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Healthcare Expenditure and Baumol Cost Disease in Sub-Sahara Africa

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Abstract

Previous studies have shown that the unbalanced growth model of Baumol (1967) provides a potential explanation for the observed secular rise in healthcare expenditure in developed countries. The model implies that healthcare expenditure is driven by wage increases in excess of productivity growth. However, no study has tested this hypothesis in the developing world. This study formally examines if healthcare costs in Sub-Sahara Africa (SSA) are affected by the Baumol Cost Disease. It relies on an empirical test proposed by Hartwig (2008) and extended by Colombier (2012), and uses a panel data set of 44 countries covering the period 2004–2016. The results suggest that the healthcare sector in SSA is partly contracted by the Baumol Cost Disease. Further, the result suggests that productivity gains over the period under study were over compensated in SSA overall, suggesting that marginal income is higher than marginal productivity in the economy.

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1. Introduction

Sub-Saharan Africa (SSA), to a greater extent than other regions, still faces a grim scenario with respect to health outcomes (World Bank, 2013; World Health Organization, 2014). While the region has seen improvements in health outcomes, many countries have missed on the Millennium Development Goals targets in this area (United Nations, 2015; United Nations, 2017), and currently are lagging behind in terms of the Sustainable Development Goals (United Nations, 2019). Though the major health indicators in the fragile health situation in SSA countries have slightly improved due to economic development, the commitment of governments and the foreign support, SSA countries still suffer from a poor and vulnerable healthcare system, and have recently witnessed serious concerns related to certain infectious diseases (Barkat *et al.*, 2016). SSA remains one of the regions with modest health outcomes; and evidenced by high maternal mortality ratios and under-5 mortality rate (Doctor *et al.*, 2018).

In an attempt to improve health outcomes, in 2001, African governments have pledged to set a target of allocating at least 15% of their annual budget to the improvement of the healthcare sector (African Union, 2001). Even since, African counties have been focusing on allocation higher expenditure on healthcare. In 2011, ten years after the declaration, 27 African countries had increased the proportion of their expenditure allocated to healthcare while only two countries, Rwanda and South Africa, had reached the 15% target (World Health Organization, 2011). By 2014, the average annual public expenditure on health in the region was 10% of total public spending in 2014 (World Health Organization, 2016).

For SSA, average total healthcare expenditure per capita in international dollars at purchasing power parity, almost doubled from $101 to $198 over the period 2000 to 2016 (World Bank, 2020). Within the same period, under-five mortality rates declined from 152.8 to 82.2 per 1,000 live births, respectively, while life expectancy at birth increased slightly from approximately 50 years to 60 years within the same period. This indicates that the percentage improvement in health status is relatively poor compared to the percentage increase in healthcare expenditure per capita. Other studies in SSA have shown that healthcare expenditure has an inelastic effect on health outcomes - life expectancy, under-five mortality and maternal mortality (Arthur and Oaikhenan, 2017; Nketiah-Amponsah, 2019).

Nevertheless, these studies recommend that SSA countries should make efforts to increase healthcare expenditure in order to improve health outcomes. These studies have taken healthcare expenditure as a policy tool for the government in influencing the healthcare sector to achieve desired outcomes while they have failed to consider that if there is a lack of growth in productivity in the healthcare sector relative to other sectors of the economy, this increases in healthcare expenditure may not necessarily translate in a proportionate improvement in health outcomes.

The above notion can be related to the concept of "Cost Disease" first coined by Baumol (1967) and later applied specifically to the healthcare sector in Baumol (1993). According to the theory, the healthcare sector is characterised as being labour intensive where wage rates increase in proportion to higher wage rates in progressive sectors, such as the manufacturing sector where productivity is relatively higher, to retain workers despite low productivity growth, driving up the unit cost of services in the healthcare sector. As demand for healthcare tends to be price inelastic, this triggers a continuous rise in healthcare expenditure. This is commonly referred to as the Baumol's Cost Disease hypothesis.

The Baumol's Cost Disease hypothesis has been tested in the healthcare sector in the developed world; examining if Baumol's model of unbalanced growth can account for differences in the growth of healthcare costs among a number of countries belonging to the Organization for Economic Cooperation and Development and US states (Hartwig, 2008; Colombier, 2012; Bates and Santerre, 2013). Hartwig (2008) empirically tests Baumol's model of 'unbalanced growth', which identifies nominal wage growth in excess of productivity growth as the main determinant of the rise in healthcare expenditure. Hartwig (2008) uses a so-called "Baumol-variable" – the difference between wage and productivity growth – to estimate the impact of price increase on healthcare expenditure. It uses a regression model that is specified in growth rates using pooled cross-section and time-series data from 19 OECD countries. It finds the 'Baumol variable' to contribute significantly to the explanation of healthcare cost growth. Colombier (2012) extends the empirical model used by Hartwig (2008) by using an "adjusted Baumol variable" to test the validity of Baumol's Cost Disease in the healthcare sector, derived from Baumol's model, using a sample of 20 OECD countries. More recently, Bates and Santerre (2013) examine if healthcare costs in the United States are affected by Baumol's Cost Disease, using a panel dataset of 50 states. The study relies on an empirical test proposed by Colombier (2012) and concludes that the United States healthcare sector suffers from Baumol's Cost Disease.

Generally, it has been considered that the theory is applicable in developed countries (Bates and Santerre, 2013). However, with increasing development and changes in the economic structure of developing countries, the applicability of this model could potentially be extended to the developing world. Nevertheless, it remains unclear about the extent to which Baumol's Cost Disease theory accounts for rising healthcare cost in the developing world. Understanding if the Baumol phenomena constitutes a significant portion of rising healthcare expenditure throughout the developing world, especially in SSA, is important from a public policy perspective in setting health related strategies.

1.1 Healthcare Financing in SSA

The SSA region has 11% of the world's population but carries 24% of the global disease burden. Africa has less than 1% of global healthcare expenditure and only 3% of the world's health workers (International Finance Corporation, 2020). Many SSA countries have a high reliance on direct out-of-pocket healthcare expenditure, accounting for an average of 36% of total healthcare expenditure compared to only 22% in the rest of the world. The next largest component of healthcare financing is domestic mandatory prepayment mechanisms (tax and mandatory insurance) constituting 35% of total healthcare expenditure, compared to 57% in the rest of the world. It has a relatively large share of funding (14% compared to <1% in the rest of the world) attributable to external funding sources. A very small share is attributed to mandatory health insurance scheme contributions, constituting an average of only 1% of total healthcare expenditure in SSA (McIntyre *et al.*, 2018).

Nevertheless, there is significant heterogeneity in healthcare financing in SSA, indicating potential variation in the degree of Baumol's Cost Disease. For instance, healthcare expenditure per capita ranges from about $16.4 in Central African Republic to $553.1 in Mauritius, with an average value of $100.2 in SSA in 2016. Further, the composition of healthcare financing sources varies considerably across different SSA countries. Direct out-of-pocket healthcare expenditure ranges from 2% to 75% of total healthcare expenditure across SSA countries, while domestic mandatory prepayment revenue ranges from 7% to 97% of total healthcare expenditure across the countries. As indicated earlier, private healthcare insurance or domestic voluntary prepayment, is very uncommon in all SSA countries except for a few Southern African countries, particularly South Africa and Botswana, where private insurance contributions account for 36% and 25% of total healthcare expenditure, respectively (McIntyre *et al.*, 2018).

In addition to the variation of the composition of healthcare financing sources, there are other heterogeneities across SSA countries which can render Baumol's Cost Disease to be potentially stronger in some countries than others. While, in 2016, the average share of the services sector is 48%, the minimum value is 27% (for Toga) and the maximum value is 71 (for Seychelles). Likewise, the SSA countries show different rates of growth over the last decade. The average growth rate is 3.2%. Nevertheless, growth rates range from -8.8 (for Equatorial Guinea) to 10.8% (for Guinea). Further, the population structure of countries in SSA also exhibit significant variations. In 2016, the proportion of population above 65 years old ranges from 1.9 to 10.4%. The lowest value is for Uganda while the highest value if for Mauritius. The mean proportion of population above 65 years old is 3.2%. Similarly, population density (people per sq. km of land area) ranges from 2.9 to 622.4 with Namibia and Mauritius having the lowest and highest values, respectively, in SSA, with the average value being 111, for year 2016. The share of labour employed in the healthcare sector varies from 0.01% (for Burundi) to 6% (for South Africa), with an average value of 1.5%, in 2016. These factors indicate a high level of heterogeneity in healthcare financing in SSA; which can have important bearing on Baumol's Cost Disease in SSA.

The objective of this study is to explore the applicability of the Baumol's model in SSA. This study contributes to the literature by empirically examining whether Baumol's Cost Disease theory at least partially accounts for the growth of healthcare costs in SSA. Baumol's Cost Disease theory is empirically tested using a panel dataset of 44 countries from Sub Sahara Africa over the period from 2004 to 2016. The rest of this paper is organised as follows. Section 2 provides the model specification and methodology used. Section 3 provides a description of the data. The estimated results are presented in Section 4. Section 5 provides concluding remarks.

2. Model Specification and Methodology

As per the Baumol model, following (Bates and Santerre, 2013) labour, L is assumed to be the only type of input, generating output in both the non-progressive, Y^{NP}, and progressive, Y^{P}, sectors; where the amount of output generated by labour at time t is given as:

$$Y^{NP}(t) = aL_{NP}(t) \qquad (1)$$

$$Y^{P}(t) = bL_{P}(t)e^{rt} \qquad (2)$$

From the above production functions, output is proportional to labour in the non-progressive sector whereas output in the progressive sector continues to grow at a constant growth rate of r over time. The marginal productivity of labour, dY/dL at time t, in the non-progressive sector can be derived as a (remains constant) whereas in the progressive sector, it can be derived as be^{rt} (rises over time).

Further as per the model, wage rates in the progressive and non-progressive sectors are assumed to be equal at a time t, but they rise over time proportional to improvements in productivity in the progressive sector. Therefore, the wage rate in both of these sectors at time *t* is formulated as:

$$W(t) = W_0 e^{rt} \quad (3)$$

Unit costs, *C*, given as the ratios of wage rates to marginal productivities in these two sectors, are expressed as:

$$C^{NP}\ (t) = \frac{W_0 e^{rt}}{a} \quad (4)$$

$$C^{P}\ (t) = \frac{W_0 e^{rt}}{b e^{rt}} = \frac{W_0}{b} \quad (5)$$

Note that unit costs in the progressive sector, $C^P(t)$, remain constant over time. However, unit costs in the non-progressive sector continually rise over time based upon the rate of productivity growth in the progressive sector. If the healthcare sector is taken as non-progressive sector, Baumol's Cost Disease can affect the healthcare sector.

Hartwig (2008) suggests that Baumol's Cost Disease hypothesis can be empirically tested by investigating whether unit cost changes in the non-progressive sector is directly proportional to the excess of economy-wide wage growth less labour productivity growth in the overall economy, given as below:

$$\Delta log(C^{NP}) = \lambda[\Delta\, log(W) - \Delta\, log(Y)] \quad (6)$$

The left-hand side of the equation, $\Delta log(C^{NP})$ represents the growth of unit costs in the non-progressive sector. The main component on the right-hand side, $[\Delta\, log(W) - \Delta\, log(Y)]$ represents the "Baumol variable" (Hartwig, 2008). This expression measures the difference between economy-wide wage growth and labour productivity growth in the overall economy, where the variables W and Y represent the economy-wide wage and output per worker, respectively.

As explained earlier, Baumol's theory posits similar wage rate adjustments for labour in both the non-progressive and progressive sectors, but there is a relative deficit in productivity in the non-progressive sector. Therefore, unit costs in the non-progressive sector is driven by economy-wide wage growth in excess of productivity improvements. As per Hartwig (2008), an estimated positive value for λ provides evidence for Baumol's Cost Disease.

As per Colombier (2012) the "Baumol variable" as in in Eq. (6) (derived by Hartwig, 2008) is tantamount to say that unit costs of the non-progressive sector increase in a directly proportional manner to the excess of wage increases over productivity growth of the whole economy. Colombier (2012) mathematically shows that the excess of wage growth above productivity growth cannot be equalled with the growth in unit costs of the non-progressive sector, unless the share of the non-progressive sector in total labour force, L_{NP}/L_P, does approach one. It is inferred that the "Baumol variable" as in in Eq. (6) is actually a special case assuming that all labour is employed in the non-progressive sector.

Therefore, to test Baumol's Cost Disease empirically, the share of the non-progressive sector in total labour force should be taken into account (Colombier, 2012). As such, the Baumol variable has to be adjusted by the inverse of the share of the non-progressive sector in the total labour force (Colombier, 2012) as below:

$$\Delta log(C^{NP}) = \frac{\beta_1[\Delta\, log(W) - \Delta\, log(Y)]}{\frac{L_{NP}}{L_P}} \tag{7}$$

In Eq. (7), a positive value for β_1 provides support for Baumol's Cost Disease. For empirical purposes, note that Eq. (7) can be rewritten as:

$$\frac{L_{NP}}{L_P} . \Delta log(C^{NP}) = \beta_1[\Delta\, log(W) - \Delta\, log(Y)] \tag{8}$$

Further, to capture the impact of the Baumol variable, other factors influencing the growth of healthcare costs must be controlled for (Bates and Santerre, 2013). This study controls for GDP, ageing population, population density, foreign aid and political stability in the context of SSA (Jeetoo, 2020) in predicting the healthcare labour-share adjusted growth of healthcare expendituresand the equation is given as, a standard fixed-effects panel model:

$$\frac{L_{NP}}{L_P} . \Delta log(HEPC_{it}) = \beta_0 + \beta_1[\Delta\, log(W_{it}) - \Delta\, log(Y_{it}) + \alpha\Delta\, log(Z_{it}) + \eta_i + \varepsilon_{it}]$$

where $i=1,...,n$; $t=1,...,T$ (9)

The model allows for variation in the various variables across countries, *i* and over time *t*. $HEPC_{it}$, W_{it} and Y_{it} represents nominal healthcare expenditure per capita, overall nominal wages per worker and real GDP per worker, of country *i* at time *t*. Z_{it} represents the vector of continuous variables to control for the above mentioned factors influencing healthcare expenditure growth of country *i* at time *t*. together with its vector of slope parameters α. The control variables, nominal GDP per capita, proportion of population above 65 years old, population density, proportion of official development assistance to GDP and political stability index are used to capture GDP, ageing population, population density, foreign aid and political stability, respectively, in the context of SSA as in Jeetoo (2020). η_i, and ε_{it} captures the country-fixed effects and the idiosyncratic error, respectively.

Eq. (9) is extended to include time-fixed effects (τ_t) and individual time trends ($t.\eta_i$), and is commonly known as the two-way fixed effect model (Baltagi, 2008):

$$\frac{L_{NP}}{L_P} . \Delta log(HEPC_{it}) = \beta_0 + \beta_1[\Delta\, log(W_{it}) - \Delta\, log(Y_{it}) + \alpha\Delta\, log(Z_{it}) + \eta_i + \tau_t + t.\eta_i + \varepsilon_{it}]$$

where $i=1, ..., n$; $t=1, ..., T$ (10)

η_i , τ_t, $t.\eta_i$ and ε_{it} captures the country-fixed effects, the time-fixed effects, the individual country time trend and the idiosyncratic error, respectively. The country-fixed effects reduce unobservable heterogeneity by capturing unobservable factors affecting the growth of healthcare expenditure, such as the propensity to adopt new healthcare technologies in each country. The time-fixed effects capture changes common to all countries over time such as new healthcare technologies. The individual country time trend allows healthcare expenditures to grow at differing rates in various SSA countries as well as other factors that are trending over time within the different countries and which may simultaneously affect both the Baumol variable and healthcare costs.

Note Eq. (10) is estimated using first difference form after transforming the variables into logarithms. This is in line with previous studies analysing the Baumol effect, because of the possible presence of unit roots in the panel data used, which could lead to spurious regression results (Hartwig, 2008; Colombier, 2012; Bates and Santerre, 2013).

Further, this paper applies the fixed-b approach which provides test statistics in linear panel models with fixed effects which are robust to heteroskedasticity, autocorrelation and spatial correlation (Vogelsang, 2012).

3. Data

The study collects an unbalanced panel data for 44 Countries[1] in SSA covering the period 2004-2016 on all the selected variables, based on data availability. Macro-level data is retrieved from the International Labour Organization, World Development indicators and the World Government indicators of the World Bank. Table I provides the descriptive statistics for all variables used in the modelling.

Table I: Descriptive statistics

	Observations	**Mean**	**Standard Deviation**	**Minimum Value**	**Maximum Value**
Share of labour employed in the healthcare sector	572	0.014	0.012	0.001	0.064
Growth of nominal healthcare expenditure per capita	522	0.045	0.141	-0.354	0.530
Growth of overall nominal wages per worker	523	0.046	0.131	-0.542	0.709
Growth of real GDP per worker	528	0.018	0.049	-0.450	0.267
Baumol variable	523	0.028	0.120	-0.510	0.602
Growth of nominal GDP per capita	523	0.048	0.134	-0.541	0.772
Growth of proportion of population above 65 years old	523	-0.002	0.014	-0.055	0.056
Growth of population density	523	0.025	0.009	-0.005	0.047
Growth of proportion of official development assistance to GDP	523	-0.039	0.460	-2.177	3.168
Rate of change in political stability index	528	-0.0006	0.058	-0.370	0.339

[1] This includes: Angola, Benin, Botswana, Burkina Faso, Burundi, Cabo Verde, Cameroon, Central African Republic, Chad, Comoros, Democratic Republic of Congo, Cote d'Ivoire, Equatorial Guinea, Eritrea, Eswatini, Ethiopia, Gabon, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mauritius, Mozambique, Namibia, Niger, Nigeria, Republic of Congo, Rwanda, Sao Tome and Principe, Senegal, Somalia, Sudan, Tanzania, The Gambia, Togo, Uganda, Zambia and Zimbabwe

4. Empirical results

Serial correlation is tested in the idiosyncratic error terms using the serial correlation test (Wooldridge, 2002). Further, the Modified Wald statistic for groupwise heteroskedasticity is computed (Greene, 2000). The null hypothesis of no serial correlation [F(1, 43) = 3.243] and the null of group-wise homoskedasticity [χ^2 (44) = 16369.37] are both rejected which highlight the existence of serial correlation and heteroskedasticity in the model. Moreover, the test for weak cross-sectional dependence (Pesaran, 2015) shows that the null that the errors are weakly cross-sectional dependent cannot be rejected [CD = -0.136]. This reveals the presence of cross-sectional dependence.

This study employs a method to estimate standard errors and hypothesis tests robust to heteroskedasticity, serial correlation, and spatial correlation developed by Vogelsang (2012) that extends the Driscoll and Kraay (1998) approach with country-fixed effects to a setting with country and time effects. Table II reports the estimates of the empirical models.

Three empirical models are run. The first one is called the one-way fixed effect model which accounts for country-fixed effects. The second one is called the two-way fixed effect model which accounts for both country-fixed effects and time-fixed effects. The third model extends on the second model to control for individual country time trends.

As explained earlier, the Baumol variable measures the difference between economy-wide wage growth and labour productivity growth in the overall economy. It is to be noted that the mean value of the Baumol variable in this study is computed to be 0.028 (using the sample of 44 SSA countries over the period 2004 to 2016). The mean value of the Baumol variable is statistically significant at 1% level of significant, with a corresponding t-statistics of 5.366 (for *H_0: Mean of Baumol variable = 0*). Interestingly, this value of the Baumol variable is very close to the corresponding estimate of 0.027 in Bates and Santerre (2013) which use a sample of 50 states in the United States over the 1980–2009 period.

The Baumol variable figure generated from this study can be interpreted as the wage-productivity gap, which indicates the extent to which workers have been compensated with wages for productivity change (Fleck *et al.*, 2011). In this particular, the result suggest that marginal income is higher than marginal productivity in the economy, indicating that workers in SSA have been overcompensated over the period 2004 to 2016. Lee and Ramanayake (2018) also reports a wage–productivity gap (i.e., low productivity relative to the ever-increasing wage rates) in developing countries; where wage rates in many developing countries tend to increase more rapidly than labour productivity. As per Lee and Ramanayake (2018) nominal wage rates constantly increase regardless of real productivity because of the typically high inflation rates in developing countries.

The estimated coefficients for the adjusted Baumol variable are positive and statistically significant under all the three specifications, with the magnitudes being very close; 0.0046 - 0.0047. However, this should be interpreted with caution as the coefficient of the adjusted Baumol variable is statistically significant at a 10% significance level (which is low but acceptable). Further, the coefficient of the adjusted Baumol variable is very low (close to zero). In Bates and Santerre (2013) the coefficient of the adjusted Baumol variable is also close to zero (using a sample of 50 states in the United States). Nevertheless, it is to be noted that the figures are not directly interpreted.

Table II: Estimation results

	Estimated coefficients		
	One-way fixed effect model	**Two-way fixed effect model**	**Two-way fixed effect model with time trend**
Baumol variable	0.0046* (0.002)	0.0047* (0.002)	0.0047* (0.002)
Growth of nominal GDP per capita	0.006*** (0.001)	0.005*** (0.001)	0.005*** (0.001)
Growth of proportion of population above 65 years old	0.005 (0.011)	0.022 (0.016)	0.022 (0.015)
Growth of population density	-0.054** (0.015)	-0.059*** (0.014)	-0.060*** (0.014)
Growth of proportion of official development assistance to GDP	0.00003 (0.0002)	-0.00003 (0.0002)	-0.00003 (0.0002)
Rate of change in political stability index	0.003** (0.001)	0.003*** (0.001)	0.003*** (0.0007)
Constant	0.002*** (0.0004)	0.002*** (0.001)	0.002*** (0.001)
Country-fixed effects	Yes	Yes	Yes
Time-fixed effects	No	Yes	Yes
Individual country time trend	No	No	Yes
Observations	517	517	517
Number of countries	44	44	44
Within R-squared	0.2536	0.2765	0.2765

The standard errors based on Vogelsang (2012) are given in parentheses and the level of significance is indicated by *** ~ 0.01, ** ~ 0.05, and * ~ 0.1.

If the coefficient of the adjusted Baumol variable is divided by the mean healthcare labour share, the estimated results of this study can be compared to the estimated λ (as in Eq. 6) from other similar studies (Hartwig, 2008; Colombier, 2012; Bates and Santerre, 2013). λ is estimated to be 0.3597; it is computed by dividing the coefficient of the adjusted Baumol variable (0.005) is divided by the mean healthcare labour share (0.0139). This can be interpreted as a one percentage-point increase in the excess of wage growth over productivity growth in the healthcare sector in SSA raises the growth rate of healthcare expenditure per capita by about 0.36 percentage-points. The analysis reveals that although the healthcare sector is caught by Baumol's Cost Disease, this effect does not come fully into effect.

This result is much lower than the comparable estimation from Hartwig (2008), but higher than the corresponding estimates of Colombier (2012) and Bates and Santerre (2013). More precisely, the estimation of the coefficient of the Baumol variable from Hartwig (2008) is closer to unity, whereas estimations from Colombier (2012) ranges between 0.109 and 0.195, while

Bates and Santerre (2013) reports estimates of 0.147. This analysis implies that the SSA countries are generally afflicted by Baumol's Cost Disease.

Though only Hartwig (2008) seems to provide evidence in favour of a full Baumol effect, with λ estimated to be very close to 1, it is important to point out that the same study relies on the implicit assumption that the nominal value-added of the Baumol industries make up close to 100% of nominal GDP, which has been criticised to be unreasonable (Colombier 2012; Bates and Santerre, 2013).

In addition, growth of nominal GDP per capita and rate of change in political stability index have positive impacts on the dependent variable while growth of population density has a negative impact on the dependent variable. Interestingly, a 1% increase in the growth of nominal GDP per capita and rate of change in political stability index, increases the growth in healthcare expenditure per capita by about 0.06% and 0.03%, respectively, while a 1% increase in growth rate of population density increases the growth in healthcare expenditure per capita by about 0.06%.

5. Conclusion

This study empirically tests whether the SSA countries suffer from Baumol's Cost Disease, using the methodology developed by Hartwig (2008) and extended by Colombier (2012). The empirical analysis uses a panel dataset of 44 SSA countries over the period 2004–2016. It applies the fixed-b approach which provides test statistics in linear panel models with fixed effects which are robust to heteroskedasticity, autocorrelation and spatial correlation (Vogelsang, 2012). The testing framework employed allows for country-fixed effect and time-fixed effects together with individual country time trends. The main finding of the study is the significance of the adjusted Baumol variable, which provides evidence that the effect of Baumol's Cost Disease in the healthcare sector, in SSA, cannot be disregarded. However, the regressions results show that Baumol's Cost Disease does not impact healthcare expenditure to full extent. Nevertheless, the result suggests that productivity gains over the period under study were over compensated in SSA overall, suggesting that marginal income is higher than marginal productivity. In addition, other causes such as higher income, higher population density and better political stability also affect the growth of healthcare expenditure in SSA.

While other studies (see for example: Okunade, 2005; Murthy and Okunade, 2009; Lv and Zhu, 2014 and Barkat *et al*., 2016) on the determinants of healthcare expenditure in Africa have neglected the Baumol effect, this study highlights the importance of accounting for this effect. Factoring in the Baumol variable is an important element in potentially improving the quality of healthcare expenditure analysis.

Policy makers should come up with policies to increase productivity in the healthcare sector in SSA, though it can be difficult to match productivity growth in the healthcare sector with "non-progressive" sectors. The wage-productivity gap can be closed by increasing productivity in the healthcare sector in SSA. Indeed, higher productivity is identified as the best "palliative" against the continuous rise in healthcare expenditure (Hartwig, 2009). Closing the wage-productivity gap has the potential of improving utilization of healthcare expenditure in SSA which is already limited and therefore, increasing the elasticity of healthcare expenditure effect on health outcomes - life expectancy, under-five mortality and maternal mortality, which can support the realisation of the Sustainable Development Goals.

Moreover, policy makers should be careful in setting policies targeting healthcare development in SSA by not focusing on expenditure nominally. Relying on nominal figures might provide misleading conclusions on promoting healthcare status in SSA, as the healthcare sector is shown to be affected by Baumol's Cost Disease, which indicates that higher expenditure is not necessarily translated into better healthcare services, both in quality and quantity. Nevertheless, it is to be noted that heterogeneity across SSA countries can render Baumol's Cost Disease to be potentially stronger in some countries than others.

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