Perceptions of Risk within Pastoralist Households in Northern Kenya and Southern Ethiopia

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Members of the same household and community may experience the world differently. Even in environments such as the arid and semi-arid lands of Northern Kenya and Southern Ethiopia, where the risks of drought, violence, and illness are quite high, individual household members may have different perceptions about the risks they face. A unique panel data set from this region allows us to examine how perceptions of risk vary within households as well as how they vary across households and communities, over a period of drought and recovery. By understanding these subjective perceptions of risk, we can better design policies that address objective sources of risk as well as helping individuals and household to develop better methods for coping with risk.

Risk perceptions are based not only on the objective risks that individuals face – such as variable rainfall – but also on their subjective assessment of risk. Their subjective assessments combine their expectations about likely events with their beliefs about their own abilities to deal with future events. For example, individuals who have large herds of animals and can move long distances with them in search of food and water may experience the risks of low rainfall differently from those living near towns with few, if any animals. The vulnerability of households to these risks may differ. As a consequence, their welfare and behaviors may then differ as well.

A small, relatively recent literature explores patterns of risk assessment with respect to individual risks, such as asset price shocks, weather, or disease.[1] However, there is scant empirical evidence on subjective risk perceptions across a range of stochastic phenomena, especially in the context of developing countries. This study builds on an earlier study that used focus groups, rather than individual-level survey data, to look at the heterogeneity of risk assessments. That initial study found that wealth, gender, and location affected the perceptions of risk (Smith, et al, 2001). In this paper, we take advantage of panel survey data collected quarterly over a period of 2 ½ years to see how perceptions of risk vary across individuals over time.

[1] See Rabin (1998) for an excellent survey.

We address three key questions in this paper. First, we examine the structural heterogeneity of risk perceptions among individuals, asking how risk perceptions differ by individual and household characteristics. Second, we examine the extent to which past shocks, both at the household and community levels, affect these risk perceptions, ostensibly by inducing people to update their beliefs regarding the likelihood of particular, stochastic events occurring, the consequences of those events, or both. Finally, we look at how risk perceptions differ among members of the same households, focusing in particular on the extent to which gender-differentiated cultural practices may or may not result in significant differences between men's and women's risk assessments.

Risk Perceptions

Some of the risks faced by pastoralists in Africa can be measured objectively, including below-normal rainfall, disease outbreaks, violence and poor market conditions. Yet these risks are rarely estimated and communicated at the spatio-temporal scales relevant to individuals' choices.[2] Moreover, research in a variety of fields suggests that people's behavior is influenced not only by the measurable, objective risks that they face but also, perhaps especially, by their subjective perceptions of risk. The policy implications are important. The WHO Health Report for 2002 notes, "During the 1980s, scientific predictions were seen to be rational, objective and valid, while public perceptions were believed to be largely subjective, ill-informed and, therefore, less valid" (p.30). They note that this has changed as public interest and pressure groups gained the ability to argue for their own assessments and interpretations of risks. "Risk had different meanings to different groups of people and … all risks had to be understood within the larger social, cultural and economic context " (p. 31). Slovic (1987) emphasizes that public policy dialogue with respect to risk management evolves only modestly in response to the introduction of new, credible scientific evidence on objective risk

[2] For example, Luseno et al. (2003) emphasize that improvements in seasonal climate forecasting in east Africa are not affecting household level behavior among pastoralists in part because the spatial resolution remains too coarse and lead times too short to be of much use to individual decision-makers.

exposure because strongly-held prior beliefs affect the way information is processed and people update beliefs.

Subjective risk perceptions are particularly valuable because they incorporate multiple factors, including the individual's understanding of the objective risks, the individual's expectations about his or her own exposure to risks, and his or her ability to mitigate (*ex ante*) or cope (*ex post*) with the adverse events if they occur. Individual capacity to manage risk can feed back into risk perceptions. As a result, people often ignore new information altogether – so-called "belief perseverance" – or willfully misread new evidence as supporting prior beliefs, a tendency called confirmation bias (Darley and Gross 1983, Kahneman and Tversky 1982, Lord, et al. 1979, Plous 1991, Rabin and Schrag 1999, Tversky and Kahneman 1982). Such biases then affect individuals' forecasts of stochastic events and the pace at which they update their beliefs in response to information arrival, especially when their welfare depends on the realization of the stochastic variable, in which case individual preferences introduce further cognitive bias, with preference-consistent information often accepted uncritically while preference-inconsistent data are processed critically (Nisbett and Ross 1980, Kunda 1990, Ditto and Lopez 1992, Hales 2003).

Although much of the early work on risk perceptions was done in developed countries, a recent literature has focused on risk perceptions in Africa, especially around the issues of HIV/AIDS. The simplest studies of risk perceptions focus on how well people understand objectively measurable risks. This allows researchers to see whether factual information is accurately understood. For example, Buhler (2003) asked respondents whether sexual intercourse was a way of becoming infected with HIV/AIDS. This approach helps to identify information gaps, but it does not account for the possibility that people may see certain risks as unimportant if they believe that their behavior can mitigate their personal risk exposure.

Other research has pushed further. Many researchers have begun to ask about the extent to which an individual perceives him or herself to be at risk. One way to measure risk

perception is to ask people an intensity measure with regard to a specific risk. For example, a survey in Malawi asks people to say whether they perceive their risk of HIV/AIDS to be none, small, moderate or great (Behrman *et al*, 2003). Their answers were presumably based on their understanding of the causes of AIDS and their own assessment of whether or not they were engaging in behaviors that might lead to HIV/AIDS.

A further way to measure subjective risk perceptions is to ask people to rank different risks. This does not give an intensity measure, but it does tell us which concerns people are the most worried about. Early work of this type asked American respondents to estimate the number of deaths for 40 different hazards and compared these with known statistical estimates. Results indicated that people tend to overestimate the number of deaths from rarer and infrequent risks, while underestimating considerably those from common and frequent causes, such as cancer and diabetes. "However, people's rank ordering by the total number of deaths does usually correspond well overall with the rank order of official estimates" (Lichtenstein et al, and Fischloff et al, cited in WHO, p. 32).

These measures of risk perceptions have been used in empirical analyses, both as explanatory variables and outcome variables. As explanatory variables, the issue is typically whether the risk perceptions affect individual behavior. For example, in urban Cameroon, young people were asked whether or not they perceived themselves to be at high risk for HIV/AIDS. This risk perception measure was used as an independent variable explaining condom use (Meekers and Klein, 2002), although this approach faces endogenity issues.

There has been far less research into the determinants of risk perceptions. Behrman, et. al (2003, p. 2) note that "very little research has focused on the determinants of subjective risk assessments." For example, the perceived threat of HIV/AIDS depends on both individual subjective risk and the ability to respond behaviorally. In the context of understanding HIV/AIDS, several studies have suggested that network effects are important in shaping both risk perceptions and behavior (Behrman *et al*.2003, Buhler *et*

al.2003). Smith et al. (2000) document how subjective perceptions of the risk of violent conflict vary directly with proximity to ethnic frontiers in the Horn of Africa. A few such contributions, not withstanding, we understand little about the factors determining risk perceptions. Lybbert et al. (2003) explore how recent rainfall, and forecast information affect pastoralists' beliefs about the likelihood of different rainfall patterns in this same region.

We would expect a number of factors to affect risk perceptions. Individual characteristics such as wealth, household status and gender may matter not only to objective risk exposure but also to one's ability to mitigate risk *ex ante* or to cope with it *ex post*. Cultural and community factors, such as the existence of strong social safety nets or effective conflict resolution mechanisms may affect perceptions as well as culturally determined gender roles that place responsibility for managing particular sorts of risks on men or women.

Gender is one factor that is commonly expected to affect risk perceptions. It is widely believed that women are more risk averse than men. This may show up in a number of different ways. Studies of the financial sector and investing sometimes find some gender differences in willingness to take investment risks. For example, when asked about the amount of financial risk that an individual and his or her spouse were willing to take with their savings and investments, 60% of female respondents, but only 40% of male respondents, said they were unwilling to take any risks (Jianakoplos and Bernasek, 1998). These authors also looked at actual financial decision-making and find that single women are relatively more risk averse than single men. They also find that single women hold smaller proportions of risky assets than either single men or married couples. Using an experimental design with three decision environments, an abstract gamble frame with and without the possibility of losses and an investment frame with losses, Eckel and Grossman (2003) find a significant sex difference in risk aversion. In addition, they find that both men and women predict that women will be more risk averse in these situations. One of the few studies that does not find gender differences in the handling of financial assets suggests that previous results may be due to differences in men's and women's

opportunity sets, rather than their attitudes (Schubert *et al*. 1999). These behavioral differences extend beyond financial decision-making. Hersch (1996) found that, on average, women made safer choices than men, in such areas as smoking, wearing seat-belts, preventative dental care, and health screening, such as regular blood pressure checks.

Behavior differences between men and women do not necessarily imply differences in risk perceptions. They suggest that either risk preferences or risk aversion differ, but it is difficult to disentangle these using just the behaviors as an outcome. If there are differences in risk aversion, then risk perceptions may be similar or different based on gender.

Study Area and Survey Data

From March 2000 through June 2002, the USAID Global Livestock Collaborative Research Support Program (GL CRSP) "Improving Pastoral Risk Management on East African Rangelands" (PARIMA) project collected quarterly survey data from 330 households in eleven communities within a single, contiguous livestock production and marketing region in the arid and semi-arid lands of northern Kenya and southern Ethiopia (Figure 1). The specific sites were chosen to capture relative variation in agricultural potential, market access, livestock mobility and ethnic diversity (Table 1). Rainfall is low and variable and the study period coincides with a major drought that affected much of the area in 2000 and continued well into 2001 in some sites. The infrastructure is extremely weak, in terms of roads, schools, and health facilities.

In addition to standard household survey questions about income, consumption, activities and livestock herds, we asked respondents to rank the risks that they felt would most affect themselves and their families over the following three-month period. In each household, we interviewed the household head, one randomly selected spouse and one randomly selected non-head/non-spouse adult (age 18 years or older) in the household. The household head answered questions regarding the income, assets, and activities of

the entire household as well as reporting his or her own risk rankings. The other individuals surveyed reported on their own assets, incomes and activities, as well as their own risk rankings. Thus, for each household, we have up to three respondents, enabling us to look not only at how risk perceptions vary across households, but also how they vary within households by gender, age or status.

In each site, a baseline survey was conducted in March 2000. Repeat surveys were conducted quarterly for an additional nine periods, through June 2002. The repeated survey recorded information both on the three-month period preceding the fielding of the survey and respondents subjective risk assessments for the coming three-month period. The quarterly interval of the survey was designed to correspond to the bimodal distribution of rainfall in the study area. Thus, for example, a survey fielded in June recorded information on the period during which the long rains usually fall (March / April / May) as well as forecasts for what is usually the ensuing dry season (June / July / August).

Table 2 presents sample descriptive statistics. Educational attainment is very low; 88 percent of those interviewed had completed no schooling at all. Mean income – which includes the value of goods produced and consumed within the household, most notably milk and meat, wages, salaries, remittance and business income – valued at approximately 70 KSh/US dollar, was less than $94 per month per household in the period from April 2000-July 2000, equivalent to less than $0.15/day per capita. On average, households rely on livestock and livestock products for 73% of their income, although the median level is higher. Fifty-four percent of households receive all of their income from livestock, while 19% report receiving no income at all from livestock. This underscores that pastoralist communities include both pure herding households – those almost wholly reliant on their livestock for their livelihoods – as well as those who have "dropped out" of the pastoral system and live in towns, commonly relying on food aid, casual labor, and small-scale activities such as producing charcoal, brewing alcohol or selling firewood, and those who have diversified beyond pastoral activities into full-time wage work or business.

The median age of those interviewed is 43. However, the age distributions differ considerably between the heads and the others. The median age for those who are not heads of household is 38. For the wives, median age is 40. Median age for the household head is 48.

Of those interviewed, 48 percent were the head of household. One third of these household heads were women. Twenty-seven percent of the sample were wives, while 25 percent were not either the head or the wife.

Risk Rankings

As already mentioned, from each respondent we obtained rankings of a series of risks that they and their households faced. In each period, each respondent was told, "We know that households in this area are concerned about problems that could happen to them. We have made a list of concerns people commonly tell us about. I am going to read you this list of concerns, and I would like you to tell me which of these you are afraid could affect your or your household in the coming three months." The list was generated from a participatory risk mapping exercise in the region.[3] The risks enumerated included: not enough pasture for animals, not enough water for animals, animal sickness or death, animal loss due to theft or raiding, insecurity /violence/fights, human sickness, no buyers for animals you wish to sell, low prices for animals you wish to sell, not enough food for people, high prices for things you buy, and crop failure[4].

Respondents were asked to identify which of these risks were of concern to them. They they were asked to rank those that they had identified in order of concern, from greatest worry to least. These risk ranking data are thus ordinal, rather than cardinal measures. Moreover, each individual ranked only those items that he or she identified as a positive

[3] See Smith et al. (2000).
[4] A final category of "other" was allowed, however, there were not sufficient answers in this category to analyze them

concern. Therefore the relevant set of risks varies across respondents. The risk rankings cannot be interpreted as absolute intensity measures, only as measures of relative importance of each concern. A ranking may go down because that issue becomes less of a concern or because another issue becomes more of a concern.

We consider three different approaches to analyzing these risk rankings data. First, the simplest approach is to analyze whether the individual responded yes to the question of whether or not the item was a concern. Individuals were unconstrained and could answer yes or no, regardless of how they had responded to other items on the list. However, this approach doesn't use the additional information from the ranking exercise at all.

A second approach is to analyze the concern(s) listed as most important. This constrains respondents' choice of the greatest risk(s) they face, yet takes advantage of the ordinal information in the data. The most restrictive version would focus on just the expressed top concern. Once one expands beyond a single risk factor, variation across respondents in the number of identified risks can affect inference, although in these data over 90 percent of respondents ranked at least three concerns. If we think that a respondent is more reliable in telling us about his or her top concern or top three (or some small number of) concerns than he or she is at ranking their seventh and eighth concerns, then using the top one or three risks helps to resolve this issue.

Finally, we can use the full ranking data. To evaluate the rankings across all of the options, we have to choose whether to treat the intervals between rankings of different individuals as the same, regardless of the differences in the number of concerns listed, or to allow the intervals to differ. Previous work found similar outcomes regardless of the method used.[5] As we know from theory (for example, the literature on voting rules), no one measure is necessarily best. But taken together, they offer a robustness check on inferences regarding relative risk perceptions. In the econometric analysis that follows, each of the approaches generates similar results.

[5] This is discussed in greater detail in Smith et al (2001). They use focus group data, rather than individual survey data, but the methodological issues are similar.

We use a uniform distribution of intervals, which allows for an ordered multinomial estimation. The measure of risk rankings, R, was calculated as follows: $R_{ij}=r_{ij}/n^*$ for individuals $i=1\ldots m$ and risks $j=1\ldots n$ where n^* is the maximum number of risks identified by any respondent. The concern rated as the most serious by individual i thus receives the ranking $r_{ij}=n^*$, so $R_{ij}=1$. For the concern rated as the second most serious by individual i, $r_{ij}=n^*-1$. For those not ranked, $R_{ij}=0$.[6] This approach creates a uniform distribution of intervals when the items are ranked, but the interval between the last item ranked and those not ranked at all will vary across individuals.

The mean risk rankings offer an indicator of relative importance of each source of risk, aggregated across each interviewee and time period (Table 3). Human sickness is the concern ranked as the most important, followed by animals getting sick and dying, food shortages, and high prices.

Table 4 presents the percentage of respondents who listed each risk category as a concern, using a simple yes-or-no assessment. It also shows the percentage of individuals ranking each concern among their "top three" and the percentage ranking each concern as the most important. The percentages are broken down by gender, household status, location, time period and livestock ownership (a proxy for both wealth and dependence on pastoralism). One immediately striking feature of the results in Table 4 is the clear differences across time and space in terms of which concerns are listed and then ranked near the top. This raises the question as to whether this spatio-temporal variation in risk assessments within a stable population reflects responses to different recent experiences – i.e., local shocks cause localized updating of subjective risk assessments – or if it instead reflects recurrent seasonality and persistent location effects.

[6] The other option is, for each person, to distribute their rankings evenly across the 0-1 interval. In this case, the interval between the first and second ranked concerns would be different for two individuals who ranked a different number of concerns. Smith et. al (2001) found qualitatively similar results using both approaches.

Human sickness is clearly the highest concern, regardless of which measure is used. The other concern that is consistently ranked very high is "not enough food for people". Animal sickness and death, lack of pasture, and high prices for purchased items are all ranked highly using at least one of the measures. Thus, the choice of measure does have some impact on rankings. The patterns, however, are very similar across the different measures.

What Characteristics Affect Risk Perceptions?

The results in Table 4 also suggest systematic differences in risk perceptions based on household characteristics – notably wealth and income – and individual characteristics such as age, gender, education and status within the household. Previous work in this area, using focus groups rather than individual survey level data, indeed found statistically significant differences across focus groups chosen to represent different sub-populations with regard to gender, wealth and location (Smith et al. 2001).

We explore the hypothesis that risk perceptions vary predictably by household or individual attributes using ordered probit estimation of the full rankings data[7] The results presented here are just for Kenya, they do not include the Ethiopia observations.[8] The independent variables include individual characteristics such as gender, age, the highest grade attained and status within the household (head or wife, with other as the omitted variable). We would expect to find differences in gender, based on previous work in this region and based on the broader literature on gender and risk discussed above. Age, education and household status may affect both the individual's exposure to risk as well as their ability to manage it. Household characteristics included as regressors are

[7] In addition, ordered probit estimations were conducted, using the same independent variables, with the yes/no response to whether the problem was a concern facing the household and whether or not the respondent listed the problem with the top three concerns. Finally, probit estimations were conducted on whether or not the problem was listed as the highest concern for the respondent. These different approaches are used to examine the sensitivity of the results to the different ways of using this ordinal data. The key results hold, regardless of the approach used. Results of these other regressions are available from the authors by request.

[8] Estimations using the Ethiopian data are in progress.

household TLU holdings, non-livestock assets, income, share of income earned from livestock and livestock products, share of income earned from salary or wages (a relatively stable source of income in this region) and household size. We also include a series of seasonal and annual dummy variables (with December and 2002 as the omitted variables). The June survey captures the period of the long rains, while December captures the period of the short rains. The drought was most severe in 2000, and by 2002, all of the areas were in a recovery phase.

To account for unobserved household-specific characteristics, we include a measure of household level average TLU over the entire period. This is time invariant and does not vary across household members.[9]

The results for five leading concerns are presented in Table 5. Here, we will highlight the results from the two most important concerns, human sickness and animal sickness and death. We then briefly discuss the more general results.

The rankings for human sickness varied considerably by area. Living in Dirib Gumbo, a community that is settled on Marsabit mountain, with relatively good access to health care, decreased the probability of ranking concern for human sickness high, while living in the other areas increased the probability. The probability also varied over time.

Having larger herds decreased the probability of being concerned with human sickness. This may be because larger herds provide a better source of nutrition[10] and thus provide for better health. It may also be that households with larger herds are more mobile and can leave areas where the risks of illness are high. This view is supported by the fact that households with high levels of non-livestock assets are more likely to rank human sickness as a concern, suggesting that the herd size effect is not simply a wealth effect. Those with higher levels of non- livestock assets tend to be more sedentary.

[9] Other approaches to account for unobserved household-specific characteristics will be used in future estimations.

[10] One study finds that nomadic groups that rely on milk consumption have lower malnutrition in children during a dry year than communities that are sedentary (Nathan et al.)

Individual characteristics, such as age, gender, education, and status as head or wife did not significantly affect the ranking on human sickness. Since women are the ones who typically care for ill family members, we had expected to see a gender effect.

For concerns about animal sickness and death, time and space were again very important in determining the rankings. The rankings were lower in the first half of the year and they were higher later in the survey period.

Curiously, concerns over animal sickness and death did not seem to be associated with herd size, although those households with other sources of wealth did rank this concern lower. Income, as opposed to wealth, was positively associated with the ordered probit ranking for animal sickness and death. Those with greater shares of income from livestock and livestock products ranked concern about animal sickness and death higher. This suggests that the dependence on livestock for consumption, rather than the absolute number of animals in a household's herd, increases the concern about animal sickness and death.

Individual characteristics were important in the ranking on animal sickness and death. As to be expected, men ranked this concern higher than women. In addition, being either the wife or the head of the household increased the ranking on this concern, relative to other adults in the household. The ranking also decreased with the age of the respondent.

Overall, gender was less of a factor in the rankings that we had anticipated. We expected that gender would be an important determinant of risk perceptions, since men and women's roles and responsibilities differ markedly in the communities under study. Men were more likely to rank three of the livestock concerns higher: not enough pasture, animal sickness and death, and animal loss due to theft or raiding.[11] By contrast, men ranked high prices as a lower concern. These patterns are consistent with the gender

[11] In all of the following discussion, only statistically significant variables are discussed.

roles of men being responsible for caring for livestock and women being responsible for purchasing items. But these differences across gender were not quantitatively large.

In addition, we might expect wealth and income to lessen a household's overall vulnerability and thus, the risk perceptions of its members. Livestock ownership (measured in TLU's) does affect many of the rankings. It increases the concern for pasture shortages and decreases the concerns for water shortages, insecurity and violence, human sickness, no buyers for animals you wish to sell, and high prices for the things that you buy. Obviously, livestock are more than just a measure of wealth. They are also a source of livelihood and income.

The other measure of wealth, nonlivestock assets, also has an impact on the rankings. Increasing assets increases the risk rankings on no buyers, low selling prices for animals, and high prices for purchased goods. The people with higher levels of nonlivestock assets tend to be more integrated into the market economy and more concerned about market factors. They are less concerned about lack of water for animals and human sickness. Households with more non-livestock assets may also be more sedentary and thus may have better access to services available in towns, such as health care.

Somewhat contrary to intuition, those with greater shares of their income from salary were concerned about violence – both animal loss due to theft and raiding and insecurity and violence were ranked high. In addition, they were concerned about the lack of buyers for animals. This may be due to the fact that those with salary incomes are more likely to have others tending their animals and thus have less direct control over them.

Finally, there are important variations across time and space. For all of the concerns, there were statistically significant coefficients on at least some of the time and space variables.

Thus, we can conclude that there is important heterogeneity across individuals, and especially across time and space, in terms of the perceived risks facing people in these

areas. The variation across time and space is greater than the variation by individual characteristics. This has important implications for policy makers. Although this area of Kenya often is all lumped together as the rangelands, the arid lands or the "north," the people living in these areas perceive the risks facing their environments differently.

How Do Shocks affect Risk Perceptions?

Given the unconditional variation in risk rankings across time and space, it is useful to probe further as to whether this reflects spatial path dependence, recurrent seasonality, or perhaps localized beliefs updating in response to local shocks. In particular, we can analyze how the events of the previous period affect how people perceive the risks that they will face in the coming period. We would expect that recent experience of shocks might affect individuals' subjective risk assessments.

The data allow us to look at both household and community level shocks. At the household level, we have information on changes in household herd size (herd size this period minus herd size last quarter), whether any household member experienced an illness or injury in the previous three months that prevented them from working, and whether any household member died in the previous period.

In addition, we can include community level variables, to see how shocks to others within the village affect expectations. From the household survey data, we can compute the mean percentage change in household herd sizes within each community over the previous survey period. Data from a contemporaneous community level survey also indicate whether there were any livestock raids, animal quarantines, or outbreaks of animal or human diseases over the previous quarter. Thus, we can examine how individuals' risk perceptions evolve in response to shocks they observe locally

(community shocks) and shocks they experience themselves (household shocks). The means of these shock variables are in Table 6. [12]

The ordered probit estimation results for the five most important concerns (as identified in Table 3) are presented in Table 7. Looking first at the two most important concerns, human sickness and animal sickness and death, a few changes stand out. In particular, some of the coefficients on the time variables are no longer statistically significant, because the events that they were initially picking up are now being entered separately. This suggests that the patterns of the drought are affecting communities differently and thus different patterns can be identified by including the shock variables. It is these experiences that affect how people perceive risk. Yet, some community level effects persist.

Health shocks are measured at two levels: the household level and the community level. In 2001, about half of all of the illness/injuries reported by the household were malaria. The other half consisted of a variety of things, including those that may be highly contagious – coughing, diarrhea, pneumonia and typhoid – and those that are not at all contagious – e.g., injuries, joint problems, scorpion bites, and pregnancy. The community level shocks were whether the community leaders reported that there had been an outbreak of disease within the community during the previous period.

The household and community level health shocks have very different effects on risk perceptions. In particular, if a household member had been ill or injured in the previous period, the individual was *less* likely to rank human sickness as a concern. However, if there had been a community-level outbreak of human disease in the previous period, the individual was *more* likely to rank human sickness as a concern. Thus, people perceive the risks of illness based on the things occurring outside of their own household. They may have better information about the illnesses going on within their household and

[12] Note that there are fewer observations for the community level data. Some of the community surveys from the later periods are not available.

know when they are unlikely to affect additional household members. On the other hand, outbreaks of disease within the community may spread to them and they may have less control over them.

Income and education both positively affected the ranking attached to concerns over human sickness, once the shocks were included. One shock – the imposition of a quarantine on aminals – lowered the ranking on human sickness. This may simply suggest that when an animal quarantine was put into place, other concerns were ranked higher, especially concerns about theft and raiding of animals, violence and insecurity, and low prices for animals.

Animal sickness and death rankings were also affected by shocks. Household-level illness decreased the ranking on animal sickness and death. Although a quarantine decreased concerns over animal sickness and death, an actual outbreak of animal disease at the community level increased it. This may reflect the fact that reported outbreaks of animal disease are better measures of the probability of infection than are quarantines. The quarantines have an impact on pastoralists, because they affect mobility and the opportunity for sales, but they are not necessarily directly related to outbreaks of disease noted by pastoralists themselves.

The shock variables had impacts more generally on the risk rankings. Households that reported having had an illness or injury were less likely to rank animal sickness and death or human sickness high and were more likely to rank animal loss due to theft and raiding, insecurity and violence, and high prices higher in their rankings.

Community outbreaks of human disease were likely to result in respondents lowering the ranking on no buyers and low prices, no food for people and crops failing and increasing the ranking on not enough water for animals and human sickness.

A death within the household during the previous period had no statistically significant effects on any of the risk rankings. Since some deaths are not shocks, but are instead

events that were expected due to illness or age of the person who died, this may mitigate the effects of this variable. In addition, only 29 observations reported a death in the household in the previous period.

Animal losses, both at the household and community levels, had an impact on risk rankings, although the community level changes had an impact on the rankings for many more of the concerns. Household herd losses decreased the ranking on not enough water for animals and increased the ranking on not enough food for people. Decreases in community level herd sizes did not increase respondent's concerns regarding livestock. Instead, decreasing community herd sizes were associated with decreasing concern about the access to pasture, water, and animal sickness and death. This suggests that respondents are looking forward to a recovery after the drought, rather than looking backward at what has just occurred. In addition, decreasing community herd sizes are associated with greater concern about loss of animals due to theft and insecurity and violence. This corresponds to the fact that some restocking efforts are made through raiding in the period following the drought.

How does Risk Vary within Households?

Our final set of questions is about how perceptions of risk vary within households. For developed countries, such as the US, there is evidence that assortative matching occurs and spouses match on the basis of observable characteristics. This might lead mates to share risk perceptions and general levels of risk aversion; specifically, assortative matching suggests that there should be more agreement between spouses than between a randomly selected man and a woman. In addition, to the extent that shared experiences and information affect perceptions, those living in the same household would be expected to share experiences and thus have more similar risk perceptions. Clearly, they face the same household and community characteristics. However, there is no evidence on the importance of assortative matching in marriage markets for pastoralists in East Africa.

By contrast, much of the literature on intrahousehold resource allocation assumes that the preferences of husbands and wives differ. The empirical work in this field typically shows how different measures of bargaining power among husbands and wives results in different outcomes, and infers that their preferences must be different. For example, Thomas (1990) demonstrates that differences in preferences must underlie the differences in expenditure patterns that result from different levels of women's non-labor income in Brazil.

A few studies have actually tried to measure preferences for husbands and wives and to compare them. Kusago and Barham (2001) separately asked husbands and wives in Malaysia how they would prefer to spend money. They find considerable preference heterogeneity on these questions.

A different approach is to look at outcome behaviors within households. Andreoni and colleagues (2003) analyzed charitable giving, based on whether the husband or the wife makes the decisions. They found considerable differences by gender. In addition, for households that report a joint decision, they find that the outcome more closely resembles the husband's preferences.

Differences in risk perception may be related to differences in preferences, but theory does not provide us with a clearly defined relationship. Although there is a literature on gender and risk, discussed above, it does not specifically look at risk perceptions within households. Since there is some evidence that community and social networks affects risk perceptions, we might expect that people within households, who have shared similar experiences at the household level, might have similar risk perceptions.

These data include the risk perceptions of both husband and wife. Thus, we can examine whether or not the perceptions differ within households and whether the levels of agreement vary by observable household characteristics, such as household wealth and

income.[13] In addition, we might expect that shared experiences within households, during a crisis period such as a drought, might impact the perceptions within households. By including the shock variables discussed above, we can explore whether these shocks increase or decrease these levels of agreement between husbands and wives.

Three measures of agreement have been created. Initially, each person was asked whether or not they were concerned about eleven possible problems. They answered either yes or no. The first measure of agreement is simply the count of the number of problems where the husband and wife gave the same response, either yes or no. The mean for all quarterly observations was 6.1 (Table 8). This is not statistically significantly different from a random distribution.

The second measure compares those ranked within the top three and asks how many of those listed in the husband's top three are also in the wife's top three? The measure is on a scale from zero to three, with a mean of 2.0. The final measure is whether or not the husband and wife list the same problem as the most important concern. Overall, in 57% of the observations, the husband and wife listed the same top concern. All of these measures suggest that the ranking of these most serious concerns is significantly, though imperfectly, correlated across spouses.

Table 8 lists the means of each of these measures for different categories of households, by location, time period, and wealth level. The patterns from Table 8 are quite striking. There is considerable variation across location, time and wealth level in the degree to which husbands and wives' risk perceptions match.

In addition, for the first two measures – the agreement on whether or not a problem was a concern and the top three concerns – ordered probit analysis was used to analyze which factors affected the level of agreement. A probit model was used on the final measure of

[13] Varadharajan (2004) similarly explores agreement between husbands and wives over decision-making authority in different spheres.

agreement on the top one. The results for all of these estimations are presented in Table 9.

The cross-tabs (Table 8) suggest that households with larger herds have more agreement generally. The econometric analysis suggests that, in fact, much of this pattern is coming from other factors, such as location. Household herd size is negatively correlated with the number of concerns about which husbands and wives agree. Nonlivestock assets are positively correlated with increased agreement between husbands and wives on several of the measures. Income and the share of income from livestock also are significant and positively related to husbands and wives agreeing on the top three concerns when the shocks are not included in the model. The most important variations are by location.

We included a number of household characteristics that we expected might be related to the types of relationships between husbands and wives. We included whether or not the household is polygamous, the difference in education between the husband and the wife, the difference in age between the husband and the wife, and the share of livestock (TLUs) owned by the wife. All of these measures have been used in various empirical studies of bargaining power within the household to measure the power differentials between the spouses.

Yet, these measures had relatively little impact. Whether or not the household was polygamous did not have a consistent impact on whether or not the husband and wife shared similar risk perceptions. The age difference also had no impact. The education difference, however, was significant in explaining the top concerns of husbands and wives; when the education difference was larger, there was less agreement on the top concern and the number of concerns on which they agreed.

Neither household nor community level shocks was statistically significant in explaining whether or not husbands and wives agreed on the top three concerns. Household level changes in herd size over the previous period were negatively related to husbands and wives agreeing on the top concern. The presence of a quarantine in the community in the

previous period was positively related to agreement on the top concern. Community level herd changes in the previous period were negatively correlated with agreement on whether or not the eleven problems were concerns, possibly suggesting that in situations where major problems were occurring there was disagreement over the diagnosis.

There is come correlation between the rankings of husbands and wives. There is not strong evidence that household or community shocks create more agreement among husbands and wives about the issues facing their households. Yet there is enough disagreement within families to suggest that it is important not simply to ask the household head about the risks that he perceives, because his views may not be shared by other household members, even during times of stress.

Conclusion

An important outcome of this work is to demonstrate that risk perceptions vary both across individuals and across time. This suggests that common development practice such as Rapid Rural Appraisal, in which researchers drop into a village for a brief visit to ask about needs and concerns, may give results that are appropriate for a given time period but that are not highly generalizable. In fact, the responses to such visits may vary considerably depending on external circumstances and recent events. In addition, it suggests that attitudes and perceptions about risk vary within households; thus, it is not sufficient to simply ask the household head about the risks facing the family.

To understand vulnerability, and thus to understand poverty and patterns of poverty, it is important to look at households over time and also to use systematic research tools, such as intensive surveys. The risks that individuals and households perceive change over time, especially with regard to shocks at the community level, and this implies that their vulnerability to different forces also varies.

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Table 1. Descriptive Information on Study Sites

Code	Name	Country	Market Access[1]	Ethnic Majority	Agricultural Potential[2]	Annual Rainfall
DG	Dirib Gumbo	Kenya	Medium	Boran	High	650
KA	Kargi	Kenya	Low	Rendille	Low	200
LL	Logologo	Kenya	Medium	Ariaal	Medium-Low	250
NG	Ng'ambo	Kenya	High	Il Chamus	High	650
NH	North Horr	Kenya	Low	Gabra	Low	150
SM	Sugata Marmar	Kenya	High	Samburu	Medium	500
DH	Dida Hara	Ethiopia	Medium	Boran	Medium	500
DI	Dillo	Ethiopia	Low	Boran	Low	400
FI	Finchawa	Ethiopia	High	Guji	High	650
QO	Qorate	Ethiopia	Low	Boran	Low	450
WA	Wachille	Ethiopia	Medium	Boran	Medium	550

[1] Those with high market access are located near a market town while those with "low market access" are located some distance from a market town, with irregular transportation.

[2] In this context, relatively "high agricultural potential" means that they can harvest a crop (typically maize) in an occasional good year, although crop failure is common nonetheless, even in these areas. Those in relatively "low agricultural potential" areas do not plant any crops.

Table 2. Descriptive Statistics on Individuals, June 2000.

Household Characteristics	**Mean**	**Std. Dev.**	**Min.**	**Max.**
TLU	16.2	35.9	0	438
Asset Value (KSh)	6870	34985	0	374050
Income KSh (3 months)	6567	11889	0	80858
Share of income from livestock	.73	.40	0	1
Share of income from Salary	.07	.22	0	1
Individual Characteristics				
Male	.49			
Head	.48			
Female head	.16			
Wife	.27			
Other hh member	.25			
Age (years)	42.9	16.8	16	98
Number of years of schooling completed (years)	.71	2.2	0	13
Household size (persons)	7.5	3.3	0	15

TLU (Tropical Livestock Unit)=.8 camel or 1 cow or .1 sheep or goat.

Income includes both cash income and the value of goods produced and consumed by the household and remittances.

Table 3. Means of Risk Rankings

Concern	**Mean**	**Std. Dev.**
Human Sickness	.735	.341
Animal sickness/death	.518	.415
Not enough food for people	.599	.359
High prices for things you buy	04	.360
Not enough pasture	.326	.374
Low sales prices for animals	.578	.362
No buyers for animals	.491	.290
Not enough water for animals	.546	.270
Insecurity/violence	.785	.290
Animal loss due to theft or raiding	.532	.261
Crops fail	.525	.434

Scale is 0-1, with 1 being the highest concern.

Table 4. Percentage of Respondents Ranking Concerns, By Gender, Status, Location, Time and Wealth

	Not Enough Pasture			Not Enough Water			Animal Sickness/death		
	Yes	Top 3	Top 1	Yes	Top 3	Top 1	Yes	Top 3	Top 1
Total	63	39	8	55	27	6	66	36	3
Female	60	37	7	54	27	6	64	35	3
Male	66	42	10	57	28	6	68	38	3
Mhead	63	40	8	55	27	5	65	37	3
Fhead	63	37	6	59	60	9	68	33	3
Wife	59	38	7	51	27	5	63	38	2
Kenya	62	32	15	56	13	3	78	50	4
DG	36	32	22	14	8	1	41	28	3
KA	84	24	7	78	10	4	93	78	5
LL	87	38	6	87	30	6	86	33	6
NG	11	5	0	11	5	3	71	63	5
NH	97	60	47	96	4	0	99	46	1
SM	70	39	4	63	28	9	87	50	3
Ethiopia	63	44	4	55	37	8	58	27	2
DH	77	60	9	76	58	20	44	6	1
DI	58	24	0	53	15	1	75	17	0
FI	29	17	5	3	1	1	22	20	8
QO	99	84	3	98	82	3	98	73	1
WA	57	46	2	54	40	20	48	18	1
June 00	86	60	11	68	41	6	80	40	1
Sept 00	84	61	17	67	32	9	81	44	4
Dec 00	63	42	7	60	34	8	69	35	2
March 01	46	26	1	38	18	2	54	34	2
June 01	49	26	7	45	17	3	60	40	2
Sept 01	54	38	8	53	31	6	63	34	2
Dec 01	61	41	7	56	32	9	60	41	3
March 02	54	21	6	51	14	3	59	27	4
June 02	62	31	9	57	21	6	65	29	7
TLU = 0	59	42	3	60	39	1	68	43	2
0<TLU≤4	49	27	4	43	20	4	59	28	2
4<TLU≤8	59	37	6	49	27	8	59	29	3
8<TLU≤16	68	47	8	59	38	8	67	37	3
16<TLU≤36	76	47	20	67	24	5	78	50	5
TLU > 36	74	41	11	60	22	4	77	48	4

	Animal loss theft/raiding			Insecurity/violence			Human sickness		
	Yes	Top 3	Top 1	Yes	Top 3	Top 1	Yes	Top 3	Top 1
Total	47	18	2	58	31	9	73	41	16
Female	45	16	1	58	32	9	72	43	17
Male	50	20	2	59	31	9	74	40	15
Mhead	48	19	2	57	31	9	72	41	15
Fhead	48	13	1	64	34	9	76	44	21
Wife	44	20	2	54	31	8	71	44	16
Kenya	47	15	3	49	14	5	79	50	32
DG	28	8	1	38	18	5	23	15	8
KA	5	2	0	3	0	0	93	79	62
LL	78	8	1	88	35	17	86	46	22
NG	22	18	5	12	9	6	87	79	50
NH	98	42	8	95	7	0	99	14	1
SM	69	17	3	74	17	3	96	73	54
Ethiopia	47	20	1	64	43	11	69	35	5
DH	26	3	0	50	20	3	5	18	3
DI	61	4	1	90	58	21	89	27	6
FI	6	2	0	6	3	1	33	30	7
QO	98	81	2	98	80	4	99	68	2
WA	46	8	1	86	56	27	74	33	6
June 00	52	15	1	51	17	2	79	38	10
Sept 00	56	17	2	60	24	6	82	41	9
Dec 00	57	18	1	62	27	5	75	42	13
March 01	46	21	2	61	43	17	74	52	19
June 01	42	22	1	58	42	10	70	49	22
Sept 01	43	22	3	58	35	11	66	36	15
Dec 01	42	20	1	61	37	6	64	43	20
March 02	43	11	2	59	32	20	70	36	18
June 02	43	12	2	52	27	4	74	34	21
TLU = 0	61	40	2	71	50	7	77	51	12
0<TLU≤4	42	10	2	55	31	12	69	38	18
4<TLU≤8	41	11	1	55	29	9	67	37	15
8<TLU≤16	53	20	1	64	37	10	74	43	13
16<TLU≤36	54	26	3	58	22	5	78	40	16
TLU > 36	41	17	2	49	24	5	83	48	27

	No buyers			Low prices to sell animals			Not enough food for people		
	Yes	Top 3	Top 1	Yes	Top 3	Top 1	Yes	Top 3	Top 1
Total	59	16	1	69	22	4	83	55	22
Female	56	14	1	68	20	3	83	57	24
Male	60	17	1	72	23	4	84	54	19
Mhead	57	16	1	69	22	4	83	56	22
Fhead	59	14	1	71	19	3	83	51	22
Wife	54	15	1	66	21	3	82	59	25
Kenya	62	15	2	72	22	6	78	43	18
DG	19	10	1	63	36	6	62	50	25
KA	97	16	1	99	16	0	93	43	15
LL	99	21	1	99	23	2	87	50	28
NG	9	3	1	16	8	3	53	46	19
NH	92	34	7	91	38	22	99	28	5
SM	71	7	2	73	9	0	80	39	13
Ethiopia	54	16	0	67	21	2	86	64	24
DH	29	2	0	51	11	3	78	65	42
DI	55	7	0	79	11	1	95	57	4
FI	38	13	2	44	21	2	71	64	50
QO	98	51	1	98	50	1	99	75	7
WA	49	3	0	63	10	3	88	58	29
June 00	80	12	1	88	16	2	95	66	31
Sept 00	74	10	1	81	15	1	93	62	31
Dec 00	65	18	0	70	20	2	92	66	29
March 01	51	19	1	51	24	3	87	67	33
June 01	53	17	1	66	24	4	77	40	16
Sept 01	47	23	2	65	27	4	74	58	16
Dec 01	45	18	2	75	31	6	79	36	11
March 02	48	12	2	64	23	5	79	56	15
June 02	50	9	1	62	14	6	64	43	5
TLU = 0	56	22	1	67	26	3	83	64	25
0<TLU≤4	42	8	1	60	15	3	81	57	23
4<TLU≤8	49	10	1	64	19	4	81	58	27
8<TLU≤16	64	21	1	73	26	4	83	56	20
16<TLU≤36	77	24	1	81	27	4	87	48	18
TLU > 36	72	15	3	82	20	4	86	47	15

	High prices			Crops fail		
	Yes	Top 3	Top 1	Yes	Top 3	Top 1
Total	80	30	6	51	33	
Female	80	30	7	50	32	
Male	80	29	5	53	34	
Mhead	79	30	6	51	35	
Fhead	84	31	8	54	27	
Wife	77	30	6	48	34	
Kenya	79	15	4	38	12	
DG	73	42	15	59	39	
KA	98	42	7	0	0	
LL	98	28	10	79	2	
NG	25	12	3	32	17	
NH	99	29	10	1	0	
SM	90	17	4	69	10	
Ethiopia	80	30	4	60	60	
DH	58	15	4	62	34	
DI	97	16	1	97	84	
FI	64	43	11	17	16	
QO	98	53	1	98	83	
WA	81	20	4	21	11	
June 00	93	18	3	69	43	
Sept 00	87	17	5	51	23	
Dec 00	87	69	7	54	36	
March 01	80	44	7	48	27	
June 01	72	30	6	51	36	
Sept 01	75	35	7	48	36	
Dec 01	80	33	5	43	30	
March 02	73	30	8	53	37	
June 02	68	25	6	42	33	
TLU = 0	79	39	8	64	45	
0<TLU≤4	73	23	6	64	42	
4<TLU≤8	77	30	6	47	31	
8<TLU≤16	82	32	5	54	32	
16<TLU≤36	88	32	6	35	20	
TLU > 36	86	30	4	39	31	

Table 5. Results of Ordered Probit Estimations, Kenya

	Not enough pasture		Animal sickness /death		Human sickness		Too little food		High prices	
HH ave.	-0.006		0.002		0.022	***	0.002		0.008	*
TLU	0.005		0.004		0.005		0.004		0.004	
TLU	0.012	**	-0.002		-0.017	***	0.002		-0.010	**
	0.005		0.004		0.005		0.004		0.004	
DG	-1.337	***	-0.560	***	-1.106	***	-0.068		-0.125	
	0.092		0.084		0.093		0.083		0.081	
KA	-0.867	***	0.549	***	1.181	***	0.194	**	0.240	***
	0.089		0.084		0.091		0.083		0.082	
LL	-0.458	***	0.030		0.400	***	0.397	***	-0.311	***
	0.092		0.087		0.089		0.088		0.086	
NG	-2.689	***	0.625	***	1.145	***	-0.230	**	-1.644	***
	0.121		0.091		0.097		0.091		0.096	
SM	-0.743	***	0.392	***	1.242	***	-0.095		-0.484	***
	0.101		0.095		0.103		0.095		0.094	
Income	0.003		0.010	***	0.003	*	-0.004	**	-0.002	
($x10^{-3}$)	0.002		0.002		0.002		0.002		0.002	
Livestock	-0.011		0.224	***	0.051		-0.350	***	0.035	
share Y	0.070		0.065		0.070		0.068		0.065	
Salary	0.107		0.199	*	-0.061		-0.217	**	-0.098	
share Y	0.114		0.102		0.108		0.103		0.102	
Age	-0.006	***	-0.004	**	-0.003		0.001		-0.0009	
	0.002		0.002		0.002		0.002		0.002	
Male	0.222	***	0.225	***	-0.048		-0.012		-0.162	***
	0.067		0.061		0.065		0.061		0.060	
Highest	-0.015		-0.016		0.018	*	0.003		-0.002	
Grade	0.012		0.010		0.011		0.010		0.010	
Assets	-.009	*	0.010	*	0.013	**	0.008	*	0.016	***
($x10^{-4}$)#	0.006		0.005		0.005		0.005		0.005	
HH size	-0.0003		-0.017	*	-0.016		-0.021	**	-0.009	
	0.011		0.010		0.011		0.010		0.010	
March	-0.200	**	-0.223	***	-0.277	***	0.697	***	-0.136	*
	0.089		0.080		0.085		0.080		0.079	
June	0.130	*	-0.188	***	-0.281	***	0.481	***	-0.151	**
	0.072		0.066		0.070		0.067		0.065	
Sept.	0.211	***	-0.022		-0.455	***	0.274	***	-0.068	
	0.075		0.067		0.072		0.067		0.067	

2000	0.952	***	-0.093		-0.923	***	0.796	***	-0.363	***
	0.092		0.083		0.092		0.084		0.083	
2001	-0.226	***	-0.187	**	-0.437	***	0.317	***	-0.314	***
	0.083		0.075		0.081		0.075		0.075	
Wife	0.049		0.246	**	0.111		-0.003		-0.070	
	0.103		0.095		0.101		0.094		0.094	
Head	-0.017		0.161	**	0.107		0.041		0.004	
	0.084		0.077		0.082		0.075		0.075	
Log Likeli-hood	-3460.8		-4163.96		-3641.3		-4452.4		-4492.9	

*** indicates significance at 0.01 level
** indicates significance at 0.05 level.
* indicates significance at 0.1 level
[#] Assets are non-livestock assets.

Table 6. Means of Shock Variables, Kenya

	n	Mean	Std. Dev.
Household-level			
TLU Change	2086	-0.20	5.34
HH illness	2141	0.26	0.44
HH death	2141	0.01	0.12
Community Level			
Raid	1616	0.19	0.40
Quarantine	1616	0.28	0.45
Disease Outbreak:			
Animals	1616	0.42	0.49
People	1616	0.48	0.50
% Change in TLU	2141	-0.02	0.20

Table 7. Ordered Probit Results with Shocks, Kenya.

	Not enough Pasture		Animal Sickness/ Death		Human sickness		Not enough Food		High Prices	
HH ave. TLU	-0.004		0.004		0.032	***	0.013	**	0.001	
	0.006		0.006		0.007		0.006		0.006	
TLU	0.011	*	-0.005		-0.029	***	-0.009		-0.003	
	0.007		0.006		0.007		0.006		0.006	
DG	-1.202	***	-0.908	***	-1.886	***	0.208	*	-0.445	***
	0.123		0.113		0.135		0.108		0.108	
KA	-0.841	***	0.468	***	0.792	***	0.318	**	0.111	
	0.133		0.115		0.122		0.114		0.114	
LL	0.236		0.217	*	-0.009		0.145		-0.543	***
	0.144		0.128		0.131		0.131		0.129	
NG	-2.323	***	0.760	***	1.295	***	-0.516	***	-1.645	***
	0.156		0.115		0.122		0.114		0.118	
SM	-0.222	*	0.477	***	1.264	***	-0.226	*	-0.489	***
	0.132		0.119		0.128		0.118		0.118	
Income ($x10^{-3}$)	0.009		0.015	***	0.007	***	-0.009	***	0.002	
	0.031		0.002		0.003		0.003		0.003	
Livestock share Y	0.021		0.186	**	0.050		-0.285	***	-0.089	
	0.078		0.072		0.077		0.075		0.073	
Salary share Y	0.189		0.201	*	-0.036		-0.018		-0.272	**
	0.144		0.121		0.130		0.122		0.123	
Age	-0.009	***	-0.006	***	-0.005	*	0.002		-0.003	
	0.003		0.002		0.003		0.002		0.002	
Male	0.219	***	0.275	***	-0.072		-0.023		-0.122	
	0.083		0.073		0.078		0.072		0.071	
Highest Grade	-0.019		-0.020	*	0.030	**	0.009		-0.003	
	0.013		0.011		0.012		0.011		0.011	
Assets ($x10^{-4}$)#	-0.008		-0.002	***	-0.002	***	-0.001	*	0.002	***
	0.008		0.0007		0.0007		0.0007		0.0007	
HH size	0.007		-0.008		0.001		-0.014		-0.012	
	0.014		0.012		0.013		0.012		0.012	

March	-0.108		-0.014		0.104		0.942	***	-0.057	
	0.151		0.122		0.133		0.122		0.124	
June	0.317	***	0.038		-0.086		0.581	***	-0.124	
	0.102		0.090		0.096		0.089		0.087	
Sept.	0.674	***	0.305	***	-0.101		0.188	**	-0.067	
	0.108		0.084		0.091		0.084		0.083	
2000	0.859	***	0.204		-0.020		0.350	*	0.286	
	0.244		0.189		0.210		0.184		0.202	
2001	-0.194		-0.014		0.144		-0.126		0.414	**
	0.224		0.156		0.170		0.154		0.172	
Wife	0.111		0.261	**	0.050		-0.008		0.026	
	0.126		0.112		0.120		0.110		0.109	
Head	0.103		0.153	*	0.080		-0.024		0.048	
	0.103		0.091		0.097		0.089		0.089	
HH	0.047		-0.286	***	-0.191	***	0.117	*	0.135	**
Illness	0.073		0.063		0.067		0.063		0.063	
HH death	-0.276		-0.185		0.111		0.017		-0.136	
	0.231		0.212		0.242		0.209		0.211	
HH herd	-0.015	**	0.002		-0.004		0.019	***	0.011	*
Changes	0.007		0.006		0.006		0.006		0.006	
Raid	-1.027	***	-0.026		-0.169		0.743	***	0.227	**
	0.122		0.095		0.104		0.093		0.093	
Quar.	-0.983	***	-0.303	***	-0.418	***	0.508	***	-0.017	
	0.137		0.093		0.098		0.094		0.098	
Animal	0.441	***	0.170	**	0.149	*	-0.396	***	0.107	
disease	0.100		0.074		0.079		0.074		0.075	
Human	-0.002		0.046		0.202	**	-0.178	***	-0.019	
disease	0.081		0.069		0.078		0.068		0.069	
Commun.	-1.952	***	-0.656	***	-0.396	*	-0.006		-0.464	**
Herd ch.	0.241		0.206		0.225		0.199		0.200	
Log Likelihood					-2551.2		-3127.2			

*** indicates significance at .01 level
** indicates significance at .05 level.
* indicates significance at .1 level
[#] assets are non-livestock assets

Table 8. Means of Household Agreement Variables, Kenya

	Yes/no	Top 3	Top 1	n
Total	6.1	2	.57	556
DG	3.5	1.9	.49	116
KA	7.1	2.2	.77	101
LL	9.9	1.9	.48	65
NG	2.9	2	.55	130
NH	9.7	2.4	.59	88
SM	7.4	1.8	.45	56
June 00	7.2	1.8	.56	71
Sept 00	6.7	2.1	.52	71
Dec 00	6.2	2	.40	67
March 01	5.2	2	.53	70
June 01	5.9	2	.60	67
Sept 01	5.3	21	.66	65
Dec 01	5.9	2.1	.70	63
March 02	6	2	.54	56
June 02	6.9	2.2	.65	26
TLU 0	3.3	1.7	.50	32
TLU .1-10	4.6	2	.52	258
TLU 10.1-20	7.2	1.9	.49	95
TLU 20.1-50	8.6	2.3	.65	125
TLU 50+	7.3	2.3	.80	46
Perfect Agreement Score	11	3	1	

Table 9. Estimations of Probability that Husband and Wife will Agree, Kenya

	Top 3		Top 3		Top 1		Top 1		Y/N		Y/N	
HH Ave. TLU	0.001		0.013		0.001		-0.005		.021	**	0.024	**
	0.010		0.012		0.005		0.007		.009		0.012	
TLU	0.013		-0.001		0.006		0.013	*	-0.020	**	-0.023	*
	0.010		0.013		0.005		0.007		.009		0.019	
DG	-0.491	***	-0.646	***	0.028		0.087		-2.780	***	-3.422	***
	0.175		0.234		0.080		0.107		.192		0.261	
KA	-0.634	***	-0.814	***	0.078		0.055		-1.306	***	-1.325	***
	0.196		-0.263		0.088		0.119		.192		0.255	
LL	-0.809	***	-0.585	**	-0.056		0.071		1.484	***	0.818	***
	0.206		0.295		0.094		0.133		.234		0.310	
NG	-0.350	*	-0.360		0.089		0.170		-3.047	***	-3.211	***
	0.183		0.238		0.082		0.106		.203		0.258	
SM	-0.706	***	-0.666	***	-0.045		-0.044		-0.717	***	-0.456	*
	0.206		0.258		0.096		0.123		.199		0.249	
Income ($x10^{-3}$)	-0.008	*	-0.006		-0.002		-0.004		.0007		0.002	
	0.004		0.005		0.002		0.002		.004		0.004	
Livestock share	0.346	**	0.201		0.026		-0.045		.184		0.017	
	0.158		0.183		0.072		0.086		.150		0.173	
Salary share	0.185		0.034		0.054		-0.039		.231		0.051	
	0.203		0.228		0.093		0.108		.195		0.217	
Assets ($x10^{-4}$)#	0.003	**	0.003	*	0.000		0.002		.074	***	0.067	**
	0.001		0.002		0.000		0.007		.013		0.016	
HH size	-0.025	*	-0.047	*	-0.004		-0.007		.004		0.001	
	0.023		0.0247		0.011		0.013		.023		0.027	
March	-0.067		-0.008		-0.078		0.101		-0.204		-0.580	**
	0.165		0.262		0.078		0.119		.157		0.251	
June	-0.093		-0.093		0.037		0.247	**	.122		0.827	***
	0.152		0.228		0.071		0.099		.146		0.225	
Sept.	0.144		0.240		0.050		0.127		-0.091		0.281	*
	0.137		0.167		0.063		0.076		.130		0.160	
2000	-0.141		-0.073		-0.137		-0.111		-0.023		1.038	***
	0.199		0.419		0.094		0.195		.188		0.396	
2001	-0.078		-0.013		0.029		0.053		-0.562	***	0.787	
	0.163		0.317		0.076		0.146		.157		0.297	
Polyg.	-0190		-0.111		-0.138	*	-0.140		-0.001		.062	
	.164		.185		0.078		.091		.162		.183	
Educ. diff.	-0.031		-0.024		-0.044	**	-0.058	**	-0.013	**	-.0004	
	0.043		.046		.022		.024		.040		.044	
Age diff.	-0.019		-0.020		-0.001		-0.008		.010		-0.013	
	.012		.016		.006		.008		.012		.015	

Wife tlu	.387	**	.313		.212	**	.219	**	.146	**	.167	
Share	.187		.2213		.087		.101		.180		.207	
HH Illness			-0.064				-0.031				.090	
			0.130				0.063				.125	
HH death			-0.399				0.310				-1.279	
			0.892				0.235				.811	
HH herd			-0.001				-0.013	*			-0.018	
Change			0.014				0.007				.014	
Raid			0.226				-0.009				.196	
			0.186				0.087				.177	
Quarantine			-0.115				0.201	**			.110	
			0.198				0.086				.192	
Animal			0.099				0.093				.170	
dis.			0.154				0.071				.146	
Human			-0.072				0.038				-0.083	
dis.			0.144				0.069				.138	
% comm.			-0.101				-0.113				-0.785	*
Herd change			0.398				0.192				.380	
Log likelihood	-616.2		-475.7		-348.2		-253.2		-964.4		-705.1	

*** indicates significance at .01 level
** indicates significance at .05 level.
* indicates significance at .1 level.
[#] Assets are nonlivestock assets.

Figure 1. Survey Sites in Southern Ethiopia and Northern Kenya