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Full Length Research Paper

Land tenure security, investments and the environment in Ghana

Daniel Kwabena Twerefou*, Eric Osei-Assibey and Frank Agyire-Tettey

Department of Economics, University of Ghana, Accra, Ghana.

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Using a nationally representative data obtained from a survey, this study attempts to examine empirically two main issues: first, the causal relationship between land tenure security and investment and secondly, the impact of tenure security (land rights) on environmental degradation. Analysis of the results indicates that investment in farmlands in Ghana is low and appears not to enhance tenure security and that the reverse causation of tenure security enhancing investment seems non-existent. This implies that agricultural investments in the country are not security-induced and that investment is not an important determinant of tenure security. However, tenure security appears to be an incentive for investment in that when endogeneity was not controlled, tenure security had a positive and significant impact on investment though the result is not robust. This implies that farmers with tenure security are more likely to invest in their lands, which may eventually lead to higher productivity. Furthermore, our results indicate that tenure security (land rights) has no significant impact on environmental degradation apart from the destruction of vegetation cover, which appears to be a major environmental problem in Ghana. General and specific policy recommendation aimed at improving tenure security and investment in land are explored.

Key words: Land tenure security, agriculture and environment.

INTRODUCTION

Ghana is well endowed with natural resources, including farmlands, rangelands, forests, wildlife, minerals and water. Yet the country's use of these resources in an efficient, equitable and sustainable manner for poverty reduction and wealth creation is unimpressive. The fragility of Ghana's environment coupled with population growth and insecure land tenure system has led to changes in investment, food security and efficient conservation of the environment. For instance, inefficient farming practices brought about by low agricultural investment and the quest to increase mineral exploitation has led to shortened fallow periods, decreased access to water, soil erosion, land degradation, deteriorating range lands, deforestation, desertification as well as land and resource-related conflicts. As land use patterns have changed, so also has the pattern of land tenure and land ownership, which has seen an evolution from communal and open access ownership to private ownership with an increasing trend towards land sale.

Land tenure security is essential in stimulating the development of land since many local and foreign investors are hesitant to invest in land when tenure is insecure. Tenure security has the potential of increasing credit use through greater incentives for investment, enhancing the collateral value of land, facilitating land transfer from less efficient to more efficient users, reducing the incidence of land disputes and raising productivity through increased agricultural investment. The reverse may also be true. Investment in land can also lead to improvement in tenure security in that, investors would like to secure the land once they have made some investments in it. The lack of land tenure security could also bring about environmental degradation. Efficient property rights play an important role if the land market in Ghana is to operate efficiently

*Corresponding author. E-mail: twerefou@yahoo.co.uk or twerefou@ug.edu.gh. Tel: +233 244603676.

and bring about good environmental management. One of the major barriers to development in Ghana is the inability to convert property such as land into usable assets, which is largely due to the lack of clear-cut and legally recognized property rights. This has resulted in tenure insecurity, conflicts and bad environmental practices. While many studies argue that efficient private ownership leads to good environmental practices, others hold the opposite view.

The causal relationships between land rights and investment as well as land rights and the environment have received relatively little attention in Ghana. Thus, the research questions that arise are: (1) What is the causal relationship between tenure security and investment; do farmers in Ghana undertake investment in farmlands to ensure tenure security or vice versa? (2) What is the nature of land ownership? (3) Does the mode of acquisition of land in Ghana affects one's rights (tenure security) in holding or transferring land? (4) Does tenure security leads to environmental conservation? This paper aims at addressing these issues. Specifically, the objective of this paper is to assess the relationships between tenure security and investment as well as the relationship between tenure security and environmental degradation.

LITERATURE REVIEW

The relationship between land tenure security and investment is more complex than it appears. This is because of the nature of causality. Generally, many studies indicate that secure tenure increases incentives to undertake productivity enhancing land-related investments. There are three main links between land rights and investment incentives and these have been explicitly identified and formally modelled in the literature (Shaban, 1987; Feder and Feeny, 1991; Besley, 1995). The first link captures the positive relation between the tenure security and investment incentives (Jacoby et al., 2002). The second link emphasizes the effect of the rights to collaterise land on the investment incentives (Feder and Feeny, 1991). The third provides a link between investment incentives and land transfer rights (Besley, 1995). Secure individual rights over land leads to higher levels of labour and management effort, which in turn encourages higher levels of investment to protect or enhance land fertility (Feder and Feeny, 1991).

In the area of agriculture, Feder et al. (1988) illustrate that increased tenure security is expected to enhance the productivity of farmers through the intensification effect, which reflects the effects of land tenure security on the incentives to invest, particularly in capital goods attached to land. First, if the farmer believes that he/she will be allowed to reap the long-term benefits of current investments, investment levels are likely to increase relative to a situation where there is tenure insecurity. Secondly, tenure security can increase farming productivity through an increase in allocative efficiency, which reduces the problem of lack of credit faced by farmers with tenure insecurity. Thirdly, with limited access to credit, farmers allocate inputs under quantitative constraints. With secure tenure as collateral, these constraints are eliminated and farmers can borrow freely to increase their application of inputs to profit- maximizing levels. Several studies, for example (Bruce, 1988) have also questioned the direction of causality between tenure security and investment, arguing that tenure security may not cause investment to increase but rather investment may stimulate tenure security.

A careful look at the literature on causality between tenure security and investment reveals that many of the studies lack the approach needed to deal with the problem of causality in the tenure security and investment nexus. Assessing the effect of tenure security on investment behaviour is a difficult task because of the causality problem (Brasselle et al., 2002). A study by the World Bank (Migot-Adholla et al., 1994) on Ghana concluded that tenure security has a clearly positive impact on investment in the Anloga area but a less noticeable impact in Wassa and no influence in Ejura. Besley (1995) used this same data to assess the sensitivity of the results to the estimation methodology used. Besley's study reached the opposite conclusion - that better land rights facilitate investment in Wassa but not in Anloga.

Brasselle et al. (2002) allowed for endogeneity between investment and tenure security in a study on Burkina Faso and found a reverse causality from investment in land to tenure security as farmers use investments such as planting trees to improve their tenure rights over the associated land. Place and Hazell (1993), Sjaastad and Bromley (1997) and De Zeeuw (1997) argue that in Sub-Saharan Africa some land improvements, particularly the planting of trees, is a well-recognized method of enhancing tenure security for holders of temporary or fragile claims. In areas where title acquisition and maintenance involve real expenditures, it is a priori possible that farmers tend to register land parcels that benefit from relatively high levels of investment or those with better profitability conditions justifying such expenditures (Roth et al., 1994). In this case, registration does not stimulate investment but is positively related to it. A recent study on 36 villages in central Uganda concludes that investment enhances tenure security, yet the reverse is not true (Baland et al., 1999).

In environmental economics, a major bone of contention is which regime of property rights is appropriate for environmental resources management. Hardin (1968) established that open-access to lands leads to the depletion of resources and environmental goods, which he referred to as the 'tragedy of the commons'. The assumption made by Hardin is that rationalprivate owners would never knowingly exploit their resources to destruction. However, according to Clark (1973) and

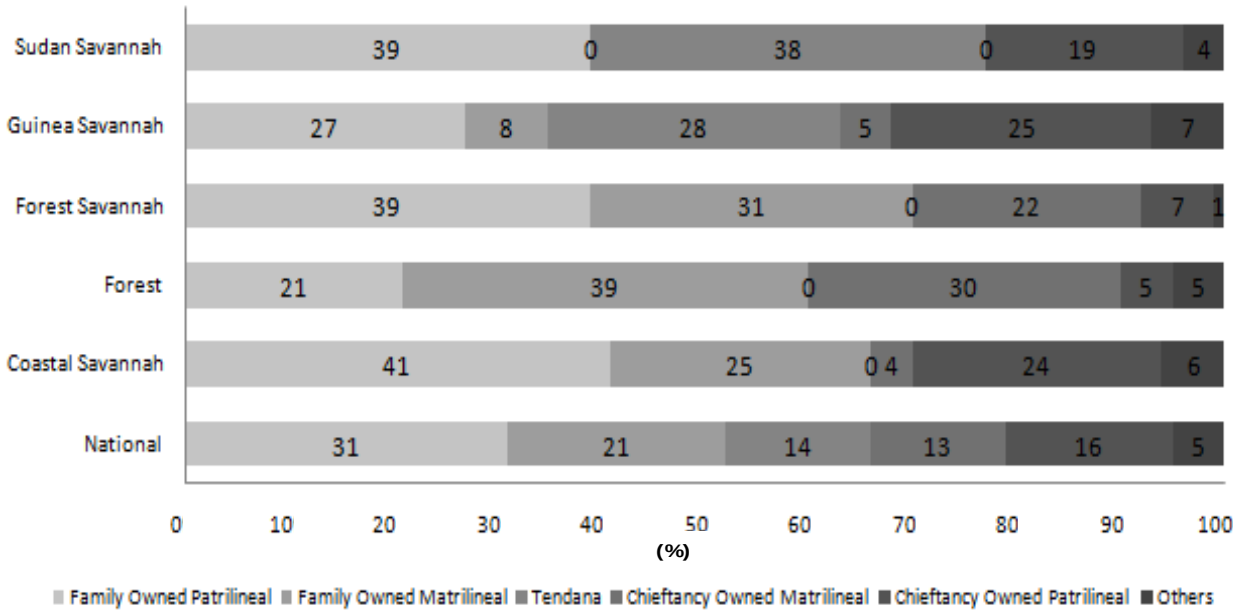

Figure 1. Land tenure system by ecological zones. Source: ISSER Land Survey.

Afeikhena (2002), this assumption is empirically unfounded as studies have shown that individual private owners have often done exactly what Hardin assumes they would not do. Clark (1973) provides an example to support this assertion. Empirically, Heltberg (2002) found that land tenure security leads to natural resources being used in a conservable and sustainable manner, but this was contrary to the findings of Lutz (1998), that in Central America, increasing concern over deforestation and environmental degradation has motivated renewed attention being paid to land titling and the securing of property rights. Foltz et al. (2000) found for the north-western Nicaragua that formal types of land-tenure were positively related to the number of trees on the property. However, Faris (1999) established a negative correlation between land rights and the number of trees on the property in the southwestern Nicaraguan agricultural frontier. The explanation given is that wealthier landowners, who were found to possess formal titles, had a greater propensity to cut down trees for the purpose of raising cattle.

METHODOLOGY

Both secondary and primary data were use for the analysis. The secondary data was obtained by assembling relevant literature from published works in the form of books, magazines, articles and other publications. Data gap emanating from the desktop research was addressed with the help of the nationally representative survey of 2,690 households conducted by the Institute of Statistical Social and Economic Research (ISSER) of the University of Ghana. About 77 and 24% of the respondents were male and female-headed households respectively. Also, about 27% of the sampled households had no formal education, while the remaining 73% had acquired at least some form of formal education. With respect to rural-urban distribution, about 43% of the respondents were from rural areas, 34% from urban areas and the rest were from peri-urban centres. Both descriptive and econometric approaches were used to examine the relationships between tenure security, investment and environment.

Descriptive data analysis

Land tenure system and problems

There are diverse land tenure systems in Ghana, however, family-owned tenure appears to dominate. About 52% of respondents described the land tenure system in their area as family owned. Out of this, 60% had a family-owned patrilineal system of ownership with the remaining having family-owned matrilineal system of ownership. The national and ecological distribution of land tenure system is presented as Figure 1. The *Tendana* system is found in only the Sudan and Guinea Savannah zones. In the forest zones the matrilineal tenure system dominates, particularly among the Ashantis.

Figure 2 provides the national and ecological distribution of the main problems of land tenure. About 48% of the respondents reported that the main problem of land tenure in their area is high land prices followed by disputes between tenants/users, insecurity of tenure and uncertainty about ownership of land. Other problems mentioned include: sales of land without owner's approval, scarcity of land, high land taxes, confiscation of unused land by family or original owners, lack of funds to farm, sole right to land administration by chiefs and *Tendana* and tribalism.

Land rights and ownership

An overwhelming majority of about 88% of the respondents indicated that they own or have controlling access to a piece of land in the district. Out of this, 61% have not registered their lands whereas 59% believed they could transfer their titles (Figure 3 and

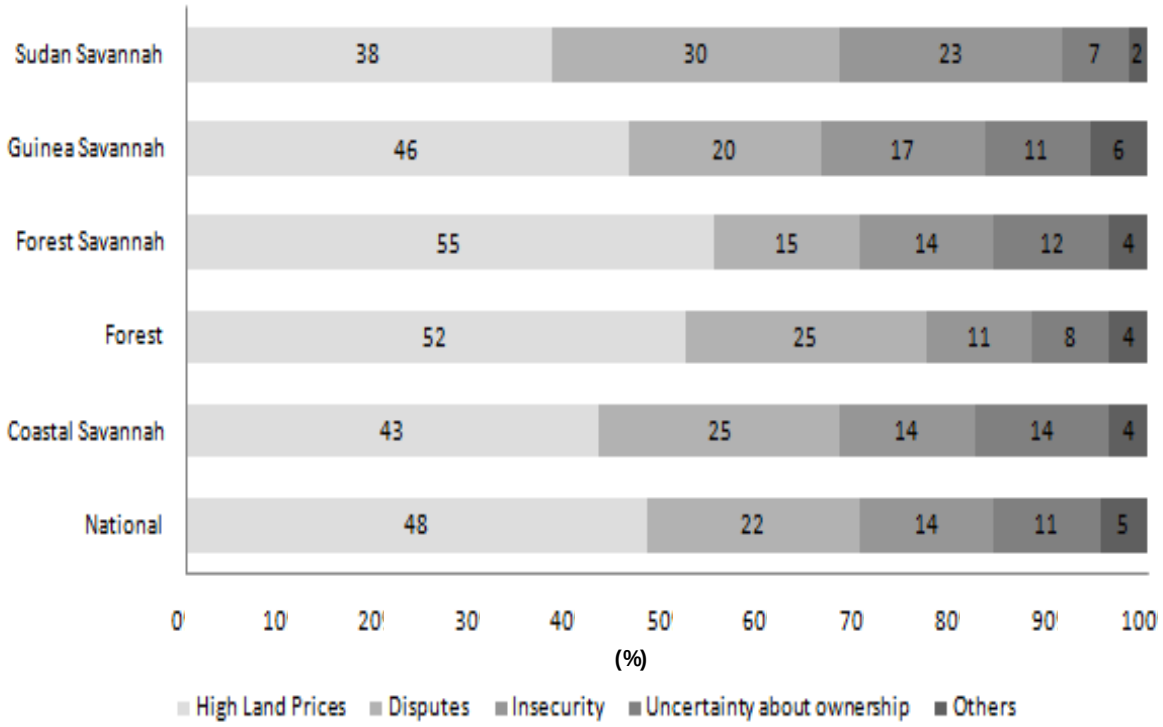

Figure 2. Problems of land tenure by ecological zones. Source: ISSER Land Survey.

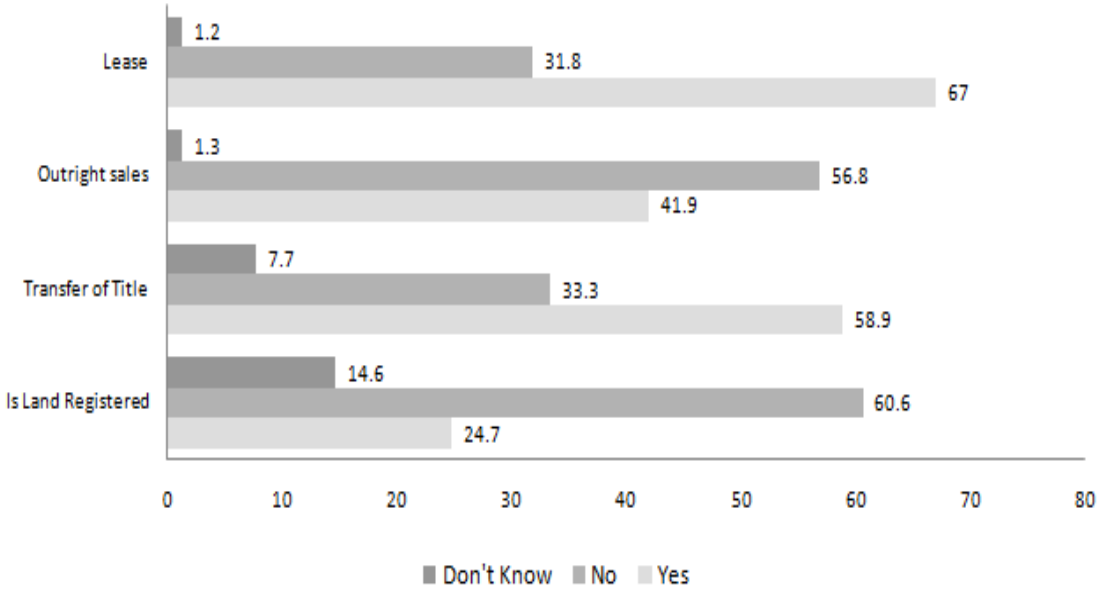

Figure 3. Land rights. Source: ISSER Land Survey.

4). Furthermore, a majority (67%) of respondents who own or have controlling access to a piece of land reported that they can lease it out if they so wished. With respect to outright sale the reverse is the case where a majority of respondents who own or have controlling access to a piece of land reported that they could not sell the land outright. The inability to sell land outright by respondents confirms the ineffective and weak property rights to land.

About 33% of respondents were of the view that Chiefs are the owners of land in their area of residence while 33% reported that families own the lands. About 22% of respondents felt that lands in their area belong to individuals. Other land owners include: the government, traditional council and tribal heads, mining companies and migrants. With the exception of the Sudan savannah zone, chiefs and families own most of the lands in all the ecological

Table 1. Areas of investment in agricultural land by ecological zones (%).

	National	Coastal Savannah	Forest	Forest Savannah	Guinea Savannah	Sudan Savannah
Equipment/ technology/ machines/ tractors	16	16	15	28	9	14
Farmhouse	34	26	54	49	9	11
Irrigation	14	50	8	4	3	3
Road and storage	8	2	11	9	10	3
Transport	19	2	10	10	54	19
Bullock plough	8	3		0	12	50
Others	1	1	3	0	3	0
Total	100	100	100	100	100	100

Source: ISSER Land Survey, 2005.

zones.

Investment in agricultural land

Analysis of the responses indicates that investment in land for agricultural purpose is generally low. About 83% of the respondents indicated that they had not undertaken any capital investment in their land for the past five years.

For those who have made some investments in agricultural lands, the investments were in the areas specified in Table 1. A critical look suggests that most of the investments are not directly in productive areas such as irrigation but rather in non-productive areas such as farmhouses, roads, transport, etc. Major reason given for not making investment on land is the non-availability of funds. Other reasons given include: poor security of tenure, lack of interest in farming, increased interest in developing the land for residential purpose, land belonging to family, small size of land, unsecured location of land for investment, owner too old to invest, infertility of land and farming not being a lucrative job.

Environmental degradation

The results indicate that large-scale farming does not pose major environmental problems. About 72% of the respondents indicated that they had not noticed any environmental problems associated with large-scale farming in their area, 22% responded in the affirmative while 6% did not know whether they had noticed any environmental problems associated with large scale farming in their area. For those who had noticed environmental problems associated with large-scale farming in their area, the major problems were chemical and water pollution followed by deforestation and land erosion as depicted in Figure 4 and 5.

Respondents appear not to be doing much to solve the environmental problems confronting them. About 56% of the respondents reported that they have not made any attempt to solve environmental problems in their area while only 30% responded in the affirmative. The remaining 14% did not know whether they had made any attempt to solve the environmental problems in their area or not. For those who responded in the affirmative, 47% had undertaken erosion prevention measures, 31% had undertaken measures to restore the forest, 13 had undertaken flood prevention measures whiles the remaining had undertaken other measures.

Small-scale farming appears to be the dominant type of farming in the areas surveyed. About 88% of respondents reported that small scale farming is the major farming system practiced in their area. Major environmental problems associated with small-scale farming include: intensive cultivation, decrease in fallow period and lack of irrigation (Figure 6).

Majority (78%) of the respondents reported that the environmental problems in their area have affected output. Measures taken by small-scale farmers to mitigate environmental degradation include: planting trees, education, irrigation, increasing fallow period and punishing people who break by-laws on the environment.

With respect to vegetation cover destruction, 53% of the respondents reported that there had been destruction of vegetative cover in their area while 42% held the opposite view. The remaining did not know whether there had been destruction of vegetation cover in their area or not. The main causes of such destruction were bushfires, harvesting of non-timber forest products and the slash-and-burn system of clearing land for farming (Figure 7). Other causes of vegetation cover destruction include: overgrazing, over-cultivation of land, sand winning, solid and liquid waste disposal.

In general, analyses of the responses indicate that for the country as a whole clearing of large tracts of land for large-scale farming and mining appears not to be problem as indicated in Table 2.

Econometric analysis

Model specification

The econometric test of the causal relationship between tenure security and investment follows closely the approach adopted by Brasselle et al. (2002) with some modification. The modification primarily centres on the measurement of land rights. Due to the limitations imposed by the ISSER survey data, we measure land rights as a discrete variable unlike the work of Brasselle et al. (2002) where land right is measured continuously. Based on this work the following binary response system of equations is specified:

$$I = \alpha + \beta T + \gamma X + u \quad (1)$$

$$T = \delta + \phi I + \lambda W + v \quad (2)$$

$$E = \omega + \Psi T + \Omega Y + \varepsilon \quad (3)$$

Where: *I - is the* observed variable for investment constructed as a dummy.; *T* - is a vector of land rights - lease, transfer and sale rights in a dichotomous form measuring land tenure security; *E* - is the observed variable for environment constructed as a dummy; *X, W* and *Y* are different vectors of exogenous variables; *u, v and* ε are uncorrelated residuals in the investment, land tenure and environmental equations respectively; α, δ and ω are the constants and β, γ, Φ, λ, Ψ and Ω are the coefficients.

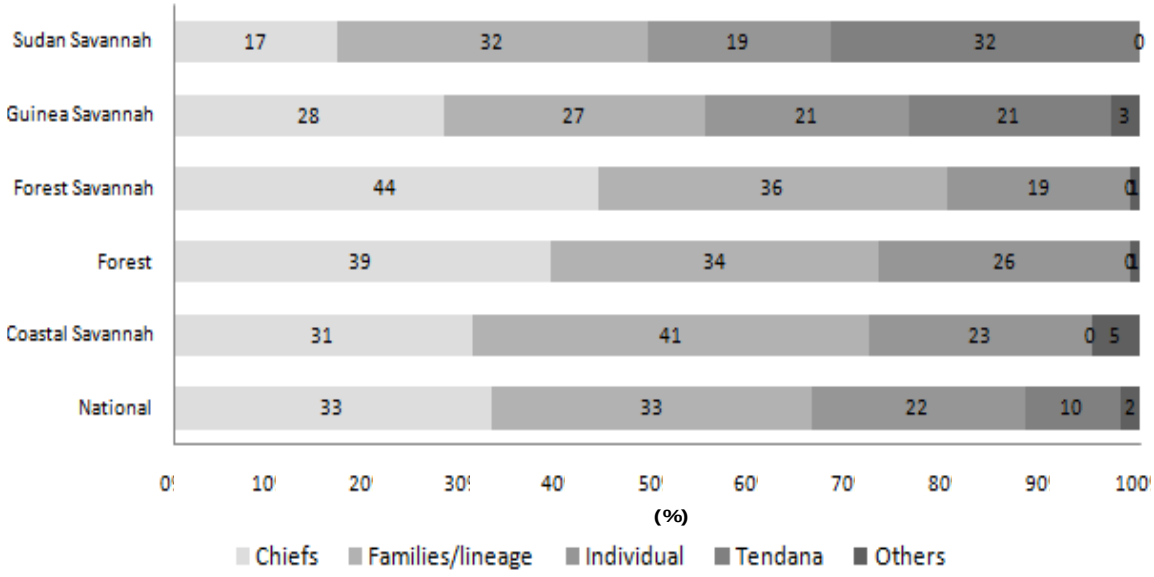

Figure 4. Land ownership. Source: ISSER Land Survey.

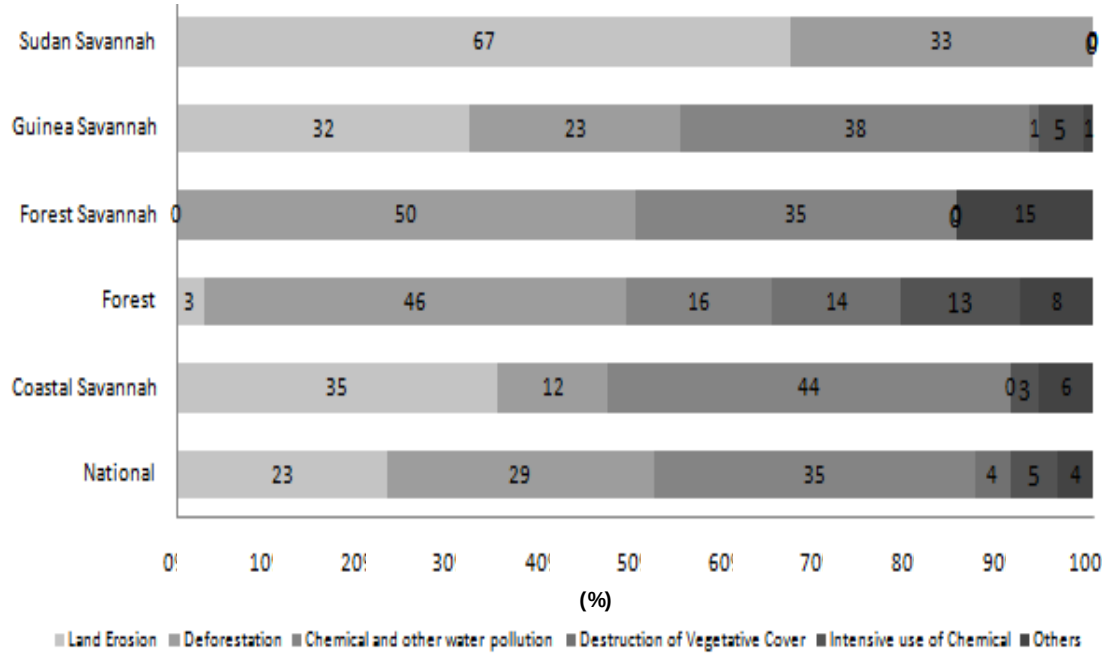

Figure 5. Environmental problems associated with large-scale farming. Source: ISSER Land Survey.

Estimation procedure

In view of the possible bi-directional causation between investment and land rights variables, there is the need to test for endogeneity bias. The study therefore, closely follows the Two-Stage Conditional Maximum Likelihood procedure, which has formally been developed by Rivers and Voung (1989) and used by Besley (1995) and Brasselle et al. (2002). Specifically, we apply the Linear Probability Model (LPM) procedure to estimate Equation (2) to find the impact of investment on land tenure security as measured by land rights. However, the study practically first estimate the reduced form of the investment function (1) that is, Equation (4). It then uses the generated residuals as explanatory variables in the second-stage equation, which is the equation explaining land rights that is, Equation (5). This is done to test for the exogeneity of investment variable in Equation (5).

$$I = w + \theta W + \chi X + u \quad (4)$$

$$T_i = \delta + \phi I + \lambda W + k\hat{u} + v \text{ , i= 1, 2, 3} \quad (5)$$

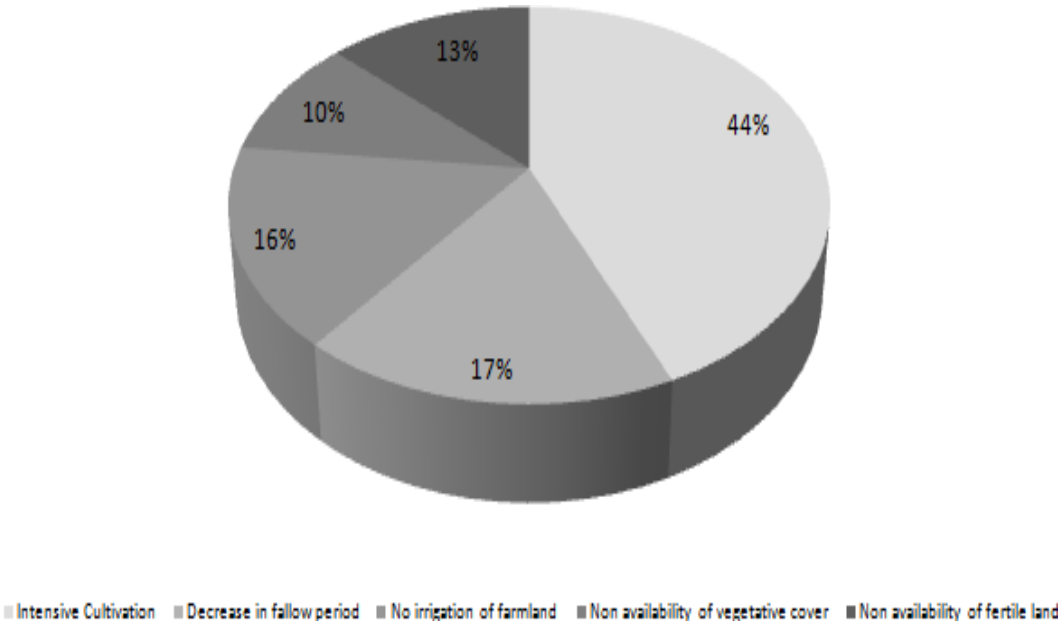

Figure 6. Environmental problems of small-scale farming. Source: ISSER Land Survey.

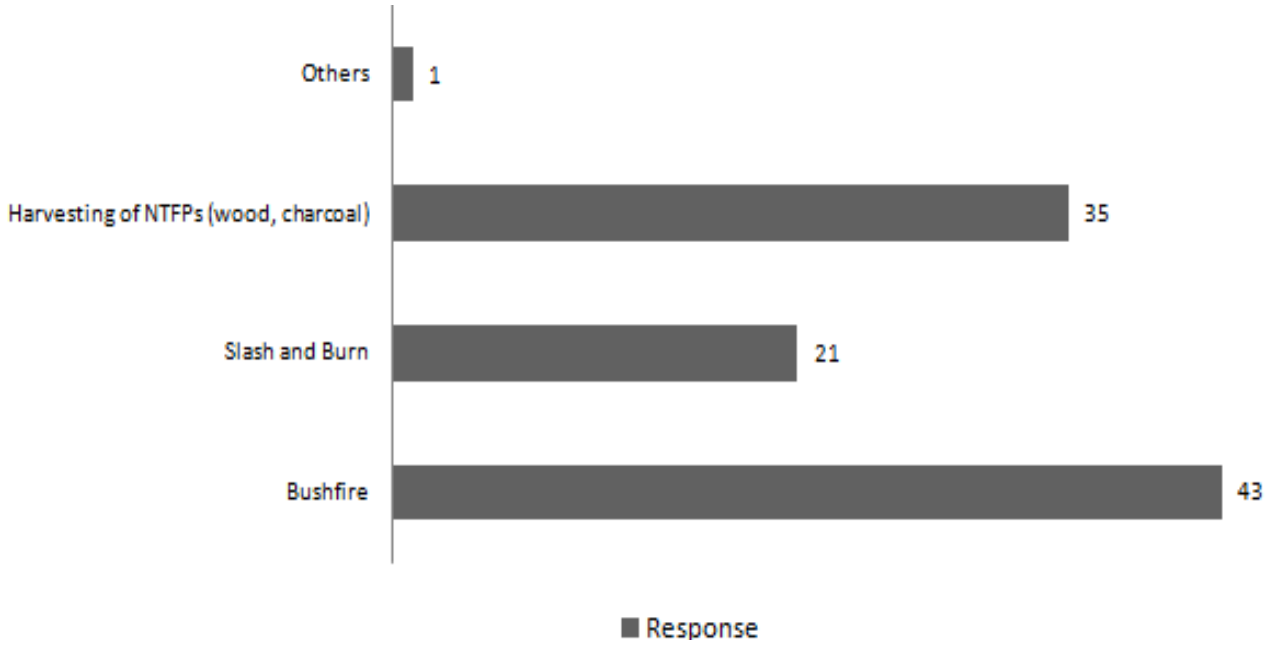

Figure 7. Causes of vegetation cover destruction (%). Source: ISSER Land Survey.

Table 2. Large- scale mining and farming (%).

		Noticed environmental problems associated with large scale farming			
		Yes	**No**	**Do not know**	**Total**
Digging up of land for large scale mining	Yes	23	71	6	100
	No	21	73	6	100
	Do not know	20	60	20	100

Source: ISSER Land Survey, 2005.

Table 3. Description of exogenous variables.

	Exogenous variables in land right equation (*W*)
Personal characteristics	Education (1- education, 0- no education), sex (male = 1; female = 0), age is measured continuously.
Migrant variable	1- respondent is an indigene and 0 if he /she is a migrant.
Nature of land title dummies	1- if it is gift, lease under statutory law, lease under customary law, cash payment and 0 otherwise.
Location dummies	1 if respondent is located in the urban and rural area and 0 otherwise. Each is compared with the peri-urban location.
	Exogenous variables in the investments equation (*X*)
Conflict	1 if the respondent is aware or has been affected by conflict and 0 otherwise.
Type of land	1 if the land is a farmland and 0 if it is for other commercial purposes.
Quality of land	1 if output per acre has increased over the last five years for the major crop cultivated and zero if there is a decrease.
Farm income and size of land	Measured continuously.
	Exogenous Variables in the environment equation (*Y*)
Mining -	1 if there is mining activities in the respondent's community, and 0 otherwise.
Forest destruction	1 if there is any form of vegetation cover destruction and 0 otherwise.
Ecological dummies	Coastal savannah, forest, forest savannah and Guinea savannah zones.

The procedure establishes whether there is simultaneity bias using the criterion of a test of the significance of *k,* the coefficient of *u* (investment residual). If *k* does not significantly differ from zero, then there is no simultaneity bias and vice versa.

The study now turns attention to the procedure involved in estimating the investment function in Equation (1). Here because land rights are proxy by three distinct discrete variables, each is included in the investment function to assess its impact. Therefore, the investment function will have three endogenous binary variables specified as follows:

$$I^* = \alpha + \sum_{i=1}^{3} \beta_i T_i + \gamma X + \sum_{i=1}^{3} \sigma_i \hat{v}_i + u \text{ , for i = 1, 2, 3 (6)}$$

The fourth term on the right hand side in Equation 6 is included to test for the exogeneity of each type of land rights. This variable is the residuals computed and extracted from a reduced-form of LPM for each land rights category as specified in Equation (7). Brasselle et al. (2002) assert that the significance of the coefficient of these variables σ_i would reveal the endogeneity of category i of land rights.

$$T_i = \eta + \partial X + \varphi W + v_i \text{ for i = 1, 2, 3} \qquad (7)$$

Finally, we assess the impact of land rights categories on environment by estimating a simple LPM of environment specified by Equation (8).

$$E^* = \omega + \sum_{i=1}^{3} \psi_i T_i + \Omega Y + \varepsilon \text{ for i = 1, 2, 3} \qquad (8)$$

Measurement of variables

Land tenure security variable: This study makes use of three main land rights that are available to households as reported by the ISSER land survey – transfer rights, lease rights and sale rights. Respondents were asked directly whether they could make an outright sale, transfer their rights or lease out the land completely for a period. These rights are entered as binary variables to measure the individual right effect on investment.

Investment variable: For the agricultural investment variable, respondents were asked whether they had made any major capital investments in their land in the last five years. Six different types of investments were reported. These are investments in new equipment/technology, farmhouse, irrigation, storage facilities, etc. The endogenous nature of tenure security implies that investment can be undertaken not only to increase productivity but also to enhance tenure security. Furthermore, because these investments were not quantified, we were compelled to use dummy variables.

Environment variable: With regard to the environmental model, this study hypothesized that households or communities with land rights (tenure security) are less likely to have environmental problems associated with their farmlands. A number of specific environmental problems that are related to farming activities have been reported in the ISSER land survey. Table 3 describes the measurements of exogenous variables used.

ECONOMETRIC RESULTS

Land right equation

The results (Table 4) shows that the coefficients on the

Table 4. Land rights equation estimations.

Variable	Lease right	Sales right	transfer right
Age of respondent	0.006 (0.004)	0.014*** (0.004)	0.005** (0.004)
Education (1 education, 0- no education	-0.100 (0.151)	0.149 (0.141)	-0.415*** (0.139)
Migrant	0.886*** (0.138)	0.434*** (0.135)	0.809*** (0.135)
Sex (male = 1; female = 0)	0.777*** (0.174)	0.246 (0.170)	0.321**(0.165)
Rural location	0.445*** (0.171)	-0.653***(0.162)	0.124 (0.161)
Urban Location	0.486** (0.205)	-0.390** (0.188)	0.184 (0.190)
Gift	1.156*** (0.202)	0.474*** (0.154)	0.263* (0.298)
Lease under law	0.674 (.652)	-0.332 (0.275)	-1.710** (0.822)
Lease under customary	-0.034 (0.177)	-0.253 (0.187)	-0.642*** (0.178)
Cash payment	1.689*** (0.307)	0.980*** (0.247)	0.779*** (0.253)
Investment	-2.086 (1.225)	1.513 (1.21)	-0.186 (1.125)
RES_9	1.948 (1.238)	-1.309 (1.132)	0.535 (1.138)
Constant	-0.941*** (0.327)	-1.727***(0.314)	-1.976*** (0.388)
Number of observations	1709	1710	1406
R – Square	0.173	0.117	0.201
Prob (F-statistic)	0.000	0.000	0.000

Source: Authors' computation. * 10% significant; ** 5% significant; ***1% significant (figures in parenthesis are standard errors).

investment variable in all three types of rights are not statistically significant even after controlling for endogeneity of investment. The residual generated from the first-stage investment equation is also not significantly different from zero. These results imply that investments on farmlands appear not to enhance tenure security in Ghana and that the reverse causation of tenure security impacting on investment seems non-existent. This may be so because most of the farmers have not undertaken tenure-enhancing long-term investments such as tree planting, parcel delimitation and farm house improvements or construction unlike the work of Brasselle et al. (2002) on Burkina Faso which reached a contrasting conclusion. With the exception of investment in farmhouses, all other investments that have been made by respondents are not tenure-enhancing investment.

The coefficient of the migrant variable is positive and statistically significant at 1% in all the three land rights equations. This implies that there is a higher probability of indigenes having tenure security than migrant. The result is not surprising since it is consistent with most customary laws in Ghana, which debar migrants or foreigners from having full ownership of land and as such limiting their right to sell or transfer land (Amanor, 1999).

Personal characteristics such as age, sex and education have mixed results as indicated in Table 4. Land acquired through cash payment and gift is more likely to have tenure security than if it is acquired through lease for specific period under statutory law or lease for an unspecified period under customary law. The right to make an outright sale of land is enhanced if the respondent is located in a peri-urban area of Ghana as against those in rural areas and urban centres. This result is also not surprising and confirms recent studies by (Kasanga and Kotey, 20001) and (Larbi and Odoi-Yemo, 1998). However, a contrary result is observed under the lease right equation since this right appears to be enhanced if a household is located either in rural or urban areas as against peri-urban areas.

Investment equations

Table 5 shows the estimation of the second stage investment equation which includes each of the residuals generated from the estimation of first stage equations of the three land rights variable (Appendices 1 to 4). The results indicate that impact of tenure security on investment appears to be ambiguous since the coefficients on transfer and lease rights are significant at 1% level but different signs, whereas that of sale right is not significant. This result cannot be taken seriously since we were unable to reject the hypothesis that there is no simultaneity bias. The specific investment equation such as the farmhouse and irrigation investment equations also did not show any significant outcome. However, we had a relatively better result, when endogeneity was not controlled for. (Appendix 5).

Tenure security had a positive impact on investment because the coefficient of all the three land rights variables were positive and significant at 10% level. This result confirms the study by the World Bank (Migot-Adholla et al., 1994).

Additionally, the quality of land variable consistently showed a positive and 1% significance level in all the investment regressions (Appendices 4 to 5). This implies that a farmer's propensity to invest on the farmland is greatly influenced by the quality of land he/she is dealing

Table 5. Investment and environmental problem models estimations.

Variable	Investment	Investment in farm house	Investment in irrigation	Environmental problem
Type of land	-0.652** (0.324)	0.444 (0.681)	1.698 (1.136)	
Quality of land	0.761*** (0.150)	0.668** (0.323)	0.610 (0.471)	
Farm income	0.036 (0.031)	-0.120 (0.083)	0.371*** (0.099)	
Conflicts	0.226 (0.219)	-0.566 (0.488)	-0.460 (0.785)	
Lease right	2.467*** (0.870)	5.362*** (1.085)	-1.334 (2.522)	0.256 (0.353)
Sales right	0.666 (0.850)	0.264 (0.895)	2.640 (2.720)	-0.004 (0.311)
Transfer right	-2.297*** (0.761)	-1.842 (1.450)	-1.272 (1.906)	0.252 (0.312)
Mining activity dummy				0.286 (0.381)
Forest destruction				0.885*** (0.314)
Coastal savannah				-1.241 (1.113)
Forest zone				-1.314 (1.070)
Forest savannah				-1.582 (1.087)
Guinea savannah				0.160 (1.056)
RES_18 (Lease)	-2.892*** (0.882)	-3.993* (1.888)	0.478 (2.542)	
RES_17(Transfer)	2.722*** (0.776)	2.170 (1.481)	0.093 (1.915)	
RES_19 (Sale)	-0.429 (0.859)	-1.185 (1.754)	-2.341 (2.671)	
Constant	-2.185***(0.583)	-3.370*** (1.216)	-2.185 (1.529)	-1.177 (1.112)
Number of observations	1398	269	269	356
R – Square	0.072	0.129	0.448	0.182
Prob (F-statistic)	0.000	0.000	0.000	0.000

Source: Authors' computation. * 10% significant; ** 5% significant; ***1% significant.

with. Other variables such as farm income and size of the farmland, which were included to ensure proper identification of the investment equation appears not to play any significant role in respondents' investment decisions. However, the coefficient of income variable in the irrigation specific investment equation of Table 5 is positive at a 1% level of significance. This is expected since irrigation projects are expensive and could be the preserve of only those with a higher income.

The regression result of the environmental equation also shows no significant impact of land rights or tenure security on environmental problems. However, the destruction of vegetation cover variable in the equation shows a high probability of environmental problem in areas of vegetation cover destruction such as large scale timber, chainsaw and mining activities. The ecological zone dummies are not statistically significant.

CONCLUSIONS AND POLICY RECOMMENDATIONS

This study has attempted to examine empirically two main issues: first, the causal relationship between land tenure security and investment and secondly, the impact of tenure security (land rights) on environmental degradation.

The main findings of the study are that investment in farmlands in Ghana is low and appear not to enhance tenure security and that the reverse causation of tenure security enhancing investment seems non-existent. However, our results indicate that tenure security appears to be an incentive for investment in that when endogeneity was not controlled, tenure security has a positive and significant impact on investment though the result is not robust.

This implies that farmers with tenure security are more likely to invest in their lands, which may eventually lead to higher productivity. The econometric model indicates that tenure security (land rights) has no significant impact on environmental degradation apart from the destruction of vegetation cover, which appears to be a major environmental problem in Ghana.

One way of ensuring land tenure security in Ghana is title registration. However, we observe from the descriptive analysis that out of 88% of the respondents who claimed to own land, only 39% had registered their land. Land title registration ensures a secure property right, which provides all types of security: sales, lease, transfer, etc. We therefore, call for policy measures in the proposed National Land Reforms programme that will enhance tenure security to facilitate investment in agricultural lands since individuals are more likely to invest in land if the title is secure. Such policies should focus on establishing a more effective and efficient land title registration system that will remove the bottlenecks in the land market and enhance individual tenure security. Efforts should aim at reviewing legislations that does not favour the implementation of efficient property rights in

order to improve tenure security.

Though the regression result indicates no significant impact of tenure security (land rights) on the environment the descriptive analysis shows that small-scale farming and the destruction of vegetation cover poses major environmental problems. Policies should therefore aim at encouraging farmers to undertake sustainable land management practices with a view to reducing environmental degradation. Agricultural extension officers should be well equipped to monitor and enforce sustainable land use and management practices. Provision of training for small-scale farmers in sustainable land management will also be of great help. Putting in measures to reduce the occurrence of bushfires, as well as shifting from the use of charcoal and firewood will also help reduce destruction of vegetation cover.

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Appendix 1. First stage equation of outright sale right.

	B	S.E.	Wald	Sig.	95.0% C.I. for EXP (B)	
					Lower	Upper
Conflict	-0.257	0.161	2.564	0.109	0.565	1.059
Income	-0.015	0.023	0.422	0.516	0.943	1.030
Quality of land	0.095	0.122	0.603	0.437	0.866	1.396
Type of land	-0.909	0.178	25.956	0.000	0.284	0.572
Size of land	0.001	0.001	0.863	0.353	0.999	1.004
Age	0.014	0.004	11.868	0.001	1.006	1.022
Migrant	0.547	0.140	15.227	0.000	1.313	2.276
Sex	0.353	0.149	5.616	0.018	1.063	1.906
Education	0.257	0.132	3.815	0.051	0.999	1.673
Rural	-0.515	0.149	11.917	0.001	0.446	0.800
Urban	-0.288	0.166	3.009	0.083	0.541	1.038
Gift transfer	0.464	0.153	9.180	0.002	1.178	2.146
Customary leased	0.387	0.544	0.506	0.477	0.507	4.274
Statutory leased	-0.300	0.185	2.620	0.106	0.515	1.065
Cash payments	0.905	0.211	18.453	0.000	1.636	3.736
Constant	-0.965	0.344	7.855	0.005		

Appendix 2. First stage equation of lease right.

	B	S.E.	Wald	Sig.	95.0% C.I. for EXP (B)	
					Lower	Upper
Conflict	0.320	0.179	3.175	0.075	0.969	1.957
Income	-0.089	0.023	15.002	0.000	0.875	0.957
Quality of land	-0.200	0.131	2.336	0.126	0.634	1.058
Type of land	-1.064	0.238	20.034	0.000	0.217	0.550
Size of land	0.012	0.005	6.306	0.012	1.003	1.021
Age	0.007	0.004	2.651	0.103	0.999	1.016
Migrant	0.837	0.139	36.292	0.000	1.759	3.034
Sex	0.530	0.149	12.630	0.000	1.268	2.275
Education	-0.077	0.142	0.294	0.588	0.701	1.223
Rural	0.366	0.158	5.373	0.020	1.058	1.965
Urban	0.336	0.181	3.427	0.064	0.980	1.996
Gift transfer	1.210	0.201	36.209	0.000	2.260	4.970
Customary leased	0.503	0.592	0.721	0.396	0.518	5.274
Statutory leased	-0.013	0.176	0.005	0.941	0.699	1.394
Cash payments	1.222	0.274	19.913	0.000	1.984	5.804
	0.143	0.387	0.135	0.713		

Appendix 3. First stage equation of transfer right.

B	B	S.E	Wald	Sig.
Conflict	0.371	0.163	5.154	0.023
Income	-0.056	0.023	5.934	0.015
Quality of land	-0.073	0.125	0.335	0.562
Type of land	-2.205	0.250	77.543	0.000
Size of land	0.000	0.001	0.014	0.906

Appendix 3. Cont'd.

Age	0.008	0.004	4.066	0.044
Migrant	0.928	0.143	42.225	0.000
Sex	0.204	0.146	1.941	0.164
Education	-0.296	0.133	4.934	0.026
Rural	0.166	0.154	1.166	0.280
Urban	0.152	0.175	0.752	0.386
Gift transfer	0.295	0.160	3.398	0.065
Customary leased	-1.718	0.777	4.884	0.027
Statutory leased	-0.700	0.182	14.743	0.000
Cash payments	0.122	0.236	0.267	0.605
Constants	1.137	0.385	8.743	0.003

Appendix 4. First stage investment equation.

Variables	B	S.E.	Wald	Sig.
Conflict	0.029	0.196	0.022	0.881
Income	0.007	0.028	0.071	0.790
Quality of land	0.654	0.147	19.769	0.000
Type of land	-0.191	0.213	0.805	0.370
Size of land	0.001	0.001	0.794	0.373
Age	-0.006	0.005	1.348	0.246
Migrant	0.148	0.172	0.749	0.387
Sex	0.642	0.216	8.857	0.003
Education	0.252	0.173	2.128	0.145
Rural	0.381	0.210	3.294	0.070
Urban	0.529	0.224	5.575	0.018
Gift transfer	-0.145	0.207	0.493	0.482
Customary leased	1.297	0.561	5.356	0.021
Statutory leased	-0.186	0.231	0.648	0.421
Cash payments	0.629	0.230	7.471	0.006
Constant	-2.628	0.451	33.879	0.000

Appendix 5. Investment equation without the land rights residuals.

Variables	B	S.E.	Sig.	Exp (B)
Transfer right	0.394*	0.164	0.016	1.482
Sale right	0.311*	0.161	0.054	1.365
Lease right	0.318*	0.180	0.077	0.727
Conflict	0.163	0.191	0.394	1.177
Income	0.015	0.027	0.577	1.015
Quality of land	0.780	0.141	0.000	2.181
Type of land	-0.207	0.201	0.302	0.813
	-1.842	0.267	0.000	0.158

*****- 10% significant.

Model summary.

Step	-2 Log likelihood	Cox and Snell R Square	Nagelkerke R Square
1	1311.811	0.032	0.052