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Elaine M. Grimm

May 6, 2009

Working Paper submitted to the Coordinator of the Research Specialization, Dr. Shanta Pandey

Mentor: Dr. Carolyn K. Lesorogol

Brown School of Social Work

Washington University in St. Louis

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Elaine M. Grimm<sup>1 2</sup> and Carolyn K. Lesorogol<sup>1</sup>

Abstract

Establishing private property in land through registration and titling has been promoted in developing countries due to the anticipated benefits of private ownership in access to credit, productivity enhancing investments, and ultimately productivity gains. Evidence of such gains is limited, however. In this paper, we examine a related question: What is the impact of privatization on cooperation in farm labor? New data collected in 2005 from Samburu District in Kenya is analyzed, comparing one community where land has been privatized (Siambu, n=70) to a second where land is communally held in a group ranch (Loiwoiting, n=30). It is hypothesized that households with title deeds (in Siambu) are less likely to cooperate in communal farm labor than households without deeds (in Loiwoiting). The hypothesis was confirmed, as the odds of cooperating in communal farm labor are 90.0% lower for households with deeds compared to those without. This effect has negative implications for collective action efforts in Siambu.

**Key words:** Land tenure; privatization; cooperation; communal farm labor; Kenya.

Introduction

Privatization of land tenure has been a favored development strategy in Africa since before independence (Smith, 2003), including in Kenya, Somalia and Uganda, among other countries (Bruce, Migot-Adholla, 1994). British colonizers instituted private land ownership for white settlers in Kenya; however, private land ownership was not extended to native Kenyans until after the Mau Mau rebellion with implementation of the *Swynnerton Plan of 1954*, “A Plan to Intensify Development of African Agriculture in Kenya” (Kanyinga, Lumumba, and Amanor, 2008; Migot-Adholla, Place and Oluoch-Kosura, 1998). In Kenya, this land policy continued

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<sup>1</sup> Brown School of Social Work at Washington University in St. Louis.

<sup>2</sup> Presenter at the International Consortium on Social Development (ICSD) 2009 in Mexico.

after independence from Britain in 1963 (Migot-Adholla, Place and Oluoch-Kosura, 1998). Programs of land registration and titling are based on the economic theory of property rights (Demsetz, 1967; Demsetz, 2002). It is theorized that registering land to household heads will provide tenure security, and titling will result in the monetization of land into collateral—as the title deed can be mortgaged as collateral to obtain access to credit. It is expected that the credit will be invested in productivity-enhancing agricultural inputs, such as fertilizer. Finally, higher use of improved agricultural inputs is hypothesized to result in increased crop yields (Bruce, Migot-Adholla, 1994; Platteau, 1996; Brasselle, Gaspart and Platteau, 2002). It is further theorized that increased land tenure security will enhance farmers' incentives to invest in their land, as farmers know they will benefit directly from these investments (Smith, 2003).

However, five African country case studies performed by the World Bank published in Bruce and Migot-Adholla (1994) provide evidence that the expected increases in tenure security, access to credit, investment in agricultural inputs, and crop yields after land privatization has not occurred in Africa, specifically not in Kenya (Migot-Adholla, Place & Oluoch-Kosura, 1989; Carter, Wiebe & Blarel, 1994). Regression results from Roth, Unruh, & Barrows (1994b) indicated a negative effect from title deed on tenure security, which indicates that farmers are less secure after land registration. Migot-Adholla, Place and Oluoch-Kosura (1989) found access to credit was not significantly higher after registration of deeds in Kenya. In all studies, evidence of use of credit was low (Bruce, Migot-Adholla, 1994). Carter, Wiebe & Blarel, (1994) report that “input levels are highest on farms without title,” (p. 148). Migot-Adholla, Place and Oluoch-Kosura (1989) and Carter, Wiebe & Blarel, (1994) found no evidence that title deed is significantly associated with increased agricultural productivity.

Smith (2003) focuses on tenure security, suggesting that tenure is a dynamic concept in Africa and that “tenure security to date has not been well defined or measured in the African context—certainly not when it was equated with titling” (p. 213). Corroborating the findings from Roth, Unruh, & Barrows (1994b), Smith contends that titles only afford as much security as the guarantor offers, and that “obtaining a title may alienate a smallholder from the local polity that backs customary land rights, thus making the title actually less secure” (2003, p. 213). Therefore, it is insufficient to measure tenure security by the mere presence of title alone.

The case studies in Bruce and Migot-Adholla (1994) in fact disaggregated the concept of tenure security into component parts. However, Smith (2003) proposes that insufficient attention was paid to the demand effect of tenure security—that is, farmers may demand titles for different reasons in the short-term (to protect access to land) and in the long-term (to access credit to invest in land improvements), which were not accurately accounted for in the previous studies. Further, Berry (1993) advises that tenure security will have little or no effect on productivity in an unstable macro-economic environment, so it is of little interest to smallholder farmers.

Smith (2003) argues along with Platteau (1992; 2000) that farmers fear foreclosure, due to what Platteau (1992) called the ‘safety-first perspective.’ As Smith (2003) explains, property rights theory does not account for the possibility that farmers may value titles for tenure security alone. Rather, the theory assumes that farmers will be interested in collateralizing their land, to then purchase inputs, and thereby increase crop yields. Yet, it has been observed in Africa, including in Samburu District of Kenya (C. K. Lesorogol, personal communication, October 2008), that farmers’ fear of dispossession is often more primary and salient than their interest in investing in land improvements. Smith’s (2003) work suggests that further investigation of the

impacts of land tenure reform in Africa is warranted. Much remains to be learned regarding the impact land tenure privatization has on communities, aside from the effect on agricultural yields.

In this study, we first tested whether ownership of title deed is associated with increased agricultural productivity in our sample from Samburu District of Kenya. Our findings were consistent with the previous studies in that no significant association between land titling and increased crop yields was found ( $t(95) = -1.55, p = 0.13$ ). Following this preliminary investigation, we shifted our inquiry to ask a related question, to test what broader effects land privatization has had on another concept that is critical to Samburu pastoralists: cooperation. This study analyzed new household level data collected from Samburu District in 2005 to ask: What is the impact of land tenure privatization through title deed registration on cooperation in communal farm labor in the Samburu District? It was hypothesized that households with title deeds would be less likely to cooperate in communal farm labor than households without deeds. Cooperation in communal farm labor was selected to measure cooperation, as farming is an emergent livelihood strategy for Samburu pastoralists. Ours is the first study to our knowledge to test the impact of land privatization on cooperation in communal farm labor specifically.

The structure of this paper begins with ethnographic background on the Samburu people, including a description of communal farm labor as practiced by Samburu farmers. The history of the land adjudication process in Samburu District is told. Then findings from previous studies that have tested the impact of land tenure privatization using experimental economics among the Samburu in Lesorogol's earlier works are referenced. Ownership of title deed was used as a proxy for privatization in these previous studies, as it is in this study. Theoretical justification of variables selected for analysis is presented. The remaining sections include: Data Analysis Techniques, Methods, Results, Discussion, and a final section on Implications and Conclusion.

## Ethnographic Background: Samburu Pastoralists

Samburu pastoralists live in northern Kenya and herd livestock across wide tracts of rangeland surrounding semi-permanent settlements (Spencer, 1965; Holtzman, 1996). Samburu District is semi-arid and prone to droughts (Lesorogol, 2008a). To survive in this harsh environment, Samburu people have developed intricate institutions based on common management of natural resources—including grazing lands and water (Ibid, 2008a). Specifically, Samburu practice various forms of reciprocity and cooperation involved in herding: if one pastoralist loses livestock in a drought, the cultural norm is for this herder to seek help from other pastoralists who will replenish his herd. Those pastoralists who donate some of their livestock to the herder in need are said to be ‘sotwatin’ or ‘stock friends,’ and the herders are socially bonded through this system of reciprocity (Spencer, 1965, p. 27).

More recently, Holtzman (1996, p. 211) observed that some Samburu are increasingly diversifying livelihood strategies by cultivating crops. In the 1970s, a group of men from the community of Siambu in Samburu District began practicing agriculture (C. K. Lesorogol, personal communication, October 2008). Crop cultivation is also practiced in the communal lands of the group ranch in Loiwoiting (Ibid, 2008). The average total acres of crops under cultivation per household is 1.85 in Siambu and 1.82 in Loiwoiting. The primary subsistence crop grown is maize. Beans, sukum, cabbage and potatoes are also commonly grown by season. Interestingly, Samburu are adapting communal, reciprocal social arrangements—similar to those described in livestock herding—to crop cultivation (Ibid, 2008). If a household needs help with a farm task, neighbors are summoned to form a work group, and will reciprocate work for others. This form of labor is usually practiced for labor-intensive tasks that need to happen quickly, like weeding maize fields (Ibid, 2008). The group completes the work together for no pay.

It may be expected that households that manage land communally in the group ranch in Loiwoiting are required to cooperate on all aspects of land management, whereas households that own title to individual parcels in Siambu do not. Thus, it may seem intuitive that households without deeds in the group ranch in Loiwoiting may be naturally more likely to cooperate with other households on any variety of tasks involving land management, including farm labor tasks. However, it is not the case that any households, either in Siambu or Loiwoiting, must cooperate in communal farm labor. Participation in communal labor is elective for households in both of these communities, and specifically, cooperation in communal farm labor is not mandated by any formal rules of the group ranch in Loiwoiting. Further, households in both Siambu and Loiwoiting have the option to choose among use of household labor (as they most commonly do—See Univariate Results), hiring paid labor, or to cooperate in communal farm labor. Given the long-standing tradition of cooperation and reciprocity in livestock herding, it is actually expected that Samburu from both Siambu and Loiwoiting would be more likely to extend cooperation to agricultural tasks. Thus, it is interesting to study the effects of a formal change in land tenure regime on cooperation among Samburu, to test if traditional norms of cooperation endure after privatization, especially given that many in Siambu initially opposed privatization.

#### Privatization of Land in Samburu District

Among pastoral households in the Samburu District of Kenya, Lesorogol (2005b; 2005c) reports that the government of Kenya began to adjudicate land tenure after 1963 in the form of group ranches, or land owned by a cluster of households. Later, “37 individuals in Siambu sought land during the adjudication process that began there in 1978,” (Lesorogol, 2005b, p. 162), which caused a conflict over land among the community elders and the ‘Group of Thirty-seven,’ who were mostly younger and more educated, (Lesorogol, 2008b). After eight years of

conflict, in 1986, a compromise was reached (Ibid, 2008). Individuals in Siambu were able to keep individual ownership of land, and subdivision of land was made almost equally (Lesorogol, 2005c; 2006; 2008b), “despite the fact that most residents opposed privatization *per se*,” (Lesorogol, 2005c, p. 131). In 1992, 240 households in Siambu received 23-acre individual plots in Siambu, where land has remained privatized in this way to date (Lesorogol, 2005b; 2006). During the land adjudication, the decision was made to institute group ranches, where land is communally managed, in other communities in Samburu District, namely, in Loiwoiting—which is physically directly adjacent to Siambu and is the second community studied in this paper; and in Mbaringon, a community Lesorogol has compared to Siambu in previous studies.

#### Previous Study Findings

Lesorogol (2005c) conducted a series of economic experiments with the Samburu as part of a broader research project. In the Public Goods game, Lesorogol (2005c) asked four “players” to contribute to a hypothetical community project. Each player could allocate up to 50 Kenyan Shillings (Ksh) in 10-shilling increments, and their “contributions were combined and doubled by the experimenter, and the total amount is divided equally among the players” (Ibid, 2003c, p. 133). Further, players were “not allowed to talk to each other, nor do they know the offers made by the other players” (Ibid, 2003c, p. 133). Lesorogol (2003c) hypothesized that players from Siambu would cooperate less than players from a comparable community where land is communally managed (Mbaringon). Lesorogol noted that “31% of players in Mbaringon contributed their entire endowment to the community project, while only 6% did so in Siambu” (p. 133). Thus, Lesorogol (2003c, p. 133) concluded that “the mutual trust required for successful cooperation” was demonstrated at higher levels in the community where land is communally managed than in Siambu. This suggests deterioration in levels of cooperation after

land privatization (Ibid, 2005c; 2008a). Lesorogol (2005c; 2008a) also collected ethnographic data, which revealed that households in Siambu have encountered difficulty cooperating to produce public goods—namely in constructing a public school. Community members in Siambu did not contribute effectively to the collective efforts directed at building the school (Ibid, 2005c; 2008a). A community's capacity to overcome problems of collective-action, including free-rider problems, is undermined when community members demonstrate low cooperation levels.

#### Theoretical Justification for Study Model

Study variables include a binary outcome variable, cooperation in communal farm labor; the main predictor variable, ownership of title deed, and several control variables including: number of years of education of the household; years of age of the household head; number of years the household has grown crops; per capita income measured in Kenyan Shillings (KSh); and a per capita measure of household wealth. All of these variables were selected based on theoretical underpinnings in the literature and extended community-level ethnographic and quantitative longitudinal studies among Samburu pastoralists conducted by Lesorogol.

The outcome variable - cooperation in communal farm labor - is a measure of cooperation. Cooperation is a form of collective action, which is important in establishing and maintaining social institutions (Ostrom, 1990; North, 1990). Lesorogol (2005b; 2008a) and Ensminger (1997) tested cooperation among Samburu and Orma pastoralists from Kenya respectively, using evidence from game theory experiments in the Public Goods Game. The central question Lesorogol (2005b; 2008a) tested using cooperation as an outcome variable concerns whether participation in collective action persists after land tenure is privatized among Samburu. The findings from these experimental economics simulations indicated deterioration in cooperation after land privatization. The current study provides a more precise measure of the

impact of title ownership on a particular form of cooperation existing in both Siambu and Loiwoiting. Because all the households in Siambu have title deeds, and none of the households in Loiwoiting do (the two communities in this study), this variable will account for community level variation in addition to variation among households.

Based on ethnographic observations recorded by Lesorogol, there is good reason to believe that years cultivating crops would impact how heavily embedded in the practices of agriculture a household is. It is expected that households may not be as aware of or as well positioned to call upon communal labor and/or hired labor in addition to standard household labor if they have not farmed for long. Thus those households that have cultivated crops for shorter amounts of time are expected to be less likely to cooperate in communal farm labor.

Ntiati (2002, p. 6), reported that, “Over the past 25 years, there has been considerable tension in the group ranches over the security of land tenure, especially for young people,” (in the Loitokitok Division of Kajiado District in Kenya). Lesorogol (2005a; 2005c) reported that younger people got the title deeds in Siambu (privatized community in Samburu District). Since the Samburu pastoralists have not traditionally cultivated crops, younger household heads in both Siambu and Loiwoiting will be more exposed to the new adaptations related to farming. Thus, it is hypothesized that the older the household head, the less likely the household is to cooperate in communal farm labor.

Results of from experimental economic data from the Public Goods Game comparing Siambu and Mbaringon, (Lesorogol, 2008b, p. 211) indicate that players with more education cooperate less. Using education level of the household head as a demographic control variable, it is hypothesized that the higher the number of years of education completed by the household head, the less likely the household is to cooperate in communal farm labor.

Ensminger (2004, p. 378) notes that in the Ultimatum Game and Dictator Game, “the presence or absence of wage/trade *income* is a highly significant predictor of offer size.” That is, households with higher income cooperate less. In the case of cooperation in farm labor, it is hypothesized that the higher the income of the household, the less likely the household is to cooperate in communal farm labor. This is because households with higher income may be better able to hire paid labor than households with lower income.

A per capita measurement of household wealth proposed by Grandin (1981) and used in previous studies conducted by Lesorogol (2005a) will be used in this study as well. Similarly to households with more income, based on ethnographic data collected by Lesorogol, it is hypothesized that the wealthier the household, the less likely the household will be to cooperate in communal farm labor. Households with either higher income or more wealth are expected to be better able to hire paid labor to supplement household labor if needed. Though again, all households in Samburu District have the choice among household, communal, or hired labor.

#### Data Analysis Techniques

Univariate descriptive statistics, bivariate statistics and logistic regression are used to analyze all of the variables included in the study model. Univariate statistics are presented in a table stratified by location with results interpreted in the results section. Bivariate relationships were examined between each individual predictor variable and the outcome variable, of cooperation in communal farm labor. Finally, because the outcome variable is a binary categorical variable, a logit model is used to test the full study model. Univariate analysis indicated that three independent variables needed to be transformed to correct for skewness and kurtosis: The square-root was taken for the “years farming” and “per capita household income” variables, and the “per capita household wealth” variable was log transformed.

## Methods

### *Data Source*

This study uses new cross-sectional data collected in 2005, which is as part of a larger, on-going longitudinal panel study conducted by Lesorogol in Samburu District. Panel data was first collected for the larger study in 2000 and in a second wave in 2005. In both 2000 and 2005, a structured household survey was conducted in the Samburu language in two communities in Samburu District: Siambu and Mbaringon. In 2005, Lesorogol also surveyed households in a third community in Samburu District, Loiwoiting, using the same household survey. Only the cross-sectional data collected from Siambu and Loiwoiting in 2005 are analyzed in this study.

### *Research Design*

This data provides a good opportunity to compare the impact of land tenure privatization by comparing Siambu and Loiwoiting, holding other important factors constant. First, Siambu and Loiwoiting are geographically directly adjacent and culturally indistinguishable. Notably, the ecology, local customs and traditions, and ethnic composition of the communities are nearly identical, and therefore serve as methodological controls. Second, all of the households in Siambu own title deeds, whereas none of the households in Loiwoiting own title deeds. Thus it is possible to isolate the impact of the two different land tenure arrangements practiced by Samburu: privatized tenure (in Siambu) and communally land management (in Loiwoiting).

### *Sampling Strategy*

The sampling strategy used in this study is disproportionate stratified random sampling, with two strata, using simple random sampling within the first stratum and systematic sampling in the second stratum. The two strata were determined using location (by community) as a proxy for presence of title deed ownership (Stratum 1: All households in Siambu, n=70) or lack of title

deed ownership (Stratum 2: All households in Loiwoiting, n=30). Ownership of title deed by household heads is the way the concept of land privatization is operationalized in this study.

Households in Siambu, Stratum 1, were selected by simple random sampling, using a sampling frame of all households that had been registered with title deeds allocated by the Kenyan government. Households in Loiwoiting were selected using systematic sampling by interviewing every third household. Systematic sampling was used in Loiwoiting because there was no existing list of residents to use as a sampling frame. Thus, only thirty (30) households were interviewed in Loiwoiting. Because the total number of households in Loiwoiting is around ninety (90), nearly one third of the households in Loiwoiting were sampled. Siambu is a much larger community of about three-hundred (300) households, of which seventy (70) or 23% were sampled in 2005. The total sample analyzed in this study disproportionately represents more households from Siambu (n=70) compared to those in Loiwoiting (n=30).

## Measurement

### *Identification and Definition of Variables*

To identify and define the seven variables included in the model tested, the variable label, name, content of the concept measured, survey question used to collect the data, and the original type and the coding of the variable, followed by disclosure of any dummy variables created, appear in this section. Respondents to this survey were household heads, which are most commonly male, though include some women who are either widowed, their husbands have migrated for work, or their husbands are not present for other reasons, such as divorce.

The outcome variable labeled “Communal Labor” with the variable name *communal labor* is a binary variable that measures the concept of cooperation, in the form of communal, reciprocal farm labor. The survey question from the Household/Shamba Survey is: “Did you

cooperate in a communal labor arrangement with other households? (CIRCLE): Yes / No.” This variable currently exists as binary variable in the data-set, thus the outcome is binary, necessitating logistic regression analysis in this study. For all households that indicate they have participated in *communal labor*, the binary variable equals 1, and for households that report not having participated in *communal labor*, the binary variable equals 0 for analysis purposes.

The main predictor variable is labeled “Title Deed” and is named *deed*. The survey question from the Genealogy Questionnaire is: “Location: \_\_\_\_\_.” Possible answers include: Siambu, Poro, Mbaringon, and Loiwoiting. Siambu is the same as Poro. Again, *all* of the households in Siambu/Poro have registered title deeds. *None* of the households in Mbaringon or Loiwoiting own title deeds. Thus, location will serve as a proxy for privatization. Because the responses to this question are character, in order to conduct analysis, a dummy variable named *deed* must be constructed from the location variable to indicate whether or not a household owns a private plot of land (or proxy measurement for privatization). If location equals Siambu, then the variable *deed* equals 1, indicating private ownership. If location equals Loiwoiting, then the variable *deed* equals 0, indicating *no* private ownership of land.

To control for the level of education, the variable labeled “Education” named *years\_of\_educ* measures the number years of education completed by the household head. This data is furnished by the Genealogy Survey Questionnaire (For Household Head) question: “Years of Education completed (including adult): \_\_\_\_\_.” This variable was collected as a continuous variable, and is kept continuous in our analysis.

The variable labeled “Age of Household Head,” named *age* will be used to control for the age of the head of household only. The data for the household head age is found in the

Genealogy Survey Questionnaire from the question for the household head: “Age \_\_\_\_\_.”

This variable is also continuous and is kept continuous in the analysis.

The variable labeled “Years Farming,” named *yrsgrowcrops*, measures the number of years a household has farmed crops. The data was collected from the Household/Shamba Questionnaire question: “Total number of years engaged in growing crops: \_\_\_\_\_.” The original continuous variable is used in analysis.

To measure household income, four variables from the secondary data source must be summed. None of these variables account for income of individual household members, as data was only taken at the household level. The first income variable used is labeled “Total Non-Farm Household Income,” and named *tothhinc*. This variable measures all income other than from livestock sales, crop sales and income from leasing land. The variable values are obtained from a 25-item checklist of possible sources of income listed in the Household/Non-Stock Income Questionnaire from Shamba Survey from the following questions: “Total \_\_\_\_\_.” (*Response to a 25-item checklist totaled* – See Appendix A for 25-item checklist). The second variable used to calculate household income is labeled “Stock Sales,” named *stocksales* collected from the Household/Stock Sales (Income) Questionnaire from Survey Questions 5.01, 5.02 and 5.03, which states, “Now, I want to ask about the livestock you, or other member of the household, have sold over the *last year*: Q: 5.01, Cattle: \_\_\_\_; Q5.02, Goats: \_\_\_\_; Q: 5.03, Sheep: \_\_\_\_; Total: \_\_\_\_\_.” The third variable is labeled “Crop Sales,” named *crop\_inc*, collected from the Shamba Survey, Household Questionnaire question: “If sold, aggregate total income from all crops.” Finally, the fourth variable is labeled “Income from Lease,” named *inc\_from\_lease*, collected from the Shamba Survey, Household Survey Questionnaire: “Have you ever leased land?” To calculate total household income, the 25 items from “non-farm income” are summed

with the “income from total livestock sales” the “income from crop sales” and the sum of “income from leasing land,” to create a new continuous variable of total household income.

Finally, household wealth is measured calculating the total Tropical Livestock Units (TLU) owned by each household divided by Active Adult Male Equivalents (AAME) of each household. The variable is labeled “Total Household Wealth in TLU/AAME,” and named *wealth*. This variable measures the number of livestock owned weighted by the current market value, divided by the total number of people in the households weighted for their productivity potential based on their age and gender (Grandin, 1981). Questions from the Livestock Holdings Survey asking for the number of each kind of livestock are required to tabulate the TLU for each household. Questions from the Genealogy Survey regarding how many people, and of what gender and age, provide information required to calculate the total AMME for each household. The wealth variable was constructed using the TLU/AAME formula to create a new continuous variable.

## Results

### *Univariate Analysis Results*

Of 98 households sampled for all variables (See Table 1.1) from Siambu and Loiwoiting in Samburu District, 20 households (20.5%) of the total sample *hire paid labor*, including eight out of 30 households (8.26%) from the group ranch (Loiwoiting); and 12 out of 70 households (12.24%) from the privatized community (Siambu). From the total sample, 15 households *cooperate in communal farm labor*, including ten (10) households out of 30 from Loiwoiting (33.33%) and only five households out of 70 from Siambu (7.14%). There were 20 households, (20.41%) of the total sample from both communities that both *hire paid labor* and *cooperate in communal farm labor*; and five (5) households (5.10%) of the total sample use *communal labor*,

but not *paid labor*, while ten (10) households or 10.20% of the total sample *hire paid labor* but do not use *communal labor*. The remaining 78 households of the total 98 households (79.59%) sampled from both communities and on the three dichotomous variables analyzed report neither hiring *paid labor* nor cooperating in *communal farm labor*. Though none of the survey questions asked households directly if they use *household labor*, based on observation, it is likely that all 100 households in the full study sample from both communities complete at least some agricultural tasks using *household labor*—whether they supplement this labor by hiring *paid labor* or cooperating in *communal farm labor* or not. Due to identity problems with the outcome variable, the hired paid labor variable is not included in the full logistic regression model.

Table 1.1

*Frequencies by Location: “Yes” responses for binary variables and the full sample shown.*

<b>Location</b>	<b>communal farm labor</b>	<b>owns title deed</b>	<b>hired paid labor</b>
Siambu (privatized)	5	70	8
Loiwoiting (communal)	10	0	12
n	100	100	98

*Source:* 2005 household survey from Samburu District in Kenya collected by Lesorogol.

Univariate results of the control variables listed by community (See Table 1.2) indicate that the average *years of education for household head* is 3.14 for the full sample, and 3.51 years in Siambu and 2.27 years in Loiwoiting. The average *age of household head* is 49.19 for the full sample, and 50.04 years in Siambu and 47.20 years in Loiwoiting. The average number of *years growing crops* is 8.90 for the full sample, and 9.64 years in Siambu and 7.17 years in Loiwoiting. The average *per capita income* in 2005 exchange rate values for Kenyan shillings (Ksh) is 11,329.58 (Ksh) for the full sample and 13,506.71 (Ksh) in Siambu and 6,422.92 (Ksh) in Loiwoiting. The average *per capita wealth* measured in TLU/AAME is 6.66 for the full sample and 4.69 in Siambu and 11.24 in Loiwoiting. Household income and household wealth move in opposite directions in Samburu. In the Samburu context, since wealth is measured in terms of

livestock holdings and productivity potential of household members, if households do not have this kind of wealth important to pastoralists, they need to compensate by seeking alternative sources of household income, which accounts for the opposite directionality. Finally, the average *total acres of crops cultivated* is 1.83 acres for the full sample, and 1.82 acres in Siambu and 1.85 acres in Loiwoiting. There is very low variation in the total acres of crops cultivated, yielding very low predictive power; thus this variable was excluded from the full logistic model.

Table 1.2

*Univariate Results by Location: Means shown.*

Location	education (in years)	age (in years)	years growing crops	per capita income (2005 Ksh)	per capita wealth (TLU/AAME)	total acres of crops cultivated
Siambu	3.51	50.04	9.64	13,506.71	4.69	1.82
Loiwoiting	2.27	47.20	7.17	6,244.92	11.24	1.85
N	100	100	100	100	100	98

*Source:* 2005 household survey from Samburu District in Kenya collected by Lesorogol.

*Note:* Income is in Kenyan Shillings (Ksh) at 2005 exchange rates when data was collected.

Tropical Livestock Units (TLU) were calculated using 2005 exchange rates for livestock: cow=1 TLU; sheep/goats = 0.08 TLU; camel = 2.5 TLU. Total household TLU was calculated for each household and then divided by the Active Adult Male Equivalent (AAME) for each household. AAME was calculated following the Grandin 1981 formula (male > 16 years = 1; female > 16 years = .86; child 0-5 = 0.52; child 6-10 = 0.85; child 11-15 = 0.96).

### *Bivariate Analysis Results*

Preliminary bivariate tests were performed to test relationships among variables to compliment analysis performed by the full logistic regression model (See Table 2.1). The association between ownership of title deed and the level of maize produced, which is hypothesized by property rights theory to be associated, was not found to be significant here, which is consistent with findings from previous studies testing the same relationships in Kenya: (t (95) = -1.55, p = 0.13). We also explored the impact of cooperation in communal farm labor on maize productivity, which was not significantly associated: (t (95)=1.19, p = 0.24). The

relationship between ownership of title deed and years growing crops was tested, which was found to be significant at the 0.05 alpha level: ( $t(98) = -2.15, p < 0.05$ ), indicating the community in which pastoralists live (as location is a proxy for ownership of title deed) is significantly associated with the number of years households have grown crops. Cooperation in communal farm labor was tested for association with household productive capacity measured as AAME (See Table 1.2 for an explanation of the calculation of AAME). There was no significant association with use of communal farm labor and household productive capacity: ( $t(98) = 0.23, p = 0.82$ ). Finally, per capita income was tested for correlation with per capita wealth, which was not shown to be associated according to the Pearson's  $\chi^2$  test = 0.05,  $p=0.56$ . This corroborates univariate analysis showing that household income and household wealth are negatively related.

Table 2.1

*Bivariate Results: Background Analysis*

<b>Variables</b>	<b>n</b>	<b>t-statistic / <math>\chi^2</math> / Pearson's <math>\chi^2</math></b>
deed & maize productivity	97	$t = -1.55, p = 0.13$
communal farm labor & maize productivity	97	$t = 1.19, p = 0.24$
deed & years growing crops	100	$t = -2.15, p = 0.04^*$
communal farm labor & household AAME	100	$t = 0.23, p = 0.82$
per capita income & per capita wealth	100	Pearson's $\chi^2 = 0.05, p=0.56$
		* $p < .05$ , ** $p < .01$ , *** $p < .001$

*Source:* 2005 household survey from Samburu District in Kenya collected by Lesorogol.

*Note:* See Table 1.2 for an explanation of TLU/AAME units used to measure household wealth.

Next, bivariate tests are performed on all the model variables to test for association with the outcome variable, communal farm labor (See Table 2.1). The only bivariate relationship for model variables found to be significant was between the main predictor, ownership of title deed, and cooperation in communal farm labor:  $\chi^2(1, 100) = 11.30, p < 0.00$ . Though none of the other relationships are significant, the bivariate directional relationships for all the variables are in the hypothesized directions, except for the years growing crops and per capita income variables.

Table 2.2

*Bivariate Results: Model Variables Tested for Association with Communal Farm Labor*

<b>Independent Variable</b>	<b>n</b>	<b>t-statistic or <math>\chi^2</math> test</b>
Household Head Ownership of Title Deed	100	$\chi^2 = 11.30, p < 0.00$ ***
Household Head Years of Education	100	t = 1.17, p = 0.24
Household Head Age	100	t = -1.75, p = 0.08
Household Years Growing Crops	100	t = -1.17, p = 0.25
Household Income (KSh)	100	t = 1.21, p = 0.23
Household Wealth (TLU/AAME)	100	t = -0.33, p = 0.74
		*p < .05, **p < .01, ***p < .001

*Source:* 2005 household survey from Samburu District in Kenya collected by Lesorogol.

*Note:* See Table 1.2 for an explanation of TLU/AAME units used to measure household wealth.

### *Logistic Regression Results*

In the full model, only the main predictor, ownership of title deed, has a statistically significant impact on the outcome variable, cooperation in communal farm labor. We find that the odds are 90.0% lower for households with title deeds compared to households without deeds to cooperate in communal farm labor, significant at the 0.05 alpha level. For the full model there were no observations missing from any of the variables, for a total sample size of (n=100). The model is well specified according to the Likelihood  $\chi^2$  Statistic: 19.19, p = 0.00; and the Hosmer and Lemeshow Goodness-of-Fit  $\chi^2$  Statistic: 5.64, p=0.69, which is not significant as it should not be for a well-specified model. As with the bivariate tests, all of the relationships trended in the direction hypothesized except for the years growing crops and per capita income variables (See Table 3.1).

Table 3.1				
<i>Logistic Regression Results on Outcome: Cooperation in Communal Farm Labor (1=yes; 0=no)</i>				
<b>Independent variable</b>	<b>Coefficient</b>	<b>Odds Ratio</b>	<b>95% C.I.</b>	
ownership of title deed (1=yes/0=no)	-2.36**	0.10	0.02	0.58
household head education (in years)	0.07	1.08	0.63	1.86
household head age (in years)	0.03	1.03	0.99	1.08
household years growing crops	0.08	1.08	0.97	1.21
per capita income (Ksh 2005 rate)	-0.01	0.99	0.98	1.10
per capita wealth (TLU/AAME)	0.09	0.91	0.35	2.39
Likelihood Ratio $\chi^2$		17.46**		
Hosmer & Lemeshow Goodness of Fit $\chi^2$		5.64, p=0.69		
Pseudo R-squared / Max rescaled R-squared		0.16 / 0.28		
n		100		
*p<0.05; **p<0.01; ***p<0.001				

*Source:* 2005 household survey from Samburu District in Kenya collected by Lesorogol.

*Note:* See Table 1.2 for an explanation of TLU/AAME units used to measure household wealth.

## Discussion

The key finding from this study is that, according to data from 2005, land privatization has had a demonstrably negative impact on levels of cooperation in communal farm labor in Siambu (where land tenure is privatized) compared to Loiwoiting (where land communally managed in a group ranch). This finding corroborates findings on cooperative behavior from previous studies using economic experiments and ethnographic observations (Lesorogol, 2008a).

It was hypothesized that the longer households have engaged in farming, the more likely households would be to cooperate in communal farm labor because the households would be more entrenched in farm practices, as when households are more entrenched in farming practices, households are expected to have more knowledge of the kinds of farm labor available

and are more integrated into the farming community. Yet the average number of years farming was higher in Siambu (average 8.08 years farming) compared to in Loiwoiting (average 5.43 years farming). It is interesting that even though households in Siambu have farmed for longer on average than households in Loiwoiting, and this difference in average number of years farming by location is significant, ( $t(98) = -2.15, p < 0.05$ ), households in Siambu are still less likely to cooperate in communal farm labor. Therefore, it seems that the effect of ownership of title deed (our proxy for privatization) outweighs the anticipated effect of longer involvement in farming, as households with title deeds are still less likely to cooperate in communal farm labor even when they have farmed for longer than households without deeds.

Another interesting finding is that higher household income is not associated with less cooperation in communal farm labor as hypothesized, which might be explained by a social desirability bias. That is, high-income households may continue to participate in communal labor to maintain appearances because it is a socially desirable practice.

#### Limitations

There is one central substantive limitation to this study: Samburu people are relatively new to crop cultivation (average number of years growing crops was ten for Siambu and seven for Loiwoiting). Therefore, the loss of cooperation in Siambu may be explained by this relative newness rather than the formal change in land tenure regime. In order to isolate these effects, it would have been preferable to use longitudinal data to compare the levels of cooperation in Siambu before and after the land adjudication process in that community. However, Lesorogol did not begin collecting data in Samburu District until 2000, and the land adjudication process occurred much earlier, between 1978 and 1986 (Lesorogol, 2005b).

Ideally there would be more independent variables to include in the model that could account for some of the variation in the use of communal farm labor. Originally, the farm size variable (total acres of crops cultivated) was included in the model since it has been found to predict cooperation in the literature (McCarthy, Dutilly-Diane, Drabo; 2004). However, there was not enough variation to contribute predictive power to the model. Whether or not a household hired paid labor was also originally included in the model. However, an identity problem between paid labor and cooperation in communal farm labor was identified—as households that endorsed having participated in communal farm labor, our outcome variable of interest, also usually endorsed having hired paid labor. Because inclusion of paid labor made the overall model unstable, the paid labor variable was removed. There are no other variables available in the data set identified by the literature that may add explanatory power to our model.

#### Implications and Conclusion

Much of the research conducted examining land registration and titling programs in Africa to date has focused on examining the impacts of land tenure privatization on tenure security and agricultural productivity. This study broadens the discussion to include analysis of the impacts of land tenure privatization on another concept critical to the effective functioning of formal and informal institutions among the Samburu, namely: cooperation. Deterioration in cooperation after land privatization was demonstrated here. Such an effect on cooperation has the potential to impact the welfare of Samburu people adversely, as Samburu people depend on norms of cooperation and reciprocal in social institutions for survival. Initial evidence in forthcoming work by Lesorogol indicates that Samburu are resisting deterioration in cooperation on outcomes regarding the more long-standing tradition and core livelihood strategy of livestock herding, demonstrating that in this case, Samburu are resisting broader impacts of privatization.

For land policy in Africa in general, there must be a greater understanding of the socio-political, economic and cultural context into which privatization is introduced before this strategy is implemented—especially if it is based on the assumption that privatization will lead to increases in either tenure security, or agricultural yields, as it has been demonstrated that these outcomes do not result from privatization in Africa. Otherwise, there may be unintended consequences that, if not accounted for, can negatively impact communities' ability to engage in successful collective action in order to produce a variety of public goods.

### Acknowledgements

There are several people I wish to thank for their help in preparing this manuscript. First, I extend my heartfelt thanks to Dr. Carolyn K. Lesorogol for her keen intellectual support, data sharing, and knowledgeable and supportive advice on this project and my broader education. I also warmly thank Dr. Shanta Pandey and Gyanesh Lama for their guidance and instruction in research methodology through the Brown School Research Specialization. Finally, I thank Dr. Ramesh Raghavan for the statistical support for this, my Master's Thesis. Work on this research project has been an enormously rich learning experience for me, and the findings add to the robust body of work Dr. Lesorogol has produced, contributing to our understanding of the Samburu in Kenya, addressing the questions that currently implicate their well-being as a people.

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## Appendix A: 25-Item Checklist for Non-Farm Household Income

Add income from crop and livestock sales; income from leasing land; and the sum of the 25-items listed:

- 1) work on a farm (shamba?);
- 2) work as a craftsman (fundu?);
- 3) work as a herder for pay?
- 4) work at a mission station or church/mosque?
- 5) work as a watchman?
- 6) work at another casual labor job?
- 7) work in a shop/duka?
- 8) work at livestock trade?
- 9) work at hides/skins trade?
- 10) work at hoteli (restaurant)?
- 11) work at other trade?
- 12) work as a teacher?
- 13) work as a civil servant?
- 14) work in development project?
- 15) work in another profession?
- 16) work selling handicrafts?
- 17) work selling own hides/skins?
- 18) work selling tobacco and/or snuff (naisigi)?
- 19) work selling home brewed alcohol (beer, gin, etc.)?
- 20) work selling milk?
- 21) work selling miraa?
- 22) work selling timber (poles)?
- 23) work selling firewood or charcoal?
- 24) Received remittances from working relative?
- 25) Total value of other gifts received over last year: \_\_\_\_\_.

Finally, list any other income sources not mentioned and total income received from these sources: \_\_\_\_\_.