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Empirical evidence to the nonmonotonic relationship between public health expenditure and economic growth

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Abstract. *Government spending does not have a monotonic relationship with economic growth. The growth impacts of government spending differ owning to several factors. This paper has examined the relationship empirically. The empirical analysis has been carried out separately for developed and developing economies. The analysis has been performed with panel datasets of 36 developed and 88 developing countries over the period of 2000-2018. Fixed Effects (FE) model and Panel Error Correction Model (PECM) were used for estimation. The long-run cointegrating relationship was estimated using a PDOLS estimator. The FE estimation showed negative impacts of public expenditure on growth in developed economies whereas no causal relationship for the case of less developed economies. In the dynamic estimation analysis, it was found that public health expenditure negatively affected growth in developed economies and positively in the less developed economies, in the long run. In the short-run, no causal relationships could be established for both the cases.*

Keywords: government health spending, economic growth, fixed effects estimation, panel error correction model, developed and less developed economies.

JEL Classification: I1.

1. Introduction

"Increased government spending can provide a temporary stimulus to demand and output but in the longer run higher levels of government spending crowd out private investment or require higher taxes that weaken growth by reducing incentives to save, invest, innovate, and work."

Martin Feldstein
(American economist)

Endogenous growth models and economists from around the world have long recognised the crucial role of human capital of economic growth and development (Lucas, 1988; Mankiw et al., 1992; Romer, 1990; Rosen, 1976; Schultz, 1961; Uzawa, 1965). One of the fundamental elements of human capital is the health. Studies have shown that improvements in health can lead to economic growth via the increase in income (Bloom and Canning, 2008; Weil, 2014). Healthcare holds a significant position in determining the quality of human capital and the government has played a vital role in the investments in healthcare services in most countries. The general consensus is that public expenditure in the health sector results in developed health expenditure which consequently leads to healthier population with increase life-span and ultimately leads to growth. From the labour force perspective, people can provide effective labour services to sustain and flourish the economy only if they are healthy and alive. However, existing theory also suggests that government expenditure can be inimical to economic growth for several reasons such as fiscal deficits, crowding-out of investments and others. Reinhart (1999) provided an intriguing analysis of the effects of life expectancy and government spending on economic growth. He concluded that longer lives are associated with accelerated economic growth whereas government spending reduces growth for any life expectancy. Added to that, recent empirical evidences propose non-monotonic relationship between life expectancy and economic growth as well (Bhargava et al., 2001; Kelley and Schmidt, 1995). The impacts of public health expenditure on growth may vary owning to different characteristics of an economy. Aísa and Pueyo (2004, 2006) theoretically analysed and proved the nonmonotonic health expenditure-growth relationship. They further put forth certain rationales. When the positive effect of public health expenditure on life expectancy, savings and growth is intense enough, crowding out effects or the effects of taking away resources from investment could be offset. Prolonged and healthy life increases productivity, reduces impatience of consumers, affects willingness of agents to substitute consumption across time, encourages savings, and leads to economic growth. This could be the case of the developing countries where life expectancy is less and it is relatively easy to improve the life expectancy by allocating few more resources to health. This corresponds to a high elasticity of probability of dying with respect to social health status. That is to say, an increase in government health spending not only leads to a longer life but also to accelerated economic growth. Conversely, in developed nations where life expectancy is high and hard to increase with additional spending, further efforts in public health spending can negatively impact economic growth since elasticity of probability of dying with respect to social health status diminishes and the crowding out effect along with the effects of taken away resources from capital accumulation become dominant.

In light of the convoluted government health spending-growth relationship, this paper aims to provide an empirical evidence to the hypotheses of Aísa and Pueyo (2004, 2006), substantially. The unprecedented empirical examination carried out in this paper is the contribution to the existing literature. A Fixed Effects model with time fixed effects and a Panel Error Correction Model is estimated on two samples of 36 developed and 88 underdeveloped nations separately, over the period between 2000 and 2018. The long-run relationship is estimated using a Panel Dynamic Ordinary Least Squares estimator.

The rest of the paper is structured as follows: Section 2 reviews the existing literature; Section 3 presents the empirical analysis, and Section 4 draws the conclusion of the study.

2. Literature review

The fact that government health spending does not have monotonic relationship with economic growth and that the growth impacts of public health expenditure may vary across countries belonging to different economic spectrums or structural factors, has been discussed in several theoretical articles (Aísa and Pueyo, 2004, 2006). The vast array of empirical evidences, attest to the fact. Wang (2015), in his analysis from the OECD countries, found that when the ratio of health spending to GDP is less than the optimal level of 7.55%, increase in health spending effectively leads to better economic performance and above that, more spending does not equate to better care. However, Çetin and Ecevit (2011) tested the growth impacts of health expenditure of 15 OECD countries for the period between 1990 and 2016 and found no significant relationship. Raghupathi and Raghupathi (2020) researched the association of public health expenditure with economic performance across United States collecting data from the period 2003-2014. They concluded a positive correlation between healthcare expenditure and economic indicators of income, GDP and labour productivity and that an increase in healthcare expenditure has a positive relationship with economic performance. Kurt (2015) used the Feder-Ram model and concluded that the direct impacts of government health expenditure in Turkey is positive and significant whereas the indirect impacts are negative. Piabuo and Tieguhong (2017) carried out a comparative analysis on the impact of health expenditure between countries in the CEMAC sub-region and five other African countries and found out that health expenditure had a positive and significant effect on economic growth in both the samples. On the other hand, Churchill et al. (2015) empirically proved the negative growth effect of government health expenditure using a sample of 306 estimates drawn from 31 primary studies.

Clearly, the available empirical research works is disparate. Hence, further efforts have been made in the following sections to shed more light on the topic.

3. Empirical analysis

3.1. Model specification and variable description

The impact of government health expenditure on economic growth has been studied empirically for the cases of developed and underdeveloped economies. Both static and dynamic analysis using panel data, were done to capture the impacts extensively.

For static analysis, the article resorts to a Fixed Effects (FE) model with both country and time fixed effects. The Hausman test and the test for including time fixed effects (testparm i.year) in Table 1 substantiates the superiority of a Fixed Effects model over Random Effects model and that including time fixed effects is necessary. The model used is specified as follows:

$$gdppc_{i,t} = a_0 + a_i + a_t + a_1 health_{i,t} + \Sigma a X_{i,t} + u_{i,t} \quad (1)$$

For the dynamic counterpart, the long and short-run relations between public health expenditure and growth will be estimated using a Panel Error Correction Model (PECM) of the form as follows:

$$gdp_{i,t} = \beta_0 + \beta_1 health_{i,t} + \beta X_{i,t} + m_{i,t} \quad (2)$$

$$\Delta gdp_{i,t} = d_0 + d_1 \Delta health_{i,t} + d\Delta X_{i,t} - \omega\left(gdp_{i,t-1} - \beta_0 - \beta_1 health_{i,t-1} - \beta X_{i,t-1}\right) + \Sigma_{i=1}^{N} \lambda_i + \Sigma_{t=1}^{T} \gamma_t + n_{i,t} \quad (3)$$

where $gdppc$ is annual GDP per capita growth rate and the dependent variable of the FE model; gdp is real GDP and the dependent variable of the PECM model; $health$ is government health expenditure and the independent variable of interest; a_i and a_t are time and country fixed effects respectively in equation (1); $\lambda_i$and γ_t in the short-run equation (3) are the country fixed effects and time dummies to control for unobserved heterogeneity and cross sectional dependence (CSD); and the term in the parenthesis in equation (3) is the error correction term. A vector of control variables X, has been carefully selected following several articles (eg. Barro, 1996; Ciccone and Jarociński, 2010; Odhiambo and Chirwa, 2016) and they are: inf is annual inflation rate and is used to control for macroeconomic stability; $trade$ is the trade share which is used as a control for the international exposure; $edin$ is the education index used a measure of human capital development; $credit$ is domestic credit to private sector which is used as a control for financial development in the economies; $agval$ and $inval$ are agricultural and industrial value addition respectively which control for the economic health; $gcapf$ is gross capital formation which is a proxy for physical capital measure/investment; and gov is a prepared composite index of governance using six governance indicators[(1)] to capture the institutional framework of the countries.

The long-run relationship estimation implies that there exists a cointegrating relationship between the variables and that the series are non-stationarity. It is also to be taken into account that in longer panels, individual time series are probably affected by the same common factors, resulting in the presence of CSD. Hence, a couple of testing procedures are to be carried out preliminarily. I begin by testing for the presence of CSD following Pesaran (2015) and subsequently, test for the presence of unit roots. At first, the CIPS test developed by Pesaran (2007) is used for series with CSD. The CIPS test belongs to the second-generation panel unit root tests and is robust in presence of CSD. For series with no CSD, I use Maddala and Wu (1999) first generation unit root test.

The cointegration relation of equation (2) is estimated using Panel Dynamic OLS (PDOLS) estimator. By adding lags and leads of the variables in (2), this estimator control for potential endogeneity. I, then estimate the PECM specification of equation (3) by using a standard fixed effects estimator.

3.2. Data type and source

The study involves annual data from a panel of 88 developing and 36 developed economies, ranging over the period from 2000 to 2018. The economies are classified following the annex prepared by Development Policy and Analysis Division (DPAD) of the Department of Economics and Social Affairs of the United Nations Secretariat (UN/DESA). All the data have been collected from World Bank World Development Indicators (2020 Q4 Edition), Worldwide Governance Indicators and Penn World Table (version 10.0).

3.3. Estimation and analysis

The FE estimation outputs are plotted in Table 1 along with the Hausman test and the time fixed effects test results.

Table 1. *Fixed effects estimation output*

Dependent Variable: $gdppc$		
	Developed Economies	Less Developed Economies
$health$	-0.3839** [0.2017]	0.153 [0.2376]
inf	0.0535 [0.04]	-0.0031** [0.001]
$trade$	0.0231*** [0.008]	0.0231*** [0.006]
$credit$	-0.0284*** [0.004]	-0.0294** [0.0126]
$edin$	0.6977 [6.1908]	1.3161 [5.3152]
$agval$	0.3825** [0.15]	-0.0274 [0.0384]
$inval$	0.0354 [0.0626]	0.1688*** [0.0339]
$gcapf$	0.2204*** [0.0349]	0.0753 [0.01987]
gov	0.2149 [0.4986]	1.122*** [0.4373]
Obs. (N)	575	1329
R^2	0.6701	0.3483
Hausman	0.0000	0.0000
testparm i.year	0.0000	0.0000
Prob>F	0.0000	0.0000

Note: ***, ** and * represent significance at 1%, 5% and 10% level respectively. Standard errors are shown in [].

The output for independent variable of interest $health$, is noted at the first row, followed by the control variables. The output shows that for the developed nations, public health expenditure has negatively affected economic growth. This result is in line with the explanations provided by Aísa and Pueyo (2006). Subsequently, it was found that though the coefficient of government health expenditure was positive for the less developed economies, no causal relationship could be established since the coefficient was not significant.

The dynamic estimation analysis is initiated by interpreting the test results of Pesaran (2015) test for CSD. From the first panel of Table 2, the outputs show that all the series display significant CSD except for gov in the case of less developed economies.

Table 2. *CSD and unit root tests*

	Pesaran (2015) Test for Cross Sectional Dependence										
	$gdppc$	gdp	$health$	inf	$trade$	$credit$	$edin$	$agval$	$inval$	$gcapf$	gov
DE	48.9***	73.4***	66.7***	22.4***	70.9***	61.8***	69.8***	45.5***	60.3***	57.7***	2.4***
LDE	27.0***	160.3***	109.0***	32.7***	113.7***	132.6***	156.8***	107.6***	121.1***	113.4***	1.2
lags	Maddala and Wu (1999) Panel unit Root Test for Less Developed Economies										
	$gdppc$	gdp	$health$	inf	$trade$	$credit$	$edin$	$agval$	$inval$	$gcapf$	gov
0	--	--	--	--	--	--	--	--	--	--	264.8***
1	--	--	--	--	--	--	--	--	--	--	210.6***
	Pesaran (2007) Panel Unit Root Test (CIPS) for Developed Economies										
	$gdppc$	gdp	$health$	inf	$trade$	$credit$	$edin$	$agval$	$inval$	$gcapf$	gov
0	-7.1***	3.208	1.07	-7.1***	3.92	-3.3***	0.7	-7.8***	1.17	-0.02	1.31
1	-2.4***	3.11	0.2	-1.4**	2.47	-2.05**	-1.11	-5.4***	4.29	-0.86	0.99
	Pesaran (2007) Panel Unit Root Test (CIPS) for Less Developed Economies										
	$gdppc$	gdp	$health$	inf	$trade$	$credit$	$edin$	$agval$	$inval$	$gcapf$	gov
0	-15.2**	3.205	-2.33	-17.5*	-0.64	2.93	2.72	0.207	-0.55	-1.7**	--
1	-7.6***	4.00	1.99	-5.98	1.26	3.75	4.08	0.72	1.15	-1.6**	--

Note: ***, ** and * represent significance at 1%, 5% and 10% level respectively.

Following the CSD test, the unit root tests are done. The lag specification is ranged from 0 to 1. The null hypothesis being existence of unit root, is accepted for all series with non-significant test statistics. Hence, the variables with significant test statistics are dropped out from the rest of the dynamic analysis. A point to note is that till now, GDP per capita growth was used as the dependent variable. Since, no unit root is found in that series, real GDP is used as the dependent variable in the PECM to indicate growth.

The outcomes of the Pedroni cointegration tests are displayed in Table 3. Skimming through the test results, we can confirm there exists a long-run cointegration relationship in equation (2).

Table 3. *Pedroni cointegration test*

	Developed Economies	Less Developed Economies
Panel v-Statistic	26.956***	10.031***
Panel rho-Statistic	5.354	10.489
Panel PP-Statistic	-9.089***	-3.15***
Panel ADF-Statistic	-9.224***	-2.208**
Weighted Panel v-Statistic	7.205***	-1.405
Weighted Panel rho-Statistic	7.191	10.903
Weighted Panel PP-Statistic	-1.084	-3.813***
Weighted Panel ADF-Statistic	-1.671**	-3.168***
Group rho-Statistic	9.101	13.823
Group PP-Statistic	-5.47***	-10.274***
Group ADF-Statistic	-2.016**	-4.395***

Note: ***, ** and * represent significance at 1%, 5% and 10% level respectively.

Estimation outcomes for (2) are shown in Table 4. The lags and leads for the PDOLS model are chosen as per AIC criterion. The model estimates a negative coefficient for public health expenditure for the developed economies and a positive coefficient for the less developed economies. Both the coefficients are highly significant at 1% level and hence, causal relationships could be established.

Table 4. *Government health expenditure and growth: The long-run relationship (PDOLS)*

Dependent Variable: gdp		
	Developed Economies	Less Developed Economies
$health$	-0.176*** [0.058]	0.4758*** [0.14]
$trade$	-0.005*** [0.001]	-0.005 [0.004]
$credit$		0.0268*** [0.009]
$edin$	-4.423*** [1.981]	18.574*** [1.695]
$agval$		-0.001 [0.02]
$inval$	0.042 [0.026]	0.0375 [0.023]
$gcapf$	0.03** [0.007]	
gov	0.247* [0.137]	
Obs.(N)	544	1127
R^2	0.9996	0.9469
Adj R^2	0.9992	0.9111

Note: ***, ** and * represent significance at 1%, 5% and 10% level respectively. Standard errors are shown in [].

In Table 5, the estimation results of equation (3) are shown. ECT is the error correction term. The result of a fixed effects model is plotted.

Table 5. *Government health expenditure and growth: PECM*

Dependent Variable: Δgdp		
	Developed Economies	Less Developed Economies
ECT	-0.4285*** [0.0441]	-0.0148*** [0.003]
$\Delta health$	-0.1022 [0.107]	-0.0355 [0.0639]
$\Delta trade$	-0.009** [0.004]	-0.0009 [0.001]
$\Delta credit$		-0.004 [0.004]
$\Delta edin$	-1.29 [2.873]	-0.1708 [1.709]
$\Delta agval$		0.003 [0.102]
$\Delta inval$	0.0429* [0.024]	0.0172** [0.008]
$\Delta gcapf$	-0.007 [0.0123]	
Δgov	-0.0973 [0.222]	
Obs. (N)	510	1061
R^2	0.6447	0.8128
Adj R^2	0.6025	0.7963

Note: ***, ** and * represent significance at 1%, 5% and 10% level respectively. Standard errors are shown in [].

From the PECM outputs, it is observed that there is no short-run causal effects of public health expenditure on growth. The coefficient of the ECT is negative and significant at the 1% level indicating that the short-run disturbances are persistent and that a deviation from the long-run equilibrium is corrected by approximately 42.8% over the following year for the developed economies and 1.4% for the less developed economies. In other words, there is long-run convergence towards equilibrium for both the cases.

4. Conclusion

Government spending is a key determinant of economic growth. Although, in general, excess government spending is known to have deleterious effects on economic growth, the relationship is not so straightforward owning to several characteristics of an economy. The positive health effects of government health expenditure dominate in the poorer countries where life expectancy is low, and the negative impacts of increased government health expenditure dominates in the developed countries where health is already optimised and cannot be improved significantly with further expenditure. Acknowledging these rationales, in this paper, I have analysed the impacts empirically. The empirical analysis has been carried out separately for developed and developing economies using a fixed effects and panel error correction model. The panel data consisted of 36 developed and 88 developing countries with the time period of 2000-2018. In the FE model, public health expenditure was found to have negatively impacted economic growth in the developed economies and no causal relationship among the variables in the developing economies. In the dynamic estimation analysis, the long-run cointegrating relationship was estimated using PDOLS methods. It was found that public health expenditure had negative effects on growth in the developed economies and positive effects in the developing economies which corroborates to the theory. However, no causal relationships could be established in the short-run for both the cohorts. The coefficients of the error correction terms in the panel error correction model confirmed that there was long-run convergence towards equilibrium in both the cases.

In this regard, it is worth noting that the paper is not free of shortcomings. Due to lack of data availability, the dataset had fewer observations and multiple gaps in the cross-sections. Hence, enhanced panel cointegration tests like the Westerlund could not be executed. For the same reason, I could not perform dynamic CCE estimation which is robust in presence of CSD, even though CSD was confirmed. The data availability issue also led to the dropping out of multiple cross-sections in the dynamic analysis. Hence, there could exist certain degrees of inaccuracies in the dynamic analysis. Lastly, the models weren't checked for endogeneity. Further scopes on the studies in this area involves finding more data, checking for endogeneity and if there exists any, more advanced estimation techniques like IV estimation or CCE-GMM estimation should be employed with suitable instruments in order to obtain more robust results.

Note

(1) The indicators are prepared by the Worldwide Governance Indicators (WGI) which are voice and accountability; political stability and absence of violence/terrorism; government effectiveness; regulatory quality; rule of law; and control of corruption. The indices are scaled

from -2.5 to 2.5 with 2.5 being the most favourable. Due to strong correlation, it would be inconvenient to use all the indices together. Also, if few variables are left out, we would be missing out crucial information. Hence, a composite index is prepared (Appendix III and Appendix IV).

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Appendix I. *List of developed economies*

Australia	Cyprus	Germany	Japan	New Zealand	Slovenia
Austria	Czechia	Greece	Latvia	Norway	Spain
Belgium	Denmark	Hungary	Lithuania	Poland	Sweden
Bulgaria	Estonia	Iceland	Luxembourg	Portugal	Switzerland
Canada	Finland	Ireland	Malta	Romania	UK
Croatia	France	Italy	Netherlands	Slovakia	USA

Appendix II. *List of less developed economies*

Algeria	Cambodia	Ethiopia	Korea Rep.	Myanmar	South Africa
Angola	Cameroon	Fiji	Kuwait	Namibia	Sri Lanka
Argentina	Central African Rep.	Gabon	Lesotho	Nepal	Tanzania
Bahamas	Chad	Gambia	Liberia	Nicaragua	Thailand
Bahrain	Chile	Ghana	Libya	Niger	Togo
Bangladesh	China	Guatemala	Madagascar	Nigeria	Tunisia
Barbados	Colombia	Guinea	Malawi	Pakistan	Turkey
Belize	Comoros	Haiti	Malaysia	Paraguay	Uganda
Benin	Congo Dem. Rep.	India	Maldives	Peru	Uruguay
Bhutan	Congo Rep.	Indonesia	Mali	Philippines	Venezuela
Bolivia	Cote d'Ivoire	Iran	Mauritania	Qatar	Vietnam
Botswana	Djibouti	Iraq	Mauritius	Rwanda	Zambia
Brazil	Egypt	Israel	Mexico	Senegal	Zimbabwe
Burkina Faso	Eritrea	Jamaica	Morocco	Seychelles	
Burundi	Eswatini	Kenya	Mozambique	Singapore	

Appendix III. *PCA of governance variable in developed economies*

Eigenvalues: (Sum = 6; Average = 1)					
Number	Value	Difference	Proportion	Cumulative Value	Cumulative Proportion
1	5.072210	4.500642	0.8454	5.072210	0.8454
2	0.571567	0.419898	0.0953	5.643777	0.9406
3	0.151669	0.043524	0.0253	5.795446	0.9659
4	0.108145	0.055227	0.0180	5.903591	0.9839
5	0.052918	0.009427	0.0088	5.956509	0.9928
6	0.043491	-----	0.0072	6.0000	1.0000

Eigenvectors (loadings)						
Variables	PC 1	PC 2	PC 3	PC 4	PC 5	PC 6
$voac$	0.423540	-0.079210	-0.161671	-0.860455	0.210004	0.060977
$polst$	0.309936	0.946092	0.075948	0.046981	-0.022752	0.018885
$goveff$	0.427297	-0.123680	-0.339209	0.460583	0.660318	0.197235
$regq$	0.411114	-0.209511	0.875752	0.078777	0.059124	0.102208
$rolw$	0.433382	-0.126466	-0.132929	0.137379	-0.216029	-0.844379
$concor$	0.430274	-0.153136	-0.261571	0.142111	-0.684980	0.483323

Correlation Matrix						
	$voac$	$polst$	$goveff$	$regq$	$rolw$	$concor$
$voac$	1.000000					
$polst$	0.616562	1.000000				
$goveff$	0.896875	0.602657	1.000000			
$regq$	0.864800	0.543504	0.867646	1.000000		
$rolw$	0.922589	0.611649	0.947116	0.897941	1.000000	
$concor$	0.918144	0.592539	0.944122	0.882043	0.954365	1.000000

Appendix IV. *PCA of governance variable in less developed economies*

Eigenvalues: (Sum = 6; Average = 1)					
Number	Value	Difference	Proportion	Cumulative Value	Cumulative Proportion
1	4.620526	4.051100	0.7701	4.620526	0.7701
2	0.569426	0.087484	0.0949	5.189952	0.8650
3	0.481942	0.305538	0.0803	5.671894	0.9453
4	0.176404	0.093238	0.0294	5.848299	0.9747
5	0.083166	0.014631	0.0139	5.931465	0.9886
6	0.068535	---	0.0114	6.000000	1.0000

Eigenvectors (loadings):						
Variables	PC 1	PC 2	PC 3	PC 4	PC 5	PC 6
$voac$	0.347913	-0.528605	0.760028	-0.122513	0.080544	0.019845
$polst$	0.343524	0.789312	0.425576	0.260268	0.055776	0.083735
$goveff$	0.436838	-0.089051	-0.351010	-0.009452	0.735033	0.371041
$regq$	0.424739	-0.269109	-0.227443	0.677334	-0.461943	0.152557
$rolw$	0.448440	0.021796	-0.190025	-0.086312	0.080947	-0.865052
$concor$	0.434302	0.129375	-0.173765	-0.671513	-0.479775	0.288678

Correlation Matrix						
	$voac$	$polst$	$goveff$	$regq$	$rolw$	$concor$
$voac$	1.000000					
$polst$	0.465392	1.000000				
$goveff$	0.606100	0.586464	1.000000			
$regq$	0.662952	0.536402	0.883935	1.000000		
$rolw$	0.645952	0.674063	0.919276	0.875094	1.000000	
$concor$	0.607260	0.680461	0.878571	0.792763	0.907286	1.000000

Appendix V. *Variable statistics for developed economies*

Variables	Observations	Mean	Std. Dev.	Min	Max
$gdppc$	720	2.058	3.279	-14.268	23.985
gdp	720	12.243	29.39	0.093	207.913
$health$	684	5.962	1.588	2.18	9.273
inf	720	2.575	3.465	-9.727	43.180
$trade$	718	104.73	63.147	19.798	408.362
$credit$	639	99.521	49.522	0.186	308.978
$edin$	684	0.826	0.066	0.648	0.946
$agval$	713	2.481	1.776	0.214	13.149
$inval$	713	24.124	5.471	9.984	40.294
$gcapf$	718	23.04	4.267	10.217	43.821
gov	684	5.04e-09	1.000	-2.141	1.54

Appendix VI. *Variable statistics for less developed economies*

Variables	Observations	Mean	Std. Dev.	Min	Max
$gdppc$	1737	2.247	5.466	-62.378	121.779
gdp	1720	4.765	16.609	0.01435	199.19
$health$	1658	2.111	1.29	0.061	7.367
inf	1731	9.249	64.855	-26.1	2630.123
$trade$	1696	77.929	50.555	0.167	437.326
$credit$	1591	36.733	34.079	0.491	164.664
$edin$	1659	0.514	0.159	0.116	0.876
$agval$	1682	15.648	12.302	0.028	79.042
$inval$	1657	28.038	12.677	3.243	87.796
$gcapf$	1671	23.946	9.544	-0.098	77.89
gov	1672	3.97e-09	1.000	-1.772	3.619

Appendix VII. *Empirical analysis variable descriptions*

Variables	Descriptions	Source
$gdppc$	*GDP per capita growth (annual %)*. Growth rate of per capita GDP annually.	The World Bank
gdp	*Real GDP (hundred thousand)*. Expenditure-side real GDP at current PPPs.	Penn World Table
$health$	*Domestic general government health expenditure (% of GDP)*. Public expenditure on health from domestic sources as a share of total public expenditure. It indicates the priority of the government to spend on health from own domestic public resources.	The World Bank
inf	*Inflation, GDP deflator (annual %)*. It as measured by the annual growth rate of the GDP implicit deflator shows the rate of price change in the economy as a whole.	The World Bank
$trade$	*Trade (% of GDP)*. Ratio of total of exports and imports to GDP	The World Bank
$credit$	*Domestic credit to private sector (% of GDP)*. It refers to financial resources provided to the private sector, such as through loans, purchases of nonequity securities, and trade credits and other accounts receivable, that establish a claim for repayment.	The World Bank

Variables	Descriptions	Source
$edin$	*Education Index*. It is an average of mean years of schooling (of adults) and expected years of schooling (of children), both expressed as an index obtained by scaling with the corresponding maxima.	UNDP HDR Database
$agval$	*Agriculture, value added (% of GDP).* Agriculture corresponds to ISIC divisions 1-5 and includes forestry, hunting, and fishing, as well as cultivation of crops and livestock production. Value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs.	The World Bank
$inval$	*Industry, value added (% of GDP).* It comprises value added in mining, manufacturing, construction, electricity, water, and gas.	The World Bank
$gcapf$	*Gross capital formation (% of GDP)*. It consists of outlays on additions to the fixed assets of the economy plus net changes in the level of inventories.	The World Bank
gov	*Governance.* Principal Component Analysis of six governance indicators.	Worldwide Governance Indicators