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THE REDISTRIBUTIVE EFFECTS OF SOCIAL HEALTH INSURANCE IN NIGERIA

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ABSTRACT

Transactions costs, market failure and redistributionare the three arguments for public intervention in insurance market. This study investigates the redistributive effects of social health insurance with moral hazard in Nigeria.The work is premised on a model of social insurance and redistribution with moral hazard and adverse selection in which economy consists of three types of decision-makers: households, insurance firms and the government. Households were assumed to face a risk of accident and able to take actions that affect the size of the loss in the event of an accident (ex-post moral hazard).The results show a negative relationship between morbidity, after-tax income and productivity with coefficients of -0.03 for both after-tax income and productivity. This confirmed the theoretical expectation of a negative relationship between morbidity, the marginal net expected social valuation of income and productivity. The covariance of expected health care spending and after-tax income with the value of 3.029e-06 ($\text{cov}_{ir}(b_{ir}p_r Z_{ir})$ = 3.029e-06) which measure equity effect is positive and its denominator which measures the efficiency effect is also positive. Since, both the equity and efficiency effects are positive, weconcluded that social health insurance is redistributive and optimal in Nigeria.

Keywords: Social Health Insurance, Moral hazard, Redistributive Effects

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1. Introduction

Transactions costs, market failure and redistributionare three typical arguments for public intervention in the field of insurance (Boadway, Leite-Monteiro, Marchand &Pestieau, 2006). However, researchershave focused more on market failure argument, which generated adverse selection and moral hazard problems due to information advantage between insurers and insured.Adverse selection and moral hazard createinefficiencies in both private and social health insurance markets, with significant different implications for optimal insurance service contract(Olayiwola, 2015; Koc, 2004). According to Olayiwola (2015), there have been changes in the estimates of value of health insurance over the years as a result of market failure arising from asymmetric information. Amongst these changes was a pre-occupation with moral hazard in which the consumption of health care was assumed not to response to income[i] but only responds to price changes as a result of buying

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health insurance. This informed the disagreements on the previous understanding of the welfare[ii]implications of moral hazard (Nyman, 2006).Poterba, (1994) in Henriet and Rochet (2006) argued that the existence of market failure in the insurance sector due to adverse selection and moral hazard problems,the existence of externalities, irrationality of households (i.e. failure of some fraction of the households to assess the risks and consequences of illnesscorrectly) and equity considerations are the basic justificationsof the theoretical literature for public interventionin health insurance.

The empiricalevidences on moral hazard and the welfare implications of health insurance from developed countries[iii] have directed public policy towards restriction of health insurance coverage to formal sector employees in developing countries(Jowett, 2004). For example, employer-based health insurance is mostlyused in Nigeria and only about 2% of economically active men and 1% of economically active women are covered by this type of insurance(NPC & ICF Macro, 2014).Nonetheless, studies have shown that due to the substantial health needs in developing countries, health insurance can still increase overall welfare, even with the presence of adverse selection and ex-post moral hazard. For example, Olayiwola, (2015) established that both adverse selection and moral hazard were evident in health insurance, social health insurance and private health insurance in Nigeria; but, there were welfare gains of 85.8%, 87.5% and 87.3% against welfare loss of -14.2%, -12.5% and -12.7% using Marshallian, Hicksian and Nyman's measures respectively. Hence, he concluded that health insurance is welfare improving in spite ofmoral hazard problems in health insurance in Nigeria.

Given the above finding, weextendour investigation to the third reasonfor public intervention in health insurance market. Therefore, this study examinesthe redistributive effect of social health insurance with moral hazard in Nigeria and determine whether social health insurance is optimal in Nigeria or not.The remainder of the study is structured as follows: section 2provides a review of existing empirical literature on market failure, health insurance and redistributive functions of health insurance, Section 3presents the theoretical framework, methodology and data. Section 4 presents and discusses the empirical results while section 5offers some concluding remarks and policy implications.

2. Literature Review

Taxes, transfers and public expenditures are the main instruments of government'sredistribution objective; but the optimal income tax literature limits the amount of redistribution government can achieve throughtaxation (Boadway & Marchand, 1995). Hence, considerable redistribution are achievethrough the expenditure side of the budget. Two strands of literature exits on the redistributive component of government expenditures. The first argued that public expenditure is a quasi-private good provided in

equal amounts to all persons while the second strand submits that public expenditure are earmark to different persons. Usher, (1977) provided the analysis of the effects of uniform public provision by considering a population of persons with identical tastes but different incomes and assuming that government is guided by a median-voter voting rule to determine how much of a quasi-private good, financed by a proportional tax, should be provided through the public sector on a uniform basis. He found that the median-voter outcome generated redistribution towards the lower-income persons, as well as a non-preferred level of output of the quasi-private good for all and thus a deadweight loss.Besley and Coate, (1991) employed the similar model with the difference that the public sector provided a uniform quality of the good to all, but lower than the quality that the higher income persons would have chosen. The authors showed that uniform provision by the public sector financed by proportional taxation could improve social welfare. Arrow, (1971) initiated the second strand of the literature by investigating optimal expenditure policy under a utilitarian social welfare function and applied it to the case of education and health. The analysis showed that given observable household characteristics, tax policy would dominate expenditure policy as a redistributive device.

Honekamp and Possenriede (2008) on the redistributive effects of different measures to finance public health insurance analysed the implications of different financing options for public health insurance on the redistribution of income from good to bad health risks and from high-income to low-income individuals. The financing options considered are either income-related (income taxes, payroll taxes, and indirect taxes), health-related (co-insurance, deductibles, and no-claim), or neither (flat fee). The authors argued that government who treat access to health care as a basic right for everyone should consider redistributive effects when reforming health care financing. They argued that itmay be difficult to finance increasing health care expenditures due to a decreasing work force and the growth in the elderly population for the insurance system that relies on contributions in the form of payroll taxes.They further submitted that health insurance contributions are progressive once there is no low wage ceiling and health insurance can be supplement through revenue from consumption taxes, which would be economically efficient since they hardly have distortive effects. Hence, the authors concluded that both efficiency and equity needs to be considered to avoid unintended adverse effects.

Henriet and Rochet, (2006) in the study of public health insuranceas an appropriate instrumentfor redistributionprovide a theoretical explanation for the fact that a public health insurance system, financed by taxes, can be an efficientmeans of redistribution, complementary to income taxation. This relies on the assumption of a negative correlation between income and morbidity. In their examination of the empirical validity of this assumption on macro data, they concluded that if morbidity is negatively correlated with income, then public provision of health insurance is theoretically an efficient instrument

forincome redistribution. In particular, they predicted that the share of the public sector in health insurance should be positively correlated with marginal income tax rates.

Blomqvist and Horn (1984) in a study of a model where individuals differ by two parameters: productivity and morbidity (probability of illness). The authors found that public provision of health insurance; modeled as a lump sum benefit to ill people, can be a useful complement to linear taxation for redistributive purposes. Rochet (1991), extends the familiar income taxation model à la Mirrlees to include income uncertainty, due to a risk of illness and prove that the existence of a social health insurance system may be justified even if the insurance market is efficient. And that a negative correlation between productivity and morbidity is a necessary and sufficient condition for full public health insurance to be optimal. Boadway et.al (2006) re-examined these findings in the study of how equity and efficiency considerations should be traded off in choosing the optimal coverage of social insurance when ex post moral hazard and adverse selection are included, and under different informational assumptions. It was found that introduction of adverse selection has the effect of encouraging social insurance and with lump-sum taxation, there could be a case for social insurance to redistribute from good to bad risks which income taxation does not do. This suggests that the covariance term is always negative and thus the case for social insurance is stronger with lump-sum taxation than with distortionary income taxation. Hence, the case for social insurance is strongest when government is well informed about household productivity and that optimal coverage is less than full in the presence of moral hazardwith public insurance system.

Spadaro et. al., (2013) analysed the redistributive impact of public health expenditure in Spain using an insurance value approach to compute individual and household's value of health services non-cash benefit. The intensity of use of different health care services was modeled using a count data framework on a nationally health care survey and predict the probabilities on the 2006 Spanish EU-SILC sample. This allowed the authors to extend disposable income with the expected monetary value of public health services and compare it with strictly cash income. The results show that public health expenditure in Spain acts progressively on income distribution, and that health in-kind benefits, can be effective in reducing poverty and inequality if considered as part of disposable income.

3. Methodology

Model and Assumptions

This work is premised on the modeling efforts of Boadway *et.al,*(2006)on social insurance and redistribution with moral hazard and adverse selection. The economy consists of three types of decision-makers: households, insurance firms and the government. Households face a risk of accident and able to take actions that affect the size of the loss in the event of

an accident (ex-post moral hazard). Households differ both in productivity and in accident risk. Insurance companies is able to observe productivity but not household risk and provide insurance competitively and with actuarial fairness. The government's objective is to redistribute income among households, given available information. Decision-making occurs sequentially wherein the government chooses its policies first; followed by the insurance firms, and then households and the outcomes of the subsequent stages are assumed to be anticipated in each case,so that equilibria of interest is subgame perfect.

Two states of health are considered; $j = 0,1$ where 0 denotes good health (no illness) and 1 ill health. There are 2n types of individuals represented by $ir(i = 1.....,n; r = L,H)$ each characterized by a wage rate w_i and a risk probability p_r, with $w_{i+1} > w_i$ and $p_H > p_L$. The proportion of households of type ir is given by f_{ir}, where $\mathrm{S}_{i,r} f_{ir} = 1$. Health status is exogenously given in the good state of health as h^0 while in the bad state, health status is given as $h^1 = \bar{h} + m(z)$, where z is healthcare expenditure resulting in health improvement, with m'(z) > 0 > m''(z). The expenditure level z; assumed to be a normal good and chosenby the household after knowing its state of health. It was also assumed that $h^1 = \bar{h} + m(z) < h^0$ for all values of z (so $m(¥) < h^0 - \bar{h}$). This implies that treatment cannot bring health status if ill to a level as high as health status if not ill (i.e., full recovery of health status). The parameters h^0 and $\bar{h}$, and the function $m(z)$,are the same for all types of households. But, the amounts of households of a given productivity class that have risk probability p_H can differ across productivity classes[iv]. This condition was given as part of the motivation for social insurance. Therefore, households have identical state-independent utility functions:

$$u(c_{ir}^j, h_{ir}^j 1_{ir}^j) \text{.....(1)}$$

where c_{ir}^j is consumption and 1_{ir}^j, is labour supply of *type-ir* household in state of health $j = 0,1$. Utility is assume to take a quasi-linear form: $u(c_{ir}^j + h_{ir}^j - g(1_{ir}^j))$ where $g(1_{ir}^j)$, the disutility of labour, is increasing and strictly convex. Labour supply depends only on the after-tax wage rate and z on its out-of-pocket price and there are no income or cross-price effects. In particular, labour supply is state-independent. Labour could be higher in the bad state of health if individual has to compensate for private healthcare spending or lower if ill health increases the disutility of labour given a more general utility function[v]. Households with illness probability p_r, maximize expected utility, weighted by the probabilities p_r for state 1 (ill health) and $1- p_r$ for state 0 (good health), taking government policies and private insurance premiums as given. They choose $c,1$ and z after their health state is determined.

Insurance firms are assumed to be perfectly competitive and that within each productivity class there is an insurance market equilibrium separating the two risk subclasses. The insurance firms offer insurance policies $(p_{iH,}P_{iH})$ and (p_{iL},P_{iL}) intended for households of productivity class *i*, where p_{ir}, is the proportion of health expenditures z_{ir} covered by private insurance firms and P_{ir} is the premium paid to insurance firms[vi]. The households choose their most preferred policy and in selecting their insurance policies, insurance companies anticipate the effect of these policies on healthcare expenditures z_{ir} (ex-post moral hazard). Therefore, competition requires that premiums are actuarially fair. Hence,

$$P_{ir} = p_r p_{ir} z_{ir}, i = 1,.....,n.....(2)$$

The government has two categories of policy instruments: tax-transfer policies and social insurance. Tax-transfer policy is a linear progressive income tax with marginal tax rate of *t* and a lump-sum poll subsidy of *a* per household. Social insurance covers a proportion *s* of healthcare expenditures z_i, financed by general tax revenues. Although private insurance coverage varies from type to type, the same rate of social insurance applies to all households (in Nigeria 15% of basic salary is applied to all formal sector employees and benefit packages are the same). There are three main stages of decision-making in the economy representing the sequence in which decisions occur. Stage 1 is when the government chooses its set of policies {t, a, s}. It cannot observe individual types or individual demands for goods, leisure or insurance, but can observe incomes; hence subsidy on healthcare expenditures *s* can be indirectly applied. The government also knows preferences and the distribution of individuals by type *ir*. The government anticipates the effect of its policies both on the insurance market and households. In Stage 2;the competitive insurance industry sells private insurance to households. Market equilibrium determines p_{ir} and P_{ir} .The insurance industry is unable to observe household risk types but can observe their productivity. Thus, insurance firms are well informed than the government. Thus, {t, a, s} are taken as given in this stage, and household behaviour is appropriately anticipated. In stage 3; the state of nature is revealed to households and householdsselect state-specific variables $\{c_{ir}^1, l^1_{ir}, z_{ir}, c_{ir}^0, l^0_{ir}\}$ and (z_{ir} is chosen only in the bad state). Households take $\{t, a, s, p_{ir}, P_{ir}\}$ as given from the previous two stages. According to Boadway *et.al,*(2006) this can be solvedby backward induction since the equilibrium is assumed to be a subgame perfect.

Assuming the backward induction solution to the problem starts with the case where the government can neither observe the health state nor the productivity of households. In this case households of type *ir* make their choices given the public policy parameters *t*, *a* and *s*

chosen by the government in Stage 1 and the private market premium P_{ir}, and coverage p_{ir} determined by the insurance market equilibrium in Stage 2. Households are only concerned by total coverage defined by $s_{ir} \circ s + p_{ir}$. The budget constraints in the two states of health are given by:

$$c_{ir}^{1} = (1- t)w_i l_{ir}^{1} + a - (1- s_{ir})z_{ir} - P_{ir} \text{.....(3)}$$

and

$$c_{ir}^{0} = (1- t)w_i l_{ir}^{0} + a - P_{ir} \text{.....(4)}$$

The *type-ir* households' problem is thus[vii]

$$\max_{(l_{ir}^{j}, z_{ir})} p_r u\{(1- t)w_i l_{ir}^{1} + a - P_{ir} - (1- s_{ir})z_{ir}, \bar{h} + m(z_{ir}), l_{ir}^{1}) + (1- p_r)u((1- t)w_i l_{ir}^{0} + a - P_{ir}, h^{0}, l_{ir}^{0}\} \text{.....(5)}$$

The first-order conditions to this problem can be solved for the state-contingent labour supply functions $l_{ir}^{0}(t, a - P_{ir}), l_{ir}^{1}(t, a - P_{ir}, s_{ir})$ and the demand function for healthcare spending $z_{ir}(t, a - P_{ir}, s_{ir})$. These can be employed to define the indirect expected utility function $v_{ir}(t, a - P_{ir}, s_{ir})$. Applying the envelope theoremgives:

$$v_t^{ir} = - w_i E_j[l_{ir}^{j} u_c^{j,ir}],\ v_a^{ir} = [u_c^{j,ir}],\ v_s^{ir} = p_r z_{ir} u_c^{1,ir}$$

E_j is taken over the two states of health, 0 and 1.

Private insurers operate in a competitive environment and observe ability w_i but not risk p_r. This gives an informational advantage to the private sector relative to the government, which cannot observe eithercharacteristic. This is a standard adverse selection problem. For productivity class *i*, a separating Nash equilibrium of theRothschild and Stiglitz (1976) type consisting of two specific contracts, (p_{iH}, P_{iH}) and (p_{iL}, P_{iL}) intended for high-risk and low-risk households respectively is required. The indifference curves areassumed to be strictly concave which is the case if moral hazard is not intensive[viii].Expected profit for each contract offered is driven to zero in a separating competitive equilibrium which implies that the contracts (p_{ir}, P_{ir}) will be actuarially fair for both risk types or

$$P_{ir} = p_r p_{ir} z_{ir}(t, a - P_{ir}, s + p_{ir}),\ r = H, L,$$

Which yields

$$P_{ir} = P_{ir}(t, a, s, p_{ir})$$

With

$$P_a^{ir} = \frac{p_r p_{ir} z_a^{ir}}{1 + p_r p_{ir} z_a^{ir}},\ P_s^{ir} = \frac{p_r p_{ir} z_s^{ir}}{1 + p_r p_{ir} z_a^{ir}} \text{ and } P_p^{ir} = \frac{p_r z_{ir} + p_r p_{ir} z_s^{ir}}{1 + p_r p_{ir} z_a^{ir}} \quad (6)$$

The expected utility of the insurance policy offered to the high-risk households can be maximizes with a fair premium $P_H(t, a, s, p_H)$. The equilibrium policy then becomes the solution to:

$$\max_{P_H} v^H(t, a - P_H(t, a, s, p_H), s + p_H)$$

This yields the first-order condition:

$$v_s^H - v_a^H P_p^H = 0 \text{.....(7)}$$

Where $v_s^H = p_H z_H u_c^{1H}$ and $v_a^H = E_j[u_c^{j,H}] = p_H u_c^{1H} + (1 - p_H) u_c^{0H}$ by the envelope conditions derived in stage 3. Putting (5) and (6) together, we obtain

$$u_c^{1H} = \frac{E_j[u_c^{j,H}]}{p_H z_H}\left[\frac{p_H z_H + p_H p_H z_s^H}{1 + p_H p_H z_a^H}\right] \text{.....(8)}$$

If $z_s^H = z_a^H = 0$, there is no moral hazard, and $u_c^{1H} = E_j[u_c^{j,H}]$ or $u_c^{1H} = u_c^{0H}$. This means that without moral hazard there is full insurance. The equilibrium value for p_L is determined by the contract on the fair premium curve of the low-risk households for which the self-selection constraint is binding, or:

$$V_H(a, t, s) = v_H(t, a - P_L(t, a, s, p_L), s + p_L) \text{.....(9)}$$

The solution to equation (9) yields the private insurance coverage $p_L = p_L(t, a, s)$ offered to the low-risk households and their value function $V_L(t, a, s) \equiv v_L(t, a - P_L(s, p_L(.)), s + p_L(.))$. By differentiating this equation we obtain:

$$V_b^L = v_b^L - v_a^L P_b^L + (v_p^L - v_a^L p_P^L) p_b^L, b = t, a, s \text{.....(10)}$$

The term in parenthesis $(v_p^L - v_a^L P_p^L)$, which is positive, reveals information externality arising from adverse selection. High-risk impose a negative externality on low-risk individuals whose risks cannot be covered (p_L is too low). Equally, since low-risk households are forced to under-insure relative to the full-information insurance equilibrium, government policies that induce an increase in their total coverage will be welfare-improving. The government chooses the linear tax parameters, *t* and *a* and the level of social insurance, *s*, to maximize the sun of expected utilities subject to its budget constraint in Stage 1 while anticipating the outcomes of the subsequent stages. The Lagrangean expression is:

$$L = \sum_{ir} f_{ir} V_{ir}(t,a,s) + l \sum_{ir} \begin{matrix} f_{ir}\{tw_i[p_r l^1_{ir}(t, a - P_{ir}(.), s + p_{ir}(.)) \\ + (1 - p_r) l^0_{ir}(t, a - P_{ir}(.))] - a - sp_r z_{ir}(t, a - P_{ir}(.), s + p_{ir}(.))\} \end{matrix} \ldots.(11)$$

Where $p_{ir}(.) = p_{ir}(t,a,s)$ and $P_{ir}(.) = P_{ir}(t,a,s,p_{ir}(.))$ are determined in Stage 2, and l is the multiplier associated with the budget constraint. We obtain (11) from the first-order condition as follows:

$$s = \Delta^{-1}\mathrm{cov}_{ir}(b_{ir}, p_r z_{ir}) + \Delta^{-1} t \sum_{ir} f_{ir} w_i (E_j[\frac{dl^j_{ir}}{ds}] - p_r z_{ir} E_j[\frac{dl^j_{ir}}{da}]) + \Delta^{-1} \frac{1}{l} \sum_i f_{iL}(v^{iL}_p - v^{iL}_a P^{iL}_p)(1 + p^{iL}_s - E_{ir}[p_r z_{ir}] p^{iL}_a \ldots(12)$$

where

$$\Delta = \sum_{ir} f_{ir} p_r (\frac{dz_{ir}}{ds} - p_r z_{ir} \frac{dz_{ir}}{da}) = \sum_{ir} f_{ir} p_r \frac{d\%_{ir}}{ds} > 0 \ldots..(13)$$

and

$$b_{ir} \circ \frac{v^{ir}_a}{l}(1 - P^{ir}_a) - sp_r \frac{dz_{ir}}{da} + tw_i E_j[\frac{dl^j_{ir}}{da}] \ldots\ldots..(14)$$

In the expression for Δ given in (13), $\frac{d\%_{ir}}{ds}$ is a compensated total change in the demand for healthcare spending with respect to s. This is a total change in the sense that the adjustment of the private insurance coverage p_{ir} and premium P_{ir} are taken into account:

$$\frac{d\%_{ir}}{ds} \circ \frac{dz_{ir}}{ds} - p_r z_{ir} \frac{dz_{ir}}{da} \ldots\ldots\ldots..(15)$$

In (14), b_{ir} is the marginal net expected social valuation of income of type- (i, r) individuals (divided by l). The interpretation of b_{ir}, from the optimal tax theory, is that if $b_A > b_B$ for two individual's A and B, redistributing income from B to A would be socially desirable. The denominator Δ, common to the three terms on the RHS of (12), is an efficiency effect arising from the ex-post moral hazard induced by social insurance. It is positive and large when spending to social insurance is more responsive. The numerators of the three terms include an equity concern (the covariance term),arising from the indirect effect of social insurance on the distorted labour market, and an efficiency concern arising from the distortion imposed on low-risk households due to the adverse selection problem affecting the insurance market.

The equity term involves the covariance over all types ir between the marginal net expected social valuations of income b_{ir} and expected healthcare spending $(p_r z_{ir})$. Theoretical considerations do not provide much help in signing this covariance. Even if a positive covariance is assume between b_{ir}, and p_r there is still a need to verify whether taking $p_r z_{ir}$

instead of p_r changes the sign. If p_r and w_i are assumed to be negatively correlated, and that z_{ir} does not increase much with w_i, then the covariance term is positive. Assessing the sign of this covariance term and its magnitude requires investigating empirically the relation between individual income and healthcare spending. The equity term would be the only one in (12) if there were no adverse selection (so the last term disappears) and utility were of the quasi-linear form (so that the second term involving cross-effects on labour supply disappears)[ix].Therefore, the expression for optimal social insurance becomes:

$$s = \mathrm{D}^{-1}\,\mathrm{cov}_{ir}(b_{ir}, p_r z_{ir}).....(16)$$

The numerator is an equity effect, while the denominator is an efficiency effect arising from the induced effect of *s* on healthcare expenditures *z*, (i.e. the ex-post moral hazard effect). If the covariance is positive, $s > 0$ since $\mathrm{D} > 0$. The importance of thismodel is that in general we would expect $s \neq 0$, but it could take either sign depending on the signs of the various equity and efficiency effects. If the assumption of the informationconstraint about the non-observable of the households' productivity imposed on the government is relaxed, the case for $s > 0$ is strengthened. This is because social insurance effectively distributes between both productivity types and risk types.

Empirical Model

The theoretical model shows that an investigation of the redistributive effects of social health insurance require examining empirically the relationship between health care spending (z) during illness, the marginal net expected social valuation of income (i.e. the after-tax income) (b_{ir}), expected health care spending (i.e. health care spending multiply by the risk probability) $(p_r z_r)$, marginal tax rate (t) (measures as 16% of income from employment for those whose income are less than or equal to the minimum wage in Nigeria i.e. ₦18,000 ($51.4) and 20% for those whose income are greater than ₦18,000), proportion of health expenditure cover by social health insurance financed out of general tax revenues (s) (measures as health expenditure minus expected health spending), consumption (c) (measures as non-health expenditures) and labour supply (l) (measures as 366 days minus days absent from work due to illness and which also assume to be a function of pre-tax income), health statusand other control variables such as age, health insurance status, gender, marital status, level of education among others.Therefore, solving the households'utility maximization function in equation (5) gives:

$$z = f(s, b_{ir}, p_r z_r, h, t, c, l, \phi).....(17)$$

Equation (17) states that morbidity (measures as health expenditure during illness) depends on proportion of health expenditure paid by insurance, the marginal net expected social

valuation of income (after-tax income), expected health care spending, health status, marginal tax rate,consumption, labour supply and other socio-economic variables. Explicitly, equation (17) can be express as:

$$z = g_1 + g_2 s - g_3 b_{ir} + g_4 p_r z_r + g_5 h + g_6 c - g_7 l + g_i \phi_i + e \text{.....(18)}$$

Equation (18) states that morbidity (z) depends on the proportion of health expenditure paid by insurance (s), after-tax income (b_{ir}), expected health care spending $(p_r z_r)$, marginal tax rate (t), consumption (c), labour supply (l) and gender, marital status, age, family type, size of the family, gender of the head of the family, education and occupation of the family head represented by $g_i \phi_i$ and other unaccounted disturbance (e). We rely on the assumption of a negative correlation between after-tax income and morbidity for the apriori expectation. This further implies that if the covariance between the net social marginal valuation of income (i.e. after-tax income) and expected health care spendingis positive and large enough, then social insurance is an efficient means of redistribution. We also expect the coefficient of $(s), (p_r z_r), (t)$ and (c) to be positive.Rochet (1991) further shows that a negative correlation between productivity and morbidity is a necessary and sufficient condition for public health insurance to be optimal and Pestieau (1996) further confirmedRochet's (1991) result in a model with a discrete distribution.Therefore, we expect a negative relationship between (z) and (l).Equation (16) which comprises of both equity effect and efficiency effect is reproduce below for the determination of the optimal social health insurance.

$$s = D^{-1} \text{cov}_{ir}(b_{ir}, p_r z_{ir}) \text{.....(16)}$$

The numerator $\text{cov}_{ir}(b_{ir}, p_r z_{ir})$ is an equity effect while the denominator (D) is an efficiency effect arising from the induced effect of *s* on healthcare expenditures *z*, i.e. the ex-post moral hazard effect. If the covariance is positive, then $s > 0$ and $D > 0$. Thus, we only need to determine whether the numerator (the equity effect) is positive or not to know the sign of the denominator (the efficiency effect). If both are positive;then social health insurance is optimal and redistribute between productivity and risk groups.Olayiwola and Olaniyan (2019), in the study of welfare effects of health insurance in Nigeria established that general methods of moments (GMM) estimator is the appropriate model for the estimation of the determinants of health care utilization with health insurance, social health insurance and private health insurance. Thus, equation (18) is estimated using GMM.

Data and Description of Variables

The data for the study were from a survey carried out from September to October 2012 in the six geo-political zones in Nigeria. One State with a large presence of formal sector

workers was chosen from each zone. This choice was based on the fact that the former sector workers are mostly covered by any type of health insurance presently in Nigeria. Lagos State was chosen in the South-West, Imo in the South-East, Rivers in the South-South, Kaduna in the North-West, Adamawa in the North-East and Abuja in the North-Central. A purposive sample survey was conducted (because those who were interviewed fit a specific description i.e. those who have health insurance and those who do not) in hospitals, government parastatals, private companies and households. The target population was the formal sector employees (private or public) and informal sector workers with or without health insurance coverage.The tool for the study is a self-designed 48 items questionnaire containing questions about respondent socio-demographic characteristics, health insurance status, health status, health care expenditures and health care utilisation. Table 1 shows the definitions and descriptions of variables used in the analysis.

Table 1: Description of the Variables used in the Analysis

Variable Dependent Variable	***Definition***	***Description***
Morbidity	Measure by individual Health Expenditure spent during the last illness	Continuous
Independent Variables Health Care Utilization		
DOCTOR	Number of consultations with doctor in the last6 months.	Count
NON-DOCTOR	Number of consultations with non-doctor health professionals (chemist, optician, physiotherapist etc.) in the last 6months.	Count
SPECON	Number of consultations with specialist in the last 6 months.	Count
INPATIENT	Number of inpatient services in the last 6 months.	Count
OTHERS	Mental and Dental Care in the last 6 months	Count
Health Care Utilization	Addition of DOCTOR, NON-DOCTOR, SPECON, OUTPATIENT, INPATIENT and OTHERS	Count
PLAACCESS	Place of Access Health Care Facility: Self-Treatment =1, Traditional Healers =2, Private Hospital=3, Government Hospital=4, Pharmacy/Drug Shop=5	Dichotomous
Health Expenditures		Count
Expected Health Care Spending	Estimate of total expenditure spent during the last illness including consultation fee, purchase of medicine and other medical expenses multiply by the Probability of Illness (measured by co-insurance rate)	Continuous
Proportion of Health Expenditure cover by Social Insurance from General Tax Revenue	Health Expenditure minus Expected Health Spending	Continuous
Health Expenditure spent during the last ILLNESS	stimate of total expenditure spent during the last illness including consultation fee, purchase of	Continuous

	medicine and other medical expenses.	
COINS	Co-insurance Rate Paid by the insured	Continuous
Income		
AFTER-TAX INCOME	Income from employment minus average tax	Continuous
MARGINAL TAX RATE	Country's average tax-rate; 16% ≤18, 000 or less; 20% >18,000	Continuous
Health Status		
GHSTATUS (GHQ)	General Health Status measured using twelve questions about general well-being of the respondent where high score indicates bad health status.	Continuous
CHRONIC	Number of chronic conditions.	Continuous
ILLNESS	Number of illnesses in the past 6 months,	Count
Health Insurance Type		
HINSTYPE	NHIS = 1, Private Health Insurance =2	Dichotomous
Socio-Economic Variables		
Married	Marital Status: Single = 1, Married = 2, Divorce/Separated = 3, Widowed =4	Categorical
SEX	0 for males, 1 for females	Dichotomous
AGE	Age of the respondent at the last Birthday	Continuous
Age-Squared	Square of Age	Continuous
HOUSEHOLD SIZE	Number of Household member.	Continuous
HOUSEHEAD	1, if father and 0 otherwise.	Categorical
OCCUPATION (Head and Spouse)	Equals 1 if works in formal sector (public and private), 0 otherwise	Categorical
EDUCATION (Head and Spouse)	Indicator for the highest educational level achieved: No formal schooling = 1, Primary =2, Secondary =3, Post-Secondary =4	Categorical
Consumption	Expenditures on food, transport & communication and others	Continuous
Labour Supply	Measured by 366 days minus number of days absent from work due to illness	Continuous
ABSENTWORK	Number of Days Absent from Work	Continuous

4. Results

Table 2 shows the summary statistics of the variables employed in the analysis. From Table 1, 61% of the respondents are covered by health insurance. About 56% of this is covered by National Health Insurance Scheme (NHIS) which represents compulsory social health insurance while 3% and 2% are covered by private health insurance and private company health insurance respectively. The results further show that average monthly health expenditure, expected health expenditure, and proportion of health expenditures paid by social insurance out of general tax revenue were about ₦7,173.3 ($21), ₦750.6 ($2.2) and ₦6,422.6 ($18.4) respectively. The mean marginal tax rate, average monthly after-tax

income and mean monthly consumption (i.e. non-health expenditures) were about 19%, ₦14, 013.1($40) and ₦34, 884.2($99.7) and the average coinsurance rate was about 11%. The mean number of days absent from work due to illness was 3days.

Other socio-demographic characteristics results showthat average general health status score was about 1.03, which is an indication of relatively good health status of the majority of the households' members. About 54% and 14% of the households' heads are government and formal private sector workers with 16% and 75% of themhaving secondary and post-secondary education respectively. The mean age was about 33 years, average household size was about 9 and about51% of the respondents are male. The natural log of health expenditures during illness, expected health expenditures, after-tax income, proportion of health expenditures paid by social insurance out of general tax revenue and consumption expenditures are employed for the estimation.

Table 2: Summary Statistics of the Variables used for Estimation

Variables	Obs	Mean	Std. Dev.	Min	Max

Hltexpend	1051	7173.29	6497.08	50	100000
Hltutilizan	1051	2.42	3.59	0	30
Exphltspen	1051	750.66	690.26	5.25	10508.2
Phesigtr	1051	6422.64	5815.68	44.75	89491.8
Magtaxr	1051	0.19	0.01	0.16	0.2
Aftertaxinc	1051	14013.07	22499.73	16	600000
Consumption	1051	34884.21	19286.84	700	300000
Ghstatus	1051	1.03	1.58	0	8
Absentwork	422	3.33	11.65	0	210
Hhsize	1051	8.52	5.39	1	70
Coinsurance	1051	0.11	0.02	0.1	0.5
Labour	1051	362.67	7.38	156	366
HINS1	1051	0.39	0.49	0	1
HINS2	1051	0.61	0.49	0	1
NHIS	1051	0.56	0.49	0	1
PVTHI	1051	0.03	0.17	0	1
PCHI	1051	0.02	0.24	0	1
Single	1051	0 .48	0.50	0	1
Married	1051	0.47	0.49	0	1
DivSep	1051	0.01	0.10	0	1
Widowed	1051	0.04	0.20	0	1
Male	1051	0 .51	0.50	0	1
Female	1051	0 .49	0.50	0	1
Age	1051	32.69	11.33	16	80
Agesquare	1051	1196.78	860.49	256	6400
Monogamy	1051	0.74	0.44	0	1
Polygamy	1051	0 .26	0.44	0	1
Fatherhh	1051	0.91	0.28	0	1
Motherhh	1051	0 .09	0.28	0	1
Hnofeduc	1051	0.05	0.22	0	1
Hpryeduc	1051	0.04	0.20	0	1
Hseceduc	1051	0.16	0.36	0	1
Hpseceduc	1051	0.75	0.43	0	1
Fhgovtemploy	1051	0.54	0.50	0	1
Fprvtsemploy	1051	0.14	0.35	0	1
Fhtrad	1051	0.07	0.26	0	1
Fhtransp	1051	0.05	0.21	0	1
Fhfarmer	1051	0.05	0.23	0	1
Fhselfemploy	1051	0.11	0.31	0	1
Fhhousewife	1051	0.01	0.12	0	1
Fhunemploy	1051	0.01	0.09	0	1
Fhothers	1051	0 .02	0.12	0	1

Given the theoretical conclusion that general health status and health insurance status are likely to be endogenous to health care utilisation, therefore, having two possible endogenous variables (health insurance status and general health status), the tests of

endogeneity were first performed to choose between the regressor that accommodate endogenous regressors and other class of count data model. The results of the endogeneity test on instrumental variable regression with Durbin (score) and Wu-Hausman are ($c^2(2)$) = 8.07 (p = 0.02)and F (2, 1023) = 3.9601 (p = 0.02) respectively. These results show thatendogeneity tests were significant at 5% level which supports the use of linear instrumental variables (IV) and generalised method of moments (GMM).To choose between IV and GMM, Pagan and Hall heteroskedasticity tests with assumed normality were carried out on IV 2SLS and GMM estimations. The Pagan and Hall's test on IV 2SLS estimate was $\chi2(2) = 93.38$ (*p-value* = 0.000)and in GMM estimate was $\chi2(2) = 16.67$ (*p-value* = 0.000). The null hypothesis of homoskedasticity was rejected at 1% level, which suggests GMM estimator as appropriate estimation technique.

Table 3: The Regression Result of the Redistributive Effects of Social Health Insurance

Variable	**Social Health Insurance**	
Dependent Variable: linHLTEXPEND (Morbidity)	**Instrumental variables (GMM) regression**	
	Coeff[a]	**(se)[b]**
GHSTATUS	0.04*	0.02
NHIS	-0.01	0.01

linPHESIGTR		0.79*	0.02
Linaftertaxinc	-0.03		0.01
linEXPHLTSPEN		0.21*	0.02
linConsumption	0.01		0.03
Labour		-0.03	0.01
Male[R]			
FEMALE		-0.05	0.04
MAGTAXR		-0.03	0.03
AGE		0.02**	0.01
AGESQUARE		-1.78e-06 **	9.14e-07
Monogamy[R]			
POLYGAMY		-0.02	0.02
HHSIZE		0.02	0.02
Father[R]			
MOTHERHH		-0.05	0.03
Post-Secondary[R]			
HNOFEDUC		-0.04	0.03
HPRYEDUC		-0.04	0.04
HSECEDUC		0.04	0.03
Government Worker[R]			
FHTRAD		-0.07**	0.04
FHTRANSP		0.01	0.04
FHFARMER		-0.05	0.04
FHSELFEMPLOY		0 .01	0.08
FHHOUSEWIFE		0 .03	0.03
FHUNEMPLOY		-0.05	0.08
FHOTHERS		-0.01	0.05
_cons		0.55*	0.05
		Wald chi2(25) = 7.5e+07*	
Number of Observations		1051	
R^2		0.56	

[a] Estimated parameters; *, **, and *** significant at 1%, 5%, and 10% level, respectively; [b] Robust standard errors [R] Reference group.

Table three shows the results using GMM estimation technique. The results show a negative causality between morbidity (measure using health care spending during illness), after-tax income and productivity (measure using labour supply) with the coefficients of -0.03 for both after-tax income and productivity. However, both the coefficients are not significant. This may be as a result of the fact that social health insurance presently covered only government and formal private sector employees. But the results still pointed to the fact that social health insurance can serve as an efficient redistribution between productivity and risk group. The results also show an increase in health expenditure during illness, which is significant at 1% level. This implies that irrespective of health insurance status,