FARMERS' WILLINGNESS TO PAY FOR TENURE SECURITY

Tekie Alemu*

ABSTRACT

An important aspect of property rights in agrarian societies is the entitlements in land. While there are numerous theoretic formulations showing the impact of secured tenure, there has not been sufficient success in the empirical sphere. This paper tries to obtain ex-ante valuation for improved tenure system of farmers in Ethiopia. The paper also tries to identify factors that trigger the choice for a positive WTP (Willingness to Pay) and those that affect the amount that farmers would pay for such a change. The results in this paper seem to reinforce the compelling reasons, discussed in the tenure literature, required for having a secured institutional setup for the farmers in Ethiopia. On the basis of this, consequent policy prescription is for the system to move towards a more secured system by banning all efforts of redistribution and allowing the farmers to decide on allocating the resource as they wish to their siblings.

1. INTRODUCTION

Coase (1937) introduced transaction costs into economic analysis and his theoretical work (Coase, 1960) demonstrated that their absence is an important precondition for Pareto efficiency. Consequently, where transaction costs are positive, "the assignment of property rights represents an additional constraint in the economic agent's budget constraint" (Smyth, 1998). These results, coupled with quests for the effects of the absence or 'improper' assignment of entitlements, have resulted in a proliferation of literature on property rights and articulates the role of initial entitlement of property rights.

Entitlements in land is a particularly relevant aspect of property rights in agrarian societies, since both the proportion of the population and the economy is dependent on this resource. It is simple and intuitive to conclude that insecure tenure leads to inefficient resource allocation theoretically, by introducing elements of market failures,

---

* Assistant Professor, Department of Economics, Addis Ababa University. The final version of this paper was submitted in June 2000.

externalities, and uncertainty into the analysis. Quantifying and obtaining empirical results of the effects of tenure insecurity, however, has proved to be much more difficult.

Despite these difficulties, some empirical evidence has been drawn from different studies. Lin (1992), for instance, studied the effects of transforming the Chinese collective farms into the so-called "household-responsibility" system. The new system was introduced over a span of 5 years starting in 1979. An important feature of the system was that the responsibility given to the household was increased over time, so that it was introduced gradually. His findings show that for the period between 1978 and 1984, i.e., as the provinces in his analysis raised the proportion of household-responsibility system, crop production grew by 42 per cent. Decomposing this growth into various factors, he established that close to 50 per cent of the growth is due to the various reforms undertaken during this period. More important, institutional changes with respect to the household-responsibility system alone accounted for the lion's share of the crop production growth (47 per cent). This is a very strong evidence of the impact of institutional changes.

Another important corroborative research, with respect to the returns from the introduction or improvement of tenure security is that reported by Feder et. al. (1988) for Thailand. The Thai agricultural system has two distinct types of tenure: one which is titled and secure, and another that is not. The latter condition is described as squatters, i.e., illegal occupation of state-owned land. Squatters can be evicted, hence the insecurity. The analysis shows that titled farmers are more productive than squatters, to the tune of 12 to 20 per cent, in three of the provinces it studied. However, it is doubtful if one could properly speak of squatting as tenure. Often this is a temporary situation, which is observed in transit to other forms of employment and is largely a response to poverty. Thus, production may not be conducted under comparable condition to titled land. Hence, the reported figures have to be qualified.

Nonetheless, the institutional scenarios on which these ex-post studies are based are unusual for the following two reasons. First, it is seldom the case that changes in land tenure occur smoothly. As Bell (1990) points out correctly, and as evidenced during the communist revolutions in both Eastern Europe and the Third World, " ... a substantial redistribution of individual property rights [in land] is most likely to occur in the wake of a social upheaval." Such abrupt changes are seldom complemented or followed by supporting institutions and policies. This may lead to frustrated land reforms such as that enacted in Ethiopia in 1975 (Dessalegn 1984). Second, it is uncommon to find communities with different forms of tenure arrangements side by side. This makes empirical comparisons between, say, properly assigned and unassigned property rights difficult.

The previous considerations and problems lead the author to look for alternative ways of valuing tenure security. This paper, therefore, bases its analysis on farmers' ex-ante valuation of introducing a relatively more secured institutional structure in landholding.

Ethiopia's institutional arrangements for gaining access to land, forms of land ownership, as well as the ways and means of handling disputes arising from the system of land tenure have been controversial. Still, in the past three decades or so, the system has undergone tremendous changes in the form of ownership permitted, some of which were radical.

The main cause of the controversies, however, need not necessarily be attributed to the absence of well-defined property rights regimes and the accompanying loss of efficiency. It may have actually been largely triggered by the fact that any change in the prevailing rights structures, often leads to fundamental reallocation of resources (i.e., land) among different interest groups. It is unfortunate, yet not surprising, that it is those segments of society with an expressive voice who get attention and thereby ensure that their interests are enhanced or at least made sure that they remain intact. The less powerful segments of society, in our context the poor farmers, lack both the opportunity and platform for making their demands heard or having them placed at the forefront, thus may not fair that well.

It is ironic, therefore, that although farmers form the segment of the population most affected by actual or potential changes in the land tenure system, it is seldom that their interests or wishes have been taken into account by researchers, policy-makers and authorities determining agricultural issues. For instance, a cursory examination of the debates, controversies and the literature on tenure system in Ethiopia reveals that, almost invariably, all types of arguments are forwarded as if they were 'good' for the farmer. It is seldom, if ever, that farmers are actually asked how they feel about these issues, controversies, and the policy options, all of which are entertained and created by outsiders who are usually out of touch with the farmers' realities. This can easily be illustrated by the most common normative statements made regarding land privatisation in Ethiopia. Most of these statements either begin or end by asserting that 'farmers must have the right to sell their land.' This is rarely presented as, 'We must have the right to buy the farmers out'. Irrespective of the argument or option forwarded, the policy option is presented as if it is nothing but positive to the farmers, while in reality they are probably seeking for their own benefits. The under text of this contains an 'elitist' view, i.e., we know better, we can identify your problems, your solutions, and even your controversies!

On the other hand, farmers are not completely powerless or apathetic. As economic agents, the ways by which farmers arrive at decisions affecting production or respond to potential or actual institutional changes are crucial. If the incentive mechanisms

give the wrong signals to them, they may take actions which individually may well be rational and efficient, but may not necessarily be so from either the society's point of view at a given point in time, or in an inter-temporal context, or both.

Tekie (1999) shows that tenure insecurity adversely affects investment in physical soil conservation in the crop producing highlands of Ethiopia. This implies that improvements in the landholding system with respect to security enhances investment, which could lead to improved production and productivity. This paper examines farmers' perceptions about the land tenure systems prevailing in Ethiopia and their interest for institutionalising more secured tenure arrangements. Moreover, the paper enquires whether farmers are prepared to ensure that such changes are instituted by paying for them. In addition to this, factors that trigger both the choice to pay and the amount that farmers are willing to pay for improved tenure security will be examined. The present study departs from previous research in that it attempts to give farmers a voice by taking their views on issues of tenure security.

2. BACKGROUND: THE CURRENT LAND-RIGHTS SYSTEM

According to the Ethiopian Constitution enacted in 1994, 'the right to ownership of rural and urban land, as well as of all natural resources, is exclusively vested in the state and in the peoples of Ethiopia' (Article 40, 3). In this regard there have been no changes in the (property) rights claimed by the state from previous proclamations. It bestows peasants only with the 'right to obtain land without payment and the protection against eviction from their possession' (Article 40, 4). Thus, individuals *residing* in rural areas, leading their livelihood from farming, have user rights over the land they have been allotted with by the community. As far as sale, mortgage or exchange of tenure is concerned, the new rules are identical to previous institutional arrangements whereby, land so allotted to individuals in the rural communities 'shall not be subject to sale or to other means of exchange' (Article 40, 4).

There is an important departure of the current land policy from the previous regime's, regarding the final authority or power in administering land. The 1994 constitution is based on devolution of power to administer land and other natural resources to the Regional States, provided that these are consistent with the laws that are promulgated by the Federal Democratic Government of Ethiopia (FDRE) (Article 52, 2d).

As a follow-up of Article 52, 2d, of the Constitution, the FDRE issued Proclamation Number 89/1989 in 1997, which detailed the roles of its regional states in administering rural land. The proclamation provides the later with the responsibility of promulgating laws pertaining to the administration of land under their jurisdiction, with

the stipulation that those do not contradict the fundamental laws of the federal government (Article 5).

The first six points of Article 6 in the proclamation details the conditions under which the regional states can introduce reallocation of land in rural areas. Reallocation includes, not only a process of periodic adjustments of individual farmers' landholdings, but also the demarcation of areas that would be used communally for grazing, residence, local forests and other social services.

The periodic reallocation of individually cultivated land among members of a community is intended to ensure that all would-be farmers could get land. Reallocation should take into account the overall magnitude of the household head's responsibility, newly formed households, as well as family size. Thus, regional states should decide the rules by which land will be reallocated among members of the rural communities. The objectives of these provisions seem to provide means for obtaining access to land to young and newly formed farming households.

As long as the available stock of unutilised land in a village is low, limited or non-existent, for newly formed households, or in-migrants into the village, redistribution is bound to affect existing farming households negatively. Whenever households are subjected to a reduced amount of land, the proclamation allows them to take their share from lands that they used prior to the redistribution. That is, in the event that the actual holding of a household exceeds the maximum amount allowable to the household during any redistribution, the amount of land deemed 'excess' would be taken away from the household, and given to other members of the farming community with less or no land at all.

An important provision of the 1997 proclamation is that households that lose land in the process of redistribution would have to be compensated by individuals to whom this land is allotted. The compensation, however, is not for the whole value of the land, as land is by definition owned by the state. Consequently, the stipulated compensation is for the labour and investment expenditures made on the land by the pre-redistribution users (Article 6, 7-12).

This may be seen as an important departure towards enhancing farmer confidence to invest in land, particularly when one compares its provisions with the form of disappropriation that prevailed in the country during the Derg regime (1974-1991), where no compensation was allowed for such actions. However, the mechanisms for valuing these compensations as well as their enforcement has not been spelt out properly. These are important because, given the current tenure arrangements, they would send signals to current users that whatever investments are made now would be redeemed in the event of land redistribution. Thus, there is a need to clearly spell out and define valuation systems and enforcement mechanisms for compensation.

The reactions to the provisions of the constitution regarding allocation, devolution of authority, land redistribution and compensation are not uniform. In order to examine these issues closely, we examine them of how three regional states (where the study sites are located) are interpreting and enforcing the provisions of the proclamation.

The Council of the Tigray National Regional State (CTNRS) enacted a law pertaining to the administration of land in 1997 (CTNRS 1997). It seems to have realised that in most parts of the region the size of landholding has reached the minimum level possible for performing any meaningful agricultural activity. It actually puts a minimum floor for the plot size beyond which it should not be subdivided. Consequently, even siblings inheriting land from their parents cannot subdivide a plot if it results in allotments of less than the limit (*ibid.* Article 16, No. 4).

It also asserts that the reallocation that have been undertaken in the region previously have been sufficiently fair. Coupled with this, there is the fact that fresh redistributions would definitely diminish the size of plots. Judging from these facts, it seems that the possibility of future redistribution in the region has been partly diminished.

On the other hand, the Council of the Amhara National Regional State (CANRS) decided to reallocate land within its jurisdiction. The main objective for enacting the redistribution implemented in 1997 was the belief that land was "grabbed by few bureaucrats and elects of agricultural cooperatives who have been proponents of the [previous] regime" (CANRS 1996). Accordingly, a substantial reallocation took place in 1997, the period when the data used in this study was collected.

The other extreme case is that of the Oromia National Regional State. To our knowledge nothing has been done regarding land reallocation since the overthrow of the Derg regime in 1991. The last redistribution reported in these sites occurred in the late 1980's. These allocations, according to the interviews in the villages, were made in the process of distributing land which was under collectives earlier.

We conclude this section by observing that there are two important positive departures from the tenure system that was envisaged and implemented by the previous (the Derg) regime. First is the principle that each region could implement its own land policy. This allows each region to assess its own needs, problems, and solutions that are appropriate for the given circumstances and act accordingly, within the framework of federal laws and regulations.[1] Second is the idea of introducing compensation on immovable investments made on land, pending on reduced land holding caused by redistribution. Needless, however, to say that refinements are needed in the valuation and enforcement spheres.

3. MODELLING WILLINGNESS TO PAY FOR INSTITUTIONAL CHANGE

We consider a model where the production function depends not only on the factors of production but also on the institutional arrangements in the economic system, the details of which are given in Appendix (1). Here we start with the indirect utility function given by:

$$V\left(p_f, p_p, w, y^* \middle| I_j\right) j = 0, 1 \qquad [1]$$

Where, p_f and p_p are the prices of farm products and market purchased products, respectively, w represents the wage rate, y^* is the income of the household, while I_j is the institutional arrangement, with j=0 implying the status quo and j=1 some proposed change.

Institutional arrangements that ensure secured and private ownership are assumed in standard economic analysis, and as argued earlier, these would generate the 'right' incentive structures, which enable economic agents to make choices that lead to efficient outcomes. Such a representation might be a very close approximation of the institutional settings in a relatively advanced market economy with competitive markets for all factors and commodities. However, this need not hold in many societies where the institutional arrangements, including markets, differ substantially.

Suppose we envisage a change in the institutional set-up from the status quo, j = 0, with insecure tenure, to one which is relatively more secured, j = 1.[2] If, the improvement entails a change in the incentive structures such that this ensures a more efficient utilisation of resources, the income of the household is bound to change. This would certainly have an impact on the supply and demand equations of the household and if these changes are substantial, relative prices may also change, which in the final analysis would also generate changes in the indirect utility function. Denoting change by Δ, we have

$$\Delta V = V\left(p_f^1, p_p^1, w^1, y^{*1} \middle| I_1\right) - V\left(p_f^0, p_p^0, w^0, y^{*0} \middle| I_0\right) \qquad [2]$$

The compensating variation defines that amount of money which can be taken away from the individual household after the change in the institutional arrangement, such that the household maintains its pre-change level of satisfaction. This we may call the willingness to pay (WTP) for an improvement in the institutional arrangement. Thus, the WTP is the amount of money that has to be deducted from the household's current income such that the following identity holds.

$$V\left(p_f^1, p_p^1, w^1, y^{*1} - WTP \middle| I_1\right) = V\left(p_f^0, p_p^0, w^0, y^{*0} \middle| I_0\right) \quad [3]$$

Assuming separability of the function with respect to WTP, we can write the reduced form for equation [3] as:

$$WTP = g(X\beta) \quad [4]$$

Where X is a vector of characteristics affecting willingness to pay and is a vector of parameters to be estimated.

4. DATA COLLECTION, ELICITATION OF VALUATION FOR SECURITY AND DATA DESCRIPTION

We collected data by administering a structured questionnaire on the willingness-to-pay (WTP) for instituting secured and private land tenure, given the current insecure land holding system, from farming households in five Peasant Associations (PA's) in Ethiopia.[3] Part of the questionnaire which was used for this paper is presented in Appendix (2). The data has been aggregated at the household level for the 526 randomly selected households from these villages, which are located in three regional states (Tigray, Amhara and Oromia).

The constitutional orders, institutional arrangements and normative behavioural codes of individuals in a community have been identified as the three pillars of institutions that define a property right and its smooth functioning for any society.

> The constitutional order refers to the fundamental rules about how society is organised–the rules of making rules. ... [Institutional arrangements] include laws, regulations, associations, contracts, and ... property rights. ... [N]ormative behavioural codes, refers to the cultural values which legitimise the arrangements and constrain behaviour (Feder and Fenny 1991).

Land tenure arrangements as a form of property rights have to fulfil these institutional set-ups. As shown in Section 2, the constitutional order has been clearly defined in the case of Ethiopia. Similarly, the institutional set-up for running the land use and its administration has been handed over to the Regional States, which has resulted in different types of reactions based on the conditions in each.

The third important element that must be considered as indicated in the above citation is how individual farmers perceive the land ownership arrangement in Ethiopia, and

whether they are willing to pay for some proposed changes in these arrangements. This is also needed, as emphasised in the CVM literature, to ascertain and to give credibility for the quoted figure, since it has been argued that, "Subjects must understand, be familiar with, the commodity to be valued" (Cummings et al., 1986).

For this purpose, we asked in our sample the type of land ownership prevailing in the country. As indicated in Appendix (3A), only one per cent of the sample was unable to identify the type of ownership prevalent in the country. More than 80 per cent of them defined it as state property while the remaining put it as some form of communal property. The confusion between state and communal property comes from the definition of the type of ownership given by the state, as discussed earlier in Section 2.

We also asked whether they would consider paying money to the government and ensure their ownership indefinitely. Thus, they were told that if this were to happen, then the government or the community would not interfere with reallocation of land in the future. They would have a right to exchange (including through selling) their land whenever the need to do so arose, and the responsibility of provision of land to the next generation, i.e., their siblings, would fall on the household.

Around 23 per cent of the sampled households would be willing to pay for such an institutional change (see Appendix (3B)). Given the low level of income of these farmers, and seen from the perspective that land has mostly been either under customary tenure or under state ownership, this is a substantial proportion. The strength of the need to such a change, however, varied among the sampled sites– Geblen and Debre Birhan are on the weaker side. Tentatively, we would put income constraints for such a result in the case of Geblen, whereas for Debre Birhan the fresh memory of the effects of redistribution might have contributed to this. However, even in these sites, there are farmers who are willing to pay for moving away from state and/or communal ownership, which inherently leads to periodic redistributions, and towards one that is private and tenure is more stable.

As a follow-up question, we asked the farmers who refused to pay their reasons for doing so. As indicated in Appendix (3C), around 64 per cent of them said that they did not have financial capacity for doing this. About 28 per cent of the sampled respondents believed that land must be given free of charge to farmers. It is also worth-noting that around 16 per cent of those who refused to pay for the change in Debre Birhan expressed their concern of future nationalisation by the government as a reason for not paying for these rights.

Those households who identified financial problems as a reason for not willing to pay for the institutional change were asked whether they would borrow soft loans for this purpose. Appendix (3D) shows that around 53 per cent of those who presented

financial reasons for not paying are willing to borrow in order to pay for the shift in the institutional set-up. As a result, a total of around 50% of our sampled households would be willing to pay for a secured (private) ownership of land.

Table 1 shows the average WTPs that have been elicited by the sample. In all sites, except for Koro Degaga, we got zero bid from more than 50 per cent. Thus, the medians are zero, even for Koro Degaga, which shows a positive median WTP, it is the minimum in the sample that has been picked.

Table 1. Descriptive Statistics of WTP in ETB† for Tenure Security per Hectare of Land

	mean	std. err.	95% conf. int.	median	min.	max	N
The Total-Sample, Out-of-Pocket WTP per Hectare							
All sites	284.45	83.34	(663.5, 991)	0	0	21333	524
Harresaw	473.52	94.46	(286.04, 661)	0	0	5455	98
Geblen	146.67	56.76	(34.02, 259.31)	0	0	4000	99
Debre Birhan area	297.66	91.72	(116.03, 479.29)	0	0	6295	119
Koro Degaga	105.80	21.88	(62.42, 149.18)	0	0	1133	109
Sirbina Godeti	415.91	130.48	(156.97, 674.86)	0	0	9697	99
The Total sample: Borrowers and Out-of-Pocket WTP per Hectare							
All sites	827.23	83.34	(663.5, 990.96)	0	0	21333	524
Harresaw	1970.51	324.48	(1326.5, 2614.52)	1033	0	21333	98
Geblen	486.43	149.09	(193.64, 785.22)	0	0	12000	99
Debre Birhan area	575.22	111.68	(354.07, 796.36)	0	0	6295	119
Koro Degaga	233.93	47.63	(139.53, 328.34)	49.56	0	4000	109
Sirbina Godeti	989.45	175.08	(642, 1336.9)	472.22	0	9697	99
Sub-sample with Positive Out-of-Pocket WTP							
All sites	1173.65	133	(910.43, 1436.87)	700	49.57	9697	127
Harresaw	1496.93	200.35	(1087.76, 1906.1)	1000.00	333.33	5455	31
Geblen	1452.00	369.80	(615.47, 2288.53)	1200.00	400	4000	10
Debre Birhan area	1771.06	416.55	(899.21, 2642.91)	707.1	89.36	6295	20
Koro Degaga	329.49	50.7	(226.46, 432.51)	200	49.57	1133	35
Sirbina Godeti	1328.24	370.44	(571.68, 2084.79)	762.6	162.64	9697	31
Sub-sample: Borrowers with Positive WTP per Hectare							
All sites	2122.5	259.53	(1609.15, 2635.85)	1334	40	21333	134
Harresaw	3411.75	654.69	(2090.54, 4732.97)	1666.67	666.67	21333	43
Geblen	2610.26	867.12	(720.96, 4500)	1600	400	12000	13
Debre Birhan area	1942.9	282.18	(1344.7, 2541.1)	1935.48	181.65	4500	17
Koro Degaga	665.11	198.32	(251.41, 1078.8)	400	40	4000	21
Sirbina Godeti	1419.49	290.22	(832.46, 2006.53)	775	193.55	9600	40
Sub-sample: Borrowers and Out-of-Pocket with Positive WTP per Hectare							
All sites	1660.8	150.75	(1363.95, 1957.65)	837	40	21333	261
Harresaw	2609.6	403.03	(1806.36, 3412.84)	1393.94	333.33	21333	74
Geblen	2106.67	520.69	(1026.82, 3186.51)	1200	400	12000	23
Debre Birhan area	1850.02	256.84	(1329.13, 2370.9)	1333.33	89.36	6295.08	37
Koro Degaga	455.34	82.68	(289.64, 621.04)	205.14	40	4000	56
Sirbina Godeti	1379.65	228.36	(924.21, 1835.09)	782.61	162.64	9697	71

†1 USD was around 7.00 ETB at the time of the survey Source: Own survey

The mean out-of-pocket WTP for tenure security of the 127 households is ETB 1173, while that for the 134 households, who were willing to borrow for making their payments, was ETB 2122, and the combined mean WTP for the 261 households is 1660. Comparisons of these means should be taken cautiously because the respondents were not facing the same question. Namely, the out-of-pocket payers were not asked what they would pay if borrowing was available.

Given this, however, with the exception of one site (Sirbina Godeti)[4], we observe that the mean WTP of the borrowing sample is larger than the out-of-pocket WTP in all others. Consequently, the borrowing sample has a mean of 1.81 times that of out-of-pocket payers. This, coupled with the fact that the borrowing sub-sample is larger, has pulled the mean of positive WTP upwards relative to the out-of-pocket borrowers.

Focussing on the out-of-pocket payers, we also observe that the variation of mean WTPs among the different sites seems to follow the level of land scarcity in the village. If we exclude Debre Birhan, where there was redistribution at the moment of data collection and concentrate on the remaining four sites, the mean WTP's per hectare for Harresaw and Geblen were ETB 1497 and 1452, respectively, while that for Koro Degaga was only ETB 330. Contrasting these figures with the mean landholding per household, which are given in Appendix (5) is indicative that these two variables are inversely related.

To conclude this section, it is important to note that the fear of being confiscated again is an important impediment to the WTP for security. Thus, one could speculate that, if this uncertainty were to be removed, it would have been possible to obtain a larger proportion of our sample with positive WTP. Moreover, there is the proposition that WTP derived from open-ended questions tend to result in lower bids than close-ended ones (Halvorsen and Saelensminde 1998). As a result, it is suspected that the average values presented would be underestimates of the true WTP.

5. STATISTICAL SPECIFICATION, DEFINITION OF VARIABLES AND ECONOMETRIC RESULTS

5.1. Statistical Specification

Cross-section data generated from household surveys often result in dependent variables that are censored, which have come to be known as limited dependent variables in the literature. The characteristic feature of these models is the fact that there is a limit value (lowest, or highest, or both) to the dependent variable, and quite a significant number of observations in the sample take this limit value. This feature is inherent in CVM surveys with zero as a limiting value. Thus, the methodologies developed for limited dependent variables is also relevant for CVM models.

Starting with Tobin's (1958) seminal paper, a number of statistical models have been developed in order to take care of these limiting values in the dependent variable. In this line Cragg (1971) elaborated on an interesting set of models by making various assumptions on the basic simultaneous equations, which were elaborated and refined further by Maddala (1983) and Amemiya (1985). In general, the models take the form:

$$z = \gamma' w_i + \delta_i \quad \text{(a)}$$
$$y_i^* = \beta' x_i + \varepsilon_i \quad \text{(b)} \qquad [5]$$
$$z_i = 1 \text{ if } y_i^* > 0 \text{ and } z_i = 0 \text{ if } y_i^* \leq 0 \quad \text{(c)}$$

Where x_i and w_i are vectors of exogenous variables. The parameters to be estimated are given by the vectors γ and β. The censored dependent variable is y_i^*, which is observed only if it is greater than the limiting minimum value, and is zero otherwise. When the dependent variable is observed we also have z_i being equal to 1, otherwise it takes a value of zero. The error terms in the equations are given by δ_i and ε_i, which are assumed to be normally distributed.

In the setting of our data, Equation [5(a)], taken separately, gives us a probit model, which could be used to identify the determinants of households' positive WTP for the institutional change. Consequently, z_i is 1 for households that said would pay for the institutional proposed institutional change and 0 otherwise.

If we assume that Equation [5(b)] holds with, $y_i = 0$ if $y_i^* \leq 0$, and $y_i = y_i^*$, otherwise, then the original Tobin's model applies. On the other hand, if we assume that the error terms in Equations [5(a)] and [5(b)] are characterised by a bivariate normal distribution, with covariance ρ, then the sample selection model applies. If we, however, assume that the probability of yi* obtaining a positive value and the level that it attains is not correlated, then we have the truncated model, if we continue to assume normality, otherwise we have an independent OLS model on the positive values only in the structural equation, Equation [5(b)].

5. 2. Definition of Variables

The explanatory variables used in estimation are the following:

1. The total area of land which is possessed by the household: This is an aggregate level of all the area of all plots that have been given to the household by the community. We use this in the probit equation with the hypothesis that households

that have larger land would be inclined to choose (or 'vote') for a change towards a more secured system–these tend to be losers given the existing tenure structure.

2. The total area of land that the household is willing to pay for: This is the amount of area for which the households were willing to pay for secured tenure. The variable is used in the second (structural) equation hypothesising that it would negatively be related with the willingness to pay per hectare, as it applies for any demand equation.
3. The average years since the holdings were under the disposal of the households: This variable considers whether the length of time that the households have had control over their holdings would have any bearing on the decision to pay for it. It has been used only on the probit equation.
4. The area of land foregone for soil conservation per hectare on the households' plots: Here we are interested to see whether investments made on soil conservation influence both the decision to chose a secured system and the level of payment. Intuitively, it should influence both positively.
5. The mean distance of plots to the households' homesteads: This is in order to investigate whether distance has any bearing on the determination of both the probability of paying and the level of payment made.
6. The number of adults aged 15 years and above in the households: Since the redistributions made so far are dependent on family size, households with more adults in them would expect increase holdings if they were to occur. Thus, we hypothesise that this variable would be inversely related to both actions.
7. The exposure of household head to literacy: Here we would like to see the impact of access to education on these actions.
8. Non-farm income of the household: We used this variable on the probit equation to see its impact on the decision to pay.
9. Value of owned domestic animals by the household: This is used as a proxy to household wealth, which is used in the probit equation.

5.3. Estimation Results

5.3.1. Factors Affecting the Probability of Positive WTP

Parameter and their slope estimates of the independent probit model are presented in Table 2.[5] The sign of each parameter seems to be consistent with expectations. Interestingly, the number of adults in the household generates negative impact on the probability of the household's choice of the institutional set-up. At the margin, the mean probability of a positive WTP is reduced by 3% points with an increase in the number of adult household members. Given the institutional set-up in the country this is to be expected. As mentioned earlier, since the main rationale for redistribution of land has been equity and access to land for newly formed households, it follows that households that have more adults would benefit from such an action and would

actually lose if the institutional set-up is changed into one of private ownership. Thus, it is not surprising at all if households with larger number of adults tend to be less enthusiastic about moving towards private ownership.

The coefficient for the amount of soil conservation investment made is positive and significant at 10 per cent level. Thus, the larger the investment made on soil conservation the larger the probability for the household to opt for a move towards private ownership of land. The marginal contribution of one additional square metre investment on the probability of positive WTP is about 6 percentage points. This is intuitive since a household with larger investments made would have to lose much more than one with less investment on insecure holdings under an unsecured tenure arrangement.

Table 2. Determinants of Willingness to Pay for Tenure Security[†]

Variable	Coefficient	Marginal Effects
Constant	-0.7624292713*** (0.27611436)	-0.2141077243*** (0.076472565)
Total household landholding (in hectares)	0.5597947290*** (0.059578081)	1572032712*** (0.017040320)
Average number of years farmers possessed the land	-0.007025052714 (0.0094768699)	-0.001972796831 (0.0026612695)
Area of land investment on soil conservation (in metres per hectare)	0.02207193545* (0.011708076)	0.06198308550* (0.032815883)
Mean distance of plots from homestead (in Km)	-0.3982899311*** (0.14940934)	-0.1118489989*** (0.041357228)
Age of household head	0.0003712995935 (0.0052308203)	0.0001042694897 (0.0014690936)
Number of adults in the household	-0.1202716709*** (0.047727193)	-0.03377505917*** (0.013344656)
Literacy of household head (0=illiterate, 1=literate)	0.3945866990* (0.20579887)	0.1108090460* (0.057724969)
Non-farm income of household (in '000 Birr)	0.2324773199** (0.10248150)	0.6528499338** (0.028835082)
Value of assets (in '000 Birr)	0.001227821359 (0.024891730)	0.0003448005564 (0.0069909237)
Number of observations 254		
Log likelihood function -227.7597		
Chi-squared 124.855		

† Dependent variable z =1 if 'out-of-pocket' willingness to pay is greater than zero; z=1 otherwise.

†† Figures in parentheses are standard errors.

***, **, * indicate significance levels of 1, 5 and 10 per cent, respectively.

A household that has made more investment on land, the more secured would it like the tenure system to be. Moreover, larger land possession induces larger probability on choosing more stable tenure system, after accounting for other factors, since in case of redistribution it results in reduced holding.

Distance from plot to its homestead, on the other hand, influences the probability of a household's payment for security negatively. In fact, at the margin, the probability of positive WTP decreases by more than 10 percentage points as the distance of farms increased by a kilometre. On the other hand, non-farm income affects this decision positively. However, wealth, defined as the total value of domestic animals owned by the household, and average tenure, defined as the mean number of years that the plots have been under cultivation by the household, do not have any statistically significant influence on the decision to pay for security.

5.3.2. Determinants of the Level of WTP

Table 3 reports the results of an independent regression model based on observations with positive WTP only, column 1 and 2 of results indicate the estimated coefficients and their total marginal effects, respectively. We also tried both the Tobit 1 and Tobit 2 models[7], which are presented in Appendix (7). Tobit 1 failed the moment-based test for normality proposed by Pagan and Vella (1899) and Tobit 2 results show that the correlation coefficient, ρ, is not statistically different from zero, implying that independence of the two equations cannot be rejected. Thus, our analysis will be based on the results of the independent model.

As can be seen from these results, there are three important variables that explain the amount that an individual is willing to pay for security that are statistically significant. Only one of these variables, the amount of soil conservation made on the land, appear on both the probit and the independent OLS equations. Total household landholding does not appear in the structural model, since in its place we use the variable total area of land farmers wanted to pay for security.

Interestingly, these variables have the expected sign as well. Thus, the larger the quantity of land, the lower the price tag farmers attach on it. Since both the dependent and independent variables enter the structural equation in levels, the marginal effects are marginal willingness to pay as well. Consequently, around the mean value of the variables, an increase in the quantity of land available for changes in tenure arrangement reduces the WTP by Birr 117.5. It is difficult to compare this result with prices of land, for the simple reason that they do not exist. It would not be fair to compare these to the 'prices' of land in urban centres, because the scarcity levels and use of land in these two are different.[8] Comparing this to the average value of farm income seems to be more reasonable, which is around Birr 1500.

At the same time, controlling for other factors, investments made on soil conservation on land occupied by the farmers increase their WTP for secured tenure arrangements. Thus, at the margin, a change in the soil conservation structure by a metre per hectare raises the WTP by ETB 12. This phenomenon goes with rational reasoning since a farmer would definitely be inclined to pay more for lands with larger investments structures built on them.

Table 3. Determinants of the Levels of WTP: the Independent Model †

Variable	Independent Model	
	coefficient	marginal[9]
Constant	11.1802*** (5.2998)	
Total household landholding (in hectares)		2.5672*** (0.3018)
Area of land investment on soil conservation (in metres per hectare)	0.0337* (0.0184)	0.1199* (0.0652)
Mean distance of plots from homestead (in Km)	-0.1044 (3.0647)	-0.6459 (14.0548)
Age of household head	-0.1595* (0.0864)	-0.7311 (0.3965)
Number of adults in the household	0.6992 (0.8389)	3.4559 (3.8478)
Literacy of household head (0=illiterate,1=literate)	3.8445 (3.5144)	17.7958 (16.12)
Non farm income of household (in '000 Birr)	-0.0203 (1.2348)	0.0045 (5.6627)
Average number of years farmers possessed the land		-0.0322 (0.0434)
Value of assets (in '000 Birr)		0.0056 (0.1141)
Total area of land farmers wanted to pay for security (in hectares)	-2.8035*** (1.0558)	-1.1753*** (0.4522)
No. of observations	127	
Adjusted R^2	0.15	
F[7, 112]	4.35	

†The dependent variable is willingness to pay per hectare of land ('00 of Birr).

†† Figures in parentheses are standard errors

***, **, * are significance levels at 1, 5 and 10 per cent respectively.

At the same time, total land at the disposal of the household would not only influence the probability of seeking change in the institutional change, but also affects the level of WTP positively.

At the same time, total land at the disposal of the household would not only influence the probability of seeking change in the institutional change, but also affects the level of WTP positively.

6. CONCLUSIONS

The sampled farming households are not only aware of the existing tenural arrangements in the country, but also are willing to pay for changes in the institution.[10] A large proportion of the sampled households (around 50 per cent) wanted to pay for a change in the existing tenure arrangements. Interestingly, around 50 per cent of those who were willing to pay, were willing to do so without our mentioning of credit facilities.

The data shows that controlling for the other variables in the model, area of land, investment in soil conservation, literacy of the household head, and non-farm income affect the probability of paying for the institutional change positively. On the other hand, mean distance of plots to the household's homestead and its number of adult members affect the probability of paying for this change negatively.

The level of payment that farmers are willing to make for the institutional change is negatively affected by total land for which the change is sought. The effect of investment on soil conservation, however, is positive.

The results in this section seem to reinforce the compelling reasons, discussed on the tenure literature, for having a secured institutional set-up for the farmers in Ethiopia. Since the country is basically dependent on agricultural production, improvising on the institutions that ameliorate productivity should be welcomed.

Consequently, the government is faced with only one imperative policy option: a movement away from the existing insecure tenure system towards a more stable and secured one. It should be clear however that the sole solution to this problem is not necessarily a full-fledged privatisation of land which is seen in current day developed economies.

On the contrary, the available option to move towards a secured system is a continuum of property rights structures. One feasible option, given the situation of the farmers in the country is, for instance, to stop any systematic redistribution of land that is sponsored by the government, be it at the federal level or the regional one, and make sure that each household would have complete say in the allocation of land among its siblings.

NOTE

[1]There may even be compelling reasons to go a bit further and propose to let the decisions be made at lower levels, preferably at the community of village levels.

[2]In the contingent valuation literature, envisaged changes are made on environmental goods which do not have market prices [see for example, Johansson 1993].

[3]Recently, the PA's have been changed into Kebele Administrations (KA's) indicating the realization of their administrative role.

[4]Explaining this difference may be hazardous without sufficient proof but we note the fact that farmers in Sirbina Godeti have a long experience of the consequences of borrowing (namely repayment responsibilities) from the government. This is a site where farmers have a long history of getting loans from the government for purchasing fertilizers. The other sites have little experience, if any, in this respect, which may have pushed their WTP by borrowing from the government. It is even possible to speculate that they may be thinking 'there would be no repayment.'

[5]Tests for multiplicative hetroscedasticity over the main continuous variables with the specification, $\mathrm{var}(\varepsilon) = \left(\varepsilon^{\gamma' w_i}\right)^2$ indicated that the coefficients in, γ, were not statistically significant.

[6]Frequencies of Actual and Predicted Outcomes, Predicted Outcomes have Maximum Probability

	Predicted		
Actual	0	1	Total
0	380	17	397
1	84	43	127
Total	464	60	524

[7]We also tried a truncated regression model on the positive values; however, the model did not converge.

[8]Land is not sold in urban centers too. But one can sell his house. It is interesting to note that the price of houses in Addis Ababa is generally far above the price of the 'house'. Consider the cases of small service quarters being sold for quite exorbitant prices, which are demolished and new buildings erected on the land. In effect, the market is taking care of the value of land as well.

[9]An important adjustment is needed for obtaining the marginal values of the independent OLS model. Using the McDonald and Moffitt (1980) decomposition of the total effects of changes in the expected value of y_i^* with respect to any explanatory variable x_j is given by

$$\frac{\partial E[y]}{\partial x_j} = F(\cdot)\left(\frac{\partial E[y\bullet]}{\partial x_j}\right) + E[y\bullet]\left(\frac{\partial F(\cdot)}{\partial x_j}\right)$$

where $E(y\bullet)$ is the expected value of the non-limit values of y^* and F(·) is the cumulative normal distribution. Thus, the total change in y^* is the sum of the change in the dependent variable for observations above the limit, weighted by the probability of being above the limit, and the change in probability of being above the limit weighted the expected value of being above the limit. [I am grateful to Fredrik Carlson for his suggestions and help in getting the statistical programme right.]

[10]We qualify this in terms of the sampled households only because this sample may not be taken as a representative sample of the country's varied cultures as well as the uses that land is put under by the communities. If at all it could be generalized, it should not pass the settled agricultural farmers. For instance, the conclusions arrived here are highly unlikely to hold for the areas where the population is dependent on cattle raising for their livelihood. Here communal landholding may well be the preferred type of tenure arrangement.

REFERENCES

Amemiya, T. (1985). ***Advanced Econometrics*** Cambridge, Massachuset: Harvard University Press.

Coase, Ronald (1996) The Nature of the Firm, in Putterman, Louis and Randall S. Kroszner (eds) ***The Economic Nature of the Firm: A Reader*** Cambridge: Cambridge University Press. Previously published [1939].

_____ (1995) The Problem of Social Cost, in Rogowsky, R. (ed) ***Comparative Politics and the International Political Economy.*** V. 1. UK: Elgar. Previously published [1960].

Cragg, J. (1971) Some Statistical Models for Limited Dependent Variables with Application to the Demand for Durable Goods. ***Econometrica,*** 39(5).

Constitution of the Federal Democratic Republic of Ethiopia, Addis Ababa. (no author, no publisher).

Council of Amhara National Regional State (1996) Proclamation to Provide for the Reallotment of the Possession of Rural Land in the Amhara National Region, *Zikre Hig*, No. 16.

Council of Tigray National Regional State (1997) A Proclamation to Decide on the Utilization of Land, Mekele, March (draft, in Tigrigna).

Cummings, Ronald G., David. S. Brookshire, and William D. Schulze (eds) (1986). ***Valuing Environmental goods: A State of the Art Assessment of the Contingent Valuation Method.*** Totowa, N. J.: Rowman and Allanheld.

Dessalegn Rahmato (1984). ***Agrarian Reform in Ethiopia***. Uppsala: SIAS.

Feder, G., Onchan T., Chalamwong, Y. and C. Hongladarom (1988). ***Land Policies and Farm Productivity in Thailand.*** Baltimore and London: The John Hopkins University Press.

Halvorsen, Bente and Kjartan Saelensminde (1998) 'Difference between Willingness-to-Pay Estimated from Open-ended and Discrete Choice Contingent Valuation Methods: the Effects of Hetroscedasticity', ***Land Economics***, 74(2).

Hanemann, Michael W. and Barbara Kanninen (1996), The Statistical Analysis of Discrete-response CV Data, Department of Agricultural and Resource Economics, University of California at Berkeley, Working Paper No. 798.

Johansson, Per-Olov (1993). ***Cost-benefit Analysis of Environmental Change***. Cambridge: Cambridge University Press.

FDRE (1997), Proclamation Number 89/1989. 'Proclamation for Rural Land Administration,' Addis Ababa (draft, in Amharic).

Lin, Justin (1992) 'Rural Reforms and Agricultural Growth in China', ***The American Economic Review***, 82(1).

Maddala, G. (1983). ***Limited Dependent and Qualitative Variables in Econometrics***. New York: Cambridge University Press.

McDonald, J. and R. Moffitt (1980) 'The Uses of Tobit Analysis', ***Review of Economics and Statistics***, V, 63:318-321.

Mitchell, Robert C. and Richard T. Carson (1989). ***Using Surveys to Value Public Goods: The Contingent Valuation Method.*** Washington, D. C.: Resource for the Future.

Pagan, Adrian and Frank Vella (1989) 'Diagnostic Tests for Models Based on Individual Data: A survey', ***Journal of Applied Econometrics***, 4, supplement.

Singh, I., L. Squire, and J. Strauss (eds) (1986). ***Agricultural Household Models: Extensions, Applications, and Policy***. Baltimore and London: Johns Hopkins University Press for the World Bank.

Smyth, Russel (1998) 'New Institutional Economics in the Post-socialist Transformation Debate', ***Journal of Economic Survey***, 12(4).

Tekie Alemu (1999), Land Tenure and Soil Conservation: Evidence from Ethiopia, unpublished PhD dissertation, Gothenburg University.

Tobin, J. (1958) 'Estimation of the Relationships for Limited Dependent Variables', ***Econometrica***, V. 26:24-26.

APPENDIX 1

Changes in the institutional arrangement are exogenously determined from the household's point of view. Though they may also be a consequence of historical development of a society, they are usually determined through the political process, and affect production by altering the incentive structures facing the individuals in their investment decisions, and choices they make in the production process. Thus, we write:

$$q = f\left(L^d, A \middle| I_j\right) \qquad \forall j = 0,\ 1 \qquad \text{[A1]}$$

where, q is an index of composite output produced by the household, which is either consumed by the household domestically (X_f) or is sold for cash in the market (q_s). The farm's demand for labour is denoted by L^d, part of which may originate from market, L^d_p, and the other part being family labour, L^d_f. Land input, which is is assumed fixed, is given by A; and for the time being, let 'I' be the prevailing institutional arrangement, which is equal 0 for the *status quo* and 1 for an envisaged change. We have ignored other capital inputs in our analysis.

The household's utility is assumed to depend on the goods consumed and leisure, which we write as:

$$U\left(X_f, X_p, l\right) \qquad \text{[A2]}$$

Where, X_p is an index of composite goods consumed by the household, which comprises of purchased goods from the market, and X_f is consumption from own production. At the same time, the total available labour in the household may be used as either input in its own farm, or it may be hired out, the remaining part of labour is leisure, given by *l*. In general the farming household faces three basic constraints:

1. A cash income constraint:

$$p_p X_p \le p_f\left(q - X_f\right) - w\left(L^d - L^d_f - L^s_{nf}\right) \qquad \text{[A3]}$$

Where L^s_{nf} is the household's labour supply on non-farm activities with

2. A labour supply constraint

$$T = L_f^d + L_{nf}^s + l \qquad [A4]$$

3. The production possibility constraint given by Equation [A1].

Following the basic model formulated by Singh et al. (1984) we collapse all the constraints into:

$$p_p X_p + p_f X_f + wl = wT + \pi \qquad [A5]$$

where $\pi = p_f q\left(L^d, A \middle| \bar{1}_i\right) - wL^d$

With a concomitant Lagrange equation:

$$L = U\left(X_f, X_p, l\right) + \mu\left(y^* - p_p X_p - p_f X_f - wl\right) \qquad [A6]$$

where

y^* is the 'full income' of the household
p_f is the price index of agricultural products in the market
p_p is the price index of purchases made by the household, and
μ is the Lagrange multiplier.

The solution to the first order conditions of Equation [A6], with respect to X_p, X_f and l, yield the equations of the demand for the farm product, the market purchased product and leisure, as a function of their respective prices, income and the institutional set up:

$$X_i = X_i\left(p_f, p_p, w, y^* \middle| \bar{1}_i\right), \quad \forall i = a, \ p \qquad [A7]$$

By substituting the demand functions in Equation [A7] into the utility function we obtain the indirect utility function which is given in Equation [1] in the main text.

APPENDIX 2. WILLINGNESS TO PAY FOR SECURITY

1. Who owns land in Ethiopia?

_____

2. Suppose the government was to sell the plots of land you are cultivating. Thus, you would have the right to sell it, the government will not redistribute land in your village, and you would take care of allocating land to your siblings. Would you be willing to pay for them?

Yes.....1 => q. 4
No.....2 ——— => q.3

3. Why not? **Code (r)** ——— If answer is 1=> q. 4, otherwise =>q. 5

4. Suppose the government was to lend you money that will be payed over a long period (say 10 years) with a soft interest rate (say 4 % per year) for such purposes. Would you borrow in order to buy the plots you currently cultivate?

Yes.....1
No.....2 ——— => q. 6

5. Give details on the amount you are willing to pay for each of the plots that you have identified earlier.

Plot No	Willingness to pay (in Birr)	Plot No	Willingness to pay (in Birr)
1		7	
2		8	
3		9	
4		10	
5		11	
6		12	

APPENDIX 3

Appendix 3A. Perceptions of peasants about form of land ownership in †

	Haressaw	Geblen	Debre Birhan	Koro Degaga	Sirbina Godeti	All sites
State	91 (92.9)	80 (80.8)	113 (95.0)	72 (66.1)	80 (79.2)	435 (82.9)
Community /P.A./ people	6 (6.1)	19 (19.2)	6 (5)	36 (33.0)	18 (17.8)	85 (16.2)
God	1 (1)			1 (0.9)		2 (0.4)
Don't know					1 (1.0)	1 (0.2)
No response					2 (2.0)	2 (0.4)
Total	98 (100)	99 (100)	119 (100)	109 (100)	101 (100)	526 (100)

Appendix 3B. Would you pay for secured private ownership of land?†

	Haressaw	Geblen	Debre Birhan	Koro Degaga	Sirbina Godeti	All sites
Yes	29 (29.6)	10 (10.1)	17 (14.3)	35 (32.1)	29 (28.7)	120 (22.8)
No	67 (68.4)	89 (89.9)	99 (83.2)	74 (67.9)	68 (67.3)	397 (75.5)
No response					2 (2)	2 (0.4)
Outliers	2 (2)		3 (2.5)		2 (2)	7 (1.3)
Total	98 (100)	99 (100)	119 (100)	109 (100.0)	101 (100)	526 (100)

Appendix 3C. Reasons for not purchasing land rights†

	Haressaw	Geblen	Debre Birhan	Koro Degaga	Sirbina Godeti	All sites
Do not have money	63 (94.0)	50 (56.2)	57 (57.6)	34 (45.9)	47 (71.2)	251 (63.5)
Land must be distributed freely	4 (6.0)	37 (41.6)	19 (19.2)	39 (52.7)	11 (16.7)	110 (27.8)
Afraid of being nationalized again		2 (2.2)	16 (16.2)	1 (1.4)	8 (12.1)	27 (6.8)
It must belong to the State			2 (2.0)			2 (0.5)
Old to buy			5 (5.1)			5 (1.3)
Total	67 (100)	89 (100)	99 (100)	74 (100)	66 (100)	395 (100)

Appendix 3D. If a financial problem, would you borrow for it?†

	Haressaw	Geblen	Debre Birhan	Koro Degaga	Sirbina Godeti	All sites
Yes	43 (68.3)	13 (26)	17 (29.8)	21 (61.8)	40 (85.1)	134 (53.4)
No	20 (31.7)	37 (74)	40 (70.2)	13 (38.2)	7 (14.9)	117 (46.6)
Sub-total	63 (100)	50 (100)	57 (100)	34 (100)	47 (100.0)	251 (100)
No response	35	49	62	75	53	274
Grand total	98	99	119	109	101	526

† Figures in parentheses are percentages

APPENDIX 4. Descriptive Statistics of the Variables Used in Regression

Variable		Harresaw	Geblen	Debre Birhan	Koro Degaga	Sirbina Godeti	All sites	Harresaw	Geblen	Debre Birhan	Koro Degaga	Sirbina Godeti	All sites
		Non-protesting group						Group with positive WTP					
Number of observations		92	60	74	69	76	371	29	10	17	35	29	120
Total land	Mean	0.47	0.33	2.66	3.58	1.94	1.76	0.4345	0.24	2.79	3.64	2.13	2.1
	Std. Dev	0.19	0.19	1.07	1.49	1.03	1.55	0.1637	0.0622	1.12	1.5	1.46	1.75
	Minimum	0.15	0.13	0.38	0.75	0.38	0.13	0.15	0.13	0.38	1.13	0.88	0.13
	Maximum	0.9	1.5	6.53	8.25	7.35	8.25	0.85	0.38	4.93	8.25	7.35	8.25
Mean tenure	Mean	16.12	20.08	17.98	12.99	19.06	17.15	16.34	16.55	18.17	12.91	17.58	15.92
	Std. Dev.	8.5469	9.41	7.49	7.54	6.82	8.3	7.62	9.37	8.26	6.93	5.74	7.47
	Minimum	4	6	4.75	2.6	2	2	4	6.5	6	4.43	6.5	4
	Maximum	43	42	43	41.83	50	50	30	38	39	33	29.29	39
Total area of land used for soil conservation	Mean	20.51	19.86	8.41	1.81	0	11.58	32.97	22.75	4.41	3.57	0	11.53
	Std. Dev.	25.62	24.8	30.8	9.55	0	22.65	24.44	24.25	18.19	13.26	0	21.46
	Minimum	0	0	0	0	0	0	0	0	0	0	0	0
	Maximum	93	100	175	70	0	175	93	62.5	75	70	0	93
Mean distance from home	Mean	273.98	222.51	353.26	742.18	603.52	487.93	547.94	141.9	538.96	664.76	528.56	476.62
	Std. Dev	822.03	396.67	613.32	714.03	506.32	634.61	276.48	195.9	354.79	546.13	349	484.92
	Minimum	0.5	0	19.25	4.33	1.13	0	3	0	19.25	4.33	12.5	0
	Maximum	6515	2000	2312.5	4235	2625	6515	2000	500	1213.43	2285.71	1400	2285.71
Age of Household head	Mean	47.36	55.18	53.51	45.9	48.33	49.78	45.69	46.8	55.53	45.6	50.28	48.26
	Std. Dev	14.94	14.31	15.55	13.12	14.51	14.89	14.86	14.99	17.96	15.35	17.26	16.19
	Minimum	20	26	25	24	16	16	20	26	28	24	16	16
	Maximum	87	92	87	83	83	92	69	83	83	83	83	83

APPENDIX 4. Continued

Variable		Harresaw	Geblen	Debre Birhan	Koro Degaga	Sirbina Godeti	All sites	Harresaw	Geblen	Debre Birhan	Koro Degaga	Sirbina Godeti	All sites
Number of adults in household	Mean	2.58	2.68	3.23	3.2	3.76	3.12	2.14	2.6	3.18	3.11	3.9	3.03
	Std. Dev.	1.5	1.15	1.37	1.41	1.86	1.54	1.46	0.97	1.29	1.6	2.08	1.71
	Minimum	0	1	1	1	0	0	1	1	1	1	0	0
	Maximum	6	6	6	7	10	10	6	4	5	7	10	10
Literacy	Mean	0.032	0.033	0.1757	0.1739	0.1316	0.11	0.04	0.1	0.29	0.23	0.28	0.19
	Std. Dev.	0.1766	0.181	0.3831	0.3818	0.3403	0.31	0.19	0.32	0.47	0.43	0.45	0.4
	Minimum	0	0	0	0	0	0	0	0	0	0	0	0
	Maximum	1	1	1	1	1	1	1	1	1	1	1	1
Non-farm income	Mean	444.42	32.6	609.23	173.34	265.5	323.62	519.9	11.4	957.44	186.47	468.41	429.82
	Std. Dev.	814.62	158.86	750.25	191.49	1102.78	755.06	945.1	27.2	1097.68	220.58	1700.48	1068.06
	Minimum	0	0	0	0	0	0	0	0	17.5	0	0	0
	Maximum	5000	1200	4444	672	8640	8640	5000	84	4444	672	8640	8640
Value of assets	Mean	1628.73	1151.08	5566.38	3685.62	2498.26	2897.56	1637.97	1232	6123.24	4591.8	2887.86	3403.14
	Std. Dev.	1555.07	674.11	3898.64	4244.92	1958.95	3197.43	1505.14	587.48	3214.39	5550.13	2036.9	3797.16
	Minimum	0	0	0	48	0	0	0	0	370	150	0	0
	Maximum	6540	3050	22100	29350	7450	29350	5185	2150	10940	29350	7390	29350
land to be paid for	Mean	0.3092	0.091	0.6919	2.78	1.41	1.03	0.3741	0.22	1.7	3.45	1.57	1.73
	Std. Dev.	0.2402	0.1268	0.9093	1.83	0.78	1.35	0.1737	0.0531	0.86	1.4133	0.67	1.52
	Minimum	0	0	0	0	0	0	0.08	0.13	0.15	1.13	0.3	0.08
	Maximum	0.9	0.5	3.15	8.25	3	8.25	0.85	0.25	3.15	8.25	3	8.25

APPENDIX 5. Single Equation Tobit 1 and Tobit 2 Estimates of the Determinants of The Level of WTP ††

Variable	Tobit 2			Tobit 1	
	Probt	structural Equation			
	Coef.	Coef.	marg. ef.	Coefficient	marg. ef.
Constant	0.2802 (0.285)††	8.1614 (5.9455)		-11.6862** (5.7355)	-2.2406** (1.0729)
Total area of land farmers wanted to pay for security (in hectares)		4.7249** (2.1135)	1.5087** (0.7194)	7.9119*** (1.1809)	1.517*** (0.2181)
Area of land investment on soil conservation (in metres per hectare)	0.0056 (0.0224)	0.01899 (0.0389)	0.0034 (0.0157)	0.046** (0.0244)	0.0088* (0.0466)
Mean distance of plots from homestead (in Km)	-0.4394* (0.2592)	-6.3786 (4.0042)	0.0608 (1.7423)	-6.8376** (2.9683)	-1.311** (0.5591)
Age of household head	-0.0169** (0.0076)	-0.3879*** (0.0979)	-0.4295 (0.0404)	-0.1479 (0.0935)	-0.0284 (0.0179)
Number of adults in the household	-0.1283 (0.1085)	-2.0573** (0.9303)	-0.0443 (0.5973)	-1.9993** (0.9282)	-0.3833** (0.1765)
Literacy of household head(0=illiterate,1=literate)	0.2526 (0.2994)	5.1247 (4.1573)	0.4303 (1.8756)	9.637*** (3.9915)	1.8477** (0.7655)
Non farm income of household (in '000 Birr)	0.1301 (0.2179)	2.7424 (1.7988)	0.2547 (1.1741)	3.3769*** (1.6385)	0.6475** (0.3150)
Average number of years farmers possessed the land	-0.0004 (0.0107)		-0.0001 (0.0038)		
Value of assets (in '000 Birr)	0.0057 (0.0541)		0.002 (0.0193)		
Total land under household (in hectares)	0.3346*** (0.0871)		0.1196*** (0.0331)		
SIGMA(1)	11.1351*** (0.9652)			22.3412*** (1.5818)	
RHO(1,2)	.146 (1.356)				
No. of observations	524			524	
Log-L	-700.3775			-704.2784	

† Probit dependent variable z =1 if 'out-of-pocket' WTP is greater than zero; z=1 otherwise; dependent variable for structural equation in Tobit 2 and Tobit 1 is the censored out-of-pocket WTP.
†† Figures in parentheses are standard errors.
***, **, * indicate significance levels of 1, 5 and 10 per cent respectively.