

CATASTROPHIC HEALTH EXPENDITURE AND MONETARY POLICY IN SUB-SAHARAN AFRICA: A FIXED EFFECT ANALYSIS

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Abstract

Catastrophic health expenditure engenders poverty and generates more illness. Thus, it is a veritable generator of the vicious cycle of poverty. It is common among the low income group prevalent among Africa economies. Studies in this area have, mostly, been among household and scarcely involve macroeconomic policy variables. This study employs panel data methodology to examine the possible impact of monetary policy on catastrophic health expenditure in 44 Sub-Saharan African economies. The p-values of the LM statistic of the test, clearly indicates residuals cross-section correlation in the model at 5% level of significance. Hence a Panel Corrected Standard Error (PCSE) is applied in the estimation of the Fixed Effect Model. Results show that monetary policy is correctly signed and statistically significant in its effect at 5% level of significant, even after being controlled for four other variables, RIMPES, EXR, PRANPW and AGDRO. The study therefore recommends, among others, that expansionary monetary policy option should be explored for now so as to enhance demand for money, such that, catastrophic health expenditure could be mitigated.

Keywords: Catastrophic-Health-Expenditure, Monetary-Policy, Fixed-Effect, Out-Of-Pocket and Sub-Saharan-Africa

JEL classification: E2 E4 E6 E7 H3 H5 I1.

1. INTRODUCTION

Target 3.8 of goal 3 of the World Health Organisation (WHO) (2015); of the sustainable development goals (SDGs) is aimed at: “achieving universal health coverage, including financial risk protection, access to quality essential health-care services and access to safe, effective, quality and affordable essential medicines and vaccines for all” To achieve the fore going would require an optimum health care system that can afford financial protection for the populace against impoverishing

health care expenditure. The above notion has a chain ripple effect of enhancing sustainable economic growth through an enhanced optimum productivity that derives its strength from efficiency fed by a healthy populace. Thus ensuring that the economy is rid of incidences of catastrophic health expenditure is a crucial function of a health system of any economy (Evans R.G., 1989; Mohammad H. K, D. Elham,, K. Zahr and M. Reza, 2019). World Health Report, (2000) asserts that creation of a guaranteed protection of the populace against financial risks is one of the fundamental goals of the health system of any economy. Catastrophic health expenditure (CHE) is one of the outcomes of a poorly designed health care system (Ekman B. 2007). Thus, ensuring protection of the economy against health financial risks and ensuring the absence of catastrophic spending in the economy spells the optimum feature of the health system of any economy (Jamison D.P., J.G. Breman and A.R. Measham, Undated). According to Mohammad H.K et al, (2019) and Yardim M.S, N. Cilingiroglu., N. Yardim (2009), (CHE) is said to occur when out-of-pocket (OOP) health expenditures due to health care expenses impoverishes the affected household or individual. The core driver of CHE is the out-of-pocket (OOP) health care expenditure. Thus, World Health Organisation WHO (2019) asserts that catastrophic health expenditure occurs when OOP incurred due to Health care treatment exceeds 40% of total expenditure of a household's capacity to pay subsistence expenditure. Wagstaff A., E. Van Doorslaer and P. Paci (1991b) and Xu .K and David (2003) state that capacity to pay is the available income after fixing subsistence expenditure, in other words capacity to pay is made up of income for non-subsistence expenditure. Xu K. and Organisation W.H. (2005) assert that subsistence expenditure is made up of expenses on basic needs of; food, shelter, clothing and basic household utilities. The consequence is that most affected households and individuals are pushed into poverty which, in consequence, feeds into poor health, thus creating an ever living vicious cycle of poverty (Damen Hailemariam, 2019 and Russel S, and L. Gilson 1997)). According to Sharifa Ezat Wan Puteh and Yasmin Almualm, (2017), CHE impoverishing effects is fuelled by geographical location of the affected households or individuals. For example, WHO, (2000) observed that CHE in rural India was 25.3% while that of the urban was 17.5% and that 87% of poverty in the poor states was attributed to OOP that occurs in the rural areas. In the rich states, poverty was 67% and the distribution was 3.5% and 2.5% for rural and urban respectively. WHO, (2002) also observed that CHE in rural Kenya is 31.1% compared to 28.1% in urban Kenya. Kawabata K, K. Xu and G. Carrin, (2002) in a study carried out in1998, observed that OOP in China had pushed 44.3% of rural households below poverty line. Education also, has been found to be another factor that enhances the vulnerability of the rural economies towards CHE. For example, Filmer D, J. Hammer, L. Prichett (2002) found out that rural Kenya, where 53.5% is illiterate, hosts more CHE victims than the urban area with 11.2%. Apart from education, poverty, unemployment and presence of disability among households were also found to influence the occurrence of CHE. Evans R.G (1989) in Xu. K., D.B. Evans, K. Kawabata, R. Zeramdini, J. Klavus and C. J. Murray (2003) noted that in Nigeria 23% of CHE prevalence is among the low

income group while 8% of it is among the high income group and that in Burkina Fasso, the rich make use of health facility more than the poor. The study also observed that in Uganda, Households headed by the unemployed and disabled are more like to encounter CHE. See (China Center for Health Statistics and Information 2009; Xu K. and David, 2003 and Xu K. 2005).

Thus, from the above, location, poverty, education, disability and unemployment are factors associated with CHE. According to, Doshmangir, L., M.Yousefi, E. Hasanpoor, M. Yousefi, H. Haghparast-Bidgoli and B. Eshtiagh, (2020), “catastrophic health expenditures (CHE) are of concern to policy makers and can prevent individuals accessing effective health care services. The exposure of households to CHE is one of the indices used to evaluate and address the level of financial risk protection in health systems, which is a key priority in the global health policy agenda and an indicator of progress toward the United Nation’s Sustainable Development Goal for Universal Health Coverage”. The question bothering this study, therefore, is apart from these household factors, is there any relationship between CHE and any known policy instrument, preferably monetary policy, such that the instrument can feature meaningfully in its modelling, with a view to deriving an optimum health policy engineering process? Meanwhile scarcely has any study looked into the association between CHE and monetary policy and reproductive health issues such as; particularly, maternal morbidity that fuels mortality and old-age dependency ratio. Fiscal policy has featured prominently in most previous studies. See Quintal, C. (2019), Schakel, H.C., Wu, E.H. & Jeurissen, P. (2018), Behera, D.K., Dash, U. (2019) and Schieber G., C. Baeza, D. Kress and M. Maior (2006). Thus this study opts to examine the impact of monetary policy on CHE in Sub-Saharan Africa. The study does not only tread on this novel trajectory, it also veers off the conventional household study pattern of previous studies to employing the panel data approach on 44 selected countries in Sub-Saharan Africa. The study stands on, Mohammad H.K et’al, (2019), (Damen Hailemariam, (2019) Wyszewianski L.(1986) and Sharifa Ezat Wan Puteh and Yasmin Almuallm, (2017) in choosing OOP as a proxy for CHE.

2. THEORETICAL LITERATURE

Catastrophic Health Expenditure (CHE) can be seen as impoverishing expenses incurred on health care spending by an economic unit. The affected economic unit could be an individual, household or an entire economy. Sharifa Ezat W. P. and Y. Almuallm, (2017), assert that catastrophic health expenditure (CHE) occurs when medical cost is equal to or exceeds 40% of a household’s non-Poverty income. Non poverty income could be seen as non-subsistence income. Subsistence needs are the basic needs of food, housing clothing and other basic needs of the household. Thus, once the household has covered these expenditures, the remaining income is referred to as non-subsistence income. Non-subsistence income is also referred to as capacity-to-pay. The threshold for CHE therefore is that it has to be

equal to or greater than capacity-to-pay. (WHO, 2002; Bovbjerg R.R, 2001; Rice T., K. Desmond and J. Gabel 1990). The major ingredient of CHE is the non-prepaid expenses incurred by the private individuals or households on health care. This is known as private or Out-Of-Pocket (OOP) health expenditure. Thus, CHE occurs once OOP is equal to or greater than capacity-to-pay. That is:

$$CHE = OOP \geq 0.4CTP \quad (1)$$

Where: CHE = catastrophic health expenditure

OOP = out-of-pocket health expenditure

CTP = capacity-to-pay.

Out of pocket health expenditure has both direct and indirect cost. Its direct cost is the monetary expenditure burden borne by the affected household or individual. The indirect cost is the opportunity cost borne in the form of absenteeism from work, time spent by relations of the sick in caring for the sick and transport cost in the course of treatment, both by the individual and the relations. In measuring CHE, WHO standard is often used by researchers to determine the individual household subsistence expenditure and CTP. The poverty line is often as given by the individual country statistics. For example, Qunhong Wu, Ye Li, Ling Xu, Yanhua Hao, David Legge, Lijun Gao, Gang Wan and Ning (2012) employ (WHO, 2001) method to compute CHE. Its scale for measurement was indicated to be an OOP for health care of $\geq 40\%$ of the capacity to pay of a household. The household samples were adjusted according to WHO, (2001), for the required standard size. Thereafter; the bi-monthly expenditure on consumption of each household was ranked into quintiles. By this adjustment, health expenditure differentials across economies can be traced to factors other than population composition differences. A proportion of an average monthly food expenditure of the total household expenditure on consumption rated between the 45th and 55th percentiles of the entire sample, defined the poverty line. This implies that the households subsistence spending forms the core of the poverty line definition in this study. The poverty line was multiplied by standard household size to derive the subsistence spending of average household. The value so derived became the critical index for determining poverty. Thus, a household with a value of total expenditure lower than the critical household subsistence spending is termed poor and if otherwise, it is termed rich. The household CTP was then proxied by her non-subsistence spending. Peradventure, there arise a phenomenon where, expenditure on food is less than subsistence spending, total expenditure minus food expenditure forms the definition of capacity to pay. From the above it is clear that CHE is impoverishing health expenditure (Su TT, Kouyaté B, Flessa S 2006). CHE is not synonymous with high prices of health care goods and services because what a given economic unit would consider expensive charges could be relatively moderate or acceptable to another (World Health Organisation 2015 and World Health Organization, 2000). The ultimate effect of CHE is poverty on the affected unit (Adhikari S.R, N.M. Maskay, and B.P.

Sharma 2009 and Hanoi, (2002). In most of the Sub-Saharan African's economies OOP on health is mostly more than 0.5 of total health expenditure, which by all means would be impoverishing. See Nigeria, national bureau of Statistics, (2018). Thus, this study proxied CHE with OOP as its dependent variable.

2.1. HEALTHCARE SYSTEM FINANCE

Health care system of any economy is a process that creates and coordinates organisations, institutions and resources that can restore, maintain and provide health care for the populace. An effective health care system is characterised by prompt response to the health needs of the populace, defence of the populace against any health threatening phenomenon, reduction of possible catastrophic financial burden resulting from illness, provision of equitable access to people focussed health care and freedom of participation, in deliberation and decision making on health care matters and policy formation, for the populace. (WHO, 2010 and Horslen S. (2009). According to Cavagnero E, G. Carrin, K. Xu, and A.M. Aguilar-Rivera (2006), there are two main types of health care finance processes. They are prepaid and the direct or out-of-pocket financial processes. The prepaid process is of different types. They are finance through government fund or tax, social health insurance schemes and private health insurance scheme. The health care finance of most African economies is characterised by orientation norms and colonisation interest, for those economies that grew as colonies of foreign concerns that structured their earlier socioeconomic outlooks. For, example, it is traditional among the Asian and European economies to pool the risk of health as a risk and hazard but among some African economies, like Nigeria, the British colonial masters, who only focused on exploiting her colonies for productive raw materials, only extended health care to the military while the missionaries only extended theirs to the clergies and few members of the various missions. The rest populace sorted out herself through OOP. At independence, the pattern still persists. Till date the pattern of health care provision in Nigeria, is still dominated by corporate, mission, military health care provision which is enjoyed by a very few sections of the economy while the rest majority cater for themselves through OOP. Even though public health institutions are set up by the various government of the different economies, in an attempt to mitigate the vagaries of catastrophic health care spending, such institutions are marred with myriad degrees of inefficiencies that show up in different degrees of negative health output, such as high: maternal mortality rate, malaria death rate, HIV/AIDS death rate low life expectancy to name but four. Apart from the prevalence of high illiteracy and poverty rates in these economies, the idea of prepaid health finance is relatively alien and adapting it is difficult. Evidence has shown that economies with prepaid health care finance system enjoy less health care burdens as against those who adopt immediate private OOP for health care. From the foregoing it is clear that the prepaid method of finance is a major panacea in the annals of curbing CHE Poverty cannot encourage prepaid health expenditure. In short, the poor see prepaid health services as luxury. Thus, they prefer to spend on immediate survival needs as housing, food

and children survival sustenance and wish illness will never come but if it comes it becomes a matter of “crossing the bridge when we get there”. Thus, the bother of this study is what policy instrument, capable of boosting aggregate demand and making prepaid health care spending a necessity good, can be employed to mitigate catastrophic health expenditure? Study in fiscal spending, as instrument for health care finance, replete health finance literature. See (Schakel C.S., E.H. Wu, and P. Jeurissen, 2018; Cheryi C.,2016; Schieber G.,C. Baeza, D. Kress and M. Maier, 2006;Nugent, R. and F. Knaul, 2006; Varatherajan, D. and B. E. David, 2010; Chris, J. and V. Camila, 2015 and Drew E.A. and H.M. Douglas 1983; Hyacinth, E.I., Musgrove P. 2000 and O. Chijoke, 2013). On the other hand, little or nothing seems to be known about monetary policy and health care finance. It is therefore the interest of this study to examine the impact of monetary policy on catastrophic health expenditure, with a view to effecting reduction of catastrophic health expenditure in the sub-Saharan economy.

2.2. MONETARY POLICY AND DEMAND FOR HEALTH CARE

Monetary policy is the systematic control of money supply in an economy by the central bank. Monetary policy could be expansionary or contractionary. Keynes J.M (1939) in Sede I.P and A. O Ogiemudia (2020) shows that it is expansionary when the central bank buys treasury notes, reduces interest rates on loans to the bank, reduce reserve requirements. These actions culminate in increasing the quantity of money in circulation which results into reduction of interest rates. With this situation, demand for money is increased and this will also create increase in aggregate demand (Khundrakpam J.K, 2012; Zolten M., Jakab-Victor and Varpalotal-Balazs, 2006; Lumen, Undated; OER Services, Undated, Investopedia, 2020). Expansionary monetary policy is employed, during economic recession, to pool out the economy from depression. During excessive inflation in the economy contractionary monetary policy is adopted. In this case, interest rates on bank loans are increased, reserve requirements are increased, and the central bank would sell bank treasury notes. This will reduce the amount of money in circulation and thereby increasing interest rates. Thus, the increased aggregate demand created during expansionary policy regime, is expected to generate increased employment and increased income. During this time, the individuals who had earlier seen prepaid health care finance as luxury goods would be able to generate enough incentives to demand for them, as necessity goods. When this takes place then catastrophic health expenditure will decrease in the affected economies. By implication the a-priori expectation between CHE and Monetary policy is negative.

2.3. EMPIRICAL LITERATURE

Meram A, C. April, R. Camilla and S. Tin (2019), carried out a systematic review and a meta-analysis, to examine factors influencing household catastrophic health expenditure (CHE) among high and low income economies globally. The study employs both manual and electronic search devices. The number of studies

that met the selection criteria involvement in the review was thirty-eight. Results of the analysis shows that, there is a significant correlation between household catastrophic health expenditure and the following: presence of an elderly or disabled person in the household, household economic-status, incidence of hospitalisation, and presence of a family member with a chronic illness. This indicates that incidences of CHE, world over, can be attributed to socioeconomic inequality. The low-income households are particularly concluded to be at high risk of financial hardship from healthcare payments, in the study. The paper thus recommended that healthcare finance policies should be improved upon to bridge the gap in socioeconomic inequality. It also recommended the implementation and strengthening of social safety networks for people who have a high need for health care

Doshmangir, L., M. Yousefi, E. Hasanpoor, M. Yousefi, H. Haghparast-Bidgoli and B. Eshtiagh, (2019), examined factors responsible for catastrophic health expenditure in Iran. In carrying out a meta-analysis, Catastrophic Health Expenditures; Health Equity; Health System Equity; Health Expenditures, Financial Catastrophe, Financial Contribution, Health Financing Equity and Financial Protection are the important terms in the research. The study with no specified time frame consulted; PubMed (October 2019), Web of Science, Scopus, Pro Quest, Embase, Science Direct and the Iran national databases for the important words. Studies that met the criteria for selection for the research were included in the meta-analysis. Data analysis was by means of error component modelling (ECM). 53 important studies were cited. Forty (40) of this, were treated within the population while 13 were handled as disease cases. At the population level, the rate of Catastrophic Health Expenditure equals 4.7% (95% CI 4.1% to 5.3%, n = 52). For the disease specific cases, (where disease is cancer) Catastrophic Health Expenditure is 25.3% (95% CI 11.7% to 46.5%, n = 13). Those to undergo dialysis had most of the Catastrophic Health Expenditure burden (54.5%). Health insurance subscription, presence of the aged (60 and above) among household members and the level of consumption of in and outpatients' services, were found to be the very critical drivers of Catastrophic Health Expenditure in the research. The research, therefore, observed that Catastrophic spending has increased in Iran since 2001 to 2015. Thus, it recommended that a health care finance burden-lessening policy be developed to tackle this problem.

Okedo-Alex. I N., C.A. Ifeyinwa, O. B. Ezeanosike, C.J. Uneke (2019) Reviewed the incidence and determinants of catastrophic health expenditure in Nigeria. Databases for the primary research study, published between 2003 and 2018, were derived from OVID, PubMed, EMBASE, Science web and CINAH. The key words used include out-of-pocket (OOP) expenditure, household, Nigeria and catastrophic health expenditure (CHE). From the study, the criteria for being selected into the study were satisfied by twenty studies. Those qualified were, therefore, selected among others for the study. Results show that the incidence of catastrophic health expenditure spanned between 8.2% and 50%. It also showed that catastrophic

expenditure was experienced by 3.2% to 100% of the households at 40% of expenditure on non-food items. Studies defined as lower threshold and inpatients had higher catastrophic health expenditure records. Type 2 diabetic and tuberculosis patients had the highest outpatient catastrophic health expenditure while human immunodeficiency virus had the highest inpatient catastrophic health expenditure. The study therefore attributes catastrophic health expenditure to age, wealth status and gender, type of residence, location composition and size of household, education and insurance status, illness type and type of healthcare provider patronised. This is because catastrophic health expenditure is found, by study, to be high among the elderly, rural dwellers, the poor, female gender, the non-insured and common health conditions. It thus recommends the employment of efficient fiscal machinery and the adoption of informal social and financial network devices for alleviating the problem of catastrophic health expenditure in Nigeria.

Ke Xu, D. Evans, G. Carrin A. Aguilar-Rivera, P. Musgrove and T Evans, (2007) examine the determinants of financial catastrophe due health spending in 89 countries of the world. The study obtained 119 household data. Findings of the study show that financial catastrophe is positively associated with out-of-pocket spending while it is negatively associated with prepayment policy. It therefore recommended that governments of economies of the world should increase prepayments made to health care providers to avoid financial catastrophe.

Bolaji S. A. & M. K. Samina (2018), examines the factors responsible for catastrophic health expenditure (CHE) in Nigeria. The study obtained secondary data from the Harmonized Nigeria Living Standard Survey (HNLSS) of 2009/10. Adopting a bivariate and logistic analytical methods, it investigated the household and individual characteristics that determine CHE. The outcome of the study thus observed and concluded that, among others, that CHE is attributable to the presence of household members within the infant and working group, (that is ages between 6-14; 15-24 & 24-54), illiteracy, non-subscription to health insurance policy and geopolitical location of the patients in the country. The study therefore concludes that policy engineering process in the country should be such that decreases catastrophic health expenditure for the populace in the country.

Ke Xu, D., B. Evans, Kei Kawabata, Riadh Zeramdini, Jan Klavus, Christopher J.L. Murray (2003) examined conditions under which catastrophic health spending takes place in 59 countries of the world. The percentage value of families delineated to experience catastrophic health expenditure (CHE) was regressed on a number of independent variables, such as, share of Out-Of-Pocket (OOP) expenditure of the total health expenditure, proportion of total health expenditure out of GDP to mention but two. Results show that CHE has a high correlation with OOP, low capacity to pay and lack of policy on prepayment. Thus, the pattern of the results is that the developed countries have minimised values of OOP expenditure compared to that of developing countries. This was attributed to presence of developed social institutions such as social health insurance and tax

funded health systems in the developed economies which is not prevalent in the developing economies.

Nguyen T., B, L.Curt, K. Nguyen, Thi and L. Lars (2008), in study compared the CHE estimated from three set of data in Vietnam and at the same time, described the proportion of household that experience CHE in Vietnam. It used the Vietnam Living Standard Survey (VLSS) 1997/98 and the Fila Bavi data set and conducted a resurvey on them between 2001 and 2002. Findings show that 9% to 10% of both data set resurvey encountered catastrophic health expenditure and that on the average, 5% and 1% experience catastrophic health expenditure monthly and annually respectively. The variation in results is attributable to difference in method of data collection.

Mohammad H., Kazemi-galougahi, E. Dadgar, Z. Kavosi & R. Majdzadeh (2019), examines the trend and determinants of catastrophic expenditure among 600 households in Tehran economy in Iran. The study employed the World Health questionnaire to select the sample. It established catastrophic expenditure as the 40% out-of-pocket spending above household capacity to pay for her subsistence needs. From this it determined the number of households that fell into catastrophic health expenditure and also determined the factors responsible for it. It also employed the concentration curve to determine the degree of inequality among the households and the determinants of inequality among them. Results of the 2019 study were compared with those of 2015. It shows that, inpatient treatment is most significant in generating catastrophic spending. The results also show that catastrophic spending had increased significantly compared with previous spending and that there are no significant economic inequalities.

Yohannes.H.M.,C.Hanlon, K.Tirfessa, S.Docrat, A.Alem, G.Medhin, C.Lund, D. Chisholm, A. Fekadu and D. Hailemariam (2019) examined the incidence and intensity of out-of-pocket (OOP) catastrophic health expenditure (CHE) and coping strategies among households with or without depression, in Ethiopia. Using a comparative cross-sectional survey, 128 and 129 households with and without depression respectively were sampled. The nine item version of the Patient Health Questionnaires (PHQ-9) was adopted in screening for depression. Classification of depressed households into high and low disability groups was attained by adopting the median value of the World Health Organisation disability assessment schedule (WHODAS) polytomous summary score. The study employed health expenditure greater than between 10% and 25% of total household consumption for primary analyses. It adopted the retrospective re-call of total household expenditure pre- and post-OOP payments for health care, to estimate poverty head count, poverty gap and normalised poverty gap. The specified linear probability model was estimated with the aid of binary regression command in STATA with `rr` option. This yielded the risk ratio estimates for the occurrence of outcomes among households with and without depression based on the level of disability. The finding was that households with depression and high level disability are more likely to face catastrophic health

expenditure and impoverishment. It thus recommended that financial protection by means of prepayment schemes, exemptions and fee waiver should be directed at households with depression.

Ye Li, Qunhong Wu, Ling Xu, David Legge, Yanhua Hao, Lijun Gao, Ning and Gang Wan (2012), evaluated the rates and distribution of catastrophic health expenditure (CHE) and impoverishment as well as determining the factor causing CHE in China. The study derived the data from Chinese ministry of health generated National Health Services Survey (NHSS, 2008). Base on this the study employs the method of stratified cluster sampling for different stages coupled with systematic random sampling to generate data from 56,400 households across China economy. The standard for critical indices, such as, poverty line, subsistence spending and capacity-to-pay, for the analysis were determined after data cleansing. Results show that despite the fact that the Chinese health sector reform has shown tremendous progress, the protection of the vulnerable from CHE induced poverty is still a serious problem. The study shows that Increased health care coverage policy does not yield improved health-service coverage or better protection against health-care costs. It therefore recommended an optimum design of health insurance coverage that will enhance an easy access of the vulnerable low income group quality health care. This will bale them out of the catastrophic and impoverishing health expenditure malady.

Sharifa Ezat Wan Puteh and Yasmin Almuallm, (2017), observed that catastrophic health expenditure is not the same as expensive health bill. A high health care bill in a rich or developed economy with optimum health care finance policy, such as a good social health care insurance in place, would not be catastrophic. On the other hand, a health bill for common ailment such as fever could be catastrophic for low income economies with sub-optimal health care finance policy. The study, therefore, opines that optimum health care finance policy that anticipates the nature of illness against cost is appropriate. It further asserts that such health care finance policy should emphasise equity and access as principal attributes of the designed health care finance policy.

3. METHODOLOGY AND DATA

This study adopted a Fixed Effect Model (FEM) to analyse monetary policy as a determinant of catastrophic health spending, and the extent to which the latter induces the former in sub-Saharan Africa. The Fixed Effect Model representative of the relationship is illustrated in equation (2) where the level of catastrophic health spending at time t for country i is presumably determined by monetary policy adjustment at time t for country i .

$$i = 1, 2, \dots, 44$$

$$t = 1, 2, 3, \dots, 9$$

$$Z_{it} = \theta_i + \beta M_{it} + \alpha w_{it} + \mu_{it} \quad (2)$$

$$i = 1, 2, \dots, 44$$

$$t = 1, 2, 3, \dots, 9$$

From equation (2), Z_{it} indicates the level of catastrophic health spending for country i at time t . It is measure by out-of-pocket expenditure (OPHEX). Mohammad H.K et al, (2019); Wyszewianski L.(1986) and Sharifa Ezat Wan Puteh and Yasmin Almuallm, (2017) employed out-of-pocket health expenditure as a major variable in capturing catastrophic health spending within their study. M_{it} equals monetary policy (primary control variable) for country i at time t and w_{it} represents ancillary regressors measure at time t for country i . These are risk of impoverishing expenditure for surgery care (RIMPS), age dependency ratio (AGDRO), Prevalence of anaemia among women of childbearing age (PRANPW) and exchange rate (EXR). θ_i denotes country (fixed) specific effect and μ_{it} is the disturbance term of the model. β and α are the estimable parameters of the model.

Thus, the empirical model for the investigation is specified as:

$$OPHEX_{it} = \theta_i + \beta_{it}M + \beta_{it}RIMPS + \beta_{it}AGDRO + \beta_{it}PRANPW + \beta_{it}EXR + \mu_{it} \quad (3)$$

On a priori ground, a negative relationship is expected between monetary policy and catastrophic health spending. Equally, a positive impact of AGDRO, PRANPW and RIMPS on catastrophic health spending is expected but inverse relationship between exchange rate and catastrophic health spending.

The suitability of the FEM for the analysis over other approaches like Random Effect Model (REM) or the error component model (ECM) is conditioned on the correlation of the individual error term with one or more of the model's regressors. This is determined using Hausman test. Ahn and Moon (2001) opined that Hausman statistic is a test of choice between the random effect and fixed effect estimators. The Hausman test hypothesizes a consistent and efficient estimate of the random effect model against the fixed effect model.

The data used for the study were collected from the World Bank online database (<https://data.worldbank.org/>) on 44 sub-Saharan Africa countries. The list of the included countries is at the appendix

4. RESULTS PRESENTATION

The estimated result on the impact of monetary policy on catastrophic health spending in sub-Saharan Africa, SSA, is as in Table 5. Prior to the estimation, a foundation of the relationship is laid using correlation technique. The correlation report is in Table 1. The result shows a positive but weak correlation between the level of catastrophic health spending and monetary policy in SSA. In addition, the risk of impoverishing expenditure for surgery care, age dependency ratio, and

prevalence of anaemia among women of childbearing age have a positive but poor degree of association with the catastrophic health spending. Contrarily, the exchange rate and catastrophic health spending are inversely and poorly correlated over the sample period.

Table 1: Summary of Correlation Result

	Ms	PRANPW	RIMPES	EXR	AGDRO
OPHEX	0.096026	0.235301	0.052688	-0.017713	0.037222
Ms	1.000000	0.179918	0.195602	-0.027034	-0.129093
PRANPW		1.000000	0.055027	-0.055198	-0.018395
RIMPES			1.000000	-0.069420	-0.241852
EXR				1.000000	-0.007602

In order to estimate the numerical value of the relationship, preference for appropriate estimation method where made. Tables 2 and 3 summarise the two model selection tests conducted. In table 2, at 5%, the alternative hypothesis is accepted with the decision that the model has a cross-section effect.

Table 2: Redundant (Fixed effect) Test

Test (Effects)	Stat.	d.f.	Prob.
F (Cross-section)	93.136882	(33,221)	0.0000
t ² _{Stat.} (Cross-section)	702.481566	33	0.0000

Also, as indicated in Table 3, the null hypothesis is rejected at 5%. The rejection means that the Fixed Effect Model (FEM) is more appropriate in the estimation of the relationship between monetary policy and catastrophic health spending in sub-Saharan Africa.

Table 3: Hausman (random effects correlation)Test

Test	t ² _{Stat.}	d.f.	prob.
Random (Cross-section)	15.776770	5	0.0075

In order to avoid the effect of a shock in one of the countries on the others in the sample for n better estimates, existence of residual cross-section dependence in the model was tested. The p-values of the LM statistic of the test, shown in table 4, clearly indicate residuals cross-section correlation in the model at 5% level of significance.

Table 4: Cross Section Dependence Test

H₀: No Cross Section Correlation in Residuals

Test	Stat.	d.f.	Prob.
Breusch-Pagan (LM)	1161.464	561	0.0000
Pesaran scaled (LM)	16.91127		0.0000
Bias-corrected scaled (LM)	14.78627		0.0000
Pesaran (CD)	-1.633227		0.1024

Source: Author's computation from e-views.

As a result, given a wide panel nature of the underlying dataset, a Panel Corrected Standard Error (PCSE) was applied in the estimation of the Fixed Effect Model.

Table 5: Estimates (FEM)

	(1)	(2)	(3)	(4)	(5)
M2	-0.159761 (0.0000)	-0.089792 (0.0000)	-0.192147 (0.0000)	-0.187304 (0.0000)	-0.172512 (0.0000)
RIMPES		0.272365 (0.0000)	0.220070 (0.0097)	0.184843 (0.0275)	0.186351 (0.0243)
EXR			0.209089 (0.0000)	0.193093 (0.0000)	0.191377 (0.0000)
AGDRO				-0.100896 (0.5819)*	-0.118610 (0.5152)*
PRANPW					0.189401 (0.0850)**
C	7.704229 (0.0000)	4.903218 (0.0000)	6.756468 (0.0000)	7.017281 (0.0000)	5.920154 (0.0000)
R ²	0.983	0.988	0.990	0.986	0.986
Adjusted R ²	0.981	0.986	0.988	0.984	0.984
F-stat	396.7601 (0.0000)	534.3298 (0.0000)	597.6751 (0.0000)	430.2187 (0.0000)	424.9290 (0.0000)
S.E. of Regm.	0.182838	0.183947	0.175793	0.171982	0.171631

Source: Authors' computation from e-views.

In Table 5, * and ** means Prob.>0.01, 0.05 & 0.1%, and Prob.>0.1

The estimates in the first column of Table 5 imply a significant effect of monetary policy on catastrophic health spending in SSA. The extent of the effect is about 16%. This means that growth in monetary policy by 1% reduces the catastrophic health spending by roughly 16%; the same way a restrictive monetary policy increases catastrophic health expenditure by the same amount. The negative link between catastrophic health expenditure and monetary policy exists because in the SSA, majority of the countries are low income country. Income is a deep-seated

determinant of catastrophic health spending (Njagi, Arsenijevic and Groot, 2018). The low-income people are more prone to the burden of the catastrophic health expenditure (Chuma and Maina, 2012).

That is, the low-income people in the society are usually those with a high burden of catastrophic health spending; the rich people are often protected from the scourge of the burden of catastrophic health spending. Expansionary monetary policy, however, increases the people's income. People with more income are unlikely to suffer from catastrophic health expenditure compare to those with little income devoted largely for food and similar daily expenditure. So, because of the income-effect of the monetary policy, there is a negative link between the catastrophic health spending and the monetary policy in SSA. The result in the second column also suggests a statistically significant inverse relationship between the monetary policy and catastrophic health spending when one variable is added to the model. The marginal effect of the extra variable added, the risk of impoverishing expenditure for surgery care, on catastrophic health spending is positive and significant as shown by its coefficient's p-value. This shows that catastrophic health spending increases along with a rising risk of impoverishing expenditure for surgery care. This indicates that non utilisation of health care insurance increases catastrophic health care spending in the SSA. Surgeries are no small health issues, nor minor ailments' treatments. They are major and cost money. Meanwhile, most times such expenditures have prior readiness back up from the victims and their relations. Countries with high risk of impoverishing expenditure for surgery care are highly likely to have an increased catastrophic health spending.

In column 3, both the risk of impoverishing expenditure for surgery care and exchange rate were added to the monetary policy variable. The relationship between monetary policy and catastrophic health spending, and the risk of impoverishing expenditure for surgery care and catastrophic health spending is unchanged. The effects of monetary policy on catastrophic health expenditure remain negative and significant on catastrophic health spending. The risk of impoverishing expenditure for surgery care, as in column 2, is positive and significant at 5% level. The coefficient of the exchange rate is positive and significant. The fact that, a good proportion of the costs of health payment in SSA are out-of-pocket expenditure (Njagi, Arsenijevic and Groot, 2018), and the dollar-naira exchange rate appreciation is known to increase the price of health care, due to increased *import cost*, explains why, exchange rate appreciation increases catastrophic health spending in SSA.

The effects of monetary policy, risk of impoverishing expenditure for surgery care and exchange rate are unchanged in column 4 when age dependency ratio was incorporated. Age dependency ratio has a negative effect on catastrophic health spending in the SSA though not statistically significant. This connotes the large scale negligence of the aged in the SSA. Most of them are illiterate, who retired from farming with little or no support from their children, who mostly are struggling to survive. Even those who retired from public employment hardly have their

pensions or gratuities paid due to large scale financial improprieties by former employers. Lastly, in the column 5 the influence of monetary policy on catastrophic health spending is negative and significant like in the previous columns. Both the exchange rate and risk of impoverishing expenditure for surgery care effects on catastrophic health spending are positive and significant. The age dependency ratio is also not statistically significant but negative. Finally, the coefficient of prevalence of anaemia among women of childbearing age is significant and positive as expected. Therefore, it would increase catastrophic health spending in the SSA.

In recap, expansionary monetary policy results in a reduced catastrophic health spending in sub-Saharan Africa

5. POLICY IMPLICATION

The results above have serious implication for policy. Below, is the analysis of the salient policy issues.

- Monetary policy instrument has a negative and statistically significant impact on catastrophic health spending in the SSA. This implies that expansionary monetary policy would increase precautionary demand for money. This will in turn, reduce catastrophic health expenditure burden.
- Risk of impoverishing surgery expenditure has a statistically significant positive impact on catastrophic health expenditure in SSA. This shows that it is a viable source of catastrophic health expenditure and also reflects the impact of low demand for health insurance.
- The high dollar-naira exchange rate also has a positive statistically significant impact on catastrophic health expenditure and thus a very strong source of catastrophic health expenditure in SSA. This is due to the low productive index of the domestic currencies of the SSA. Their domestic currencies have low demand. Most of the SSA economies are primary, monoculture export and import dependent economies. The Marshall-Lerner condition of trade does not favour their exports.
- Anaemia in pregnant women also has a positive and statistically significant impact on catastrophic health care spending and as such a strong source of catastrophic health expenditure in the SSA. This will tend to raise questions as to how much policy attention is given to pregnant women's health and to reproductive health, generally in the SSA?
- Age dependency ratio is negatively correlated to health catastrophic spending. Even though not statistically significant, it reflects the negligence of the aged populace in the SSA.

6. SUMMARY AND CONCLUSION

The paper examines the impact of monetary policy on health catastrophic expenditure in the SSA. After due attention to the statistical peculiarities of the data

set a panel corrected standard error (PCSE) model is specified to estimate a fixed effect panel data. Result shows that monetary policy is negatively signed and statistically significant in its impact on catastrophic health expenditure. All the explanatory variables but age dependency ratio, met their a-priori expectation. It is also adduced that negative sign of the age dependency ratio reflects the negligent disposition of the SSA economies towards the aged. Catastrophic health care expenditure is a very serious health care finance challenge that demands serious policy attention in order to curb the numerous negative health burdens in the SSA. If health universal coverage is to be achieved in the sub-region, catastrophic health expenditure must be given policy attention by the managers of the SSA's economies. The model shows a good fit by the usual test statistics (F-stat. and \bar{R}^2) which are all statistically significant.

7. POLICY RECOMMENDATIONS

Base on the fore going the following are the policy recommendations of the study:

- Expansionary monetary policy option should be explored for now so as to enhance demand for money such that catastrophic health expenditure would be mitigated.
- Reproductive health policy should be directed at making access and affordability of health care easy. This will help to mitigate anaemia and possibly mortality among pregnant women.
- Serious policy effort should be directed at getting the populace to adopt health insurance culture. This will help in securing patients against catastrophic surgery expenditure.
- There should be serious policy efforts made at caring for the aged people. A ministry of old people should be created to articulate the health and welfare needs of the aged. Such a ministry could also be responsible for the budget of the ministry for deriving an optimum finance model for government.
- Diversification of the economies from only one export is an important policy option to be pursued. This will increase the demand for the domestic currencies of the SSA economies, thereby increasing their exchange rates.

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