Land Ownership, Household bargaining Power and Child Health Outcomes: Evidence from the NDHS

Atsiya Pius Amos (PhD Researcher)*[1], Atsiya Godiya Pius (PhD)†[2], and Agbutun Shedrach Adzugbele‡[3]

[1]*Department of Economics and Related Studies, The University of York, UK.*
[2]*Center for Gender Studies, Nasarawa State University, Keffi-Nigeria*
[3]*Department of Economics, University of Nigeria, Nsukka-Nigeria*

∗Email: aap517@york.ac.uk; Corresponding author
†Electronic address: godiyap@gmail.com
‡Electronic address: adzuagbutun@gmail.com

ABSTRACT

The Demand Side Financing option to eliminate financial barrier to uptake of child health interventions in developing countries can be analyse from the dimension of intrafamilial resource allocation within households. An understanding of the operation of domestic economy is potentially relevant in stimulating demand for child health. The role of women land ownership status in influencing household decision making and consequently child health outcome was investigated in this study. The Non-cooperative model, particularly the Separate sphere model was taken to a Nigerian Demographic Health Survey data. Specifically, the propensity score model was used to estimate the causal treatment effect of women land ownership status on the nutrition of children (stunting and wasting). We uncover a reduced probability (3%), on average, of a child becoming stunted if the mother owns land. The effect size was however reduced (0.7%) when a more robust treatment indicator-LandRight was used. The wasting model corroborates the stunting outcome but with improved and statistically significant treatment effect (2%) when the Land Right was controlled for. Our findings were robust to different propensity score methods such as the Nearest Neighbour Matching, Inverse Probability Weight, and Regression Adjustment among others. Taken together, this evidence is suggestive of a negative Average Treatment Effect (ATE) associated with mere land ownership among women in Nigeria. In effect, land ownership right is likely to reduce the probability of children becoming either stunted or wasted.

Keywords: Bargaining Power, Household Decision, Child Health, Nigeria.

JEL classifications: D13, I12, I38

1 Introduction

The influence of bargaining power in the dynamics of decision making within the household and the consequent effects on household outcomes is gaining increasing evidence. In developing countries where gender inequality is persistently biased towards the women folks, increasing the bargaining power of women is hypothesized to impact on women's power over decision making about resource allocation within the household. A dimension of intra-household gender inequality in decision making right assertion appears to find explicit expression in the pattern of household asset ownership in developing countries (especially land ownership). To be specific, women status is argued to be

enhanced through land ownership status. It is reasoned that land ownership influences human rights, increases economic efficiency and productivity, empowers women, and promote welfare and well-being (Agarwal 1994). Land can be deployed productively to generate resources or use as collateral to assess credit facilities resulting in empowerment. Such empowerment guarantees control over decision and is likely to deliver on welfare.

Effectively, having power to make decision could influence up-take of health interventions and consequently household outcomes. This was shown in the case of Indonesian women take-up of reproductive health programmes which were discovered to be largely influenced by the extent of their control over economic resources (Beegle and Thomas, 2001). But the household structure has implications on the dynamism of intra-household resource allocation. There are different strands of models that describe the operations of households which can be broadly categorised into: Unitary models and Collective (bargaining) models. An underlying distinction between the unitary and collective models is whether *there is pooling of household resources*. With Unitary models, a unique utility function that aggregates all preferences of all decision-making units within the household structure is specified. This is made possible by the assumptions of transferable utility that allows for the redistribution of utility as well as the consistency of preferences for both individual and aggregate household members (Bardhan and Udry, 1999). Succinctly, a homogeneous utility function (assuming homothetic preferences) is specified for all household members such that maximization of the aggregated utility function is equivalent to individual utility maximization.

The process of decision making under the unitary model was considered to be oversimplified (Chiappori, 1988) and seemingly not compatible with certain household structures elsewhere. Theoretically, an aggregated utility function is likely to mask certain vital information about individual preferences (Arrow, 1951). Empirically, the external validity of the "pooled resources" hypothesis seems to be reasonable doubtful especially among developing countries where it has been repeatedly rejected (Dwyer, Daisy and Bruce, 1988; Fapohunda, 1988; Guyer, 1980). Rather, the existence of varied preferences between decision making units within a household can be regarded as a plausible assumption. Hence, the emergence of an alternative framework-the collective models.

In a generic sense, collective frameworks are either modelled as cooperative bargaining or non-cooperative models. Cooperative bargaining Models initially developed by McElroy and Horney (1981) and Manser and Brown (1980) adopts a game theoretic model in analysing bargaining situation within the household assuming a two-person household of major decision makers. Considering a restricted bargaining between spouses, the bargaining power of a spouse is assumed to be dependent on his or her "outside options" also known as threat points which are defined as utility outside marriage or potential welfare entitled to a spouse if not a member of the household. Such threat points can be influenced by some extra household environmental parameters (EEPs) such as institutional, demographic and legal factors (Folbre, 1992). Consensus on the choice of appropriate threat point in household analysis appears not to be established in the literature. Lundberg and Pollak (1993) in their Separate Spheres Model preferred to regard the "non-cooperative agreement point" as a threat point. This is further discussed elsewhere.

Using the non-cooperative framework, this study seeks to examine the effect of the implied assumption of varied preferences on child health outcomes. If individuals with greater share of power assert their preferences within households, it will be interesting to examine for instance, the effect of women ownership of land on bargaining power and how that influences child nutrition amongst households in Nigeria. This study is motivated by the need to understand the decision- making dynamics within households and the possible impact of any public policy on such dynamics. Inappropriate knowledge of the internal processes of domestic economy might exacerbate existing inequalities with implications

on child welfare. This is important especially for countries in search of solution to child ill-health burden through the stimulation of the Demand Side Financing option of households. Nigeria, which accounts for approximately 2.3% of the global population, have an under-five death burden greater than India which accommodates 17.9% of the world population (Nte, 2012).

A major contribution of this study to the literature is an attempt to use a robust indicator of bargaining power in teasing out the "pure effect" of bargaining power on child health. From the review of literature elsewhere, it appears there are dearth of studies with resolved endogeneity concerns on the measurement of bargaining power. A recurring indicator used to measure the relative intrahousehold bargaining position but with endogeneity concerns is income. In spite of such concerns, assignable income appears to enjoy high patronage (e.g., Folbre, 1984; and Hoddinott and Haddad, 1995) perhaps due to its intuitive appeal and empirical tractability. Several attempts to address the endogeneity concern such as the use of unearned income and aggregate sex ratios on the labour market (Rao and Greene, 1993; Chiappori, Fortin, and Lacroix, 2002); and consumption or expenditure pattern (Lundberg, Pollak, and Wales, 1997; Ward-Batts, 2008) appears unconvincing for implied causal inference. With regards to unearned income, it is still doubtfulwhether current unearned income is not a reflection of previous labour supply. This study will however beguided by ethnographic studies of family life in Nigeria detailing the pattern of behaviour as well as culturalnorms and role expectations among spouses in the choice of indicator(s) of bargaining power.

Following Beegle and Thomas (2001), we insist on delineating ownership from control of assets. Beegle and Thomas had considered assets ownership of a woman to be influential in reproduction health decision within the household.But this study argues that effective power is likely to transcend mere ownership or perception of ownership to having control over household resources especially in patriarchal climes. This is more central in societies with rigid cultural norms that are matriarchically biased. We argue that the use of reported ownership of economic resources without allowing for "control" will only represent a noisy proxy with a downward biased estimated effect. We innovate by creating an indicator of "effective power" that uses both "ownership" and "right" to decision making. Specifically, an index involving land ownership status and the decision to make household decision was constructed. We consider land ownership by inheritance to be exogenously determined. Also, we apply an econometric method (the propensity score matching) robust to the treatment of endogeneity in estimating the "treatment effect" of land ownership. We are unsure of an existing study that reflects on the impact of women's land rights on empowerment and consequently on child welfare.

Nigeria is a good choice for such a study for several reasons. There is prevalence of autonomous societies having distinct cultural practices with some that are stereotypically patriarchal with gender biases in literacy rates, labour participation, and decision-making rights. Guyer (1997) provides an insightful discussion of the many ways in which sources of power could vary according to the social, economic and cultural contexts.Thus, culture is crucial in the determination of decision making. For instance, several comparative studies across different cultures have shown that there is a less joint decision making and more husband dominance in a less egalitarian and more patriarchal society (Mann and colleagues, 1998). Nigeria appears to be a perfect example that will reflect the role of culture/ethnicity in the modelling of household decision in Sub-Saharan countries. In addition, Nigeria is predominantly an agrarian economy with a considerable proportion (about 70 percent) of household engaged in agriculture and residing in rural areas where land ownership is a vital source of economic power.

2 Theoretical Model

This study proposes the use of separate sphere model by Lundberg and Pollak (1993). Lundberg and Pollak in line with Woolley (1988) considered a non-cooperative Cournot-Nash equilibrium as an alternative threat point other than divorce in the cooperative framework from which bargaining could proceed. A separate sphere family equilibrium is guaranteed with delineated division of labour and responsibilities as specified by gender and gender roles expectation-hence, a voluntary contribution equilibrium. Each spouse is expectedto make decision within his or her own sphere that will maximize the outcome assigned him or her, subjectto the constraint of individual resources. In non-technical terms, the voluntary contribution equilibriumis guaranteed by social enforcement of the obligations corresponding to generally recognised and accepted gender role. To the extent of enforcement of such obligations is a matter of interplay of power within the household structure and the expected gain from cooperation. In essence, equilibrium distribution in a non-cooperative framework depends on the total family resources as well as the gender of the person in control of such resources. In the case of a public good[1] such as child health, it is reasonable to suspect that there willbe a tendency for suboptimal supply under the non-cooperative family equilibrium if husbands have greater power. To be explicit, the willingness of decision makers within the household to supply public goods will depend in part on their preference and this might result in a corner solution. Lundberg and Pollak, using a game theoretical framework, assumed a household of two major decision makers each having control private resources (different budget constraints). Preferences of husband (h) and wife (w) are represented by a von Neumann-Morgenstern utility function:

$$U_i(x_i, q_1, q_2) \qquad where\ i\ =\ h, w$$

Where x_i is a vector of private goods, q_1, q_2,q2 are household public goods both consumed by h and w.

Individually, spouses' utility functions are specified as:

$$U_h(x_h, q_1, q_2); U_w(x_w, q_1, q_2);$$

The utility of each individual is both a function of exclusively consumed and jointly consumed goods(which are conditional on a net income transfer). In other words, the Joint consumption of public goods establishes the link between h and w. In maximizing utility, an individual considers the net transfer[2] as givenwhile selecting the bundle of goods to consume exclusively.

Within the framework of Nash bargaining, the equilibrium values of x_i, q_1 and q_2 maximizes the productof the gains from cooperation-The Nash bargaining solution. Gains are defined in terms of threat pointsthat represent the utility each spouse would achieve in the absence of agreement. In other

---

[1]For conceptual clarity, child care is strictly considered a public good while private good is operationally defined in line with Dunbar, Lewbel and Pendakur (2012), as a good that cannot be shared or jointly consumed by more a person.

[2]This study assumes a contractual transfer level of zero, resulting in a corner solution, since there is no binding agreementbetween spouses (supplementary transfer= 0). This implies that the husband spends his entire uncommitted income $I_h - t$ on his private good,x_h, and the wife allocates her total income $I_h + t$ to her private good and child services. The utilities corresponding to this voluntary contribution equilibrium are $V^h(p, I_h^* - t, I_w^* + t), V^w(p, I_w^* - t, I_h^* + t)$, where t is a minimum transfer based on prenuptial agreements that is unbinding and costly to enforce. In general, for a family at corner solution ($S = 0$) , conferring more bargaining power to the mother will affect the threat points (family equilibrium).

words, the Nashbargaining solution is express as the point in the feasible set that maximizes a "social welfare function" whichdepends on the threat point. The Nash social function (NSF) is presented as:

$$N = (U^h - T^h)(U^w - T^w)$$

with the threat point for husband as:

$$T^h(p_1, P_2, I_h, I_w)$$

and for wife as:

$$T^w(p_1, P_2, I_h, I_w)$$

while; $T^i(p_1, P_2, I_h, I_w)$ is the indirect utility function. P_1 and P_2 are relative prices of public goods whichare assumed to be equal and normalizes to unity. Exogenous incomes (also considered as net transfer) receiveby husband and wife are represented in model 4 as I_h and I_w. The NSF is maximized subject to individualincome constraint to derive the demand functions for both public and private goods.

$$MaxN = [U^h(x_h, q_1, q_2) - T^w(p_1, P_2, I_h, I_w)][U^w(x_w, q_1, q_2) - T^w(p_1, P_2, I_h, I_w)]$$

$$s.t.; \; x_h + x_w + p_1q_1 + p_2q_2 = I_h + I_w$$

(a constraint depicting equality between joint income and expenditure). The maximization process yieldsthe below demand functions which are functions of prices and net transfers.

$$s.t.; \; x_h + x_w + p_1q_1 + p_2q_2 = I_h + I_w$$

$$x_i = g^{xi}(p_1, P_2, I_h, I_w), i = h, w$$

$$q_k = g^{qh}(p_1, P_2, I_h, I_w), k = 1, 2$$

It could be inferred from the above that the entering of I_h, I_w into the demand functions separately willaffect both the feasible set as well as the threat point. The Nash equilibrium in this case is the level of goods(private or public) consumed by both individuals that satisfies the demand functions simultaneously.

With respect to public goods$(q_k)$the separate sphere model predict the occurrence of a corner solutions due to nonneutrality in the provision of public goods. This prediction could be modified when cash transfer or binding premarital agreements between husband and wife are allowed.

To put the above in a broader context, assume a simple Cournot equilibrium in the provision of public goods by husband and wife. Suppose further that q_1 in $equation$1 is within the domain of the husband, such that in the absence of cooperative agreement, the husband decides unilaterally on the quantity of $q_1$to allocate. In the same manner, we assume q_2 falls within the domain of the wife. Assume that the above assignment of public goods provision is exclusive and reflects some sort of socially sanctioned allocation of marital responsibilities defined by gender roles and gender roles expectations rather than by differences in productivities or preferences.

The husband maximizes

$$U^h(x_h, q_1, \overline{q_2}) s.t.; \; I_h = x_h + p_1 q_1$$

Where $\overline{q_2}$ is the level of public goods chosen by the wife. This yields a set of reaction functions

$x_h = f^{xh}(p_1, I_h, \overline{q_2}),$

$q_1 = f^{q1}(p_1, I_h, \overline{q_2}).$

Where the wife's demand functions for (x_w, q_2) will depend on $\overline{q_1}$. The Cournot equilibrium is determine by the intersection of the spouses' public goods reaction curves. Given that the utility functions are separable and the reaction functions are independent of the quantity of the public goods provided by the spouse, using the Klein-Rubin-Stone-Geary utility functions,

$$U^h = \propto_h \ln(x_h - x_h') + \beta_h \ln(q_1 - q_{1h}') + (1 - \alpha_h - \beta_h)\ln(q_2 - q_{2h}')$$

$$U^w = \propto_w \ln(x_w - x_w') + \beta_w \ln(q_2 - q_{2w}') + (1 - \alpha_w - \beta_w)\ln(q_2 - q_{1w}')$$

the corresponding demand functions are expressed as:

$$x_h = x_h^i + \propto_h I_h^*; q_1 = q_{1h}' + \frac{\beta_h}{p_1} I_h^*$$

$$x_w = x_w^i + \propto_w I_w^*; q_2 = q_{2h}' + \frac{\beta_w}{p_1} I_w^*$$

And the discretionary expenditure is defined as

$I_h^* = I_h - x_h' - p_1 q_{1h}'$

$I_w^* = I_w - x_w' - p_2 q_{2w}'$

with indirect utility functions as;

$V_0^h(p_1, p_2, I_h^*, I_w^*)$

$V_0^w(p_1, p_2, I_h^*, I_w^*)$

The above expression implies that the utility of the husband for instance, depends on the resources of his wife through his consumption of "her" public goods.

3 Method

Empirical Model
The propensity score model was used to estimate the causal treatment effect of women land ownership status on the nutrition of children. Following Rosenbaum and Rubin (1983), we define propensity score as the conditional probability of receiving a treatment (land ownership) given pretreatment characteristics:

$$p(X) \equiv \Pr(D = 1|X) = E(D|X)$$

where $D = \{0,1\}$ is the indicator of exposure to treatment and X is the multidimensional vector of pretreatment characteristics. Rosenbaum and Rubin (1983) show that if the exposure to treatment is

random within cells defined by X, it is also random within cells defined by the values of the one-dimensional variable $p(X)$. As a result, given a population of units denoted by i, if the propensity score $p(X_i)$ is known, then the

Average effect of Treatment on the Treated (ATT) can be estimated as follows:

$\Gamma \equiv E\{Y_{1i} - Y_{0i}|D_i = 1\}$

$= E[E\{Y_{1i} - Y_{0i}|D_i = 1\}, p(X_i)\}]$

$= E[E\{Y_{1i}|D_i = 1, p(X_i)\}$- $E[E\{Y_{0i}|D_i = 0, p(X_i)|D_i = 1]$

where the outer expectation is over the distribution of $(p(X_i)|D_i = 1)$ and Y_{1i} and Y_{0i} are the potential outcomes in the two counterfactual situations of (respectively) treatment and no treatment.

For some reasons, we insisted on probit estimation of both the propensity score (which is the default) and the ATE estimation. The logit model is another reasonable alternative. To be clear, a simple binary Probit model was used in modelling child health (nutrition) outcomes as a function of defined predictors mentioned elsewhere. Given the dichotomous nature of the dependent variable, the discrete choice model was considered appropriate. It was used in modelling the probability of a child becoming stunted or wasted given the extent of autonomy the mother has over decision making within the household attributable to her land ownership.

The expected value of each outcome variable is expressed as:

$$E(Y_i) = P(Y_i = 1) = F(\beta X_i')$$

$$E(Y_i) = P(Y_i = 0) = 1 - F(\beta X_i')$$

Suppose the assumption of a normal distribution in the heights and weights of the sampled population of under five children is considered, the empirical specification of the models if a child is stunted ($S = 1$ and 0, otherwise) or wasted ($W = 1$ and 0, otherwise) are expressed thus:

$$P(S = 1) = \emptyset(\alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_2 X_3, \ldots \ldots \ldots + \beta_n X_n)$$

$$P(W = 1) = \emptyset(\alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_2 X_3, \ldots \ldots \ldots + \beta_n X_n)$$

Where $S =$ Stunting; $W =$ Wasting, X_1=Vector of Effective Control Indicator variables, $X_2 \ldots \ldots X_n$=Vector of "ownership factors", and $X_3 \ldots \ldots X_n$ =Socio-economic factors. The models are estimated using the method of maximum likelihood.

Estimation Strategy
We intend our treatment (land ownership) to have implied causal effects. Hence, we match our data. As a data preprocessing nonparametric technique, matching is useful in obtaining accurate causal effect estimates with small bias and variance (Ho, King, Imai & Stuart, 2007)
Since our data is observational in nature, we begin by making the ignorability (or no omitted variable bias) assumption conditioning on the definition of our key causal or "treatment" variable (Land ownership) and a set of control variables. We preprocess the data set using the propensity score matching method. This was done to make the treated group to be as similar as possible to the control group. The basic insight is that in the preprocessed data set, the treatment variable is made to be closer

to being independent of the control variables and this renders any subsequent parametric adjustment either irrelevant or less important. Put differently, this breaks or reduces the link between the treatment variable and the control variables in a nonparametrical way but it reduces the potential for bias. We expect the preprocessed data set to include a selected subset of our observed sample for which treatment (T_i) and the controls (X_i)are unrelated. This would imply that the treatment (women with land ownership) and control groups (women without land ownership) have the same background characteristics. Algebraically, we argue that the below relationship is expected to hold and it is use to verify balance

$$\bar{P}(X|T = 1) = \bar{P}(X|T = 0),$$

where $\bar{P}$ refers to the observed empirical density of the data, rather than a population density. We satisfy the above equation by preprocessing (matching each treated unit with one control unit for which all the values of $X_i$that are identical[3].

A commonly used matching procedure is to summarize all the variables in X with the propensity score (Rosenbaum and Rubin 1983). The propensity score is the true probability of unit i receiving treatment, given the covariatesX_i, $e(X_i) = p(T_i|X_i)$. It is usually estimated via a logistic regression of T_i on a constant term and X_i (without regard to Y_i). As a "balancing score", if the treatment and control groups have identical propensity score distributions, then all the covariates will be balanced between the two groups. In addition, if treatment assignment is strongly ignorable given the covariatesX_i, then it is also ignorable given only the propensity score. This means that matching can be done using just the one-dimensional propensity score, instead of all the variables in X. To be explicit, the propensity score is usually estimated by a logistic regression of $T_i$on X_i.

Data
The Nigerian Demography Health Survey (NDHS) data set of 2013 was used to investigate if land ownership right of women influences nutrition of children. The 2013 NDHS is a national sample survey that provides information on fertility levels, marriage, fertility preferences, awareness and the use of family planning methods, child feeding practices, nutritional status of women and children, adult and childhood mortality among others. Specifically, the women file was used since the target groups include married women aged between 15-49 as well as children less than 59 months of births. In total, a representative sample of 40,680 households was selected for the survey from 904 clusters using a stratified three-stage cluster design. Aside being the fifth and latest in the series of Demographic and Health Surveys conducted so far in Nigeria, the NDHS 2013 data contains suitable indicators of control over household resources with multiple indicators of child health outcomes.

Variables
Dependent variables
The dependent variables which are binary response variables indicate the health status of living children staying with their mothers in households as stunted (S) and/or Wasted (W). Formally, a child is described as stunted if height is more than 2 standard deviations below the international reference median for their age. Similarly, a wasted Child is whose weight is more than 2 standard deviations below the international reference median for their height. In this study, Stunting is considered as a

---

[3]If all treated units are matched, this procedure eliminates all dependence on the model functional form in the parametric analysis. Unmatched treated units will either need to be adjusted during parametric modeling or simply dropped but this will change the quantity of interest.

measure of long-term nutritional deprivation of children and is used to measure the long-term impact of the decision-making process on child health. On the other hand, Wasting is considered as acute under-nutrition that can be occasioned by severe drought in an agricultural society. Wasting is considered sensitive in measuring the effect of short-term decision on nutrition or health care provision.

Independent variables

The treatment variable is land ownership (and land ownership right). Land is considered as an asset that can be sold to offset unexpected financial difficulty. Depending on the location, it can be used as collateral to secure facility from a financial institution. In the survey data, land Ownership (land) was simply defined as an indicator variable stating whether a woman owns land alone, jointly or does not own land. We had argued elsewhere that owning land on the one hand and owning and exercising control on the other are likely to differ. Following Meinzen-Dick et al. (1997) and Schlager and Ostrom (1992),we define land rights as a variety of legitimate claims to land and the benefits and products produced on that land. Such "claims" should be enforceable by an external legitimized authorized, be it a village-level institution or some higher-level judicial or executive body of the State (Agarwal 1994). We collapsed responsesto the question "if a woman owns land" in the survey into: *Women ownership alone* and *joint ownership* to indicate treatment group and the *no ownership*response to capture the control group.

To control for the right over land owned, we constructed a composite index called *LandRight* using the land ownership status indicator and a set of decision making rights variables (*Decisioncontrol*) captured in the survey. The *"Decisioncontrol"* variables express the autonomy over decision making on critical issues within the household. To be specific, three decision-making rights indicators were considered in this study: (i)Decision on Household Expenses (*HHExpenses*) defined as "Person who usually decides on large household purchases earnings" (ii) Decision on Wife's Health care (*healthcareDec*) captured as "Person who usually decides on wife's health care" and (iii)Decision to visit Relatives (*visitRelatives*) -Social decision making right or Decision to form social capital was expressed as "Person who usually decides on visits to family or relatives".

We control for key socio-economic determinants to include: (i)WealthIndex (Household wealth groupsquintiled from the original full household sample using a principal components analysis of the flooring material, toilet facilities, cooking fuel, water source, electricity, ownership of radio, television, and bicycle adjusted by the number of householdmembers. (ii) Wife's Religion (The religion of the wife was indicated as a categorical variable- Catholic, Other Christian,Islam and Traditionalists. (iii)Household Size (the number of household members listed (iv) Woman Education (Highest educational level attained measured as-No education, Primary, Secondary and Higher (v)Locality (Type or place of Residence measured as- Urban and Rural and (vi) ethnicity (we restricted the various ethnic groups to 11 as used consistently in the previous waves of the survey. Ethnicity is considered a valid proxy to control for the impact of culture on bargaining power.

3.1 Results

Sample Description

The study sample is made up of 119,330 women within the ages of 15-49 years, of whom 67603 (56.65%) received treatment (owned land) and 51727 (43.35) did not (do not have land). The baseline characteristics of the treated and control groups are outlined in Table 1. Majority of the women with land ownership status are above 25 years old (94 %) and are from households headed by males. Most of such women practice Christianity/traditional worship (58.8%) and are atleast in possession of basic primary education. They are likely to be employed (87%) and found in rural areas (62%). Relatively, children from households with women land ownership status are less likely to be stunted or wasted

compared to children of women without land ownership status. In comparison with landless women, women with land ownership status appear to be more educated (64% vs 29%), more likely to be employed (87% vs 66%), may reside more in the urban areas (38% vs 25.3%)and are less likely to practice Islam (41% vs 79%).

Table 1. Summary Statistics

	(1)		(2)		(3) Non-Land Own	
	Total		Land Own			
	Mean	sd	Mean	sd	Mean	sd
stunted	0.36	0.48	0.30	0.46	0.44	0.50
wasting	0.17	0.37	0.14	0.34	0.20	0.4
Age25yrs <	0.08	0.27	0.06	0.24	0.11	0.31
Age25-49yrs	0.92	0.27	0.94	0.24	0.89	0.31
male.hh Head	0.87	0.34	0.86	0.35	0.88	0.33
Female-hh Head	0.13	0.34	0.14	0.35	0.12	0.33
Islam	0.57	0.49	0.41	0.49	0.79	0.41
Christians-others	0.42	0.49	0.59	0.49	0.20	0.40
No-Prim Educ	0.51	0.50	0.36	0.48	0.71	0.45
Atleast Prim Educ	0.49	0.50	0.64	0.48	0.29	0.45
No-employ	0.58	0.49	0.13	0.34	0.34	0.47
employ	0.42	0.49	0.87	0.34	0.66	0.47
urban	0.32	0.47	0.38	0.49	0.25	0.43
rural	0.68	0.47	0.62	0.49	0.75	0.43
ebira	0.01	0.09	0.01	0.11	0.00	0.06
fulani	0.08	0.27	0.05	0.22	0.12	0.32
hausa	0.32	0.47	0.18	0.38	0.5	0.50
ibibio	0.02	0.13	0.02	0.15	0.01	0.09
igbo	0.11	0.31	0.15	0.36	0.05	0.22
ijaw	0.04	0.19	0.05	0.22	0.02	0.13
kanuri	0.01	0.12	0.01	0.09	0.02	0.15
Nupe	0.01	0.12	0.01	0.11	0.02	0.13
Urhobo	0.01	0.11	0.02	0.13	0.01	0.08
yoruba	0.11	0.31	0.17	0.38	0.03	0.17
Fulfulde	0.01	0.11	0.00	0.05	0.03	0.16
Others	0.27	0.44	0.32	0.47	0.20	0.40
LandRight	0.57	0.50				
N	223748		67603		51727	

Propensity Score Matching
A logistic regression model was used in which the treatment status (Land ownership Right vs. no land ownership right) was regressed on the baseline characteristics listed in Table 1 above in the first instance. Variable selection in to the model was guided by the logic of Austin, Grootendorst, & Anderson (2007). They suggested the inclusion of only variables that affect the outcome or those that affect both treatment selection and outcome. For instance, the decision to visit relatives (or form social

capital was included because individuals are likely to command resources by virtue of their membership to social networks(Portes, 1998). These resources which could also be at community-level (Putnam, 1995) is usually reflected in the structure of social relationships facilitated by the mobility of the woman. Women with restricted mobility often dictated by culture or religion in the study area are likely to be social capital constrained. Women education, in general, is known to be protective in the enhancement of a woman's autonomyover her health. Such autonomy is expected to impact on the health of the child from the prenatalstage to post birth. Ultimately, the variables selected are plausible predictors of children anthropometric measures in the study area. Subsequently, the probit specification was used in estimating the treatment effect through a can of command (teffects psmatch, atet) implementable in stata. For comparative purposes, we used other methods of estimating treatment effects such as the Regression Adjustment, Inverse Probability Weighting, Augmented Inverse Probability Weighting, Inverse Probability Weighted Regression Adjustment, and Nearest Neighbor Matching. We used the above methods to regress stunting and wasting on an indicator variable for mere land ownership and the baseline covariates listed in Table 1. We then repeat the above procedure using a robust treatment indicator-Land ownership Right. The Land ownership Right (Land Right) variable isan index constructed from three decision making right variables- Decision to visit Relatives (visit Relatives), Decision on Household Expenses (HHExpenses) and Decision of Wife's Health care (healthcareDec). We argue that the ”Decision control” variables express the autonomy over decision making on critical issues within the household. As a compound index, it is suggestive of the "right to final decision making" within the household.

Table 2. Treatment Effect-Propensity Score Matching (Stunting)

	(1) Stunting	(2) Stunting
ATET		
rIvs0.LandOwn	-0.0305***	
	(-3.97)	
rIvs0.LandRight		0.00742
		(-1.02)
N	**24460**	**24502**

t statistics in parentheses * p<0.05, ** p<0.01, *** p< 0.001

From results reported in Table 2 above, we uncover a reduced probability (3%), on average, of a child becoming stunted if the mother owns land (see Table 2, column 1). The effect size was however reduced (0.7%) when the LandRight treatment indicator was used. It is reasonable to suspect an attenuation bias. This is in contrast with the wasting model that corroborate the stunting outcome but with improved and statistically significant treatment effect (2%) when the right to make decision was controlled for (See Table 3).

Table 3. Treatment Effect-Propensity Score Matching (Wasting)

	(1) Wasting	(2) Wasting
ATET		
rIvs0.LandOwn	-0.0151*	
	(-2.57)	
rIvs0.LandRight		-0.0224***
		(-3.63)
N	**24451**	**24493**

t statistics in parentheses * p<0.05, ** p<0.01, *** p< 0.001

As sensitivity tests, different propensity score methods were used to estimate the ATE of land ownership status among women. To be explicit, methods such as the Regression Adjustment, Inverse Probability Weight, Augmented Inverse Probability Weighting,Inverse Probability Weighted Regression Adjustment, and Nearest Neighbor Matching were used and results reported in the Appendix (See Tables 4-7). The difference in treatment effect size with respect to the different treatment effect estimators used with land ownership as a treatment indicator are close to each other. For instance, the effect size for the stunting models ranges between 3% to 5% in all cases. Taken together, this evidence is suggestive of a negative ATE associated with mere land ownership among women in Nigeria. Similar intuition can be deduced from the wasting models where the ATE is in the range of 1% -2% with respect to land ownership. When land ownership right was adjusted for in all the alternative wasting treatment models, there was improvement in the range of ATE(2% -4%). In effect, land ownership right is likely to reduce the probability of children becoming wasted by approximately 2%-4%.

Discussion
From this study findings, it can be summarily argued that Nigerian households with women having control over resource allocation through land ownership can be said to be more efficient in the production of child health. Having decision making power is reasoned to influence the assertion of the woman's preference towards investing on child health. We delineate possible causal pathways. For instance, land ownership as a source of empowerment, increases women's security, influence and control over household decisions (Haddad et al. 1997; Agarwal 1997). It is likely to influence the autonomy of a woman with such autonomy determining the extent of assertion of control over her own life (Jejeebhoy, 2000) without recourse to consultation with others (Brunson, et al., 2009). In terms of women's well-being, Panda and Agarwal (2005) found that women who owned land or houses were significantly less likely to experience marital violence. While the association between maternal health and child health is not in doubt (Minkovitz, 2002) and historical (Mechanic, 1964), land in the hands of women can bean asset that can be sold or use as collateral to secure facility to smooth income shocks. Another possible pathway through which land ownership (right) can affect child health is nutrition. Landownership right has been discovered to influence children nutrition (Kumar, 1978 as cited in Agarwal 2002) through food security. Recognizing women's land rights may increase agricultural productivity and thereby increase the total amount of resources available-the efficiency argument. If productivity of women is hindered by gender norms that prevent the cultivation of certain crops (especially cash crops) due to lack of ownership right, eliminating such barriers will increase efficiency and generate more resources for welfare-the welfare argument. The welfare argument suggest that securing women's land rights will promote the welfare and well-being of women and their families, as well as the broader community. This welfare rationale rests on the notion that resources put in the

hands of women, rather than men, are more likely to be used to the benefit of children and others. This point is supported by studies on the effects of women's and men's income on household well-being measures. Compared to equal amounts of men's income, women's income is consistently associated with greater positive effects, as measured by child survival, household calorie level, food expenditures, and children's nutritional status (e.g. Quisumbing et al. 1995; Thomas 1990). Women themselves often note that land rights would provide security in the face of their husband dying or abandoning them and in cases of domestic violence (Agarwal 1994).

Finally, we argue that land ownership is likely to confer greater security in marriage creating a disincentive for divorce. Such security exist in the face of husbands demise or cases of domestic violence (Agarwal 1994). The divorce threat point is likely to be credible if women have land right. This has been shown in the case of widows who owned land and were given greater respect and consideration than widows who did not (Agarwal, 1994). All these put together implicates land ownership in enhancing the bargaining power of women with clear influence over decision making rights.

Policy Implication
Nigeria is primarily rural and agrarian making land to be vital in the determination of economic livelihood. Hence, the role of land in bargaining power determination is crucial. It is regarded largely as a norm among majority ethnic groups in Nigeria for women not to own land or even inherit land from their parents or deadhusbands. Also, it is still a rarity in most societies for parents to give land to daughters. To the extent land ownership influences child nutrition through the power structure pathway as suggested by this study findings, it is therefore needful that cultural norms and religious dogmas that constraint the amount and nature of inheritance transfer to women be modify. Further, if feminization of agriculture is accurately evidenced in Nigeria, increasing the agricultural productivity of women might imply cultural norms adjustment to gender land rights. Increased women agricultural productivity is likely to improve child nutrition and general household welfare. Our study findings is suggestive of the need to address women land right issues as potentialchannel of satisfying the ongoing international development agenda of child health. Reducing the number of stunted and wasted children is investment in productivities of the future labour force of Nigeria and public policy to promote women land ownership could be potentially relevant.

Conclusion
Major findings from this study suggest that women's land rights empower women and influences the nutrition of under-five children. We had argued that land ownership right is associated with decision making rights within the households. Given the preference of women, if in control of resources, child nutrition is likely to be impacted. Land ownership right in an agrarian society can be plausibly asserted to determine the status of women in the family structure. This appears to hold potentials in addressing the issue of women empowerment. In spite of its strategic relevance in improving household welfare in general, adjustment to existing cultural and religious dogmas regarding women land right remain a complex issue. Land is finite in supply and with rising population growth, there is increasing pressure on available land. Substitutability of land ownership along gender line is likely to be resisted without strong legislation. Promoting equality of rights to inheritance/acquisition is potentially a way forward. It is important that such equality be reflected in terms of quality of land to be distributed/allocated. This is of practical importance to women in agriculture since productivity depends in part on the structural quality of land. Lastly, we suggest that investigating a heterogeneous treatment effect by ethnic group is a space for further research. In the absence of a verifiable land right claim (such as a certificate of land ownership in the woman's name), we had constructed an index aggregating rights

overs household spending, health decision and visits to relations. External validity of this study findings will be improved if a specialized survey insisting on legal claim is used to estimate treatment effects.

REFERENCES

Allendorf, K. (2007, Nov). Do Women's Land Rights Promote Empowerment and Child Health in Nepal? *World Dev., 35*(11), 1975-1988.

Becker, G. S. (1981). *A Treatise on the Family.* London: Harvard University Press.

Becker, S. O., & Ichino, A. (2002). Estimation of average treatment effects based on propensity scores. *The Stata Journal, 2*(4), 358–377.

Brunson, E., Shell-Duncan, B., & Steele, M. (2009). Women's autonomy and its relationship to children's nutrition among the Rendille of Northern Kenya. *American Journal of Human Biology, 21*, 55-64.

Buis, M. (2010). Stata tip 87. Interpretation of interactions in nonlinear models. Stata tip 87. *The Stata 2010, 10*(2), 305–308.

Cleland, J., Conde-Agudelo, A., Peterson, H., Ross, J., & Tsui, A. (2012). Contraception and Health. *The Lancet, 380* (9837), 149-156.

Doss, C. (1996). Testing among models of intrahousehold resource allocation. *World Development, 24*.

Doss, C. (2011). Intra-household Bargaining and Resource Allocation in Developing Countries. A background paper. *World Development Report. Gender Equality and Development*.

Doss, C. R. (1996). "Testing the Unified Model for Ghana: Evidence and implications," Mimeo, Dept. of Applied Economics (St Paul, MN: University of Minnesota,1996).

Dunbar, G. R., Lewbel, A., & Pendakur, K. (2012). Children's Resources in Collective Households:Identification, Estimation, and an Application to Child Poverty in Malawi. *The American Economic Review., 103*(1), 438-471.

Glassman, A., Duran, D., Fleisher, L., Singer, D., Sturke, R., Angeles, G., et al. (2013). Impact of conditional cash transfers on maternal and newborn health. *J Health Popul Nutr, 31*(4 (Suppl 2)), 48-66.

Guyer, J. (1997). "Endowments and assets: The anthropology of wealth and the economics of intrahousehold allocation,". In L. Haddad, H. J., & A. H., *Intrahousehold resource allocation in developing countries: models, methods and policy.* Baltimore: Johns Hopkins Press.

Harraka, M. (2013). Catholic Education. *A journal of Inquiry and Practice, 6*(2).

Ho, D. E., King, G., Imai, K., & Stuart, E. A. (2007). Matching as Nonparametric Preprocessing forReducing Model Dependence in Parametric Causal Inference Political Analysis . *15*, 199–236.

Hulme, D. (2009). The Millennium Development Goals (MDGs): A Short History of the World's Biggest Promise. . *Brooks World Poverty Institute Working Paper 100*.

Jejeebhoy, S. (2000). Women's autonomy in rural India: its dimensions, determinants and the influence of context. In P. Harriet, & G. Sen, *Women's Empowerment and Demographic Processes: Moving beyond Cairo.* Oxford: Oxford University Press.

Jutting, J. P. (2001). The impact of health insurance on the access to health care and financial protection in rural developing countries: the example of Senegal. *Washington, DC: World Bank*.

Lundberg, S., & Pollak, R. A. (1993). Separate Spheres and Bargaining and the Marriage Market. *Journal of Political Economy, 101*(6), 988-1010.

Mann, L., Radford, M., Burnett, P., Ford, S., Leung, K., Bond, M., et al. (1998). Cross- cultural Differences in Self-Reported Decision making Style and Confidence. *International Journal of Psychology, 33*(5), 325-335.

Manser, M., & Murray, B. (1980). "Marriage and household decision-making: A bargaining approach.". *Inrernarional Economic Review, 21*(1).

McElroy, M., & Homey, M. (1981). "Nash-bargained household decisions: Toward a generalization of the theory of demand," . *International Economic Review, 22*(2), 333-349.

McPeak, J. G., & Doss, C. (2006). Are Household Production Decisions Cooperative? Evidence on Pastoral Migration and Milk Sales from Northern Kenya. *American Journal of Agricultural Economics, 88*(3), 525-541.

Mechanic, D. (1964). The influence of mothers on their children's health attitudes and behavior. *Pediatrics, 33*(444).

Minkovitz, C. S., O'Campo, P. J., Yi-Hua Chen, & Grason, H. A. (2002). (2002)Associations Between Maternal and Child Health Status and Patterns of Medical Care Use. *Ambulatory Pediatrics., 2*(2), 85-92.

Norton, E., Wang, H., & Ai, C. (2004). "Computing interaction effects and standard errors in logit and probit models". *The Stata Journal, 4*(2), 154–167.

Portes, A. (1998). Social Capital: its origins and applications in modern sociology. *Annual Review of Sociology, 24*(1), 1-24.

Putnam, R. D., Simon, & Schuster. (2000). Bowling Alone: The Collapse and Revival of American Community . A journal of Inquiry and Practice. Vol. 6 (2)

Quisumbing, A. R., & Maluccio, J. A. (2003). (2003). Resources at Marriage and Intrahousehold Allocation: Evidence from Bangladesh, Ethiopia, Indonesia, and South Africa. *Oxford Bulletin of Economics and Statistics, 65*(3), 283-327.

Samuelson, P. A. (1956). Social Indifference Curves. *Quarterly Journal of Economics, 70*, 1-22.

Udry, C. (1996). Gender, Agricultural Production, and the Theory of the Household. *Journal of Political Economy, 104*(5), 1010-46.

Ulph, D. (1988). A General Non-Cooperative Nash Model of Household Consumption Behaviour, mimco University of Bristol.

UNICEF. (n.d.). *Multiple Indicator Cluster Survey (MICS)*. Retrieved March 26, 2003, from http://www. unicef.org/reseval/micsr.html

Victora, C. G., Hanson, K., Bryce, J., & Vaughan, P. (2004). Achieving Universal Coverage with Health Interventions. *The Lancet, 364*(9445).

Witter, S., Fretheim, A., Kessy, F., & Lindahl, A. K. (2012). Paying for performance to improve thedelivery of health interventions in low- and middle-income countries. *Cochrane Database Systematic Review, 2*(2).

Appendix

Table 4 Comparison of Effect Sizes Across Different Propensity Score Methods for Stunting (Land Ownership).

ATE	ra	ipw	aipw	ipwra	nnmatch
LandOwn	-0.0514***	-0.459***	-0.04282***	-0.0486***	-0.0366***
	(-5.81)	(-4.90)	(-5.31)	(-5.40)	(-3.94)

Ra=Regression Adjustment; ipw=inverse Probability Weight; aipw=Augmented Inverse Probability Weighting, ipwra=Inverse Probability Weighted Regression Adjustment; nnmatch=Nearest Neighbor Matching

Table 5 Comparison of Effect Sizes Across Different Propensity Score Methods for Wasting (Land Ownership).

ATE	ra	ipw	aipw	ipwra	nnmatch
LandOwn	-0.0225**	-0.0188*	-0.0204**	-0.208**	-0.0126
	(-3.16)	(-2.46)	(-2.75)	(-2.83)	(-1.64)

Ra=Regression Adjustment; ipw=inverse Probability Weight; aipw=Augmented Inverse Probability Weighting, ipwra=Inverse Probability Weighted Regression Adjustment; nnmatch=Nearest Neighbor Matching

Table 6 Comparison of Effect Sizes Across Different Propensity Score Methods for Stunting (Land Ownership Right).

ATE	ra	ipw	aipw	ipwra	nnmatch
LandOwn	-0.0531***	-0.0508***	-0.0512***	-0.05126***	-0.0162***
	(-7.98)	(-7.52)	(-7.60)	(-7.61)	(-2.40)

Ra=Regression Adjustment; ipw=inverse Probability Weight; aipw=Augmented Inverse Probability Weighting, ipwra=Inverse Probability Weighted Regression Adjustment; nnmatch=Nearest Neighbor Matching

Table 7 Comparison of Effect Sizes Across Different Propensity Score Methods for Stunting (Land Ownership Right).

ATE	ra	ipw	aipw	ipwra	nnmatch
LandOwn	-0.00422***	-0.0422***	-0.0395***	-0.0397***	-0.0218***
	(-7.83)	(-7.83)	(-7.16)	(-7.20)	(-3.87)

Ra=Regression Adjustment; ipw=inverse Probability Weight; aipw=Augmented Inverse Probability Weighting, ipwra=Inverse Probability Weighted Regression Adjustment; nnmatch=Nearest Neighbor Matching