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The Impact of Health Care Expenditure and Infectious Diseases on Labour Productivity Performance in Africa: Do Institutions Matter?

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ABSTRACT

This study was rooted from the findings that for many years infectious diseases remain the major cause of death around the globe especially in Africa. Economic theory also predicts among others that HIV/AIDS reduces labour supply and productivity, and the GDP of Africa declines by 2-4% annually. In addition, institution is one of the reasons for slower growth in Africa. The study, therefore, examined the impact of health care expenditure per capita and infectious diseases such as HIV/AIDS and tuberculosis (TB) on labour productivity performance in Africa using System GMM Estimation methods for 50 panels of African countries from 2002–2011. The results show that health-care expenditure per capita is positive but insignificant to labour productivity performance in the region. The results also confirm the negative impact of infectious diseases on labour productivity performance in the region. Government effectiveness and control of corruption are positive and significant to the improvement of health care expenditure in Africa. In addition, the study also revealed that political instability and conflict also contribute positively to the spread of infectious diseases in the region. Thus, it is recommended that African governments and health-related development partners increase the financial amount allocated to the health sector. At the same time, more efforts are needed to curb and control the spread of infectious diseases through strengthened institutions to improve health-care expenditure in the region.

Keywords: Health care expenditure, infectious diseases, labour productivity, Africa

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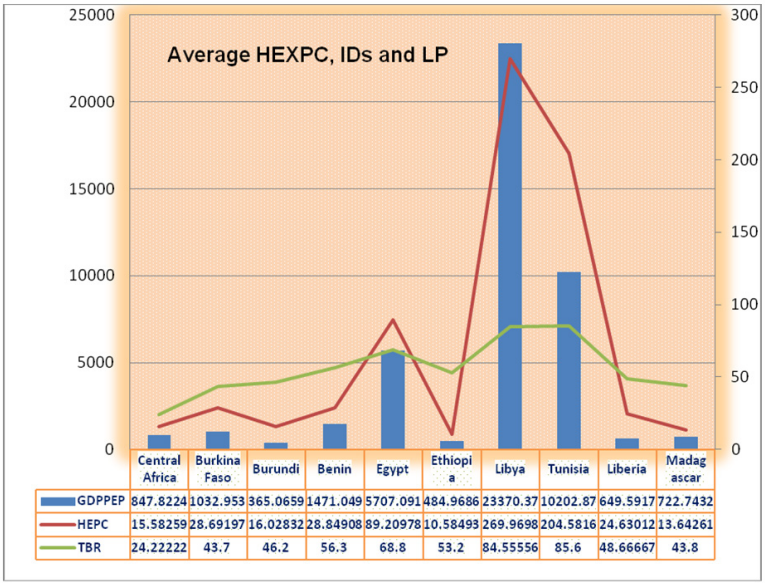
INTRODUCTION

For many years, Africa remains one of the lowest regions with health care expenditure in the world despite being the worst region affected by infectious diseases (IDs) such as HIV/AIDS and tuberculosis (TB). These IDs

play a critical role in negatively affecting labour productivity and economic growth. In 2011, Africa recorded an estimated 60% of the global HIV burden (UNAIDS, 2012). A similar report by the World Health Organisation (WHO, 2013) showed that Africa recorded more than double the world's average of TB cases (122 per 100,000 people). At the individual country level, two African countries, South Africa and Swaziland, had the highest incidence rates of per capita TB cases, with about 1 new case for every 100 people a year. On health care expenditure, the World Health Organisation (2011) reported that Africa has the lowest expenditure compared with other regions. The report further showed that average health care expenditure per capita (HEXPC) was $1,405 and total health care expenditure (as a % of GDP) was 5.9 % in Africa, while in the regions of the Americas and Europe, HEXPC was more than double that in Africa ($3,534 and $2,367, respectively). The trend of both health expenditure and IDs in the African region are depicted in Fig.1.

As reported by WHO (2012), most of the African countries had low health care expenditure but higher TB and low LP. Fig.1 presents these relationships.

From the above figure, countries with higher IDs (TB) cases tend to have lower value of labour productivity per worker as opposed to countries with lower cases of IDs. For example, Burundi recorded the lowest value of labour productivity with low health care expenditure but high TB cases. The figure also shows a high value



	Central Africa	Burkina Faso	Burundi	Benin	Egypt	Ethiopia	Libya	Tunisia	Liberia	Madagascar
GDPPEP	847.8224	1032.953	365.0659	1471.049	5707.091	484.9686	23370.37	10202.87	649.5917	722.7432
HEPC	15.58259	28.69197	16.02832	28.84908	89.20978	10.58493	269.9698	204.5816	24.63012	13.64261
TBR	24.22222	43.7	46.2	56.3	68.8	53.2	84.55556	85.6	48.66667	43.8

Fig.1: Relationship between Health Expenditure, Infectious Diseases and Labour Productivity in Africa

Source: Researcher Design. GDPPEP is GDP per worker, HEXPC is health expenditure per capita both as $ 2005 Constant price), TBR is TB rate total detection (all form). Data from WDI (2003)

of labour productivity recorded by Libya with high health care expenditure but lower TB cases. Another country with similar relationship is Tunisia, where the level of labour productivity superseded the rate of TB cases recorded at the same time, showing a high health care expenditure during the period of the review.

The low health care expenditure and high burden of HIV/AIDS in Africa could be due to poor institutions in the region. These context institutions, as defined by the World Bank, refer to sets of formal and informal rules governing the actions of individuals and organisations as well as the interactions of participants in the development process (Kumssa & Mbeche, 2004). More elaborately, institutions can be formal and informal. While a formal institution relates to adherence to the established rules and regulations in society, an informal institution refers to trust and networks, which define informal rules or constraints for economic activities and self-mechanism (Ibrahim & Hook, 2014).

The institutional index used in this study includes government effectiveness, control of corruption and political stability, as well as war and conflicts. Government effectiveness is defined as the government's capability to formulate and implement sound policies that could foster social and economic interactions between people and the state. It is concerned with the perception of public service quality, government credibility, the degree of independence from political pressures and policy implementation. Government effectiveness measures the level of bureaucracy, quality of personnel, and institutional failure (Kaufmann, Zoido-lobatón, & Aart, 1999). Political stability and the absence of violence are other institutional qualities defined as propensity for government change in a given period of time, which measure the average number of coups and revolutions per year (Gurgul & Lach, 2013). Control of corruption is also regarded as a measure to reduce the tendency towards corrupt practices.

In light of the above, the motivation of this study is rooted from the study by Boutayeb, (2006) who asserted that for many years, IDs remain the major cause of death around the globe especially in Africa and LDCs. Economic theory also predicts that HIV/AIDS increases import but reduces labour supply, productivity and export. These result in the decline of the GDP of Africa by 2-4 % annually, (Dixon *et al*., 2013). A weak institution was one of the reasons for slower growth in Africa, (Campos & Nugent, 2000). Similarly, reports from WHO, UNAIDS, Grigoli and Kapsoli (2013) and Conference Board (2013), indicated low health expenditure, high rate of IDs, inefficiency of health expenditure and low labour productivity in Africa over the years, respectively. This study was to find out whether the poor labour productivity performance in Africa could be attributed to the afore-mentioned indicators.

Most studies conducted on health care expenditure and productivity have either focussed on one country analysis such as Nigeria (Umoru & Yaqub, 2013) and Spain

(Rivera & Currais, 2003), or examined a particular sector of the economy (Aggrey, 2012). More so, there are a few studies done on the role of institutions on economic growth and development (Osman, 2012), Acemoglu and Robinson (2010), and Siddiqui and Ahmed (2009). Therefore, this study focuses on health care expenditure and IDs on labour productivity compared with the role of institutional quality in the entire African region. In specific, the objective of this study was to empirically examine the above issues in Africa. The study included a panel of 50 African countries covering a 10-year period (2002–2011) using endogenous growth theory and the system GMM estimator as its theoretical base and methodological approach, respectively.

LITERATURE REVIEW

Theoretical and Empirical Literature

This study relies heavily on the endogenous growth theory and human capital model. Some studies (Lucas, 1988; Romer, 1990; Barro & Sala-I-Martin, 1995) have applied the Augmented Solow Model to determine the relationship between human capital and growth. Endogenous growth theory argues that economic growth is an endogenous result of an economic system rather than the result of external forces (Romer, 1994). Additionally, in endogenous growth theory, government policies are regarded as technological changes that improve growth. Government policy can affect the growth rate of aggregate output and consumption by affecting the efficiency of human capital accumulation technology (e.g., government policies that make educational systems more efficient). This might be accomplished through the implementation of better incentives for performance in the school system (Williamson, 2011).

On the other hand, the human capital model is widely used in the field of health. This model was developed by Grossman in 1972, as one of the versions of the endogenous growth model. Grossman (1972) shows that his model draws heavily on the human capital theory developed by Becker (1965), Ben-Porath (1967) and Mincer (1974). The idea of health, as a part of the human capital stock of the person is not new; in fact, the first health demand model was created by Grossman in 1972, which provides a framework for modelling human capital accumulation and its relationship to health (in terms of health care expenditure and IDs). Therefore, the incorporation of institutions into endogenous growth theory is one justification for adopting the theory as a basis for the assessment of the impact of institutions on health care expenditure and IDs in Africa. As such, this study relies on endogenous growth theory as well as human capital theory.

The Impacts of Health Expenditure on Labour Productivity and the Economic Impact of Infectious Diseases

The empirical relationships between health care expenditure, health outcomes and labour productivity have been previously established. Some studies have found a positive relationship, while others have concluded the existence of a negative relationship between health expenditure and

health outcomes and output. For example, Bloom *et al*. (2003) and Bloom, Canning and Sevilla (2004) disclose that health capital indicators positively influence aggregate output, with 22–30% of the growth rate attributed to health capital. Rivera and Currais (2003), in a panel data analysis, suggested that current government health spending has a positive effect on productivity in a Spanish region.

On the economic impact of IDs, several studies have empirically examined the impact of IDs such as HIV/AIDS and TB on economic growth and development. For example, Grimard and Harling (2004), in panel data estimation using an augmented Solow growth model, found that countries with a lower burden of TB recorded faster growth than countries with a high incidence of TB. The results showed that those countries recorded between 0.2% and 0.4% lower growth for every 10% increase in the TB incidence. In another study assessing the impact of HIV/AIDS on FDI in developing countries using panel data GMM estimators, Asiedu, Jin, and Kanyama (2011) found a negative relationship between HIV/AIDS and productivity in terms of FDI, where FDI diminishes as the prevalence rate increases. The study, however, shows that 1% increase in HIV prevalence is expected to reduce FDI by about 0.0811 and 0.111% in short-run and long-run periods, respectively.

The Impact of Institutions on Infectious Diseases

The complementary effects of institutional quality and technological progress are the main reasons for the very low growth in productivity in Latin America; therefore, institutional quality is one of the key determinants of growth by providing incentives to invest in technology (Franko, 2007). Researchers (Siddiqui & Ahmed, 2013; Acemoglu & Robinson, 2010) have posited that the quality or effectiveness of institutions has a stronger effect on long-term growth. It was also empirically established that institutional factors have a significant influence on total factor productivity and that countries with better institutions exhibit higher productivity (Méon & Weill, 2013).

Further, Hall and Jones (1999) reported that institutions and government policies increase capital accumulation and productivity per worker. They found that in 127 countries, a positive relationship exists between output per worker and the measure of social infrastructure. Accordingly, a change in the effectiveness of governance and social infrastructure is associated with a 5.14% change in output per worker. Hence, war and conflicts contribute immensely to the increase in HIV/AIDS infection. For example, a decade of ethnic war, with mass movements of refugees from conflict in Rwanda, has led to an escalating rate of HIV that has spread from cities, such as Kigali, to the rural parts of the country (Smallman-Raynor & Cliff, 1991). Away from Africa, Wollants *et al*. (1995, as cited in Smallman-Raynor & Cliff, 1991) showed that the high HIV infection rates in El Salvador soldiers were attributed to the high levels of risky sexual behaviour by soldiers associated

with the 12-year civil war and numerous prostitution centres surrounding military posts. Corruption, on the other hand, was found to affect growth and productivity; more specifically, institutions that protect property rights are crucial to economic growth and investment (Knack & Keefer, 1995).

DATA AND METHODOLOGY

Empirical Framework

To assess the impact of health care expenditure, IDs on labour productivity performance, as well as the role of institutions on health care expenditure in Africa, the following assertion is in line with the main focus of this study. Thus, the basic argument in human capital and endogenous growth theory is that an increase in workers' quality through improved education and health improves productivity. This study therefore adapts from Oluwatobi and Ogunrinola (2011), the augmented Solow model, which is in line with literatures from Barror & Sala-I-Martin (1995), Romer (1990) and Lucas (1988). The endogeneous growth theory assumes that output is a function of stock of labour, capital and human capital in the form of stock of health and level of education. The study therefore adapted endogenous (augmented Solow) model in the form of:

$$Y = A\ K^{\alpha}(hL)^{\beta} \quad (1)$$

where; Y=Output level; K=Stock of physical capital; h=Level of Human Capital; L=Labour, measured by number of workers; A=Level of Total Factor Productivity; α =Elasticity of capital input with respect to output; while β =Elasticity of labour input with respect to output.

Econometrically with the introduction of error term, the model becomes;

$$Y = AK^{\alpha}(hL)^{\beta} + u. \quad (2)$$

Transforming (2) into a log-linear form, and taking the natural log of some variables, as well as augmenting the model to include other control and relevant variables of the study, the final model for achieving objectives 1 and 2 becomes:

$$Y_{it} = \alpha_0 + \alpha_1 \ln K_{it} + \alpha_2 \ln h_{it} + \alpha_3 L_{it} + \alpha_4 \ln \delta Z_{it} + u_{it} \quad (3)$$

Where,

Y=Output level representing productivity per worker as dependent variable in the cases of the estimation of the impact of health-care expenditure and LP. Similarly, it also stands for both HEXPC and HIVPR as dependent variables used in the estimation of the role of institutions on both health-care expenditure and IDs in Africa. α_0 is a constant term and $\alpha_1 \ldots \alpha_4$ are coefficients of the explanatory variables. While K is Stock of physical capital; h represents level of human capital in the form of school enrolment; L is labour supply and A theoretically stands for Total Factor Productivity. Additionally, δZ is a vector of parameters of other control variables, while letters *i* and *t* represent vectors of countries and time respectively, and U is the random error term.

Variable Measurements and Data Sources

The variables used in this study include the following; GDP per worker (lnLP) measured in PPP 2005 constant prices (proxy of labour productivity per worker). HEXPC measured in 2005 constant prices. Population Growth (POPG) was measured as the % of annual growth (proxy of labour supply). Gross Capital Formation (CP) measured as the % of GDP (proxy of physical capital). GDP per capita (GDPC) was measured in 2005 constant prices. Gross Enrolment Secondary (HCP) was measured as the total enrolment of both sexes (proxy of human capital). Gross National Income (GNI) was measured in 2005 constant prices. HIVPR was measured as total detection cases among the population aged 15–49 (example of IDs). TB detection rate (TBDR) was measured as the % of all forms. Trade Openness (OPN) was measured as the % of GDP [(exports + imports) / GDP]. Gross National Income (lnGNI) was measured as PPP in the 2005 constant prices. All data for the above variables were obtained from WDI, World Bank (2013). The study used three indexes of institutional quality: Govt. Effectiveness (GEFTVS), Control of Corruption (COCRP), and Political Instability, Violence & War (PSAV). Data for all three institutional indexes were soured from WGI (2013).

Econometric Model

To achieve the objectives of this study, relevant variables as discussed in subsection 3.2 are specified in line with the theory endogenous growth model and human capital model, as described in subsection 2.1 above. The variables are also specified in line with the dynamic panel data approach, which accounts for the dynamic adjustment among the variables. Using the above framework (equation 3) and taking the natural log of some of the variables of interest, the final econometric models of the study are specified in equation 4.

$$\begin{aligned}\ln LP_{it} = {} & \beta_0 + \beta_1 \ln LP_{it-j} + \beta_2 \ln CP_{it} + \beta_3 POPG_{it} \\ & + \beta_4 \ln HCP_{it} + \beta_5 \ln HEXPC_{it} + \beta_6 IDs_{it} \\ & + \beta_7 \ln OPN_{it} + \beta_8 \ln \mathrm{GNI}_{\mathrm{it}} + \varepsilon_{it}\end{aligned} \quad (4)$$

Where, other components of the model are as defined in equation (4). LP is the dependent variables proxy to GDP per worker/person employed, CP and POPG represent Capital and labour supply, respectively. HCP is the control variable representing human capital; HEXPC is health care expenditure per capita and IDs stands for (HIVPR and TBDR). Also, OPN is used as a policy variable to account for the economies openness, while *J* is the vector of lag variables. Equation 6, therefore, is used for the estimation of the impacts of health care expenditure and IDs on labour productivity in Africa. Accordingly, the parameters of LP, CP, POPG, HEXPC and OPN are expected to have a positive relationship with the labour productivity, while both IDs are expected to affect labour productivity negatively, unless otherwise.

To assess the role of institutions on health care expenditure and the spread of IDs, three institutional variables were considered. These variables were assumed to contribute immensely on the performance

of health care expenditure and control of IDs, equation 3 was used as the econometric model for the estimation of the impact of health care expenditure and IDs on labour productivity, as well as the assessment of the role of institutions on health care expenditure and spread of IDs in Africa. The models include all the relevant variables and they are specified as equation 5 and 6, where, other variables are as defined above, INS represent three institutional quality variables namely: GEFTVS, CCRP and PSAV. GNI is the gross national income (used as additional variable for the robustness re-estimation analysis), and *J* is the vector of lagged dependent variables. Accordingly, the parameters of the two INS variables (GEFTVS, CCRP) are expected to be positive, where quality institution will improve health care expenditure positively. The parameter of PSAV is also expected to be positive, where political instability and war increase the spread of IDs.

Estimation Method

The study used Generalised Method of Moment (GMM) as method of estimation. As pointed out by Baltagi (2005), in panel data estimation, both the Generalised Least Square (GLS) estimators and the Fixed Effect estimators would produce constant estimates in the presence of dynamics and endogenous regressors. To curb this problem, Arellano and Bond (1991) proposed a dynamic panel GMM, which is an instrumental variable estimator that uses all past values of endogenous regressors, as well as the current values of strictly exogenous regressors as instruments. Arellano and Bond (1991) started by transforming all regressors by differencing all regressors and used generalised method of moments. This process is called Difference GMM (Hansen, 1998).

System GMM Estimator becomes more efficient due to some shortcomings of the Difference GMM, particularly near unit root problems and it is not efficient when the individual cross section (N) is large. This study reports results of system GMM. According to Arellano and Bover (1995) and Blundell and Bond (2000), the different GMM estimator neglects vital information in the level relationship and in the relations between the level and the first difference. Indeed, the variables at level are weak instruments for their first difference and are potential source of persistency. To curb

$$\ln HEXPC_{it} = \beta_1 \ln HEXPC_{it-j} + \beta_2 \ln GDPC_{it-j} + \beta_3 INS_{it-1} + \beta_4 \ln CP_{it-j} + \beta_5 POPG_{it-j} + \beta_6 \ln OPN_{it-j} + \beta_7 \ln GNI_{it-j} + \varepsilon_{it} \quad (5)$$

$$HIVPR_{it} = \beta_1 HIVPR_{it-j} + \beta_2 \ln GDPC_{it-j} + \beta_3 INS_{it-j} + \beta_4 \ln CP_{it-j} + \beta_5 \ln HCP_{it-j} + \beta_6 POPG_{it-j} + \beta_7 \ln OPN_{it-j} + \beta_8 \ln GNI_{it-j} + \varepsilon_{it} \quad (6)$$

this problem, they advocated a different approach known as system GMM. The system GMM approach estimates both the level and first difference regression as a system by instrumenting the level regression with the lagged level variables. The system GMM has two estimators, "One step" and "Two step" estimators, where the two-step estimator is the optimal estimator that provides efficient estimates.

Countries of the Study

The study covers all African countries with the exclusion of Somalia, South Sudan, Zimbabwe and Seychelles due to a lack of data on essential variables.

RESULTS AND DISCUSSION

This subsection discusses the two-step system GMM results obtained in the estimation of the impacts of health care expenditure and IDs on labour productivity performance in Africa. The estimation used LP as the dependent variable against other explanatory variables, as specified in equation 4. On the role of institutions on health care expenditure and IDS in Africa, the estimation used both HEXPC and HIVPR as dependent variables against other explanatory variables, as specified in equations 5 and 6, respectively.

Empirical Results

The Impact of Health-Care Expenditure and Labour Productivity

The results of Difference GMM analysis presented in Table 1 exhibit some elements of near unit root or persistency problem as the coefficients obtained from the lagged dependent variable in all the 3 models are closed to 1. This problem, according to Blundell and Bond (2000), is capable of resulting to inefficient estimates. Similarly, the Sargan test P-values obtained in all models shown in Table 1 failed to reject the null hypothesis of validity of over identifying restrictions and it indicates that the instrumental variables used are invalid.

At the same time, the P-values of serial correlations of AR (1) in models 2 and 3 from the table indicate the presence of first-order serial correlation. These conditions, therefore, justify the weaknesses of Difference GMM, and that the result using this estimation technique is in efficient for this analysis. However, the result of Difference GMM is presented in Appendix A for comparison with the System GMM, which was adopted for analysis in this study.

Table 1 also presents System GMM Estimators (two-step) which examines the impacts of health care expenditure on labour productivity performance. As highlighted earlier, the two-step system GMM is theoretically more efficient than the Difference GMM result. Estimates of two-step system GMM in model 1 in the table revealed that health care expenditure was positive, but statistically insignificant for explaining labour productivity performance.

The above result is quite contrary to the theory; our prior expectation was that improving health expenditure would lead to better and enhanced health care delivery through the better provision of health

infrastructure. It was expected to reduce the level of illness, absenteeism and improve worker ability and concentration, hence, leading to an overall improvement in their productivity performance. However, this relationship could be attributed to issues including inadequate resources for health, inefficient management of health resources, corrupt governments and other deficiencies that are evident in African health systems. The result is also in line with the reasons highlighted by Novignon *et al.* (2012) that in Africa, where health infrastructure is mostly underdeveloped, increasing health expenditure is necessary, but not a sufficient condition for improving health status. They further argued that the efficiency and effectiveness of the allocation and utilisation of such resources should be given priority.

On the impact of IDs on labour productivity, for example, HIV appears negatively and statistically significant at reducing per worker productivity in Africa. The result of system GMM obtained from model 2 in Table 1 shows that a 10% increase in HIVPR among workers

TABLE 1
Estimation of the Impacts of Health Expenditure and Infectious Diseases on Labour Productivity (Difference and System GMM)

VARIABLES	MODEL 1		MODEL 2		MODEL 3	
	Diff. GMM.	SYS. GMM	Diff. GMM.	SYS. GMM	Diff. GMM.	SYS. GMM
$LnLP_{t-1}$	0.859***	1.034***	0.742**	1.088***	0.834***	1.047***
	(8.16)	(59.00)	(3.17)	(37.17)	(3.90)	(76.22)
$LnHEXP_{t-2}$	0.009	0.006	-0.001	0.002	-	-
	(0.41)	(0.51)	(-0.03)	(0.12)		
$LnCP_{t-2}$	0.017	0.007	0.011	0.002	0.002	0.002
	(1.15)	(0.74)	(0.80)	(0.15)	(0.14)	(0.15)
$lnHCP_{t-2}$	0.006	0.007*	0.005	0.009**	0.006*	0.006*
	(1.48)	(1.95)	(1.54)	(2.27)	(1.73)	(1.73)
$POPG_{t-1}$	0.023*	0.022**	0.001	0.021**	0.009	0.026**
	(1.81)	(2.33)	(0.11)	(2.24)	(0.66)	(2.12)
$lnOPN_{t-2}$	-0.045	0.015	0.011	0.006	0.006	0.010
	(-1.31)	(0.70)	(0.55)	(0.29)	(0.29)	(0.49)
$hivpr_{t-2}$	-	-	-0.013	-0.013**	-	-
			(-1.63)	(-2.55)		
$lnTBDR_{t-2}$	-	-	-	-	-0.001***	0.001***
					(-4.97)	(-5.09)
SARGAN TEST	5.860	15.797	5.517	18.539	5.287	11.199
	(0.4391)	(0.260)	(0.480)	(0.183)	(0.5076)	(0.594)
AR (1)	0.0015	0.0006	0.0280	0.0008	0.0670	0.0061
AR (2)	0.3866	0.5933	0.3433	0.6809	0.5503	0.7325

***, ** and *: significant at 1 %, 5 % & 10 % respectively, values in parenthesis are t-values. And lnLP=GDP per worker, lnHEXP=Health Care Expenditure per capita, HIVPR=prevalence of HIV, lnTBR=all forms of TB detection rate, lnCP= Capital, lnHCP= human capital, POPG= Labour, on and lnOPN=Trade Openness. Time dummy for 2003-2010 are statistically significant across the entire models.

aged between 14 and 49 reduces labour productivity by 0.13 units. The negative relationship obtained above could be due to a lack of concentration at work, frequent absenteeism through sick leave or the tendency to discriminate workers living with HIV. This result confirmed that HIV/AIDS remains one of the major public health problems in Africa, as shown by several reports (UNAIDS, 2012). The result is also consistent with empirical findings by Dixon *et al*. (2013).

On the other hand, the system GMM result in model 3 from the same table (1) relates that TB is negatively and statistically significant at diminishing labour productivity per worker in Africa, as the other IDs shown in model 2. The coefficient shows that a 10% increase in TBDR leads to a 0.001 % decline in per worker productivity. This finding, however, is not new in this area and is in line with the WHO World TB Report (2012), as well as the empirical findings of Asiedu *et al*. (2011) which indicate that IDs such as HIV/AIDS and TB negatively affect labour productivity and economic growth.

Post-Estimation/Diagnostic

The Sargan test of identifying restrictions with the high P-value of test result of two-step system GMM estimates presented in Table 1 for models 1-3 are: 0.260, 0.183 and 0.594. This statistics, according to GMM rule, failed to reject the null hypothesis of no over-identifying restrictions. This, therefore, confirmed that all specifications are well specified and that the instrument vectors used are appropriate with no endogeniety problem.

Additionally, the test result by Arellano and Bond (1991) is presented in Table 1, where the p-values from the two-step system GMM estimate in all the models with the values: 0.0006, 0.0008 and 0.0061. These values are statistically significant at the 1% level. This indicates that the null hypothesis is rejected. This also means that there is no serial correlation of the first-order in the estimation. On the other hand, the test result for second-order autocorrelation AR (2) as presented in the same table, based on the high p-values obtained from the two-step system GMM in all the models, with the values of 0.5933, 0.6809 and 0.7325, failed to reject the null hypothesis of no autocorrelation in line with GMM rule. This, therefore, indicates the absence of second-order serial correlation among the estimates. Accordingly, the absence of serial correlation of both first-order and second-order in the result presented in the above table, confirms that the instruments used are independent of the error term (no autocorrelation) and hence appropriate for the estimation.

Finally, the test statistics of the countries time-specific effects, using time dummy, also rejects the null hypothesis of irrelevance of time-specific effects on the impacts of health care expenditure, IFDs on LP in Africa. It was found that the time dummies are jointly significant at the 1% level, implying the relevance of time-specific effect in the analysis.

The Role the Institutions on Health Expenditure and Infectious Diseases

The second objective of this study is to examine the impact of institutions on health care expenditure and IDs with specific reference to HIV/AIDS. However, due to the factors discussed in Table 1 earlier as some of the weaknesses of Difference GMM result for the estimation of the role of institution on health care expenditure and IDs are presented in Appendix B for comparison.

The system GMM result (two-step) presented in Table 2 examines the role of control of corruption in improving the level of health care expenditure in Africa. The coefficient of COCRP as an institutional input presented showed a positive and statistically significant impact of institution on HEXPC in Africa. According to the result, a 10 unit increase in the (index) of control of corruption in Africa will lead to a $0.12 increase in per capita health care expenditure. This result confirms the conclusion that corruption is one of the factors negatively affecting the performance of health care expenditure in Africa. This revelation is in line with those of Knack and Keefer (1995) and Fisman and Gatti (2002).

The system GMM result obtained in model 2 in the same table (2) shows that the institutional variable referred to as GEFTVS is positive and statistically significant at improving the quantity and quality of per person health care expenditure in Africa. However, looking at the current per capita health care expenditure, the positive nature of this relationship could be interpreted as a backward trend where the low level of health care expenditure in Africa could be due to weak institutions. Also, from the system GMM result obtained, the quality of institutions would contribute meaningfully to improving health care expenditure (resulting in an upward trend relationship). According to this result, 10 units increase in (index) government effectiveness will lead to a $0.14 increase in HEXPC in Africa after a minimum period of a year.

The above finding justifies our assertion that inefficient government and inefficiency in resource allocation and utilisation mitigates the performance of health care expenditure towards the provision of population health care infrastructure in Africa. Moreover, the poor contribution of health care expenditure contributes to poor labour productivity performance in the region. This finding confirms the earlier empirical findings of Acemoglu and Robinson (2010) and Siddiqui and Ahmed (2013). The result is also in line with Wu, Tang, and Lin (2010), who concluded that in low-income countries' government spending does not contribute meaningfully to productivity and economic growth due to inefficient government and inferior institutions,

Additionally, the study examined the role of institution not only on health care expenditure, but also on the spread of IDs such as the analysis of the impact of PSAV on the HIV/Aids prevalence rate in Africa. The system GMM result presented in model 3 in Table 2 showed that a 10 unit increase in the (index) of political instability and

war could lead to a 0.14 increase in HIV prevalence among the population aged from 14 to 49 years in Africa. The above result conformed to the finding by Cliff and Noor (1993), which revealed that the 1982 crises in Mozambique had caused a serious destabilisation in the economy of the country, which resulted in the deterioration of the children's health.

Political instability has long been a common phenomenon in Africa. This situation has led to a proliferation of military bases and refugee camps across the region. The coefficient obtained in this estimation confirms that institutions contribute positively to the control of IDs such as HIV, TB and malaria in Africa. According to the dynamic analysis, the

TABLE 2
Estimation of the Impact of Institution on Health Care Expenditure and Infectious Diseases (Difference and System GMM)

VARIABLES	MODEL 1	MODEL 2	MODEL 3			
	Diff. GMM.	SYS. GMM	Diff. GMM.	SYS. GMM	Diff. GMM.	SYS. GMM
$lnHEXPC_{t-1}$	0.700*** (6.70)	0.785*** (18.86)	0.803*** (8.97)	0.810*** (19.24)	-	-
$HIVPR_{t-1}$	-	-	-	-	0.961*** (15.26)	0.942*** (183.59)
$lnGDPC_{t-2}$	0.293 (1.26)	0.035 (1.04)	0.157 (0.79)	0.090** (2.49)	-	-
$lnCP_{t-2}$	0.031 (1.02)	0.033 (1.61)	0.094*** (3.08)	0.030 (1.30)	-0.042 (-1.60)	-0.049** (-2.07)
$lnHCP_{t-1}$	-	-	-	-	-0.005 (-1.30)	-0.010 (-0.47)
$POPG_{t-1}$	-	-	-	-	0.042 (1.59)	0.020 (0.91)
$lnOPN_{t-1}$	0.061 (0.75)	0.145*** (4.29)	-0.244*** (-3.18)	0.042 (1.35)	0.027 (0.84)	0.018 (1.06)
$COCRP_{t-1}$	0.014*** (3.64)	0.012** (3.47)	-	-	-	-
$GEFTVS_{t-1}$	-	-	0.018* (2.74)	0.014*** (3.53)	-	-
$PSAV_{t-1}$	-	-	-	-	0.010 (1.52)	0.010* (2.49)
SARGAN TEST	5.164 (0.522)	10.222 (0.746)	8.832 (0.183)	18.539 (0.183)	5.878 (0.437)	15.118 (0.370)
AR (1)	0.0002	0.0002	0.0002	0.0001	0.7024	0.6881
AR (2)	0.3306	0.5251	0.2839	0.5068	0.2110	0.2409

***, ** and *: significant at 1 %, 5 % & 10 % respectively, values in parenthesis are t-Statistics. And lnHEXP=Health Care Expenditure per capita, HIVPR=prevalence of HIVPR, lnGDPC= per capita GDP, lnCP= Capital, lnHCP= Human Capital, POPG=Labour and lnOPN= Trade Openness, GEFTVS= index of effectiveness of govt. COCRP= index of control of corruption and PSAV= index of political instability… Time dummy for 2006 - 2010 are statistically significant.

effect of political instability and war could start to manifest after a period of at least one year.

Post-Estimation/Diagnostic

The Sargan test of identifying restrictions (Arellano & Bond, 1991) shows that the high P-value of the test result of two-step system GMM estimates (Table 2) for models 1-3, as 0.746, 0.183 and 0.370 respectively in all models also failed to reject the null hypothesis of no over-identifying restrictions. These, therefore, confirmed that all the specifications are well specified and that the instrument vectors used are appropriate with no endogeniety problem. Additionally, the Arellano and Bond test examined the statistics AR (1) and AR (2) for the presence of serial correlation in the first differenced residual of the first and second orders. The results of the first-order autocorrelation AR (1) in Table 4.4 show the p-values from 2-step system GMM estimates in all the models with the values of 0.0002, 0.0001 and 0.0003 are statistically significant at the 1% level. These indicate that the null hypothesis is rejected. This also means that there is no serial correlation of the first-order in the estimation.

On the other hand, the test result for second-order autocorrelation AR (2), as presented in the same table, based on the high p-values obtained from two-step system GMM in all the models, with the values of 0.5251, 0.5068 and 0.2409, failed to reject the null hypothesis of no autocorrelation in line with GMM rule. These, therefore, indicate the absence of second-order serial correlation among the estimates. Accordingly, the absence of serial correlation of both first-order and second-order of the results presented in the above table confirms that the instruments used are independent of the error term (no autocorrelation), and hence appropriate for the estimation.

Finally, the test statistics of the countries' time-specific effects, using time dummy, also reject the null hypothesis of irrelevance of time-specific effects on the role of institutions on health care expenditure and IFDs in Africa. It was found that the time dummies were jointly significant at the 1% level, implying the relevance of time-specific effect in the analysis.

Robustness Checks

To check the robustness of the above results, following Ibrahim and Hook (2014), another estimation was carried out where some variables were removed (lnHCP, lnOPN, POPG) from some models, and different variables (lnGNI) were added into the equation and estimated. The result of the new estimation confirmed the earlier results of both sign and significance. The result obtained shows that country income level is statistically significant at influencing the level of health care expenditure, whereas model 3 in Table 4.4 2 shows that a 10% increase in country GNI will lead to a $0.18 % increase in health care expenditure per person in Africa. In the other models in the tables, however, the role of GNI is insignificant for both health expenditure and IDs. Similarly, the P-values of Sargan

and both serial correlation of AR 1 & AR 2, as well as time-dummy test of time-specific effects as Post-estimation tests, were all in line with GMM estimation method, as highlighted earlier. The results of the robustness checks for the re-estimation of the impact of health-care expenditure and IDs on LP and the role of institution on health-care expenditure and IDs are presented in Tables 3 and 4.

CONCLUSION AND POLICY IMPLICATIONS

Conclusion

The present paper examined the impact of health care expenditure and IDs, with reference to HIV/AIDS and TB, on labour productivity performance in Africa from 2002- 2011 covering 50 panels of countries. The results obtained from this study used endogenous growth theory and the system

TABLE 3
Robustness Check for Estimation of the Impact of Health Care Expenditure and Infectious Diseases on Labour Productivity (Difference and System GMM)

VARIABLES	MODEL 1		MODEL 2		MODEL 3	
	Diff. GMM.	SYS. GMM	Diff. GMM.	SYS. GMM	Diff. GMM.	SYS. GMM
$LnLP_{t-1}$	0.844***	0.784***	0.824***	1.047***	1.089***	1.033***
	(8.64)	(13.62)	(11.17)	(73.93)	(59.53)	(65.57)
$LnHEXP_{t-2}$	0.010	-	-	-	-	0.009
	(0.45)					(0.71)
$LnCP_{t-2}$	0.018	0.023	0.018	0.004	0.003	0.013
	(1.17)	(1.61)	(0.97)	(0.31)	(0.24)	(1.40)
$lnHCP_{t-2}$	0.005	0.003	0.006	0.007*	0.009**	0.008**
	(1.42)	(1.02)	(1.53)	(1.87)	(2.35)	(2.12)
$Popg_{t-1}$	0.016	0.016	0.022	0.026**	0.021**	0.021**
	(1.28)	(1.26)	(1.57)	(2.03)	(2.20)	(2.17)
$lnGNI_{t-1}$	-0.001	-0.001	0.001	-0.002	-0.002	-0.002
	(-0.01)	(-0.37)	(0.06)	(-0.52)	(-0.14)	(-0.60)
$hivpr_{t-2}$	-	-.011	-	-	-.012**	-
		(-1.20)			(-2.35)	
$lnTBR_{t-2}$	-	-	-0.001***	-0.001***	-	-
			(-4.03)	(-4.94)		
SARGAN TEST	5.557	10.389	6.107	11.401	13.664	16.376
	(0.475)	(0.109)	(0.411)	(0.577)	(0.398)	(0.229)
AR (1)	0.0010	0.0007	0.0173	0.0052	0.0007	0.0005
AR (2)	0.3885	0.3309	0.5429	0.7614	0.6839	0.6345

***, ** and *: significant at 1 %, 5 % & 10 % respectively, values in parenthesis are t-Statistics. And lnHEXP=Health Care Expenditure per capita, HIVPR=prevalence of HIVPR, lnGDPC= per capita GDP, lnCP= Capital, lnHCP= Human Capital, POPG=Labour and lnOPN= Trade Openness, GEFTVS= index of effectiveness of govt. COCRP= index of control of corruption and PSAV= index of political instability… Time dummy for 2006 - 2010 are statistically significant.

GMM estimation method. More specifically, it examined empirically whether the level of HEXPC in Africa contributed to labour productivity per worker. In other words, it examined how the amount being spent on each person translated into his/her productivity through the provision of health infrastructure and services that improve

TABLE 4
Robustness Check for the Estimation of the Role of Institution on Health Care Expenditure and IDs (Both Difference and System GMM)

Variables	MODEL 1		MODEL 2		MODEL 3	
	Diff. GMM.	SYS. GMM	Diff. GMM.	SYS. GMM	Diff. GMM.	SYS. GMM
$LnHEXP_{t-1}$	0.708*** (6.71)	0.809*** (18.00)	0.790*** (8.28)	0.846*** (19.96)	-	-
$HIVPR_{t-1}$	-	-	-	-	0.957*** (14.71)	0.945*** (172.98)
$lnGDPC_{t-2}$	0.291 (1.26)	0.015 (0.42)	0.187 (0.91)	0.058 (1.63)	-	-
$lnCP_{t-2}$	0.033 (1.15)	0.032 (1.48)	0.096** (3.26)	0.028 (1.20)	-0.037* (-1.67)	-0.039** (-2.18)
$lnHCP_{t-1}$	-	-	-	-	-0.005 (-1.28)	0.012 (-0.30)
$POPG_{t-1}$	-	-	-	-	0.041 (1.50)	0.019 (0.93)
$lnGNI_{t-1}$	0.012 (0.80)	0.015 (1.43)	-0.002 (-0.09)	0.018* (1.78)	0.002 (0.29)	-0.001 (-0.36)
$lnOPN_{t-1}$	0.054 (0.68)	0.136 (4.06)	-0.259** (-3.16)	0.039 (1.21)	-	-
$COCRP_{t-1}$	0.013*** (3.55)	0.012** (3.26)	-	-	-	-
$GEFTVS_{t-1}$	-	-	0.017* (2.64)	0.012* (2.58)	-	-
$PSAV_{t-1}$	-	-	-	-	0.010** (1.5)	0.014** (2.99)
SARGAN TEST	5.088 (0.5326)	10.051 (0.7585)	9.145 (0.166)	19.100 (0.161)	6.314 (0.389)	16.117 (0.306)
AR (1)	0.0002	0.0002	0.0002	0.0002	0.6886	0.6803
AR (2)	0.3848	0.6376	0.2522	0.6625	0.2229	0.2183
Observation	345	396	345	396	346	397
No. of Group	50	50	50	50	50	50
No of Instruments	14	22	12	20	14	22

***, ** and *: significant at 1 %, 5 % & 10 % respectively, values in parenthesis are t-values. And lnLP=GDP per worker, lnHEXP=Health Care Expenditure per capita, HIVPR=prevalence of HIV, lnTBR=all forms of TB detection rate, lnGDPC= per capita GDP, lnCP= Capital, lnHCP= Human Capital, POPG=Labour and lnOPN= Trade Openness, GEFTVS= index of effectiveness of govt. COCRP= index of control of corruption and PSAV= index of political instability… Time dummy for 2006 - 2010 are statistically significant.

population health. The results showed evidence of a positive but statistically insignificant contribution of health care expenditure to labour productivity performance in the region. This finding justifies the assertion made by Novignon *et al*. (2012).

This study also shows that institutional quality or government effectiveness is positive and statistically significant at improving the quantity and quality of per person health care expenditure in Africa. At the same time, control of corruption, as another institutional input, has a positive and statistically significant impact on HEXPC in the region. However, the current situation in Africa showed a backward trend, where the low level of institutions results in a low level of impacts on health care expenditure and the spread of IDs. On the other hand, the result confirmed the impact of institutions on the spread of IDs. The coefficient obtained in this estimation confirms that institutions contribute positively to the control of IDs such as HIV, TB and malaria in Africa.

Policy Implications

In order to make health care expenditure plays a positive and significant role in improving labour productivity per worker, African governments and health-related development partners should increase the amount allocated to the health sector in accordance with the Abuja declaration. In addition, with the incoming Millennium Development Strategy (MDS) to be launched by the United Nations as a continuation of the MDGs, which are set to terminate by 2015, stakeholders of the proposed MDS should learn from the shortcomings of the MDGs and ensure the proper appropriation of funds to the health sector. To curb the effects of IDs (HIV & TB) on labour productivity as investigated in this study, despite several campaign programmes at the local, regional, state/province and national, as well as sub-regional levels, more efforts are needed to curb the spread of diseases. These diseases have been the major causes of deaths, reduced labour supply and productivity, and other negative effects that Africa is known for. Stakeholders (governments and NGOs) should increase funding to improve the awareness and prevention of these diseases, which will go a long way in saving lives and improving labour productivity and economic growth in the region. On the quality of institutions, government effectiveness, control of corruption and other institutional measures should be strengthened in Africa to improve health care resources management.

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