The Effect of Economic Growth on the Utilisation of Childhood Immunisation: New Evidence From 50 African Countries

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ABSTRACT: Africa bears the greatest brunt of under-five mortality in the world. Among the major approaches used in tackling under-five deaths is childhood immunisation. While income is regarded as a major determinant of demand for child health inputs including immunisation, the existing studies are microlevel analyses, which do not provide a bigger picture of how an enhancement in economic growth (aggregate income) contributes to the utilisation of childhood immunisation in an economy as a whole. Since Africa has experienced economic growth in the recent decades, this study aims to fill this gap in the literature by examining the contribution of economic growth to the utilisation of childhood immunisation in selected African countries. The study uses a panel design involving data on 50 African countries over the period, 2002 to 2019. Utilisation of DPT (diphtheria, pertussis (or whooping cough) and tetanus) and measles immunisation are used as proxies for childhood immunisation while the system Generalised Method of Moments (GMM) regression is used as the estimation technique. We find economic growth to have a positive significant effect on the utilisation of childhood immunisation. Thus, it is imperative to intensify the enablers of economic growth in Africa in order to increase the utilisation of childhood immunisation.

KEYWORDS: Under-five mortality, childhood immunisation, economic growth, Africa

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Introduction

Under-five mortality remains a major public health problem, especially in Africa. In 2020, out of the 5 million deaths reported among children under-5 years, more than 80% of these deaths happened in Sub-Saharan Africa (SSA) and southern Asia.[1] Moreover, in the same year, SSA had the highest rate of under-five mortality-74 deaths per 1000 live births-, which was twice the global rate and 14 times greater than the risk for children in North America and Europe.[1]

A major approach recognised in dealing with under-five mortality is immunisation. For instance, between 2000 and 2022, 57 million deaths were averted as a result of measles vaccination.[2] In addition, deaths of newborns attributed to tetanus reduced by 97% between 1988 and 2018 largely as a result of scaling-up immunisation.[3]

Nonetheless, the coverage of childhood immunisation falls below the recommended targets. For instance, in 2022, infants numbering 14.3 million did not receive the first (initial) dose of the DPT (diphtheria, pertussis (or whooping cough) and tetanus) vaccine while 6.2 million infants had received partial vaccination.[4] Among these 20.5 million infants, a little below 60% of them lived in 10 countries of which 5 were on the African continent (Angola, the Democratic Republic of the Congo, Nigeria, Ethiopia and Mozambique).[4]

To enhance the coverage of childhood immunisation, it is important to know the factors that determine its utilisation or uptake. This has led to a number of empirical studies that have examined the factors associated with the utilisation of childhood immunisation or vaccination in African countries.[5-12] Nonetheless, to the best of our knowledge, these past studies focussed on the microlevel (household or individual level data) hence they have not provided an understanding of the determinants of the utilisation of childhood immunisation at the macrolevel (aggregate or overall level). Meanwhile, doing a macrolevel analysis provides a wider insight into the determinants of childhood immunisation uptake. Per the theory of demand for health inputs,[13] a major potential macrolevel determinant of childhood immunisation uptake is economic growth, since it is a general indicator of the level of income in an economy as a whole. Therefore, since Africa has experienced some improvements in economic growth in recent times or decades (For instance, 1.27%, 2.44% and 2.65% economic growth rates in 2016-2018 respectively, in SSA),[14] this study aims to investigate the effect of economic growth on the utilisation of childhood immunisation in Africa, while controlling for other factors.

By conducting this study, we provide the first empirical evidence of how economic growth has affected the uptake of childhood immunisation in Africa. We find that an increase in economic growth is associated with a rise in the utilisation of childhood immunisation even after robustness checks. The findings therefore shed light on the role economic growth can play in enhancing the utilisation of childhood immunisation, which is very critical towards child survival. Moreover, an improvement in child survival will aid in attaining the

Sustainable Development Goal (SDG) 3.2 (ie, stop avoidable deaths of under-five children and newborns, with all countries targeting a reduction in neonatal mortality and under-five mortality to 12 and 25 per 1000 live births respectively, by 2030).[15]

Methods

Study design

This study uses a panel design involving 50 African countries (see Table 3) with annual data spanning the period, 2002 to 2019. The number of countries used is based on data availability and the period is selected to reflect the observance of economic growth in Africa in recent times or decades. Moreover, we do not go beyond 2019 because the COVID-19 pandemic caused disruptions in economic growth and the utilisation of childhood immunisation across countries after 2019. The panel design is used because the study involves several countries with data over a number of years. Using such design aids in tackling omitted variables bias as well as enhancing the precision of inferences emanating from parameter estimates.[16]

Data and variables

The study sources data from the World Development Indicators (WDI) of the World Bank.[17] The utilisation of childhood immunisation (CIM), measured by DPT and measles immunisation uptake are used as the dependent variables. The main independent variable is economic growth (EG). Three measures of economic growth are used: 1 measure is used in the baseline analysis (economic growth1) and 2 measures are used for robustness checks (economic growth2 and economic growth3). Based on literature,[13,18-24] health expenditure (E), primary educational enrolment (education (PE)), under-five mortality (UM) and population growth (PG) are used as control variables. Details of how the variables are measured as well as their expected signs can be found in Table 1.

As regards the expected signs of the variables, based on the theory of demand for health,[13] we expect increments in economic growth, health expenditure and education to be associated with a rise in the utilisation of immunisation. Thus, economic growth implies an improvement in income which would enhance the ability of people to pay for costs associated with immunisation uptake. Also, education is expected to have a positive association with the utilisation of immunisation given that people with formal education are more likely to be informed about the importance of immunisation relative to those without formal education.[9] Similarly, current health expenditure is expected to have a positive association with the utilisation of childhood immunisation because, an increase in health expenditure implies more spending on the supply and demand for health consumables such as vaccines. For under-five mortality, as it increases, perceived susceptibility to childhood mortality will be high. This, according to the health belief model,[18] will increase the willingness of caregivers to utilise immunisation for their children in order to protect their lives, assuming that the perceived barriers are less than the perceived benefits. We therefore expect a positive association between under-five mortality and the utilisation of childhood immunisation. As population growth increases, it is expected that more efforts will be made to increase the availability of vaccines for children, and there would also be higher demand for vaccines. We therefore expect the effect of population growth on the utilisation of childhood immunisation to be positive.

Statistical analysis

The association between the utilisation of childhood immunisation and economic growth is examined by specifying the functional relationship below:

$$\mathrm{CIM} = f(\mathrm{EG,E,\ PE,\ UM,\ \ PG}) \tag{1}$$

where all notations are as already defined. Equation (1) is re-specified in a more estimable form as follows:

$$\begin{aligned}\mathrm{CIM_{it}} = {} & \varpi + \beta_0 \mathrm{CIM_{it-1}} + \beta_1 \mathrm{EG_{it}} + \beta_2 \mathrm{E_{it}} + \\ & \beta_3 \mathrm{PE_{it}} + \beta_4 \mathrm{UM_{it}} + \beta_5 \mathrm{PG_{it}} + \aleph_t + \aleph_{it}\end{aligned} \tag{2}$$

where i, t, ϖ, $\aleph$ and $\aleph$ represent the countries, time (year), intercept, time fixed effects and the error term respectively, while the βs are coefficients of their respective variables. The lag of the dependent variable ($\mathrm{CIM_{it-1}}$) is introduced because the utilisation of childhood immunisation could exert some persistence overtime.

For the estimation technique, we use the dynamic panel system Generalised Method of Moments (GMM) regression of Arellano and Bover[25] and Blundell and Bond[26] to estimate equation (2). The system GMM is chosen for the following reasons: (i) it is able to capture the persistence of dependent variables overtime, (ii) it is able to deal with the problem of endogeneity emanating from the persistence term correlating with the error term and (iii) it is capable of handling problems associated with the dependent variable being able to affect the independent variables, which is also a form of endogeneity.[20,21,27-32]

The system GMM employs past values of independent variables as instruments as well as level and first difference equations in dealing with endogeneity. The suitability of the system GMM estimates is determined by the absence of overidentification and second-order serial correlation as well as avoiding the proliferation of instruments. Hence, the insignificance of the *P*-values of the Hansen overidentification test (Hansen *j*) and the Arellano-Bond second-order serial correlation test (ARB) are used to establish the absence of overidentification and second-order serial correlation, respectively. To avoid the proliferation of instruments, the

Table 1. Measurement and expected signs of variables.

VARIABLE	DEFINITION/MEASUREMENT	SOURCE	EXPECTED SIGN
Utilisation of childhood immunisation	Measles immunisation: The percentage of children aged 12 to 23 months who have received vaccination for measles prior to 12 months or any period preceding the survey.	WDI	Not applicable
	DPT immunisation: The percentage of children aged 12 to 23 months who have received vaccination for DPT prior to 12 months or any period preceding the survey.		
Economic growth	Economic growth1: This refers to Gross Domestic Product (GDP) measured in constant 2015 United States Dollars (USD).	WDI	+
	Economic growth2: This is the annual growth rate of GDP per capita measured in percentages.		
	Economic growth3: This is the annual growth rate of GDP measured in percentages.		
Health expenditure	This is measured as current health expenditure (healthcare services and goods consumed each year) as a percentage of GDP.	WDI	+
Primary education	This refers to the ratio of total gross enrolment in primary education relative to the overall number of people in the age group officially designated for primary education.	WDI	+
Under-five mortality	The likelihood that a new-born baby will die before attaining the age of 5 years per 1000 live births.	WDI	+
Population growth	This refers to the annual growth rate of the number of people living in a country, measured in percentage.	WDI	+

'+' Means will increase immunisation uptake.

number of instruments should be less than the number of countries.[20,21,27-32]

To prevent the challenge (aberration) associated with high recurrent data and avoid the proliferation of instruments as well as make our data more suitable for the system GMM estimation,[27,33] we take 3 years averages of our data. The averaged data are used for all the analyses except the graphs. Given the huge figures of the baseline economic growth measure (economic growth1), in running the system GMM, we log-transformed it in order to reduce its differences with other variables in terms of measurement.[34] However, before the system GMM results, univariate analysis of the variables are presented.

Results

The study results are presented in this section under 2 subsections namely, univariate analysis and multivariate analysis.

Univariate analysis

Descriptive statistics of the study variables and country-level analysis of childhood immunisation are presented in this sub-section.

In Table 2, it can be seen that on the average, 79.059% and 76.604% of children in the selected countries have received DPT and measles immunisation, respectively. The average GDP (economic growth1) over the study period is $39.480 billion, while the average growth rates of per capita GDP (economic growth2) and GDP (economic growth3) are 1.862% and 4.33% respectively. The average health expenditure as a percentage of GDP is 5.235%. Also, on the average, primary education enrolment is 99.395%, under-five mortality per 1000 live births is 83.083 and population growth rate is 2.403%.

Over the study period, the highest and least utilisation of both DPT and measles immunisation can be found in Seychelles and Chad, respectively (Table 3).

In Figure 1, over the study period (2019 figure less 2002 figure), it can be seen that Botswana, Central African Republic, Egypt, Guinea and Mauritania experienced a decrease in the utilisation of DPT immunisation among children, with Mauritania having the greatest decrease. The utilisation of DPT immunisation for children in Tanzania and Seychelles did not change while all the remaining countries show an increase in the utilisation of DPT immunisation for children, with the greatest increase (42%) found in Niger and Sierra Leone.

Algeria, Angola, Central African Republic, Egypt, Eswatini, Gambia, Madagascar, Mauritania and Tanzania exhibit a fall in the utilisation of measles immunisation for children and the highest decrease can be found in Eswatini and Mauritania. All the remaining countries exhibit an increase in the utilisation of measles immunisation among children and the biggest increment is found in Niger (38%) (Figure 2).

Multivariate analysis

The baseline (Table 4) and robustness checks (Table 5) system GMM estimates of the effect of economic growth on the

Table 2. Descriptive statistics of variables.

VARIABLE	OBS	MEAN	STD. DEV.	MIN	MAX
DPT vaccine utilisation	300	79.059	17.126	22.333	99
Measles vaccine utilisation	300	76.604	16.726	21.333	99
Economic growth1	297	3.948e+10	8.089e+10	1.573e+08	4.989e+11
Economic growth2	296	1.862	3.218	–11.181	18.213
Economic growth3	296	4.33	3.526	–10.566	23.806
Health expenditure	298	5.235	2.178	1.53	18.889
Primary education	286	99.395	21.013	39.496	146.941
Under-five mortality	300	83.083	40.836	13.9	208.867
Population growth	300	2.403	0.927	–0.236	5.046

Variables are not log-transformed.

utilisation of childhood immunisation are presented in this sub-section.

In the baseline results, the lags of childhood immunisation utilisation or uptake have positive significant effects on the current levels of immunisation uptake, which indicates the persistence of childhood immunisation overtime (Table 4).

Regarding the main variable of interest, we find a positive significant association between economic growth and the utilisation of childhood immunisation (Table 4). Since in the baseline economic growth is log-transformed and the utilisation of childhood immunisation is not log-transformed, we have to divide the coefficients of economic growth by 100 to ensure a better interpretation.[35] Thus, given the coefficients of 1.298 and 1.629 for economic growth in the DPT and measles models respectively, the interpretation is that, a percentage increase in economic growth is associated with an increase in the utilisation of DPT and measles immunisation for children by 0.013% and 0.016% respectively, at the 1% level of significance (Table 4).

Further, in Table 4, health expenditure is found to have a positive significant effect on the utilisation of both DPT ($\beta = .770$, $P < .01$) and measles ($\beta = .933$, $P < .01$) immunisation. In addition, the findings show an increase in educational enrolment to be associated with an increase in the utilisation of measles immunisation ($\beta = .050$, $P < .05$). Nonetheless, we find an increase in under-five mortality to be associated with a decrease in the utilisation of both DPT ($\beta = -.114$, $P < .01$) and measles ($\beta = -.100$, $P < .05$) immunisation. Further, when population growth increases, it is found to be associated with an increase in the utilisation of DPT immunisation ($\beta = 2.341$, $P < .01$).

In the robustness checks results, the lags of the dependent variables maintain their positive significant coefficients, hence confirming the persistence of immunisation utilisation overtime. Regarding models using the second measure of economic growth (Economic growth2), we find a positive significant association between the second measure of economic growth, and the utilisation of DPT ($\beta = .615$, $P < .01$) and measles ($\beta = .451$, $P < .01$) immunisation. Similarly, health expenditure and educational enrolment are found to have positive significant association with the utilisation of immunisation (DPT: $\beta = .464$, $P < .05$; measles: $\beta = .346$, $P < .1$ (for health expenditure), DPT: $\beta = .114$, $P < .01$; measles: $\beta = .141$, $P < .01$ (for educational enrolment)). In addition, a rise in under-five mortality is found to be associated with a fall in the utilisation of DPT ($\beta = -.143$, $P < .01$) and measles ($\beta = -.071$, $P < .05$) immunisation. However, population growth is found to have a positive significant association with the utilisation of immunisation (DPT: $\beta = 3.611$, $P < .01$; measles: $\beta = 1.144$, $P < .01$) (Table 5).

Using the third measure of economic growth (Economic growth3), we find a positive significant association between economic growth and the utilisation of immunisation (DPT: $\beta = .527$, $P < .01$; measles: $\beta = .436$, $P < .01$). The signs and significance of the control variables are similar to the other models even when the third measure of economic growth is used (Table 5).

Discussion

To the best of our knowledge, this study provides the first empirical evidence of the effect of economic growth on childhood immunisation utilisation across African countries. As expected, economic growth is found to have a positive significant association with the utilisation of childhood immunisation. The implication is that, the economic growth experienced on the African continent has been beneficial to the utilisation of childhood immunisation. Moreover, although for some few countries childhood immunisation rates in 2019 were less than that of 2002 (Figures 1 and 2), so far as the immunisation rates for all the years are positive (Table 2), economic growth can be said to be a major contributory factor. This finding is in line with the theory of demand for health which postulates a positive association between income and the demand for health inputs.[13] Thus, rising economic growth is likely to be associated with an enhancement in the ability of

Table 3. Childhood immunisation utilisation per country, 2002 to 2019.

COUNTRY	DPT	MEASLES
Algeria	92	89.111
Angola	52.056	48.778
Benin	75.556	67.333
Botswana	95.5	95.5
Burkina Faso	87.5	86.111
Burundi	91.722	88.722
Cabo Verde	95.167	93.889
Cameroon	77.944	70.778
Central African Republic	44.444	48.778
Chad	33.944	38.444
Comoros	82.944	79.111
Congo, Dem. Rep.	64.389	62.5
Congo, Rep.	72.889	67.833
Cote d'Ivoire	75.5	69.222
Djibouti	78.667	75.167
Egypt, Arab Rep.	96.056	95.333
Equatorial Guinea	49.056	48.889
Eswatini	89.611	91.222
Ethiopia	55.833	52.222
Gabon	67.056	62.167
The Gambia	93.833	92.111
Ghana	90.333	88.5
Guinea	54.389	51.556
Guinea-Bissau	77.222	76.167
Kenya	85.833	85.611
Lesotho	89.167	86.833
Liberia	65.778	66.333
Madagascar	72.333	66.056
Malawi	89.611	85.444
Mali	71.167	67.389
Mauritania	74.833	72.056
Mauritius	96.889	96.5
Morocco	97.778	97.167
Mozambique	81.778	82.222
Namibia	84.889	75.222
Niger	66.278	66.333
Nigeria	46	46.444
Rwanda	96.389	92.778
Sao Tome and Principe	96.056	90.5
Senegal	87.556	78.611
Seychelles	98.5	98.333
Sierra Leone	79.667	77.778
South Africa	79.778	74.778
Sudan	85.5	80.333
Tanzania	90.556	91.944
Togo	80.056	70.333
Tunisia	97.722	96.333
Uganda	78.056	75.944
Zambia	85.444	88.278
Zimbabwe	81.722	81.222

governments to afford and supply health inputs (such as vaccines) to their citizens. Moreover, rising economic growth could be associated with an enhancement in income at the household level which could increase the ability of households to afford child health inputs. For instance, childhood vaccination (hence, immunisation) may be free but transportation cost may be incurred to reach vaccination sites, hence, people without money will not be able to afford and access vaccination. Our finding concurs with past microlevel studies on the role of household income or wealth in the utilisation of child health inputs.[5,6]

Since people exposed to formal education are more likely to know about the importance of immunisation in preventing diseases and deaths,[9] it is not surprising that our findings reveal a positive association between educational enrolment and the utilisation of childhood immunisation. The finding on the role of education in utilising childhood immunisation is supported by several microlevel studies on the African continent.[6,8-10,36,37] Therefore if education has positive association with the uptake of health inputs such as immunisation, it is not surprising that a number of studies[21,38,39] have found education to be associated with an enhancement in health outcomes.

Given that rising spending on health could increase the supply of vaccines and also connotes that people could afford cost in accessing vaccination such as transportation cost, it is not surprising that we find a positive significant association between health expenditure and the utilisation of childhood immunisation.

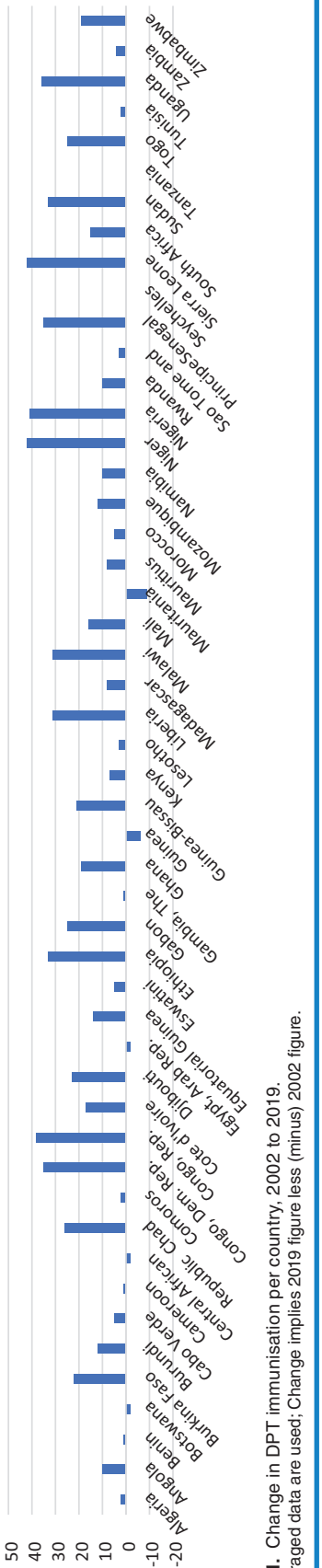

Figure 1. Change in DPT immunisation per country, 2002 to 2019.
Non-averaged data are used; Change implies 2019 figure less (minus) 2002 figure.

Figure 2. Change in measles immunisation per country, 2002 to 2019.
Non-averaged data are used; Change implies 2019 figure less (minus) 2002 figure.

Table 4. Baseline 2-step system GMM estimates of the effect of economic growth on the utilisation of childhood immunisation.

	DPT	MEASLES
L.DPT vaccine utilisation	0.7253*** (0.0271)	
Economic growth1	1.2978*** (0.3547)	1.6293*** (0.2539)
Health expenditure	0.7702*** (0.2022)	0.9325*** (0.2633)
Primary education	0.0010 (0.0203)	0.0495** (0.0203)
Under-five mortality	−0.1139*** (0.0200)	−0.0998** (0.0373)
Population growth	2.3407*** (0.4882)	0.5202 (0.3613)
L.Measles vaccine utilisation		0.6946*** (0.0539)
Constant	−9.7714 (7.0229)	−18.7221*** (4.6318)
Observations	237	237
No. of countries	50	50
No. of instruments	46	46
ARB	0.0488	−0.8774
ARB *P*-value	0.9611	0.3802
Hansen *j*	35.1507	35.8288
Hansen *j* *P*-value	0.4611	0.4294
F-stat.	3941.8599	194.4928
F-stat. *P*-value	0.0000	0.0000

Abbreviations: ARB, Arellano-Bond second-order serial correlation test statistic; Hansen *j*, Hansen overidentification test statistic; L., first lag of the associated variable. Economic growth1 is log-transformed; For brevity, time fixed effects are not reported; Standard errors in parentheses; *$P < .1$, **$P < .05$, ***$P < .01$.

Surprisingly, a rise in under-five mortality is found to be associated with a fall in the utilisation of childhood immunisation. This finding conflicts with the health-belief model,[18] which posits that, when people feel more susceptible to contract diseases or die, they will be more willing to utilise health inputs, assuming that the perceived barriers are less than the perceived benefits. Nonetheless, the possible explanation is that, if under-five mortality is increasing and people are not aware that the non-utilisation of immunisation could be one of the possible reasons, the utilisation of immunisation will not increase. Moreover, deep-seated negative perceptions about vaccines may prevent people from utilising immunisation for their children even if under-five mortality is high.

The finding of a positive significant association between population growth and the utilisation of childhood immunisation is not farfetched because, when population increases, governments are likely to ensure a commensurate rise in investment in the health sector which could increase the supply of health inputs[19] such as vaccines. Moreover, the rise in population growth implies the number of children in need of vaccines would increase, hence, increasing the utilisation of childhood immunisation, all other things being equal.

Limitations

Notwithstanding the novelty of our study, it is not without limitations. First, due to data paucity, four African countries were not added to our study, hence could limit the generalisation of our findings to the entire continent, although we contend that using 50 out of 54 countries is representative of the African continent. Second, we do not cover the utilisation of other childhood immunisation against diseases such as polio, yellow fever among others. Studies in the future may therefore focus on addressing these limitations.

Conclusion

The study findings highlight the potential role economic growth can play in the utilisation of childhood immunisation which is critical in lessening the burden of under-five mortality on the African continent. Therefore, measures such as skills development, technological advancement among others that can propel economic growth[24] on the African continent should be deepened in order to increase the uptake of child health inputs such as vaccines. Moreover, enhancing educational enrolment and health expenditure on the African continent will also be very critical towards decreasing under-five deaths

Table 5. Robustness checks 2-step system GMM estimates of the effect of economic growth on the utilisation of childhood immunisation.

	DPT	MEASLES	DPT	MEASLES
L.DPT vaccine utilisation	0.7140*** (0.0421)		0.7147*** (0.0412)	
Economic growth2	0.6147*** (0.0694)	0.4511*** (0.0683)		
Economic growth3			0.5268*** (0.0680)	0.4362*** (0.0653)
Health expenditure	0.4637** (0.1903)	0.3464* (0.1923)	0.4574** (0.1968)	0.3678* (0.1964)
Primary education	0.1142*** (0.0381)	0.1412*** (0.0370)	0.1275*** (0.0425)	0.1414*** (0.0371)
Under-five mortality	−0.1428*** (0.0271)	−0.0710** (0.0298)	−0.1374*** (0.0268)	−0.0739** (0.0297)
Population growth	3.6106*** (0.4503)	1.1441*** (0.3800)	2.8840*** (0.3736)	0.6586* (0.3733)
L.Measles vaccine utilisation		0.7321*** (0.0527)		0.7307*** (0.0536)
Constant	9.9315* (5.0323)	6.4434 (5.4330)	8.6718* (5.0124)	6.7265 (5.3458)
Observations	236	236	236	236
No. of countries	50	50	50	50
No. of instruments	44	45	44	45
ARB	0.1279	−0.6224	0.1267	−0.6182
ARB *P*-value	0.8983	0.5337	0.8992	0.5365
Hansen *j*	28.7003	37.2319	29.1152	37.4414
Hansen *j* *P*-value	0.6812	0.3226	0.6611	0.3141
F-stat.	582.7017	584.5769	592.9212	688.3547
F-stat. *P*-value	0.0000	0.0000	0.0000	0.0000

Abbreviations: ARB, Arellano-Bond second-order serial correlation test statistic; Hansen *j*, Hansen overidentification test statistic; L., first lag of the associated variable. For brevity, time fixed effects are not reported; Standard errors in parentheses; $^{*}P<.1$, $^{**}P<.05$, $^{***}P<.01$.

since they are associated with an enhancement in childhood immunisation uptake.

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Author Contributions
Conceptualisation: MI; Data acquisition: MI; Analysis: MI; Interpretation: MI; Writing of original draft: MI, AA; Critical revision for important intellectual content: MI, AA; All authors read and approved the final version of the manuscript.

Ethics Approval and Consent to Participate
Consent to participate or ethical approval is not needed since aggregated data from secondary sources are used for this study.

Consent for Publication
Not applicable.

Availability of Data and Materials
The data employed in carrying out this study can be obtained for free from the website of the World Bank (https://databank.worldbank.org/reports.aspx?source=World-Development-Indicators#advancedDownloadOptions).

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