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# Panel Data Analysis of Institutional Quality and Population Health Outcomes

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# Panel Data Analysis of Institutional Quality and Population Health Outcomes

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## Abstract

*This study investigates the institutional quality effect on population health outcomes. Explanatory variables are government stability, corruption, law and order, democratic accountability and bureaucracy quality. Whereas for the population health proxies are infant mortality rate and life expectancy. The sample of this study consist of 105 countries. Five years' average data from 1984 to 2012 is taken from the Political Risk Services Group and World Development Indicators 2015. This study considers econometric techniques like Fixed Effects, Random Effects and GMM. Study findings indicate that population health is positively affected by the institutional quality that is increasing life expectancy and dropping infant mortality rate. Furthermore, GDP per capita, physician, and population density display a positive influence on life expectancy. The results propose that to achieve population better health outcomes, authorities must cautiously contemplate the quality of institutions.*

***Keywords:*** health outcomes, institutional quality
***JEL Classification:*** C00, C3, I10

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**Dislaimer:** This paper we have presented at the Annual Conference of the Applied Economic Research Center in Karachi (Oct, 24-26, 2017) http://www.aerc.edu.pk/international-conference-2017-presentations/#1483511310616-c16d1d34-f5e5. However this is the improved version.

## 1. Introduction

Population health is a crucial economic concern for many developing countries for the reason that health is one of the main vital contributing factor of human capital. Better health is fundamental to have a superior skills, efficient output and excellent education (Makuta & O'Hare, 2015). Institutional quality plays a significant role in defining the population health status. It is believed that lower quality of institution leads to poor health in terms of higher infant mortality and lesser life expectancy.

Institutional quality has a substantial influence on health. As it is obvious that health has a main role in the whole welfare of a nation, therefore it is crucial to have a better quality of institutions. Majority of previous studies on health focus on public spending, governance quality, corruption in health organization and democracy (Acemoglu, Johnson, Robinson, & Yared, 2005; Besley & Kudamatsu, 2006; Filmer & Pritchett, 1999; Govindaraj & Rannan-Eliya, 1994). It is noticed that there are rare studies which emphasis on health effects of institutional quality (Dhrifi1, 2018; Knowles & Owen, 2010). Considering the literature, this study aims to look at the institutional quality impact on health. It is hypothesized that population health is positively influenced by the good quality of institutions.

To achieve the objective of study, panel data from 105 countries are analyzed. Population health outcomes are measured by two variables, i.e. infant mortality rate and life expectancy. Quality of institution is measured by "corruption, law and order, bureaucratic quality, government effectiveness and democracy". The end goal of this study is to provide useful insight to both economists and healthcare officials.

The rest of the study is planned as follows. Following the introduction, section two presents the literature review. The data and methodology of the study are discussed in section three. Results and discussions are the main thrust of section four. Finally, section five provides policy implications and conclusion.

## 2. Literature Review

The literature regarding the institutional quality impact on health is inadequate. However, some studies have investigated the effect of governance quality on health outcome. For instance, (Acemoglu, Johnson, Robinson, & Yared, 2005; Besley & Kudamatsu, 2006; Govindaraj, & Rannan-Eliya, 1994) indicate that people enjoy good results show that health expenditures have a negative effect on infant mortality with the inclusion of governance indicators. It means lower corruption leads to a reduction in infant mortality and raise in life expectancy. The findings suggest that without lowering the level of corruption, it is impossible to achieve Millennium Development Goals of lowering infant mortality and raising life expectancy[4].

Recently, Makuta and O'Hare (2015) examine the relationship between public spending on health and quality of governance. In the same way, sub-Saharan African 43 countries have been estimated over the period 1996-2011 by two-stage least squares regression. They find that good governance improves the positive impact of public spending on health and such impact is larger in those countries where the quality of governance is higher. It represents that an increase in public spending reduces infant mortality and increases life expectancy sharply as compared to other countries having poor quality of governance.

Moreover, Nadpara and Samanta (2015) scrutinize the corruption impact on population health. Estimations are grounded on 30 countries over the period 1996-2011. Health status is measured by two reliable measurements; "life expectancy (at birth) and infant mortality (per 1000 live births)". Two categories of corruption are considered; "corruption without theft" which decreases the quantity of medical services[5]. "Corruption with theft" which decreases the quality and efficiency of medical service[6]. The

[4]"The United Nations Millennium Development Goals are eight goals that all 191 UN member states have agreed to try to achieve by the year 2015. The United Nations Millennium Declaration, signed in September 2000 commits world leaders to combat poverty, hunger, disease, illiteracy, environmental degradation, and discrimination against women.

[5] In this method, medical provider charges the bribe with official price for medical service. The provider transfer price to official account of treasury and keep bribes with himself. In fact, inclusion of bribe increases the cost of medical services and higher prices are not affordable by poor".

[6] "In this case provider charges, only official price for the services and does not transfer price to official account of treasury rather keeps all the money with him. Under this method of corruption, cost of medical service remains low and less price is affordable for the customers".

results indicate that health is badly affected by corruption in poor developing countries than in developed countries. However, good governance focusing on the implementation of law and order improves health outcomes[7].

Similarly, another study by Adindu (2010) states that hospital managers are found to be involved in corruption. They miss-utilize[8] hospital equipment and infrastructure for private purpose. The study highlights that all the members of staff at the hospital, including doctors and nurses, are corrupt. Doctors divert the patient from government hospitals to private hospitals to maximize their return. Overall poor management of organizations and departments are responsible for the corruption in the health sector. The above discussion reveals that previous studies have considered the impact of governance quality and public health expenditures on health.

## 3. Methodology and Data

To meet the objective of this study, we are considering institutional quality instead of governance quality. To measure institutional quality, this study prefers political risk index of International Country Risk Guide (ICRG) over Gastil index and civil liberties indexes. ICRG is first used by (Hall & Jones, 1999; Knack & Keefer, 1995) arguing that these indicators of institutional quality determine property right and contractual right better than Gastil index and civil liberties indexes. Moreover, Gastil index and civil liberties indexes have multiple dimensions which do not truly represent institutional quality. The ICRG index is consist of 12 variables and ranges from 0 to 100. Higher values show the high quality of institutions. Using ICRG index, this study considers "corruption, law and order, bureaucratic quality, government effectiveness and democracy" to measure institutional quality. These indicators have been frequently utilized in the literature as a proxy of institutional quality (Chong & Gradstein, 2007; Knack & Keefer, 1995; Hall & Jones, 1999; Perera

[7]"They applied two structural equations with life expectancy being the dependent variable in the first equation and infant mortality rate being the dependent variable for the second equation".

[8] "Corruption in health care cuts across the board involving almost everyone in the organization, however, the most corrupt in my opinion are the hospital managers who collect allocation for hospital equipment and other infrastructure but will not make them available but rather divert them for personal purpose".

& Lee, 2013; Majeed & Gillani, 2017) is measured by infant mortality rate and life expectancy. These two variables are the most appropriate and accurate variables for measuring health outcomes (Beckfield, 2004; Babones, 2008; Ram, 2006; Nadpara & Samanta, 2015; Majeed & Khan, 2019; Majeed & Liaqat, 2019). First, we check the impact of the independent variable (that is institutional quality) on life expectancy. Then we regress infant mortality on the independent variable. A country with healthier health will have a low infant mortality rate and higher life expectancy. It is expected that if an independent variable is positively associated with life expectancy, the same variable would be negatively associated with an infant mortality rate (Nadpara & Samanta, 2015).

For a detailed analysis, the study has used some control variables, for instance, primary care physicians, agriculture value-added, GDP per capita and public expenditure. It means that people with enough physicians will have improved health condition than few primary care physicians, for calculation we are taking physician per 1000 inhabitant. We have used agriculture value-added as well. Because, well-known agriculture performant is compulsory for the attainment of Health Millennium Development Goals. Public expenditures are also considered because they have a significant impact on health status. These variables have also been utilized by various previous studies (Asafu-Adjaye, 2008; Chong & Calderon, 2000; Drabo, 2010; Majeed & Ajaz, 2018; Nadpara & Samanta, 2015). The details of all dependent, independent and control variables are given in Table 1. The changes in institutional variables from year to year are very small (Chong & Calderon, 2000; Perera & Lee, 2013). So it is appropriate to use the Random Effects Model instead of the Fixed Effects Model (FEM). To see the robustness of results, this study estimates other econometric technique Generalized Method of Movements (GMM) using the following equations.

$$Health_{it} = \alpha_{0+}\alpha_1 lagdpc + \alpha_2 inst_{it} + \alpha_3 x_{it+}\varepsilon_{it} \qquad (\mathbf{1})$$

Where *inst* represents institutional quality. Now we write the equation of health status considering all these variables.

$$Health_{it} = \alpha_{0+}\alpha_1 lagdpc + \alpha_2 gs_{it} + \alpha_3 x_{it} + \varepsilon_{it} \qquad (\mathbf{2})$$

$$Health_{it} = \alpha_{0+}\alpha_1 lagdpc + \alpha_2 cor_{it} + \alpha_3 x_{it} + \varepsilon_{it} \quad (\mathbf{3})$$
$$Health_{it} = \alpha_{0+}\alpha_1 lagdpc + \alpha_2 dem_{it} + \alpha_3 x_{it} + \varepsilon_{it} \quad (\mathbf{4})$$
$$Health_{it} = \alpha_{0+}\alpha_1 lagdpc + \alpha_2 law_{it} + \alpha_3 x_{it} + \varepsilon_{it} \quad (\mathbf{5})$$
$$Health_{it} = \alpha_{0+}\alpha_1 lagdpc + \alpha_2 bq_{it} + \alpha_3 x_{it} + \varepsilon_{it} \quad (\mathbf{6})$$

Following previous studies (Rodgers, 1979; Babones, 2008; Beckfield, 2004; Flegg, 1982; Pampel & Pillai, 1986), health is measured by life expectancy and infant mortality rate.

$$le_{it} = \alpha_{0+}\alpha_1 lagdpc + \alpha_2 inst_{it} + \alpha_3 x_{it} + \varepsilon_{it} \quad (\mathbf{7})$$

$$mor_{it} = \beta_{0+}\beta_1 lagdpc + \beta_2 inst_{it} + \beta_3 x_{it} + \varepsilon_{it} \quad (\mathbf{8})$$

Description of symbols are given in Table 1. The sample composed of 105 countries among them, 28 are developed, and 77 are developing countries. Five years' average data is used from 1984 to 2012. It is because that changes from year to year are very small for institutional variables (Chong & Calderon, 2000; Perera & Lee, 2013). The time frame of our sample is based on data availability of "International Country Risk Guide (ICRG)". Name of Countries are given in Appendix Table A9. The data are collected from two sources. Data for health variables and control variables are taken from World Development Indicator (WDI 2015) database. Political risk index of "International Country Risk Guide (ICRG)" as a measure of institutional quality is taken from the Political Risk Services (PRS) Group.

## Table 1. Variable Description

**1. Dependent Variables: Health Outcomes**

| Variable | Symbol | Description of Variable | Expected sign |
|---|---|---|---|
| Life Expectancy at Birth | le | The years that newborn baby will live. It summarizes the mortality over life course | Negative |
| Infant Mortality Rate | mor | The possibility of new born baby in a year dying before getting the age of one. | Positive |

**2. Independent Variables: Institutional Quality**

| Variable | Symbol | Description of Variable | Measurement Scale | Description of Measurement Scale |
|---|---|---|---|---|
| Government Stability | gs | Government capability is to do its affirmed programs and to stay in office. | 0 to 12 | 0 = unstable and weak government 12= indicates stable and strong government. |
| Corruption | cor | Valuation of corruption inside the political system | 0 to 6 | Lower value of corruption indicates high corruption in that country and vice versa. |
| Law and Order | law | The law measure "strength and impartiality of the legal system" and the Order is estimated using the "popular observance of the law". | 0 to 6 | 6 score shows fair lawful system and more public truthfulness to rules. |
| Democratic Accountability | dem | It measures how government is quick to respond to its people. | 0 to 6 | High score means, government is highly reactive and exposed to the people means strong democracy |
| Bureaucratic Quality | bq | measurement of tendency that minimizes the revisions of policy when governments altere. | 0 to 4 | More points are assigned to countries where the bureaucracy has the strong point and knowledge to govern without severe changes in policy or in government services |

| | |
|---|---|
| **Institutional Quality** | |
| Political risk index of "International Country Risk Guide (ICRG) "is used as institutional quality". The ICRG index is consist of 12 variables and ranges from 0 to 100. Higher values show high quality of institutions. In our study, we have taken five variables, i.e. "corruption, law and order, bureaucratic quality, government effectiveness and democracy". | |
| **Control Variables** | |
| GDP per capita | "Lag of GDP per capita is taken as a measure previous income of individual, as health of an individual depends upon his/her previous income |
| Public expenditure | Public expenditure on health, it is expected that expenditure on health have a positive impact on population's health |
| Agriculture value-added | Agriculture contributes to reduced child mortality indirectly by increasing diversity of food production and making more resources available to manage childhood illnesses. |
| Primary care physicians | Primary care is characterized by the supply of physicians and medical specialist. For that we are using physician per 1000 inhabitant". |

## 4. Results and Discussions

Statistical results in Table A1 (see Appendix) show that the average score of our sample is 4.05. The country having the highest ICRG index (6.6) is Luxembourg. While, the country Serbia and Montenegro are with the lowest index (0.636). Cross country analysis helps to understand that the developed countries have a high ICRG index (6.6) whereas developing countries have the highest institutional quality indexes (5.92).

In our sample, infant mortality rate and average life expectancy for all countries are 67 years and 38 per 1,000 life expectancy. Between the developed countries, highest life expectancy (83) has been found in Hong Kong, and Iceland has the lowest infant mortality (1.6). In contrast, among developing countries, the highest life expectancy is 79.7 in Costa Rica and lowest infant mortality is 4 in Bolivia.

The estimated results of Fixed Effects Regression are given in Table A2. The first column shows the institutional quality has a significant positive influence on life expectancy. That is one unit rise in institutional quality increase life expectancy by 1.17 years. All other variables of institutional quality except corruption are positively correlated with life expectancy. It means less corruption leads to high life expectancy. Column (4) shows that with one unit increase in democracy rises life expectancy by 0.7 years. The positive impact of democracy on health is consistent with the findings of studies (Govindaraj & Rannan-Eliya, 1994; Acemoglu, Johnson, Robinson, & Yared, 2005; Besley & Kudamatsu, 2006).

Democracy is positively associated with the services such as supply of clean water, health care facilities and better nutrition. On average, institutional quality is positively related to the life expectancy (Lewis, 2006; Makuta & O'Hare, 2015; Rajkumar & Swaroop, 2008; Lin, Chien, Chen, & Chan, 2014). The opposite results are found for infant mortality. Table A3 shows that institutional quality and infant mortality are negatively associated with each other. Column (1) helps to interpret that one unit increase in institutional quality decreases infant mortality by 8.4 per 1,000 live births. All control variables such as a number of physician and population density are positively related to the life expectancy. The coefficient on GDP per capita in Table A2 column (1) is interpreted as 1$ increase in previous income increases the life expectancy in the current year by 0.0001 year. These findings are similar to the (Asafu-Adjaye, 2008; Drabo, 2010). Countries with higher GDP per capita have more resources and monetary fund to spend on health care and medical services (Nadpara & Samanta, 2015). Contrary, all these control variables are negatively related to infant mortality rate.

Considering the limitation of Fixed Effects model that is time-invariant and intercept is same for all the countries, the study also utilizes Random Effects Model which intercept contains time-invariant country specific characteristics. The random component is a deviation from the mean value of intercept. This is also called the Error Component Model (ECM). The second limitation of Fixed Effects Model is the loss of a degree of freedom. Random Effects Model also deals with this problem. Table A4 shows that institutional quality coefficient is significant in all six models, and it has a positive relationship with life expectancy. In addition, control variables that include the lag of GDP per capita, physicians and population density are significant and positively related to life expectancy. Countries with better health measures and initial endowment have better health status (Drabo, 2010). The effect of institutional quality on life expectancy is given in column (1) Table A4. The coefficient of institutional quality is significant and positively related to life expectancy. That is one unit increase in institutional quality increases life expectancy by 1.2 years at 1% level of significance. All other institutional variables except corruption are positively related to life expectancy. It is estimated

that one unit rise in democracy increases life expectancy by 0.8 years. Moreover, column 5 Table A5 shows that one unit increase in democracy decreases infant mortality by 5.7 per 1,000 live births. It is interpreted that the democratic government is more responsive to the people's needs and wants to build trust among the population for the next election process. Majority of the population are in favor of health care programs, considering their preference, the government make reforms in the health care sector. These reforms lead to better health outcomes that is low infant mortality and high life expectancy (Nadpara & Samanta, 2015). The coefficient of corruption is negative and significant (see Table A4 column 3). It indicates that one unit increase in corruption decreases life expectancy by 0.5 years. Corruption high value indicates less corruption in that country. It means that less corrupted country has a high life expectancy. Same is found for infant mortality that is shown in Table A5 column 3. One unit increase in corruption increases infant mortality by 3.4 per 1,000 live births. Corruption's adverse effect on health status is consistent with various previous studies (Adindu, 2010; Nadpara & Samanta, 2015). Corruption occurs due to weak governance, poor accountability system and law & order. In health organization corruption set the ground for the lack of basic infrastructures and necessary medicines that consequence in dropping the quantity and quality of health care services (Adindu, 2010; Nadpara & Samanta, 2015).

The law and order coefficient indicates that 1 unit increase in law and order causes an increase in life expectancy by 0.42 years. This means a country with high law and order have low corruption and better health status (Nadpara & Samanta, 2015). Coefficient of government stability determines that one point increase in government stability increases life expectancy by 0.27 years. Indeed, more stable and legislative government leads to better health outcomes. Consequently, policies regarding health care increase health outcomes (Nadpara & Samanta, 2015). The coefficient of bureaucracy shows that one unit increase in bureaucracy increases life expectancy by 2.4 years.

In this study, the use of panel data can generate the problem of autocorrelation and heteroscedasticity. Secondly, there is a possibility of reverse causality between health and institutions. That

inverse causality is also known as endogeneity. In order to tackle endogeneity and heteroscedasticity, we have estimated our model by Generalized Method of Moment (GMM). The results are shown in Table A6. The coefficient of institutional quality is significant and positively related to life expectancy. The empirical result implies that with one unit increase in institutional quality, the life expectancy increases by 1.73 years. All other variables of institutional quality are found with a positive sign and significant. The coefficient of corruption shows that one unit rise in corruption causes 0.1 years rise in life expectancy. Similarly, the coefficient of bureaucracy quality and law and order show a significant positive impact on life expectancy. This means a country with high law and order have low corruption and better health status (Nadpara & Samanta, 2015). The coefficient of bureaucracy shows that one unit increase in bureaucracy increases life expectancy by 0.4 years.

Additionally, the coefficient of government stability defines that life expectancy rise by 0.06 years as one point government stability increase. Similarly, the law and order coefficient indicates that 1 unit rise in law and order causes the life expectancy increased by 0.44 years. Democracy has a significant positive impact on life expectancy (shown in Table A6 column 4). It is concluded that institutional quality has a significant positive effect on a population health outcome that is raising life expectancy and dropping infant mortality rate. The control variables like physicians, GDP per capita and population density show positive effect on life expectancy. As 1$ increase in previous GDP per capita the life expectancy increases by 7.5 years. In the same way, the coefficient of physician states that one unit increase in a number of physicians, the life expectancy increases by 4.1 years. The supply of physicians characterizes primary care. Population with more primary care physicians will have well health status than population having lesser primary care.

## 5. Conclusion and Policy Recommendation

Institutional quality plays a critical role in determining the health status of a society. The findings reveal that institutional quality is an essential element of health status. The estimated results show that institutional variables like "democracy, government stability, bureaucratic quality and law & order" have a significant positive

impact on health status. Besides this, it is found that in health organization corruption origins the shortage of basic infrastructures and medicines which as a result pull down the health care services quality and quantity. Overall, the impact of institutional quality on population health is positive. If a country attains great institutional quality, the health status of its populations will be enhanced. Without having good institutional quality, it is impossible to achieve the Millennium Development Goals (MDGs). The findings suggest that officials must give additional consideration to institutional quality to obtain improved health outcomes. The provision of sanitation, clean water and vaccination should be ensured to improve health status. Further research can explore the time series element of institutional data to scrutinize the relationship between institutional quality and population health outcomes.

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## Appendix A

**Table A1: Summary Statistics of Full Sample**

| Variables | Observation | Mean | Standard Deviation | Min | Max |
|---|---|---|---|---|---|
| **Full Sample** | | | | | |
| **2. ICRG index** | | | | | |
| Government Stability | 2850 | 7.621 | 2.077 | 1 | 12 |
| Corruption | 2834 | 3.057 | 1.315 | 0 | 6 |
| Law and Order | 2834 | 3.625 | 1.449 | 0 | 6 |
| Democratic Accountability | 2834 | 3.938 | 1.529 | 0 | 6 |
| Bureaucratic Quality | 2834 | 2.136 | 1.142 | 0 | 4 |
| Average of Institutions | 2856 | 4.054 | 1.100 | 0.636 | 6.6 |
| **3. Health Variables** | | | | | |
| Life Expectancy | 3031 | 67.218 | 10.168 | 35.792 | 83.480 |
| Infant Mortality | 3013 | 38.982 | 36.344 | 1.6 | 170.9 |
| **4. Control Variables** | | | | | |
| GDP per capita | | | | | |
| Agriculture Value added | 2867 | 9104.21 | 14300.69 | 113.706 | 86129 |
| Physician | 2591 | 15.650 | 13.4610 | 0 | 65.972 |
| Population growth | | | | | |
| Population density | 1508 | 1.982 | 1.348 | 0.004 | 6.167 |
| Public health expenditure | 3034 | 1.443 | 1.269 | -5.814 | 11.180 |
| | 3007 | 219.898 | 821.399 | 1.204 | 7589.10 |
| | 1853 | 3.641 | 1.991 | .009 | 10.094 |

## Table A2: FEM Regression of Life Expectancy and Institutions

| Variables | Life Exp | Life Exp | Life Exp | Life Exp | Life Exp | Life Exp |
|---|---|---|---|---|---|---|
| L.GDP per capita | 0.000*** | 0.000** | 0.000*** | 0.000*** | 0.000*** | 0.000*** |
| | (4.92e-05) | (4.94e-05) | (4.91e-05) | (4.85e-05) | (4.93e-05) | (5.00e-05) |
| Institutions | 1.171*** | | | | | |
| | (0.261) | | | | | |
| Physician | 2.000*** | 1.938*** | 1.803*** | 2.118*** | 2.087*** | 2.239*** |
| | (0.486) | (0.492) | (0.493) | (0.479) | (0.489) | (0.494) |
| Pop. Density | 0.002 | 0.002 | 0.003** | 0.003** | 0.002* | 0.002* |
| | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) |
| Govt Stability | | 0.331*** | | | | |
| | | (0.080) | | | | |
| Corruption | | | -0.938*** | | | |
| | | | (0.205) | | | |
| Democracy | | | | 0.739*** | | |
| | | | | (0.150) | | |
| Bureaucracy | | | | | 1.021*** | |
| | | | | | (0.278) | |
| Law & Order | | | | | | 0.368* |
| | | | | | | (0.192) |
| Constant | 57.92*** | 60.34*** | 66.29*** | 59.80*** | 60.58*** | 61.16*** |
| | (1.208) | (0.841) | (1.073) | (0.854) | (0.844) | (0.956) |
| Observations | 442 | 442 | 442 | 442 | 442 | 442 |
| R-squared | 0.243 | 0.237 | 0.245 | 0.252 | 0.229 | 0.206 |
| Number of code | 103 | 103 | 103 | 103 | 103 | 103 |

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

## Table A3: FEM regression of Infant Mortality and Institutional Quality

| Variables | Inf Mortality | Inf Mortality | Inf Mortality | Inf Mortality | Inf Mortality | Inf Mortality |
|---|---|---|---|---|---|---|
| L.GDP per capita | 6.20e-05 | 4.40e-05 | 0.000** | 0.000 | 0.000 | 0.000 |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| Institutions | -8.419*** | | | | | |
| | (1.330) | | | | | |
| Physician | -8.477*** | -7.441*** | -6.624*** | -9.331*** | -10.18*** | -10.24*** |
| | (2.469) | (2.451) | (2.462) | (2.417) | (2.591) | (2.570) |
| Pop. Density | -0.006 | -0.005 | -0.014** | -0.012** | -0.001 | -0.010* |
| | (0.006) | (0.006) | (0.006) | (0.006) | (0.0061) | (0.006) |
| Govt Stability | | -2.872*** | | | | |
| | | (0.401) | | | | |
| Corruption | | | 7.553*** | | | |
| | | | (1.022) | | | |
| Democracy | | | | -5.365*** | | |
| | | | | (0.757) | | |
| Bureaucracy | | | | | -2.922** | |
| | | | | | (1.477) | |
| Law & Order | | | | | | -2.539** |
| | | | | | | (1.001) |
| Constant | 84.23*** | 69.97*** | 20.55*** | 70.76*** | 56.92*** | 60.39*** |
| | (6.167) | (4.199) | (5.340) | (4.290) | (4.465) | (4.963) |
| Observations | 440 | 440 | 440 | 440 | 440 | 440 |
| R-squared | 0.166 | 0.191 | 0.197 | 0.188 | 0.077 | 0.084 |

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

## Table A4. REM regression of Life Expectancy and Institutions

| Variables | Life Exp | Life Exp | Life Exp | Life Exp | Life Exp | Life Exp |
|---|---|---|---|---|---|---|
| L.GDP per capita | 0.000*** | 0.000*** | 0.000*** | 0.000*** | 0.000*** | 0.000*** |
| | (3.66e-05) | (3.72e-05) | (3.73e-05) | (3.65e-05) | (3.65e-05) | (3.74e-05) |
| Institutions | 1.220*** | | | | | |
| | (0.250) | | | | | |
| Physician | 2.914*** | 2.990*** | 3.024*** | 3.024*** | 2.984*** | 3.088*** |
| | (0.372) | (0.377) | (0.380) | (0.367) | (0.367) | (0.378) |
| Pop. Density | 0.002*** | 0.002*** | 0.002*** | 0.002*** | 0.002*** | 0.002** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |

| | | | | | | |
|---|---|---|---|---|---|---|
| Govt Stability | | 0.279*** | | | | |
| | | (0.079) | | | | |
| Corruption | | | -0.507*** | | | |
| | | | (0.189) | | | |
| Bureaucracy | | | | 1.245*** | | |
| | | | | (0.265) | | |
| Democracy | | | | | 0.804*** | |
| | | | | | (0.148) | |
| Law & Order | | | | | | 0.422** |
| | | | | | | (0.184) |
| Constant | 56.46*** | 59.07*** | 62.71*** | 58.82*** | 58.18*** | 59.64*** |
| | (1.233) | (0.985) | (1.043) | (0.899) | (0.951) | (1.014) |
| Observations | 442 | 442 | 442 | 442 | 442 | 442 |
| Number of code | 103 | 103 | 103 | 103 | 103 | 103 |

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

## Table A5: REM regression of Infant Mortality and Institutions

| Variables | Inf Mortality | Inf Mortality | Inf Mortality | Inf Mortality | Inf Mortality | Inf Mortality |
|---|---|---|---|---|---|---|
| L.GDP per capita | 6.01e-05 | -0.000 | -0.000 | 2.69e-05 | 7.15e-05 | -4.51e-05 |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| Institutions | -9.200*** | | | | | |
| | (1.219) | | | | | |
| Physician | -12.43*** | -12.78*** | -13.43*** | -13.50*** | -12.65*** | -13.36*** |
| | (1.444) | (1.496) | (1.530) | (1.444) | (1.435) | (1.504) |
| Pop. Density | -0.005 | -0.00435 | -0.006** | -0.005* | -0.008*** | -0.006* |
| | (0.003) | (0.003) | (0.003) | (0.003) | (0.003) | (0.003) |
| Govt Stability | | -2.597*** | | | | |
| | | (0.395) | | | | |
| Corruption | | | 3.405*** | | | |
| | | | (0.920) | | | |
| Bureaucracy | | | | -5.481*** | | |
| | | | | (1.310) | | |
| Democracy | | | | | -5.737*** | |
| | | | | | (0.721) | |
| Law & Order | | | | | | -3.303*** |
| | | | | | | (0.913) |
| Constant | 93.57*** | 78.21*** | 49.50*** | 69.18*** | 79.59*** | 70.11*** |
| | (5.248) | (4.065) | (4.050) | (3.453) | (3.713) | (4.017) |
| Observations | 440 | 440 | 440 | 440 | 440 | 440 |
| Number of code | 102 | 102 | 102 | 102 | 102 | 102 |

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

## Table A6: GMM regression of Life Expectancy and Institutional Quality

| Variables | Life Exp | Life Exp | Life Exp | Life Exp | Life Exp | Life Exp |
|---|---|---|---|---|---|---|
| Institutions | 1.739*** | | | | | |
| | (0.588) | | | | | |
| L.GDP per capita | 7.58e-05*** | 0.000*** | 0.000*** | 7.44e-05*** | 3.60e-05 | 0.000*** |
| | (2.83e-05) | (2.03e-05) | (3.00e-05) | (2.11e-05) | (2.48e-05) | (2.57e-05) |
| Physician | 4.179*** | 4.361*** | 4.404*** | 3.924*** | 4.082*** | 4.295*** |
| | (0.306) | (0.300) | (0.304) | (0.292) | (0.279) | (0.322) |
| Pop. Density | 0.002*** | 0.002*** | 0.002*** | 0.002*** | 0.002*** | 0.002*** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| Govt. Stability | | 0.067 | | | | |
| | | (0.260) | | | | |
| Corruption | | | 0.104 | | | |
| | | | (0.406) | | | |
| Democracy | | | | 1.723*** | | |
| | | | | (0.406) | | |
| Bureaucracy | | | | | 2.441*** | |
| | | | | | (0.482) | |
| Law & Order | | | | | | 0.447 |
| | | | | | | (0.376) |
| Constant | 53.32*** | 58.98*** | 59.17*** | 53.79*** | 55.69*** | 58.16*** |
| | (2.223) | (2.094) | (1.124) | (1.548) | (0.955) | (1.222) |
| Observations | 432 | 432 | 432 | 432 | 432 | 432 |
| R-squared | 0.593 | 0.577 | 0.578 | 0.598 | 0.620 | 0.580 |
| Hansen J. Test | 0.10 | 0.47 | 0.41 | 0.36 | 0.26 | 0.39 |

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

## Table A7: System GMM Regression for Life Expectancy and Institutions (Developed Countries)

| Variables | Life Exp | Life Exp | Life Exp | Life Exp | Life Exp | Life Exp |
|---|---|---|---|---|---|---|
| Institutions | -0.354 | | | | | |
| | (0.432) | | | | | |
| L.GDP per capita | 0.0001*** | 0.000*** | 0.000*** | 8.59e-05*** | 9.90e-05*** | 0.000*** |
| | (1.91e-05) | (1.30e-05) | (1.67e-05) | (1.37e-05) | (1.87e-05) | (2.01e-05) |
| Physician | 1.001*** | 1.152*** | 0.650** | 1.179*** | 1.232*** | 0.851*** |
| | (0.278) | (0.250) | (0.311) | (0.256) | (0.266) | (0.304) |
| Pop. Density | 0.000*** | 0.000*** | 0.000*** | 0.001*** | 0.000*** | 0.000*** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| Govt. Stability | | -0.039 | | | | |
| | | (0.145) | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Corruption | | | -0.560** | | | |
| | | | (0.243) | | | |
| Democracy | | | | 1.391** | | |
| | | | | (0.642) | | |
| Bureaucracy | | | | | 0.372 | |
| | | | | | (0.558) | |
| Law & Order | | | | | | -0.644 |
| | | | | | | (0.406) |
| Constant | 73.15*** | 71.40*** | 74.58*** | 63.61*** | 69.69*** | 74.89*** |
| | (2.521) | (1.248) | (1.759) | (3.583) | (2.060) | (2.463) |
| Observations | 113 | 113 | 113 | 113 | 113 | 113 |
| R-squared | 0.430 | 0.425 | 0.433 | 0.395 | 0.423 | 0.431 |

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

## Table A8: System GMM Regression for Life Expectancy and Institutions (Developing Countries)

| Variables | Life Exp | Life Exp | Life Exp | Life Exp | Life Exp | Life Exp |
|---|---|---|---|---|---|---|
| Institutions | 1.162 | | | | | |
| | (0.758) | | | | | |
| L.GDP per capita | 0.001*** | 0.001*** | 0.001*** | 0.001*** | 0.001*** | 0.0014*** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| Physician | 3.811*** | 3.808*** | 3.844*** | 3.859*** | 3.943*** | 3.796*** |
| | (0.415) | (0.423) | (0.420) | (0.392) | (0.398) | (0.423) |
| Pop. Density | 0.0143*** | 0.014*** | 0.014*** | 0.014*** | 0.0132*** | 0.0145*** |
| | (0.003) | (0.003) | (0.003) | (0.002) | (0.002) | (0.003) |
| Govt. Stability | | 0.133 | | | | |
| | | (0.283) | | | | |
| Corruption | | | -0.018 | | | |
| | | | (0.632) | | | |
| Democracy | | | | 0.933** | | |
| | | | | (0.475) | | |
| Bureaucracy | | | | | 1.625*** | |
| | | | | | (0.603) | |
| Law & Order | | | | | | 0.254 |
| | | | | | | (0.429) |
| Constant | 52.02*** | 55.07*** | 56.08*** | 53.21*** | 53.87*** | 55.29*** |
| | (2.780) | (2.336) | (1.634) | (1.636) | (1.076) | (1.444) |
| Observations | 319 | 319 | 319 | 319 | 319 | 319 |
| R-squared | 0.471 | 0.460 | 0.461 | 0.468 | 0.488 | 0.464 |

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

## Table A9: A List of Countries

| | | | |
|---|---|---|---|
| Algeria | France | Mali | Slovakia |
| Angola | Gambia | Malta | Slovenia |
| Argentina | Guatemala | Mexico | Sari Lanka |
| Bangladesh | Guinea | Moldova | Sweden |
| Belarus | Guinea-Bissau | Mongolia | South Africa |
| Belgium | Guyana | Morocco | Spain Switzerland |
| Bolivia | Honduras | Mozambique | Tanzania |
| Botswana | Hong Kong | Namibia | Thailand |
| Brazil | Hungary | Netherlands | Togo |
| Bulgaria | Iceland | New Zealand | Trinidad & Tobago |
| Burkina Faso | India | Nicaragua | Tunisia |
| Cameroon | Indonesia | Niger | Turkey |
| Chile | Iran | Nigeria | Uganda |
| China | Iraq | Norway | Ukraine |
| Colombia | Ireland | Pakistan | Uruguay |
| Congo | Israel | Panama | Venezuela |
| Costa Rica | Italy | Paraguay | Vietnam |
| Denmark | Jamaica | Peru | Yemen |
| Dominican | Japan | Philippines | Zambia |
| Republic | Jordan | Poland | |
| Ecuador | Kazakhstan | Portugal | |
| Egypt | Kenya | Romania | |
| El Salvador | Kore, DPR | Russia | |
| Estonia | Latvia | Senegal | |
| Ethiopia | Luxembourg | Serbia & Montenegro | |
| Finland | Malawi | Sierra Leon | |
| Ghana | Malaysia | Singapore | |
| Greece | | | |

# Appendix B

## Table B1: Multicollinearity test for Health and Institutions

| Dependent Variable Health Variables (life expectancy) | | |
|---|---|---|
| Independent Variables | VIF | 1/VIF |
| GDP per capita | 1.83 | 0.546 |
| Institutional quality index | 1.86 | 0.538 |
| Mean VIF | 1.61 | |

## Table B2: Heteroscedasticity Test for Health and Institutions

| White's general test | | Breusch-pagan's test for Heteroscedasticity | |
|---|---|---|---|
| p-value | 0.00 | p-value | 0.00 |

## Table B3: Jarque Bera Test of Normality for Health and Institutions

| | | | |
|---|---|---|---|
| Jarque bera | 2.553 | Chi (2)P value | 0.279 |
| **Shapiro Wilk Test of Normality for Health and Institutions** | | | |
| Z value | 2.146 | P Svalue | 0.015 |

## Table B4: Model Specification Test

**Link Test for Health and Institutions**

| Dependent variable lifexpec | Coefficient | Standard deviation | t- stats | Prob value > \|t\| |
|---|---|---|---|---|
| Hat | 1.975 | 0.484 | 4.08 | 0.000 |
| Hat-Square | -.007 | 0.484 | -2.02 | 0.045 |
| Constant | -31.809 | 15.929 | -2.00 | 0.047 |

**Ramsey RESET test for equation**

$H_0$= Model has no omitted variables
F-stats= 11.81
Prob. value > F-stats= 0.000

# Appendix C

## Table C1: Hausman Test

**Hausman Test for Health and Institutions**

| Test Statistics | Value | p-value |
|---|---|---|
| Chi-square | 22.06 | 0.001 |

## Table C2: Breusch Pagan Multiplier Test

**Breusch Pagan Multiplier Test for Health and Income Inequality**

| Test Statistics | Value | P value |
|---|---|---|
| Chi- Square | 518 | 0.00 |

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