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Article

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FINANCIAL ECONOMICS | RESEARCH ARTICLE

Official development assistance, income per capita and health outcomes in developing countries: Is Africa different?

E. Chuke Nwude^{1*}, Robinson O. Ugwoke², Peter Chinyere Uruakpa³, Ugochukwu Sebastine Ugwuegbe⁴ and Nnenna G. Nwonye¹

Abstract: In this study, we investigate the effect of official development assistance and income per capita on health outcomes in developing countries. Health outcome is proxied by life expectancy and under-5-mortality rate. We accounted for the endogeneity problem in the model by employing a dynamic two-step system generalized method of moments (GMM) estimator. We find that official development assistance does not improve health outcome in developing countries, while income per capital significantly improves health outcome in developing countries. The study reports that CO2 emission is not a significant determinant of health outcome in developing countries but the prevalence of HIV and Immunization significantly determines health outcomes in developing countries. More specifically the prevalence of HIV increases the under-5-mortality rate and decreases life expectancy; immunization increases life expectancy but decreases under-5-mortality rate. It was equally revealed in the study that health outcome in Sub-Saharan Africa (SSA) does not significantly differ from health outcomes in other developing countries. We equally reported that the effect of income per capita on health outcome in Sub-Saharan Africa countries is not significantly different from that of non-SSA countries. The effect of official development assistant on health outcome in SSA was

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PUBLIC INTEREST STATEMENT

Understanding the determinants of health outcome in developing countries of the world has remained a major policy concern to both national and international policy makers alike. In this study we provided an insight into the influence of official development assistance and income per capita on health outcome of developing countries. Our empirical evidence suggests that income per capita is a significantly determinant of health outcome in developing countries, implying that as income per head increases people tends to afford basic diets/nutrients necessary for healthy living, resulting to improved health outcome. However, we failed to provide empirical evidence in support of a significant relationship between official development assistance and health outcome in developing economies of the world. This finding suggests that inflow of foreign aid has not helped in reduce out-of-pocket health expenditure, contrary to some researchers believe.

found to be significantly different from non-SSA countries. The study reveals that the effect of ODA on life expectancy in SSA is less compared to its effect on non-SSA countries. Similarly, the effect of ODA on under-5-mortality is higher in SSA countries as against other non-SSA countries.

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1. Introduction

Improving public health outcomes has remained a concern to both national and international policymakers alike. The increasing attention on public health outcomes is motivated by the understanding that “wealthier nations are healthier nations” and “gains from rapid economic growth flow into health gains” (Pritchett & Summers, 1996). The idea that foreign aid positively improves health outcomes of the recipient country is plausible, as it reduces out of pocket health expenditure by individual households, making health services available to the household at little or no cost (Asiedu et al., 2015). On the other hand, the positive effect of income on health outcomes has been affirmed by many researchers, since higher-income provides additional purchasing power for households to increase their health expenditure, thus leading to improved health outcomes of the households. Under this circumstance, the impact of foreign aid and a country’s income level on health outcomes will depend to a large extent on the country-specific factors such as the prevalence of HIV and CO2 emission among other factors.

Mix findings characterized the results of the extant literature on the effect of official development assistance and health outcome (Bendavid & Bhattacharya, 2014; Ebeke & Drabo, 2011; Gupta et al., 2018; Kotsadam et al., 2018; Maju et al., 2019; Mallaye & Yogo, 2012; Ndikumana & Pickbourn, 2016; Negeri & Halemariam, 2016; Oryema et al., 2017; Pitt et al., 2018). One strand of the literature reports that aid improves health outcomes, promoting the argument on the effectiveness of aid in promoting development in the recipient country (Chauvet et al., 2008; Ebeke & Drabo, 2011; Mallaye & Yogo, 2012; Masud & Yontcheva, 2005; Negeri & Halemariam, 2016). The proponents of aid-led-development maintains that increase in aid inflow to developing nation increases the availability of basic social-economic goods and services that helps to improve the quality of life in the recipient countries which would not have been made accessible to the citizenry if aid were not provided. Access to official development assistance (ODA) by recipient countries particularly improves the health sector through affordable or cost-free medical products and services and by so doing improve health outcome. It equally helps to reduce out-of-pocket health expenditure. The second strand argued that aid is ineffective in promoting health outcomes in developing nations (Gebhardt et al., 2008; Kosack, 2003; Kosack & Tobin, 2006; Williamson, 2008; Wilson et al., 2009). This group contends that countries and international organizations provide these aids to developing countries with breath-taking conditions which end up creating very tight economic conditions for the citizens of the recipient country hence rendering aid ineffective. These aids more often than none creates stringent austerity measure which leaves the citizens more devastated than before. Other factors that were identified as key determinants of aids ineffectiveness in developing countries include corruption, poor institutional framework, and lack of political will, among others. Despite the relevance of these findings in shaping policy framework in developing nations, much is yet to be known about the effectiveness of ODA in improving health outcomes in developing nations.

The axiom “a wealthier nation is a healthier nation” has given rise to significant extant research that focused on the effect of income per capita on health outcomes (Asiedu et al., 2015; Harttgen et al., 2013; Headey, 2013; Or, 2000; Subramanyam et al., 2011). Income has remained one of the major determinants of health outcomes the world over. As the disposable income of nations increase they tend to increase the consumption of quality goods and health services which improves the health outcome of the citizens of the nation. Similarly, increases in income, the individual tends to increase out-of-pocket health expenditure, hence increasing their chance of survival in any given health condition.

Despite what may look like a large number of studies on this subject matter, none of the studies focused on the combined effect of aid and income per capita on health outcomes in developing countries. Similarly, Sub-Saharan Africa (SSA) exhibits unique characteristics. World Bank report 2015 indicated that 736 million people globally are extremely poor, 50% of these numbers live in just five (5) countries majority of who are in SSA. Moreover, 33% of people with extreme poverty are in SSA high that the rest of the world with 1%, South Asia with 2%, East Asia and Pacific with 6% Middle East and North Africa with 3%. Aside from India and Bangladesh with a high record of people with extreme poverty, a vast majority of the poorest people in the world are said to live in SSA. According to UNDP (2019) report on Global Multidimensional Poverty Index (MPI), on average 57.5% of the SSA population are multi-dimensionally poor high than the global figure of 23.1%. The same is the case in terms of population growth in SSA as against the rest of the world. These unique characteristics in SSA might have a significant influence on the health outcome of the region, factors that extant researches have not effectively accounted for.

This study seeks to investigate the combined effect of ODA and income per capita on health outcomes of developing countries. Considering the uniqueness of SSA countries, we attempted to establish whether health outcome in SSA is different from non-SSA countries by including SSA dummy variable on the assumption that SSA countries have heterogeneous characteristics from other developing countries as identified earlier. The novelty provided by this study is that we tested for the slope effect of the model by including the interaction term between ODA and SSA dummy in the model. Our rationale is to determine if the uniqueness of SSA countries affect the level of impact that ODA has on health outcome. In line with the work of Asiedu et al. (2015), we equally included the interaction term between income per capita and SSA dummy to establish whether the effect of income per capita on health outcome is significantly different in SSA countries than that of non-SSA countries. The interaction terms highlights the intervening effect of the unique characteristics of the SSA countries on the level of impact that ODA and income per capita has on health outcome. The study equally controlled for the effect of prevalence of HIV, CO2 emission and immunization on health outcomes.

The paper is structured as follows: after this brief introduction is section two, review of related literature, presenting the views of other researchers in this study area, followed by section three, data and methodology, section four, discussions of the result and section five presents the conclusions and recommendations.

2. Review of related literature

Several studies have investigated the effect of economic factors in public health outcomes at the national and international levels. In this section, we review current related literature that shares common characteristics with our current study. For better understanding, we will categorize this review into three broad groups. One we will present the findings on the effect of income per capita on health outcome which has been well-documented in the literature. Second, we will summarize the findings on the contributions of foreign aid on public health outcomes. Third, other social-economic factors (prevalence of HIV/AIDS, and CO2 emission) that have been reported to impact health outcomes are reviewed.

2.1. Income per capita and health outcome

Numerous studies have validated the axiom that “wealthier nations are healthier nations”, This has been proved to be factual since gain derived from increased economic prosperity translate to

improved health outcomes (Pritchett & Summers, 1996 as cited in Asiedu et al., 2015). This position was challenged by Anand and Ravallion (1993) who contended that the effect of income per capita on health outcomes turns insignificant when poverty and government spending variables are controlled for in the same model.

Asiedu et al. (2015) investigated the contribution of per capita income on the health outcome of 128 developing countries covering a period of 1994 to 2014. Employing a dynamic panel model (system GMM), they concluded that per capita income contributes positively and significantly to improving life expectancy but negatively and significantly impact under-5-mortality rate. They also reported that non-country specific factors significantly enhanced health outcomes and that the impact is progressive over time.

Or (2000) examined the determinants of health outcomes in industrialized countries employing pooled, cross-country, time-series models for a sample of 21 OECD countries covering the period of 1970 to 1992. In their result, they found that health expenditure exerts a negative effect on mortality rate, with female mortality show statistically significant effect while male mortality is insignificant. A more strong negative relationship was found between GDP per capita and pre-mature mortality rate among countries in OECD.

Harttgen et al. (2013) examined the contribution of GDP per capita on health outcomes in Sub-Saharan Africa countries. Employing child under-nutrition-stunting, underweight and wasting as proxies for health outcomes, the empirical evidence reveals a modest relationship between GDP per capita and child under-nutrition. In a similar study, Headey (2013), opined that GDP per capita is a significant determinant of nutritional preference of households in developing countries. Contrary to the theoretical framework, Subramanyam et al. (2011) in a study of the Indian economy failed to provide empirical evidence that economic growth (proxied by GDP per capita) leads to a reduction in childhood under-nutrition which proxied health outcome.

Vollmer et al. (2014), investigated the relationship between per capita income and childhood under-nutrition. Employing 121 demographic and health surveys from 36 low-income and middle-income countries they reported little or no relationship between income per capita and decrease in childhood under-nutrition. Baird et al. (2011) examined the effect of aggregate income shocks on infant mortality with empirical evidence from 59 developing countries in the world. The study concluded that GDP per capita negatively affects infant mortality. Female infant mortality was found to be more profound than the male mortality in the negative effect of GDP per capita.

Smith and Haddad (2002) in a study on the potent of economic growth in reducing under-nutrition reported that growth in per capita income results in a reduction in under-nutrition in developing countries. They suggest that as the income per head increases, individuals have increased ability to consume goods and services that improve their nutrition in particular and health outcome in general.

Filmer and Pritchett (1999) included per capita income in a study of the impact of public health spending on health outcomes and found that 95% of the cross-national variation in mortality is explained by GDP per capita, inequality, female education, ethnic fragmentation, and predominant religion. Predominantly most of the studies found a positive and significant impact of GDP per capita on health outcomes. They provided evidence in support of the postulated axiom that a wealthy nation is a healthy nation. Subramanyam et al. (2011) contended that these postulations do not hold in India as GDP per capita does not lead to the reduction of childhood under-nutrition.

Dhrifi (2018) reported that health expenditure impacts positively on reducing child mortality for upper-middle-income and high-income countries, while it does not have statistically significant in low-income and lower-middle-income countries. Private health expenditure was reported to be more effective in high development level as against the public health expenditures. The reverse is

the case with a lower development level where public health expenditures were reported to be more effective in reducing child mortality than the private health expenditure. Ray and Linden (2020) noted that public health expenditure is generally more health-promoting than the private health expenditures but the effect of the two components of health expenditures are less pronounced compare to the effect of primary education in promoting health outcomes.

Rahman et al. (2018) in a similar study showed that total, private and public health expenditures have a negative and statistically significant effect on infant mortality rate but the level of private health expenditure effect is larger than that of public health expenditures. Per capita income growth was also reported to have improved population health outcomes significantly.

GNI per capita was shown not to have a significant effect on health outcomes even after instrumenting for GNI per capita Sterck et al. (2018). In another related study, it was reported that the elasticity of per-capita health expenditure and GDP growth has a positive and statistically significant effect on health outcomes in middle income-countries (Bustamante & Shimoga, 2018).

2.2. Foreign aid and health outcome

Here we review the findings of another group of researchers who focused on the effect of foreign aid on public health outcomes. Two theories surround the argument on the effect of aid on health outcomes the optimist and the pessimist. The optimists argue that foreign aid is a significant determinant of health outcomes in the recipient countries, while the pessimists contend that foreign aid has not contributed significantly to the improvement of health outcomes. Prominent among this two contending views are the works of Kosack (2003), Masud and Yontcheva (2005), Chauvet et al. (2008), Kosack and Tobin (2006), Williamson (2008), Wilson et al. (2009), Mishra and Newhouse (2009), Ebeke and Drabo (2011), Mallaye and Yogo (2012), Bendavid and Bhattacharya (2014), Negeri and Halemariam (2016), Ndikumana and Pickbourn (2016), Oryema et al. (2017), Kotsadam et al. (2018), Gupta et al. (2018), Pitt et al. (2018), Maju et al. (2019), and Dingle et al. (2020).

In line with the optimistic viewpoint, Mallaye and Yogo (2012) examined the effect of health aid on health outcomes in Africa, employing a panel data of 28 countries in Sub-Saharan Africa for the period of 200–2010. They reported that health aid contributes to improvement in health outcomes in sub-Saharan African countries. An increase in health aid by one will increase life expectancy by 0.14, decreasing HIV prevalence and infant mortality by 0.05 and 0.17 respectively. They concluded that there is a non-linear relationship between health aid and health outcome. They suggested that the impact of health aid on health outcomes is more effective in the poorest countries than the other.

In a related study, Mishra and Newhouse (2009) analyzed the impact of health aid on infant mortality, employing panel data of 118 countries covering the period of 1979 to 2004. Their result reveals that an increase in health aid is negatively and significantly associated with infant mortality. The result failed to provide empirical evidence to support a significant effect of overall aid on the reduction of infant mortality. Masud and Yontcheva (2005) appraised the contribution of foreign aid in poverty reduction by tracing its impact on human capital indicators. The findings suggest that multilateral aid is more effective in reducing infant mortality than bilateral aid. Ebeke and Drabo (2011) concluded that health aid and public health expenditures are significant determinates of access to health services in aid recipient countries.

Chauvet et al. (2008) investigated the effect of aid and remittances on human capital development proxied by infant and child mortality rates. Employing a panel data of 109 developing countries and a cross-country quintile-level data of 47 developing countries, the result indicates that health aid improves significantly health outcome of the countries under study. Negeri and Halemariam (2016) assessed the relationship between health development assistant and health statues in 43 Sub-Saharan Africa countries covering the period of 1990 to 2010. Employing fixed effect, random effect and first-difference generalized method of moment's estimator, they found

that a one percent increase in health aid saves the life of two infants per 1,000 live births in the region for the period under consideration.

Contrary to the position of the optimists are the pessimists who contend that foreign aid is futile to advancement in health outcomes of aid recipient countries. Wilson et al. (2009) one of the proponents of the pessimist theory, argued that huge funds channeled into the health sector fundamentally have not improved health indicators in any way. The noted strongly the inability of health aid to meet the health needs of the recipient countries, hence aid has little or no impact on health outcomes in these countries. The empirical result of Kosack and Tobin (2006) failed to establish any link between improvement in health outcomes and official development assistance. Similarly, a negligible impact of health aid on health outcomes (i.e infant mortality, life expectancy, and death rate) was revealed by Williamson (2008). The political systems in a country also moderate the effect of aid on health outcomes, because aid has a positive effect on the human capital development index when a country is practicing democracy but the effect turns negative if the country is an autocratic government (Kosack, 2003). Gebhardt et al. (2008) investigated the effect of health aid on health outcomes of recipient countries for the period of 1980 to 2005 using the random coefficient model and found that aid is not a significant determinant of health outcomes. This, however, signifies that aid does not contribute to improvement in health outcomes for the period under study.

Aime (2010) reviewed the effect of foreign aid on health outcomes of developing countries and concluded that aid is ineffective in improving health outcomes. Reviewed paper in his study reported that the domestic environment and other country-specific factors have made aid very ineffective in promoting health outcomes and economic growth generally. They attributed the ineffectiveness of aid to the recipient country as most of the factors that inhibit aid effectiveness are indigenous to the recipient country. We differ from this submission and note that the recipient country cannot be held responsible completely for the poor performance of aid in economic growth and improved health outcomes. Most donors come with different objectives that often are counter-productive to the growth and development of the recipient countries. This no doubt contributes to the ineffectiveness of aid in promoting economic growth and health outcome. The argument of Niyonkuru (2016) supports the fact that aid ineffectiveness in developing countries can be attributed mainly to hidden agendas from donors who present stringent and unbearable conditionality which are hard to meet by the recipient countries followed by austerity measures that place the vulnerable citizens in a more precarious condition.

Ndikumana and Pickbourn (2016) examined the effect of foreign aid allocation on access to social services among countries in SSA. They reported a non-linear relationship and concluded that aid targeted to water supply and sanitation increases access to these social services. Bendavid and Bhattacharya (2014) reported that foreign aid to the health sector improves health outcomes significantly within the period under study.

Kotsadam et al. (2018) took a micro-level perspective of the effect of development aid on infant mortality in Nigeria and reported that geographical proximity to active aid projects contributes significantly to improving the under-5-mortality rate. Moreover, they reported that the effect of aid is more among less privileged groups in society. Gupta et al. (2018) opined that health aid per capita spending was linked to a large and significant decline in the level of state fragility. They suggested that increased health aid to Africa significantly explain raise in peaceful societies in SSA. Maju et al. (2019) noted that an increase in water and sanitation expenditures occasioned by demand for more and appropriate foreign aid allocation could lead to a reduction in women's exposure to some deadly diseases like HIV/AIDS.

Oryema et al. (2017) investigated the effect of debt relief on the under-five-mortality rate in SSA and reported that participation in High Indebted Poor Countries Initiative significantly decreases under-5-mortality rate while outright debt cancellation is not statistically

significant. Dingle et al. (2020), employed Muskoka2 method in estimating the level of aid for reproductive, maternal, newborn and child health for the period of 2002–2017, reported that the proportion of this class of aid received by low-income countries increased from 31% in 2002 to 52% in 2017. SSA was reported as the largest recipient with Nigeria accounting for 7% of the global flow of this class of aid, followed by Ethiopia with 6% and Kenya and Tanzania with 5% respectively.

2.3. Other socioeconomic factors and health outcomes

Different authors have employed several other factors that affect health outcomes in their model mostly as control variables. Asiedu et al. (2015) employed school enrollment (male and female), health expenditure and prevalence of HIV (male and female) as control variables in assessing the effect of income on health outcomes. School enrolment (female), health expenditure was found to have a negative and significant effect on the under 1-year mortality rate, while the prevalence of HIV (female) has a positive and significant effect on the under-1-year mortality rate. Mallaye and Yogo (2012) included school enrolment rate (primary), primary completion rate (female), the urban population as a percentage of the total population, labor force, gross fixed capital formation and composite of governance in estimating the model on the effect of health aid on health outcome. Their result indicates that school enrolment, urban population, primary completion rate are positively associated with life expectancy, the prevalence of HIV with only urban population reporting significant. While they are negatively associated with infant mortality and school enrolment and urban population are statistically significant. Negeri and Halemariam (2016) in their study included the primary year of schooling, rule of law, regulatory quality, government effectiveness, control of corruption, and improved sanitation facilities as a control variable. The result indicates that all the variables exert a negative impact on infant mortality except regulatory quality and control of corruption that has a positive impact on infant mortality.

However, evidence from extant research indicates that no study has attempted to investigate the joint effect of official development assistance and income per capita on the health outcome of developing economies. Similarly, controversies characterizes the existing result on the subject matter as there has been no conclusive evidence on the effect of aid or income on the health outcome of developing economies. Most of the studies focused on either country-level analysis or regional analysis with no effort to investigate the differential effect of aid and income on the health outcome of regions like SSA with unique characteristics and other developing economies of the world. This study, therefore, provided the gap in the literature by investigating the joint effect of ODA and income per capita on health outcomes in developing countries. We equally provided empirical evidence that x-rayed the deferential effect of ODA and income per capita on the SSA region with other developing economies of the world by including the SSA dummy and interaction terms, hence contributing to the literature.

3. Data and methodology

The study investigates the effect of official development assistant and income per capita on health outcomes of 81 developing countries of the world (see Appendix 2). The panel data covers a period of 1999 to 2017 represent 20 years period, amounting to a total of 1,620 observations. Contain in Appendix 1 is a list of all the developing countries under study as classified by the World Bank. In other to account for the endogeneity problem that may arise in the data set we employ a panel dynamic model.

Negeri and Halemariam (2016) estimated a dynamic panel model as shown below:

$$Y_{i,t} = \beta_0 Y_{i,t-1} + \beta_1 X_{1,t} + \beta_2 \delta_{2,t} + \vartheta_{1(i)} + \vartheta_{2(t)} + \varepsilon_{i,t} \quad (1)$$

Where $Y_{i,t}$ is the mortality rate used to proxy health statuses of country i , $Y_{i,t-1}$ is the lagged of the dependent variable (mortality rate), $X_{1,t}$ is health aid, $\delta_{2,t}$ is a vector of control variables, $\vartheta_{1(i)}$ and $\vartheta_{2(t)}$ represent country and time effects, $\varepsilon_{i,t}$ is an idiosyncratic error term with $E(\varepsilon_{it}) = 0$ for i and t .

Negeri and Halemariam (2016) employed the first-step difference generalized method of moments (GMM) proposed by Arellano and Bond (1991) in estimating equation one above. Meanwhile, Arellano and Bond (1991) difference GMM has some potential setbacks among which are small sample bias mostly when the dependent variable is a highly persistent data and the number of time dimension is small. To address the issue of persistence in the dataset, it is important to take a five years average of the data. This approach reduces the number of observations significantly but the dependent and independent variable (mortality rate and health aid) remained persistent. However, to overcome the finite sample bias in this type of study, we adopted the system generalized method of moments proposed by Blundell and Bond (1998).

The system GMM estimator proposed by Blundell and Bond (1998) contains additional orthogonality conditions that provide some asymptotic efficiency gains. Roodman (2009) opined that this efficiency gain does not come without some costs: an exponential increase in the number of the instrument together with the number of time-period. This gives rise to finite sample bias and as well increase the possibility of obtaining a false positive result and a deviously high pass rate of key specification tests like Hansen (1982) J-test. Following Roodman (2009), propositions, we estimated the system GMM model with a collapsed instrument matrix.

We used a strongly balanced panel data sourced from World Bank Development Indicators for a sample of 81 countries, covering the period of 1999 to 2017. We reduced the data count by employing five years average of the dataset resulting in only four-time counts.

We adopted two different measures of health outcome (Life expectancy, and under-5-mortality rate), as our dependent variable while official development assistance (ODA) and gross domestic product per capita (GDPPC) are the main independent variables under study. We included other socioeconomic variables (prevalence of HIV, CO2 emission, and Immunization) as controls to account for their effect on health outcomes.

We estimate a variant of the equation below in line with Blundell and Bond (1998):

$$LE_{i,t} = \beta_0 LE_{(i,t-1)} + \beta_1 ODA_{i,t} + \beta_2 GDPPC_{i,t} + \beta_3 HIV_{i,t} + \beta_4 CO2_{i,t} + \beta_5 IMM_{i,t} + \beta_6 SSA + \beta_7 ODA_{i,t} \times SSA + \beta_8 GDPPC_{i,t} \times SSA + \vartheta_0 + \vartheta_{1(i)} + \vartheta_{2(t)} + \varepsilon_{i,t} \quad (2)$$

Where i refer to countries, t refers to time, LE is life expectancy used as a proxy for health outcome, ODA is the official development assistance, $GDPPC$ is the gross domestic product per capita which is a proxy for income per capita. HIV is the prevalence of HIV, $CO2$ is the emission of $CO2$, IMM is the immunization of children under ages 0 to 23 months for measles, SSA is a dummy variable that takes the value of 1 if a country is in Sub-Saharan Africa (SSA) and zero otherwise, this dummy was included on the assumption that SSA is different from other countries when it comes to health outcomes. SSA dummy seeks to establish if there is a significant difference between health outcomes in SSA and health outcomes in non- SSA countries. $ODA \times SSA$ is an interaction term that provides empirical information on whether the effect of ODA on health outcomes differs significantly in SSA countries from other non- SSA countries. $GDPPC \times SSA$ is the interaction term that seeks to establish whether there is a significant difference between the effect of $GDPPC$ on health outcomes in SSA countries and other countries outside SSA .

3.1. Description of variables

There is no unanimous agreement on the main measure of health outcomes among the various indicators that constitute health outcomes. As numerous as their measures are, researchers have made use of different proxies for health outcomes. Consistent with the work of Negeri and Halemariam (2016), Asiedu et al. (2015), and Mallaye and Yogo (2012), this study adopted life expectancy (LE) and under-5-mortality rate as proxies for health outcome in investigating the effect of ODA and income per capita on health outcome. To control for the effect of other socio-economic variables that affect health outcomes, extant literature included different variables such as the prevalence of HIV, school enrollment, capital formation, etc (Asiedu et al., 2015; Mallaye & Yogo, 2012; Negeri & Halemariam, 2016). In addition to the prevalence of HIV which is believed to significantly reduce life expectancy and as well significantly increase under-5-infant mortality, we included other variables such as CO2 emission and Immunization. The choice of CO2 emission is to enable us to capture the effect of environmental hazards like air pollution on the health outcome of residents of developing countries. Immunization was also included in the model to determine the effect of government intervention/preventive measures on health outcomes. We looked beyond school enrolment to consider CO2 emission because globally emphases are shifting to environmental sustainability as a sure way of survival on planet earth. We sourced all our data from the World Bank database (see Appendix 1).

In Table 1, the result of some commonly used descriptive statistics of the data was reported. We observed that during the study period 1998–2017, the average GDP per capita 2,616 with a minimum value of 126.5 USD and a maximum of 15,690. The result of the standard deviation indicates a marginal deviation around the mean. The mean official development assistance as a percentage of GDP for the period under investigation was 34.01%, with a standard deviation of 70.22%. The minimum value of stood at –0.4% and the maximum value was 819.9%. The average life expectancy for the full sample is 65.34, the data set reveals that Lebanon has the highest life expectancy with 79.77 and Rwanda has the lowest life expectancy with 36.60. The mean prevalence of HIV for the full sample of developing countries stood at 2.453 with a minimum of 0.100 and a maximum of 28.04. The deviation around the mean is 4.919 which indicates minimal deviation. The average emission (CO2) is 1.627 with a deviation around the mean of 2.039, suggesting a minor deviation. 0.0813 is the minimum value while 15.03 represents the maximum value. Table 2, present the result of the correlation matrix of the variables included in the model. The result of the correlation matrix indicates that there is no strong correlation among the independent variables while strong correlation was observed among the dependent and independent variables.

Table 1. Descriptive statistics

	(1)	(2)	(3)	(4)	(5)
VARIABLES	N	mean	sd	Min	Max
ODA	405	34.01	70.22	–0.400	819.9
GDPPC	405	2,616	2,907	126.5	15,690
HIV	405	2.453	4.919	0.100	28.04
IMM	405	81.63	16.85	20.60	99
USMR	405	65.34	52.02	5.500	254.3
CO2	405	1.627	2.039	0.0183	15.03
LE	405	64.82	9.444	36.60	79.77
Number of CROSSID	81	81	81	81	81

Source: Authors computation

Table 2. Correlation matrix

	LE	U5MR	ODA	GDPPC	HIV	HIV	IMM
LE	1.0000						
U5MR	-0.9283	1.0000					
ODA	-0.5206	0.5573	1.0000				
GDPPC	0.5973	-0.5720	-0.3278	1.0000			
HIV	-0.4899	0.2783	0.0961	-0.0911	1.0000		
CO2	0.4895	-0.5064	-0.2855	0.5833	-0.1670	1.0000	
IMM	0.7006	-0.7732	-0.2803	0.4010	-0.0832	0.4214	1.0000

Source: Authors computation

4. Estimation of results and discussion

4.1. Estimation of foreign aid, income per capita and life expectancy using two-step system GMM

We present the estimated result from two-step System GMM in Tables 3 and 4 for life expectancy and under 5 mortality rates. The result in Table 3 presented the estimation of the effect of official development assistant and income proxied by GDP per capita. We found from the result that official development assistance negatively and significantly affects life expectancy, while income per capital significantly and positively impacts life expectancy for the period under investigation. This result is in tandem with the pessimist theories who argued that official development assistance does not have a positive effect on the health outcomes of the recipient countries. We equally corroborate the axiom that “wealthy nation is a healthy nation” following the coefficient of GDPPC which is positive and significant. This result is robust after controlling for the prevalence of HIV, CO2 emission, immunization, SSA and other interaction variables.

The result reveals that the Prevalence of HIV reduces life expectancy significantly as indicated by the coefficient of the variable. We found this result to be consistent even after including SSA dummy and other interaction terms in the model. We failed to provide empirical evidence in support of CO2 emission as a significant determinant of health outcomes (life expectancy) in developing countries for the period under study.

This, however, suggests that CO2 emission is not a major determinant of life expectancy in developing countries, this result is persistent across all the models. The coefficient of immunization indicates that immunization is a significant determinant of life expectancy in developing countries under the study period. The result is also persistent after controlling for SSA and other interaction terms. The result of SSA dummy which tests for the intercept effects indicates that health outcome in SSA is not significantly different from health outcome in non-SSA countries under consideration the result was persistent until we interacted with ODA and it turned to be significant. We equally found that the interaction of SSA dummy with GDPPC indicates that there is no difference in the effect of income per capita on life expectancy between SSA countries and non-SSA countries. This result is contrary to the findings of Asiedu et al. (2012), who reported a significant difference between SSA and non-SSA countries. On the other hand, we report that there is a significant difference in the effect of ODA on life expectancy in SSA countries compared to non-SSA countries. The result indicates that the effect of ODA on life expectancy in SSA countries is less as against non-SSA countries.

4.2. Estimation of foreign aid, income per capita and under 5 mortality rate using two-step system GMM

The result presented in Table 3, contains the outcome of the two-step system GMM estimator which examined the effect of foreign aid, income per capita on the under-5-mortality rate. The

Table 3. Result of two-step-system-GMM

VARIABLES	LE (1)	LE (2)	LE (3)	LE (4)	LE (5)
LLE	0.563*** [0.0702]	0.568*** [0.0635]	0.605*** [0.0512]	0.595*** [0.0536]	0.627*** [0.0588]
ODA	-0.0134** [0.00534]	-0.00815*** [0.00252]	-0.00769*** [0.00264]	-0.00809** [0.00339]	0.0461* [0.0239]
GDPPC	0.000529*** [0.000152]	0.000317*** [0.0000924]	0.000324*** [0.000078]	0.000345*** [0.0000966]	0.000405*** [0.000101]
HIV		-0.341*** [0.069]	-0.343*** [0.0576]	-0.346*** [0.0601]	-0.341*** [0.0602]
CO2		-0.0629 [0.192]	0.0256 [0.213]	0.0205 [0.226]	0.0807 [0.235]
IMM		0.123*** [0.0223]	0.143*** [0.0238]	0.140*** [0.0252]	0.148*** [0.0242]
SSA			2.333 [1.534]	2.273 [1.799]	3.947** [1.875]
GDPPC_SSA				-0.00024 [0.000373]	
ODA_SSA					-0.0559** [0.0252]
Constant	29.02*** [4.421]	19.26*** [3.012]	14.22*** [3.924]	15.23*** [4.005]	11.19** [4.41]
Observations	324	324	324	324	324
No. of CROSSID	81	81	81	81	81
Hansen_test	4.843	4.165	4.475	4.213	3.236
Hansen Prob	0.184	0.244	0.107	0.122	0.198
AR(1)_test	2.752	2.05	2.097	2.079	2.278
AR(1)_P-value	0.00592	0.0403	0.036	0.0376	0.0228
AR(2)_test	-0.739	-1.189	-1.492	-1.529	-1.9
AR(2)_P-value	0.46	0.234	0.136	0.126	0.0574
No. of Instrum.	7	10	10	11	11

Robust standard errors in parentheses, *** p < 0.01, ** p < 0.05, * p < 0.1

This table reports the regression result from two-step System GMM for life expectancy. LE(1) only considered ODA, and GDPPC, LE(2) included other control variables like the prevalence of HIV, CO2 emission, and immunization. LE(3) included a dummy of SSA, to establish if life expectancy is significantly different between SSA and non-SSA countries. LE(4) included the interaction effect (GDPPC_SSA) to find out if the effect of GDPPC on life expectancy for SSA countries is significantly different from that of non-SSA countries. LE(5) included the interaction term (ODA_SSA) to find out if the effect of ODA on life expectancy rate for SSA countries is significantly different from that of non-SSA countries.

Source: Authors computation

model also included other control variables together with the dummy of SSA and the interaction terms. We found that official development assistance has a positive and significant effect on the under-5-mortality rate. In line with pessimist theory, the result suggests that official development assistance deteriorate the health outcome in developing country proxied by under-5-mortality rate. This result is persistent across all the models that controlled for HIV, IMM, CO2, SSA dummy and GDPPC interaction with SSA. These, however, indicate that an increase in official development assistance by a unit will increase the under-5-mortality rate by 0.0431. Instead of ODA decreasing the under-5-mortality in line with the *a priori* expectation, our empirical result corroborates the

Table 4. System GMM result based on under-5-mortality

VARIABLES	Model 1	Model 2	Model 3	Model 4	Model 5
L.U5MR	0.746*** (0.0351)	0.651*** (0.0429)	0.714*** (0.0461)	0.728*** (0.0473)	0.716*** (0.0427)
ODA	0.0352*** (0.0121)	0.0401*** (0.0101)	0.0426*** (0.00860)	0.0444*** (0.00862)	−0.194** (0.0894)
GDPPC	−0.000444** (0.000222)	−0.000382** (0.000188)	−0.000374* (0.000213)	−0.000481* (0.000250)	−0.000684** (0.000282)
HIV		0.465*** (0.117)	0.744*** (0.180)	0.579*** (0.185)	0.781*** (0.191)
CO2		−0.205 (0.215)	−0.634 (0.401)	−0.594 (0.392)	−0.835* (0.483)
IMM		−0.482*** (0.0939)	−0.548*** (0.112)	−0.510*** (0.108)	−0.554*** (0.102)
SSA			−14.39*** (3.790)	−16.10*** (4.911)	−18.93*** (5.094)
GDPPC_SSA				0.00185 (0.00124)	
ODA_SSA					0.246*** (0.0929)
Constant	5.892** (2.595)	51.75*** (10.71)	58.50*** (12.93)	54.66*** (12.37)	63.08*** (12.63)
Observations	324	324	324	324	324
No. of CROSSID	81	81	81	81	81
firm effect	YES	YES	YES	YES	YES
year effect	NO	NO	NO	NO	NO
Hansen_test	15.63	12.81	7.128	8.076	8.045
Hansen Prob	0.00135	0.00507	0.0283	0.0176	0.0179
Sargan_test	70.79	45.08	8.858	11.42	8.375
Sargan Prob	0	8.88e-10	0.0119	0.00331	0.0152
AR(1)_test	−0.0342	−0.200	−0.309	−0.172	−0.754
AR(1)_P-value	0.973	0.841	0.757	0.864	0.451
AR(2)_test	−3.058	−2.405	−2.143	−2.164	−2.143
AR(2)_P-value	0.00223	0.0162	0.0321	0.0304	0.0321
No. of Instruments	7	10	10	11	11

Robust standard errors in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

This table reports the regression result from two-step System GMM for under-5-mortality. Model 1 only considered the ODA, and GDPPC, Model 2 included other control variables like the prevalence of HIV, CO2 emission, and immunization. Model 3 included a dummy of SSA, to establish if the under-5-mortality rate in SSA is significantly different from non-SSA countries. Model 4 included the interaction effect (GDPPC_SSA) to find out if the effect of GDPPC on the under-5-mortality rate for SSA countries is significantly different from that of non-SSA countries. Model 5 included the interaction term (ODA_SSA) to find out if the effect of ODA on the under-5-mortality rate for SSA countries is significantly different from that of non-SSA countries.

Source: Authors computation

pessimist theory which presupposes that official development assistance cannot improve health outcomes in the recipient country.

Our result also provided empirical evidence that income per capita exerts a negative effect on the under-5-mortality in developing countries under consideration. We found that the result is

consistent across different models that controlled for HIV, CO₂, IMM, and SSA dummy as well as other interaction terms. This result is also consistent with the findings of Asiedu et al. (2012), Harttgen et al. (2013), and Headey (2013), who reported a negative relationship between GDP per capita and under-5-mortality rate. The prevalence of HIV shows a positive and significant effect on under-5-mortality rate in developing countries. This, however, suggests that as the prevalence of HIV increase it leads to an increase in mortality of children under the ages of 5. More children under the ages of 5 are lost as HIV spreads across the population. The result, however, indicates that the prevalence of HIV is a significant determinant of health outcomes proxied by under-5-mortality in developing countries. Similarly, increased immunization significantly reduces the mortality rate of children under the ages of 5. As more children aged 12 to 23 months are immunized against measles, it significantly reduces the death rate of children aged 0 to 4 years.

Meanwhile, we examined the intercept effect to see whether the under-5-mortality rate in SSA differs significantly from those of non-SSA countries. The result indicates that SSA countries differ significantly from non-SSA countries. Countries in SSA have a lower child mortality rate than those countries in non-SSA countries. The interaction term indicates that the effect of income per capita on the under-5-mortality rate of SSA is not significantly different from non-SSA countries. On the other hand, the second interaction term indicates that the effect of official development assistance on under-5-mortality differs significantly among SSA and non-SSA countries. The result suggests that the effect of ODA on the under-5-mortality rate is higher in SSA countries than the non-SSA countries.

4.3. Robustness test

We tested for the robustness of the result by estimating the one-step system GMM and found that the results were consistent across all the models specified. The same result holds through for the variables used to proxy for health outcomes. Meanwhile, to conserve space, we presented only the result of the two-step system GMM, while that of the one-step system GMM is presented in Appendix 3.

4.4. Diagnostic test

Various diagnostic tests were conducted to enhance the reliability of the result obtained from the two-step system GMM. This is to ensure that the data are consistent with the assumptions of Blundell and Bond (1998). First, we report the result of the autoregressive of order 1 (AR(1)). The result indicates the rejection of the null hypothesis which states that the moment conditions are valid, which applies only when there is no autocorrelation in the idiosyncratic error. This, however, implies that there is a serial autocorrelation in the model at AR(1). The result of AR(2) indicates the acceptance of the null hypothesis, suggesting that there is no serial correlation in the model at AR(2) which is consistent with the assumption of Blundell and Bond (1998). The test for the instrument over-identification restriction was conducted using the Hansen test, which is based on the null hypothesis that the instruments as a group are exogenous. The result indicates that the probability value of the Hansen test is greater than 0.05 hence, we failed to reject the null hypothesis, in line with the underlining assumption. The result of this diagnostic test is consistent across all the models estimated for this study.

5. Conclusions and recommendations

Given the increasing debate on the effect of income per capita on health outcomes, few studies relate to the effectiveness of aid on health outcomes. Much fewer studies have attempted to capture the combined effect of aid and income per capita on health outcomes of developing countries. This study, therefore, seeks to contribute to the existing literature by providing empirical evidence on the effect of foreign aid, and income per capita on health outcomes of developing countries. We employed a panel data set of 81 developing countries, covering the period of 1998 to 2017.

In other to account for the effect of the endogeneity in the model, the study employed the two-step system GMM proposed by Blundell and Bond (1998). The result suggests that official development assistance has a negative and significant effect on life expectancy in developing countries under considerations. We equally found a positive and significant relation between official development assistance and the under-5-mortality rate among the developing countries under investigation. This

result aligns with the pessimist theory, by concluding that official development assistance does not contribute positively to the improvement of health outcomes in developing countries. Specifically, the effects of official development assistance on life expectancy in SSA countries were found to be lower than that of non-SSA countries. Whereas official development assistance effect on the under-5-mortality rate is higher in SSA countries compared to non-SSA countries. Extant studies have shown that multilateral and bilateral aids exert different effects on poverty reduction (Alvi and Senbenta 2012). Our present study, however, looked at aggregate foreign aid creating room for further studies to examine the disaggregated effect of foreign aid on health outcomes by including bilateral and multilateral aid.

However, in line with extant literature on income per capita and health outcome, we concluded that income per capita is a significant determinant of health outcomes in developing countries. Explicitly, an increase in income per capita improves life expectancy significantly, and at the same time reduces the under-5-mortality rate. The interaction between income per capita and SSA suggests that there is no significant difference between the effects of income per capita on health outcomes in SSA countries and other non-SSA countries. One of the major limitations of this study centers on the application of income per capita as a measure of disposable income. Evidence has shown that income per capita is not a clear reflection of the disposable income in the hands of an individual citizen. And so, further studies can leverage on this to look at the micro-level effect of income on health outcome modeling the household disposable income which is a true measure of income on health outcome indicators.

The prevalence of HIV contributes significantly to reducing life expectancy in developing countries, while it equally contributes significantly to increasing the under-5-mortality rate among developing countries under consideration. An increase in immunization also contributes significantly to improving life expectancy, and at the same time reduces under-5-mortality significantly among the developing countries studied.

In line with the evidence provided by our findings on the effect of aid and income per capita on health outcomes in developing countries, we, therefore, recommend that developing countries should depend less on official development assistance from international organizations and other donor agencies. Effective policies and programs that will enhance the domestic economy and guarantee suitable income should be vigorously pursued since income per capita contributes more to improvement in health outcomes than ODA. Effective immunization and broader coverage of the exercise should also be implemented to significantly reduce under-5-mortality and improve life expectancy. Proactive measures aimed at reducing the prevalence of HIV should also be adopted in order to improve life expectancy and reduce under-5-mortality.

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Appendix 1

Variable	Description	Source
ODA	Net official development assistance (ODA) per capita consists of disbursements of loans made on concessional terms (net of repayments of principal) and grants by official agencies of the members of the Development Assistance Committee (DAC), by multilateral institutions, and by non-DAC countries to promote economic development and welfare in countries and territories in the DAC list of ODA recipients; and is calculated by dividing net ODA received by the midyear population estimate. It includes loans with a grant element of at least 25 percent (calculated at a rate of discount of 10 percent)	World Bank Database
GDP per capital (GDPPC)	GDP per capital (GDPPC) which represents income is considered to be very relevant to health outcome since a high level of income increases ability to pay for quality goods and services (quality medical services), provides access to quality housing, and better nutrition. “GDP per capita is gross domestic product divided by midyear population. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or depletion and degradation of natural resources. Data are in current U.S. dollars	World Bank Database
Prevalence of HIV	“Prevalence of HIV refers to the percentage of people ages 15–49 who are infected with HIV”.	World Bank Database
Immunization	Child immunization, measles, measures the percentage of children ages 12–23 months who received the measles vaccination before 12 months or at any time before the survey. A child is considered adequately immunized against measles after receiving one dose of vaccine”.	World Bank Database
Under-5-mortality rate (U5MR)	Under-5-mortality rate (U5MR), is one of the proxies for health outcomes used in this study. It is “the number of death among infants before the ages of 5 years, per 1,000 live births, in a given year. We adopted this measure of health outcome because it is more susceptible to change given changes in our main variables and other socioeconomic variables under considerations”. The under-five mortality rate is the probability per 1,000 that a newborn baby will die before reaching age five, if subject to age-specific mortality rates of the specified year.	World Bank Database

(Continued)

Variable	Description	Source
CO2	Carbon dioxide emissions are those stemming from the burning of fossil fuels and the manufacture of cement. They include carbon dioxide produced during consumption of solid, liquid, and gas fuels and gas flaring”.	World Bank Database
Life expectancy at birth (LE)	Life expectancy at birth (LE) “indicates the number of years a newborn infant would live if prevailing patterns of mortality at the time of its birth were to stay the same throughout its life”.	World Bank Database

Appendix 2

List of Developing Countries understudy

Albania	Congo, Dem. Rep.	Jamaica	Pakistan
Algeria	Congo, Rep.	Kazakhstan	Panama
Argentina	Costa Rica	Kenya	Paraguay
Armenia	Cote d'Ivoire	Kyrgyz Republic	Peru
Azerbaijan	Cuba	Lebanon	Philippines
Bangladesh	Dominican Republic	Macedonia, FYR	Rwanda
Belize	Ecuador	Madagascar	Senegal
Benin	Egypt, Arab Rep.	Malawi	Sierra Leone
Bolivia	El Salvador	Malaysia	Sri Lanka
Botswana	Gabon	Mali	Sudan
Brazil	Georgia	Mauritania	Eswatini
Burkina Faso	Ghana	Mexico	Tajikistan
Burundi	Guatemala	Mongolia	Tanzania
Cambodia	Guinea	Morocco	Thailand
Cameroon	Guinea-Bissau	Mozambique	Togo
Central African Republic	Guyana	Namibia	Tunisia
Chad	Haiti	Nepal	Uganda
Chile	Honduras	Nicaragua	Uruguay
Colombia	India	Niger	Uzbekistan
Comoros	Iran, Islamic Rep.	Nigeria	Vietnam
			Zimbabwe

Appendix 3. One Step System GMM for 5-Mortality rate

	(1)	(2)	(3)	(4)	(5)
VARIABLES	SGMM1	SGMM2	SGMM3	SGMM4	SGMM5
L.LE	0.330** (0.152)	0.365*** (0.127)	0.565*** (0.0591)	0.554*** (0.0602)	0.575*** (0.0650)
ODA	−0.0275*** (0.0103)	−0.0149*** (0.00471)	−0.0113*** (0.00359)	−0.0129*** (0.00479)	0.0484** (0.0233)
GDPPC	0.000852*** (0.000248)	0.000544*** (0.000144)	0.000411*** (9.06e-05)	0.000462*** (0.000114)	0.000481*** (0.000106)
HIV		−0.474***	−0.396***	−0.379***	−0.404***

(Continued)

(Continued)					
	(1)	(2)	(3)	(4)	(5)
VARIABLES	SGMM1	SGMM2	SGMM3	SGMM4	SGMM5
		(0.0920)	(0.0684)	(0.0643)	(0.0746)
CO2		-0.0348	0.0682	0.0704	0.129
		(0.201)	(0.188)	(0.204)	(0.211)
IMM		0.173***	0.156***	0.158***	0.158***
		(0.0350)	(0.0237)	(0.0263)	(0.0242)
SSA			2.926**	3.454*	4.257**
			(1.417)	(1.870)	(1.763)
GDPPC_SSA				-0.000415	
				(0.000372)	
ODA_SSA					-0.0620**
					(0.0248)
Constant	42.93***	27.95***	15.37***	15.74***	13.42***
	(9.160)	(5.535)	(3.840)	(3.816)	(4.309)
Observations	324	324	324	324	324
Number of CROSSID	81	81	81	81	81
Hansen_test	4.843	4.165	4.475	4.213	3.236
Hansen Prob	0.184	0.244	0.107	0.122	0.198
AR(1)_test	2.312	1.642	2.098	2.178	2.184
AR(1)_P-value	0.0208	0.101	0.0359	0.0294	0.0289
AR(2)_test	0.159	-0.896	-1.539	-1.575	-2.025
AR(2)_P-value	0.874	0.370	0.124	0.115	0.0429
No. of Instruments	7	10	10	11	11

Robust standard errors in parentheses

*** p < 0.01, ** p < 0.05, * p < 0.1

SGMM1 to SGMM5 denote One-Step system GMM model1 to model5.

One Step System GMM for Under-5-Mortality rate

One Step System GMM for Under-5-Mortality rate

	(1)	(2)	(3)	(4)	(5)
VARIABLES	SGMM1	SGMM2	SGMM3	SGMM4	SGMM5
L.U5MR	0.783***	0.679***	0.679***	0.686***	0.701***
	(0.0446)	(0.0585)	(0.0537)	(0.0560)	(0.0504)
ODA	0.0431***	0.0495***	0.0484***	0.0481***	-0.169*
	(0.0136)	(0.0111)	(0.00849)	(0.00870)	(0.0984)
GDPPC	-0.000135	-0.000182	-0.000401	-0.000402	-0.000620*
	(0.000226)	(0.000241)	(0.000263)	(0.000299)	(0.000331)
HIV		0.358*	0.877***	0.789***	0.880***
		(0.182)	(0.244)	(0.242)	(0.285)
CO2		-0.239	-0.589	-0.478	-0.732
		(0.203)	(0.409)	(0.372)	(0.495)
IMM		-0.429***	-0.614***	-0.575***	-0.573***
		(0.127)	(0.141)	(0.138)	(0.125)
SSA			-12.71***	-12.02**	-16.53***

(Continued)

	(1)	(2)	(3)	(4)	(5)
VARIABLES	SGMM1	SGMM2	SGMM3	SGMM4	SGMM5
			(4.460)	(5.330)	(5.822)
GDPPC_SSA				0.000864	
				(0.00125)	
ODA_SSA					0.217**
					(0.102)
Constant	2.090	44.95***	65.43***	60.89***	64.18***
	(2.678)	(14.56)	(16.32)	(15.85)	(15.53)
Observations	324	324	324	324	324
Number of CROSSID	81	81	81	81	81
Hansen_test	15.63	12.81	7.128	8.076	8.045
Hansen Prob	0.00135	0.00507	0.0283	0.0176	0.0179
Sargan_test	70.79	45.08	8.858	11.42	8.375
Sargan Prob	0	8.88e-10	0.0119	0.00331	0.0152
AR(1)_test	-0.155	-0.248	-0.334	-0.282	-0.724
AR(1)_P-value	0.877	0.804	0.738	0.778	0.469
AR(2)_test	-2.668	-2.140	-2.136	-2.114	-2.092
AR(2)_P-value	0.00763	0.0324	0.0326	0.0345	0.0364
No. of Instruments	7	10	10	11	11

Standard errors in parentheses

*** p < 0.01, ** p < 0.05, * p < 0.1

SGMM1 to SGMM5 denote One-Step system GMM model1 to model5.



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