access) for the selected countries. The HII has been composed for the developing countries in the following manner:

$$H_{jt} = \frac{W_{jt}}{W_{jt-1}} \times 100, \tag{A.3}$$

where, W_{jt} is the value of the j^{th} health infrastructure related indicator at time t for each cross-section and following (A.3) we construct the transformed value (index in percent) of the jth indicator at time t for each country as H_{jt}. Therefore, the HII for each cross-section can be represented as

$$HII_{it} = \sum_{j=0}^{7} \frac{I_{jt}}{7}. \quad \text{(A.4)}$$

Note, expression (A.4) illustrates greater value of HII_{it} implies greater level of health infrastructure for the i^{th} cross section.

REFERENCES

Ainsworth M., and M. Over (1994), "Aids and African Development," *World Bank Research Observer*, 9(2), 203-240.

Allegret J.P. and S. Azzabi (2012), "Développement Financier, Croissance de Long Terme et Effets de Seuil," *Panoeconomicus*, 59, 553-581.

Alsan M., D.E. Bloom, and D. Canning (2006), "The Effect of Population Health on Foreign Direct Investment Inflows to Low- and Middle-Income Countries," *World Development*, 34, 613-630.

Arellano M. and S. Bond (1991), "Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations," *Review of Economic Studies*, 58(2), 277-297.

Arellano M. and O. Bover (1995), "Another Look at the Instrumental Variable Estimation of Error-Components Models," *Journal of Econometrics*, 68, 29-52.

Azémar C. and R. Desbordes (2009), "Public Governance, Health and Foreign Direct Investment in Sub Saharan Africa," *Journal of African Economies*, 18, 667-709.

Baltagi B. (2008), *Econometric Analysis of Panel Data*, Chichester, UK: John Wiley and Sons.

Barro R.J. (1996), *Health and Economic Growth*, Mimeo.

Bhargava A., D.T. Jamison, L.J., Lau and C.J.L. Murray (2001), "Modeling the Effects of Health on Economic Growth," *Journal of Health Economics*, 20, 423-440.

Blonigen B. and C. O'Fallon (2011), "Foreign Firms and Local Communities," NBER Working Paper 17282, Cambridge, MA.

Blundell R. and S. Bond (1998), "Initial Conditions and Moment Restrictions in Dynamic Panel Data Models," *Journal of Econometrics*, 87(1), 115-143.

Bryant J. (1969), *Health and the Developing World*, New York/London: Cornell University Press.

Breusch T. and A. Pagan (1980), "The Lagrange Multiplier Test and Its Application to Model Specifications in Econometrics," *Reviews of Economic Studies*, 47, 239-253.

Campos N.F. and Y. Kinoshita (2008), *Foreign Direct Investment and Structural*

Reforms: Evidence from Eastern Europe and Latin America, Washington, DC: IMF Institute.

Chatterjee T. and S. Dinda (2016), "Health Status and Convergence in developing Open Economies: Is Health Status converging in developing Economies?" in R, Das, (ed), *Global Indicators of Economic and Political Convergence*, IGI Global, USA.

Chatterjee T. and K. Gupta (2014), "Trade Liberalization, Health Care and International Fragmentation: The Role of Health Capital Mobility," *Pakistan Development Review*, 53 (1).

_____ (2015), "Quality and Finite Changes of Trade Policy: A General Equilibrium Analysis," *Foreign Trade Review*, 50 (1), SAGE.

Chaudhuri S. and S. Mukhopadhyay (2014), *Foreign Direct Investment in Developing Countries: A Theoretical Evolution*, New Delhi, Springer.

Cole M.A. and E. Neumayer (2006), "The Impact of Poor Health on Total Factor Productivity," *Journal of Development Studies*, 42(6), 918-938.

Dawson P.J. (2010), "Financial Development and Economic Growth: A Panel Approach," *Applied Economics Letters*, 17(8), 741-745.

Deaton A. (2003), "Health, Inequality, and Economic Development," *Journal of Economic Literature*, 41(1), 113-158.

Firebaugh G. (2003), *The New Geography of Global Income Inequality*, Harvard University Press, Cambridge, MA.

Gallup J. and J. Sachs (2000), "The Economic Burden of Malaria," Center for International Development Working Paper, 52, Cambridge, MA: Harvard University.

Gravelle H. (1998), "How Much of the Relation between Population Mortality and Unequal Distribution of Income Is a Statistical Artefact?" *British Medical Journal*, 316(7128), 382-385.

Grossman M. (1972), "On the Concept of Health Capital and the Demand for Health," *Journal of Political Economy*, 80(2), 223-255.

Gyimah-Brempong K. (1998), "The Political Economy of Budgeting in Africa: 1971-1991," *Public Budgeting and Fiscal Management*, 4(4), 590-616.

Herzer H. and P. Nunnenkemp (2012), "FDI and Health in Developed Economies: A Panel Cointegration Analysis," Working Chapter No. 1756, Kiel Institute for the World Economy.

_____ (2015), "Income Inequality and Health: Evidence from Developed and Developing Countries," *Economics*, 9(4), 1-56.

Hurlin C. and V. Mignon (2008), "Panel-Data Cointegration Tests: A Survey," *Economie and Prévision*, 180-181, 241-265.

Jamison D.T., L.J. Lau and J. Wang (1998), "Health's Contribution to Economic Growth, 1965-1990," in *Health, Health Policy and Health Outcomes: Final Report*, Health and Development Satellite WHO Director-General Transition Team, Geneva: World Health Organization: 61-80.

Hiebert L. D. (2002), "The Determinants of the Cost Efficiency of Electric Generating

Plants: A Stochastic Frontier Production Approach," *Southern Economic Journal*, 68(4), 935-946.

Im K.S. and M.H. Pesaran (2003), "On the Panel Unit Root Tests Using Nonlinear Instrumental Variables," *Cambridge Working Papers in Economics*, No.0347, University of Cambridge.

Leigh A. and C. Jencks (2007), "Inequality and Mortality: Long-run Evidence from a Panel of Countries," *Journal of Health Economics*, 26(1), 1-24.

Maddala G. and S. Wu (1999), "A Comparative Study of Unit Root Tests with Panel Data and A New Simple Test," *Oxford Bulletin of Economics and Statistics*, 61(S1), 631-652.

Marjit S., B. Mandal and S. Roy (2014), "Trade Openness, Corruption and Factor Abundance: Evidence from a Dynamic Panel," *Review of Development Economics*, 18(1), 45-58.

Mayer D. (2001), "The Long-Term Impact of Health on Economic Growth in Latin America," *World Development*, 29(6), 1025-1033.

Martikainen P.T. and T.V. Valkonen (1996), "Excess Mortality of Unemployed Men and Women During a Period of Rapidly Increasing Unemployment," *Lancet*, 348(9032), 909-912.

Martikainen P.T. and T.V. Valkonen (1996) "The Effect of Differential Unemployment Rate Increases of Occupation Groups on Changes in Mortality," *American Journal of Public Health*, 88(12), 1859-1861.

Mushkin S.J. (1962), "Health as an Investment," *Journal of Political Economy*, 70(5), 129-157.

O'Brien R.M. (2007), "A Caution Regarding Rules of Thumb for Variance Inflation Factors," *Quality and Quantity*, 41(5), 673-690.

Pesaran H. (1997), "The Role of Econometric Theory in Modeling the Long Run." *Economic Journal*, 107(440), 178-191.

Pesaran H. and Y. Shin (1999), "An Autoregressive Distributed Lag Modeling Approach to Cointegration Analysis," in S. Strom (Ed.), *Econometrics and Economic Theory in the 20th Century: The Ragnar Frisch Centennial Symposium,* pp. 371-413, Cambridge, UK: Cambridge University Press.

Pesaran H. and R. Smith (1995), "Estimating Long-Run Relationships from Dynamic Heterogeneous Panels," *Journal of Econometrics*, 68(1), 79-113.

Preston S.H. (1975), "The Changing Relation Between Mortality and Level of Economic Development," *Population Studies*, 29(2), 231-248.

Roodman D. (2009), "How to Do Xtabond2: An Introduction to Difference and System GMM in Stata," *Stata Journal*, 9(1), 86-136.

Sapolsky R.M. (2004), "Social Status and Health in Humans and Other Animals," *Annual Review of Anthropology*, 33, 393-418.

Solt F., (2009), "Standardizing the World Income Inequality Database," *Social Science Quarterly*, 90(2), 231-242.

Sorkin A.L. (1977), "*Health Economics in Developing Countries*," Lexington, MA:

Lexington Books.
Stevens P., J. Urbach and G. Wills (2013), "Healthy Trade: The Relationship between Open Trade and Health," *Foreign Trade Review*, 48 (1), 125-135.
Swamy V. and V. Narayanamurthy (2018), "What Drives the Capital Flows into BRICS Economies?" *World Economy*, 41, 519-549.
Timothy P.O. (2018), "Impact of Economic Globalization on Life expectancy in Nigeria," *Health Economics and Outcome Research: Open Access*, 4(2).
Torre R. and M. Myrskylä (2011), "Income Inequality and Population Health: A Panel Data Analysis on 21 Developed Countries," Working Paper 2011-006, Max Planck Institute for Demographic Research, Rostock.
Wilkinson R.G. (1996), *Unhealthy Societies: The Afflictions of Inequality*, London and New York: Routledge.
_____ (1997), "Comment: Income, Inequality, and Social Cohesion," *American Journal of Public Health*, 87(9), 1504-1506.
_____ (2000), *Mind the Gap: Hierarchies, Health, and Human Evolution*, London: Weidenfeld and Nicolson.
Wilkinson R.G. and K.E. Pickett (2006), "Income Inequality and Population Health: A Review and Explanation of the Evidence," *Social Science and Medicine*, 62(7), 1768-1784.
Windmeijer F. (2005), "A Finite Sample Correction for the Variance of Linear Efficient Two-step GMM Estimators," *Journal of Econometrics*, 126(1), 25-51.
Zheng H. (2012), "Do People Die from Income Inequality of a Decade Ago?" *Social Science and Medicine*, 75(1), 36-45.

Mailing Address: Tonmoy Chatterjee, Department of Economics, Bhairab Ganguly College, 2, Feeder Rd, Beehive Garden, Belghoria, Kolkata, West Bengal 700056, India, Email: tonmoychatterjee.economics@gmail.com

Received April 26, 2020, Revised April 23, 2022, Accepted May 19, 2022.