Bridging for Peaceful Co-existence: What Role for Personal Wealth and Entitlement in Conflict Mitigation in Dry Lands of Eastern Ethiopia

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Abstract

Capitalizing on the mobility of livestock is one of the major ways in which pastoralists have managed ecological uncertainties and risks, as it enables them the opportunistic use of the resources. However, agricultural encroachment onto rangelands by nearby agro-pastoralists has led to a shortage in grazing area and threatened the mobility of the pastoralists. As this process leads to a significant disruption and weakening of the risk-management systems of pastoralists, they seek for various institutional arrangements with agropastoralists to enable them access to common grazing land.

Based on an exploratory survey and data derived from interview of 146 households in eastern Ethiopia, this paper uses an adaptation of the sequential rationality game theoretical model and institutional analysis to discrete choice models. The analytical framework, in its entirety, presents a simple model of household and community level decision-making, in which they are concerned about their welfare along many different dimensions.

Choice of institutional arrangement, namely no opinion, reciprocal, sharing milk and the right to use milk, is modelled using multinomial logit discrete choice procedure. The model chi-squared statistic is significant at the 1% level of probability. For all arrangements, there are three to five observable characteristics of household that provide statistically significant predictive power for practicing a given arrangement. The paper argues resource scarcity may enhance the bargaining position of asset-poor members of an agro-pastoral society and urges the wealthier agropastoralists to comply with a non-violent resolution of competing claims towards a resource sharing arrangement.

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1. Introduction

1.1. Background

Millions of poor people in Ethiopia live in semi-arid agropastoral and pastoral areas and have suffered extreme marginalization and food insecurity because of reduced access to pastureland, and in some places steadily extending croplands. The lack of institutional support for the pastoralists has further excluded their participation in decision making. Yet the possibilities for sustainable pastoral and agropastoral production system is to key improve the efficiency of natural resource use with the right, technologies, policies, and institutions.

In pastoral areas community-based land tenure institutions provide households with their means of livelihoods by effectively managing common properties such as rangelands and woodlands. These indigenous systems also facilitate adaptation to changing environmental uncertainties. They need to be systematically studied in order to be adequately empowered, so that they best able to take account of multiple resource users and uses and establish institutions that recognize the rights of many users over the same resource and be able to manage and resolve conflicts.

Indeed, it is relatively recently that researchers started to focus on the dynamics and institutions of sustainability in community based natural resource management employing (Ostrom, 1990; Leach et al., 1999). In the new political and socio-economic context of Ethiopia, researches focused on the management of community-based natural resources are also emerging (Birhanu, et al., 2002; 2003). The finding of Birhanu et al. (2002) confirms that collective action for grazing land management is widespread in the highlands of northern Ethiopia and both formal and informal property right institutions govern the use and allocation of croplands, forestlands, and grazing lands.

Hardin (1968) explains the logic behind his model on the “tragedy of the commons”, today well known example of a pasture with open access. The essence is that each herder is motivated to add more and more animals because he receives the direct benefit of his own animals and bears

only a share of the costs resulting from overgrazing. Despite all the evidence and theoretical arguments aimed at refuting the "tragedy", Hardin's thinking has been reflected in actual natural resource policy in much of Sub-Saharan Africa (Swallow and Bromley 1995, Lawry 1990).

However, many studies have now contested the universal applicability of Hardin's prediction. Policy makers and social scientists show increasing interest in cooperative means of to manage common resources (Bromely, 1992; Uphoff, 1992; White and Runge, 1995). This interest is reflected in new attempts to strengthen common property system, to develop voluntary institutions to manage transboundary resources and to promote community based conservation and the role of civil society in economic development (de Janvry et al., 1993, Lawry, 1990). The concern now is not whether local institutional arrangements can be effective, but under what circumstances they are most appropriate (Uphoff, 1993).

The management of natural resources in the eastern lowlands of Ethiopia, where pastoralists and agropastoralists prevail, depends on a complex body of rules established by local groups-rules established over time to resolve how best to regulate access to croplands and grazing lands. The definition of these rules, their supervision and adjustment depend on local organizations acting under the authority of traditional institutions. These organizations rarely act without having obtained widespread support for the decisions that need to be taken, by seeking the advice tribal/clan headmen and various local institutions.

The study areas, the Yerer and Daketa valleys are located in eastern Ethiopia and from an agro-ecological perspective, the area can be classified into two zones namely, *woina dega* (mid altitude) and *kola* (lowland). The valleys are characterized by sparse and irregular rainfall, and are highly drought-prone. Both the Dakata and the Yerer rivers are seasonal. They dry on the surface around the end of October. However, there seems to be plenty of sub-surface water - a well that is a few meters in depth produces water even during the driest periods. The valley bottom is fertile and suited for the production of many lowland agricultural products during favourable rain seasons. During the rainy season, there is a lush growth of grass and shrubs supporting thousands of livestock and wildlife. Even after a long time the rainy season is over,

the grass continues to grow on the seasonally swampy places. In many parts of the valley, cactus weeds present a dangerous competition to the grazing grassland.

Much of the benefit of the valley is exploited by the agro-pastoralist. Because of occasional violent armed clashes in the past between clans or sub-tribal groupings, each group or community is supposed to graze at a given space of the valley at a certain season of the year. It is not uncommon to see in one place armed herdsmen among their livestock; and when one group tries to encroach on the territorial confines of another, fighting may break out resulting in the loss of life and the abduction of the enemy's livestock.

The agro-pastoral communities represent various clans or sub-tribes including *Girie-Babile, Malingur, Hawiya, Abiskul, Werehume, Rer-Worfa, Ugas Koshin, Rer Isahak* and *Mekabil*. During the dry season, the agro-pastoralists live almost entirely on sorghum and maize. During the wet season, milk is the main food, except on feast days, not much meat is consumed.

In terms of social status, the village leader (*aba genda*) is the most powerful personality in the community. The village leaders are the key administrative people for the Government to work with the agro-pastoralists. Initially the title and position of a village leader was mostly hereditary, however, over time it has become elective, that is, if the local Government representative sanctions such transfer of leadership.

Livestock, largely composed of cattle, sheep and goats, and camel, are vital sources of household welfare. Livestock have the ability to withstand fluctuations in weather patterns better than crops, and therefore, provide both food and income security. Hence, there is heavy involvement of the communities in this area in livestock production. The inhabitants of the Yerer and Daketa valleys used to follow a traditional transhumant pattern of pastoralism with regular movement to and away from the valley.

Livestock are watered at the shallow wells and seasonal streams during the wet season and deep hand-dug wells during dry seasons. They are grazed on the densely bushed hillside during the wet season, but allowed to browse along the riverside and on croplands during the dry season.

The possession of a large number of livestock has remained the ambition of agro-pastoralists in the area. Even in the years of good harvests, households tend to sell the surplus and buy cattle or goat in return.

The valleys are largely used for grazing by the Oromo and the Somali lowlanders. Occasionally, in time of severe drought and grass shortage, the Issas also bring their herds of cattle and graze. The highland residents may also come from the plateau surrounding the valley; they usually have settled communities and at one time or another have tried to grow sorghum and corn further down the valley but abandoned these fields because of forest birds and wild animals. Besides grazing, these people also derive economic benefit from the valley by selling on the roadside fuelwood and charcoal to people travelling between Harar and Jijiga towns.

The seasonal movement has changed gradually and crop cultivation in the fertile valley bottom has evolved and crop-livestock interaction increased. In the last fifty years, land tenure and land use systems were transformed from largely pastoralists exploiting communal rangelands to settled agro-pastoralists utilizing privately owned croplands and communally owned grazing lands. Households tend to grow crops when the rainfall conditions permit. The major crops grown in the region include sorghum, maize and groundnuts. Vegetables are also gaining importance with introduction of small-scale irrigation technologies mainly by Menschen fuer Menschen Foundation.

Even though the incumbent agro-pastoral communities have long considered the Yerer and Daketa valleys as theirs, other pastoral groups from semi-arid areas of the Somali Regional State also access the common grazing lands, particularly during drought years. The growing number of migrant pastoralists and their large number of cattle exercise an increasing pressure upon grazing land, particularly during times when it is ecologically fragile. Thus understanding institutional arrangements between community members of the pastoral and agropastoral communities that are adjusted to ensure sustainable resource utilization and conflict mitigation and that depend on complex body of rules established local communities is of critical importance.

1.2. Objectives of the study

The ultimate purpose of this study was to sensitise policy makers, contribute to policy dialogue and to the development of actions, which enhance sustainable pastoral livelihoods. The study will seek effective ways to reduce rural households' vulnerability by increasing the efficiency of land use and management in the study area based on proper understanding of the nature and role of local level institutions and institutional arrangements. It focuses on institutional arrangements that prevail in the study area which mediate entitlements, collective action and access to resources, particularly grazing lands.

Thus, the specific objectives of this study can be articulated as:

- Employing the game theoretic model, seek to elucidate how institutions at various level influence the access to natural resource of diverse groups of people and how these in turn help to shape household asset.
- Identify major factors that determine involvement in various institutional arrangements for and effectiveness in access to common grazing lands.
- Assess qualitatively/quantitatively the implications of various institutional arrangements.

2. Theoretical framework

This study uses an adaptation of the sequential rationality game theoretical model (Mas-Colell, et al., 1995) and institutional analysis (Slanger 2001; North, 1990) to discrete choice models (Greene, 2003). The analytical framework, in its entirety, presents a simple model of household and community level decision-making, in which they are concerned about their welfare along many different dimensions. It starts by observing and understanding the behavioural pattern of households and communities within the prevailing vulnerability context. Factors, which constitute the vulnerability context, are primarily external and can hardly be influenced by a single household or villagers. They are also dynamic and changing over time. For the analysis of the accommodating decision of the agropastoralists, an extensive form of a sequential rationality game theoretical model can be adapted, in which case a player's strategy should specify optimal actions at every point in the game tree (Mas-Colell, et al., 1995). That is, given that a player

finds himself at some point in the tree, his strategy should prescribe play that is optimal from that point on, given his opponents' strategies.

Consider the following extended game, representing in a stylized manner the strategic interaction between pastoralists and agropastoralists in times of drought and resource scarcity (Figure 1). The pastoralists, who during normal times inhabit the semi-arid areas of the eastern lowlands of Ethiopia, consider encroaching grazing lands that are situated at the vicinity of the Eastern Highlands, normally inhabited by agropastoralists.

To help us build our theoretical framework, let us assume that the pastoralists (P) can either (1) remain in their original area (i.e. "stay out" of the agro-pastoralists' grazing land) which may mean accepting a loss of livestock due to feed and water scarcity, or (2) they may decide to move into and "encroach" the agro-pastoralists' grazing land, which are already under intense pressure due to drought conditions. The agropastoralists (A) have two alternative strategies at their disposal in response to an encroachment by pastoralists: they may either (1) accommodate them, accepting a loss in livestock productivity because of increased resource pressure, or they may (2) opt for fighting against to defend their territories against the "intruders". However, this decision is influenced by the heterogeneity that prevails in the agropastoral societies.

In fact, in contrast to some popular perceptions (the "community myth"), rural communities are not homogenous entities, but often are heterogeneous in terms of the assets, social status and ethnic origin of households (Guijt and Shah 1998). In our case, we specify the livestock assets that different households hold within the agropastoral community as expression of heterogeneity. We therefore distinguish between agropastoralists who own relatively large number of livestock, hereafter referred to as those who own livestock (A^L), and agro-pastoralists who do not own or own very few livestock, here after referred to as those who do not own livestock (A^0)

Our game now offers interactive moves between the different players. That is, pastoralists might negotiate with agropastoralists who do not own livestock for a mutual agreement that allows pastoralists to use the resource entitlements that the agropastoralists have as part of their community, but thus far could not make use of. In exchange, the agropastoralist families will

receive some remuneration from the pastoralists, for example in the form of livestock. This arrangement would allow pastoralists to enter the grazing land with the mutual agreement of the poorer segment of the agro-pastoralist society.

(Figure 1 here)

This strategic move can result in seven possible equilibriums.
(1) Decision path 1- Reference case-We set this as reference case with (P_1; $A^0{}_1$; $A^L{}_1$) set as (0;0;0). This is the case when pastoralists remain in their usual grazing area and the incremental costs and benefits are zero.

(2) Decision path 2: P negotiates with A^0 and reaches an agreement with them. P may then still decide to stay out of the area for other reasons. This move requires negotiation costs for both, and social costs for A^0, because it looses support from A^L in response to A^0's willingness to make an agreement with P that may harm A^L.

(3) Decision path 3: Assisted intrusion- P negotiates with A^0 who agree, and P decides to encroach the grazing land, A^L accommodates P. P has negotiation costs, but gains from grazing resources which can maintain its livestock or minimize livestock losses due to drought. A^0 has negotiation and social costs, but gains remuneration from P in the form of livestock or other assets. A^L looses livestock productivity due to increased competition over grazing resources. Represent this loss by ($-L^L{}_3$).

(4) Decision path 4: - P reaches an agreement with A^0 and encroaches the grazing land, but in this case, A^L decides to fight it out to keep the intruders out of the grazing area. P has negotiation costs, loss in livestock due to fighting and decreasing marketing opportunities, but may also gain in terms of livestock productivity if the fight is successful (which is reasonable to assume, because P has the support from A^0). A^0 has negotiation costs, social costs, but may gain some livestock from P in return for its assistance. A^L has maximum livestock loss both, due to fighting and due to vanishing market opportunities ($-L^L{}_4$) as well as human cost ($- HC^L{}_4$), gain reputation for defending its territories ($+ R^L{}_4$.).

(5) Decision path 5:- P negotiates with A^0, but fails to reach an agreement, and P decides to stay out of the grazing area. Here, A^0 has less negotiation costs, but may also have social benefits; because it may strengthen its links with A^L. P has to bear the negotiation costs. A^L has no direct costs or benefits, potentially it may have to afford the costs for financing the remuneration (social benefits) it is willing to grant A^L for its supporting behaviour.

(6) Decision path 6:- P negotiates with A^0, but fails to reach an agreement. In this case, however, P decides to encroach the grazing area anyway. A^L decides not to fight and to accommodate the intruders. A^0 has negotiation costs and may have social benefits, if A^L is willing to concede something. P has to bear the negotiation costs associated with mobility in terms of human labour as well as energy used by animals, but reaps the benefits from grazing its livestock in the better grazing land, thus avoiding the losses it would otherwise have to bear due to the drought. A^L will have losses in livestock assets due to increasing pressure on grazing resources and it may have to compensate A^0 for its supporting behaviour.

(7) Decision path 7: - P negotiates, A^0 does not agree, P nevertheless encroaches, and in this case, A^L fights back trying to keep the intruders out of the grazing land. A^0 has negotiation costs, may have small social benefits from A^L but may also have to bear human costs from fighting. P will have very little scope for winning the contest, because it does not have the support of A^0 and thus lack area expertise and faces a strengthened A^L (allied with A^0). P will have to bear negotiation costs, livestock losses (due to manifold reasons: death due to lack of pasture, loss during fighting, decreasing marketing opportunities due to insecurity of the area). And, like the other players, P has to bear the human costs of fighting. A^L may have livestock losses due to fighting and decreasing marketing channel, human costs, some costs for remunerating the support of A^0, but may also gain reputation as a strong fighter willing to defend its territory which may keep other potential intruders away from encroaching the grazing resources.

Now, what are the conditions for a specific decision path to come into being? For this, we have to apply backward reasoning from the decision nodes. While we could derive the conditions for

each equilibrium, we will focus here on a few selected equilibrium paths, which may reasonably occur in reality.

Let us first compare paths 3 and 4. P has successfully negotiated with A^0 and encroached the grazing land. A^L has to take the decision whether to fight or not. For A^L not to fight, the following condition must hold:

$$A^L_3 > A^L_4 \leftrightarrow -L^L_3 > -L^L_4 - HC^L_4 + R^L_4 .$$

It is reasonable to assume that $-L^L_4 - HC^L_4 << -L^L_3$, because the livestock losses during fighting are at their maximum and the human costs are to be added, while the probability of A^L to loose the battle is high, because P has the support of A^0. This is with the condition that A^L does not attribute extremely high gains to R^L_4 (for credible commitment). Hence, we can assume that the above condition, indeed, holds. Then, P can reasonably assume that A^L will choose not to fight, it is always reasonable for P to encroach, because $P_3 > P_2$. Hence, P will encroach. Now, we have to consider whether it is reasonable for A^0 to agree to a mutual agreement with P. If it agrees, we can expect that P will encroach and A^L will not start a fight. In fact, if this is the case, then it is, indeed, rational for A^0 to agree, because A^0_3 is maximised. It has only relatively minor costs of negotiation and social costs, but gains additional livestock from P. Therefore, the most likely equilibrium will be decision path 3, i.e. P will start negotiations.

It is also possible to observe that the equilibrium situation for such migration will also have a distributional effect. That is, those members of the community in Yerer and Daketa valleys who do not possess livestock to graze on the common grazing land can now benefit by assisting migrants making use of their social capital and endowments to the common grazing land, thereby, sharing the additional utility that P gains or a reward for their role in minimizing the herd loss from P.

In this study, we shall attempt neither to quantify the values of the payoffs that can be observed at the terminal nodes nor to assess the probabilities associated with playing a strategy of fighting or accommodation. We will try to make an in depth study of local institutions that can mediate access to the common resources, the norms and rules which govern mutual arrangements, the

ways of arbitration of conflict in resource utilization by different stakeholders, and how the benefits are distributed.

It is important to bear in mind that this theoretical model provides a *stylized* representation of the situation and makes many simplifying assumptions. We cannot say *per se* how far the theoretical analysis corresponds with the structure of decision-making in our specific case study. However, the model is helpful in generating new hypotheses that are then further investigated in *empirical* work. The theoretical model suggests two propositions, which need to be further confined, validated and tested in the empirical studies:

Proposition 1: *Resource competition in times of natural scarcity may enhance the bargaining position of asset-poor members of an agro-pastoral society and, in turn, enable them to improve their asset stock and relative socio-economic status by forming an alliance with external players.*

Proposition 2: *The alliance of asset-poor agro-pastoralists with outsider pastoralist encroachers changes the relative power assets of pastoralists vis-à-vis agro-pastoralists and urges the latter to comply with a non-violent resolution of competing claims towards a resource sharing arrangement.*

3. Methodology

3.1. Survey Design and Data Collection

In order to have a clear understanding of the problems associated with voluntary collective action in which natural resource management fall into the responsibility of a group of users, it is necessary to be able to trace the interdependence through effective methodologies of acquiring reliable information. In this regard, the first task performed in data collection phase was to identify major issues in the management of grazing land and other resources in the study area through literature review, examination of secondary data, and informal exploratory surveys. Informal surveys were particularly useful because reliable prior studies on collective action and property rights are often unavailable or, if available, are mostly incomplete. Since it is necessary to obtain a variety of information through questionnaire survey, the pre-tasting of the survey questionnaire during an informal survey was also essential.

In the extensive survey, all peasant associations were covered and semi-structured group interview with community representatives was conducted. This was supplemented by information acquired from key informants with the help of moderation toolkit. Selection of appropriate communities for intensive household survey was based on the intermediate results of the extensive survey. One criterion was to ensure representation of communities with contrasting characteristics in terms of wealth. The sample size considered the complexity of the issue and accuracy and coverage of data necessary for the statistical analysis to be used. A total of 150 households were covered during the intensive survey, but only 146 responses were complete to be used for further analysis. The households were selected randomly proportionate to size from a complete list of members of the Peasant Associations. A structured questionnaire was designed and pre-tested before executing the intensive household survey. Data collected include family composition, inventory of assets, history of acquisition of assets, current production and non-labour input use, property rights, history of institutional arrangement with pastoralist, among others.

3.2. Framework for Econometric Analysis

This research has investigated factors associated with choice of institutional arrangements to facilitate mobility of pastoralists for the use of common grazing lands for mutual benefit. We assume that agropastoralists will accommodate pastoralists on their common grazing land only if the private benefits from accommodating the pastoralists exceed the costs they are supposed to incur, i.e. the net benefit (NB) is positive. Among the various private benefits are gains from sharing calves, using milk, drought power, and potential improvements in asset endowment. In addition, accommodation may provide additional utility obtained from non-market benefits resulting from reciprocal arrangements. On the other hand, accommodation costs include not only part or all of the social cost of alienation from the wealthier agropastoralists, but also the negotiation and transaction time needed to learn about the incoming pastoralists.

The net benefits (NB_j) derived from the *j*-th alternative institutional arrangement can be decomposed into a systematic and random component. That is, net benefit is the sum of observable and unobservable components,

NB_{ij} (choice *j* for household *i*) = $V_{ij} + \varepsilon_{ij}$

The net benefit level NB_{ij}, which is household *i*'s net benefit from choosing alternative *j*, is determined by the systematic component of net benefit of V_{ij} and random components, ε_{ij}, which is assumed to be independently and identically distributed (Greene, 2003). The random component represents the unknown components of the households' net benefit function, which can also be represented by a linear function of a vector of attributes which characterize the *i*-th household, X_i: i.e.,

(1) $NB_j = X_i\beta_j + \varepsilon_j$ Where $\varepsilon_j \sim N(0, \sigma^2)$ and j = 0, 1, …, J.

Where β_j represents parameters to be estimated and ε_j the disturbance term. The disturbance terms are assumed to be independently and identically distributed.

The agropastoralist *i* chooses institutional arrangement *j*, if:

(2) $NB_{ij} > NB_{ik}$, for all $k \neq j$.

where NB_{ij} is the net benefit to the *i*-th household of alterative *j*, and NB_{ik} is the net benefit of alternative *k* to *i*-th household. If each institutional arrangement is considered as a possible net benefit maximization decision by the agropastoralist, the decision maker is expected to choose that alternative which will maximize the present value of net benefit. Therefore, given finite set of alternatives to select among, the decision of the *i*-th household can be modelled as maximizing the present value of streams of net benefits by picking the *j*-th alternative from among the *J* discrete choices available such that:

$\text{Max}_J \{E(NB_{ij}) = f_j(X_i) + \varepsilon_j,$ for j = 1, 2,…, J.$\}$

Where f_j is a function of $X_i = (X_{i1},\ldots, X_{in})$, which is a (1 x n) vector of attributes of the *i*-th household that are expected to potentially affect the desirability of an alternative.

The probability that household *i* chooses alternative *j* is equal to the probability that the net benefit of alterative *j* is greater than the net benefits of all other alternative choices set. That is,

(3) $\Pr(NB_{ij} = j) = \Pr(NB_{ij} > NB_{ik}) \quad \forall \; j \neq k$

In the study area, we can distinguish among three major categories of institutional arrangements that agropastoralists seek for practice in managing accommodation and facilitate the mobility of the pastoralists: reciprocity, sharing calves, the right to use milk. Given the multinomial nature of these institutional arrangements, a nominal logit econometric technique can be used in the empirical investigation of the factors associated with the decision to accommodate pastoralists.

Therefore, a multinomial logit model from Greene (2003) was used for the analysis. Since NB_{ij} is latent, it is not observable. Therefore, let Y_{ij} be the indicator variable, so that:

(4) $$P(Y_{ij} = j) = \frac{\exp(\beta_j X_i)}{\sum_{k=1}^{J} \exp(\beta_j X_i)}$$

where Pr(.) is the probability that the *i*-th household prefers and practices the *j*-th arrangement (j = 0, 1,…, J). Respondents are asked whether they have hosted pastoralist during the last five years and if yes which institutional arrangement they practiced and preferred most. Then the model is estimated with four alternatives, namely: j=0 if the respondent indicated s/he did not host any pastoralist or do not have any opinion regarding the best arrangement; j=1 if the respondent indicated s/he has hosted pastoralist on reciprocity. That is, the head of household recognizes that agropastoralists livelihoods are also subject to ecological uncertainty and therefore they can be faced with adverse conditions forcing them to migrate to areas normally inhabited by pastoralist. In this case, these communities will accommodate them in response to

their good treatment in adverse conditions. j=2 if the respondent indicated s/he has hosted pastoralists in exchange for sharing the new born animals within the herd during the entire stay of the pastoralist with the agropastoralists household. That is, if the herd gave for six young animals (calves), then the agropastoralists is entitled to take three. j=3 if the respondent indicated s/he used the milk from the herd during its stay. The first arrangement, j=0, which is that the respondent indicated s/he did not host any pastoralist, is used as the reference choice. X_i represents a vector of demographic, economic and spatial characteristics for the observed individual households. β_js are a vector of estimated parameters.

Normalization of the alternatives by one of the categories ($\beta_k = 0$) yields the multinomial logit model as:

$$(5) \qquad P(Y_{ij} = j) = \frac{\exp(\beta_j X_i)}{1 + \sum_{k=1}^{J} \exp(\beta_j X_i)} \qquad \text{for j = 1, 2,…, J.}$$

The probability of omitted (*j*-th) alternative can be derived from the formula:

$$(6) \qquad P(Y_{ij} = j) = \frac{1}{1 + \sum_{k=1}^{J} \exp(\beta_j X_i)}$$

Since the coefficients of such models are not directly interpreted in contrast to OLS results, marginal effects were estimated to express the probability of change alternative arrangement in accommodating pastoralists with respect to each independent variable, measured from the mean of the variable.

$$(7) \qquad \frac{\partial P_{ij}}{\partial X_{ij}} = (\beta_{jx} - \sum_{k=1}^{J} P_{ij} \beta_{jx}) P_{ij} \qquad \text{for j = 0, 1,…, J.}$$

where β_{jx} is the coefficient of X for alternative *j*. The marginal effect on the redundant category is obvious as the sum of the marginal effects of all alternatives equal to zero. The data are analyzed employing LimDep version 7.0 econometric software. More over, descriptive analysis will be used to provide detailed description of the rules and institutions that govern resource entitlement, use and system performance.

4. Results and Discussion

4.1. Descriptive Characteristics of the Sample Households

Household demographic profile of the 146 respondents surveyed is indicate that the average number of persons per household was 6.93 in Daketa valley and 6.30 in Yerer valley with an overall average of 6.70. The adult female members of the household, who constitute on average 24%, shoulder great pressure and responsibility in the household affairs of the community we surveyed. Their responsibility include, among other things, cooking, gathering firewood, caring for children and the elderly. They are also responsible for caring for sheep and goats, the breeding stock, including milking cows and young animals, as well as for marketing animal products, particularly milk. Fetching water for human consumption, among other responsibilities of women, was raised as the most time consuming and labour demanding task. Not only does the distance to water sources increase during dry seasons, but the water level in the wells also drop thus making the task even more difficult for women.

The respondents were also asked in the household survey: "How wealthy do you consider yourself?" and the answers were coded 1, lower than most; 2, same as most; and 3, higher than most. Even though such a subjective measure of poverty is advantageous in terms of simplicity for collecting information, the response may be influenced by considerations that do not reflect the actual welfare of the household. Particularly, some household-heads may be unwilling to admit that they are poor as it may imply low status in the community. Whereas, others may claim that they are poor if they anticipate that the survey results will bring them some assistance, which may arise as a result of failure to understand the purpose of the research. Table 1 shows the frequency distribution for the two locations under consideration.

(Table 1 here)

Proportionately more households (33.7%) in Daketa valley consider themselves less wealthy than other members of the community, where as the corresponding value for Yerer valley is 16.7%.

For agropastoralist societies in the study area livestock and livestock products are the main source of livelihoods. Therefore, data was gathered on livestock ownership of each respondent household. The results reveal that agro-pastoralist households in the study area had an average of 11.79 TLU per household. Agro-pastoralist in Daketa valley own relatively larger herds, and this is also statistically significant ($P < 0.01$). The results also show that cattle (cow, ox/bull, and young animals) constitute large proportion of the livestock population. The cattle herd was also female dominated with a cow to ox/bull ratio of 6.01:1, 4.5:1 and 5.64:1 for Daketa valley and Yerer valley, and the whole respondents, respectively. A more female-dominated herd structure is of course a common feature of pastoralist communities.

With an average of 9.41 animals per household, Daketa agro-pastoralists had the larger herd of small ruminants. Small ruminants are valuable assets to the households particularly in terms of their contribution to food security, especially during the onset of drought. It is this category of the livestock that households prefer to dispose of in order to get food in exchange. They are also considered to contribute towards “efficient” utilization of household labour as they employ young children’s labour that would have remained idle otherwise.

Agropastoralists in Daketa and Yerer valleys consider water as perhaps the most fundamental resource because trekking of livestock to water sources is among the major duties for the members of the community. The information obtained through the household survey revealed that on average households trek their livestock for 2.97 kilometers during dry season and 0.94 kilometers during wet season to watering points.

Various types of water sources are used in the study area, including hand dug wells, digging stream beds, ponds, hand pump and reservoirs. The deep hand-dug wells, locally known as *ella*, are of particular importance in shaping social organizations in Daketa valley where surface water is relatively scarce. The deep hand-dug wells are mostly used during dry seasons to supply water both for people and livestock. The wells, which can be up to 8 meters deep, require an enormous amount of labour both for lifting water and excavating and removing the soil after each rainy season that in turn requires a continuous and coordinated supply of labour. Those relatively

wealthier members of the community with larger herds obviously need more labour to lift water and members of poorer households may supply such labour in exchange for food or promises of a future calf.

Capitalizing on the mobility of livestock is one of the major ways in which pastoralists have managed ecological uncertainties and risks (Bassett, 1986; Scoones, 1994). Various studies are showing that mobile production systems in arid and semi-arid lands of Africa appear to be economically more efficient than sedentary systems (Scoones, 1993, 1994). Since the productivity of the ecosystem in arid- and semi-arid areas is spatially and temporally variable and to a large degree unpredictable, mobility enables the opportunistic use of the resources (Niamir-Fuller, 2000). The prolonged dry seasons of the 1980s and 1990s observed a mass movement of the pastoralists of the Somali Regional State towards the Yerer and Daketa valleys which are normally agropastoralist territories. In most instances the pastoralists return to their transhumance system, very few have been able to settle by converting into agro-pastoralists.

Agropastoralists in Daketa and Yerer valleys are largely governed by the customary land tenure system where land nominally belongs to the state but the council of the peasant association, in collaboration with concerned government offices, allocates cultivation rights to individual households, while pasture land remains under the management and control of the community. Individual households may gain more exclusive use right by investing their labour into the development or maintenance of water points. Therefore, one can observe a mix of private, common, and state property and sometimes open access resources as mediated by local institutions.

Agricultural encroachment onto rangelands both by nearby farmers from the highland and agro-pastoralists them selves has led to a shortage in pasture area and threatened the mobility of the animals of pastoralists. This can lead to a significant disruption of the periodic transhumance cycle and the weakening of the risk-management systems. The variability of boundaries between grazing and cultivated lands always required the mediation of traditional institutions in granting access to different users. Moreover, poorer community members may be negatively affected in the process because land encroachment prevents them from directly accessing common

resources, and precludes them from extracting wood for charcoal making and fuel wood for sale. Therefore, they tend to engage in negotiations with wealthier pastoralist from nearby semi-arid areas to facilitate mobility and encroachment. The payoffs of such negotiations are very important starting points for asset building. These community members are, therefore, more likely to contract with outsiders in order to support their families as well as foster capabilities.

In the study area in eastern Ethiopia, we can distinguish among three major institutional arrangements for managing the mobility of the pastoralists: sharing calves, the right to use milk, reciprocity. Table 2 shows that 87.6 percent of households who consider themselves "lower than most" in terms of personal wealth accommodated pastoralists in return for either the right to use milk or sharing calves, whereas 57.10 percent of the wealthier groups looked for reciprocal arrangement.

Under such circumstances when resource scarcity and pressure is felt by pastoralists due to ecological uncertainties, then the main strategies of the poorer members of the community is to assist pastoralists to encroach into the common resource when approached so as guarantee their own welfare at the expense of other community members who are considered to be relatively better off. But one can also note that accommodating is not the exclusive behaviour of the poor, as the medium and wealthier households also accept the pastoralists, though the terms of negotiation and contract may vary.

(**Table 2 here)**

The results of the survey reveal that the poorer a household is, the more it is involved in an arrangement that enables it to share calves. All community members who accommodate pastoralists in exchange for sharing calves own an average of 10.67 TLU per household. The possibility of poor agro-pastoralists engaging in hosting pastoralists has persuaded the relatively wealthier community members to call for mutual arrangements with the poorer members to exclude potential entrants, thereby benefiting from reduced overstocking on common rangeland. Failure to reach an agreement, however, may result in disputes.

The reciprocal arrangement is found to be largely a risk-management strategy by relatively wealthier community members. Wealthier members of the agro-pastoral communities accommodate pastoralists and extend their resources particularly the rangelands and water points for the major reason that they expect the same treatment from pastoralists in case members of the agro-pastoral communities face drought and are forced to migrate to areas under the control of pastoralists. The survey results reveal that those respondents who hosted pastoralists based on reciprocity arrangements had an average of 17.06 TLU per household. The existence of such reciprocal arrangement has been crucial for sustaining agro-pastoral and pastoral communities in their production systems. Reciprocity also plays an important role in enhancing livelihoods of the pastoral and agro-pastoral communities by extending resource availability through institutional arrangements between community members and others, and so creating greater security.

A summary of the descriptive statistics of the study variables is given in Table 3. The results indicate that those households who have not practiced any institutional arrangement are characterized by the longest distance from the road and watering point, on average. Where as households who practiced reciprocal arrangement are characterized by the least distance to the office of an development agent, the largest number of livestock holding in terms of tropical livestock unit and longest distance to primary grazing lands. The longest average distance to town (3.73) is reported by those households who are engaged in sharing calves. It is also evident from the results that households who practiced using milk are more aged, have the highest average number of children per household (1.97), more than average dependency ratio (1.97), the least holding in terms of tropical livestock unit and number of cows per household.

Care must be taken when describing the values in the discrete variables section of Table 3. We will try here to explain some. Consider the raw referring to the sex of household head. The descriptive statistics results showed that 89 percent. When we look into the gender composition of households who practiced the various institutional arrangements we find that female headed households constitute 5, 7, 11 and 19 percent of households who preferred not to engage in any arrangement, reciprocal, sharing calves and the use of milk, respectively. Further disaggregation of results showed that 43.75 and 31.25 percent of female headed households preferred for using

milk and sharing calves, respectively, where as 31.54 and 30 percent of male headed households practiced reciprocal and sharing calves, respectively.

(Table 3 here)

Those households who did not host pastoralists most frequently use (i.e., 86% of them) hand dug well as the main source of water for their livestock, followed by those who practiced using milk (78%). Of the 21 households who responded as they have not practiced any form of institutional arrangement 17 (81%) used stream beds as their primary source of water during the dry season, where as the corresponding proportion was found to be 68, 77 and 81 percent for those who practiced reciprocal, sharing calves and using milk to host the pastoralists.

4.2. Determinants for Institutional Arrangement

The multinomial logit analysis was performed using the LimDep 7.0 Discrete choice logit procedure. Table 4 reports the results for estimation, marginal effects and standard error of each of the variables in each of the jointly determined models. The model chi-squared statistic (111.38 with 36 degrees of freedom) is significant at the 1% level of probability. In addition, the predicted shares for each institutional arrangement are relatively consistent with the actual shares. For all arrangements, there are three to five observable characteristics of household under consideration that provide statistically significant predictive power for practicing a given arrangement.

The model was determined as systems of equations in which equations for various institutional arrangements among the pastoral and agropastoral community members were jointly determined using iterated seemingly unrelated regression. The parameter coefficients of such models are difficult to interpret directly. Instead the marginal effects are the only means to effectively interpret the effect of explanatory variables on the distribution of proportion of dependent variables. Marginal effects are the probability of change in favour of a specific arrangement with respect to each independent variable, measured from the mean of that variable. A positive or

negative sign of marginal effects, the only reliable indicator in such models, indicates an increase or decrease in the probability of engaging in the arrangement under consideration.

There are some statistically significant variables that provide predictive information on the engagement of households in institutional arrangement. Overall, variables including the sex of household head, dependency ratio and personal wealth ranking provide the most predictive power whether or not the household engage in reciprocal arrangement, where as number of household members, distance from home to the nearest market centre and personal wealth ranking were found to be more relevant in determining to engage sharing calves. On the other hand, sex of household head, number of household members, distance to watering point and distance to primary grazing land were found to be statistically significant in determining the likelihood that a household engage in the use of milk.

Although the marginal effects of sex of household in reciprocal arrangement was negative and statistically significant, they were negative for both sharing calves but not statistically significant and using milk which is statistically significant. More specifically, if a household is headed by a man, it is 30.2 percent more likely that it will engage in reciprocal arrangement and 27.9 percent less likely to engage in using milk. Theoretical expectation was that as age of the household head increases, it would be more likely that the household engage itself in reciprocal arrangement. Because in such agropastoral societies traditional institutions play great role in mitigating environmental uncertainties through mutual arrangements, mediated by elders, in which the immediate and material benefit is not much of importance. It is, therefore, unclear why the marginal effects of age of household head are not statistically significant for any of the arrangements.

If a household increases household size by one person, he/she is 9.2 percent more likely to fall in using milk, and 6.8 percent less likely to engage in sharing calves. While the remaining coefficient on the household size is not statistically significant, it indicates that a household is 1.6 percent less likely to practice reciprocal arrangement. The marginal effect for dependency ratio, however, indicates that if dependency ratio increases, a household is 21.9 percent more likely to engage in reciprocal arrangement. The expectation was that an increase in dependency ratio

implies addition of more children as household members which largely depend on milk for their daily nutrition.

Hence, other things being equal, an increase in dependency ratio would have a positive and significant effect on using milk. Even though the sign of the marginal effect for dependency ratio is positive as expected, it is not statistically significant. An explanation for this may be sought in terms of the consumption pattern of the pastoral and agropastoral communities. In such communities, animal products particularly milk constitute an important component in the daily consumption. Therefore, what matters is the household size as it determines the aggregate demand for milk as compared to the share of children which is relatively low.

(Table 4 here)

A household nearer to the market centre is 10.7 percent more likely to share calves, but 4.8 percent less likely and 2.2 percent more likely to engage in reciprocal and using milk, even though the marginal effects are not statistically significant.

The order in which the household head places his personal wealth against other members of the community has also relatively strong predictive power regarding the probability of engaging in a certain institutional arrangement. The positive and statistically significant estimated marginal effect for whether or not the household consider itself better than most, average and lower than most supports the study's theoretical expectations that if a household is better off it will prefer reciprocal arrangement. Households who consider themselves better off in terms of wealth are 49.1 percent more likely to engage in reciprocal arrangement and 60.7 percent less likely to engage in sharing calves. They are also 8.5 percent more likely to engage in sharing milk, but this is not statistically significant. The statistically significant results indicate that there is sufficient evidence to believe that wealthier households are more likely to engage in reciprocal arrangement and less likely in sharing calves, implying that the poor should seek the other way round. Meaning, the poorer a household is, the less likely that it prefers reciprocal arrangement and the more likely it will engage in sharing calves.

5. Summary and Conclusions

This study used game theoretic model to establish propositions regarding the accommodating behaviour of members of agropastoral communities in facilitating the mobility of pastoralist during the time of environmental uncertainty. It was proposed that resource scarcity can enhance bargaining power of the resource poor households through engaging in various institutional arrangements where by bridging the way for peaceful settlement of competing claims over grazing land. This research used a household survey data in Daketa and Yerer valleys in eastern Ethiopia, and employed descriptive statistics and multinomial logit model to predict household's decision to engage in a specified institutional arrangement based on observable demographic and socio-economic factors.

The Daketa and Yerer valleys with their relatively better quality rangelands and availability of water points create good conditions for grazing during dry seasons, which, in turn, attract a number of pastoralists, thereby necessitating the creation of institutional arrangements to get access. Such institutional arrangements can reduce the vulnerability of poor community members who traditionally depend on common property resources. They take advantage of the stock of goodwill and social networks among community members (i.e., social capital) to facilitate access for the pastoralists that enables poor community members to build livestock asset. Cooperation and institutional arrangement also constitute forms of social capital through which members can generate and acquire assets that would be difficult or impossible for them to obtain in isolation, or without this particular legacy.

Even though recent research findings cautioned against assuming that common property regimes guarantee equitable distribution of benefits (Agrawal and Gibson, 1997), our finding is that in the case of the Daketa and Yerer valleys of Ethiopia, such institutional arrangements enhance the capability of resource poor community members to make the most from the common grazing land. This paper has tried to elucidate some of the complexities in the linkages between status of wealth and engaging in strategic choice to facilitate herd mobility of pastoralists. The case study revealed that poor members of the agro-pastoral community transform their endowments (right of access and use) of common grazing land and social capital to actual entitlements of economic

value of livestock through institutional arrangements. Therefore, it is necessary to recognize that thoughtful policies should give due emphasis to the complexities of such arrangements.

The results of the multinomial logit model revealed a set of important factors that determine household's decision for specific institutional arrangement. Those statistically significant variables that provide predictive information on whether or not the household engages in reciprocal arrangement include the sex of household head, dependency ratio and personal wealth ranking. Where as, number of household members, distance from home to the nearest market centre and personal wealth ranking were found to be more relevant in determining to engage sharing calves. On the other hand, sex of household head, number of household members, distance to watering point and distance to primary grazing land were found to be statistically significant in determining the likelihood that a household engage in the use of milk.

The order in which the household head places his personal wealth against other members of the community has also relatively strong predictive power regarding the probability of engaging in a certain institutional arrangement. The positive and statistically significant estimated marginal effect for whether or not the household consider itself better than most, average and lower than most supports the study's theoretical expectations that if a household is better off it will prefer reciprocal arrangement. Households who consider themselves better off in terms of wealth are 49.1 percent more likely to engage in reciprocal arrangement and 60.7 percent less likely to engage in sharing calves. They are also 8.5 percent more likely to engage in sharing milk, but this is not statistically significant. The statistically significant results indicate that there is sufficient evidence to believe that wealthier households are more likely to engage in reciprocal arrangement and less likely in sharing calves, implying that the poor should seek the other way round. Meaning, the poorer a household is, the less likely that it prefers reciprocal arrangement and the more likely it will engage in sharing calves.

The results indicate that resource competition in times of natural scarcity may enhance the bargaining position of asset-poor members of an agro-pastoral society and, in turn, enable them to improve their asset stock and relative socio-economic status by forming an alliance with external players. Hence, it is a kind of paradox that times of scarcity may offer opportunities for

asset-poor players to improve their overall and relative position within a society. The findings also suggests that the bargaining position of relatively resource poor agropastoralists can create a changing balance in the incremental costs and benefits for pastoralists and better off agropastoralists that may determine whether there will be a peaceful or violent solution to the competing resource claims. Furthermore; the alliance of asset-poor agro-pastoralists with outsider pastoralist encroachers changes the relative power assets of pastoralists vis-à-vis agro-pastoralists and urges the latter to comply with a non-violent resolution of competing claims towards a resource sharing arrangement. Hence, it is important to recognize that agropastoralist households are heterogeneous in terms of resource entitlement which has strong policy implications for conflict resolution.

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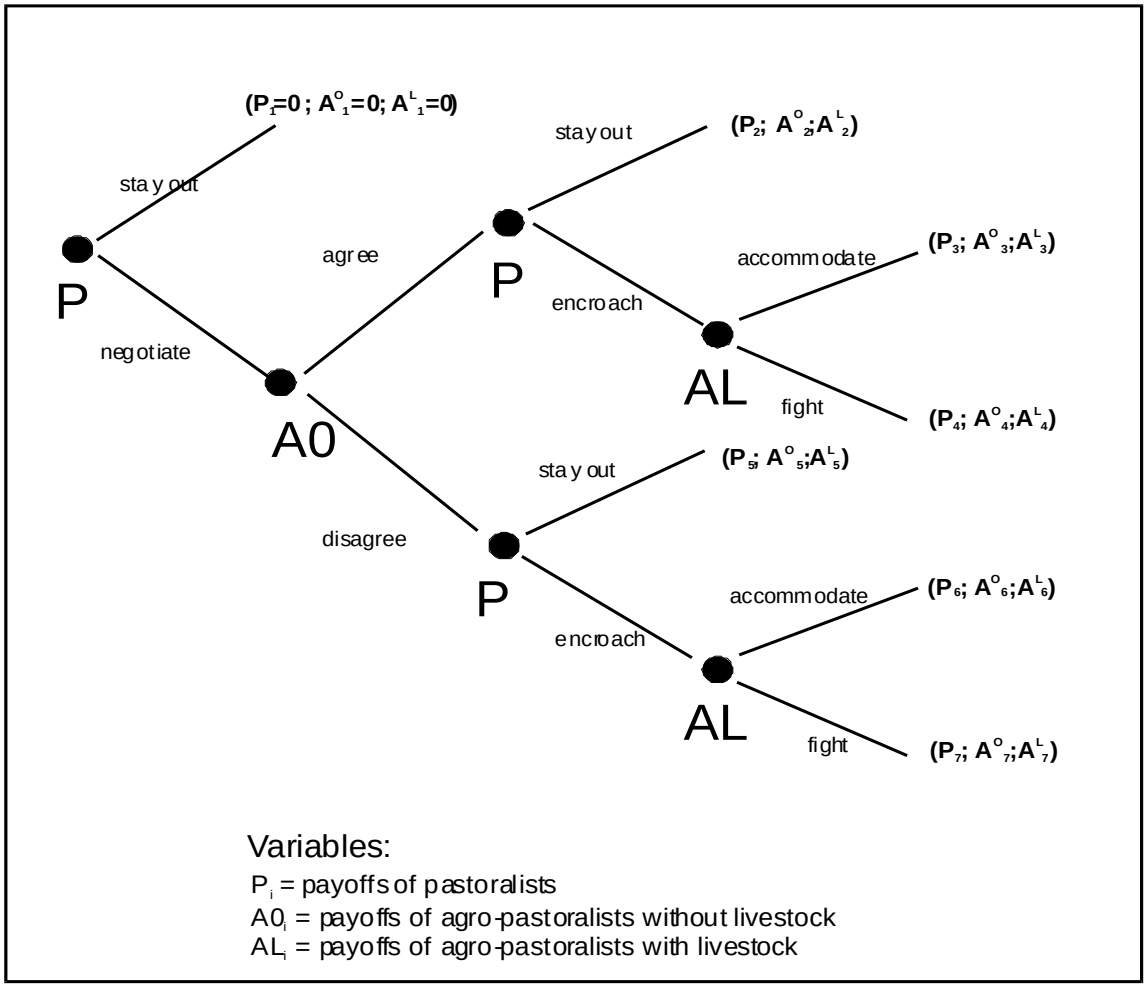

Figure 1. Extended game representing payoffs from various institutional arrangements

Table 1. Frequency distribution for personal wealth ranking (% of respondents)

Personal wealth ranking	Location		Overall sample (n = 146)
	Daketa (n = 92)	Yerer (n = 54)	
Lower than most	33.7	16.7	27.4
Same as most	50.0	72.2	58.2
Higher than most	16.3	11.1	14.4

Table 2. Percentage of respondents who hosted pastoralists by wealth and institutional arrangement

Personal wealth ranking	Institutional arrangement				Total (n = 146)
	Not practiced (n = 21)	Reciprocal (n = 44)	Share calves (n = 44)	Use milk (n = 37)	
Lower than most	3.42	---	13.7	10.3	27.4
Same as most	10.96	21.92	13.02	12.3	58.2
Higher than most	---	8.22	3.42	2.74	14.4
Total	14.38	30.14	30.14	25.34	100.0

Table 3. Mean and standard deviation of major attributes by practiced institutional arrangement

	Institutional arrangement									
	Overall		No preference		Reciprocal		Share calves		Use milk	
Attributes	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Age of household head (HAGE)	39.66	13.21	39.95	14.95	38.41	13.47	39.30	12.03	41.43	13.57
Children less than 6 years old (CLD6)	1.73	1.42	1.29	1.31	1.59	1.53	1.86	1.41	1.97	1.32
No. of adults (ADLT)	3.16	1.78	3.00	1.41	3.14	1.34	2.91	1.25	3.59	2.70
Household size (HHS)	6.70	3.15	5.62	3.26	6.61	2.88	6.45	2.61	7.70	3.78
Adult equivalent unit (AEU)	5.42	2.62	4.60	2.68	5.35	2.36	5.21	2.06	6.23	3.27
Dependency ratio (DEP)	1.28	0.91	0.84	0.87	1.23	0.83	1.35	0.91	1.50	0.95
Dist. to road (DistRD)	1.02	0.69	1.28	0.94	0.90	0.63	0.96	0.60	1.10	0.67
Dist. to town (DistTWN)	2.94	2.63	2.48	1.05	2.31	0.67	3.73	3.69	3.01	2.99
Distance to development agent (DistEXTN)	0.66	0.52	0.47	0.47	0.75	0.52	0.62	0.47	0.72	0.59
Tropical livestock (TLU)	11.80	11.10	9.25	5.88	17.06	12.19	10.67	11.19	8.34	9.92
No. of cows (COW)	5.47	4.86	4.24	2.68	7.75	5.20	5.11	5.17	3.89	4.10
No. of oxen owned (OX)	0.97	1.19	0.62	0.74	1.61	1.40	0.77	1.05	0.65	0.98
Distance to watering point (DistWTR)	2.97	1.07	3.05	1.08	3.00	0.92	2.93	1.10	2.96	1.22
Distance to grazing land (DistGRZ)	2.05	3.71	1.25	1.61	3.05	4.83	1.93	3.26	1.44	3.38
Discrete variables	Percent of households who responded “yes”									
	146		21		44		44		37	
Household head is male	89		95		93		89		81	
Use hand dug wells	70		86		66		59		78	
Use stream bed	76		81		68		77		81	
Use pond	10		10		11		2		19	
Use hand pump	26		29		34		27		14	
Use reservoir	8		14		00		2		19	

Table 4. Multinomial logit model predicting institutional arrangement, marginal effects, and standard errors in parentheses.

	Reciprocal		Share calves		Right to use milk	
Variable	Coeff.	Marginal effect	Coeff.	Marginal effect	Coeff.	Marginal effect
Constant	-7.18	-0.802	-2.235	0.830	-5.268	-0.258
		(0.4504)		(0.459)		(0.380)
COMM	1.13	-0.035	1.508	0.100	1.267	0.002
		(0.1760)		(0.183)		(0.161)
HSEX	0.44	0.302	-0.781	-0.056	-1.690	-0.279
		(0.1761)*		(0.198)		(0.144)**
HAGE	-0.07	-0.004	-0.038	0.008	-0.081	-0.007
		(0.0061)		(0.006)		(0.0053)
HHS	0.09	-0.016	-0.024	-0.068	0.492	0.092
		(0.0304)		(0.033)**		(0.027)***
DEP	2.47	0.219	1.337	-0.141	1.733	0.012
		(0.1124)**		(0.118)		(0.0951)
DistRD	-2.03	-0.054	-2.006	-0.068	-1.748	0.024
		(0.1242)		(0.1038)		(0.085)
DistTWN	1.36	-0.048	1.794	0.107	1.611	0.022
		(0.0562)		(0.04)***		(0.029)
DistEXTN	1.88	0.128	1.185	-0.094	1.577	0.042
		(0.1369)		(0.155)		(0.139)
PWR	1.19	0.491	-2.077	-0.607	-0.246	0.085
		(0.183)***		(0.18)***		(0.145)
TLU	-0.13	0.007	-0.197	-0.017	-0.147	0.002
		(0.028)		(0.031)		(0.031)
DistWTR	0.56	-0.013	0.439	-0.068	1.036	0.114
		(0.060)		0.0634		(0.054)**
DistGRZ	0.004	0.015	-0.022	0.011	-0.156	-0.028
		(0.014)		0.0187		(0.016)*

Predicted (%)	35.62	27.40	21.92
Actual (%)	30.14	30.14	25.34
χ^2 statistic = 111.38	*df* = 36	Prob>χ^2	0.000

*, **, and *** represent 0.10, 0.05, and 0.01 levels of statistical significance, respectively.

Note: redundant category is “not practiced” any institutional arrangement.