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The cyclicality of government health expenditure and its effects on population health

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ABSTRACT

Scholars have raised concerns that cutbacks on government health expenditure (GHE) during recessions may jeopardise population health. The present research investigates the extent to which population health outcomes are affected by responses of GHE to business cycles, i.e., *cyclicality* of GHE. We estimate GHE cyclicality by regressing detrended GHE on detrended gross domestic product (GDP). Our analysis of data for 1995 through 2014 from 135 developing countries shows that mean cyclicality is 0.61, or that a one percent deviation from the GDP trend is positively correlated with a 0.61 percent deviation from the GHE trend. Further, countries in which GHE is less procyclical appear to have shorter life expectancies and higher adult mortality rates. These results suggest that reducing procyclicality of GHE by protecting GHE in bad times may generate substantial health gains. Importantly, our results show that increasing the weight of social security funds in health budgets, and improving institutional quality, can be critical to breaking the procyclical pattern of GHE.

1. Introduction

Harmful health effects of economic downturns for developing countries, as exemplified by observed increases in mortality rates, are well documented [1–6]. There are several transmission mechanisms through which economic decline harms health. The two primary pathways from economic crisis to health outcomes are reductions in household incomes and in government health expenditure (GHE) [4,7]. Contraction in GHE during recessions may exacerbate the health risk imposed by reductions in household spending on health care and on other consumption (e.g., nutrition) that supports health. In particular, scholars have raised concerns that cutbacks on GHE during recessions could further jeopardise population health [8], and that government budgetary responses can crucially influence the magnitude of health risks arising from economic crises [9,10]. A World Health Organization (WHO) high-level consultation urged all countries to build awareness of how economic downturns affect health spending and outcomes, and to "identify actions that can help to mitigate the negative impact of economic downturns" [11]. Such messages' common theme is that responses of government health spending to economic decline are critical, and that a constructive role exists for state activity during economic downturns.

In spite of these lessons, history shows that it is often all too easy for governments to decrease health spending during busts, only to increase it during booms. For example, the 1997 Asian economic crisis [4] and the 2008–2009 global financial crisis [12,13] both resulted in GHE contraction across countries, to varying degrees. One reason may be related to absence of sufficient evidence to inform policy makers of the long-term health consequences resulting from short-term changes in government health spending. The present authors seek to help fill this gap for developing countries by examining the extent to which population health outcomes are affected by responses of GHE to business cycles, i.e., cyclical responses, or *cyclicality*, of GHE. This study also looks into factors that may explain differential GHE cyclicality. We explore whether, in addition to the usual determinants of fiscal cyclicality, health financing factors, including the size of social security fund for health, may explain variation in cyclical responses of GHE.

The cyclical response of GHE can affect all countries' health sectors and subsequently their health outcomes in several ways. One is through effects on the provision of public health services. All public health systems need predictable resources in order to maintain necessary levels of services, e.g., screening and immunization, irrespective of the economic situation. There is also danger that cost-effective preventive care may be sacrificed in the face of

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budgetary pressures [11]. Furthermore, during recessions demand for health services is likely to shift somewhat from private to public sector, where health care is usually less expensive to households. Cutting back on GHE in bad times could result in undersupply of public services that are most crucial when household incomes drop.

The positive association of GHE and gross domestic product (GDP) over business cycles, i.e., *procyclical* responses of GHE, is more detrimental to developing than to developed countries. One reason concerns universal health coverage, a key health target of United Nations' Sustainable Development Goals. Universal health coverage includes "financial risk protection, access to quality essential health-care services and access to safe, effective, quality and affordable essential medicines and vaccines for all" [14]. While this can be achieved through introducing effective publicly financed insurance or social security funds for health, reductions in those funds during economic downturns are likely to have the greatest negative impacts on the poor and vulnerable – those hit hardest by recessions. Undeniably, the financial protection function of GHE generates a uniquely vital need for the state to respond to the business cycle in a non-procyclical manner. Additionally, in poor countries, the effect of economic fluctuations on public spending on health may well be a matter of life and death for some. When an economic downturn threatens to bring irreversible health effects, timely and adequate public fiscal response is critical. Such a short-run effect on major life risks is almost certainly not typically found to an equivalent degree in other types of social spending, such as education or housing.

A World Bank volume [7] provides a framework for accessing, tracking and mitigating the impacts of economic crises on the health sector. However, empirical analysis of GHE responses to business cycles is limited. Known to us are five related studies on OECD countries [15–19]; two studies on European countries [20,21]; four studies with global coverage [22–25] and one on China [26]. Among the few studies covering developing countries, the results are mixed: Arze del Granado et al. [24], Velenyi et al. [25], and Chen [26] find GHE in general to be procyclical; Afonso et al. [23] report that GHE moves with no clear pattern relative to GDP, i.e., GHE is acyclical; and Doytch et al. [22] conclude that GHE is procyclical in middle-income and acyclical in low-income countries.

Still fewer studies have looked into the connection of cyclical response of GHE to population health. Researchers have argued that more effort should be devoted to the consequences for health of GHE contractions due to economic crises [21]. Cleeren et al. [19] provide evidence for OECD countries that falling public healthcare expenditure during economic downturns actually reduces mortality rates. There is no similar evidence from developing countries.

Analysis of explanatory factors for GHE cyclicality has focused almost exclusively on developed countries [16,18,19]. The factors examined include, among others, credit restraint and political polarization. The single study known to us which focuses on less-developed countries is Doytch et al. [22], which concludes that corrupt middle-income developing countries tend to have procyclical GHE. Developing countries differ greatly from developed countries in government borrowing constraints and political economy. Hence, we are interested in whether factors found to be related to GHE cyclicality in developed countries exhibit the same relationship with GHE cyclicality in developing countries.

The present study is original in a number of ways. We explore the pathway from recessions to health outcomes through changes in GHE over business cycles for developing countries. Our method is that we first estimate responses of GHE to business cycles by regressing detrended GHE on detrended gross domestic product (GDP). We then examine the impact of GHE cyclicality on population health outcomes. We thus diverge from the usual method of regressing health outcomes directly on the economic cycle. It is important to examine GHE cyclicality because by acting on GHE, countries may be able to change the effects of the recessions on health outcomes. Further, our analysis of determinants of GHE cyclicality leads to strategies for changing cyclicality of GHE and subsequently increasing health gains. This work thus responds to the global agenda (of, e.g., WHO and the World Bank) for making the health sector more resistant to economic crises. Our sample includes 135 developing countries, which extends the geographic reach of GHE cyclicality literature to low- and middle-income countries. This large sample enables the present study to generate findings on the impact of government responses to economic crises beyond country case studies.

2. Materials and methods

GHE analysed in this study is equivalent to ğeneral government expenditure on healthäs defined by the WHO [27].

2.1. Estimating the cyclical response of government health expenditure

The present study follows the definition of comovement in economic time series, and defines GHE as pro/countercyclical when it is above/below trend, respectively, when GDP is above trend. To estimate the cyclical response of GHE, we decompose both GHE and GDP into trend and cyclical components by using the Hodrick-Prescott filter. Using data from 1995 to 2014, we then run country-by-country time-series regressions of the form:

$$ghe\_gap_{i,t} = \beta_i gdp\_gap_{i,t} + \varepsilon_{i,t} \quad (1)$$

where $ghe\_gap_{i,t}$ and $gdp\_gap_{i,t}$ refer to gaps (or cyclical components) of GHE and GDP for country i in year t, respectively. They are also termed detrended GHE and detrended GDP, respectively. A positive/negative GDP gap indicates an economic expansion/contraction. The coefficient (β_i) for de-trended GDP is the *cyclicality parameter* for a country as indexed by i. Its estimate $\hat{\beta}_i$ is the measure for cyclicality of GHE and is a key result in this study. A positive value for the cyclicality parameter indicates that GHE is procyclical; a negative value indicates that GHE is countercyclical. Because we transform GHE and GDP into natural logarithms, the cyclicality parameter has an interpretation of comovement elasticity: when GDP deviates from its trend by one percent, GHE deviates from GHE trend by β_i percent. Appendix A-1 discusses other methods for estimating cyclicality of a fiscal variable and reasons we adopt a time-series approach to estimate GHE cyclicality.

2.2. The health model: Estimating the effect of cyclicality of government health expenditure on population health outcomes

In assessing the relationship between cyclicality in GHE and population health outcomes, we specify a model for health, in the form of a cross-sectional regression, as

$$health_i = \gamma_0 + \gamma_1 \hat{\beta}_i + \gamma_2 income_i + \gamma_3 environment_i + \gamma_4 h\_system_i + u_i \quad (2)$$

Subscript i denotes the time-averaged value for country i of the corresponding variable over the study period of 1995-2014. $\hat{\beta}_i$ is the estimate for country i's cyclicality parameter obtained from Eq. (1), and $\gamma_2 \sim \gamma_4$ refer to vectors of coefficients. The estimate of interest in this model is γ_1, which captures the linkage between GHE cyclicality and population health. The dependent variable, population health outcomes ($health_i$), is measured by life expectancy at birth and adult mortality rates. Mortality rate is the probability of dying between ages of 15 and 60 per 1,000 adults. We transform both variables into natural logarithms to improve model fit. We hypothesize

that population health is worse in countries with more procyclical GHE, i.e., where the cyclicality parameter is positive and relatively large. Thus we expect γ_1 to be negative for the life expectancy and positive for the adult mortality rate model.

Other health determinants in the literature are included in Eq. (2). Income-related factors ($income_i$) include variables for GDP trend and income inequality as measured by Gini index. Environmental risk factors ($environment_i$) include variables for the share of population exposed to air pollution and that with access to an improved water source. Health-system factors (h_system_i) include variables for the share of deliveries attended by skilled health staff, and the share of children immunized against diphtheria, pertussis, and tetanus (DPT). For detailed descriptions of the variables in Eq. (2), see Appendix A-2.

Note that we did test an alternative specification for the health model, using trends in life expectancy and adult mortality rates as the dependent variables, which did not markedly change regression results. In addition, we tested additional control variables, including national (total) health expenditure, private health expenditure, primary school enrolment rate, persons over 65 as share of population, and female as share of population. None of these control variables was statistically significant. They are all excluded from our final specification.

2.3. Model for determinants of cross-country variation in cyclicality of government health expenditure

In examining determinants of cyclical responses of GHE, we treat the GHE cyclicality parameter estimate ($\hat{\beta}_i$) as the dependent variable, and explore health financing and political economy variables that may contribute to variation in GHE cyclicality across countries. The model for determinants of GHE cyclicality is expressed as a cross-sectional regression:

$$\hat{\beta}_i = \delta_0 + \delta_1 priority_i + \delta_2 aid_i + \delta_3 ssf_i + \delta_4 democracy_i + \delta_5 institution_i + v_i \quad (3)$$

where $\hat{\beta}_i$ is obtained from Eq. (1), and subscript i indexes countries as above. All explanatory variables are the time-averaged values for country i.

Health financing policies must be developed in the context of a government's fiscal space [28]. Principal among ways to create fiscal space for health would appear to be prioritization of health within government budgets ($priority_i$), and receipt of external grants for health (aid_i) [29]. We postulate that GHE may be less procyclical in countries which prioritize GHE or receive more health aid. We measure prioritization of health by the ratio of GHE to general government expenditure, as in Tandon et al. [30]. External health aid is measured by the trend component of log-transformed development assistance for health, as obtained by using the Hodrick-Prescott filter. Moreover, GHE cyclicality is likely to be associated with the role played by social security agencies among the various financing agents in the health sector. Social security agencies are typically organized separately from other activities of government units, with their own revenue sources [31]. As a consequence of their fiscal independence, social security funds for health (SSF) may display cyclical behavior which differs from that displayed by other sources of funds. To capture this effect, we rank countries by their SSF to GHE ratios, and introduce two dummy variables for countries in the top and second quarter (collectively termed ssf_i), respectively.

We consider two political economy factors that potentially explain cyclicality of GHE: political polarization ($democracy_i$) and institutional quality ($institution_i$). Political polarization is associated with the "voracity effect", the phenomenon of government spending increasing more than proportionally relative to income during economic upturns due to multiple powerful groups contending for fiscal resources [32,33]. This effect is especially prominent when political power is dispersed among several parties or coalitions. Power dispersion is more likely to be observed in democracies than in autocracies. Accordingly, we postulate that the more democratic a country is, the more procyclical its GHE will be. On the subject of institutional quality, Calderón et al. [34] find that the level of institutional quality is critical to achieving countercyclical macroeconomic policies. Thus, we conjecture that the greater is institutional quality, the less procyclical GHE will be. We measure the level of democracy and institutional quality by using two indicators developed by the International Country Risk Guide (ICRG), "democratic accountability" and "bureaucracy quality" [35]. We convert the original scores of both ICRG indicators to scales ranging from 0 to 1, where a higher value indicates greater democracy or institutional quality. For measurement issues regarding SSF and ICRG indicators, see Appendix A-3.

2.4. Estimation strategies and study sample

A complication arising in the present analysis is that some of the independent variables in Eqs. (2) and (3) may be correlated with the error terms, thus leading to inconsistent estimates of regression coefficients. Those endogenous independent variables include the income-related variables (i.e. GDP trend and Gini index) in the health model, and the variable for prioritization of health and health aid in the model for determinants of GHE cyclicality. Reasons for endogeneity of these variables are discussed in Appendix A-4.

To resolve endogeneity problems, we estimated the health model and model for determinants of GHE cyclicality, using two-stage least squares method. We have chosen instrumental variables that are correlated with endogenous independent variables, and not correlated with the error terms. For the health model, we instrument for country i's GDP trend using the weighted sum of per capita GDP trends of country i's export trade partners. The Gini index is instrumented by residuals from a double-log regression of the Gini index on life expectancy and adult mortality rates. With respect to the model for determinants of GHE cyclicality, we use country i's own ratio of GHE to general government expenditure for year 1995 (the first year of the study period) as an instrumental variable for prioritization of health. The trend of health aid is instrumented by the weighted sum of GDP trends for donor countries. Formal tests show that the proposed instrumental variables are valid. Appendix A-4 details construction and validity of these instrumental variables. We correct for non-constant variance in both models by using robust standard errors. All estimation is undertaken using Stata 15.

The full sample used to estimate the GHE cyclicality parameter (β_i) consists of 135 developing (79 middle- and 56 low-income) countries for the twenty-year study period, 1995 through 2014 (Eq. (1)). For the health model (Eq. (2)) and model for determinants of GHE cyclicality (Eq. (3)), the number of sample countries varies according to data availability. See Appendix A-5 for country inclusion criteria and a list of countries analysed in different models. All fiscal variables used in this study are in per capita terms and are expressed in constant 2011 international dollars. Table 1 summarizes model variables and corresponding data sources.

3. Results

3.1. Estimates for cyclicality of government health expenditure

This section presents results from Eq. (1) for estimating cyclicality of GHE. Estimates for country-specific cyclicality parameters ($\hat{\beta}_i$) are provided in Appendix A-5 and summarized in Table 2. Table 2 shows that GHE is procyclical in approximately 70% of developing

Table 1
Descriptive statistics and sources of data.

	N[a]	Mean	S.D.[b]	Min	Max	Data source
Life expectancy (years)	115	64.80	8.66	42.69	78.18	WDI[e]
Adult mortality rate (per 1000 adults)	115	233.23	106.19	84.39	596.95	WDI/HNP[f]
Trend of per capita GDP (100 international dollars)	115	71.44	59.75	5.90	251.48	WDI
Gini index (from 0 to 100)	115	41.73	8.96	23.36	62.60	WDI
Share of population exposed to air pollution	115	0.73	0.37	0.00	1.00	WDI
Share of population with access to clean water	115	0.80	0.17	0.37	1.00	WDI
Share of deliveries attended by skilled health staff	115	0.74	0.26	0.12	1.00	WDI
Share of children immunized against DPT[c]	115	0.82	0.15	0.31	0.99	WDI
Prioritization of health (ratio of GHE to GGE[d])	87	0.11	0.04	0.03	0.24	GHED[g]
Trend of per capita health aid (international dollars)	87	16.14	20.72	0.30	120.69	IHME[h]
Social security funds for health[j]						
If SSF-to-GHE ratio between 0.12 and 0.45 (= 1)	87	0.25	0.44	0.00	1.00	GHED
If SSF-to-GHE ratio greater than 0.45 (= 1)	87	0.25	0.44	0.00	1.00	GHED
Democratic accountability (ICRG scores, from 0 to 1)	87	0.63	0.22	0.08	0.98	ICRG[i]
Bureaucracy quality (ICRG scores, from 0 to 1)	87	0.46	0.19	0.00	0.85	ICRG

[a] N = number of countries.
[b] S.D.= standard deviation.
[c] DPT = diphtheria, pertussis, and tetanus.
[d] GGE = general government expenditure.
[e] WDI = World Development Indicators (published by the World Bank).
[f] HNP=Health, Nutrition and Population statistics (published by the World Bank).
[g] GHED = Global Health Expenditure Database (published by WHO).
[h] IHME = the Institute for Health Metrics and Evaluation (see Financing global health 2015: development assistance steady on the path to new global goals. Seattle, WA: IHME, 2016.).
[i] ICRG=International Country Risk Guide (published by Political Risk Services Group).
[j] For the distribution of SSF-to-GHE ratio, the 2nd and 3rd quartiles are equal to 0.12 and 0.45, respectively.

Table 2
Summary of estimates for cyclicality parameter for government health expenditure, by income group and WHO region.

Country classification	Number (%) of countries for which GHE is pro- or countercyclical					Cyclicality parameter estimate, $\hat{\beta}_i$		
	Procyclical, $\hat{\beta}_i>0$		Countercyclical, $\hat{\beta}_i<0$		Total	Mean[S.D.]	Min	Max
All developing countries	94	(69.63)	41	(30.37)	135	0.61[1.53]	−4.75	5.65
By income group								
Middle-income	55	(69.62)	24	(30.38)	79	0.67[1.46]	−2.49	5.65
Low-income	39	(69.64)	17	(30.36)	56	0.53[1.63]	−4.75	3.97
By WHO region								
African Region	32	(76.19)	10	(23.81)	42	0.98[1.65]	−2.49	5.04
Region of the Americas	17	(62.96)	10	(37.04)	27	0.48[1.39]	−1.45	3.94
Eastern Mediterranean Region	11	(68.75)	5	(31.25)	16	0.80[1.68]	−1.38	5.65
European Region	21	(75.00)	7	(25.00)	28	0.39[0.85]	−1.43	2.47
South-East Asia Region	4	(57.14)	3	(42.86)	7	0.25[2.23]	−3.99	3.01
Western Pacific Region	9	(60.00)	6	(40.00)	15	0.21[1.83]	−4.75	2.74

Note: Mean[S.D.] shown in the fifth column is the unweighted arithmetic means and standard deviations of estimates of GHE cyclicality parameter for country classifications indicated.

countries studied. The mean of cyclicality parameter estimates for all developing countries is 0.61: a one percent deviation from the GDP trend is positively correlated with a 0.61 percent deviation from the GHE trend.

Countries in the same region may be prone to common economic shocks; we thus further examine the cyclical response of GHE in the six WHO regions. Table 2 shows that the mean of cyclicality estimates is the greatest (0.98) in the African Region, followed by the Eastern Mediterranean Region (0.80). By contrast, the means of cyclicality estimates, though positive, are much smaller for the South-East Asia (0.25) and Western Pacific (0.21) Regions.

Fig. 1 shows distributions of cyclicality parameter estimates. The y-axis denotes fractions of countries within individual WHO regions. At the x-axis, a solid vertical line denotes the mean of cyclicality estimates. Countries to the right/left of a dashed line (which denotes $\hat{\beta}_i = 0$) have GHE that is pro/countercyclical. It can be observed that the variability of cyclicality estimates is high within all regions, except for the European Region.

3.2. Effects of cyclicality of government health expenditure on population health

We display the relationship between GHE cyclicality estimates and time-averaged population health outcomes across countries in Fig. 2. The figure shows that GHE cyclicality estimates are negatively correlated with life expectancy and positively correlated with adult mortality rates.

These relationships are confirmed by results from the health model (Eq. (2)) presented in Table 3. The regressions show that, when controlling for income-related, environmental, and health-system factors, the procyclical response of GHE (a higher value of $\hat{\beta}_i$) is negatively related to population health outcomes. A unit increase in (pro)cyclicality of GHE is associated with a 1.5 percent reduction in life expectancy (p-value<0.05), and with a 5.6 percent increase in the adult mortality rate (p-value<0.05). These figures approximate roughly 0.97 life year lost per person (multiplying 0.015 by 64.8, the mean life expectancy in Table 1) and 13.1 lives lost over the study period per 1000 adults (multiplying 0.056 by 233.2, the mean

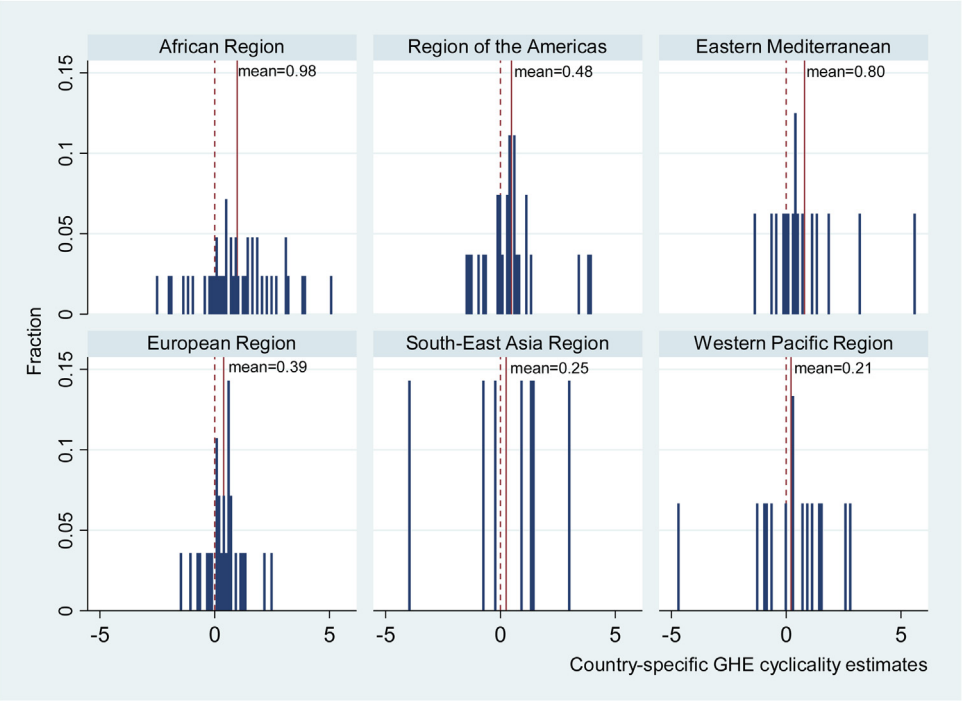

Fig. 1. Distribution of GHE cyclicality parameter estimates ($\hat{\beta}_i$) for 135 developing countries, by WHO region.
Note: The x-axis denotes country-specific GHE cyclicality estimates ($\hat{\beta}_i$) obtained from Eq. (1). The y-axis denotes fractions of countries. The dashed line denotes zero at x axis. The solid line denotes the unweighted arithmetic means of GHE cyclicality estimates for countries in WHO region indicated.

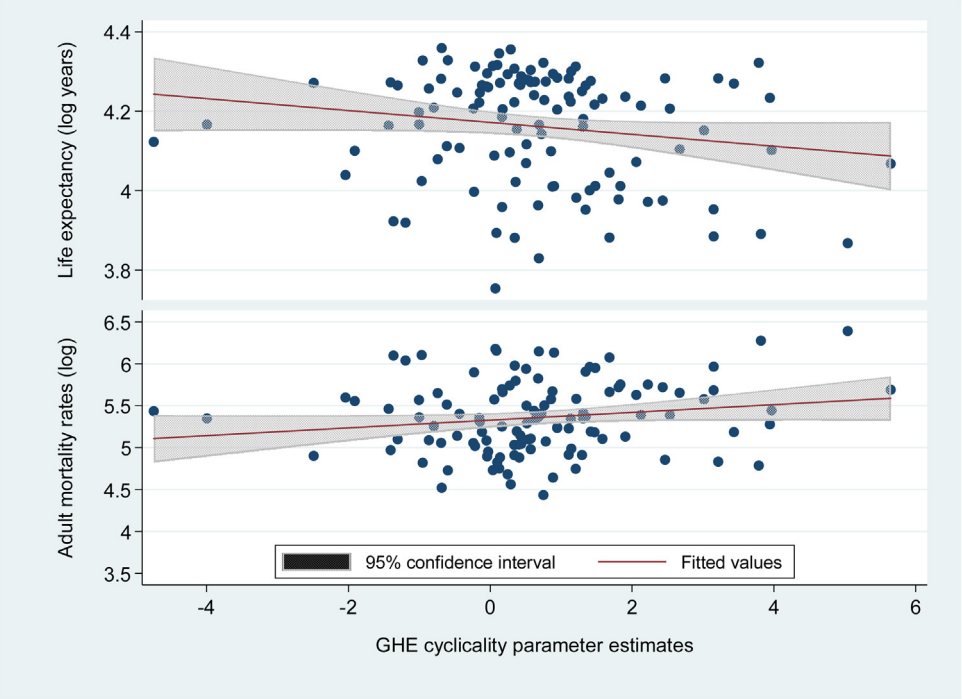

Fig. 2. Cross-sectional relationship of GHE cyclicality with time-averaged life expectancy and adult mortality rates for 115 sample countries over 1995-2014.
Note: Fitted values are linear predictions of estimates for GHE cyclicality on life expectancy and adult mortality rates, respectively.

mortality rate per 1000 adults in Table 1) for developing countries analysed. Note that because GHE cyclicality is itself a percentage, a unit increase in GHE cyclicality, from $\hat{\beta}_i$ to $\hat{\beta}_i$ +1, means a one percentage point increase in deviation of GHE from its trend when GDP deviates from its trend by one percent.

For sensitivity analysis, we used alternative thresholds to determine the statistical significance of GHE cyclicality estimates $\hat{\beta}_i$ and then re-ran the health model. The regression results did not change markedly. See Appendix A-6 for related discussion.

Table 3
Regression results from the health model.

	Life expectancy, in log *years*		*Adult mortality rate, in logs*	
Explanatory variables	Coef.	P-value	Coef.	P-value
Cyclicality of government health expenditure, $\hat{\beta}_i$	−0.015	(0.019)	0.056	(0.029)
Income-related factors				
Per capita GDP trend (in logs)	−0.018	(0.582)	0.209	(0.148)
Gini index (in logs)	−0.066	(0.124)	0.016	(0.943)
Environmental risk factors				
Share of population exposed to air pollution	−0.027	(0.288)	−0.106	(0.301)
Share of population with access to clean water	0.384	(0.004)	−1.543	(0.002)
Health-system factors				
Share of deliveries attended by skilled staff	0.175	(0.020)	−0.690	(0.032)
Share of children immunized against DPT[a]	0.172	(0.053)	−0.346	(0.335)
Number of observations or countries	*115*		*115*	

Notes: [a]DPT = diphtheria, pertussis, and tetanus. Regressions are estimated by using two-stage least squares method. The endogenous variables are per capita GDP trend and Gini index. The instrumental or excluded exogenous variables are the weighted sum of per capita GDP trends of country i's export trade partners, and residuals from a double-log regression of the Gini index on life expectancy and adult mortality rates. A total of 115 countries are included in this analysis. All model variables, except GHE cyclicality, are time-averaged values for individual countries. Heteroskedasticity-robust standard errors are used.

Table 4
Regression results from model for determinants of cyclicality of government health expenditure (GHE).

	Cyclicality of GHE, $\hat{\beta}_i$	
Explanatory variable	Coef.	P-value
Prioritization of health (ratio of GHE to GGE[a])	−7.925	(0.196)
Trend of per capita health aid (in logs)	−0.141	(0.395)
If SSF[b]-to-GHE ratio between 0.12 and 0.45 (= 1)	−0.012	(0.972)
If SSF-to-GHE ratio greater than 0.45 (= 1)	−0.482	(0.045)
Democratic accountability (from 0 to 1)	1.767	(0.014)
Bureaucracy quality (from 0 to 1)	−1.748	(0.046)
Number of observations or countries	*87*	

Notes: [a]GGE = general government expenditure; [b]SSF = social security funds for health. The model is estimated by using two-stage least squares method. The endogenous variables are prioritization of health and trend of per capita health aid. The instrumental (excluded exogenous) variables are country i's own ratio of GHE to general government expenditure for year 1995 (the first year of the study period), and the weighted sum of GDP trends for donor countries. All explanatory variables are time-averaged values for individual countries. Regression is weighted by the inverse of the variance of the GHE cyclicality estimates to account for different degrees of precision of the dependent variable across countries. Heteroskedasticity-robust standard errors are used.

3.3. Determinants of cross-country variation in cyclicality of government health expenditure

Table 4 presents results for determinants of GHE cyclicality. Of the three health financing factors investigated, prioritization of health, health aid and the share of social security funds, only the last appears to be significant. The interpretation is that, as compared with countries in the bottom half of the distribution (the reference group), countries in the top quarter of the distribution, those with the greatest shares of social security funds for health (over 45% of GHE) have GHE that is less procyclical ($p < 0.05$). For the political economy variables, regression results show that countries with higher levels of democracy have GHE that is more procyclical (p-value<0.05), and that countries with better institutional quality have GHE that is less procyclical (p-value<0.05).

4. Discussion

4.1. GHE is procyclical for average low- and middle-income countries

Our estimates indicate that GHE is procyclical for average low- and middle-income developing countries, taken as a group (Table 2). This result agrees with findings from three of the five prior studies discussed above [24–26]. Another result which deserves attention is that the African Region has GHE that is the most procyclical among WHO regions. In the 2001 Abuja Declaration [36] members of the African Union set a target that government health expenditure would rise to 15 percent of their annual budgets. Setting goals as a percentage of government budgets may mean setting a procyclical target.

4.2. Countries where government health expenditure is more procyclical have shorter life expectancies and higher adult mortality rates

Using cross-sectional data aggregated over twenty years, we demonstrate that, controlling for various health determinants, countries where GHE is more procyclical appear to have shorter life expectancies and higher adult mortality rates (Table 3). This result is in contrast to that of Cleeren et al. [19] for OECD countries – all of them developed – showing that procyclicality of public healthcare spending actually drives down the growth in the mortality rate in these countries. Cleeren et al. [19] argue that cutting public healthcare expenditure is easier to justify during economic contraction, and could make the health sector more efficient.

For developing countries, our results indicate that moving away from procyclical toward countercyclical response of GHE may yield health gains, which seems intuitive. Governments of developing countries generally underspend rather than overspend on health. Thus, reducing public spending on health in bad times is likely to move a country away from the optimum in relation to population health in the developing world.

Given limited public resources in most developing countries, moving GHE in a more countercyclical direction is apt to mean reducing GHE in good times and increasing it in bad times. To examine whether the relationship between GHE cyclicality and population health differs as between booms and busts, we revise the time-series regression shown by Eq. (1) and estimate the cyclicality parameter separately for periods of booms and busts. The resultant dual cyclicality parameter estimates are then included in the health model (Eq. (2)) as the key explanatory variables to capture the link between GHE cyclicality and population health during booms and busts, respectively. See Appendix A-7 for specification of and regression results from this extended health model. The results indicate that reductions in GHE during busts are associated with reduced life expectancies and increased adult mortality rates. The response of GHE during booms, by contrast, seems to have little connection with population health. The results for both booms and

busts support a countercyclical strategy for GHE, since reductions in GHE during booms (i.e., countercyclical changes in good times) are not associated with population health; while increases in GHE during busts (i.e., countercyclical changes in bad times) are likely to generate greater health gains than would similar increases in GHE during booms.

Moreover, findings of potential health gains (approximately 0.97 life year per person and 13.1 lives saved per 1000 adults) associated with a unit reduction in (pro)cyclicality of GHE are not only statistically significant, but also economically significant. *Lancet* Commission on Investing in Health [37] points out that "reductions in mortality account for about 11% of recent economic growth in low-income and middle-income countries", and calls for governments of developing countries to take advantage of such opportunities. Our analysis supports this movement by verifying that government actions on GHE in the short run (over the business cycle) are critical, as they have the potential to increase payoff from investing in health.

The World Development Report 1993 [38] advocates targeting GHE on cost-effective programs for improving health in developing countries. We have shown that GHE cyclicality can serve as an additional lever for government to achieve better health outcomes. Government health spending in many developing countries is projected to remain low through 2040 [39]. The lever found in this study may benefit countries even where increasing long-term trends in GHE is difficult.

4.3. Social security funds for health, democracy and institutional quality are determinants of cyclical response of government health expenditure

Our results as displayed in Table 4 indicate that use of social security funds for health, level of democracy, and institutional quality all help explain cross-country variation in GHE cyclicality. One possible reason GHE is less procyclical in countries that rely more on social security funds for health is that there are built-in automatic stabilizers within most social security systems. Similar evidence has been presented in Furceri [16] for OECD countries. For example, during economic downturns, people are more likely to become unemployed or experience reductions in income, tending to expand eligibility for social security schemes and reimbursements to households. Thus, there is upward pressure on health social security funds during recessions. Moreover, the magnitude of the effects of automatic stabilizers often depends in part on the extent to which informal sectors or vulnerable populations are covered. International evidence on the evolution of social health insurance systems over time shows that they usually first cover the formal sectors and slowly expand to other population groups [40]. This may explain in part why the effect of SSF on GHE cyclicality as found in this study is significant only for countries where SSF accounts for major shares of GHE (over 45%): their funds are likely to reach more deeply into informal sectors.

The positive correlation between democracy and procyclical GHE is consistent with the relationship between political polarization and fiscal procyclicality as discussed in Section 2.3. The ICRG indicator "democratic accountability" awards the highest score for countries with alternating governments. With an alternating government a regime could be uncertain about whether its successor would value the same constituency [41]. Thus an incumbent government might have an incentive to save less and spend more during economic upturns, yielding procyclical changes at least in good times.

The association found between low institutional quality and GHE procyclicality in this study echoes the results from the fiscal cyclicality literature [34]. A weak institution constantly changes policies when there are negative income shocks. In contrast, a strong institution, with an independent bureaucracy, often is independent of political pressures and has an established mechanism for recruitment and training [35]. These criteria for a strong institution seem essential to continuity of public services and countercyclical policies under economic contraction.

Note that we do not see a positive correlation between democracy and procyclical GHE as suggesting that democracy is undesirable, as there are powerful advantages of democracy on many grounds. Instead, our interpretation is that, given a country's democracy level, increasing the weight of social security funds in health budgets, and improving institutional quality, as by strengthening independence of civil service, seem critical to breaking the procyclical pattern of GHE. Developing social security funds for health will require determination among health policymakers. Improving institutional quality may be beyond the reach of health authorities and may require multi-sectoral collaboration.

Regarding directions for future research, our results (Table 4) indicate that aid is not a function of GHE cyclicality. It seems worthwhile to assess how aid can be structured to improve population health by mitigating procyclical responses of GHE during downturns in recipient countries. We do not know whether procyclicality of GHE can be attributed to procyclicality of aid; research should address this issue.

5. Conclusions

Economic downturns have long challenged public policies for health expenditure in developing countries. Empirical research on the cyclical response of GHE has, however, heretofore been minimal. The present research extends the cyclicality literature by relating GHE cyclicality to health outcomes and identifying determinants of GHE cyclicality for developing countries. This research also complements the literature on the health impact of recessions by focusing on responses of GHE to recessions, rather than on recessions per se.

Our analysis shows that, for average low- and middle-income countries, GHE tends to be procyclical. Among WHO regions, the positive relationship between GHE and GDP is the strongest in the African Region. Moreover, we demonstrate that countries with procyclical GHE appear to have shorter life expectancies and higher adult mortality rates. These results suggest that procyclicality of GHE as observed in many developing countries is likely to be profoundly harmful. Importantly, our results show that increasing the weight of social security funds in health budgets, and improving institutional quality, may be critical to breaking the procyclical pattern of GHE.

Overall, the present research contributes to knowledge in health policy by providing evidence on long-term health consequences of short-term government responses, which helps to settle debates on health expenditure cutbacks during economic crises. Potential health gains from moving towards countercyclical GHE are economically significant, and can be instrumental for developing countries where mortality rates are high. Moreover, strategies arising from this study for breaking the procyclical pattern of GHE contribute to the global agenda of, e.g., WHO and the World Bank for strengthening the resistance of the health sector to economic crises. Findings from the present research may serve as a basis for country case studies to identify good and bad practices in managing cyclicality of GHE. These results are also relevant to international organizations, who should strengthen their leadership roles in reducing procyclicality of government health expenditure in developing countries.

Ethical approval

The authors of the manuscript titled "The cyclicality of government health expenditure and its effects on population health" declare that ethics approval is not required, because this article does not contain any studies with human participants performed by any of the authors.

Conflict of interest

The authors declare that they have no conflicts of interest.

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Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:https://doi.org/10.1016/j.healthpol.2018.11.004.

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