Theoretical and Applied Economics
Volume XXIX (2022), No. 1(630), Spring, pp. 63-82

Institutional quality and public healthcare

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Abstract. *This paper attempts to empirically identify the impact of institutional quality on the effectiveness of public healthcare mechanisms around the world. The percentage of out-of-pocket expenditure from total health expenditure is taken as a proxy – the higher this percentage, the more people seem to rely on private institutions, implying lower effectiveness of government facilities. Panel data regression analysis is undertaken for 173 countries over the period 2002-2018. Smaller datasets are used for analyzing the BRICS and South Asian economies. Results highlight the positive effect of institutional quality, and reaffirm the expected positive impact of government expenditure on healthcare quality.*

Keywords: institutional quality, public healthcare, panel data regression analysis, medical institutions, government expenditure.

JEL Classification: C23, H41, H51, I15, I18, N30, N35.

1. Introduction

A country's economic growth and development is chiefly dependent on the quality of its human capital. A healthier and more educated workforce is generally more productive, can work longer hours, and is able to handle more complex problems. Hence, human capital, in turn, is developed largely through proper disbursement and allocation of education and healthcare.

The availability and quality of healthcare impacts consumer decisions on spending and savings. Cheap and accessible services will encourage consumers to utilize them whenever required without having to make special provisions for the same in their personal budgets. This may have a direct bearing on the standard of living of individuals in an economy. Thus, healthcare affects both the total production of output, and the demand for that output.

Healthcare services, whether curative, preventive, or palliative, are provided by the public as well as private sector. However, healthcare markets have certain unique characteristics arising from inherent market failures – asymmetric information between the doctors and patients regarding the severity of illness or difficulty, adverse selection for insurers of a skewed population most in need of healthcare, and moral hazard of excess consumption of services by the insured. Thus, theory suggests that the private market should fail to provide adequate healthcare services, and hence these facilities are publicly financed and/or regulated in most countries. Yet developing and underdeveloped economies around the world are strongly dominated by private healthcare structures, even when governments claim to provide largely subsidized alternatives.

This happens because it is generally accepted among people living above as well as below the poverty line that the private sector provides "better" services – their services are believed to be timelier and more effective. On the other hand, the public sector seems to fall short of providing good quality healthcare to the population because of low institutional quality – rampant corruption, political instability, ineffectiveness of governance, low regulatory quality, poor implementation of rules and laws, and low accountability.

This paper attempts to empirically identify the impact of institutional quality on the effectiveness of public healthcare mechanisms around the world. The percentage of out-of-pocket expenditure from total health expenditure is taken as a proxy variable reflecting the quality of public healthcare systems – the higher this percentage, the more people seem to rely on private institutions, implying lower effectiveness of government facilities. The Worldwide Governance Indicators are used to model the quality of the government's institutions. Panel data regression analysis is undertaken using a dataset compiled from The World Development Indicators and Worldwide Governance Indicators, for 173 countries over the period 2002-2018. Smaller datasets are used for analyzing the economies of South Asia and BRICS.

The remaining paper is structured in the following way: Section 2 gives a review of literature. Section 3 describes the data and the methodology applied for the analysis. Section 4 looks at how different indicators of governance impact the quality of public healthcare individually – it pinpoints the specific aspects of institutional quality that affect public healthcare. Section 5 discusses how all governance indicators taken together affect

the quality of public healthcare – it gives a more complete description of the total impact of institutional quality on healthcare. Sections 6 and 7 discuss how institutional quality affects public healthcare in the countries of BRICS and South Asia. Section 8explains the results, gives policy recommendations, and concludes the paper.

2. Literature review

Literature in economic growth clearly confirms the growing importance of health in raising incomes and overall productivity. Inadequate health infrastructure and illness can shorten the life of individuals and reduce their lifetime incomes (Babatude, 2012). Conversely, better healthcare systems for children can improve the overall literacy rate, raise the mean years of schooling, increase the school completion rate, and improve the efficiency of human capital formation (Schultz, 1999). This highlights the need to develop strong public healthcare institutions.

A host of studies confirm the positive relationship between government spending on healthcare and better health outcomes. These studies usually focus on how public spending on primary healthcare is positively associated with better life expectancy (Ravallion, 1997) and lower child and infant mortality (Gupta et al., 1999). However, the correlation is not strong. Pritchett (1996) hypothesizes that this may reflect the low efficacy of public spending. Lewis (2006) explains that well-intentioned spending by the government may have no impact if institutions do not function.

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Several studies discuss the relationship between public and private healthcare structures, often comparing the two. These studies highlight the difference in quality of service provided by the public and private sector, which explains the growing popularity of the latter. Aljunid (1995) discusses the significance of private providers in Asian countries using data and case studies highlighting the distribution of health facilities, health expenditures, manpower, and rates of utilization. He highlights the differences in the "quality of care" as one of the major factors affecting choice of provider. Group discussions in a study in Mali reveal that public sector healthcare is chiefly characterized by long waiting hours, poor attitudes of nurses and physicians, and shortage of drugs (Ainsworth, 1983).

Chattopadhyay (2013) discusses the dynamics of corruption in healthcare and its implications in the medical industry. He explains how corruption traps people in poverty, aggravates income inequality, increases the costs of patient care, and deprives the poor from accessing healthcare services.

Rajkumar and Swaroop (2002) check how difference in the quality of governance – measured by the level of corruption and quality of bureaucracy – affect the efficacy of public spending. They find that countries with lower corruption can use public spending to reduce child and infant mortality rates.

Sodhi and Rabbani (2014) discuss the need to develop a strong primary healthcare infrastructure base before moving on to providing insurance coverage for universalizing access to healthcare services in countries dominated by private healthcare structures. In turn, they consider the need for strong regulatory systems as an effective way to manage such countries if restructuring of the health system towards public provision is not feasible. Even though invoking state regulatory mechanisms is likely to be complex, it is argued that it is the responsibility of the government to protect its populations from exploitation by the free market structure of the private sector by regulating the private health sector (Garner and Thaver, 1993).

High absenteeism, arising due to improper implementation of rules and laws, is a major problem in several developing economies. Banerjee and Duflo (2011) found local health posts in Udaipur to be closed during working hours 56 percent of the time. In fact, the average absent rate of health workers in India is 43 percent (Chaudhury et al., 2006).

Various studies and scholars discuss how the political environment of a country affects its healthcare. For instance, Besley and Kudamatsu (2006) use panel data to check how democratic institutions affect health. They conclude that democracy promotes greater life expectancy, although the correlation is conditional. Ross (2006) on the other hand, finds no significant effect of democracy on infant and child mortality. Klomp and Haan (2009) use a structural equation model with demographic and economic control variables to examine the relationship between political institutions and health. They show that democracy is positively correlated to individual health, and regime instability impacts individual health negatively.

Voice and accountability play an important role in determining public healthcare delivery. While the government has recognized the role of accountability in improving the quality of our medical institutions and is implementing policies like the National Rural Health Mission to strengthen voice and empower local governments, these initiatives fail to address the incentives that drive service delivery (Hammer et al., 2007).

3. Data, methodology, and conceptual framework

The analysis uses a dataset compiled from The World Development Indicators and Worldwide Governance indicators, for 173 countries over the period 2002-2018. Smaller datasets are used for analysing the economies of South Asia and BRICS containing 6 and 5 countries, respectively. The percentage of out-of-pocket expenditure from total health expenditure is taken as a proxy variable reflecting the quality of public healthcare systems. A higher percentage insinuates that people rely more on their own incomes to use medical services. If, despite the availability of highly subsidized government-provided services, and irregular incomes, people seem to rely on private institutions, then the most compelling reason behind this may be the low quality of service provided in a public hospital. Thus, a higher percentage of out-of-pocket expenditures chiefly implies a lower dependence on publicly provided services, implying lower effectiveness of government facilities.

The World Governance Indicators are used here to observe institutional quality. As per the World Governance Indicators website, "The six aggregate indicators are based on over 30 underlying data sources reporting the perceptions of governance of a large number of survey respondents and expert assessments worldwide." While numerous studies have looked at particular aspects of institutional quality and its relationship with the quality of healthcare, almost no studies look at the overall influence of all aspects of institutional quality taken together. In this regard, this study uses a more reliable, transparent, and all-encompassing dataset on the various aspects of institutional quality as given by the World Governance Indicators.

The abbreviations used for these variables are given in Table 3.1.

Table 3.1. *Abbreviations used in the analysis*

Abbreviation	Meaning
oopc	Out-of-pocket expenditure (% of current health expenditure)
ghed_gg	Domestic General Government Health Expenditure (% of general government expenditure)
cc	Control of Corruption
ge	Government Effectiveness
rq	Regulatory Quality
rl	Rule of Law
va	Voice and Accountability
psv	Political Stability and Absence of Violence/Terrorism

3.1. Descriptive statistics

The summary statistics for the 173 countries over 17 years has been computed and presented in the Appendix (Table A.1.1). Descriptive Statistics have also been presented for the BRICS nations and the nations of South Asia (Table A.1.2, Table A.1.3).

As per Table A.1.1, Table A.1.2, and Table A.1.3, it appears that more than 50% expenditure on healthcare is spent from out-of-pocket in South Asia on average. The corresponding BRICS average is 37.7%, still higher than the world average of 34.01%. However, the standard deviation is approximately 19 for all cases, and the overall out-of-pocket expenditures range from 0.08% to about 84.34%, reflecting the high variability in this variable.

The percentage of Government expenditure on healthcare out of total expenditure has an average value of 9.93%, with some countries spending as high as 42%. However, the averages for the two groups- BRICS and South Asia – are lower, and the maximum reaches only 15%. Again, the mean values of the six indicators are quite lower for the two groups of countries than for the whole world. The within variation for all these indicators is quite low, suggesting that there is not much variability in the value of these indicators within a country over time.

3.2. Methodology and conceptual framework

A Panel Data Regression Analysis is undertaken to estimate the effects of government expenditure on healthcare, control of corruption, government effectiveness, regulatory quality, rule of law, voice and accountability and political stability and absence of violence/terrorism on the percentage of out-of-pocket expenditures.

The main advantage of using Panel Data is that it can be used to evaluate both cross sectional and time series data to obtain more reliable estimates with minimum errors. The data has more degrees of freedom and more sample variability than cross sectional or time series data, which gives more accurate results (Hsaio, 2007). It helps to control for individual heterogeneity, and the data is more informative, variable, with lesser collinearity than a simple time series data (Klevmarken, 1989).

One can conduct three types of regression analyses using Panel Data – A Pooled Ordinary Least Squares (OLS) Estimation model, a Fixed Effects model, and a Random Effects model.

A Pooled OLS model, or a constant coefficient model, assumes that the coefficients of the econometric model remain constant across time and across cross sectional units. It is not, hence, generally used in literature owing to its restrictive nature.

Individual Specific Effects models, like Fixed Effects model and Random Effects model, assume that there is some unobserved heterogeneity across individuals. If these individual specific effects are correlated to the regressors, a Fixed Effects model is used. Each cross-sectional unit is expected to have a different intercept and the same slope parameter. This model is an efficient model if the panel data is strongly balanced. If, however, individual specific effects of cross-sectional units are distributed independently of the regressors, a Random Effects model is more appropriate. This model works better for an unbalanced panel.

The Hausman Test helps to determine which of the two tests would be more appropriate to conduct. It tests whether there is a significant difference between the fixed effects and random effects estimators.

4. Single governance indicator analysis

Six aspects of Institutional Quality are considered. These six variables are expected to be correlated to one another, and the Correlation matrix in the Appendix (Table A.2) confirms this expectation. Hence, taking all variables together shall lead to inaccurate and insignificant results arising due to the problem of multicollinearity.

To check for the effects of each of these variables, therefore, each aspect of institutional quality is taken *one by one*. This helps avoid the problem of imperfect multicollinearity. Moreover, it focuses on the specific aspects of institutional quality that affect the effectiveness of public healthcare.

4.1. The econometric model

The econometric model used for this analysis can be described using the following equation:

$$Y_{it} = \beta_0 + \beta_1 X_{it}^1 + \beta_2 X_{it}^2 + u_{it},$$

where:
The subscript ‘i’ represents the countries, i = 1, 2, 3, …, 173.
The subscript ‘t’ represents the time, t = 1, 2, 3, …, 17.

Y_{it} is the dependent variable reflecting the percentage of Out-of-pocket Expenditure out of Total Health Expenditure for country 'i' at time 't'.
X_{it}^{1} is the independent variable reflecting the percentage of Domestic General Government Health Expenditure out of General Government Expenditure for country 'i' at time 't'.
X_{it}^{2} is the independent variable reflecting the Indicator of Institutional Quality that we wish to check for.
β_0 represents the unknown intercept for each cross-sectional entity.
β_k, k = 1, 2, represents the coefficients for the independent variables X^k.

4.2. The analysis

The results of the Fixed Effects and Random Effects estimation methods based on the given econometric model are presented in Tables 4.1 and 4.2 respectively. The Hausman Test is then conducted to determine the appropriate estimation method. The calculations for the same are given in Table 4.3. Subsequently, the interpretation of the main results is given on the basis of the appropriate estimation method.

Table 4.1. *Fixed effects estimation results*

Regressor/Statistic	1	2	3	4	5	6
Constant	42.907 (.499)***	42.892 (.500)***	42.881 (.500)***	42.838 (.499)***	42.821 (.501)***	42.905 (.501)***
qhed_gg	-.899 (.049)***	-.894 (.049)***	-.894 (.049)***	-.895 (.049)***	-.887 (.050)***	-.892 (.050)***
cc	-2.206 (.525)***	-	-	-	-	-
ge	-	-1.633 (.513)***	-	-	-	-
rq	-	-	-1.429 (.483)***	-	-	-
rl	-	-	-	-2.551 (.561)***	-	-
va	-	-	-	-	-.756 (.539)***	-
psv	-	-	-	-	-	-.933 (.327)***

Table 4.2. *Random effects estimation results*

Regressor/Statistic	1	2	3	4	5	6
Constant	43.237 (1.22)***	43.233 (1.27)***	43.224 (1.28)***	43.126 (1.22)***	43.132 (1.27)***	43.311 (1.18)***
qhed_gg	-.934 (.049)***	-.929 (.049)***	-.929 (.049)***	-.926 (.049)***	-.920 (.049)***	-.938 (.049)***
cc	-3.299 (.479)***	-	-	-	-	-
ge	-	-2.463 (.474)***	-	-	-	-
rq	-	-	-2.059 (.453)***	-	-	-
rl	-	-	-	-3.681 (.508)***	-	-
va	-	-	-	-	-1.777 (.495)***	-
psv	-	-	-	-	-	-1.585 (.319)***

Table 4.3. *Hausman test results*

Aspect of Institutional Quality in the regression equation	Hausman Test Results		Appropriate Estimation Method
	Chi-square test value	P-value	
cc	26.30	0.0000	Fixed Effects
ge	21.23	0.0000	Fixed Effects
rq	19.49	0.0001	Fixed Effects
rl	23.44	0.0000	Fixed Effects
va	27.37	0.0000	Fixed Effects
psv	81.13	0.0000	Fixed Effects

The Hausman Test is conducted in the following manner:
Panel variable: Code (strongly balanced).
Time variable: year, 2002 to 2017.
Delta: 1 unit.
Test: Ho: difference in coefficients not systematic.

Based on the results shown in Table 4.3, it can be inferred that the fixed effects model as the most appropriate model for this study as the p value is less than 0.05 for each aspect of institutional quality. Thus, the estimation results in Table 4.1 is all that is required for the purpose of statistical inference and interpretation.

As per the results shown in Table 4.1, an increase in the percentage of government expenditure on healthcare by 1 unit will lead to a fall in the percentage of out-of-pocket expenditures on healthcare by 0.887 to 0.899 units.

An increase in the Rule of Law, Control of Corruption, Government Effectiveness, Regulatory Quality, Political Stability and Absence of Violence/Terrorism, and Voice and Accountability individually by 1 unit will lead to a fall in the percentage of out-of-pocket expenditures by 2.551, 2.206, 1.633, 1.429, 0.933, and 0.756 units, respectively. All the values obtained from the Fixed Effects model are statistically significant at the 99% confidence level.

5. Multivariable analysis: The World

While checking for how each specific aspect of institutional quality affects the quality of public healthcare gives statistically significant results, it should be constructive to see how all these variables affect out-of-pocket expenditures together. However, as noted before, taking all variables together will not give accurate results due to multicollinearity. Hence, we check for the Variance Inflation Factor (VIF) of the Ordinary Least Squares Estimation of the model. Variables are dropped from the analysis till a mean VIF < 5 is obtained. The VIF tables are given in the Appendix.

On the basis of calculation of VIF, and the corresponding results in Table A.3.1 in the Appendix, four Governance Indicators are used – Control of Corruption, Regulatory Quality, Voice and Accountability, and Political Stability and Absence of Violence/ Terrorism. A compiled dataset of 173 countries over the period 2002-2018 is considered.

5.1. The econometric model

The econometric model used for this analysis can be described using the following equation:

$$Y_{it} = \beta_0 + \beta_1 X_{it}^1 + \beta_2 X_{it}^2 + \beta_3 X_{it}^3 + \beta_4 X_{it}^4 + \beta_5 X_{it}^5 + u_{it}$$

Where,
The subscript 'i' represents the countries, i = 1, 2, 3, …, 173.
The subscript 't' represents the time, t = 1, 2, 3, …, 17.
Y_{it} is the dependent variable indicating the percentage of Out-of-pocket Expenditure out of Total Health Expenditure for country 'i' at time 't'.
X_{it}^1 is the independent variable reflecting the percentage of Domestic General Government Health Expenditure out of General Government Expenditure for country 'i' at time 't'.
X_{it}^2 , $X_{it}^3, X_{it}^4, and\ X_{it}^5$ are the independent variables reflecting Control of Corruption, Regulatory Quality, Voice and Accountability, and Political Stability and Absence of Violence/Terrorism respectively for country 'i' at time 't'.
β_0 represents the unknown intercept for each cross-sectional entity.
β_k, k = 1, 2, 3, 4, 5, represents the coefficients for the independent variables X^k.

5.2. The analysis

The results of the Fixed Effects and Random Effects estimation methods based on the given econometric model are presented in Tables 5.1 and 5.2 respectively. The Hausman Test is then conducted to determine the appropriate estimation method. The calculations for the same are given in Table 5.3. Subsequently, the interpretation of the main results is given on the basis of the appropriate estimation method.

Table 5.1. *Fixed effects estimation results – world analysis*

oopc	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
ghed_gg	-.902	.05	-18.21	0	-.999	-.805	***
cc	-1.872	.615	-3.04	.002	-3.079	-.666	***
rq	-.533	.546	-0.97	.33	-1.604	.539	
va	.32	.586	0.55	.585	-.829	1.47	
psv	-.664	.34	-1.95	.051	-1.332	.003	*
Constant	42.977	.501	85.82	0	41.995	43.959	***

Mean dependent var	34.060	SD dependent var	19.179
R-squared	0.112	Number of obs	2935.000
F-test	69.706	Prob > F	0.000
Akaike crit. (AIC)	17644.888	Bayesian crit. (BIC)	17680.795

*** p < .01, ** p < .05, * p < .1.

Table 5.2. *Random effects estimation results – world analysis*

oopc	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
ghed_gg	-.935	.049	-19.11	0	-1.03	-.839	***
cc	-2.702	.592	-4.56	0	-3.863	-1.542	***
rq	-.486	.532	-0.91	.36	-1.528	.556	
va	-.151	.554	-0.27	.786	-1.237	.936	
psv	-1.014	.336	-3.02	.003	-1.673	-.355	***
Constant	43.232	1.166	37.06	0	40.945	45.518	***

Mean dependent var	34.060	SD dependent var	19.179
Overall r-squared	0.367	Number of obs	2935.000
Chi-square	438.357	Prob > chi2	0.000
R-squared within	0.111	R-squared between	0.390

*** p < .01, ** p < .05, * p < .1.

Table 5.3. *Hausman test – world analysis*

	(b)	(B)	(b-B)	sqrt(diag(V_b-V_B))
	fixed	random	Difference	S.E.
ghed_gg	-.9020189	-.934599	.0325801	.0078742
cc	-1.872441	-2.702414	.8299729	.1678934
rq	-.5325584	-.4863519	-.0462065	.1259812
va	.3203127	-.1506146	.4709273	.1904354
psv	-.6644533	-1.014278	.3498245	.0528119

The Hausman test is conducted in the following manner:
b = consistent under Ho and Ha; obtained from xtreg.
B = inconsistent under Ha, efficient under Ho; obtained from xtreg.
Test: Ho: difference in coefficients not systematic.
chi2(5) = (b-B)'[(V_b-V_B)^(-1)](b-B) = 56.93.
Prob > chi2 = 0.0000.

Based on the results of the Hausman test given in and under Table 5.3, it can be inferred that the Fixed Effects model is more appropriate than the Random Effects model, since the p value = 0 < 0.05. Hence, the estimation results in Table 5.1 is all that is required for the purpose of statistical inference and interpretation.

As per the results of Table 5.1, an increase in the percentage of government expenditure on healthcare by 1 unit leads to a fall in the percentage of out-of-pocket expenditures on healthcare by 0.902 units. This is statistically significant at the 99% confidence level.

An increase in the Control of Corruption by 1 unit will lead to a fall in the percentage of out-of-pocket expenditures by 1.872 units, significant at the 99% confidence level, while an increase in the measure of Political Stability and Absence of Violence/Terrorism by 1 unit leads to a fall in the percentage of out-of-pocket expenditures by 0.664 units, significant at the 90% confidence level.

6. Multivariable analysis: BRICS

BRICS is an economic and political regional organization of the world's five emerging market economies – Brazil, Russia, India, China, and South Africa. Founded in 2009, it aims to promote peace, development, and cooperation between its member states, with the notion that these economies will collectively dominate growth of the global economy by 2050 (Wilson and Purushothaman, 2003). As such, it should be constructive to note any differences in the relationship between the quality of public institutions and government healthcare for these nations compared to the general world analysis. Thus, a compiled dataset of the 5 countries given above is considered for the period 2002-2018.

On the basis of calculation of VIF, and the corresponding results in Table A.3.2 in the Appendix, five Worldwide Governance indicators out of six for the analysis – Government Effectiveness, Regulatory Quality, Rule of Law, Voice and Accountability, and Political Stability and Absence of Violence/Terrorism.

6.1. The econometric model

The econometric model used for this analysis can be described using the following equation:

$$Y_{it} = \beta_0 + \beta_1 X_{it}^1 + \beta_2 X_{it}^2 + \beta_3 X_{it}^3 + \beta_4 X_{it}^4 + \beta_5 X_{it}^5 + \beta_6 X_{it}^6 + u_{it}$$

Where,
The subscript 'i' represents the countries, i = 1, 2, 3, 4, 5.
The subscript 't' represents the time, t = 1, 2, 3, …, 17.
Y_{it} is the dependent variable indicating the percentage of Out-of-pocket Expenditure out of Total Health Expenditure for country 'i' at time 't'.
X_{it}^1 is the independent variable reflecting the percentage of Domestic General Government Health Expenditure out of General Government Expenditure for country 'i' at time 't'.
X_{it}^2 , $X_{it}^3, X_{it}^4, X_{it}^5, and\ X_{it}^6$ are the independent variables reflecting Government Effectiveness, Regulatory Quality, Rule of Law, Voice and Accountability, and Political Stability and Absence of Violence/Terrorism respectively for country 'i' at time 't'.
β_0 represents the unknown intercept for each cross-sectional entity.
β_k, k = 1, 2, 3, 4, 5, 6, represents the coefficients for the independent variables X^k.

6.2. The analysis

The results of the Fixed Effects and Random Effects estimation methods based on the given econometric model are presented in Tables 6.1 and 6.2 respectively. The Hausman Test is then conducted to determine the appropriate estimation method. The calculations for the same are given in Table 6.3. Subsequently, the interpretation of the main results is given on the basis of the appropriate estimation method.

Table 6.1. *Fixed effects estimation results – BRICS analysis*

oopc	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
ghed_gg	-4.883	.483	-10.11	0	-5.846	-3.92	***
ge	-11.594	3.149	-3.68	0	-17.868	-5.32	***
rq	-5.696	3.783	-1.51	.136	-13.234	1.841	
rl	-6.865	3.859	-1.78	.079	-14.555	.825	*
va	-2.535	4.152	-0.61	.543	-10.808	5.737	
psv	5.91	2.243	2.63	.01	1.44	10.379	**
Constant	79.623	4.621	17.23	0	70.415	88.832	***

Mean dependent var	37.792	SD dependent var	19.764
R-squared	0.645	Number of obs	85.000
F-test	22.400	Prob > F	0.000
Akaike crit. (AIC)	448.383	Bayesian crit. (BIC)	465.481

*** p < .01, ** p < .05, * p < .1.

Table 6.2. *Random effects estimation results – BRICS analysis*

oopc	Coef.	St.Err.	t-value	p-value	[95%Conf	Interval]	Sig
ghed_gg	-5.742	.251	-22.85	0	-6.234	-5.249	***
ge	-7.639	3	-2.55	.011	-13.52	-1.758	**
rq	-9.027	3.03	-2.98	.003	-14.966	-3.089	***
rl	6.561	3.06	2.14	.032	.563	12.56	**
va	-4.589	1.042	-4.41	0	-6.631	-2.548	***
psv	4.478	1.638	2.73	.006	1.268	7.687	***
Constant	88.935	2.598	34.23	0	83.843	94.028	***

Mean dependent var	37.792	SD dependent var	19.764
Overall r-squared	0.966	Number of obs	85.000
Chi-square	2225.179	Prob > chi2	0.000
R-squared within	0.559	R-squared between	0.999

*** p < .01, ** p < .05, * p < .1.

Table 6.3. *Hausman Test – BRICS analysis*

	(b)	(B)	(b-B)	sqrt(diag(V_b-V_B))
	fixed	random	Difference	S.E.
ghed_gg	-4.882973	-5.74155	.8585774	.4125524
ge	-11.5939	-7.63913	-3.954771	.9552202
rq	-5.696404	-9.027387	3.330983	2.264762
rl	-6.864849	6.561271	-13.42612	2.351139
va	-2.535335	-4.589348	2.054013	4.018957
psv	5.909687	4.47776	1.431927	1.532775

The Hausman Test is conducted in the following manner:
b = consistent under Ho and Ha; obtained from xtreg.
B = inconsistent under Ha, efficient under Ho; obtained from xtreg.
Test: Ho: difference in coefficients not systematic.
chi2(6) = (b-B)'[(V_b-V_B)^(-1)](b-B) = 27.26.
Prob > chi2 = 0.0001.
(V_b-V_B is not positive definite).

Based on the results of the Hausman test given in and under Table 7.3, it can be inferred that the Fixed Effects model is more appropriate than the Random Effects model, since the p value = 0 < 0.05. Hence, the estimation results presented in Table 7.1 is all that is required for the purpose of statistical inference and interpretation.

As per the results of Table 7.1, an increase in the percentage of government expenditure on healthcare by 1 unit in the BRICS nations will lead to a fall in the percentage of out-of-pocket expenditures on healthcare by 4.883 units, while an increase in the measure of government effectiveness in these countries by 1 unit will lead to a corresponding decline in the percentage of out-of-pocket expenditures by 11.594 units, indicating the high impact of government on healthcare in the BRICS nations specifically. These results are statistically significant at the 99% confidence level.

An increase in the Rule of Law by 1 unit will lead to a fall in the percentage of out-of-pocket expenditures by 6.864 units, significant at the 90% confidence level, while an increase in the measure of Political Stability and Absence of Violence/Terrorism by 1 unit leads to a fall in the percentage of out-of-pocket expenditures by 5.909 units, significant at the 95% confidence level.

7. Multivariable analysis: South Asia

Six countries – India, Pakistan, Bhutan, Bangladesh, Nepal, and Sri Lanka – are considered for our analysis. These countries are a part of the South Asian Association for Regional Cooperation – an intergovernmental organization promoting development, cooperation, and economic and regional integration. India, Bhutan, Bangladesh, Pakistan, and Nepal are among the 26 countries in the world suffering from anemia as well as stunting, and Sri Lanka is one of the 5 countries suffering from anemia (Fanzo et al., 2018). As such, effective public healthcare is crucial for the region's development. A compiled dataset of the six countries over the period 2002-2018 is considered.

On the basis of calculation of VIF, and the corresponding results in Table A.3.3 in the Appendix, five out of the six Worldwide Governance Indicators are used for analysis – Control of Corruption, Government Effectiveness, Regulatory Quality, Voice and Accountability, and Political Stability and Absence of Violence/Terrorism.

7.1. The econometric model

The econometric model used for this analysis can be described using the following equation:

$$Y_{it} = \beta_0 + \beta_1 X_{it}^1 + \beta_2 X_{it}^2 + \beta_3 X_{it}^3 + \beta_4 X_{it}^4 + \beta_5 X_{it}^5 + \beta_6 X_{it}^6 + u_{it}$$

Where,
The subscript 'i' represents the countries, i = 1, 2, 3, 4, 5, 6.
The subscript 't' represents the time, t = 1, 2, 3, …, 17.
Y_{it} is the dependent variable indicating the percentage of Out-of-pocket Expenditure out of Total Health Expenditure for country 'i' at time 't'.
X_{it}^1 is the independent variable reflecting the percentage of Domestic General Government Health Expenditure out of General Government Expenditure for country 'i' at time 't'.
$X_{it}^2, X_{it}^3, X_{it}^4, X_{it}^5, and\ X_{it}^6$ are the independent variables reflecting Control of Corruption, Government Effectiveness, Regulatory Quality, Voice and Accountability, and Political Stability and Absence of Violence/Terrorism respectively for country 'i' at time 't'.
β_0 represents the unknown intercept for each cross-sectional entity.
β_k, k = 1, 2, 3, 4, 5, 6, represents the coefficients for the independent variables X^k.

7.2. The analysis

The results of the Fixed Effects and Random Effects estimation methods based on the given econometric model are presented in Tables 7.1 and 7.2 respectively. The Hausman Test is then conducted to determine the appropriate estimation method. The calculations for the same are given in Table 9.3. Subsequently, the interpretation of the main results is given on the basis of the appropriate estimation method.

Table 7.1. *Fixed effects model results – South Asia analysis*

oopc	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
ghed_gg	-3.38	.48	-7.03	0	-4.334	-2.425	***
cc	.929	2.768	0.34	.738	-4.569	6.428	
ge	-4.844	3.063	-1.58	.117	-10.929	1.241	
rq	-.111	2.568	-0.04	.966	-5.213	4.991	
va	.682	1.809	0.38	.707	-2.912	4.276	
psv	1.099	1.032	1.07	.29	-.951	3.148	
Constant	72.11	3.384	21.31	0	65.388	78.832	***

Mean dependent var	53.616	SD dependent var	18.776
R-squared	0.384	Number of obs	102.000
F-test	9.339	Prob > F	0.000
Akaike crit. (AIC)	564.124	Bayesian crit. (BIC)	582.499

*** p < .01, ** p < .05, * p < .1.

Table 7.2. *Random effects estimation results – South Asia analysis*

oopc	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
ghed_gg	-2.913	.312	-9.34	0	-3.524	-2.302	***
cc	-17.205	1.777	-9.68	0	-20.687	-13.722	***
ge	-.591	2.356	-0.25	.802	-5.208	4.026	
rq	10.168	2.138	4.76	0	5.978	14.358	***
va	6.643	1.228	5.41	0	4.236	9.051	***
psv	-1.538	.996	-1.54	.123	-3.49	.414	
Constant	69.424	2.801	24.78	0	63.934	74.914	***

Mean dependent var	53.616	SD dependent var	18.776
Overall r-squared	0.937	Number of obs	102.000
Chi-square	1416.112	Prob > chi2	0.000
R-squared within	0.164	R-squared between	0.995

*** p < .01, ** p < .05, * p < .1.

Table 7.3. *Hausman Test – South Asia analysis*

	(b)	(B)	(b-B)	sqrt(diag(V_b-V_B))
	fixed	random	Difference	S.E.
ghed_gg	-3.379797	-2.912829	-.4669678	.3654963
cc	.9293775	-17.20464	18.13402	2.122203
ge	-4.84419	-.5908427	-4.253347	1.95759
rq	-.1108911	10.16824	-10.27913	1.423542
va	.6822548	6.643295	-5.96104	1.328148
psv	1.098737	-1.537709	2.636446	.2686583

The Hausman Test is conducted in the following manner:
b = consistent under Ho and Ha; obtained from xtreg.
B = inconsistent under Ha, efficient under Ho; obtained from xtreg.
Test: Ho: difference in coefficients not systematic.
chi2(6) = (b-B)'[(V_b-V_B)^(-1)](b-B) = 26.37.
Prob > chi2 = 0.0002.
(V_b-V_B is not positive definite).

Based on the results of the Hausman test given in and under Table 7.3, it can be inferred that the Fixed Effects model is more appropriate than the Random Effects model, since the p value = 0.0002 < 0.05. Hence, the estimation results in Table 7.1 is all that is required for the purpose of statistical inference and interpretation.

As per the results of Table 7.1, an increase in the percentage of government expenditure on healthcare by 1 unit in the BRICS nations will lead to a fall in the percentage of out-of-pocket expenditures on healthcare by 3.379 units, significant at the 99% confidence level. Regression with the Institutional Quality regressors does not give statistically significant results.

8. Conclusion

Percentage of government expenditure on healthcare: All the above analyses show a high negative correlation between percentage of government expenditure on healthcare and the percentage of out-of-pocket expenditures, significant at the 99% confidence level. This reflects the simple result that the more budgetary allocations are made to healthcare, the more effective is its quality and delivery, and hence the less people must rely on their own incomes to access medical services. More funds naturally translate to more subsidized services, better accessibility, better infrastructure, and better availability of medical staff.

It seems that the impact of government expenditure on the healthcare services of the BRICS nations and South Asian nations is relatively stronger. While 1% increase in the allocation of budgetary funds to healthcare will bring about 0.9 units fall in the percentage of out-of-pocket expenditures on healthcare as per the world average, it will fall by approximately 4.883 units for the BRICS nations and 3.379 units for South Asia.

High negative correlations between the six governance indicators and the percentage of out-of-pocket expenditures are observed.

Rule of law: For the multivariable analysis done for the World and South Asian nations, this regressor had to be dropped due to its high collinearity with other indicators. This is intuitive, as the execution of laws and rules itself depends on the amount of corruption, political climate, quality of regulation, accountability, and effectiveness of the government in general. This also helps explain why the single governance indicator analysis suggests that this regressor has the highest impact on the effectiveness of public healthcare systems.

Control of corruption: This regressor seems to have the highest impact on the effectiveness of public healthcare delivery after Rule of Law. The multivariable world analysis gives significant results at the 99% confidence level, indicating that an increase in the government's ability to control the misuse of public power by 1 unit will reduce out-of-pocket expenditures by 1.872 units. This might be because lower corruption will make healthcare more accessible to a larger proportion of the population and allow individuals to pay fairer prices for the services they receive.

Government effectiveness: The effectiveness of the government seems to be a significant determinant of healthcare delivery in the BRICS nations. The value of the indicator ranges between -0.50 to 0.69 (Appendix 1.2) with low within variation, implying that government effectiveness is generally quite low and does not really change over time in a particular country. While the single governance indicator analysis implies that a 1 unit increase in the effectiveness of governance shall lead to a decline in the percentage of out-of-pocket expenditures by 1.633 units, the multivariable model suggests that a 1-unit improvement in Government effectiveness leads to a reduction in the percentage of out-of-pocket expenditures by 11.59 units in the BRICS nations. This is quite high and seems to suggest that a government with lesser political pressures, more credibility, and more carefully constructed and implemented policies will be able to improve public efficacy in healthcare delivery to a greater extent in these nations.

Regulatory quality: While no significant results were obtained for the multivariable analysis, the single governance indicator analysis seems to indicate that an improvement in the quality of regulatory bodies will ensure better healthcare delivery, suggesting a fall in the percentage of out-of-pocket expenditures by 1.429 units in response to a 1 unit rise in the measure of Regulatory Quality. Stricter regulation might encourage lesser absenteeism among the medical staff and proper maintenance of medical institutions.

Political stability and absence of violence/terrorism: The single governance variable model as well as multivariable models all suggest that better political stability and lower violence encourages better healthcare. A stable political environment will naturally ensure better implementation of current policies, lesser interruptions in formulating new policies, and lower hiccups in establishing better healthcare infrastructure.

Voice and accountability: While this indicator seems to have the smallest impact on public healthcare delivery according to the single governance indicator model, its importance cannot be ignored. A country with a louder 'voice' can exercise its choice, elect its leaders, and freely express its concerns. This also means that it can hold its government

accountable, which encourages the government to work in the country's interests, and accordingly design and implement new policies and programs.

As such, to improve public healthcare systems, the following policy recommendations are made:

BRICS

1. Increasing budgetary allocation to healthcare – Policies must be implemented which ensure that greater allocations of budgetary funds are made towards the improvement of the public health sector in these nations. This may be done by making infrastructural investments as well as hiring more healthcare workers.
2. Improving government effectiveness – The effectiveness of government expenditure can be improved through human resource management. This involves hiring qualified medical workers who provide good quality service, and managers who ensure accountability and proper implementation of rules. Governments can also practice performance informed budgeting to ensure that it apportions its spending in the most efficient way. Given that the analysis suggests a 1 unit increase in effectiveness can reduce the percentage of out-of-pocket expenditures by 11.594 units, it is essential that the governments of the BRICS nations focus chiefly on building plans that ensure minimum wastage and give maximum gains.

South Asia

A sizable portion of government spending needs to be earmarked towards the improvement of the public health sector in the South Asian countries, essentially through substantial investments in infrastructure projects for new establishments as well as maintenance and restructuring of the already established hospitals and clinics. A higher percentage of government expenditure on healthcare will also naturally lead to better institutional quality, in the form of better infrastructure, more accessibility, and adequate appointment of healthcare workers. This positive relation is also clear from the results of the correlation matrix in the Appendix (Table A.2).

Conclusions

In conclusion, the results for all the panel data regression analyses done so far collectively underline the importance of raising the percentage of government expenditure done on healthcare. Specifically, additional expenditure should be focused on improving institutional quality by establishing more effective methods of regulation and control. An effective monitoring system is necessary to minimize corruption and ensure that government initiatives are effective. Rules and laws need to be specified, and governments as well as private institutions should be held accountable for their actions.

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Appendix

1. Summary of statistics

Table A.1.1. *Summary statistics – World*

Variable		Mean	Std. Dev.	Min	Max	Observations
oopc	overall	34.01911	19.19602	.0803496	84.34808	N = 2941
	between		18.53597	.113628	77.70254	n = 173
	within		5.174449	8.44684	59.25915	T = 17
ghed_gg	overall	9.93182	4.785466	.7338877	42.05201	N = 2941
	between		4.412653	1.709406	29.15094	n = 173
	within		1.880199	-.0293498	39.36442	T = 17
cc	overall	-.0165955	.9881904	-1.826384	2.469991	N = 2941
	between		.974884	-1.589455	2.343982	n = 173
	within		.1769001	-1.348425	.7139508	T = 17
ge	overall	-.006158	.9662073	-2.270754	2.436975	N = 2941
	between		.9516181	-1.650921	2.163212	n = 173
	within		.1814051	-1.157736	.7699962	T = 17
rq	overall	-.008861	.9457838	-2.625506	2.260543	N = 2941
	between		.9284824	-2.017957	1.936267	n = 173
	within		.1926632	-1.448033	1.020494	T = 17
rl	overall	-.0257413	.9648793	-2.322118	2.100273	N = 2941
	between		.9531904	-1.691921	1.982346	n = 173
	within		.1654232	-.9654921	.6764889	T = 17
va	overall	-.0132945	.9788876	-2.259159	1.800992	N = 2941
	between		.9661383	-2.115932	1.62948	n = 173
	within		.1728512	-1.052259	.9146172	T = 17
psv	overall	-.018954	.9253544	-2.810035	1.755193	N = 2935
	between		.8832388	-2.293934	1.409054	n = 173
	within		.2849599	-1.415699	1.413158	T= 17

Table A.1.2. *Summary statistics – BRICS*

Variable		Mean	Std. Dev.	Min	Max	Observations
oopc	overall	37.79175	19.76351	7.698547	73.42475	N = 85
	between		21.17408	9.811367	67.69679	n = 5
	within		5.25859	27.23662	54.99815	T = 17
ghed_gg	overall	8.42645	3.062084	2.745441	13.58636	N = 85
	between		3.265927	3.146211	12.05419	n = 5
	within		.8612483	5.641508	9.958621	T = 17
cc	overall	-.3476525	.4041796	-1.132048	.5681056	N = 85
	between		.414652	-.9484613	.1693918	n = 5
	within		.1554819	-.7533294	.0510612	T = 17
ge	overall	.0217063	.3041109	-.5004948	.6926963	N = 85
	between		.2950449	-.3303684	.4530921	n = 5
	within		.1483684	-.2992081	.3595764	T = 17
psv	overall	-.5653819	.4508922	-1.513351	.3298446	N = 85
	between		.4588801	-1.14422	-.1019729	n = 5
	within		.1812224	-1.151973	-.0638261	T = 17
rq	overall	-.0950383	.3335715	-.5463259	.8042418	N = 85
	between		.3388779	-.3536498	.4480012	n = 5
	within		.1352984	-.4391736	.2612023	T = 17

Variable		Mean	Std. Dev.	Min	Max	Observations
rl	overall	-.2742088	.3587099	-.9701154	.255048	N = 85
	between		.3822791	-.8362925	.1082733	n = 5
	within		.101839	-.4967291	-.0218302	T = 17
va	overall	-.1908924	.9041266	-1.74897	.7157369	N = 85
	between		.998089	-1.606826	.6300931	n = 5
	within		.1049383	-.4405914	.2466305	T = 17

Table A.1.3. *Summary statistics – South Asia*

Variable		Mean	Std. Dev.	Min	Max	Observations
oopc	overall	53.61566	18.7758	10.30409	78.0159	N = 102
	between		19.84476	16.75014	67.69679	n = 6
	within		4.593754	40.41185	65.01265	T = 17
ghed_gg	overall	5.444596	2.294017	2.618796	11.04907	N = 102
	between		2.342066	3.146211	9.063609	n = 6
	within		.8038621	3.610756	7.965386	T = 17
cc	overall	-.3929171	.7155324	-1.496538	1.646751	N = 102
	between		.7582487	-1.085497	1.02636	n = 6
	within		.1677059	-.8039583	.2274739	T = 17
ge	overall	-.3284451	.4712712	-1.053647	.7845386	N = 102
	between		.4921138	-.8322482	.4207399	n = 6
	within		.1352221	-.7285946	.0469781	T = 17
psv	overall	-1.014006	1.060068	-2.810035	1.283388	N = 102
	between		1.077309	-2.293934	.9374487	n = 6
	within		.3834131	-2.014614	-.1273888	T = 17
rq	overall	-.5754695	.3076659	-1.169393	.1947514	N = 102
	between		.2758714	-.9188311	-.1503762	n = 6
	within		.1749557	-1.032949	.1698904	T = 17
rl	overall	-.3294892	.4846129	-1.047653	.6275315	N = 102
	between		.5106233	-.8265506	.3238756	n = 6
	within		.1241703	-.6361962	-.0258333	T = 17
va	overall	-.3929916	.4743093	-1.290271	.4621931	N = 102
	between		.439973	-.8723251	.4275575	n = 6
	within		.2491158	-1.169979	.1810133	T = 17

2. Correlation matrix

Table A.2. *Correlation matrix*

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1) oopc	1.000							
(2) ghed_gg	-0.492	1.000						
(3) cc	-0.548	0.529	1.000					
(4) ge	-0.474	0.533	0.921	1.000				
(5) rq	-0.429	0.530	0.859	0.930	1.000			
(6) rl	-0.545	0.522	0.943	0.934	0.903	1.000		
(7) va	-0.469	0.533	0.756	0.725	0.757	0.803	1.000	
(8) psv	-0.554	0.399	0.725	0.657	0.609	0.746	0.642	1.000

3. VIF tables

Table A.3.1. *Variance Inflation Factor – World*

	VIF	1/VIF
cc	5.285	.189
rq	4.374	.229
va	2.878	.347
psv	2.23	.448
ghedgg	1.491	.671
Mean VIF	3.252	.

Table A.3.2. *Variance Inflation Factor – BRICS*

	VIF	1/VIF
rl	7.107	.141
rq	6.023	.166
va	5.23	.191
ge	4.909	.204
ghedgg	3.492	.286
psv	3.215	.311
Mean VIF	4.996	.

Table A.3.3. *Variance Inflation Factor – South Asia*

	VIF	1/VIF
cc	6.929	.144
ge	5.283	.189
psv	4.778	.209
ghedgg	2.194	.456
rq	1.854	.539
va	1.455	.687
Mean VIF	3.749	.