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**SOIL CONSERVATION BY-LAWS: PERCEPTIONS AND ENFORCEMENT
AMONG COMMUNITIES IN UGANDA**

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*Paper presented at a Workshop on Policies for Improved Land Management in Uganda,
held in Kampala at the Hotel Africana, June 25 – 28, 2001*

Project on Policies for Improved Land Management in Uganda

A collaborative Project of:

International Food Policy Research Institute (IFPRI)
Makerere University, Faculty of Agriculture (MUFA)
National Agricultural Research Organization (NARO)
Agricultural Policy Secretariat (APSEC)
Center for Development Research (ZEF), University of Bonn, Germany

INTRODUCTION

There are four major strategies that may be used to address land and water degradation problems: research and development of effective, relevant and cost-effective Soil and Water Conservation (SWC) technologies, extension and education on SWC technologies, economic incentives, and regulation (Abler and Shortle, 1991). Research and development efforts that involve farmers are likely to produce effective, relevant and cost effective SWC technologies. Many SWC technologies that have been developed without the involvement of farmers have not been adopted widely (Blackburn and Holland, 1998; Ryan, 1997; Katyal and Vlek, 2000).

Extension and education efforts increase farmers' awareness of the effects of land degradation, and strategies for addressing the problem. Education of farmers is the most important tool that may be used to address the land degradation problem. It is difficult, if not impossible, to enforce effectively by-laws and restrictions that make little or no sense to farmers. The economic incentives that may increase adoption of SWC technologies are profit, and land tenure security. The SWC technologies need to demonstrate a significant increase in yield and profits. Farmers also need to have land tenure security that will motivate them to invest in the SWC technologies (Syers, et al., 1996; and Whiteside, 1998).¹

¹ Discussion of impact of land tenure impact on agricultural productivity in Africa has centered on land ownership security. This follows the conventional economic theory, which posit that resource allocation by economic agents requires both tradable land property and development of land market. When land is perceived as a commodity then landowners/users would allocate the resource most efficiently through the land market.

Regulation of SWC technologies involves by-laws and restrictions that regulate the farming activities of farmers in a given community. It is becoming increasingly evident that the participation of the local community and institutions are critical in addressing the land degradation problem (Blackburn and Holland 1998; Baland and Platteau, 1996; Rasmussen and Meinzen Dick, 1995; Raussen, et al; 2001). For instance Garrity, 2000 observes that problems like land degradation for which agro forestry is a possible solution cannot be successful implemented by individual farmers, but rather cooperatively at the community level. This is because effectiveness of agro forestry in controlling land degradation caused by soil erosion calls for wider adoption of tree, shrub and grass planting.

The main objective of this study is to identify the factors that influence the level of compliance with by-laws and restrictions related to land management. Identification of these factors will be helpful in finding ways and means of increasing compliance with by-laws and restrictions (hereafter, compliance with by-laws and restrictions will be referred to simply as compliance).

METHODOLOGY

A stratified random sampling method was used to select 107 LC1's (communities) in Uganda. The stratification criteria were access to market (as measured by an index of potential market integration based on travel time to nearest five markets weighted by their population (Wood et al 1999); population density and agricultural potential (as

measured by length of crop growing period, rainfall pattern, and altitude). The 21 strata identified represent development domains since the agricultural potential, market access, and population density are likely to define development pathways (Sserunkuma et al 2001).

In this research a community is defined as the lowest administrative unit, which in Uganda is called Local Council 1 (LC1). A semi-structured questionnaire was used to interview about 10 to 15 community members. The respondents included the LC1 chairman or secretary, secretaries for youth, defence and production. It was also requested that women and youth be represented in the discussion.

Descriptive statistics were used to analyze the by-laws and restrictions existing in the surveyed communities, perception on soil fertility deterioration and level of enforcement of by-laws. An ordered logit model was used to analyze the factors that influence the level of compliance with by-laws and restrictions (See Appendix 1).

VARIABLES AND HYPOTHESES

The variables included in the ordered logit model are: Agricultural potential, access to markets population density, wealth indicators (percentage of households with metal roof and percent of households with livestock), land tenure system, methods of enforcement, level of tax collection, and presence of organizations related to agricultural development.²

² The distribution of the continuous variables included in the model was checked for normality. The continuous explanatory variables are tax revenue, number of programs related to agriculture and proportion of households with metal roof or cows. With the exception of tax revenue all the continuous variables were

The agricultural potential is expected to have an ambiguous influence on compliance. High agricultural potential is likely to increase the value of land and hence the need to comply to by-laws and restrictions that lead to soil conservation. However, labor in the high agricultural potential areas is likely to be more expensive due to many agricultural activities that are permitted by this potential. This leads to high opportunity cost for labor that may be required to abide by restrictions.

Market access also has an ambiguous effect on compliance. As market access increases the value of land increases. Hence the incentive to comply with by-laws and restrictions for soil conservation also increases. However greater market access may provide “exit options” to farmers who fail to comply to community by-laws and restrictions making it more difficult for communities to enforce penalties on non-compliers (Pender and Scherr, 1999).

The population density is likely to impact compliance positively. As population increases, scarcity for land increases. Consequently the value of land increases prompting farmers to conserve their soils by complying with by-laws and restrictions put in place. However at very high population levels, the consequent land scarcity may lead to attempts by community members to “free-ride” on efforts of others (Gebremedin, Pender and Tesfaye, 2000).

normally distributed. Tax revenue had a lognormal distribution hence it was transformed to normality by taking the natural log of tax revenue.

Physical capital is likely to have an ambiguous effect on compliance with by-laws and restrictions. Increase in physical capital is likely to increase the ability of farmers to buy resources required for complying with by-laws and restrictions. For example if the by-law requires farmers to construct bench terraces, the rich farmers are able to hire labor for that purpose. However more physical capital would increase the opportunity cost for farmers' family labor thus making it expensive to use family labor for compliance purposes. Physical capital may also be a substitute for well-managed land, hence its increase may reduce compliance.

Tax is also an indicator of physical capital because tax is collected from adults (graduated tax) and from other sources of legal income. This implies, communities with higher income would tend to collect more tax than poorer communities, which as argued above is likely to have an ambiguous impact on compliance. The sub county is responsible for tax and other revenue collections at the community level. It retains at least 65% of its total revenue collection and the rest submitted to the district. Out of revenue retained the sub county, in accordance with the Local government Act 1997 it is expected to remit at least 5% to the county, at least 55 to the parish and at least 25% to the LC1 level (ASPEC, 2000). LC1 officials are involved in revenue collection process. Their role includes mobilization of payments and follows up on defaulters. This implies, a community that has effective leadership combined with responsive, law-abiding community members would tend to collect more tax revenue than a community with poor leadership and/or non-responsive and poor law observance community. A law-abiding

community is likely to comply with restrictions related to land management. Effective leadership would also tend to increase compliance.

Level of education may increase people's awareness on future benefits of complying with land management by-laws and restrictions. However, education is not included as no appropriate measure of education was measured at community level.

The method of enforcement is related to degree of deterrence that is associated with a given method. A fine meted to offenders is assumed to have the lowest degree of deterrence as compared to the other methods reported, namely, prison, confiscation and both fine and prison. It is expected that the change from fine to other enforcement methods would lead to higher compliance.

Presence of programs/projects related to agricultural development is likely to increase compliance. This is because organizations related to agricultural development are likely to promote awareness on effects of land degradation on agricultural development.

Land tenure security, stability and attachments are likely to increase compliance.³ Tenure insecurity narrowly defined, is the landholders perception of the probability of losing land within some future period of time (Roth et al 1989).

³ Until 1975, there were four main types land tenure systems namely the customary, freehold, mailo and leasehold. In 1975, President Idi Amin through the Land Reform Decree abolished the freehold and mailo tenure systems. All land in Uganda was declared public land, which was to be administered by one authority, the Uganda Land Commission. The freehold and mailo tenure systems were converted into leaseholds. Whereas this was really never enforced, the 1975 Land Reform Decree it brought a lot of ambiguity to the land code. The government of President Yoweri Museveni set out to clear the ambiguity

Insecure or unstable land tenure is expected to influence compliance negatively as farmers with insecure tenure have no attachment to their farms. This creates little incentive for them to comply to land management by-laws and restrictions. In Uganda the most common land tenure systems in most areas are customary, freehold, leasehold and mailo.

Customary tenure provides stable land tenure, as it is acceptable within the community. The tenure also creates a strong sense of ownership and altruism since land is passed from one generation to another. The authors believe that as long as landholders perceive their (present and future generations) ownership to be secure, they are more likely to comply with bylaws related to land. It is therefore expected that a change from customary land tenure to other tenure systems would negatively affect compliance to land management restrictions.

DATA

Perceptions on changes of soil fertility

The farmers were asked to report their perceptions on changes of soil fertility in their community. Table 1 summarizes the responses given for high and low population and market access communities. Table 1 shows that the percentage of communities reporting severe land degradation in the high population and market access areas is higher than the case for low population and market access areas. This is contrary to Schuh's observation

by enacting the Land Act. This Land Act 1998, restored the abolished tenures in accordance with the 1995 constitution.

that in areas of low market access (characterized by high transaction costs and other price disincentives), land degradation is more severe.

Table 2 also shows that the degree of soil fertility deterioration is higher in high agricultural potential areas (bimodal high and unimodal high rainfall) than in low potential areas (bimodal and unimodal low rainfall).

Types of Restrictions: The most common types of restrictions on private land are reported in Table 3. About 38% of the 107 communities surveyed reported that they have a restriction barring them to slash and burn bush. About 29% reported that they are not allowed to cut trees. About 16% of the communities reported that they are not allowed to make charcoal. Table 3 also reports that LC1 officials and LC1 members were the most common authorities enforcing restrictions on private land. This implies grass root organizations are the most common authorities enforcing restrictions related to land management, hence expected to be more effective than the case for external organizations.

Just a few communities (12%) reported to have common lands with restrictions on their use. The most common restrictions on common lands applied to common forests and woodlands, wetlands and lands bordering water bodies. The most common restriction was no cultivation in the common lands (Table 4).

Enforcement and compliance with by-laws and restrictions affecting land management:

Table 5 shows that about 43% of the sample communities reported that the slash and burn restriction is well enforced but 41% reported that restriction on cutting trees and charcoal making are poorly enforced. Consequently, 46% of the sample communities reported that majority of LC1 members comply to the bush burning restriction and 37% of the communities reported that everyone in their communities comply to the bush burning restriction (Table 6).

For the tree cutting restriction 56% of the sample communities reported that minority comply and 31% reported that majority comply to the restriction requiring them to plant a tree after cutting one.

ECONOMETRIC RESULTS

The results show that presence of programs related to agriculture and the environment, land tenure and proportion of households with metal roofs significantly (at $p = 0.1$) influence compliance (Table 7). As expected presence of programs is predicted to increase compliance. The most common organizations reported to be operating in the surveyed communities with percent of communities reporting their presence in brackets are NEMA (18%), research organizations-NARO/CIAT/AHI (13%), Agro Forestry Project (11%), UNFA (11%), religious based programs-SOCCADIDO/MADDO (7%), AT (Uganda)/African 2000 Network/SG2000 (7%), AEP (4%), Heifer Project

International (4%), others (25%)¹. Further discussion to the programs is found in Jagger, 2001.

The impact of land tenure on level of compliance is evaluated by comparing the compliance under the customary land tenure system, and the other tenure systems. The ordered logit results show that change from the customary to the freehold system significantly (at $P=0.01$) reduce compliance.

Table 7 shows that there was no significant impact on level of compliance as one changes from customary to mailo, or leasehold land tenure systems. Since leasehold land tenure system gives ownership titles to farmers, it is expected to be a secure tenure system. However ownership titles may not guarantee stability of the land tenure.

The proportion of households with metal roofs positively influenced compliance (at $P=0.10$). This implies physical capital is likely to increase farmers' ability to increase their compliance level. The rest of the variables included in the model are not significant at $P=0.10$. The non-significant variables are agricultural potential, collection of tax, method of by-law enforcement, proportion of households with cows, population density and market access. Overall the model did not significantly (at $P= 0.2$) account for the changes of the level of compliance. The probable reason for the weak explanatory power

¹ The abbreviated names of the programs are given in full below:
NEMA – National Environment Management Authority; NARO – National Agricultural Research Organization; CIAT - Centro Internacional de Agricultura Tropical (International Center for Tropical Agriculture); AHI – African Highlands Initiative; UNFA – Uganda National Farmers Association SOCCADIDO – Soroti Catholic diocese Integrated Development Organization; MADDO – Masaka Diocese Development Organization; AT (Uganda) – Appropriate Technology (Uganda); SG 2000 – Sasakawa Global 2000; and AEP – Agricultural Extension Project.

of the model maybe aggregation. There were many restrictions related to land management, hence it was necessary to take an average level of compliance. This aggregation reduces the variability of the dependent variable. It was not possible to estimate a model for each of the restrictions since there were many restrictions and few communities reporting each restriction.

It is also possible other important and relevant variables that are important in explaining the level of compliance were not included in the model. An example of such variables is average level of education of farmers, which is likely to increase degree of awareness on land degradation and hence increase compliance. Education was not included because the data was not collected.

SUMMARY OF RESULTS AND REFLECTION ON FINDINGS

Over 80% of communities in the high population density, high market access and high agricultural potential perceive that their soil fertility has deteriorated severely. On the contrary, the majority of communities in the low population density, low market access and low agricultural potential perceived that soil fertility in their farmers have not changed or had a minor deterioration over the past 10 years. No community reported to have observed minor or major improvement in soil fertility. The results confirm the observation that soil fertility in Uganda has been declining resulting in less crop yields (MAAIF, et al., 1999; and MAAIF and MFEPD, 2000).

The most common by-laws and restrictions related to land management that were applied to private land are no slash and burn, no cutting trees and no charcoal making. The majority of the communities reported that the authorities enforcing the no slash and burn restriction are the LC1 officials' and/ or members of the communities. Enforcement of by-law and restrictions by authorities at the grassroots level may lead to higher compliance because, the grassroots authorities and participation of local people makes both responsive and responsible for the by-laws and restrictions that are put in place (Berkes, 1989; Rhoades, 1999). Local people and authority also know better the community, its physical and socio-economic environment. However, if the by-laws and restrictions are not popular, elected local authorities (like the LC1 chairman in Uganda) may fail to effectively enforce them for fear of losing in the next election.

Over 64% of the communities reported that the no slash and burn restriction is enforced fairly well and consequently the majority comply. However, the no cutting trees and no charcoal burning restrictions are poorly enforced, probably because it is hard to enforce them given that 96% of cooking energy is derived from woody biomass (NEMA, 1998). The no cutting trees restrictions demands farmers to cut a tree(s) and cutting trees to replace the one cut. In order to encourage communities to comply to this restriction, there is a need to giving incentives to farmers who plant trees and to tax the charcoal makers and use the tax revenue for tree nursery establishment and tree planting campaigns.

The results also show that there is poor compliance with restrictions that require farmers to construct and maintain soil and water conservation (SWC) structures and to plant trees

after cutting a tree(s). There is therefore a need to research further on the strategies that may be used to address the problems of land degradation in the high population and market access areas and other areas.

The major factors that influence level of compliance with by-laws and restrictions related to land management are land tenure, presence of agriculture and environmental-related programs and physical capital as indicated by proportion of households with metal roof. Households owning land under customary land tenure are likely to comply with by-laws and restrictions at higher level than those owning land under freehold. Recent empirical results have shown that customary land tenure systems are flexible, equitable and more secure (Bruce, 1993). Under the customary tenure, land is required to remain in the hands of the family or lineage (Baland, et al., 1999). The transition of land ownership from one generation to another is 'smooth' and stable giving owners a sense of security. In addition, there is a great attachment to land, which is viewed as a possession that will be passed from one generation to another. As such, landholders under this system are more likely to comply with bylaws that may eventually increase the sustainability of the land.

For the freehold system (in which titles are issued) to offer the same feeling of security, it would require that the title be enforceable and/or supported by an adequate legal system. If the formal land code is ambiguous in its definition of rights or the government lacks the will or the means to enforce those rights, landholders may not perceive greater security with the title. Now at the implementation stage of the new Land Act 1998, there is still a need to examine in detail the requirements for its implementation. Estimates of

the costs for the implementation of the Land Act 1998 suggest that they are unaffordable (APSEC 2000). Implementation is also based on unrealistic assumptions, e.g., that there is enough manpower to man the land tribunals, this is not true (District and Sub-county tribunals were established to handle land disputes). Such is the ambiguity and lack of the means to enforce rights that may result in tenure insecurity of holders under the freehold and leasehold tenure systems. This may act as a disincentive to sustainable use of land as well as compliance to bylaws.

As expected, presence of agriculture and environmental-related programs in a community increased the level of compliance. This implies that the programs probably increased knowledge and awareness of communities about SWC technologies and the adverse effects of land degradation (further discussion on programs is referred to the paper by Jagger, 2001 presented in this workshop).

This research observed that increase in physical capital, as indicated by proportion of households with metal roofs, is likely to increase level of compliance. This implies, the government's efforts to reduce poverty are likely to increase level of compliance in the long run.

Future Research

Our results are based on preliminary findings that are likely to be revised after in-depth analysis using more data. Particularly, the overall model could not significantly (at $p=0.10$) explain the variation of the level of compliance. Further research is needed to identify other relevant and important variables that could improve the explanatory power

of the model. For instance, the role of education of the community was not included in the model for lack of appropriate data. Similarly, the role of economic incentives, extension and education efforts in increasing compliance need to be examined.

The compliance with by-laws and restrictions enacted by local councils need to be compared to compliance with laws and restrictions enacted by external authorities. In the same vein, level of compliance enforced by local authorities need to be compared with compliance when the restrictions and by-laws are enforced by external authorities.

Table 1: Perceptions on changes of soil fertility status in community

| Population density and market access | Perception on soil fertility status | | |
|---|-------------------------------------|---------------------|---------------------|
| | No change | Minor deterioration | Major deterioration |
| | % Reporting | | |
| Population density | | | |
| Low (N=40) | 23.5 | 18.6 | 57.9 |
| High (N=67) | 6.8 | 11.6 | 81.6 |
| Market access | | | |
| Low (N=35) | 23.3 | 30.7 | 46.0 |
| High (N=72) | 7.8 | 6.7 | 85.5 |

Table 2: Relationship between agricultural potential and perception on soil fertility changes

| Agricultural potential | Perception on soil fertility status | | |
|------------------------|-------------------------------------|---------------------|---------------------|
| | No change | Minor deterioration | Major deterioration |
| Bi-modal: | % Reporting | | |
| High rainfall (N=40) | 1.7 | 9.0 | 89.3 |
| Medium rainfall (N=27) | 19.4 | 19.3 | 61.3 |
| Low rainfall (N=18) | 12.8 | 17.1 | 70.1 |
| Unimodal: | | | |
| High rainfall (N=12) | 0.0 | 0.0 | 100.0 |
| Medium rainfall (N=3) | 0.0 | 39.9 | 60.1 |
| Low rainfall (N=7) | 55.5 | 8.1 | 36.3 |

N.B: No community reported to have minor or major soil fertility improvement.

Table 3: Type of restrictions on private land

| Type of restrictions | % Reporting restrictions** | Authority enforcing restriction (% Reporting)** | | | |
|----------------------|----------------------------|---|--------------------|------------|------------|
| | | LC1 officer and member (1) | Forest rangers (2) | Both 1 & 2 | Others *** |
| No slash and burn | 38.4 | 61.7 | 3.7 | 0.9 | 11.2 |
| No cutting trees | 28.6 | 24.3 | 19.6 | 9.4 | 1.9 |
| No charcoal making | 15.5 | 10.3 | 15.0 | 2.8 | 1.9 |
| Other restrictions * | 17.5 | 15.9 | 0.0 | 0.0 | 8.4 |

* Includes limit on cultivation of steep slopes, no cultivation in wetlands, control soil erosion and runoff, no brick making, and no damaging SWC structures.

** Percent of the 107-sample size computed along each column.

*** This includes parish, district, central government and CBO officials.

Table 4: Restrictions on Common Lands

| Restrictions | Type of common Resource | | | |
|--------------------|-------------------------|---------------|---------------------------------|------------------------|
| | Forest/woodland (N=4) | Wetland (N=4) | Land bordering water body (n=3) | Other resources *(N=2) |
| | % Reporting | | | |
| No cultivation | 75.0 | 50.0 | 66.7 | 50.0 |
| No tree cutting | 0.0 | 0.0 | 0.0 | 0.0 |
| Other restrictions | 25.0 | 50.0 | 33.3 | 50.0 |

* Other resources are: common grazing land (reported by one community) and common water body (reported by one community)

Table 5: Level of restrictions enforcement on private land

| Level of enforcement | Restrictions | | | |
|----------------------|--------------------------|---------------------------|------------------------------|------------------------------|
| | Slash and burn (N=79) | No cutting tree (N=59) | No charcoal making (N=32) | Other restrictions (N=26) |
| | % Reporting | | | |
| Not enforced | 8.9 | 1.7 | 12.5 | 26.9 |
| Poorly enforced | 26.6 | 40.7 | 40.6 | 30.8 |
| Fairly enforced | 21.5 | 33.9 | 25.0 | 15.4 |
| Well enforced | 43.0 | 23.7 | 21.9 | 26.9 |

Table 6: Level of compliance to by-laws and restrictions affecting land management

| Restriction /by-law | Level of compliance | | | |
|---|---------------------|--------------------|--------------------|----------------------|
| | No one complies | Minority comply | Majority comply | Everyone complies |
| | % Reporting | | | |
| Tree planting after cutting (N=16) | 6.3 | 56.3 | 31.3 | 6.3 |
| No bush burning (N=41) | 4.9 | 12.2 | 46.3 | 36.6 |
| No tree cutting (N=26) | 0.0 | 27.0 | 46.2 | 27.0 |
| Construct/maintain SWC structures (N=16) | 40.0 | 40.0 | 10.0 | 10.0 |
| Other restrictions (N=17) | 7.1 | 35.7 | 42.9 | 21.4 |

NB: For the tree cutting restriction 56% of the sample communities reported that minority

Table 7: Determinants of compliance to restrictions related to land management

| Variable | Coefficient | P-value |
|---|-------------|---------|
| Agricultural potential ¹ | | |
| Bimodal medium and low rainfall | 0.95 | 0.25 |
| Unimodal high | 0.27 | 0.81 |
| Unimodal low | 1.79 | 0.18 |
| Tax collection (log of tax collected) | -0.21 | 0.53 |
| Number of programs related to land management | 0.80 | 0.08 |
| Land tenure ² | | |
| Mailo | -9.4 | 0.24 |
| Leasehold | 0.65 | 0.76 |
| Freehold | -3.41 | 0.01 |
| Method of enforcement ³ | | |
| Imprisonment | 0.27 | 0.78 |
| Confiscation | 1.47 | 0.30 |
| Fine and prison term | -0.31 | 0.63 |
| Proportion of households with: cows | 0.02 | 0.14 |
| Metal roof | 0.02 | 0.06 |
| Population density ⁴ | -0.49 | 0.50 |
| Market access ⁵ | -0.71 | 0.28 |

1. Dummy variable for agriculture potential: 1 = Bimodal high rainfall, 2 = Bimodal medium and low rainfall, 3 = Unimodal high rainfall, 4 = Unimodal low rainfall.
2. Dummy variable for land tenure: 1 = customary land tenure, 2 = Mailo, 3 = Leasehold and 4 = Freehold.
3. Dummy for method of enforcement: 1 = Fine, 2 = Imprisonment, 3 = Confiscation and 4 = Both fine and imprisonment.
4. Dummy variable for population density: 1 = High population density, 0 = Low population density.
5. Dummy variable for market access: 1 = High market access, 0 = Low market access.

APPENDIX 1

Ordered Logit

The level of compliance is categorized in ordered categories, i.e. $1 < 2 < 3 < 4$.

Where 1 = Nobody complies

2 = Just some comply

3 = Majority comply

4 = All comply

The ordinal nature of compliance calls for use of an ordered logit model.

Let $y^* = \beta' X + e$

Where y^* is the unobserved benefit/cost of complying or not complying to local by-law/restriction.

$Y = 1$ if $y^* \leq b_1$

$Y = 2$ if $b_1 < y^* \leq b_2$

$Y = 3$ if $b_2 < y^* \leq b_3$

$b_i =$ is a constant

We assume that y^* depends on a set of observable vector of X and a random error e_i that has a normal distribution (Greene, 1997)

The probabilities for intervals falling under a given category

$\text{Prob}(y=4) = F(\beta' X)$

$\text{Prob}(y=3) = F(\beta' X + b_1) - F(\beta' X)$

$\text{Prob}(y=2) = F(\beta' X + b_1 + b_2) - F(\beta' X + b_1)$

$\text{Prob}(y=1) = 1 - F(\beta' X + b_1 + b_2)$

APPENDIX 2

It has also been observed that privatization and titling of customary tenure influenced land rights and security in favor of the rich acknowledge and influential (plateau, 1996, Roth, et.al. 1994 Atwood 1990 and carter eta al. 1994).

It is generally agreed that the impact of titling depends on other factors such as market access, market access, preexisting production systems and production potential, adjudication criteria and procedure and the design of support institutions for the tenure systems (Hunt, 2001).

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