Health Spending, Democracy and Child Mortality in Developing Countries

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Abstract: **This paper assesses the impact of health spending on child mortality in the developing countries, taking into account the role of democracy. We use the two-stage dynamic panel generalized method of moments. Our sample covers 126 countries over the period 1995-2017. Our main results show that health expenditure is negatively and significantly associated with child mortality. However, when we take into account democracy, regionalization and the income level, we find that, health expenditure has a negative and significant effect on child mortality only in the upper-middle-income countries and Sub-saharan Africa. Elsewhere, it is in the countries of Eurasia, North Africa, and Latin America that a significant reduction in the child mortality rate takes place in the presence of democratic institutions; to this must be added the least developed countries. For example, respect for civil liberties, control of government by a democratically elected parliament, combined with spending on health care, contribute to a significant decrease in child mortality. The results of this study are an important issue for policymakers, providing them with a kind of theoretical and empirical argument presenting health expenditure as a major determinant in public health policy. Thus, in their fight against child mortality, it is in the interest of governments in developing countries to improve not only the quality of their health spending but also, and above all, their institutional framework, especially democratic governance.**

Keywords: **Health Spending, Democracy, Child Mortality, Developing Countries**

I. INTRODUCTION

The importance of the child mortality rate as an indicator of human health and development was first recognized and highlighted on the international agenda in the early 2000s, with its inclusion in the Millennium Development Goals (MDGs), which had a target date of 2015. For example, global under-five mortality was to be reduced from 93 deaths per 1,000 live births in 1990 to 31 in 2015, but the targets differed considerably within and across countries. Indeed, child mortality is associated with various factors such as maternal health, quality and access to medical care, socioeconomic conditions, and public health practices (Dhrif, 2018) and its reduction is nowadays considered as the ultimate goal of governments in public health policy. It is in this context that efforts to reduce it have received a new impetus after 2015, with the inclusion of the goal of ensuring better health and well-being for all in the 2030 agenda of the Sustainable Development Goals (SDGs), with an absolute level of 25 deaths per 1,000 live births as the main target (UN-IGME, 2019a). Despite considerable progress in reducing child mortality, the MDGs have not been met by almost all regions, except for East and South-East Asia, where it has fallen from 55 to 18 deaths per 1,000 live births. In Europe and North America, where the under-five mortality rate was at a low level in 1990, the under-five mortality rate more than halved between 1990 and 2015.

Indeed, the global child mortality rate has fallen from 146 deaths per 1,000 live births in 1950 to 28 deaths per 1,000 live births in 2019, a reduction of 80%. The largest reduction occurred in North Africa and Western Asia, where the rate fell from 313 deaths per 1,000 live births in 1950 to 26 in 2019, a reduction of more than 90%. Central and South Asia and sub-Saharan Africa also recorded large reductions in absolute terms, with rates declining by more than 200 deaths per 1,000 live birth points. In contrast, under-five mortality is highest in sub-Saharan Africa, with a rate of 74 deaths per 1,000 live births. This means that a child born in sub-Saharan Africa in 2019 is about 20 times more likely to die before the age of five than a child born in Australia and New Zealand (UN, 2019).

The importance of health in factor accumulation is recognized in most endogenous growth models. Indeed, enriched human capital is considered an important factor in achieving the desired economic growth and development in any country. According to the neoclassical growth model, the growth of human capital, in terms of education and health, has a positive effect on per capita income in the long run (Romer, 1996). Based on the undeniable role of population health and its contribution to the national economy, researchers have been conducting studies for more than two decades to explore how it can be improved. Hitiris and Posnett (1992) and Feldstein (1988) were responsible for the first theoretical studies on national income and the accounting of national health expenditures. Numerous studies have sought to analyze the impact of health expenditure on health outcomes (Husain, 2010; Farag et al. 2012); however, the results are inconclusive or even contradictory.

The findings from these studies can be classified into three groups: On the one hand, those that present health expenditure as the main determinant of declining child mortality. These findings corroborate existing theoretical and empirical studies. Child health outcomes have also been found to be positively

and statistically significantly related to delays in health expenditures (Gupta and Baghel, 1999; Baldacci et al. 2004; Berger and Messer 2002; Bokhari et al. 2007; Rhee, 2012). For example, Rhee (2012) conducted a country-specific analysis of the effects of health expenditures on infant mortality rate and life expectancy at birth in Korea and found that there is a significant and positive relationship between health care spending and both measures of health outcomes. Bokhari et al. (2007) estimated the relationship between health expenditure, per capita income, and health outcomes using under-five mortality and maternal mortality as health outcome measures. The results suggest, however, that economic growth contributes more to health outcomes than public spending on health for developing countries. On the other hand, some studies find little or no significant relationship between the two variables (Filmer and Pritchett, 1997, 1999; Thornton and DeSalle, 2002; Musgrove, 1996). Filmer and Pritchett (1997), based on an empirical study, demonstrated that public health expenditures are not a factor in reducing infant mortality. They estimate that variables such as income, income inequality, women's education, and the degree of ethnolinguistic fragmentation explain almost all variations in child mortality in a country.

Finally, the literature notes the third category of studies based on the idea that the effectiveness of health expenditures in reducing child mortality depends on a combination of factors (Berger and Messer, 2002; Khaleghian and Gupta, 2005; Harttgen and Misselhorn, 2006; Dhrif, 2018). Berger and Messer (2002) found that the mortality rate depends simultaneously on health expenditures and the choice of a health insurance system. In particular, an increase in the share of public funding devoted to health care spending is accompanied by an increase in mortality rates. Khaleghian and Gupta (2005) have shown that public spending on health plays a more important role for the poor in low-income countries than in high-income countries, indicating that the return on health spending was higher in high-income countries. Harttgen and Misselhorn (2006) showed that access to health infrastructure significantly reduces child mortality and that socioeconomic factors are the main determinants of child health status.

However, controversies over the conclusions may be due to several factors: country-specific characteristics (quality of institutions and governance, geography and social and historical facts, and many others), the nature of the instruments used, and the time horizon of the studies. Focusing exclusively on factors related to the quality of governance, the literature reveals that the institutional environment plays an undeniable role in the analysis of the impact of health expenditure on child mortality. Rajkumar and Swaroop (2008) have provided a fairly powerful analysis of the role of governance in improving child health outcomes. Examining differences in the results of work on public health expenditure in the presence of different levels of governance quality, they find that good governance improves the impact of public expenditure on child mortality.

Good governance is important in the delivery of health care, and returns on health investments are low when governance issues are not addressed. Governance affects health through two main channels. Its indirect effect on national income, (corruption reduces economic growth) and thus on household income and health determinants and directly on the health care sector. In more developed countries, governance has a positive effect on health through the health care sector, while in less developed countries, good governance affects health mainly through its indirect impact on income, and i.e. the income channel predominates (Makuta and O'Hare, 2015). Governance not only has an independent influence on health outcomes (Halleröd et al, 2013). However, it also mediates the impact of public health on health outcomes. As a result, the allocation of funds to the health sector under poor governance may be insufficient to improve health outcomes. Indeed, poor intra-sectoral allocation, poor targeting, and inefficient delivery are among the reasons for the negligible impact of public health on health (Novignon et al, 2012). Dhrif (2018) tests the impact of public health expenditure on child health taking into account institutional quality. His main findings show that health expenditure has a positive and significant effect on child mortality only for high-income countries, whereas for low-, lower-middle- and upper-middle-income countries, health expenditure has no significant impact on child health status.

Despite this wealth of work, very few have assessed the contribution of health spending to reducing child mortality in democratic environments. Other authors have pointed out that the conclusions of many of these studies overlook the potential existence of lagged effects arising from the relationship between health spending and child mortality. Furthermore, it will be interesting to empirically test the nature of this relationship by taking into account the lagged effect of health expenditures. Building on the work of Dhrif (2018), it will be important for us to determine the threshold level of public spending on health that is consistent with declining child mortality. The contribution of our research effort is threefold. First, to assess the impact of health spending on child mortality in developing countries, taking into account their degree of democratization. Second, to capture and analyze the delayed effect of health spending on child mortality. Finally, determine the minimum threshold of health expenditure (as share of GDP) compatible with the reduction of child mortality.

II. METHODOLOGY AND DATA

The main objective of this research effort is to assess the impact of health expenditure on child mortality, as measured by under-five child mortality rates (U5Mort) in developing countries, taking into account the degree of democratization and using annual data for the period 1995-2017. To do so, we specify a model to capture the direct and indirect effects of health expenditures. Thus, the model proposed in this study is based on the work of Dhrif (2018), Gwatkin et al (2007); Novignon and Lawanson (2017); Berthelemy and Seban

(2009) which explains the IMR by public health expenditure and a set of control variables generally used in this type of work. It is a dynamic two stage GMM model that seems more appropriate in that it can simultaneously test the effects of health expenditure on infant mortality directly via medical needs and indirectly via the degree of democratization. The specification of the model is consistent with the literature and allows the identification of channels through which total health expenditure and other variables affect the health of children under 5 years of age (Dhrif, 2018).

The basic model is written as follows:

$$U5M_{it} = \beta_i + \phi X_{it} + \varepsilon_{it} \quad (1)$$

With i (i=1, 2, 3,……, 126) denoting the country and t the period (t = 1995…… . 2017)

Where $U5M_{it}$ is the infant mortality rate (per 1,000 live births) of country i at date t, it is measured by the proportion of deaths of infants and children under 5 years of age. X_{it} Represents a vector of some hypothetical macroeconomic variables that affect children's health. β_i Is the country-specific effect that is distributed independently and is constant for all countries, ε_{it} is the error term assumed to be distributed independently in all periods of country i.

For the analysis of panel data, the Generalized Method of Moments (GMM) proposed by Arellano and Bond (1991), then developed by Blundell and Bond (1998) is used here to control for endogeneity in our estimates. This method responds to the need to study panel data by providing solutions to the heterogeneity of individual behavior in the sample, i.e. endogeneity due to the presence of lagged endogenous variables in the model and simultaneity (two-way causality between variables). Empirical work suggests, however, that the previous level of mortality is suitable for explaining the current level of child mortality.

Therefore, we estimate a dynamic model from equation (1) as follows:

$$U5M_{i,t} - U5M_{i,t-1} = \beta_i - U5M_{i,t-1} + \phi X_{i,t} + \varepsilon_{i,t} \quad (2)$$

The use of level lagged variables as first-difference model estimation tools is proposed by Arellano and Bond (1991) gives:

$$(U5M_{i,t} - U5M_{i,t-1}) - (U5M_{i,t-1} - U5M_{i,t-2}) =$$
$$(U5M_{i,t-1} - U5M_{i,t-2}) + \phi(X_{i,t} - X_{i,t-1}) + \varepsilon_{i,t} - \varepsilon_{i,t-1}$$

(3)

Then, according to Arellano and Bond (1991), the timing conditions are applied to determine the difference estimator as follows:

$$E\left[U5M_{i,t-r}, (\varepsilon_{i,t} - \varepsilon_{i,t-1})\right] = 0 \text{ and}$$
$$E\left[X_{i,t-r}, (\varepsilon_{i,t} - \varepsilon_{i,t-1})\right] = 0 \text{ for r >2 and t= 3, 4, ….T}$$

(4)

This step is necessary for the estimation because the lagged differences are used in the explanation of the variables as instruments in the level equation with the presence of two assumptions: that the error term is uncorrelated and that there is no correlation between the difference of the explanatory variables and the error term despite the association between the levels of the explanatory variables and the country-specific error term. As a result, we obtain the following stationarity properties:

$$E\left[U5M_{i,t+p}, \varphi_i\right] = E\left[U5M_{i,t-q}, \varphi_i\right] \text{ and } E\left[X_{i,t-p}, \varphi_i\right] = E\left[X_{i,t-q}, \varphi_i\right] \text{ and for all p and q} \quad (5)$$

According to Arellano and Bover (1995), the additional moment conditions for level regression are presented as follows:

$$E\left[(U5M_{i,t-r} - U5M_{i,t-r-1})(\varphi_{i,t} + \varepsilon_{i,t-1})\right] = 0 \text{ and}$$
$$E\left[(X_{i,t-r} - X_{i,t-r-1})(\varphi_{i,t} - \varepsilon_{i,t-1})\right] = 0 \text{ and for r =1}$$

(6)

The moment conditions in equations (4, 5, and 6) are used to derive the GMM system estimator. Instrument validity determines the consistency of the GMM estimator and the Arellano-Bond overidentification test is used to examine the validity of the instruments.

Finally, to estimate health expenditures and the effect of democracy on the infant mortality rate (IMR), we specify our basic empirical model as follows:

$$U5M_{i,t} = \beta_i + \beta_1 U5M_{i,t-1} + \beta_2 HealthExp_{i,t} + \beta_3 Democr_{i,t} + \phi X_{i,t} + \varepsilon_{i,t}$$

(7)

$HealthExp_{it}$ is health care expenditure measured as a percentage of GDP; $Democr_{it}$ is the variable denoting democracy with, β_i the coefficients to be estimated for the country; X_{it} is a vector of the other explanatory variables generally identified by theory as control variables or simply the other determinants of well-being and health; finally, ϕ is the vector of parameters to be estimated associated with X_{it} the column vector and ε is the error term.

Subsequently, to test the extent to which the impact of health expenditure on child mortality is influenced by the degree of democratization, the interaction term between health

expenditure and the level of democracy should be included in equation (7) as follows:

$$U5M_{i,t} = \beta_i + \beta_1 U5M_{i,t-1} + \beta_2 HealthExp_{i,t} + \beta_3 (Democr_{i,t}) + \beta_4 (HealthExp_{i,t} * (Democr_{i,t})) + \beta_5 X_{i,t} + \varepsilon_{i,t} \quad (8).$$

Where $HealthExp_{it} * Democr_{i,t}$ is the interactive term between health expenditure and democracy variables and whose β_4 coefficient captures the role of democratic institutions in mediating the impact of health expenditure on U5M. As mentioned in the literature, better institutional quality is considered more effective in reducing U5M. If β_4 the estimated coefficients were negative and significant, this would indicate that there is complementarity and that the degree of democracy plays an important role in mediating the impact of health spending on children's health.

Data sources.

It should be recalled that the objective of this research effort is to evaluate the impact of health expenditure on child mortality, taking into account democracy in developing countries According to the latest OECD Development Assistance Committee (DAC) ranking, developing countries are classified into four categories: Least Developed Countries (LDCs), the majority of which are sub-Saharan African countries. Low-Income Countries (LICs), Lower Middle-Income Countries (Lower Middle-Income Countries), and Upper Middle-Income Countries (Upper Middle-Income Countries) by using the method of moments generalized in the Panel. The choice of this technique is to prevent endogeneity biases that can occur in econometric regressions. To confirm the validity of the instruments used, we carry out the Sargan test; this test is based on the null hypothesis that there is no autocorrelation between the residuals and the instruments used. Our sample covers 126 countries over the period 1995-2017. The data for this study come from the World Development Indicator database (WDI, 2018). Table 1 below presents descriptive statistics for the different variables used.

Table 1: Descriptive statistics of explanatory variables

Variables	Observations	Mean	Standard Deviation	Minimum	Maximum
Health Expenditure (%GDP)	2898	5,620	2.346	1,025	25,475
Log Health Expenditure	2898	1,641	0.418	0,024	3,237
Literacy	2898	70,51	26.971	0	99,994
Log Literacy	2760	4,235	0.392	2,522	4,605
GDPpc	2898	4,75e+10	1.38e+12	0	4,63e+13
LogGDPpc	2875	7,649	1.049	5,212	9,928
PrimaryFemaleCopletion	2898	4,220	0.637	-3,863	5,740
LogPrimaryFemaleCompletio	2898	78.187	25.110	0	142.123
Immunizations DPT	2898	80,597	19.480	0	99
Log Immunizations DPT	2875	4,361	0.297	1,791	4,595
Social Globalisation	2898	35,122	15.057	0	77,170
Democracy	2645	-0,234	18,937	-88	10
*Democracy*Health Expenditure*	2645	-0,823	34,555	-210,794	24,129

Source: Authors' construction

III. RESULTS AND DISCUSSION

The results of the econometric estimates using the two-step GMM method are reported in Table 2. Thus we have retained as variables of interest: the under-five mortality rate, and as variables of interest health expenditure and democracy; as control variables, we have the female primary school enrolment rate and immunization coverage Immunization against diphtheria, tetanus, and polio. Thus, we had to run four different regressions of our model to obtain a clear description of the results obtained. The results in the first column of the table are obtained without the introduction of the health expenditure variable. The idea is to be able to capture the impact of the control variables such as the GDP/capita, DPT immunization, and social globalization. Column 2 is obtained by adding our variable of interest which is health expenditure. Column 3 includes, in addition to the variables mentioned above, the democratic indices. The fourth and last column groups together not only the above variables but also and above all those relating to the analysis of the correlation between health expenditure and democracy and the variable HealtExpe*Democracy. The results on the validity of the instruments used on different regression models are confirmed. This can be observed via the calculated values of the probabilities of the sargan test. The results of the estimates of the different models (columns 1 to 4) show that the coefficients associated with the health expenditure variables and the lagged value of the infant mortality rate are significant and are otherwise of the expected sign. This suggests, on the one hand, that health expenditure is essential in public policies to combat child mortality in developing countries. On the other hand, we can confirm that the current level of under-five mortality is a function of its previous level, this is consistent with the results of Dhrif (2018) who found that the initial level of the infant mortality rate (IMR) has a positive sign and is statistically highly significant, suggesting that the previous level of infant mortality rate is relevant to explain the current level of child deaths.

Indeed, the results show that there is a negative and significant relationship at the 1% significance threshold between health expenditure and the infant mortality rate. The estimated value of the expenditure coefficient suggests that a 10% increase in health expenditure translates into a 1.83% decrease in the

level of infant mortality. This is consistent with the assumption that health expenditure is an important instrument in the fight against child mortality. These results confirm those of Novignon and Lawanson (2017)[1], (Berger and Messer, 2002). This means that it is in the interest of developing countries to invest substantially in their health systems to achieve a global result on the health of populations in general and that of children in particular. While many developing countries face unprecedented constraints on resource levels, it has been suggested that additional revenues could still be generated if resources are well managed (McIntyre and Meheus, 2014).

Table 2: Impact of health expenditure on child mortality in developing countries

Variables	Dependant Variable : $U5M_{it}$			
	(1)	(2)	(3)	(4)
$U5M_{i,t-1}$	0.916*** (0.000)	0.908*** (0.000)	0.907*** (0.000)	0.907*** (0.000)
Female Primary completion	-0.010 (0.120)	-0.010* (0.052)	-0.001* (0.051)	-0.010* (0.051)
GDPpc	-0.115*** (0.000)	-0.125*** (0.000)	-0.122*** (0.000)	-0.122*** (0,000)
ImmunizationDPT	-0.010 (0.112)	-0.010 (0.150)	-0.010 (0.173)	-0.010 (0.144)
GlobaSocial	-0.001*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)
HealthExpendi		-0.017*** (0.000)	-0.018*** (0.000)	-0.018*** (0.000)
Democracy			-0.002** (0.022)	-0.0001 (0,799)
HealtExpe*Democracy				-0.0001 (0.801)
Constant	1.256*** (0.000)	1.397*** (0.000)	1.382*** (0.000)	1.382*** (0.000)
Sargan Test[2]				
	0.100	0.100	0.100	0.175
Observation	1786	1765	1765	1765

IMR, Infant Mortality Rate (Under 5), GDPpc: Gross Domestic Product per capita, ImmunizationDPT, DPT immunization (%), GlobaSocial: Social globalization, HealthExpendi, Health expenditure. **** Significance at 1%, ** significance at 5%, * significance at 10%.

Furthermore, variables such as GDP per capita, social globalization are all statistically significant at 1% and negatively correlated with the infant mortality rate. Our results show that a 10% increase in the level of GDP per capita is associated with a 12.23% decrease in the child mortality rate. An improvement in the GDP growth rate in developing countries could, however, solve the problems of food insecurity, precarious buildings, and equipment, lack of adequate social infrastructure, and insufficient budget to reduce child and maternal mortality. Besides, higher incomes lead to improved public health infrastructure such as water and sanitation, better nutrition, better housing, and the ability to pay for health care (Pritchett and Summers 1996; Culter et al. 2006). In terms of globalization, we note that a 1% increase in the level of social globalization reduces infant mortality by 0.1%; this to a significant 1%. Social globalization, understood here as the interconnection between the citizens of the world has become an important determinant in the fight against scourges, social, and health crises. Indeed, a high level of national and international migration is an important contextual element that significantly affects the health status of children in developing countries.

Democracy and child mortality

Now, we examine the relationship between health spending and child mortality with a focus on democracy. The estimated coefficients of the third model are of expected sign (see the last column). Democracy contributes significantly to the reduction of under-five mortality in developing countries. Thus, a 10% increase in the level of democracy is associated with a 0.002% decrease in the child mortality rate. That said, in democratic countries, child mortality is a major policy concern. Even if this coefficient seems low, it should be noted that it is significant at 1% of the significance threshold. However, when we make the variable democracy interact with health spending, the signs and value of the elasticity of democracy remain unchanged but become insignificant. However, we observe that the *DemoHealth* variable combining democracy and health expenditure reduces child mortality but not significantly.

Overall, our results show that health spending is an important determinant of child mortality reduction in developing countries, and this evidence is much stronger when the institutional and, above all, the democratic framework is improved, especially when there is oversight of executive action by a democratically elected parliament. However, these results conceal a certain weakness, given that they are obtained on the assumption that all the countries in the sample have the same characteristics, which is not the case in reality. Recall that our sample covers 126 developing countries, each with its economic structure and effects, i.e. all of them are heterogeneous. In this case, it is difficult to generalize our results to all the individuals in our sample. To this end, it is necessary to check whether our results could withstand certain tests. For this purpose, we perform two robustness checks.

Robustness Check 1: Spatial Robustness Test

This first test consists of making a regional distribution of our sample; this is done by dividing it into three sub-samples: the Eurasian countries of North Africa and the Middle East; the

[1] The results of Novignon and Lawanson show a positive and significant relationship between health expenditure and child health outcomes with elasticities of -0.11 for infant mortality, -0.15 (under-five mortality) and -0.08 (neonatal mortality).

[2] Sargan test of overidentifying restrictions ; H0: overidentifying restrictions are valid

countries of sub-Saharan Africa and finally the countries of Latin America and the Caribbean. We use the same estimation strategies and time horizon (1995-2017). The results of the test are contained in Table 3 below. It appears that the impact of health expenditure on child mortality varies considerably from one sub-region to another. In particular, we observe that only sub-Saharan Africa is the region where health expenditure has a negative and significant effect on children's health, while the effects appear to be statistically insignificant for the countries of the Middle East and Eurasia and Latin America and the Caribbean. This result is consistent with other studies that have found no significant relationship between the two variables (Filmer and Pritchett 1999; Thornton and DeSalle 2002) and with Dhrif (2018). These results show that expenditure cannot be considered in all places as a major determinant of child mortality reduction.

Table 3: Robustness Check 1.

Impact of health expenditure on child mortality in developing countries

Variables	Dependant Variable : $U5M_{it}$		
	Sub-saharan Africa	Latin America and Caribbean	Eurasia and MENA
$U5M_{i,t-1}$	0.976*** (0.000)	0.787*** (0.000)	0.541*** (0.000)
Female Primary completion	-0.003** (0.049)	-0.161** (0.024)	-0.947*** (0.000)
GDPpc	-0.011*** (0.000)	-0.202*** (0.000)	-0.361*** (0.000)
ImmunizationDPT	-0.010*** (0.000)	-0.100 (0.136)	0.982*** (0.000)
GlobaSocial	- 0.004*** (0.000)	-0.002** (0.002)	0.012*** (0.000)
HealthExpendi	-0.010*** (0.000)	0.100 (0.063)	-0.029 (0.215)
Democracy	-0.003 (0.323)	-0.010*** (0.000)	-0.010*** (0.000)
HealtExpe*Democracy	-0. 004*** (0.035)	0.003 (0.001)	0.001 (0.000)
Constant	0.305*** (0.000)	3.70*** (0.000)	8.411*** (0.000)
Sargan Test	0.479	0.997	0.813
Observation	719	425	316

IMR, Infant Mortality Rate (Under 5), GDPpc: Gross Domestic Product per capita, ImmunizationDPT, DPT immunization (%), GlobaSocial: Social globalization, HealthExpendi, Health expenditure. **** Significance at 1%, ** significance at 5%, * significance at 10%.

Moreover, concerning taking democracy into account in our analysis, it turns out that only the countries of North Africa, the Middle East, and Eurasia, and those of Latin America, due to the functioning of democratic institutions and respect for civil liberties respectively, show a significant impact of the reduction of infant mortality thanks to public spending. That is, a high degree of democracy can solve the problem of inefficient health spending and reduce the rising costs of medical technology and services. This leads to the inference that democratic stability and the institutional context can be accompanied by a better quality of health expenditure.

The above robustness test results show that only sub-Saharan Africa is the only sub-region where health expenditure contributes significantly to the reduction of child mortality, so a 10% increase in the volume of health expenditure is accompanied by a 1% drop in the level of child mortality at the 1% significance level. However, this test reveals another important factor in the reduction of child mortality: the rate of female enrolment in primary education. Indeed, when we segment our sample, it turns out that the level of female primary school enrolment is significantly and negatively correlated with the infant mortality rate in all sub-regions. However, these results do not always allow us to understand the behavior of child mortality by taking into account the classification of countries according to income. This requires an examination of the impact of health expenditure across the different income groups to which countries belong.

Robustness Check 2

The second part of our test consists of dividing our sample into three groups based on the different income brackets according to the 2016 OECD Development Assistance Committee (DAC) country classification approach. The DAC classifies countries into four categories according to their level of per capita income. These are the Least Developed Countries (LDCs) and Low-income Countries (LICs) whose Gross National Income per capita is less than or equal to $1005. Lower-middle income countries (LIMICs) with a per capita GNI of $1,006-$3,955. Finally, Upper Middle-Income Countries (Upper middle Income Countries (UMIsup) with Upper (GNI per capita $3,956 -$12,235 in 2016). The results of our estimation are contained in Table 4 below (Columns (1), (2), (3)).

Table 4: Results of Robustness Test 2

Impact of health expenditure on child mortality in developing countries

Variables	Dependant Variable : $U5M_{it}$		
	LIC/LDC (GNI per capita <=$1,005)	Lower-middle income countries GNI per capita ($1 006-$3 955)	Upper Middle-Income Countries (GNI per capita $3,956 -$12,235 in 2016)
$U5M_{i,t-1}$	0.928*** (0.000)	0.875*** (0.000)	0.948*** (0.000)
Female Primary completion	-0.03*** (0.000)	-0.050* (0.012)	-0.020* (0.035)
GDPpc	-0.040* (0.023)	-0.145* (0.013)	-0.040** (0.006)
ImmunizationDPT	-0.020*** (0.000)	0.0001 (0.996)	0.010 (0.642)
GlobaSocial	- 0.003*** (0.000)	-0.001* (0.015)	-0.0002** (0.005)
HealthExpendi	-0.033*** (0.000)	-0.030* (0.025)	-0.001 (0.932)
Democracy	-0.001** (0.003)	-0.0001 (0.924)	0.004*** (0.000)
HealtExpe*Democracy	0.0002* (0.046)	0.0001 (0.547)	-0.002*** (0.000)

Cnte	0.845*** (0.000)	1.870** (0.006)	0.493** (0.001)
Sargan Test	0.918	0.966	0.870
Observation	622	504	528

IMR, Infant Mortality Rate (Under 5), GDPpc: Gross Domestic Product per capita, ImmunizationDPT, DPT immunization (%), GlobaSocial: Social globalization, HealthExpendi, Health expenditure. **** Significance at 1%, ** significance at 5%, * significance at 10%.

These results show that it is only in the least developed, low- and lower middle-income countries that health expenditure has a positive and significant effect on child mortality, whereas, for upper-middle-income countries, such expenditure does not have a significant impact on child mortality. A 10% increase in health expenditure in the least developed countries is accompanied by a 3.3 percentage point decrease in the child mortality rate. This result is also strongly confirmed in Table 4. This result confirms the point we made earlier, namely that the level of per capita income is a determining factor in reducing child mortality in developing countries. Thus, for all three groups of countries classified according to income, GDP per capita appears to be significantly and negatively correlated with the child mortality rate.

About the degree of democratization, it emerges that only the least developed countries are likely to bene t from a premium on improved child mortality as a result of respect for some principle of democracy. For example, respect for civil liberties and parliamentary oversight of the government could contribute to a significant reduction in child mortality. Curiously, democracy rather contributes to increasing child mortality rates in upper-middle-income countries. Thus, in this income category, a 10% increase in the level of democracy is associated with a 0.4% increase in the under-five mortality rate at the 1% significance level. On the other hand, the opposite result is obtained when we analyze the impact of the interaction of democracy with health expenditures on child mortality. To this effect, a 10% increase in the level of interaction between health expenditure and the level of democracy is associated with a 0.2% drop in the infant mortality rate at the 1% threshold. Overall, it appears that it is in the interest of developing countries to improve their macroeconomic situation and their institutional environment to effectively and sustainably reduce their child mortality rate.

IV. CONCLUSION AND POLICY IMPLICATIONS

The objective of this research effort is to assess the impact of health expenditure on child mortality with consideration of democratic quality in the context of developing countries over the period 1995-2017 using the method of generalized moments in Panel. The choice of this technique is to prevent endogeneity biases that can occur in econometric regressions. To confirm the validity of the instruments used, we carry out the Sargan test. This test is based on the null hypothesis that there is no correlation between the residuals and the instruments used. The results show that there is a negative and significant relationship between health expenditures and the infant mortality rate. This is consistent with the hypothesis that health expenditure is a major determinant in the fight against child mortality. However, the results of the robustness tests show that it is only in the least developed, low- and lower middle-income countries that health expenditure has a negative and significant effect on child mortality, whereas, for lower-middle-income countries, health expenditure does not have a significant impact on child mortality. Concerning the degree of democratization, it appears that only countries in Eurasia, North Africa, and Latin America achieve significant reductions in child mortality rates in the presence of democratic institutions; to this must be added upper-middle-income countries. For example, respect for civil liberties and parliamentary oversight of government contribute to a significant decrease in child mortality.

In general, our results show that health spending is an important determinant of child mortality reduction in developing countries, and these results are even stronger when the institutional and democratic framework is improved, especially when there is oversight of the executive branch of government by a democratically elected parliament. The results of this study are an important issue for policy-makers, providing them with a kind of theoretical and empirical argument for the use of health spending. Thus, in their fight against child mortality, it is in their interest to improve the quality of health expenditure and, above all, their institutional framework. A better allocation of resources for the health sector in developing countries could, however, solve the problems of food insecurity, precarious buildings, and equipment, lack of adequate social infrastructure, and insufficient budget to reduce child and maternal mortality.

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