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The Land Rights and Farm Investment Ghana: The Missing Link in the Operationalisation of Tenure Security

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208 - THE LAND RIGHTS AND FARM INVESTMENT GHANA: THE MISSING LINK IN THE OPERATIONALISATION OF TENURE SECURITY

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ABSTRACT

Land management reform has re-emerged as a priority for many African countries and strongly supported by so-called development partners. This time round, a more nuanced theme combining the classic goals of enhancing tenure security, improving investment and productivity of land with those of poverty reduction and equity in land access. Many continue to question the neo-classical premise which perceives customary systems to not provide the necessary security to promote agricultural investment and productivity due to the lack of clearly defined private and enforceable property rights. Given the variety of methods used measuring land tenure security it would be useful to examine how the different measures of tenure security influence the outcomes of interest within the premise of the neo-classical hypothesis. This paper examines how diffrent methods of quantifying and measuring tenure security influence farm investment. We use data from 11 districts located in 4 agro-ecological zones of Ghana to analyse the land tenure security-farm investment nexus and how different measures of tenure security influenced household land improvement investment decision making.

1. INTRODUCTION

Neo-classical theory has over the years profoundly articulated the privatisation of land rights as a precondition for investment and economic growth. The theory posits a strong relationship between tenure security and farm investments, arguing that producers' willingness to invest their full effort to make long-term improvements in land is determined by the expectations of their rights to land over time (Marshal, 1890; Mill, 1848). Pivotal in the neo-classical land tenure hypotheses is the facilitating role of privatised land rights. Individualisation of land rights is perceived to provide incentives for investments in land by improving tenure security, improving access to credit and reducing the incidence fragmentation and conflicts over land.

Figure 1.1 highlights the relationship between land tenure security (individualised land rights) and productive efficiency within the context of neo-classical theory of land tenure. The theory argues that well-defined and protected land rights influences efficiency and economic growth by providing security that increases the willingness of individuals to invest, improves credit demand and supply, and facilitates efficient land transactions that enable producers with higher abilities gain access to land.

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Figure 1.1: Theoretical Relationship between Tenure Security and Productive Efficiency

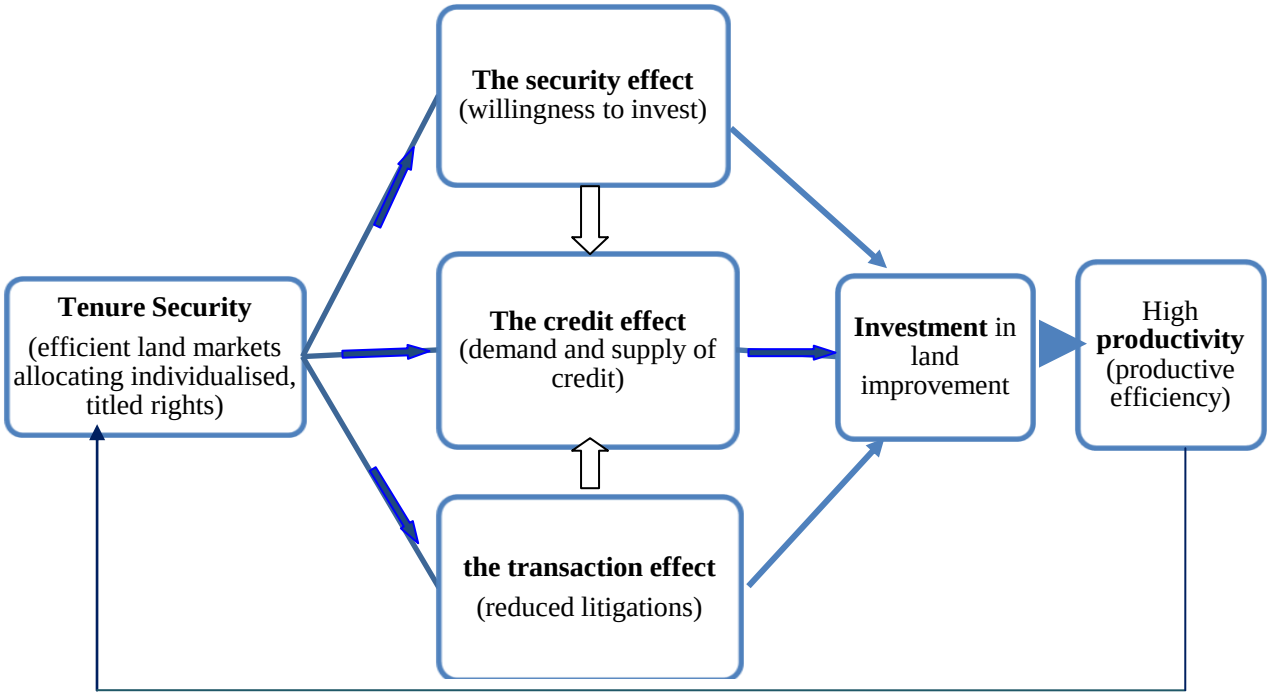

Figure 1.1 illustrates how demand-side (incentives to farmers) and supply-side (incentives to lenders) factors interact in neo-classical hypotheses of land tenure security:

(i) Individualisation increases investment by improving tenure security. Higher tenure security increases expected investment returns, thereby increasing the demand for capital (including credit) for land investments.

(ii) Individualised land rights accompanied by transferable titles improve the creditworthiness of the landholders, thus enhancing the lands' collateral value, and thereby raising lenders' expected returns.

(iii) Individualisation will cause efficient land market to emerge. Land will be transferred to those who are able to extract a higher value of product from the land as more productive users bid land away from less productive users i.e. land is allocated to more efficient producers. In addition, increased tenure security would reduce both transaction costs and the incidence of disputes, thus freeing up resources, which would otherwise have been used for litigation.

(iv) Improved productivity or productive efficiency further increases the incentives of individuals to acquire private land rights, thus reinforcing tenure security.

The neo-classical land tenure security-productivity nexus has profoundly influenced the land research agenda in Sub-Saharan Africa and fuelled much of the widespread efforts to harmonise and formalise land markets in developing countries.

Despite cogent arguments linking private land rights to improved access to finance, investment and productive efficiency, empirical studies have largely failed in the attempt to validate the

much hypothesised strong relationship between land rights, investment, and agricultural productivity on African croplands (Gavian and Fafchamps, 1996). This paper joins the growing list of studies examining how tenure security influences agricultural investment decisions and productivity (Harrison, 1987; Migot- Adholla et al., 1991; Place and Hazell, 1993; Laffont and Matoussi, 1995; Ahmed et al., 2002; Tikabo and Holden, 2004). Although land rights across Sub-Saharan Africa are derived from mostly informal arrangements and secured by a combination of customary and statutory arrangements, many perceive the largely privatised statutory arrangements as more efficient in protecting people's interests in land. As a result, several studies have narrowly restricted the definition of tenure security to formal market based procedures such as cash-based land transactions and deed registration that notwithstanding the stark reality that land acquired through traditional processes and the rights secured by social norms and believes have provided relative tenure security overtime.

Approaches used by researchers to operationalise or measure tenure security has varied significantly thus raising concerns in terms of what actually constitutes tenure security within the context of Africa's largely plural land tenure systems as well as how the pathways through which such tenure security influence farm investment decisions. Using data from Ghana, the paper explores how tenure security influences household farm investment decisions.

The paper is organized as follows: Section II explores the theoretical foundation of the neo-classical hypothesis and the reasons advanced by researchers for the apparent failure to establish the posited strong relationships between land tenure security and the desired outcomes of improved land investment, access to finance and productive efficiency. In Section III, we discuss the empirical models employed in the analysis. In section IV we use data from Ghana to demonstrate how varying measures of tenure security affects household land improvement investment. The last section presents the conclusion to the paper.

2. EMPIRICAL RESEARCH AND EVIDENCE ON THE LAND TENURE SECURITY AND PRODUCTIVITY NEXUS

The early twentieth century witnessed the emergence of different schools of thoughts with diverging views on the role of land tenure security in productivity of the agricultural sector of developing countries. Probably inspired by the nineteenth century pioneering works of John Stuart Mill and Alfred Marshall, the contending schools of thought introduced empirical dimensions to either support or discredit views being articulated depending on which side of the debate one belonged. The first school which this article refers to as the "land reformist school", argued that land tenancy arrangements in Least Develop Countries (LDCs) were responsible for the apparent inefficiency in the agricultural sector. According to the reformist school, land tenure arrangements such as sharecropping resulted in inefficient allocation of resources and also reduced tenants' incentive to improve agricultural land (Georgescu-Roegen, 1960; Issawi, 1957; Heady, 1947; Shickele, 1941). To counter the constraints imposed by insecurity inducing land ownership and use arrangements, the "reformists' school" proposed measures such as rental rate reduction, land redistribution, introduction of minimum term lease systems and the abolition of sharecropping as policy instruments. These measures, the proponents argued, would limit the growth of so-called undesirable land use arrangements and mitigate their effects on resource allocation decision making among tenant farmers. On the other side of the debate was the "equal efficiency" school which argued that land tenure had no bearing on productive efficiency and

that poverty of the agricultural sector was due to factor endowment (mainly a large body of unskilled labour relative to land and capital). The "equal efficiency" school also rejected reformists' arguments in support of land reform, stressing that those arguments were founded on normative welfare criteria rather than the positive criterion of economic efficiency (Cheung, 1968, 1969a).

The primary source of contention was the so-called security hypothesis which posits that uncertainty regarding land ownership reduces farmers' willingness to make long-term investments to improve land productivity. Authors who identify with the security hypothesis advocated individualisation of land rights arguing, that, uncertainties pertaining rights are significantly reduced and the possibilities of reaping returns from investments enhanced under private land ownership (Feder et.al. 1988). The second source of contention was the "access to resources or credit hypothesis" which argues that, secure land rights (assumed to be individualised rights) leads to greater demand for land improvements as well as for complementary inputs as farmers are assured of reaping returns to investment in land while at the same time improving the credit-worthiness of the farmer and enhancing his chances of receiving formal credit.

The contributions of these contending schools of thought have contributed to the growth of literature on comparative productive efficiency of different land tenure forms in Africa and Asia in particular. The neo-classical hypotheses outlined above have for several decades provided the theoretical bases for research on land tenure security and productivity in Sub-Sahara Africa. Authors including Hagos and Holden, 2006; Tikabo and Holden, 2004; Ahmed et al., 2002; Gavian and Ehui, 1998; Hayes et.al, 1997; Laffont and Matoussi, 1995; Place and Hazell, 1993; Migot- Adholla et al., 1991; Atwood, 1990; Feder and Onchan, 1987; Harrison, 1987; Shaban, 1987; Ip and Stahl, 1978, among a host of others have all drawn variously from the neo-classical hypothesis of land tenure.

The growing list of studies examining the relationship between land tenure security and long-term farm investment or productivity have done little to quell uncertainty and controversy over the much hypothesised nexus especially in Africa. Most of the studies in Africa, including those mentioned above have produced mixed results with the greater majority failing to establish the hypothesised strong links between tenure security, investments and productive efficiency. The Evidence seems to suggest that the impact of individualised titling on smallholders' access to credit is negligible. In the case of Rwanda and Ghana World Bank-funded studies did not find any significant correlation between individualization of land rights and access to credit. No significant relationship could be found between the percentage of households receiving formal credit or any credit and the proportion of land held with "complete transfer" rights (Migot-Adholla et al., 1991; Place and Hazell, 1993).

On the relationship between land title and investment, most empirical studies have produced inconclusive results. In Ghana for example, Migot- Adholla et al. (1991) found that increasing individualised land rights do not appear to have any effect on agricultural investment and yields. The study made similar findings for Rwanda and Kenya. In areas of Kenya with land registration, no link was found between land titling and long-term investments to improve land

(Barrows and Roth, 1989). In Zimbabwe, Harrison (1987) found little variation in the productive performance between small holder farmers with no land title and large scale commercial farmers with land titles.

Few studies however find evidence of higher efficiency on individualised plots. Laffont and Matoussi (1995) found significant evidence of Marshallian inefficiency in a study in Tunisia; Ahmed et al. (2002) found significant inefficiency on sharecropped land but not so on land under fixed-rent contracts.

Unlike in Africa, the evidence on the relationship between titled land rights and productivity has been more consistent in Asia and Latin. In India, Shaban (1987) found that yields on owner-cultivated plots were 16% higher than yields obtained under sharecropping by the same farmer. Salas et.al (1970) found positive correlations between the degree of ownership security and farm investment per unit of land in Costa Rica. Villamizar (1984) demonstrates that capital per hectare was substantially higher on titled farms than on undocumented or encroached land in Brazil. In Thailand, Feder and Onchan (1987) shows that the probability of investing in land improvements is significantly affected by possession of secure ownership.

While it is not uncommon for empirical data to contradict the posits of theory, the widespread failure to establish posited relationships between land tenure security and outcomes such as improved access to credit, increased investment and land productivity for the secured right holders has led some to question the plausibility of the neo-classical hypotheses of land tenure within the African context as well as the approaches adopted to test these hypotheses.

2.1 Diagnosis of the Failure of the Neo-Classical Land Tenure Hypotheses in Africa

Varied reasons have been advanced for the inconsistent empirical results on the land tenure security productivity nexus or more appropriately, the apparent failure to establish the anticipated relationships between land tenure security and productivity. In Ghana, Rwanda and Kenya, a study by Migot-Adholla et.al, (1991) attribute the absence of correlation between land rights and investment in land improvement and productivity to thin formal and informal capital markets. Their arguments presume that the failure to observe the anticipated covariation between land tenure security on the one hand and investment or productivity on the other border institutional structure or failure rather than theoretical or methodological lapses.

A catalogue of related studies including Okoth-Ogendo (1976), Collier (1983), Noronha (1985), Bruce (1986) and Barrows and Roth (1989) outline varied factors responsible for the apparent failure of the credit and land tenure security nexus. As is the case with Migot-Adholla et.al (1991), the first set of factors border on institutional failures blamed largely on structural deficiencies within land management systems. Due to the high cost of information and related transaction costs, governments in most parts of Africa are not able to ascertain the rightful land owners to accurately document existing land rights. As a result, land registration procedures in many African countries are perceived as inefficient and produce land titles that are disputed and mostly ineffective. Disputed land titles are not reliable collateral and would most likely be rejected by formal and semi-formal credit institutions. Secondly, challenges pertaining to the foreclosure of land rights and other landed property because markets are thin and inefficient has rendered land based collaterals unattractive to some lenders. A third and perhaps more prominent

factor is the limited participation in markets for the greater majority of the populations. Okoth-Ogendo (1976) in particular argues that, title to agricultural land is in some instances regarded as inferior collateral for loans compared with urban properties, attachment of salaries and other forms of valuable property. The few demand side arguments on the relationship between land titles and access to credit point to risk aversion on the part of smallholders who unwilling to incur land-secured debts and in the process lose their land through foreclosure (Green, 1987; Shipton, 1988; Barrows and Roth, 1989).

2.2 Measuring Rights and Tenure Security

Land tenure security has been defined as the individual's perception of his/her rights to a piece of land on a continual basis, free from imposition or interference from outside sources, as well as the ability to reap the benefits of labor or capital invested in land, either in use or upon alienation (Place, Roth and Hazell 1994). Because tenure security is not directly observed, devising an objective index of tenure security to correlate with agricultural performance and other outcome variables has so far been problematic (Roth and Haase, 1998). Several measures of tenure security have been employed by researchers. The most common is a self-reported indicator which represents some underlying variable. This indicator takes a value of 1 if the underlying variable takes positive values and 0 when the underlying variable takes negative (Alemu 1999; Holden and Yohannes 2002; Matchaya, 2009). The self-reported binary indicator of tenure security suffers from problems inherent in questions about people's perception of the security of their tenure. For example depending on how questions are posed there is the likelihood individuals may frequently report insecurity in anticipation of some form of help or may not correctly understand the question (Matchaya, 2009). The second problem with the self-reported binary indicator of tenure insecurity has to do with the failure to take into account the underlying cause of insecurity. The binary perception of insecurity is usually obtained by asking individuals whether they fear losing their land in the future? It is obvious that the response to this question will vary significantly if the dimension of fallowing is added i.e. if the farmer is asked whether he or she fears losing her land if it is not cultivated for a specified period of time.

Some studies have measured land tenure security by documentation or registration of land rights (Feder and Onchan, 1987; Hayes et.al., 1997). Under this categorisaton, registered lands with titles or deeds are considered as secure while undocumented land without titles are perceived as insecure. This definition is criticised for assuming that land title is analogous to security and ignoring the fact that context specific customary laws and institutions are also important in determining land ownership security.

The rights gamut approach which associates tenure security with the type of rights held over land, that is, whether the plot holder exercises complete or preferential rights (Hayes et.al, 1997); land titling or documentation (Place and Hazell, 1993); and forms of land transactions i.e. land is acquired though purchase, rental, sharecropping, and gift (Ahmed, et.al., 2002; Gavian and Ehui, 1998).

2.3 Approaches of the Land Tenure Research in Ghana

In the case Ghana, the approaches adopted by studies investigating the tenure security-productivity hypotheses reveal a certain degree of proclivity to notions of superiority of individualised land rights or the necessity for land titling. As a result, the inquest into the apparent failures of the neo-classical land tenure hypotheses appears lopsided with emphasis on

identifying analytical and modelling deficiencies as opposed to interrogating issues that border on conceptualisation and operationalisation of land tenure security, the most significant parameter of the hypothesis.

The common response to the failure to observe expected relationships between tenure security and productivity is the attempt to argue that tenure security is endogenous and that earlier studies lacked the econometric rigour to adequately account for the perceived endogeneity of tenure security. Many of the more recent investigations of the tenure security-productivity hypotheses have therefore focused on resolving the issues of endogeneity in tenure security mostly through the use of the so-called robust econometric modelling (Twerefou, et.al, 2011; Hayes et.al, 1997; Besley, 1995). The findings of these studies have done little to resolve the ambiguity surrounding the relationship between tenure security and expected improvements in investments. Most of the findings are mixed and in some cases contradictory (Migot-Adholla et.al., 1991; Besley, 1995).

Using the same data set as Migot-Adholla et.al., (1991), Besley (1995) assumed that land rights were endogenous with farmer investment aimed at improving their rights over land. The study concluded that better land rights facilitated investment in Wassa but not in Anloga, a direct opposite of the findings made by Migot-Adholla et.al., (1991). Twerefou, et.al, (2011) in their study of and tenure security, investments and the environment in Ghana, set tenure security as endogenous. The findings of the study were mixed in terms of the relationship between tenure security and farm investments, with the conclusions raising doubts about the endogeneity of tenure security assumption. They found that investment in farmlands in Ghana were low, appeared not to enhance tenure security and argued that the reverse causation assumption of tenure security enhancing investment seemed non-existent. Twerefou et.al., (2011) concluded that tenure security appeared to be an incentive for investment in that when endogeneity was not controlled, though the authors alluded to challenges with the robustness of this result. This conclusion is however contradicted by Dzanku (2008) even though he treated tenure security as exogenous.

Goldstein and Udry (2008) employ revolutionary approach to investigating the tenure security productivity nexus. In their study of investment and productivity in agriculture in Ghana, they demonstrate that individuals who hold powerful positions in a local political hierarchy have more secure tenure rights and as a consequence invest more in land fertility and have substantially higher output. They further show that the intensity of investments on different plots cultivated by an individual corresponded to that individual's security of tenure over those specific plots and, in turn, to the individual's position in the political hierarchy relevant to those specific plots. The underlying difference in approaches used has little or nothing to do with the mechanics of models used but with the definition and measurement of tenure security.

Within the context of land tenure and productivity research, the findings of Goldstein and Udry (2008) may be described as the exception rather than the rule. What accounts for the remarkable contrast between the findings of Ibid and related studies even in Ghana (Twerefou et.al., 2011; Dzanku, 2008; Besley, 1995; Migot-Adholla et.al., 1991) may constitute the missing link in the operationalisation of the neo-classical land tenure hypothesis within the context of Sub-Sahara Africa.

The variance in approaches and findings make the question of what constitutes tenure security within the context of Sub-Saharan African in general and Ghana in particular crucial for both research and land policy reform. The security of property rights in land is a multi-phased process involving customary legitimisation of rights followed by formal or statutory validation of those rights. Toulman (2005) describes the processes of securing land rights as a two step process with the first step involving the recognition of a claim as being legitimate by neighbours and others within the vicinity, usually in accord with local norms and values. The second step involves validation, i.e. recognition of the claims by the state. He argues that in practice, the lack of state recognition may not matter if land is not under particular pressure, and if local systems work reasonably well. It is important to stress that the latter validation without the former may not be enough to secure even usufruct rights in several African jurisdictions. Ault and Rutman (1979) argued that there was no private ownership of land in most of Africa and that security of tenure was guaranteed as long as tribal laws and customs were obeyed strictly.

In defining and measuring tenure security, factors outside of the formal land framework which may influence people's sense of security must be taken into consideration. A common feature of indigenous land tenure systems in Sub-Saharan Africa is the fact that rights to farm land are established through use. Once land is cleared and crops are planted, rights to the land and the produce are removed from clan or kinship control and vested in the individual cultivator. When use is discontinued, the land reverts to the common pool. One factor often overlooked in operationalisation of land tenure security is the fact that rights to a piece of land are virtually never lost while the said land is under cultivation. The rights tend to become weaker if land is fallowed or use is discontinued for relatively extended periods (Goldstein and Udry, 2006; Quisumbin et.al., 2001). This implies households would feel more secure with plots they can fallow or vacate for technically optimal periods of time without losing their rights to the plots.

3. EMPIRICAL ANALYSIS

3.1 Econometric Specification

Given the diverse approaches to measurement tenure security, we set out a do comparative analyses of how the various measures and proxies of tenure security affect household farm investment decisions.

The farmer, bases his investment decisions on his level of tenure insecurity (which has been variously measured) and chooses between investments in capital equipment, which is not lost in the event that he/she loses his rights to land, and long-term soil improvement and irrigation-related investments, which are completely lost in an eviction. The model of this paper draws from the framework employed by Feder and Onchan (1987) which has also been applied by several studies including Place and Hazell (1993) in Ghana, Rwanda and Kenya; Hayes and Roth (1997) in Gambia. Unlike Place and Hazell (1993) and Hayes and Roth (1997), this study adds the dimension of investment in the development of irrigation structures.

Based on the theory and the large body of empirical research undertaken on the subject of land tenure and farm investment across a number of African countries (Clay et.al. 1998; Feder and Feeny, 1993; Hagos and Holding, 2006), the study specifies an estimable empirical model as:

$$\sum_{t-1}^{T} I_i = f\left(tenure, wealth_{T=1}, H_{T-1}^{c}, plot, return, \ market, crop, Zone\right) \tag{1.1}$$

where: $\sum I_i$ measures household conservation and irrigation investment in plot i. The study measured this by the GH¢ value of conservation investment in soil and water and irrigation related investments. The survey solicited household responses on whether they made investment in soil and water conservation and irrigation and if so how much (GH¢ expenditure) was invested. The tenure variable represents factors that influence the farmer's expectation of retaining tenure or his land rights such as whether the plot is owner operated, rented, temporally transferred (loaned). The duration of tenure is also included and is expected to improve farmers perceived tenure security. The $wealth_{T-1}$variable denotes household wealth and asset holdings including relative farm size, livestock holdings, labour and other resource endowments. H_{T-1}^{c} represent household demographic characteristics such as age and education of household head. The variable plot represent farm characteristics such as soil type, drainage, degree of fragmentation (ratio of total number of parcels to total farm size), and access to irrigation. The vector $market$ measures market access variables such as borrowing and access to agricultural extension information. The variable $crop$ denotes the type of crop cultivated, either short duration crops or annuals or perennials that require land for several seasons. The $Zone$ variable controls for location fixed effects such as distance to markets, population density and rainfall.

The household soil conservation and irrigation investment decision making is assumed to happen at two levels. The household first decides whether to invest or not to invest and upon deciding to do the latter, make decision on the level of investment. Both the decision to invest and the level of investment are influenced by factors including those outlined in the empirical model (equation 1.1). The level of conservation is given by

$$I^{L} = X_1\beta_1 + \varepsilon_1 \tag{1.2}$$

where I^{L} is the level of household conservation investment which depends on the vector of X_1 explanatory variables outlined in section 1.1.

The decision to invest or not is given by

$$I^{D} = X_2\Omega_2 + v_2 \tag{1.3}$$

Where $\left(X \ \ and \ \ I^{D}\right)$ are observed, whereas I^{L} is observed only when $I^{D} = 1$.

The model assumes that ε_1 and v_2 is independent of X with mean zero implying that X is exogenous, and $v_2 \sim N(0, 1)$. Given such a model, if the error terms in Equations (1.2) and (1.3) are related, they must first be estimated jointly given the premise that the household chooses whether to invest and then, having decided positively chooses the level of conservation investment. This implies there could be problems of selection bias hence requiring that the two equations be estimated jointly. The estimation procedure therefore involved testing for the presence of selection bias using the Heckman selection model (Heckman, 1979), and examining the likelihood ratio test of independence.

We specify four investment functions each with identical non-tenure security related covariates but different proxies and indicators of land tenure security. In the first function, tenure security is measured by land titling, where it is assumed plot holders with formal land title documents are relatively more secure compared holders with undocumented rights over land. The self-reported binary indicator of perception of the degree of tenure insecurity is used in the second function as a measure of tenure security, while tenure security measured by the ability to maintain rights to plots or lands fallowed over a period of time is used as a proxy of tenure security in the third function. The fourth function uses the mode of acquisition and the form of rights exercised over land as proxies of tenure security.

3.2 Data Description

The data used in this paper was from 2,928 farm households in 23 districts across Ghana, divided into three zones namely, the Northern Agriculture Zone (Northern Region), the Afram Basin (Ashanti and Eastern Regions), and the Southern Horticultural Belt (South-East Coastal Plains). Known as the Farmer Based Organisation survey, the data collected by the Institute of Statistical, Social and Economic Research (ISSER) of the University of Ghana is intended to facilitate the monitoring and evaluation of the Millennium Challenge Compact signed between the government of Ghana and the Millennium Challenge Corporation (MCC) of the United States of America.

The Farmer-Based Organisations survey collected information on the overall living circumstances and farming activities of members of FBOs and their respective households. In-depth household data was collected using two sets of questionnaires; a household questionnaire and a community questionnaire: The survey collected information on a wide range of household attributes including demographic, education and health characteristics; migration; household transfers; information seeking behaviour; household assets and participation in financial markets (borrowing, savings and lending behaviour); household agriculture activities including land ownership and transactions and agriculture processing and, non-farm enterprises of households. Information was also collected on the location of households, community facilities and farm sizes using geographic position system units (GPS). The community questionnaire was essentially a market price survey.

4. RESULTS AND DISCUSSION

4.1 Descriptive Statistic

Table 1 presents description and summary statistics of variables used in the investment models.
We adjusted the standard errors to correct for clustering effects. Only 20% of sampled households are headed by females. Since men have better access and control of land use, we expect that the domination of male-headed households in the sample should lead to a positive and significant sex variable for both the decision to invest and the intensity of investment. Although about 70% of households heads reported to have attended basic school, only about 20% are able to read and write a simple sentence in English.

Only 14% percent of sampled households perceive their tenure status as insecure. The distribution appears to be even across observations in terms of the modes of land acquisition and

forms of land rights. Even though 30% of sampled households hold land titles, only 20% are reported to exercise complete rights over their land. Close to 20% of households purchased their land outright while 30% received land as gifts. Only 1% of land is held in sharecropping arrangements. Even though 80% of sampled households indicated they could vacate their lands and still maintain ownership, the period of time for which they could vacate the plots averaged at 0.5 years. This probably could be an indication of the hypothesized insecurity associated with leaving land idle.

Only about a third of sampled households made land improvement and irrigation related investment. Households invested an average of about 200 hundred Ghana Cedis on land improvement and irrigation. Compared with average value of farm produce and average non-farm income, households invest about 29% of farm revenue (excluding livestock) or 60% of non-farm revenue. We expect the number of years of operating a piece of land as well as the already existing physical structures on the land to strongly influence both the decision and quantum of investment in land. Sampled households have owned and used land for over 9 years on the average with over 10% of the farms enclosing pre-existing physical structures.

Table 1: Descriptive Statistics

Variable and Description	Estimate	Standard Error
Household Characteristics		
Sex (dummy 1= male 0= female)	0.8	-
Age (Number of years)	47.1	12.7
Age square	2257.9	1243.1
Dependency ratio (ages below 15 and above 64/ ages 15 and below 65)	1.1	0.9
Basic education (Dummy 1=attended basic school 0=otherwise)	0.7	-
Literacy (dummy, 1= can read and write; 0=otherwise)	0.2	-
Assets and Wealth variables		
Livestock Holding (in Tropical Livestock Units)	2.5	7.9
Land Holding	12.2	11.7
Value of output (GH¢ value of output per acre)	695.1	3,888.7
Family labour (man hours per season)	270.8	573.5
Non-farm income per household (GH¢)	336.5	2,001.1
Land Tenure and Security Variables		
Perception of tenure security (Dummy, 1= feels insecure; 0= otherwise)	0.1	-
Complete rights (dummy, 1= exercises complete; 0= limited rights)	0.2	-
Ownership with deed (Dummy, 1= registered land with deed; 0= otherwise)	0.3	-
Gift land (Dummy, 1= received land as gift; 0= otherwise)	0.3	-
Purchased land (Dummy, 1= purchased and paid cash for land; 0= otherwise)	0.2	-
Sharecropped land (Dummy, 1= land acquired under sharecropping; 0= otherwise)	0.1	-
Possibility of fallowing/vacation of land (Dummy, 1= could fallow; 0= otherwise)	0.8	-
Period of fallow/vacation of land (number of years)	0.5	0.7
Years of land ownership (Number of years)	9.1	6.7
Probability of investment in land	0.3	-
Intensity of investment land	202.5	846.7
Number of physical structures	0.1	0.5
Crop and Location Variables		
South (Dummy, 1= southern horticultural belt; 0= otherwise)	0.2	-
Northern agricultural zone (Dummy, 1= northern agricultural zone; 0 =otherwise)	0.4	-
Cash crops (Dummy, 1= cash crops; 0 = otherwise)	0.1	-
Plot Characteristics		

Index of land fragmentation (Number of plots/ acre)	1.6	1.8
Access to irrigation (Dummy, 1= irrigated, 0= land rain-fed)	0.1	0.3
Soil water retention (Number of hours it takes for soil to lose moisture)	21.4	70.1
Ratio of zonal to household farm	0.9	0.0
Market Access and Participation		
Receive extension visits	0.5	
Distance to major market (Kilometers)	2.3	16.5
Borrowing (Dummy, 1= has borrowed; 0= has not borrowed)	0.2	

4.2 Land Tenure Security and Farm Investment Decisions

First, we test for sample selection bias using a Heckman two-step model (Deaton, 1997). We also presumed there could be heteroskedasticity given that the data was cross-sectional and therefore adjusted the standard errors for within-district cluster correlation (Wooldrige, 2002).

The Heckman test for sample selection bias tests the null hypothesis of $H_0 : \rho\varepsilon_1 v_2 = 0$ against the alternative hypothesis $H_A : \rho\varepsilon_1 v_2 \neq 0$. The measure of correlation between $\varepsilon_1 \; and \; v_2$ is the correlation coefficient ρ. If the null hypothesis of $\rho\varepsilon_1 v_2 = 0$ is rejected then the decision to invest equation (the sample selection equation) and the level of investment (outcome equation) cannot be said to be independent and thus must be estimated jointly by the Heckman technique. Table 2 presents the result of the Heckman sample selection test. The Wald's test of independence indicates that $\rho\varepsilon_1 v_2$ is not significantly different from zero hence failure to reject the null hypothesis $H_0 : \rho\varepsilon_1 v_2 = 0$. As indicated, the significance of this result is that money value of investments) could be treated as two independent equations and estimated separately.

Table 2: Heckman Sample Selection Test

Heckman Sample selection model	Statistics	P-Value
Rho	-0.0502	
Wald test of independence of equations (rho = 0):	$\chi^2 = 0.42$	Prob > χ^2 = 0.5194

Source: Author's computations using MIDA FBO Survey, 2008

The binomial probit and censored regression (Tobit) models were used to estimate the decision to invest and level of conservation and irrigation investments, respectively. The standard Probit and Tobit models may be formulated as

$$y_i^* = x'_i\beta + \epsilon_i$$
$$y_i = 1 \; if \; y_i^* = 1$$
$$= 0 \; otherwise$$
$$y_i^* = x'_i\beta + \epsilon_i$$
$$y_i = y_i^* \; if \; y_i^* > 0$$

$= 0 \; if \; y_i^* \leq 0$ (5.1)

where I = 1, 2, . . . ,N, and ϵ_i is assumed to be NID (0, δ^2) and independent of x_i . This model is a censored regression model where observations may be censored from below. To correct for possible heteroskedasticity, robust standard errors are estimated.

Two dimensions are relevant in the analysis of the relationship between land tenure and farm investment, the costs and returns associated with the investment under consideration and the time required to reap returns to investment. The costs of investments, the time horizon of expected stream of benefits and land ownership/tenancy arrangement combine to influence farmers' investment decisions. While farmers may use complementary inputs such as fertiliser, chemicals or improved seed without worrying much about the rights gamut they hold over their land, the same cannot be assumed with regards to investments in long-term soil improvements and irrigation which are more costly and the returns harvested over extended periods of time. With long term investments in land, it is expected that farmers would evaluate the time dimensions involved in reaping the stream of future returns to investments as well as the risk factors including the probability of losing rights to land and only make long-term investments if their evaluation of inherent risks are favourable.

Table 3 present regression results of the determinants of household soil and irrigation investment decisions. We hypothesised that tenure security (or insecurity) is an important determinant of the farmer's decision to invest in land improvement and irrigation. Since the paper sought to do a comparative assessment of the multiple indices and proxies used in land tenure research, we estimated four models in each case as outlined in section 3.1. As can be seen in table 3 many of the other covariates with the exception of tenure security variables have remained relatively stable in terms of magnitudes and direction across the four models. Much of the discussion would therefore focus on highlighting the explanatory power of the different proxies of tenure security rather than entire model.

The degree of security measured by land titling (Model I) and perception of insecurity (Model III) did not significantly explain households' decision to invest. Land tenure security proxied by mode of acquisition and land control variables (Model IV) produced mixed results. While sharecropped land exhibited the expected negative relationship with the decision to invest, lands purchased outright had an unexpected negative signed. Having full control over land (including the right to transfer) was also not significant. In Model II, tenure security was measured in terms of whether households could vacate their lands and still maintain ownership and if they did how long they could do so. The number of years households could vacate/fallow their land had a significant positive effect on investment at the 1% level. Tenure security measured by the binary indicator of the perception of insecurity (Model IV) did not exert a significant influence on the probability of households of investing in long-term land improvement and irrigation.

The effect of household resource endowment on the decision to invest was found to be mixed. Household livestock (in TLU) holding and household labour were significant but the latter was without the expected sign. Location and crop characteristics were also found to have significant

effects on the decision to invest. Compared with the Affram Basin, Households located in the Northern agricultural zone had lower propensities to invest.

Table 3: Maximum Likelihood Estimates of the Determinants of the Decision to Invest

Variable	**Model I (n = 2,928)**		**Model II (n= 2,928)**		**Model III (n = 2,928)**		**Model IV (n = 2,928)**	
Household Characteristics	Coeffi-cient	Robust Standard error	Coeffi-cient	Robust Standard error	Coeffi-cient	Robust Standard error	Coeffi-cient	Robust Standard error
Sex	0.062	0.072	0.0085	0.074	0.034	0.071	0.023	0.072
Age	0.017	0.003***	0.0198	0.003***	0.017	0.003***	0.017	0.003***
Age square	-0.002	0.003***	-0.000	0.003***	-0.002	0.001***	-0.005	0.003***
Dependency ratio	-0.022	0.0248	-0.019	0.025	-0.020	0.238	-0.017	0.023
Basic education	0.055	0.023*	0.0592	0.023*	0.059	0.022**	0.057	0.022*
Ability to read and write	0.141	0.047**	0.1522	0.049**	0.105	0.046*	0.086	0.0473*
Assets and Wealth								
Livestock Holding (in TLU)	0.006	0.002*	0.007	0.003*	0.006	0.002*	0.0066	0.002*
Land Holding	0.008	0.006	0.004	0.006	0.016	0.006	0.0006	0.006
Value of output	-0.002	0.009*	-0.012	0.001	-0.001	0.000*	-0.001	0.0001
Family labour	-0.001	0.000***	-0.013	0.003***	-0.007	0.003*	-0.007	0.001*
Land Tenure Security								
Sharecropped land							**-0.107**	**0.056***
Purchased land							**-0.510**	**0.092****
Land title	**-0.049**	**0.058**						
Years of land usage	0.013	0.011	0.014	0.003***	0.011	0.003***	0.012	0.003***
Duration of land contract	-0.002	0.011						
Dispute	0.131	0.098	0.139	0.112	0.072	0.129	0.138	0.097
Following/vacation of land			**-0.022**	**0.067**				
Period of fallow/vacation			**0.561**	**0.026*****				
Perception of tenure insecurity					**0.082**	**0.090**		
Complete rights							**-0.037**	**0.049**
Crop and Location								
Southern horticultural belt	0.014	0.065	-0.028	0.067	-0.021	0.064	-0.064	0.064
Northern agricultural zone	-0.262	0.069*	-0.293	0.071***	-0.248	0.068***	-0.272	0.069***
Distance to major market	-0.003	0.001*	-0.003	0.001	-0.003	0.001*	-0.003	0.001**
Cash crops	0.178	0.084*	0.061	0.086	0.213	0.082*	0.249	0.083**
Plot Characteristics								
Ratio of zonal to farm size	-0.151	0.075*	-0.093	0.076	-0.123	0.074	-0.039	0.074
Index of land fragmentation	-0.029	0.040	-0.025	0.042	0.009	0.040	0.009	0.040
Access to irrigation	0.304	0.068***	0.373	0.069***	0.317	0.065***	0.325	0.065***
Drainage	0.002	0.001	0.121	0.054*	0.004	0.002*	0.045	0.002
Number of physical structures	0.109	0.052*	0.041	0.002	0.107	0.051*		
Market Access and Participation								
Receive extension visits	-0.061	0.045	-0.138	0.046***	-0.077	0.044*	-0.090	0.044*
Borrowing	0.188	0.050***	0.156	0.051**	0.156	0.048**	0.155	0.049**
Constant	-0.596	0.141***	-0.877	0.157***	-0.607	0.138***	-0.512	0.140***
Log pseudo likelihood	2621.6		-2444.1		-2741.0		-2723.2	
Wald χ^2	192.1		591.8		173.4		206.9	
Prob > χ^2	0.000		0.000		0.000		0.000	
Pseudo R^2	0.035		0.136		0.031		0.037	

4.3 Land Tenure Security and the Intensity of Investments

The level of soil conservation and irrigation investment was measured by the amount (GH¢) spent by the household to improve and conserve soil water and fertility as well as on irrigation. Table 4 presents the determinants of the intensity of land improvement and irrigation investment. Compared to the results of the probability of investment (Table 3), differences in the amounts spent by households in soil conservation and irrigation were to a great extent explained by resource endowment variables than by the differences in types of land use and ownership arrangements.

Although land titling was found to exert a significant influence on the amount of money households invested on land improvement and irrigation, the negative coefficient sign indicating an inverse relationship between possession of land title and land investment expenditure was inconsistent with both the theory and apriori expectations. This observation could be a vindication of assertions that farm owners without land title are never actually faced with eviction as long as the said piece of land remains in agricultural use and the occupant continues to use the land. Tenure security measured by the duration of fallow or vacation of farmland (Model III) was significant at 1%, consistent with results from the selection equation . The consistency in the level of significance and sign of the duration of fallow/vacation of land variable could mean that the widely accepted measures of land tenure security such as title documentation, rights gamut and the binary perception of insecurity may not adequately capture what constitute tenure security within the context of Ghana's plural land tenure system.

Three of the indicators of household wealth/influence included livestock holding (TLU), land holing in acres and value of farm output were significant and had positive coefficient signs. Value of farm output and TLU were significant in almost all four models. The plausible explanation is that households gaining from their farms may have more resources to devote to soil improvement investment as well as the incentive and capability to invest to either maintain or further enhance productivity.

The signs of the education variables were mixed. Attaining basic education had a negative coefficient sign contrary to expectation. The ability to read and write exerted a significant positive effective on the amounts households invested in all four models. We believe that household heads who are able to read may be better informed about inputs, technology as well as land tenure related issues thus enabling them better evaluate risks and opportunities better.

Plot characteristic variables such drainage and access to irrigation were significant across all four models. The ratio of zonal to household farm size had a negative coefficient sign. This is consistent with expectations as households' with farms larger than the community's average investing more. Access to irrigation exerts a significant positive effect on the investment intensity. It was expected households would invest more in plots with alternative sources of watering as risks imposed by unpredictability of rainfall is greatly diminished. We did not have any specific expectation regarding the sign of the drainage variable.

Table 4: Determinants of the Intensity of Land Improvement and Irrigation Investment

Variable	Model I		Model II		Model III		Model IV	
	Coeffi-cient	Robust Standard error	Coeffi-cient	Robust Standard Error	Coeffi-cient	Robust Standard error	Coeffi-cient	Robust Standard error
Household Characteristics								
Sex	89.756	26.491**	91.218	26.442**	88.357	26.735**	92.520	26.862**
Age	-3.477	0.991***	-3.008	0.957**	-3.024	0.966**	-3.154	0.9619**
Age square	0.007	0.009	0.003	0.009	0.005	0.009	0.004	0.009
Dependency ratio	22.122	6.661**	13.176	6.177*	15.489	6.314*	13.527	6.317*
Basic education	-31.174	10.315**	-28.954	10.009**	-28.427	10.153**	-32.851	10.298**
Ability to read and write	49.873	18.484**	45.387	17.753*	44.975	18.008*	48.167	18.478**
Assets and Wealth								
Livestock Holding (in TLU)	3.502	2.392	5.453	2.023**	5.459	2.192*	4.343	1.983*
Land Holding	24.049	6.458***	21.453	6.327**	23.154	6.505***	22.355	6.258***
Value of output	0.201	0.045***	0.213	0.048***	0.201	0.045***	0.215	0.048***
Family labour	0.047	0.044	-0.015	0.021	-0.011	0.025	-0.016	0.024
Land Tenure Security								
Sharecropped land							**-8.998**	**22.238**
Purchased land							**39.941**	**31.277**
Land title	**-111.611**	**26.033*** **						
Years of land usage	-2.810	3.365	-2.045	1.000*	-2.053	1.030*	-3.003	1.079**
Duration of land contract	**0.140**	**3.398**						
Dispute	6.875	32.156	23.632	34.800	21.513	42.728	4.433	32.043
Following/vacation of land			**24.639**	**26.904**				
Period of fallow/vacation			**0.759**	**0.164*** **				
Perception of insecurity					**-5.648**	**31.506**		
Complete rights							**60.885**	**17.464**
Crop and Location								
Southern horticultural belt	166.543	38.435***	150.62	37.783***	158.746	38.422***	159.71	37.783***
Northern agricultural zone	-189.510	35.934***	-159.092	33.172***	-180.523	35.010***	-165.613	35.164***
Distance to major market	-1.521	0.790*	-1.027	0.792	-1.055	.789547	-0.601	0.798
Cash crops	-133.483	26.505***	-134.422	26.600***	-136.551	26.873***	-147.142	27.398***
Plot Characteristics								
Ratio of zonal to farm size	-167.505	76.382*	-140.352	75.283*	-157.479	76.732*	-151.791	74.936*
Index of land fragmentation	-4.276	17.870	6.952	18.813	4.016	18.767	10.907	19.207
Access to irrigation	66.408	24.693**	49.343	22.224*	53.074	23.075*	50.047	22.552*
Drainage	-0.478	0.159**	-0.579	0.176**	-0.580	0.177**	-0.563	0.182**
Number of physical structures	-66.150	16.295***	-50.521	15.789**	-57.943	16.326***		
Market Access and Participation								
Receive extension visits	-75.480	18.273***	-70.906	17.409***	-78.667	18.072***	-60.219	17.416**
Borrowing	-7.226	23.393	-0.694	22.837	-1.817	23.923	-2.774	22.836
Constant	85.983	52.403	39.126	58.420	63.649	52.497	47.515	52.968
Log pseudo likelihood								
F	(25, 1478)	= 11.1	(25, 1601)	= 15.6	(24, 1517)	= 11.5	(26, 1601)	=14.4
Prob > F		= 0.000		= 0.000		= 0.000		= 0.000
Pseudo R^2		= 0.021		= 0.02		0.019		= 0.02
Uncensored observations		= 1142		1236		1168		1236
Left-censored observations		= 361		390		373		390

5. Conclusions and Implications

Even though the empirical findings of this study does not offer clear-cut proposals for resolving the challenges encountered in the attempts to evaluate the impacts of tenure security on farm investments and land productivity, it at least joins the growing literature advocating an out-of-the-box approach to land tenure research in Ghana and by extension Sub-Saharan Africa. The results of this study raises questions of what has come to be known as failure of the neo-classical hypotheses of land tenure in Africa. The question of what constitutes a failure of the neoclassical hypotheses of land tenure appears more ambiguous if the findings of this study are anything to go by. While land tenure security defined as land titling produced mixed results as is the case with many preceding studies (Migot-Adholla et.al., 1991; Dzanku, 2008; Twerefou, et.al, 2011), land tenure security proxied by the length of time households are able to maintain ownership even when they vacate such plots significantly explained household investment and is consistent with Goldstein and Udry (2006).

The strutting of land title as the ultimate form of tenure security with little understanding and appreciation of the relevant corresponding customary authentications represent a profound lapse in the measurement of tenure security. In pluralistic land tenure regimes such as the one in Ghana, formal titles that are not recognised and supported by customary structures and institutions may well serve as sources of insecurity. It is therefore worrying if the relationship between farm investments and tenure security in Ghana and for that matter much of Sub-Saharan Africa is described as weak based on the narrow definition of land tenure security as land titling.

Failure to observe the anticipated strong relationship between land tenure security on the one hand and farm investment or productivity on the other hand can only be described as a failure of the notions of superiority of land titling and not the failure by farm households to take into account their land tenure security in investment decision making. The registration of agricultural land is widely uncommon in many farming regions of Ghana. It is mostly non-agricultural land or lands being transferred from agricultural uses that are registered. It is therefore plausible that farm investments in such plots decline.

Sharecropping is perhaps the most undesirable of land use arrangement, widely perceived in theory as inefficient and less amenable to innovation and efficiency-enhancing technology adoption. One argument often advanced in favour of individualisation of land rights is the perceived control of the production processes. The assumed lacks of control over investment decisions as well as the harvesting returns under sharecropping forms the basis of Marshall's thesis of 1890. Our results show that the cultivation of sharecropped land did not exert a significant influence on the amounts households invested in land improvements and irrigations. Having complete rights over land also did not significantly influence the intensity of household farm investments. While the basic tenets of the Marshallian theory remain relevant, it is important to note sharecropping has undergone tremendous transformations over the years leading to the emergence of numerous variations of sharecrop arrangements that enhances the security of the tenants.

There is virtually no disagreement in terms of how land rights are secured under customary land arrangements. Plot holders' rights to farmland are rarely contested if the holders continue to cultivate such plots. In instances where plot holders are able to exert some influence on

customary land institutions at the community level they improve the recognition of their entitlement over farmlands they cultivate and thus in some instances are ablel maintain ownership even when they vacate or fallow the plots. This form of tenure security has been overlooked by researchers. While not disputing the scientific plausibility of the approaches adopted to investigate the land tenure security investment nexus, this paper has underline the importance of adopting approaches that adequately capture the underlying issues of tenure insecurity within local contexts.

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