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Convergence of Health Expenditure in Sub-Saharan Africa: Evidence from a Dynamic Panel

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Abstract

To address the problem of underfunding of health systems in SSA the Abuja Declaration of 2001 set a target to allocate 15% of a country's budget to public health expenditure. However there is no empirical evidence on whether SSA countries are converging or diverging from the target and whether there is significant effect of the Abuja instrument on other health expenditure indicators. This study tested convergence of health expenditure in SSA in the post Abuja declaration period. The linear dynamic panel model was estimated by GMM-IV method on a panel of 41 SSA countries for the period 2000 to 2011. The empirical results show evidence of absolute and conditional convergence of health expenditure in SSA. Real income per capita, donor funding for health care and benefitting from HIPC debt relief influenced direction and rate of convergence of health expenditure. The Abuja policy instrument (public health expenditure as a percent of government) reduced the rate of convergence of other health expenditure measures except for private health expenditure as percent of total health expenditure which was increasing in the study. The results imply that continued reliance on donor funding for health systems directly or through debt relief is likely to delay convergence to Abuja target. SSA governments can formulate sustainable health financing mechanisms that reduce dependency on external source for health system support in the long run.

Keywords: Convergence, Health Expenditure, SSA, Dynamic Panel

1. Introduction

The Abuja declaration on increasing public health expenditure (OAU, 2001) was a landmark attempt to address insufficient funds allocation to the health sector in Sub-Saharan Africa (SSA). The impetus for the Abuja Declaration came from the challenge of persistent burden of morbidity and mortality in Africa (UN Inter-Agency, et al., 2012; UN DESA, 2011; World Bank, 2013). The central focus was to reduce mortality and morbidity arising from HIV/AIDS, Malaria and Tuberculosis (OAU, 2001). Further, the Abuja target was made in the context of meeting Millenium Development Goals (MDGs) on health (UN, 2000). In the Abuja declaration, Africa Union states committed to allocate 15% of government expenditure to the health sector. There also exists other global efforts to help SSA governments sustain and increase health expenditure, such as Global Fund (Global Fund; 2011, 2012) and President Emergency Plan for AIDS Relief (PEPFAR, 2013). Health expenditure in SSA before the Abuja Declaration was relatively low. For example, in the seven years (1995-2001) preceeding the Abuja Declaration the real per capita health expenditure, the average public health expenditure as a percent of total government expenditure and the average total health expenditure as a percent of GDP were US$ 76.74 (2005 PPP international), 7.9% and 5.2% respectively (World Bank, 2013). The corresponding world values were US$ 522, 15.1% and 9.1% respectively.

Since the Abuja declaration health expenditure in SSA has increased and health outcomes improved (morbidity and mortality rates have declined). The average real per capita health expenditure rose by more than US$ 45.10 while the average total health expenditure as a percent of GDP and public health expenditure as a percent of government expenditure increased by about 1.3% and 1.6% respectively between 2001 and 2011 (World Bank, 2013). Table 1, shows an upward trend in health expenditure in SSA for the period 2001- 2011 except for private health expenditure measures. Over the same period total health expenditure as a percent of GDP grew by 8.4% and the Abuja policy instrument, public health expenditure as a percent of government expenditure increased by 12.8%. Public health expenditure as a percent of GDP increased by about 0.3% and the public health expenditure as a percent of total health expenditure rose by 11.5%. The increase in public health expenditure measures, was accompanied by a decrease in private health expenditure measures during the post-Abuja period. However, within the private health expenditure component the share of out of pocket expenditure increased by about 2.7%.Table 1 also shows that average per capita health expenditure in SSA rose by a massive 82% over the period 2001-2011. Despite the large increase in per capita health expenditure in SSA it was one seventh of the World's average per capita health expenditure. The average, however, hides large cross-country differences.

However, public health spending in most SSA countries falls short of the Abuja target (Tandon and Cashin, 2010). Consequently, the distribution and composition of health expenditure across SSA countries and overtime is uneven. Apart from Botswana which achieved the target for the period 2004-2007 other high per capita health expenditure (> US$350) SSA countries have not attained the target (World Bank, 2013).

The literature on determinants of health expenditure in SSA and other regions is extensive (Murthy and Okunade, 2009; Temah, 2009; Ke, et al., 2011; Lu, et al., 2010). However, the issue of health expenditure convergence among SSA countries has not been addressed. Several studies have examined convergence of health expenditure in developed countries and other regions outside SSA (for example, Narayan, 2007; Wang, 2009; and Kerem, et al., 2008). However, SSA is unique in some respect. First, health sector in SSA countries rely heavily on donor funds. In 2011 donors funded more than 25% of total health expenditure in 25 SSA countries (World Health Organization, 2013). Second, several SSA countries received external debt relief under the HIPC Initiative (International Monetary Fund, 2013). Although some studies related health expenditure, donor funding and debt relief (Murthy and Okunade, 2009; Temah, 2009) none examined whether the two variables influenced convergence of health expenditure in SSA. Most countries which have achieved the Abuja target are over reliant on donor funding and/or benefitted from the debt relief initiatives (World Bank, 2013).

The main aim of the study is to determine whether there is convergence of health expenditure after Abuja Declaration in SSA. The specific objectives are as follows; test for convergence in health expenditure in SSA after the Abuja Declaration; examine whether the Abuja declaration policy instrument (public health expenditure as a percent of government expenditure) has influenced convergence rates of other health expenditure measures in SSA; estimate whether donor funding, HIPC debt relief and real per capita GDP have influenced convergence of health expenditure in SSA.

This study contributes to empirical literature on health expenditure in SSA in three ways. First, to the best of the author's knowledge this one of the few econometric studies on health expenditure convergence in SSA. Second, this study considers more health expenditure measures than the studies in developed regions which have only tackled convergence of per capita health expenditure and total health expenditure as a percent of GDP.

Convergence analysis of health expenditure in SSA is necessary to determine the extent of implementation of Abuja Declaration across its member countries. Furthermore, other initiatives aimed at the entire SSA region such as, Ouagadougou Declaration on primary health care and health system in Africa 2008 (Barry, et al., 2010) provide motivation to conduct health expenditure convergence analysis for SSA. The study of convergence of health expenditure allow one to understand how health systems are integrated and homogeneity in quality of health service delivery in SSA. The technocrats in the SSA health sector are also likely to use the study results to project timelines in which all member countries can achieve the Abuja target. This study is relevant in the quest for determining whether, member countries of SSA are converging towards the target, of allocating 15% of government expenditure to public health service delivery. Subsequently, it is necessary to understand how the increase in public health expenditure as a percent of government expenditure as influenced the upward growth of other health expenditure measures in SSA. When public health expenditure as share of government expenditure was triggered up in 2001 there was a likelihood of increase in other measures of health expenditure. This implies that they are likely to trend together towards a higher equilibrium. Second, the study tests for beta-convergence of health expenditure using dynamic panel data methods. Most of the health expenditure convergence literature have analyzed cross-sectional, time series data and panel data using unit root tests which yield stochastic convergence. Some which have attempted to measure beta convergence have used estimation methods which have not accounted for dynamics and endogeneity. Dynamic panel data estimation is able to account for endogeneity, unobserved heterogeneity and stationarity. Third, the study goes beyond estimates of both absolute convergence and estimates conditional convergence on health expenditure while controlling for donor funding and HIPC debt relief. Although, Abuja Declaration has been in force since 2001 there has been uncertainty on the reasons why some countries are not fully implementing it. This study has examined whether or not external funding of health care, real income per capita and being Heavily Indebted Poor Countries debt relief beneficiary have contributed to convergence of health expenditure in Sub-Saharan Africa. Knowledge of how they have impacted on speed of achieving Abuja target in SSA is of high importance to deduce sources of variations in implementing the policy.

The remainder of this paper is organized in four sections. Section 2, reviews the literature. Section 3, discusses the methodology used in the paper. Section 4 presents the empirical results on convergence of health expenditure measures. Section 5, presents a summary, conclusion and policy implications.

2. Literature Review

2.1 Convergence of Health Expenditure

Convergence is a process in which entities become similar overtime (O'Connor, 2013). Convergence analysis of health expenditure borrows its theoretical model from economic growth literature (Narayan, 2007; Hitiris and Nixon, 2001; Hofmarcher, et al., 2004). The convergence hypothesis is in tandem with that of neoclassical economic growth models (Solow, 1956). The convergence hypothesis in health economics postulates that low healthcare spending economies tend to catch up with high health care spending ones to a common value (Hitiris, 1997; Narayan, 2007).

Three conceptualizations of convergence are exemplified in the literature. The beta β- convergence originates from economic growth literature (Barro, 1984; Boyle and McCarthy, 1997). It occurs when health spending in low health expenditure countries increases faster than in countries with high health expenditure over a given time horizon (Narayan, 2007). The alternative concept of sigma σ-convergence in health expenditure is also borrowed from the economic growth literature (Baumol, 1986; Barro and Sala-i-Martin, 1992). The σ-convergence in health expenditures is experienced if cross-country variation in expenditures decline overtime (Hitiris and Nixon, 2001). Stochastic convergence is also borrowed from economic growth literature (Benard and Durlauf, 1995; Carrion-i-Silvestre and German-Soto, 2008). Stochastic convergence occurs when health expenditure of one country relative to a reference country's health expenditure is stationary leading to a steady state (Carrion-i-Silvestre, 2005; Jewell, 2003).

Another concept that has gained prominence in the convergence literature is the club convergence (Dorwick and Delong, 2003). In the context of health expenditure a convergence club refers to a group of countries whose health expenditure tends to converge to a multiple steady state e.g. the health expenditure convergence is conditional on income, productivity or living standards differences. Ben-David (1994) identified two forms of club convergence: upward convergence club consisting of countries where the members catch up with the richer ones. High health expenditure countries are said to be in the upward convergence club. Downward convergence club, comprises extremely poor countries. This form of convergence reduces disparities between high and low health care spending countries.

In addition, to distinguishing β-convergence, the literature distinguishes absolute (unconditional) and conditional convergence (Wang, 2009). Absolute β-convergence, occurs when health care spending in a cross-section of countries converges to the same equilibrium, while conditional β-convergence, occurs when health expenditure converges to a different equilibrium.

2.2 Empirical Studies on Convergence of Health Expenditure

The empirical literature on convergence of health expenditure has concentrated on developed regions such as USA, European Union and OECD (e.g. Narayan, 2007; Wang, 2009; Panopoulou and Pantelidis, 2012; Hitiris and Nixon, 2001; Fallahi, 2011). A variety of estimation methods and data have been used to test convergence. The methods include, time series, cross-sectional and panel data econometric methods.

One strand of the literature used time series econometrics to test for convergence in health expenditure (for example, Narayan, 2007). For instance, the univariate and panel unit root tests such as Augmented Dickey–Fuller (ADF) and Lagrange Multiplier (LM) with structural breaks have been used in this type of literature. Narayan (2007) examined whether health expenditure of Spain, Canada, Japan, Switzerland and UK converged to US health expenditure over the period 1960-2000. Augmented Dickey-Fuller (ADF) test and Lagrange multiplier (LM) univariate and panel tests with structural breaks were used. The latter complements the ADF test which could yield misleading results as it is insensitive to structural breaks (Perron, 1989). The ADF estimates showed that there was no convergence in real per capita health expenditure between USA and three countries (Spain, Canada and Japan) but weak convergence with that of UK. On the other hand, the LM test results of the study indicated that when structural breaks are taken into account there was evidence of stochastic convergence in per capita health expenditure of the five countries to USA per capita health expenditure. The panel LM test with structural breaks provided strong statistical evidence that real per capita health expenditure converged in

UK, Japan, Canada, Switzerland and Spain. This implies that methods with structural breaks are more relevant in determining stochastic convergence in health expenditure. The study concluded that per capita health expenditure in UK, Canada, Japan, Switzerland and Spain converged to USA's per capita health expenditure.

Another strand of literature on health expenditure convergence are those which have used pooled cross-section data (for example, Hitiris and Nixon, 2001; Kerem, 2008; Wang, 2009). Hitiris and Nixon (2001) studied the convergence of health expenditure (per capita health expenditure and total health expenditure as share of GDP) in a panel of 15 European Union (EU) countries for the period 1960-1995. The estimate of σ- convergence was based on cross-sectional data spanning 1960-1995 (with 10 years averages), while the β- convergence estimate was based on panel data for 1980 to 1995. Non-parametric results for sigma σ- convergence support convergence of per capita health expenditure and total health expenditure as a share of GDP. This indicated that variability in the health expenditure variables were falling during the period 1960 to 1995 in EU. The paper applied a random effect model to determine existence of β- convergence. The absolute β- convergence estimates indicated that per capita health expenditure converged at the rate of 0.11% and total health expenditure as a ratio of GDP converged at the rate of 0.03%. The results also showed conditional convergence in per capita health expenditure at 0.09% and total health expenditure as a ratio of GDP 0.11%. The study concluded that the convergence estimates of health expenditure supports efforts for EU integration.

Kerem, et al. (2008) estimated the convergence of health expenditure in the European Union using a cross-sectional data with variables measured as averages over the period 1992 to 2004. The countries were divided in three groups: 23 (EU-23), 15 (EU-15) and 8 (EU-8). The authors tested for β- convergence of total health expenditure as share of real GDP and per capita health expenditure based on Kendall's index of rank concordance. The rate of convergence of total health expenditure as share of GDP ranged between 0.04% and 0.05% among the three groups of EU member countries. The rate of convergence in per capita health expenditure was between 0.03% and 0.05%.

Convergence analysis can also be carried out among states or regions within a country. For example, Wang (2009) examined convergence of state level per capita health expenditure in the US for the period 1980 to 2004. The study used cross-section regressions with bootstrap confidence interval (CI), and multivariate stationarity test. The paper also tested for club convergence hypothesis. The estimated rate of absolute β-convergence was -1.7% and rate of convergence conditional on per capita income was -1.4% but statistically insignificant at conventional levels. Stationarity tests based on time series data revealed that 38 states formed 16 perfect convergence clubs consisting of two or three states. This means that stochastic convergence exists in the respective states. The health expenditure in 12 other states followed individual time paths. The authors concluded that a large number of convergence clubs is evidence of lack of convergence in health expenditure across US states.

A number of studies used panel time series to test existence of health expenditure convergence (Gerdtham and Löthgren, 2000; Fallahi, 2011; Aslan, 2009; Lau and Fung, 2013). Gerdtham and Löthgren (2000) investigated stationarity (stochastic convergence) of real per capita health expenditure for 21 OECD countries for the period 1960-1997 using ADF and Kwiatkowski-Phillips-Schimdt-Shin (KPSS) unit root tests. The ADF panel unit root estimates indicated that the unit root hypothesis cannot be rejected in the OECD. This may be as a result of low power unit-root data generation processes resulting from potential multicollinearity in the case of trending variables. An alternative test (KPSS) which corrects for multicollinearity with a null hypothesis of presence of stationarity was used in the study to verify the ADF estimates. The test rejected the presence of stationarity of real per capita health expenditure. This result implied that real per capita health expenditure in the 21 OECD countries did not converge.

Fallahi (2011) tested for convergence of total health expenditure as a share of GDP in a panel of 10 OECD countries for the period 1960-2006. The test was based on LM and KPSS tests for stationarity and structural breaks. The beta convergence was tested using robust OLS. The panel unit root test result did not reject stationarity of total health expenditure as a share of GDP. This provided evidence for presence of stochastic convergence in total health expenditure as a share of GDP. There was no evidence of β-convergence for Austria, Finland, Iceland, Japan and UK. But Canada, Norway and Spain converged to the US total health expenditure. The author concluded that real convergence (stochastic and β at the same time) existed in Canada, Ireland, Norway and Spain before the structural breaks.

Aslan (2009) investigated convergence of per capita health expenditure among 19 OECD countries for the period 1970 to 2005. The author applied both panel unit root and persistent method to determine the presence of convergence between USA and OECD or within OECD countries. Using panel unit root test on real per capita health expenditure the unit root hypothesis was not rejected between OECD and USA and also within the OECD members. This indicated there was no stochastic convergence of per capita health expenditure in OECD and its relation with USA. Application of the persistent method[1] revealed stochastic convergence of per capita health expenditure relative to average OECD per capita health expenditure.

Unlike the previous studies Lau and Fung (2013) examined the existence of convergence of per capita health expenditure in 14 EU countries for the period 1975-2008 based on nonlinear panel unit root test. This test assumed that growth of health expenditure was nonlinear because of structural changes arising from regional integration processes in EU. The authors argued that nonlinearity had not been taken into account in most of the conventional unit root tests. The test used was a non-linear panel Augmented-Dickey Fuller test which accounts for cross-sectional dependency[2]. The estimates indicated that unit root hypothesis could not be rejected even after accounting for nonlinearity which is not different from linear panel unit root test.

Literature on health expenditure convergence is moving toward the use of panel data estimation methods. Panopoulou and Pantelidis (2012) investigated whether or not per capita health expenditure in a panel of 19 OECD countries converged over the period 1972 to 2006 and whether or not health expenditure convergence led to convergence in health outcomes. The paper used a methodology developed by Phillips and Sul (2007) to test for sigma convergence and club convergence. The estimated results show per capita health expenditure for 19 OECD countries diverged at the rate of 0.5%. However, the study identified two convergence clubs. One club comprises of Norway and USA with higher per capita health expenditure. The second convergence club comprises the other 17 OECD countries. They concluded that convergence lead to a rise in health expenditure which results in funding deficit for the health sector. However, there was no evidence that convergence in health expenditure was accompanied by convergence in health outcomes.

Using a panel of 17 EU countries for the period 1990 to 2012 Apergis, et al. (2013) examined the convergence of various types of public expenditures as percentages of GDP. The study applied a panel convergence test developed by Phillips and Sul (2007) which permits testing for club convergence hypothesis. The study found that for the 17 countries public health expenditures did not exhibit club convergence. The study concluded that EU countries tend not to follow similar paths for their public health expenditure measures.

The studies reviewed in this section lead to several conclusions regarding the existence of convergence of health expenditure around the world. First, hardly any studies have examined health expenditure convergence in developing regions and none for SSA. This study advances literature on convergence of health expenditure by focusing on SSA and by examining a range of health expenditure measures unlike the existing studies. In addition to real per capita health expenditure and total health expenditure as a share of GDP, public health expenditure as share of government expenditure and, total health expenditure and private health expenditure as a share of total health expenditure are examined. The conditional variables such as being a HIPC debt relief beneficiary and benefitting from externally (donor) funded health care are unique to SSA health system and have been added in the analysis to understand how they have affected the achievement of Abuja Declaration target. The relative effects of Abuja policy instrument (public health expenditure as a percent of government) on growth of other health expenditure in post Abuja period is also estimated. It applied a new approach linear dynamic panel model and GMM-IV estimation method to SSA data to test for the convergence. This method controls for endogeneity, unobserved heterogeneity and stationarity and therefore yields estimates that are more robust than those from standard panel data methods or time series methods. Further, the method uses dynamic instruments which takes care of cross-sectional dependency.

3. Methodology

3.1 Theoretical Model

The theoretical model is modified under the premise of neoclassical theory of economic convergence (Swan, 1956; Barro, 1984; Abreu, et al., 2005). Assuming that health expenditure (HE) is a function of real GDP per capita (Y) and Population (P).

$$\boldsymbol{HE} = \boldsymbol{f}\,(\boldsymbol{Y}, \boldsymbol{P}) \quad \ldots\ldots(2.1)$$

[1] *Persistent method analyses unit root hypothesis by taking the ratio of per capita health expenditure for country I for period t to the average of the region for period t. This is then subjected to panel unit root estimation (Lima and Resende, 2007).*

[2] *Cross sectional dependency refers to correlation across individual countries observations.*

Real GDP per capita *(Y)* is assumed to increase health expenditure. This is because as an economy grows more welfare services such as provision of health care may attract more resource for improving human capital (e.g. health). Population is also a source of growth of health expenditure in a given country. Population influences the expansion of health expenditure, when additional resources are needed for health services given its health endowment.

Equation (2.1) is a general functional form. Assuming a Cobb-Douglas production function of health expenditure takes the form.

$$\boldsymbol{HE = A(Y)^{\alpha}\,(P)^{\beta}} \quad (2.2)$$

The inclusion of income in the growth equation of health expenditure is motivated from Wang (2009). He noted that health expenditure is a vital part of consumption and it is likely to converge across regions if income converges. Assuming that health expenditure $(\widetilde{he})$ and incomes $(\tilde{y})$ are expressed as ratio of population of a given country. A Taylor expansion of $\ln \tilde{y}$ around the steady state $\tilde{y}^*$ is specified as follows,

$$\frac{\dot{\tilde{y}}}{\tilde{y}} = \boldsymbol{\varphi(\ln \tilde{y}^* - \ln \tilde{y})} \quad (2.3)$$

This implies that the growth rate of income per person $(\dot{\tilde{y}})$ is proportional to the distance between its current value and the steady state. φ is the rate of convergence of the steady state and can be expressed as follows. $\varphi \approx (1-\alpha)(\pi + g + \delta)$. It depends on other factors such as growth of population(π), depreciation (δ) and the growth rate of knowledge (g) in a given country and other pertinent policies affecting the magnitude of health expenditure measure.
Assuming that the differential equation (2.3) and using the intensive Cobb-Douglas function $\widetilde{he} = \tilde{y}^{\alpha}$ equation 2.4 is derived.

$$\boldsymbol{\ln \widetilde{he}\ (t) = (1 - e^{-\varphi t}) \ln \widetilde{he}^* + e^{-\varphi t} \ln\ \widetilde{he}(0)} \quad (2.4)$$

$\widetilde{he}(0)$ is per capita health expenditure at time zero. Equation (2.4) is converted to a model that can be tested empirically. The health expenditure is measured in per capita terms, $he = \widetilde{he}A$. Substituting for this equation in (2.4) it follows that,

$$\boldsymbol{\ln he\ (t) - \ln he(0) = (1 - e^{-\varphi t}) \ln A(0) + gt - (1 - e^{-\varphi t}) \ln he(0) + (1 - e^{-\varphi t}) \ln \widetilde{he}^*} \quad (2.5)$$

The initial level of health expenditure growth is assumed to be constant and k is a vector of control variables such as donor funding for health, HIPC debt relief and Abuja policy instrument (public health as a percent of government expenditure) determines the steady state. The convergence of health expenditure model in equation (2.5) can be expressed as follows:

$$\boldsymbol{\ln he\ (t) = \tau + \beta \ln[he(t) - \ln he\ (0)] + k'\gamma} \quad (2.6)$$

$\beta < 0$ takes the negative sign to imply convergence. γ is the vector coefficient of control variables. When the vector of control variables is assumed to be zero absolute convergence is determined. The β-convergence hypothesis states that countries with low health expenditure catch-up with those with high health expenditure over a given time period.
HIPC debt relief is likely to influence the growth of health expenditure. One of the condition of the award for the beneficiaries was to improve health indicators by allocating the extra resources in public health services delivery. The Abuja policy instrument is likely explain the growth of other health expenditure measures in the health systems of SSA. The argument for inclusion of donor funding, HIPC debt relief and the Abuja policy instrument emanates from Wang (2009). He highlights the fact that coordination of policies across regions may influence resource redistributions which in tandem result in convergence of health expenditure where income convergence does not exist.

3.2 Testing for Convergence

This study specifies both absolute and conditional convergence of health expenditure in SSA based on the equation (2.6). The health expenditure variables are public health expenditure as a percent of government expenditure (Abuja policy instrument), real health expenditure per capita, total health expenditure as a share of

GDP, public health expenditure as a share of total health expenditure and private health expenditure as a share of total health expenditure.

3.2.1 Absolute Convergence

The econometric specification for absolute beta (β) convergence is shown in equation (2.7).

$$\Delta E_{i,t} = \zeta + \zeta_1 E_{i,t-1} + \varepsilon_{i,t} \quad i=1, 2,\ldots, N, t=1, 2,\ldots, (T-1) \quad \ldots\ldots(2.7)$$

Where $E_{i,t-1}$is the natural logarithm of the health expenditure variable of country i, in year $(t-1)$. $\Delta E_{i,t}$ is the natural growth of current health expenditure from the year $(t-1)$ to t. $\varepsilon_{i,t}$ is the idiosyncratic error term which has both time-specific and unobservable individual effects. The lagged health expenditure coefficient represents the convergence term. The convergence hypothesis is that high health expenditure countries tend to have lower health expenditure growth than low health expenditure countries. The ζ_1 is the convergence coefficient of $E_{i,t-1}$ and is expected to be negative, $\zeta_1 < 0$.

3.2.2 Conditional Convergence

The econometric specification used to test for conditional beta (β) convergence is an extended version of equation (2.7).

$$\Delta E_{i,t} = \psi + \psi_1 E_{i,t-1} + X'_{i,t-1}\Gamma + v_{i,t} \quad i=1, 2,\ldots, N, t=1, 2,\ldots, (T-1) \quad \ldots\ldots (2.8)$$

Where $E_{i,t-1}$ and $\Delta E_{i,t}$ are defined as in equation (2.7). $X_{i,t-1}$ is the vector of conditional variables. Two sets of conditional variables were used. One specification of the conditional variables are natural log of real income per capita, external funded health expenditure as percentage of total health expenditure and HIPC Debt relief dummy variable (to indicate whether or not a particular country was under the HIPC debt relief). In the second specification, the interaction of the Abuja policy instrument (public health expenditure as percent of government expenditure) with other health expenditure measures are added as conditional variables. This is to determine how change in public health expenditure as percent of government expenditure affects convergence (or divergence) of the other health expenditure measures. $v_{i,t}$ is the idiosyncratic error term comprising time-specific and unobservable individual effects.

If conditional β-convergence exists the coefficient of $E_{i,t-1}$ expected to be negative, $\psi_1 < 0$. Under conditional convergence each Sub-Saharan Africa country's health expenditure would converge to a different steady state.

3.3 Estimation Procedure

In this study absolute and conditional convergence in health expenditure are estimated using linear dynamic Generalized Method of Moments Instrumental Variables (LDPD GMM-IV). This hybrid estimation technique combines Arellano and Bond (1991), Arellano and Bover (1995) and Blundell and Bond (1998) estimators. Unlike static panel data methods such as fixed effects (FE) and random effects (RE), the LDPD not only controls for unobserved heterogeneity but also endogeneity and unit root (accounts for stationarity). The estimates of fixed and random effects panel data models are presented for comparison with LDPD estimates. The instrument used in the estimation models are classified as either GMM type or standard with them being at levels or differenced. GMM instruments are based on moment functions that are dependent on observable random variables and unknown parameters that embody zero expectation in the population when evaluation is done at the true parameters (Wooldridge, 2002). Standard instruments are special case of GMM which assumes there is no heteroscedasticity.

The robustness for the dynamic panel estimates was checked by testing for instruments validity using Sargan over identification test. The Wald Criterion test was used to determine the overall significance of the estimated models. Finally, presence of serial correlation was tested using the Arellano-Bond autocorrelation test. Description of the data and variables used in the convergence regressions are displayed in Table 2.

4. Empirical Results

4.1 Descriptive Statistics

The descriptive statistics for the variables considered in this chapter and defined in Table 2 are shown in Table 3. From Table 3, the pooled mean of total health expenditure as a ratio of GDP in the sample of countries over the period 2001-2011 was 5.9%. The minimum of total health expenditure as percent of GDP was reported in Equatorial Guinea in 2005 (1.7%) while the maximum was in Sierra Leone (22.2%) in 2009.

The mean of Abuja declaration policy instrument (public health expenditure as a percent of government expenditure) was 9.5%, below the target of 15% envisaged in the declaration. This indicates that some of Sub-

Saharan Africa countries have not been implementing the policy. The country that reported the highest public health expenditure as a percent of government expenditure was Equatorial Guinea in 2002 (26.9%) while Sudan had the lowest 0.97% in 2001.

The mean of public health expenditure as a percent of total health expenditure was 48.4% during 2001-2011. This indicates that slightly over half (51.6%) of health care expenditure in SSA was from the non-state sector. Congo, Democratic Republic had the lowest public health expenditure as percent of total health expenditure at (5.3%) in 2001 which culminated to having highest private health expenditure as a percent of total health expenditure of 94.7%. On the other hand, Seychelles reported the highest public health expenditure as percent of total health expenditure (93.5%) in 2006 hence having the lowest private health expenditure ratio of total health expenditure of 6.5%. The mean of real health expenditure per capita is US$166.4. Although, higher than health expenditure per capita (US$ 34- US$40) recommended by Commission on Macroeconomics and Health (Commission on Macroeconomic and Health, 2001) the standard deviation among SSA countries is large. During the period 2001-2011, the minimum real health expenditure per capita (US$ 9.6) was recorded in Congo, Democratic Republic in 2001 while Equatorial Guinea (US$ 1,806) had the maximum real per capita health expenditure in 2009.

Sub-Saharan Africa can be classified in the lower middle income category. This is because the average real GDP per capita (real income per capita) of US$ 3,295.80 falls within the per capita range of US$ 1035- US$4,086 as defined by World Bank (2014). However, the standard deviation showed large disparities in income distribution in the sub-continent. The lowest real GDP per capita US$247 was recorded in Congo, Democratic Republic in 2001 while the highest (US$ 31, 968.6) was recorded in Equatorial Guinea in 2011. The average of external (donor) funded health expenditure, 21.8% indicated that Sub-Saharan Africa countries depend substantially on donor funds to run health systems. The country with the lowest donor funded health care was South Africa (0.2%) while Eritrea health care was highly supported by donors at 92% of their total health expenditure in 2004. The statistics show that during the period 2001-2011 about 30% of SSA countries benefitted from HIPC debt relief. .

4.2 Absolute and Conditional Convergence of Health Expenditure in Sub-Saharan Africa

This section presents estimates for absolute and conditional convergence of health expenditure in Sub-Saharan Africa corresponding to equations (2.7) and (2.8). As indicated earlier in contrast studies of developed countries health expenditure, this study estimated convergence of multiple measures of health expenditure. The sub-sections 4.2.1 to 4.2.5 present econometric estimates for specific measures of health expenditure.

4.2.1 Public Health Expenditure as a Percent of Government Expenditure

Table 4 present estimates of absolute and conditional convergence of public health expenditure as a percent of government expenditure. This variable was the Abuja Declaration policy instrument picked in 2001 and the target was 15%. The results of two model specifications are presented. The rate of absolute convergence of public health expenditure as percent of government expenditure is estimated in model 1. Model 2 extends model 3 by adding three control variables: external health expenditure as a percent of total health expenditure, HIPC debt relief dummy and real income per capita. This yields conditional convergence rate. As explained previously the GMM- IV estimator is able to control for endogeneity and autocorrelation problems. The presentation of results is primarily focused on GMM models.

The p-value of the Wald test rejects the null hypothesis that the explanatory variables do not jointly explain growth of public health expenditure. The p-values of Sargan test for instruments validity suggest that the null hypothesis cannot be rejected and over identifying restrictions are valid. The Arellano Bond test of serial correlation does not reject the null hypothesis of no second order autocorrelation as indicated by the larger p-values. Therefore, the diagnostic tests suggest that the estimates are consistent.

In model 1 of Table 4, the coefficient estimate of the lagged public health expenditure as a percent of government expenditure is negative (-5.37) and significant (p-value = 0.03). This estimate of absolute convergence implies that public health expenditure as percent of government expenditure in SSA countries converges towards the Abuja target at the rate of 5.4% per year between 2001 and 2011. In contrast to this study Apergis, et al. (2013) did not find absolute convergence of health expenditure for 17 EU countries.

Turning to conditional convergence (model 2), the coefficient estimate of lagged public health expenditure as a percent of government expenditure is -5.70 with p-value of 0. This indicates that the rate of conditional convergence of public health expenditure as a percent of government expenditure is 5.7% conditional on external health expenditure as a percent of total health expenditure, being a beneficiary of HIPC debt relief and real income per capita. The percentage of health expenditure funded from external (donor) sources has positive but insignificant impact on growth of public health expenditure. HIPC debt relief beneficiary countries had higher growth in public health expenditure as a percent of government expenditure compared to non HIPC beneficiary countries. Growth in real per capita income in SSA had negative impact on growth of public health expenditure.

4.2.2 Real per Capita Health Expenditure

Table 5 present the estimates of absolute convergence (model 3) and conditional convergence (Model 4 and Model 5) of real per capita health expenditure in SSA. In model 4 the convergence of real per capita health expenditure was tested conditional on whether country received debt relief under HIPC, external health expenditure as a percent of total health expenditure and real income per capita. Model 5, is extension of model 6. It includes public health expenditure as percent of government expenditure (Abuja policy instrument) and the interaction of public health expenditure as percentage of government expenditure and real per capita health expenditure. Model 5 results are used to determine how Abuja policy instrument has affected the convergence rate of real per capita health expenditure between 2001 and 2011.

Based on the p-values of Wald test, the null hypothesis that there is no joint significance of the explanatory variables is rejected. The Arellano-Bond autocorrelation test does not reject the null hypothesis of no autocorrelation since the test statistics are statistically insignificant as indicated by respective p-values. This suggests that there is no serial correlation in the first difference errors of these models. The p-value of the Sargan test statistic indicate that the test fails to reject the null hypothesis that the instruments used in the models are valid. Thus the results of diagnostic tests suggest the models are correctly specified.

Model 3 tests for absolute convergence of real per capita health expenditure. The coefficient of the lagged real per capita health expenditure is -3.26 and significant at 1% level. This result suggest that SSA countries converged to the same equilibrium of real per capita health expenditure at the rate of 3.3% per year between 2001 and 2011. Other studies in developed regions support the findings. Wang (2009) found an absolute convergence of -1.7% in US. Hitiris and Nixon (2001) found absolute convergence of -0.03% for EU. Kerem, et al. (2008) also found absolute convergence ranging from -0.03% to -0.05% for per capita health expenditure in EU. Other studies have found stochastic convergence for per capita health expenditure (Aslan, 2009; Wang, 2009) but Gerdtham and Löthgren (2000) and Lau and Fung (2013) did not find stochastic convergence.

Next, focusing on model 4 to test for conditional convergence, the coefficient of the lagged real per capita health expenditure is -8.74 and significant at 1%. The estimate indicate that the convergence rate of real per capita health expenditure in SSA was 8.7% conditional on share of total health expenditure financed by external donor funding, real per capita income and HIPC debt relief. Thus increase in external funding for health care, real per capita income and having benefitted from the HIPC debt relief increased the growth of real per capita health expenditure. All the conditional factors had positive and significant coefficients. Hitiris and Nixon (2001) found conditional convergence for per capita health expenditure at -0.09% in EU and in US Wang (2009) found a conditional convergence of -1.4%.

In order to test whether or not convergence rate in real per capita, health expenditure was influenced by the Abuja policy variable (public health expenditure as a share of total government expenditure) an interactive variable between one period lag of natural log real per capita health expenditure and public health expenditure as a percentage of government expenditure was included (Table 5, Model 5). The coefficient of lagged real per capita health expenditure and of the interactive variable are negative and positive respectively. Both are statistically significant. If SSA governments allocate 9.5% (mean) of their government budgets to public health the conditional convergence rate for real per capita health expenditure is about 5.5% (Table 5, Panel B). On the other hand, if they allocate 15% of their total government expenditure to public health the rate of conditional convergence is 4.55%. The coefficients of conditional variables in model 5 are positive and significant. But the magnitudes are smaller than in model 4.

4.2.3 Total Health Expenditure as a Percent of GDP

Table 6 present the results for both absolute and conditional convergence of total health expenditure as percent of GDP for Sub-Saharan Africa. Estimates of absolute convergence are presented under model 6. Model 7 and model 8 provide estimates of total health expenditure as a percent of GDP conditional convergence.

As indicated by the p-values of the Wald test in model 6, model 7 and model 8, the null hypothesis that all explanatory variables coefficients are jointly zero is rejected. The Arellano-Bond autocorrelation test did not reject the null hypothesis of no serial correlation as indicated by the large p-values. Finally, as indicated by the p-values of the Sargan test, the null hypothesis that the over identification restrictions are valid cannot be rejected. Therefore, the instruments used in the models are valid.

In model 6 of Table 6, the lagged total health expenditure as a percent of GDP coefficient estimate is -5.98 and significant at 1%. This indicates that total health expenditure as a percent of GDP in SSA converges towards the same equilibrium at the rate of 5.98% per year over the period 2001-2011. Literature from the developed region have also shown the same results. Kerem, et al. (2001) found absolute convergence of between -0.04% and -0.05% for total health expenditure as a percent of GDP and Hitiris and Nixon (2001) reported a convergence of -0.11%. Fallahi (2011) showed that total health expenditure exhibited beta convergence among some countries in OECD as well as stochastic convergence.

The estimates of model 7, show that the coefficient estimate of lagged total health expenditure as a percent of GDP is -9.43 and significant. This means that total health expenditure as a percent of GDP conditionally converge at 9.43%. Hitiris and Nixon (2001) found a conditional convergence of 0.11% in EU for total health expenditure as a percent of GDP. The conditional variables external health expenditure as a percent of total health expenditure, real income per capita and being HIPC debt relief beneficiary are positive and statistically significant.

Model 8 repeats the analysis but includes interaction term between total health expenditure as a percent of GDP and public health expenditure as a percent of government expenditure. Total health expenditure as a percent of GDP has a negative and significant coefficient. The coefficient of the interaction term is positive and significant. Panel B of Table 6, shows that at the mean (9.5%) of public health expenditure as a percent of government expenditure, the conditional convergence rate of total health expenditure as a percent of GDP is 11.04%. However, if the public health expenditure as a percent of government expenditure is at the Abuja target (15%), the conditional convergence rate of total health expenditure as a percent of GDP falls to 7.56%. The results indicate that as countries in SSA implement the Abuja declaration the convergence rate of total health expenditure as a percent of GDP slows across the member countries. As in model 7, the conditional variables have positive and significant coefficients. However, the coefficients are much larger than those in model 7.

4.2.4 Public Health Expenditure as a Percent of Total Health Expenditure

Table 7 present the estimates of absolute and conditional convergence of public health expenditure as a percent of total health expenditure. The models pass various diagnostic tests, suggesting that they are well specified. The Wald test rejects the null hypothesis that all coefficient of explanatory variables are jointly equal to zero. Arellano-Bond autocorrelation test does not reject the null hypothesis of no serial correlation in the first difference errors. Sargan test does not reject the null hypothesis that over identification restrictions are valid.

The lagged public health expenditure as a percent of total health expenditure in model 9 is negative (-1.63) and significant at 1% level. The associated coefficient implies that absolute convergence of public health expenditure as a percent of total health expenditure was 1.63% annually during the period 2001-2011. Estimates of model 10, indicate that the coefficient of public health expenditure as a percent of total health expenditure is -2.30 and significant at 1%. This implies that conditional on HIPC debt relief, real income per capita and donor funding for health to public health expenditure as a percent of total health expenditure converged at 2.3% per year to different steady states. The coefficient estimate of external health expenditure as a percent of total health expenditure (donor funding for health) is negative but insignificant. Real income per capita has a positive and significant coefficient while HIPC debt relief has a negative and significant coefficient. This means that holding other variables constant increase in real income per capita increases growth in public health expenditure as a percent of total health expenditure. On the other hand, holding other variables constant HIPC debt relief beneficiary countries had lower public health expenditure as a percent of total health expenditure than non HIPC debt relief countries.

Turning to the model with interaction term (model 11), coefficient of lagged public health expenditure as a percent of total health expenditure is negative and significant at 1% level. The interaction term between public health expenditure as a percent of total health expenditure and Abuja policy instrument is positive and significant. When public health expenditure as a percent of government expenditure is at its mean (9.5%) the conditional convergence rate of public health expenditure as a percent of total health expenditure is 1.57%. But when public health expenditure as a percent of government expenditure is at the Abuja target (15%) the conditional convergence public health expenditure as a percent of total health expenditure is 1.2%. Both external health expenditure as a percent of total health expenditure and HIPC debt relief are negative and significant. Real income per capita coefficient is positive and significant.

4.2.5 Private Health Expenditure as a Percent of Total Health Expenditure

The estimates of absolute and conditional convergence in private health expenditure as a percent of total health expenditure are displayed in Table 8. All the diagnostic tests are satisfactory, suggesting the models are well specified. The Wald test for overall significance of explanatory variables rejects the null hypothesis of no joint significance. The Arellano-Bond autocorrelation test does not reject the absence of serial correlation and the Sargan test does not reject the over identification restrictions.

The lagged private health expenditure as a percent of total health expenditure enters model 12 with a negative and significant coefficient of -1.24. This implies an absolute convergence rate of 1.24% in private health expenditure as a percent of total health spending. But conditional on real income per capita, HIPC debt relief and external health expenditure as a percent of total health expenditure (model 13) the convergence rate of private health expenditure as percent of total health expenditure was 0.75%. External health expenditure as a percent of total health expenditure (donor funding) coefficient is positive and insignificant while that one of HIPC debt relief enters with a positive and significant coefficient. Real income per capita enters with a negative and significant coefficient. An increase in real income per capita reduces the growth of private health expenditure as a percent of total health expenditure. The beneficiaries of HIPC debt relief had higher growth in private health expenditure as a percent of total health expenditure than non HIPC countries.

The interactive term lagged share of private health expenditure in total health expenditure and share of public health expenditure in total government expenditure in model 14 is negative and significant. When evaluated at the mean (9.5%) of public health expenditure as a percent of government expenditure the conditional convergence rate of private health expenditure as a percent of total health expenditure was at 2.1%. But when evaluated at the Abuja target of 15% the conditional convergence rate increased to 2.68%.

5. Conclusions

The main objective of this paper was to determine whether health expenditure in SSA has been converging since the Abuja declaration. Under the convergence hypothesis lower health spending countries increase their health expenditure allocation to catch up with their higher spending counterparts (Wang, 2009; Narayan, 2007). The post Abuja declaration period has been characterized by overdependence on external support as 25 SSA countries have over 25% of their total health expenditure funded by donors (World Health Organization, 2013). Second, most of the countries which have benefitted from the HIPC debt relief are the ones who have implemented the Abuja target. Third, most of the high income countries in SSA have higher per capita health expenditure but have not reached the Abuja target 10 years on with an exception of Botswana. The aim of the study was to determine whether external health resources, real income per capita and HIPC debt relief affected convergence rates of the various health expenditure measures. It also sought to determine whether the Abuja target variable, public health expenditure as a percent of government expenditure, influenced the speed of convergence of other health expenditure measures.

The study of convergence in social spending has been limited to developed countries even as social spending share of government spending in developing countries has expanded. The current study extends the literature in several ways. First, it examines a broader set of health expenditure measures than previous studies which only considered either total health expenditure as a ratio of GDP and/or per capita health expenditure. Second, the study provides econometric evidence on convergence of health expenditure in the developing world and Sub-Saharan Africa using recent development in estimation of linear dynamic panel data (LDPD). Specifically, it applies a hybrid dynamic panel estimation technique from Arellano and Bond (1991), Arellano and Bover (1995) and Blundell and Bond (1998). The main advantage over other estimation methods is that it takes into account dynamics and controls for endogeneity, unobserved heterogeneity and stationarity.

Third, previous studies on conditional convergence of health expenditure control only for real income per capita. The current study not only controls for real income per capita but also controls for two developments in SSA since the Abuja declaration. First, many countries became heavily reliant on external (donor) health financing. Second, some countries benefitted from HIPC debt relief. Fourth, the study provides evidence on the interaction between the Abuja policy instrument (public health expenditure as percent of government expenditure) and other health expenditure measures.

The estimates of absolute convergence indicate negative and significant coefficients of lagged public health expenditure as a percent of government expenditure, lagged real health expenditure per capita, lagged total health expenditure as a percent of GDP, lagged public health expenditure as a percent of total health expenditure and lagged private health expenditure as a percent of total health expenditure. Therefore, each of these health expenditure measures converged toward its particular steady state between 2001 and 2011. The estimates of the conditional convergence models indicate that taking into account important features of SSA relevant to health expenditure convergence of various health expenditure measures exists. In addition, conditional convergence rate of various health expenditure measures declined with increase in public health expenditure as a percent of government expenditure, with an exception of private health expenditure as a percent of total health expenditure.

The estimates in the conditional models showed that external health expenditure as a percent of total health expenditure (donor funding) was positive but did not affect growth of public health expenditure as a percent of government expenditure and private health expenditure as a share of total health expenditure during the period 2001 to 2011. On the other hand, it contributed to increase of real per capita health expenditure, total health expenditure as a share of GDP but reduced public health expenditure as a share of total health expenditure significantly. Real income per capita in the post Abuja declaration period 2001- 2011 reduced the growth of public health expenditure as a percent of government expenditure and private health expenditure as a share of total health expenditure significantly. But it led to increased growth of real per capita health expenditure per capita, total health expenditure as a share of GDP and public health expenditure as a share of total health expenditure significantly.

Sub-Saharan Africa countries that benefitted from HIPC debt relief had a significant increased growth in public health expenditure as a percent of government expenditure, real per capita health expenditure, total health expenditure as a percent of GDP, private health expenditure as a percent of total health expenditure more than the non-beneficiaries. On the other hand, the HIPC debt relief beneficiaries had a reduced growth in public health expenditure as a percent of total health expenditure compared to their counterparts who did not benefit from the debt relief.

In conclusion, SSA countries with low health expenditure relative to the steady state, move toward the steady state faster than countries whose health expenditure, is not far away from the steady state. Convergence of various types of health expenditure exists even after taking into account conditional factors. External health expenditure as a percent of total health expenditure increased the divergence of real per capita health expenditure and total health expenditure as a percent of GDP but led to convergence of public health expenditure as a percent of total health expenditure to the steady state. Real income per capita also contributed to divergence of real per capita health expenditure, total health expenditure as a percent of GDP and public health expenditure as a percent of total health expenditure. On the other hand, it lead to convergence of public health as a percent of government expenditure and private health expenditure as a percent of total health expenditure respectively. SSA countries who benefitted from HIPC debt relief diverged from the steady state of public health expenditure as a percent of government expenditure, real per capita health expenditure, total health expenditure as a share of GDP, private health expenditure as a percent of total health expenditure more than the non-HIPC countries. On the other hand, HIPC benefitting countries converged to a steady state of public health expenditure as a percent of total health expenditure more than non HIPC ones in SSA.

The increase in public health expenditure as a percent of government expenditure (Abuja policy instrument) affected the growth rate of other health expenditure measures in the period 2001-2011. The simulation at its mean (9.5%) shows that there was a decrease in the growth of real per capita health expenditure, total health expenditure as a percent of GDP, public and private health expenditure as a share of total health expenditure. Thus, there was increased convergence rate of the health expenditure measures. However, at the Abuja target (15%) the estimates showed a slower decline in the growth of health expenditure measures except for private health expenditure as a share of total health expenditure. This implies that as SSA countries implement the Abuja target other health expenditure measures variability also decrease overtime.

Implication for the research work indicate that policy makers need to continue lobbying for its implementation across the Sub-Saharan Africa countries. This will motivate lower spending countries to catch up with the higher health spending ones in all categories of health expenditure. The presence of convergence, provide evidence that the total, public and private health expenditure categories are trending together in SSA. The continued upward convergence of public health expenditure (increase in growth of public health expenditure between the period 2001- 2011) might have increased health service delivery and quality of life. This is through trained health personnel, availability of medical equipment and drugs and good infrastructure such as medical facilities. The downward convergence of private health expenditure (declining trends in private health expenditure in SSA in the period 2001-2011) indicates that they are decreasing and the burden of health care is shifting away from the households. This implies that vulnerability of households is decreasing. Therefore, more efforts by the policy makers are needed to increase effectiveness of public health expenditure in health service delivery in order to cushion the vulnerable in SSA. The contribution of donor funding and HIPC debt relief to growth of some health expenditure measures in SSA shows over reliance on external sources to support our health systems. Additionally, HIPC debt relief benefitting countries showed positive growth of their health expenditure. There is need to introduced alternative and sustainable health financing mechanisms such as community based health insurance to reduce dependency on donor funding for health care and other external initiatives such as HIPC debt relief.

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Table 1: Composition and Patterns of Health Expenditure in Sub-Saharan Africa 2001-2011

	2011		**Growth in % (2001-2011)**	**High Health Expenditure Countries in 2011**	**Low Health Expenditure Countries in 2011**
	SSA	**World**			
Total Health Expenditure as % of Gross Domestic Product	6.5	10.1	8.4	Liberia (19.5%), Sierra Leone (18.8%), Lesotho (12.7%)	Seychelles (3.8%), Central Africa, Rep. (3.8%), Eritrea (2.6%), Rep. of Congo (2.5%)
Public Health Expenditure as % of Gross Domestic Product	3.6	5.5	0.3	Lesotho (9.5%), Liberia (6.2%), Rwanda (6.1%), Swaziland (5.6%)	Guinea (1.6%), Eritrea (1.3%), Chad (1.2%)
Public Health Expenditure as % of Total Health Expenditure	45.1	59.7	11.5	Seychelles (92.1%), Cape Verde (75%), Equatorial Guinea (68%), Rep. of Congo (67%), Malawi (66%)	Sudan (28.4%), Guinea (27.3%), Chad (27.1%), Guinea-Bissau (26.8%), Sierra Leone (18%)
Public Health	9.7	15.1	12.8	Rwanda (23.7%), Liberia (18.8%), Malawi	Eritrea (3.6%), Chad (3.3%),

Expenditure as % of Government Expenditure				(18.5%), Zambia (16%), Togo (15.4%), Madagascar (15.3%)	Uganda (2.5%), Sudan (2.4%), Nigeria (2%)
Private Health Expenditure as % of Total Health Expenditure	54.9	40.3	-8.2	Sierra Leone (82%), Cote d'Ivoire (73.7%), Uganda (73.7%), Guinea-Bissau (73.2%), Guinea (72.6%), Sudan (71.6%)	Seychelles (7.9%), Cape Verde (24.9%), Lesotho (25.9%), Malawi (26.6%)
Out-of-Pocket Health Expenditure as% Private Health Expenditure	56.5	49.7	2.7	27 countries spent >70% of total health expenditure.	Only 4 spent <20%. Botswana, Mozambique, Namibia, South Africa.
Private Health Expenditure as % of Gross Domestic Product	3.6	4.1	-2.3	Sierra Leone (15.4%), Uganda (7%), Sudan (6%), Burundi (5.9%), DR. Congo (5.7%), Sao Tome and Principe (5.2%)	Equatorial Guinea (1.3%), Eritrea (1.3%), Cape Verde (1.2%), Congo (0.8%), Seychelles (0.8%)
Health Expenditure per Capita (US$ in PPP International)	155	1024.33	82.1	Equatorial Guinea (1642), Seychelles (989.40), South Africa (942.50), Mauritius (841.90), Botswana (734.10),Swaziland (433.50), Namibia (364.80)	Madagascar (39.60), Niger (39.30), DR. Congo (32.10), Central Africa (30.90), Eritrea (16.99)

Source of data: World Bank (2013); World Health Organization (2013).

Table 2: Data Sources and Definition of Variables

Variable	**Variable description**	**Data Source**
Total health expenditure as % of GDP	Total health expenditure is the sum of public and private health expenditure. It covers expenditure for the provision of health services (preventive and curative), family planning activities, nutrition activities, and emergency aid designated for health but does not include provision of water and sanitation. This is expressed as a ratio of GDP.	World Development Indicators (World Bank, 2013)
Real health expenditure per capita	Real health expenditure per capita is the sum of public and private health expenditures as a ratio of total population. Data are in international US$ converted using 2005 purchasing power parity (PPP) rates.	World Development Indicators (World Bank, 2013)
Public health expenditure as % of total health expenditure	Public health expenditure consists of recurrent and capital spending from government (central and local) budgets, external borrowings and grants (including donations from international agencies and nongovernmental organizations), and social (or compulsory) health insurance funds. This is expressed as a ratio total health expenditure.	World Development Indicators (World Bank, 2013)
Public health expenditure as % of government expenditure.	Public health expenditure consists of recurrent and capital spending expressed as ratio of total government expenditure. It is the Abuja Declaration 2001 policy instrument for raising health expenditure in Sub-Saharan Africa.	World Development Indicators (World Bank, 2013)
Private health expenditure as % of total health expenditure.	Private health expenditure includes direct household (out-of-pocket) spending, private insurance, charitable donations, and direct service payments by private corporations. This is expressed as a ratio of total health expenditure.	World Development Indicators (World Bank, 2013)
External health expenditure as % of total health expenditure (donor funding for health care)	External resources for health are funds or services in kind that are provided by entities not part of the country in question. The resources may come from international organizations, other countries through bilateral arrangements, or foreign nongovernmental organizations. These resources are part of total health expenditure.	World Development Indicators (World Bank, 2013)
Real income per Capita	GDP per capita based on purchasing power parity (Purchasing Power Parity).Data are in constant 2005 international US$.	World Development Indicators (World Bank, 2013)
HIPC Debt relief Dummy variable	Dummy variable for HIPC beneficiary countries in Sub-Saharan Africa. 1, HIPC beneficiary; 0, otherwise.	Various World Bank Bulletins for HIPC beneficiary Countries.

Table 3: Descriptive Statistics of Variables included in Health Expenditure Convergence Models

Variable	Mean	Std. Dev	Min	Max
Total Health Expenditure as a percent of GDP	5.9	2.6	1.7	22.2
Public Health Expenditure as a percent of Government Expenditure	9.5	4.5	0.97	26.9
Public Health Expenditure as a percent of Total Health Expenditure	48.4	17.2	5.3	93.5
Private Health Expenditure as a percent of Total Health Expenditure	51.6	17.2	6.5	94.7
Real Health Expenditure Per capita (PPP, 2005 International US$)	166.4	233.8	9.6	1806.5
Real GDP per Capita (PPP, 2005 International US$)	3295.8	5164.9	247.9	31968.6
External funded health expenditure as a percent of Total Health Expenditure	21.8	18.0	0.20	92.0
HIPC Debt Relief Dummy (1: Beneficiary; 0 otherwise)	0.30	0.48	0	1

Note: Number of Observations = 495.

Table 4: Absolute and Conditional Convergence of Public Health Expenditure (Dependent Variable is Growth of Public Health Expenditure as a Percent of Government Expenditure)

Independent Variables	Model 1: Absolute Convergence			Model 2: Conditional Convergence		
	FE	RE	LDPD	FE	RE	LDPD
Lagged public health expenditure as a percent of government expenditure	**-5.316***** (-9.50)	**-1.623***** (-5.29)	**-5.369**** (-2.19)	**-5.295***** (-9.30)	**-1.773***** (-5.33)	**-5.698***** (-6.70)
Lagged external health expenditure as a percent of total health expenditure	-	-	-	**-0.02** (-0.13)	**0.110** (1.13)	**0.038** (0.15)
Lagged ln(real GDP per capita)	-	-	-	**-25.885**** (-2.05)	**-2.075** (-1.22)	**-54.476**** (-2.45)
Heavily Indebted Poor Countries (HIPC) debt relief dummy variable (1 if beneficiary. O otherwise)	-	-	-	**1.821** (0.37)	**-1.754** (-0.55)	**23.819*** (1.70)
Constant	**55.383***** (10.13)	**20.380***** (6.34)	**55.889***** (6.18)	**247.389***** (2.65)	**35.496***** (2.54)	**455.047***** (2.33)
Number of Observations	450	450	450	450	450	450
F-Test, (p-value)	90.17 (0.00)	-	-	23.71 (0.00)	-	-
R-Squared	18.2	18.3	-	19.1	17.4	-
Wald Test χ^2, (p-value)	-	28.03 (0.00)	4.81 (0.03)	-	33.86 (0.00)	183.09 (p=0.00)
Hausman test χ^2, (p-value)	62.16 (0.00)		-	64.28 (0.00)		-
Sargan Test χ^2, (p-value)	-	-	9.270 (0.99)	-	-	12.609 (1.00)
Arellano-Bond Autocorrelation test (AR2) z-value (p=value)			-0.331 (0.74)			-0.525 (0.60)
Number of Instrumental Variables			29			48

Notes: (1) FE- Fixed Effects Model; RE- Random Effects Model; LDPD- Linear Dynamic Panel Data Model
(2) t-values are for the FE Estimation, and z-values are for the RE and LDPD estimations are shown in the parentheses;
(3) ***, **, * show significance of the estimates at 1%, 5% and 10%.
(4) Instruments: Model 1 (GMM-IV four period lagged public health expenditure as a percent of government expenditure); Model 2 (GMM-IV two period lagged public health expenditure as a percent of government expenditure).

Table 5: Absolute and Conditional Convergence of Real Health Expenditure (Dependent Variable is Growth of Real per Capita Health Expenditure)

Panel A. Regression Results									
Independent Variables	**Model 3: Absolute Convergence**			**Model 4: Conditional Convergence I**			**Model 5: Conditional Convergence II**		
	FE	**RE**	**LDPD**	**FE**	**RE**	**LDPD**	**FE**	**RE**	**LDPD**

Lagged ln (real health expenditure per capita)	**-4.147*** (-7.57)	**-0.541*** (-3.23)	**-3.259*** (-3.04)	**-7.262*** (-9.17)	**-1.759*** (-4.32)	**-8.736*** (-5.26)	**-8.261*** (-9.81)	**-3.198*** (-7.64)	**-7.220*** (-3.88)
Public health expenditure as a percent of government expenditure* lagged ln (real health expenditure per capita)	-	-	-	**-**	**-**	**-**	**0.155*** (11.49)	**0.148*** (11.73)	**0.178*** (3.37)
Lagged public health expenditure as a percent of government expenditure	-	-	-	-	-	-	**-0.453*** (-6.48)	**-0.604*** (-10.23)	**-0.693*** (-4.37)
Lagged external health expenditure as percent of total health expenditure	-	-	-	**0.049*** (2.69)	**0.002** (0.18)	**0.117*** (2.82)	**0.039** (2.51)	**0.001** (0.06)	**0.078** (2.44)
Lagged ln (real GDP per capita)	-	-	-	**8.409*** (4.42)	**1.344*** (3.11)	**12.053*** (4.71)	**9.116*** (4.99)	**1.490*** (3.50)	**8.067*** (2.84)
Heavily Indebted Poor Countries (HIPC) debt relief dummy variable	-	-	-	**1.095** (1.97)	**0.164** (0.44)	**2.350** (2.27)	**0.899*** (1.87)	**0.349** (0.99)	**1.769*** (2.87)
Constant	**20.223*** (8.19)	**3.995*** (5.18)	**16.227*** (3.36)	**-29.713*** (-2.48)	**-0.614** (-0.31)	**-52.095*** (-1.81)	**-32.580*** (-2.90)	**4.063** (2.01)	**-29.353*** (-1.99)
Number of Observations	450	450	450	450	450	450	450	450	450
F-Test, (p-value)	57.36 (0.00)	-	-	23.18 (0.00)	-	-	43.76 (0.00)	-	-
R-Squared	0.12	0.12	-	0.19	0.17	-	0.40	0.34	-
Wald Test χ^2, (p-value)	-	10.46 (0.00)	17.81 (0.00)	-	21.35 (0.00)	28.56 (0.00)		177.19 (0.00)	20.92 (0.00)
Hausman test χ^2, (p-value)	47.83 (0.00)		-	77.03 (0.00)		-	58.20 (0.00)		-
Sargan Test χ^2, (p-value)	-	-	17.006 (p=0.93)	-	-	53.75 (0.13)		-	43.55 (p=0.36)
Arellano-Bond Autocorrelation test (AR2) z-value (p=value)			-1.398 (0.16)			-1.333 (0.18)			-0.279 (0.78)
Number of Instrumental Variables			29	-	-	48			48

Panel B: Evaluation of the impact of Abuja policy instrument on convergence of real per capita health expenditure for conditional model with interactive term (model 5) (evaluated at the mean of SSA = 9.5%, Abuja Threshold =15%)

	Mean	**15% Threshold**
The coefficient estimate of lagged real per capita health expenditure.	**-7.220**	**-7.220**
The coefficient of interaction of ln (real per capita health expenditure) and public health expenditure as a percent of government expenditure (0.178)	1.691	2.67
Net Convergence rate	**-5.529**	**-4.55**

Notes: (1) FE- Fixed Effects Model; RE- Random Effects Model; LDPD- Linear Dynamic Panel Data Model

(2) t-values are for the FE Estimation, and z-values are for the RE and LDPD estimations are shown in the parentheses;

(3) Mean value (9.5%) obtained from descriptive statistics in Table 3.

(4) Instruments: Model 3 (four period lagged ln (real per capita health expenditure) (GMM); Model 4 (two period lagged ln (real per capita health expenditure) (GMM), one period lagged difference of external health expenditure as a percent of total health expenditure, HIPC debt relief dummy); Model 5 (two period lagged ln (real per capita health expenditure) (GMM) , one period lagged difference of external health expenditure as a percent of total health expenditure (GMM), one period lagged external health expenditure as a percent of total health expenditure and HIPC debt relief dummy).

Table 6: Absolute and Conditional Convergence of Total Health Expenditure (Dependent Variable is Growth of Total Health Expenditure as a Percent of GDP)

Panel A: Regression Results									
Independent Variables	**Model 6: Absolute Convergence**			**Model 7: Conditional Convergence I**			**Model 8: Conditional Convergence II**		
	FE	**RE**	**LDPD**	**FE**	**RE**	**LDPD**	**FE**	**RE**	**LDPD**
Lagged total health expenditure as a percent of GDP	**-5.558***** (-9.06)	**-0.827***** (-3.00)	**-5.979***** (-4.92)	**-6.045***** (-9.42)	**-0.863***** (-3.05)	**-9.428***** (-3.59)	**-11.418***** (-12.98)	**-4.969***** (-9.96)	**-17.065***** (-8.62)
Public health expenditure as a percent of government expenditure* lagged total health expenditure as a percent of GDP	-	-	-	**-**	**-**	**-**	**0.485***** (10.62)	**0.391***** (10.04)	**0.634***** (4.23)
Lagged public health expenditure as a percent of government expenditure	-	-	-	**-**	**-**	-	**-1.883***** (-5.85)	**-2.403***** (-9.13)	**-8.091***** (-8.06)
Lagged external health expenditure as a percent of total health expenditure	-	-	-	**0.121** (1.48)	**-0.008** (-0.16)	**0.822**** (2.27)	**0.095** (1.31)	**-0.040** (-0.88)	**0.709*** (1.83)
Lagged ln (real GDP per capita)	-	-	-	**11.853*** (1.86)	**-0.645** (-0.75)	**31.163**** (2.12)	**11.527**** (2.03)	**-0.615** (-0.79)	**9.932*** (1.69)
Heavily Indebted Poor Countries (HIPC) debt relief dummy variable	-	-	-	**0.403** (0.17)	**-0.239** (-0.15)	**16.615***** (2.72)	**0.736** (0.34)	**1.711** (0.243)	**17.004***** (2.91)
Constant	**35.352***** (9.70)	**7.697***** (4.39)	**37.813***** (5.31)	**-52.661** (-1.13)	**12.954*** (1.74)	**-197.478*** (-1.73)	**-29.217** (-0.70)	**36.361***** (5.10)	**46.542** (1.05)
Number of Observations	450	450	450	450	450	450	450	450	450
F-Test, (p-value)	82.03 (0.00)	-	-	22.39 (0.00)	-	-	38.55 (0.00)	-	-
R-Squared	0.17	0.17	-	0.18	0.15	-	0.37	0.27	-
Wald Test χ^2, (p-value)		9.00 (0.00)	16.77 (0.00)	-	9.57 (0.05)	13.88 (0.01)		115.90 (0.01)	257.92 (0.00)
Hausman test χ^2, (p-value)	74.47 (0.00)		-	81.60 (0.00)		-	158.24 (0.00)		-
Sargan Test χ^2, (p-value)	-	-	44.85 (0.12)	-	-	15.087 (0.30)	-	-	39.38 (0.21)
Arellano-Bond Autocorrelation test (AR) z-value (p=value)			AR(2) -0.406 (0.68)			AR(6) -0.983 (0.33)			AR(2) 0.096 (0.92)
Number of Instrumental Variables			37	-	-	18			40

Panel B: Evaluation of the impact of Abuja policy instrument on convergence of total health expenditure as percent of GDP for conditional model (model 8) with interactive term (evaluated at the mean of SSA = 9.5%, Abuja threshold =15%)		
The coefficient estimate of lagged total health expenditure as a percent of GDP	**Mean**	**Threshold (155)**
	-17.065	**-17.065**
The coefficient of interaction of total health expenditure as a percent of GDP and public health expenditure as a percent of government expenditure (0.634)	6.023	9.51
Net Convergence rate	**-11.042**	**-7.555**

Notes: 1) FE- Fixed Effects Model; RE- Random Effects Model; LDPD- Linear Dynamic Panel Data Model

2) t-values are for the FE Estimation, and z-values are for the RE and LDPD estimations are shown in the parentheses;

3) Where p= are the probability values.

4) Instruments: Model 6 (three period lagged total health expenditure as a percent of GDP (GMM): Model 7 (six period lagged total health expenditure as a percent of GDP (GMM) , difference of HIPC, and one period lagged difference of external health expenditure as a percent of total health expenditure, HIPC debt relief dummy and one period lagged external health expenditure). Model 8 (two period lagged total health expenditure as a percent of GDP (GMM), difference of growth of total health expenditure as a percent of GDP, one period lagged difference of ln (real income per capita), HIPC debt relief dummy).

Table 7: Absolute and Conditional Convergence of Public Health Expenditure (Dependent Variable is Growth of Public Health Expenditure as a Percent of Total Health Expenditure)

Panel A: Regression Results									
Independent Variables	**Model 9: Absolute Convergence**			**Model 10: Conditional Convergence I**			**Model 11: Conditional Convergence II**		
	FE	**RE**	**LDPD**	**FE**	**RE**	**LDPD**	**FE**	**RE**	**LDPD**
Lagged public health expenditure as a percent of total health expenditure	**-1.401***** (-10.15)	**-0.270***** (-5.32)	**-1.633***** (-4.49)	**-1.375***** (-9.83)	**-0.248***** (-4.18)	**-2.302***** (-3.91)	**-1.866***** (-9.97)	**-0.666***** (-7.40)	**-2.203***** (-4.10)
Public health expenditure as a percent of government expenditure* lagged public health expenditure as a percent of total health expenditure	-	-	-	-	-	-	**0.047***** (7.02)	**0.047***** (7.69)	**0.067***** (3.05)
Lagged public health expenditure as a percent of government expenditure	-	-	-	-	-	-	**-0.917**** (-2.00)	**-2.164***** (-6.53)	**-0.241** (-0.17)
Lagged external health expenditure as a percent of total health expenditure	-	-	-	**-0.103** (-1.03)	**0.004** (0.06)	**-0.210** (-0.59)	**-0.140** (-1.48)	**-0.055** (-0.87)	**-0.255*** (-1.66)
Lagged ln (real GDP per capita)	-	-	-	**-3.445** (-0.45	**-0.558** (-0.44)	**195.930***** (2.91)	**-0.241** (-0.03)	**-0.443** (-0.35)	**41.520***** (2.58)
Heavily Indebted Poor Countries (HIPC) debt relief dummy variable	-	-	-	**-0.655** (-0.22)	**-2.685** (-1.36)	**-25.133*** (-1.90)	**-1.538** (-0.55)	**-2.105** (-1.08)	**-15.038*** (-1.85)
Constant	**70.157***** (10.47)	**15.625***** (6.03)	**81.324***** (4.63)	**96.963*** (1.70)	**19.677**** (2.15)	**-1329.168***** (3.15)	**83.241** (1.54)	**37.072***** (3.91)	**-219.868***** (-2.14)
Number of Observations	450	450	450	450	450	450	450	450	450
F-Test, (p-value)	103.00 (0.00)	-	-	26.07 (0.00)	-	-	27.65 (0.00)	-	-

R-Squared	0.20	0.20	-	0.21	0.17	-	0.29	0.21	-
Wald Test χ^2, (p-value)	-	28.34 (0.00)	20.12 (0.00)	-	29.93 (0.00)	18.51 (0.00)		96.26 (0.00)	134.01 (0.00)
Hausman test χ^2 , (p-value)	77.63 (0.00)		-	82.50 (0.00)			117.58 (0.00)		-
Sargan Test χ^2, (p-value)	-	-	27.879 (0.97)	-	-	18.889 (0.76)	-	-	21.738 (0.99)
Arellano-Bond Autocorrelation test (AR) z-value (p=value)			1.235 (0.22)			1.221 (0.22)			-0.501 (0.62)
Number of Instrumental Variables			46	-	-	29			48

Panel B: Evaluation of the impact of Abuja policy instrument on convergence of public health expenditure as percent of total health expenditure for conditional model with interactive term (model 11) (evaluated at the mean of SSA = 9.5%, Abuja threshold =15%)		
The coefficient estimate of lagged public health expenditure as a percent of total health expenditure	**Mean**	**Threshold**
	-2.203	**-2.203**
The interaction of public health expenditure as a percent of total health expenditure with public health expenditure as a percent of government expenditure (0.067)	0.637	1.005
Net Convergence rate	**-1.566**	**-1.198**

Notes:1) FE- Fixed Effects Model; RE- Random Effects Model; LDPD- Linear Dynamic Panel Data Model.
2) t-values are for the FE Estimation, and z-values are for the RE and LDPD estimations are shown in the parentheses.
3) Where p= are the probability values.
4) Instruments: Model 9 (two period lags of public health expenditure as a percent of total health expenditure (GMM): Model 10 (three period lags of growth of public health expenditure as a percent of total health expenditure (GMM)): Model 11 (two period lags of public health expenditure as a percent of total health expenditure (GMM), one period lagged difference of external health expenditure as a (GMM), one period lagged difference of public health expenditure as a percent of total health expenditure (GMM) and one period lag of public health expenditure as percent of total health expenditure).

Table 8: Absolute and Conditional Convergence of Private Health Expenditure (Dependent Variable is the Growth of Private Health Expenditure as a Percent of Total Health Expenditure)

Panel A: Regression Analysis									
Independent Variables	**Model 12: Absolute Convergence**			**Model 13: Conditional Convergence I**			**Model 14: Conditional Convergence II**		
	FE	**RE**	**LDPD**	**FE**	**RE**	**LDPD**	**FE**	**RE**	**LDPD**
Lagged private health expenditure as a percent of total health expenditure	**-0.949***** (-10.33)	**-0.106***** (-3.21)	**-1.241*** (-1.79)	**-0.959***** (-10.31)	**-0.126***** (-3.20)	**-0.753**** (-2.20)	**-0.507***** (-4.79)	**0.343***** (6.82)	**-1.015**** (-2.43)
Public health expenditure as a percent of government expenditure* lagged private health expenditure as a percent of total health expenditure	-	-	-	**-**	**-**	**-**	**-0.059***** (-13.68)	**-0.047***** (-12.84)	**-0.105***** (-6.68)
Lagged public health expenditure as a percent of government expenditure	-	-	-	-	-	-	**1.287***** (4.87)	**2.538***** (11.82)	**-0.074** (-0.05)
Lagged external health expenditure as a percent of total health expenditure	-	-	-	**-0.048** (-0.73)	**-0.033** (-0.77)	**0.135** (0.77)	**-0.010** (-0.19)	**-0.054** (-1.49)	**-0.013** (-0.14)
Lagged log of real GDP per capita	-	-	-	**5.413** (1.06)	**-0.786** (-0.94)	**-22.504***	**1.605** (0.38)	**-0.540** (-0.75)	**-54.144****

						* (-2.13)			* (-3.69)
Heavily Indebted Poor Countries (HIPC) debt relief dummy variable	-	-	-	**-1.575** (-0.80)	**-0.481** (-0.37)	**9.236*** (1.97)	**-1.218** (-0.03)	**0.296** (0.26)	**16.932**** (2.44)
Constant	**48.848*** ** (10.20)	**5.169**** * (2.87)	**63.979** * (1.78)	**10.775** (0.28)	**12.576** (1.53)	**199.667** ** (2.24)	**29.820** (0.92)	**- 15.026*** (-1.92)	**498.233*** ** (3.54)
Number of Observations	450	450	450	450	450	450	450	450	405
F-Test, (p-value)	106.70 (0.00)	-	-	27.09 (0.00)	-	-	57.77 (0.00)	-	-
R-Squared	0.21	0.21	-	0.21	0.18	-	0.47	0.35	-
Wald Test χ^2, (p-value)	-	10.33 (0.00)	3.22 (0.07)	-	11.57 (0.02)	94.67 (0.00)	-	189.82 (0.00)	335.92 (0.00)
Hausman test χ^2, (p-value)	96.65 (0.00)		-	99.64 (0.00)		-	82.11 (0.00)		-
Sargan Test χ^2, (p-value)	-	-	7.802 (0.90)			35.378 (0.36)	-	-	21.546 (0.25)
Arellano-Bond Autocorrelation test (AR) z-value (p=value)			AR(6) -0.942 (0.35)			AR(3) -0.249 (0.80)			AR(5) 0.048 (0.96)
Number of Instrumental Variables			16			38			25

Panel B: Evaluation of the impact of Abuja policy instrument on convergence of private health expenditure as percent of total health expenditure for conditional model with interactive term (model 14) (evaluated at the mean of SSA = 9.5%, Abuja threshold =15%)

	Mean	**Threshold**
The coefficient estimate of lagged private health expenditure as a percent of total health expenditure	**-1.105**	**-1.105**
The coefficient of interaction of private health expenditure as percent of total health expenditure and public health expenditure as a percent of government expenditure (0.067)	-0.998	-1.575
Net Convergence rate	**-2.103**	**-2.68**

Notes: 1) FE- Fixed Effects Model; RE- Random Effects Model; LDPD- Linear Dynamic Panel Data Model.

2) t-values are for the FE Estimation, and z-values are for the RE and LDPD estimations are shown in the parentheses;

3) Where p= are the probability values.

4) The instruments: Model 12 (six period lags of private health expenditure as a percent of total health expenditure (GMM)): Model 13 (three period lags of external health expenditure as a percent of total health expenditure (GMM), one period lagged difference of private health expenditure as percent of total health expenditure (GMM) and one period lag of private health expenditure as percent of total health expenditure): Model 14 (five period lagged private health expenditure (GMM), one period lagged difference of external health expenditure as a percent of total health expenditure, one period lagged difference of private health expenditure as a percent of total health expenditure, difference of public health expenditure as a percent of government expenditure, one period lagged private health expenditure as a percent of total health expenditure).

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