

Land Reform in Africa: No-Intervention Agreements*

Martin Dufwenberg, University of Arizona & University of Gothenburg

Gunnar Köhlin, University of Gothenburg

Peter Martinsson, University of Gothenburg

Haileselassie Medhin, University of Gothenburg

Draft

This version: 2010-04-25

Abstract

This paper investigates the effect that an option to call a mediator has on using voluntary agreements to solve a land conflict using a framed field experiment in the highlands of Ethiopia. A game theoretical model to describe this situation is constructed including a discussion related to social preferences, which subsequently the experimental design is based on. The results show that a significant proportion (43%) of the respondents was ready to choose a voluntary agreement even without a mediator institution. Still, with 57% claiming more than half of the contested land, indicates the strong potential for land conflict. This proportion was brought down to 31% with the introduction of a mediator institution. In the experiment, such an institution is found to both decrease the number that go for conflict by claiming more than half of the contested land, and to have a substantial proportion, 56%, that choose a no-intervention agreement. The introduction of a voluntary mediator institution could therefore be an interesting low-cost intervention in the early stages of a formalization of land rights.

Keywords: *Ethiopia; Experiment; Land reform.*

JEL codes: *C78; C93; D63; Q15.*

* Acknowledgments: Financial support from the Swedish Agency for International Development Cooperation (Sida) to the Environmental Economics Unit at University of Gothenburg and from The Swedish Research Council is gratefully acknowledged.

1. Introduction

Property rights, trust, and peaceful relations with neighbors are important to individuals' willingness to invest and to economic prosperity.¹ Many individuals in developing countries live their lives insecure, in fear for example that the government will confiscate their land or that a neighbor will claim access to it and that police protection will be insufficient. An important goal for development assistance is to define and foster respect for property rights, and to promote trust and peaceful relations among citizens.

Our contribution is twofold. First, we propose a specific and potentially inexpensive form of policy that could help define property rights and promote respect for borders among neighbors. The key underlying idea combines recent work in behavioral economics (on social preferences) and somewhat less recent work in game theory (on forward induction). The suggestion is to not impose heavy-handed government regulation as a solution to property rights and borders control, but rather to have this be a costly option which agreeing farmers can forego. Such a *no-intervention-agreement* signals the intention and expectation that subsequent play will conform with a cooperative pattern of mutual benefit to the neighbors, and social preferences (in a variety of guises) make such behavior incentive-compatible.

Second, we test (and find support for) the usefulness of this approach in a framed field experiment in the Amhara region of Ethiopia. Lack of institutions that secure property rights is among the fundamental reasons why many sub-Saharan African countries remain poorer compared to the rest of the world (Knack and Keefer, 1995; Goldsmith, 1995; Acemoglu et al, 2001) and Ethiopia, with its weak land institutions, is an example of a region where our proposal could be implemented.

¹ The relevant literatures in support of these claims are too numerous to attempt any serious survey (see e.g. Coase, 1960, and Hardin, 1968, for a starter on property rights, Knack and Keefer (1997) for an angle on trust, and witness the developments in Rwanda 1994 for an example of how things can go wrong when neighbor relations are not peaceful.

Section 2 elucidates on why lack of property rights and trust among neighbors creates severe economic inefficiencies in developing countries. Our proposal is meant to have potentially broad applicability in many such countries, and yet in our experiment we zoom in on the Amhara so in section 2 we also describe the institutional structure of that region in some detail. Section 3 moves to theory. We tell a formal story, structured as a game-theoretic example, that serves as the intellectual foundation of our no-intervention-agreement policy proposal. Section 4 reports on the design and is followed by the results of the experiment in the proceeding section. Finally, section 6 concludes.

2. Lack of property rights, the need for reform, and the case of Amhara

The issue of property rights is particularly important in land, the most important resource in most Sub-Sahara African countries with a historically complex tenure structure that varies from place to place (Feder and Noronha, 1987). Land ownership structure and the implied level of tenure security could have important implication on the investments and productivity in agriculture. This is particularly important given the low levels of agricultural productivity and food insecurity in most parts of Sub-Saharan Africa (World Bank, 2007). The empirical relationship between land tenure and investment decision by smallholders is a widely discussed topics in the agricultural economics literature. The evidence is mixed: while some studies find tenure insecurity to be an important constraint for increase in agricultural productivity and long-term investments like trees (e.g. Friedman et al, 1988; Hayes et al, 1997; Gebremedhin and Swinton, 2003; Smith, 2004; Deininger and Jin, 2006; Goldstein and Udri, 2008; Mekonnen, 2009;), others find it less important (e.g. Pinckney and Kimuyu, 1994; Kung, 1995, Holden and Yohanness, 2002). There is also a growing interest in the potential problem of endogeneity (e.g. Brassele et al, 2002; Gray and Kivane, 2006).

Poor definition of property rights in land, combined with other factors such as population pressure, inefficient land redistributions and decreasing quality of land because of degradation, could also lead to costly conflicts among land holders that could negatively affect overall agricultural productivity. During the last decade there has been a rapid increase in land conflicts² in sub-Saharan Africa, which often are a result of poorly determined ownership of land. Despite this, the conflict side of land property right structure has gained less attention in the literature. There is now a range of modes of interventions that differ in many dimensions. At one end of the range we have Indonesia that has opted for a voluntary (at village level) but quite expensive land titling scheme where a title costs about 80 international \$ at PPP (Grimm and Klasen, 2009). At the other end of the spectra we have Ethiopia that has opted for a mandatory, but very cheap approach of certification where each certificate costs about 1 USD (Deininger and Jin, 2006).

Still, institutional innovations that aim to strengthen property rights in land need to be equipped with adequate and cheap tools to minimize the incidence of conflicts in areas with scarce land and limited resources/institutions for conflict resolution. Based on experimental evidence from the highlands of Ethiopia, this study proposes a specific and comparatively inexpensive form of policy that may help to define land property rights and to promote respect for borders.

Home to a predominantly agrarian population operating on state owned land subject to recurrent land redistributions over the past few decades, Ethiopia is a research hot spot on the issue of land tenure. More than 80% of Ethiopia's population is subsistence farmers with only user rights to their land. Moreover, borders between land holdings are often poorly defined. Combined with high population pressure and land fragmentation, this has led to a high

² Land conflicts in rural areas can take place in many ways: between communities, between farmers and the state, and between farmers themselves. We are interested in farmer-to-farmers conflicts which usually take place as land-grabbing or border conflicts.

incidence of land-related conflicts. The Ethiopian government has taken measures to tackle this problem by implementing a comprehensive land reform to establish well defined tenure rights throughout the country. Today, this has only been realized partly, and only in some of the regions.

Farm fragmentation is an important characteristic of highland agriculture in Ethiopia. After the end of the feudal system in 1974, land was distributed to tenants in many parts of the Ethiopian highlands both in the government and rebel controlled regions. Even though there were some differences, the process was similar in important aspects such as attaining equitable distribution of fertile and less fertile land. Fragmentation was the inevitable outcome. Numerous subsequent redistributions, combined with division between off-spring, have further increased fragmentation despite a dwindling per-capita land size because of population pressure. Farm fragmentation could bring about serious inefficiency to the farming system, and the relative importance of such cost is expected to increase as land size (hence individual parcel size) declines. Moreover, highly fragmented farms means that a given household shares borders with numerous households, which increases the likelihood of border conflicts and the transaction cost involved in solving them.

According to our household survey, the average land-holding size in the East Gojam zone is 1.45 hectare fragmented on an average of 4.1 parcels. In South Wollo zone, the average land-holding is 1.04 hectare fragmented on 4.5 parcels, on average.

3. Theory

In this section we present and give a theoretical justification for our policy proposal. We gain traction through the combination of assumptions regarding social preferences and the logic of forward induction. For reasons of readability we structure the material below with

subheadings concerning in turn the game form, selfish preferences, social preferences, our policy proposal, forward induction, and overall conclusions.

The game form

Consider two neighboring farmers each of whom owns a house with some adjacent land. The border between the farmers' properties is not well-defined, but each farmer can lay claim to some section of the land between his house and that of his neighbor. The benefit from land is that it can be used for agricultural production and hence yield income. If a farmer lays claim to land on which his neighbor does not lay a claim then this farmer gets that land at 'full value,' proportional to the size of the land. If both farmers lay claim to some piece of land then there is loss of value due to 'conflict'; the farmers then get to split only half of what would be the value of the land uncontested (so each gets a quarter of the value of the contested land).

This situation can be formally described using the following game form:

- There are two farmers/players, called 1 and 2.
- Each farmer's strategy set equals $\{0, 1, \dots, D\}$, where D is the distance in furlongs³ between the houses; a player's strategy indicates how many furlongs of land (measured from the edge of his house) to which he lays claim.
- If a farmer chooses x while his neighbor chooses y then the farmer gets land value $v \cdot (x-z) + v \cdot z/4$, where v is the value of uncontested land per furlong and z is the number of furlongs of contested land: $z = \max\{x+y-D, 0\}$.

The selfish case

³ Furlong is of course not a standard measure of area. We use it here to make a forward reference to the local measure *tilm* in rural Ethiopia, which has a similar historical reference in the measurement of length and area of agricultural land based on furrows.

With this specification, if a farmer cares only about land value he has a dominant strategy to lay a claim of D . The outcome when both farmers choose accordingly is inefficient; each gets a payoff of $v \cdot D/4$ whereas had each chosen $D/2$ then each would have gotten a payoff of $v \cdot D/2$. In light of the inefficiency, there may be scope for government intervention to ensure property rights and border protection. For example, if enforcing an equal split of land costs C and this is charged equally to the farmers then each of them gets a payoff of $(v \cdot D - C)/2$ which is worthwhile if $(v \cdot D - C)/2 > v \cdot D/4$, or equivalently $C < v \cdot D/2$.

For a specific example, consider (in anticipation of the upcoming experiment) the case where $D=4$, $C=10$, and $v=8$. We get the game in Figure 1:

	0	1	2	3	4
0	0, 0	0, 8	0, 16	0, 24	0, 32
1	8, 0	8, 8	8, 16	8, 24	2, 26
2	16, 0	16, 8	16, 16	10, 18	4, 20
3	24, 0	24, 8	24, 8	12, 12	6, 14
4	32, 0	26, 2	20, 4	14, 6	8, 8

Figure 1

Strategy 4 is dominant; when both players choose accordingly they each get a payoff of 8. Both of them would be better off if an equal split (the strategy profile (2,2)) were enforced and the cost of 10 split equally between the farmers who each would get a payoff of $(v \cdot D - C)/2 = (8 \cdot 4 - 10)/2$. This which would be beneficial since $(8 \cdot 4 - 10)/2 = 11 > 8$.

Social preferences

One may hope to find cheaper solutions. One reason why this could be feasible arises if the farmers do not just care for land value. This is compelling in light of the recently burgeoning literature on social preference, which argues (with reference to introspection as

well as societal and experimental data) that humans often harbor many objectives other than own material gain. In response, theorists have developed a variety of formal models of non-selfish preferences including inequity aversion (e.g. Fehr and Schmidt, 1999, Bolton and Ockenfels, 2000), concerns for the least well-off individual (e.g. Charness and Rabin, 2002), reciprocity (e.g. Rabin, 1993, Dufwenberg and Kirchsteiger 2004, Falk and Fischbacher 2006), or guilt aversion (e.g. Battigalli and Dufwenberg, 2007, cf. Charness and Dufwenberg 2006). See Fehr and Gächter (2000), Sobel (2005), or Fehr and Schmidt (2009) for reviews and insightful commentary why economists should take social preferences seriously.

The models mentioned in the previous paragraph can all be applied to the above game form. They then modify the farmers' utilities and capture very different psychological intuitions. One may think that it matters greatly to economic analysis which model is considered, but while this is true as regards general games it is not important as regards predictions for our game form with the farmers. All models admit as an equilibrium the cooperative outcome where each farmer lays a restrained claim of $D/2$. If the farmer could coordinate on such a 'nice' equilibrium there would be no need for government intervention to improve the outcome. This rosy outcome is not guaranteed, however, in the sense that all of the models also admit the high-conflict strategy profile where each farmer lays a claim of D as an equilibrium. So, regardless of the model in question (among the cited ones), we have a problem of equilibrium selection. Moreover, the equilibria are Pareto-ranked, so that equilibrium $(D/2, D/2)$ is preferred to equilibrium (D, D) for each player under each model.

The claims of the previous paragraph were informal and while they could be made precise for each of the models space constraints prevent us from doing this and select just one model for exact illustration. We pick that of Fehr and Schmidt (1999) for no other reason than

its simplicity.⁴ Applied to a two-player game, that model says that if player i gets a dollar payoff of $\$_i$ while co-player j gets $\$_j$ then i 's utility equals

$$\$_i - \alpha_i \cdot \max\{\$_j - \$_i, 0\} - \beta_i \cdot \max\{\$_i - \$_j, 0\}$$

where $0 \leq \beta_i \leq \alpha_i$ and $\beta_i < 1$.

To exemplify, consider again the case of the farmers game form with $D=4$, $C=10$, and $v=8$. The Fehr-Schmidt model subsumes the case where the farmers care only about land value as a special case; if $\alpha_1 = \alpha_2 = \beta_1 = \beta_2 = 0$ we get the game in Figure 1. However, the case with multiple Pareto-ranked equilibria arises if α_i and β_i are large enough, $i=1,2$. For example, if $\alpha_1 = \alpha_2 = 1$ and $\beta_1 = \beta_2 = 1/2$ we get the game in Figure 2:

	0	1	2	3	4
0	0, 0	-8, 4	-16, 8	-24, 12	-32, 16
1	4, -8	8, 8	0, 12	-8, 16	-22, 14
2	8, -16	12, 0	16, 16	2, 14	-12, 12
3	12, -24	18, -8	14, 2	12, 12	-2, 10
4	16, -32	14, -22	12, -12	10, -2	8, 8

Figure 2: Payoffs Adjusted for Social Preferences

This game has multiple Pareto-ranked equilibria, including in particular (2, 2) and (4, 4) as flagged for before. This completes our illustration of the Fehr-Schmidt models at work. Analogous examples could have been construed for the other social preference models and the different sentiments that these models capture.⁵

⁴ Even so, equity has indeed been a major policy concern when it comes to land redistribution in Ethiopia, which makes inequity aversion an unusually relevant example.

⁵ For example, if the farmers were motivated by reciprocity the (2,2) equilibrium would be backed up by the farmer's perception that the neighbor is kind (a well-defined notion) and the farmer's desire to be kind in return.

The no-intervention-agreement proposal

We are now ready to present our proposal: Augment the above game form with a new option *M*: each farmer may call on a ‘mediator’ in which case government sends out a team of contract-theorists, policemen, and judges who at cost *C* (paid for equally by the farmers) enforce the $(D/2, D/2)$ outcome. The twist here is that if *neither* farmer chooses this option – the interpretation being that they have ‘agreed’ to forego government intervention – then they play the same game form as described earlier.

Once preferences are specified, this change of rules generates a game which can be analyzed. For example, with Fehr-Schmidt preferences and $D=4$, $C=10$, and $v=8$ we get the game in Figure 3:

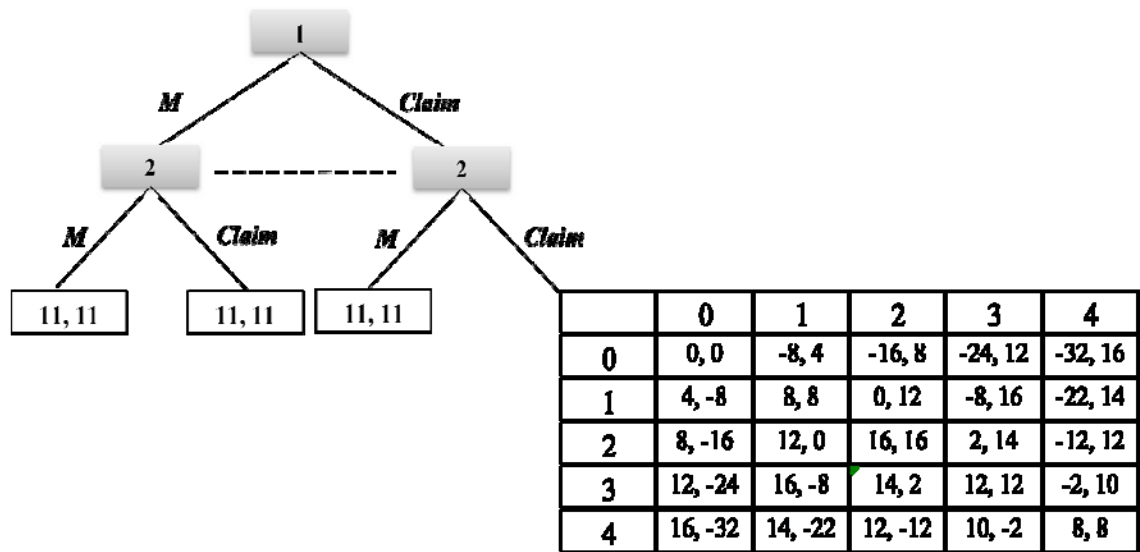


Figure 3: With a Mediator Option

Forward induction

The (4, 4) equilibrium, on the other hand, would be backed up by the farmer’s perception that the neighbor is unkind and the farmer’s desire to be unkind in return. Another example would be guilt aversion. Here in the (2,2) equilibrium the farmers would choose 2 because they expect the neighbor to expect them to do this, and they would feel guilt if they deviated and harmed the co-player relative to his expectations. On the other hand, in the (4, 4) equilibrium each farmer would be happy choosing 4 as he could not feel guilt by harming the neighbor relative to his beliefs as the neighbor already expects no favor from the other.

What behavior should be expected in this game? Before proceeding formally, consider the following intuitive chain of arguments:

- (i) No rational player rejects M with the intention of following up with 0 or 1; by choosing 0 or 1 a player could at most get 8 in the proper subgame (where both players have rejected M) so he would have been better off choosing M .
- (ii) Therefore, in the proper subgame, each player must expect the co-player to choose 2, 3, or 4.
- (iii) However, in the proper subgame each player should figure out (ii), so it does not make sense to choose 4 since 4 is a best response only if the opponent chooses 0 or 1 (which (ii) ruled out).
- (iv) But then it does not make sense to choose M since each player should figure out (iii) and so realize that by rejecting M and then choosing 3 he could get at least 12 (since by (iii) the co-player will not choose 4) and 12 is more than the 11 he would get from M .
- (v) The prediction, then, is that players will choose 2 or 3.

Game theorists call the chain (i)-(v) a forward induction argument; past choices tell stories about predicted future choices which in turn may affect initial choices. There is no unique agreed upon definition of forward induction and different game theorists have proposed a variety of solution concepts to capture forward induction reasoning.⁶ We do not wish to enter here a discussion of what concept is ‘best’ but opt for the simplest solution concept which can capture the chain (i)-(v) in our game. Arguably (and following Ben-Porath and Dekel 1992) this is iterated elimination of weakly dominated strategies (IEWDS) applied to the (reduced) normal form of the game in Figure 3, presented in Figure 4:

	M	0	1	2	3	4
M	11, 11	11, 11	11, 11	11, 11	11, 11	11, 11
0	11, 11	0, 0	-8, 4	-16, 8	-24, 12	-32, 16
1	11, 11	4, -8	8, 8	0, 12	-8, 16	-22, 14
2	11, 11	8, -16	12, 0	16, 16	2, 14	-12, 12

⁶ See e.g. Kohlberg and Mertens; van Damme; Ben-Porath and Dekel; Battigalli and Siniscalchi, Asheim and Dufwenberg; Battigalli and Dufwenberg.

3	11, 11	12, -24	16, -8	14, 2	12, 12	-2, 10
4	11, 11	16, -32	14, -22	12, -12	10, -2	8, 8

Figure 4

The reader may verify that IEWDS eliminates, in turn, strategies 0 and 1, then strategy 4, then strategy M , so that finally strategies 2 and 3 survive. If we focus on equilibria involving strategies that survive IEWDS (as do Kohlberg and Mertens 1986, cf. van Damme 1992) one sees that there are two: (2, 2) and (3,3).⁷

Overall conclusions

Several remarks are in order. First, note that (4, 4) is not an equilibrium; we rule out the old full-conflict outcome. Second, (M , M) is not an equilibrium; we rule out the outcome with costly mediated government intervention. Third, each of the predicted equilibria (2, 2) and (3,3) involve an outcome which is better than the outcome with mediated government intervention (since players get at least 12 each, rather than 11 each). Fourth, while the mediated government intervention is not used, the fact that it *could have been used* shaped the analysis. If the M choice were not available we would be back to the game in Figure 2, with its live possibility of a high-conflict (4,4) equilibrium.

Two more comments: Fifth, as regards the formal development regarding social preferences we have here relied on the Fehr-Schmidt model. However, analogous stories could be told for any of the other social preference models mentioned above. Sixth, it is important to appreciate, however, that our analysis requires not only the idea of forward induction but also the presence of social preferences. If the players cared for land value only the forward induction argument could never kick in. To see this, note that if we augment the

⁷ There is also an equilibrium in mixed strategies where each player chooses 2 with probability 5/6 and 3 with probability 1/6 in which each player has an expected payoff of 13.67.

game in Figure 1 with the M option, *mutatis mutandis* we get the game in Figure 5 in which M is the sole survivor of IEWDS:

	M	0	1	2	3	4
M	11, 11	11, 11	11, 11	11, 11	11, 11	11, 11
0	11, 11	0, 0	0, 8	0, 16	0, 24	0, 32
1	11, 11	8, 0	8, 8	8, 16	8, 24	2, 26
2	11, 11	16, 0	16, 8	16, 16	10, 18	4, 20
3	11, 11	24, 0	24, 8	24, 8	12, 12	6, 14
4	11, 11	32, 0	26, 2	20, 4	14, 6	8, 8

Figure 5

4. Experimental design

The objective of the experiment is to test the effect of introducing the no-intervention-agreement proposal. Thus, as described in above section, we have two different treatments; (i) only voluntary agreements between the neighbors, with no mediator option (ii) a treatment that features the option of a no-intervention-agreement where subjects can choose to avoid costly governmental intervention (in the form of mediation) by making a voluntary agreement. The experiment uses a between-sample design and subjects are anonymously matched in pairs. We conduct what is coined a framed field experiment by List and Harrison (2006) since we use a subject pool of rural Ethiopian farmers with border problems and the experiment was described in the context of determination on where to draw the borderline. The contested land in Ethiopia is not the whole land size, but rather marginal land. Thus, we frame the experiment that the contested amount of land in tilms, where 1 hectare approximately corresponds to 30-40 tilms depending on the land type and local tradition. The contested land is set to be 4 tilms, which should be compared to the average land ownership of 1.25 hectare. Since a large fraction of the subjects were illiterate, the experiment was orally described. In the treatment “no-intervention-agreement proposal”, the subjects can chose to opt for having a mediator resulting in a for sure income. This treatment consists of two-stages, first the subjects decide if they prefer to make an agreement without help from a mediator or if they would like such intervention. Given that both subjects choose no intervention, they proceed to the second-stage, which is as described above.

The experiment took place in 8 kebeles in the highlands of Ethiopia. In each kebele 60 households were selected randomly for the two treatments of the experiment. In order to avoid contagious effects in our experiment by word-of-mouth communication between treatments that had to be run at different points in time, we conducted the treatments overlapping. Each session took about 3-4 hours from arrival to payment. The experiment venue, usually in a

local school, had three adjacent rooms: the experiment room (Room 1), the waiting room (Room 2) and the exchange room (Room 3). An experiment day looked like the following: Treatment 1 subjects arrived between 7:00 – 8:00 and they gathered in Room 2. Registration and unique ids were provided and Treatment 1 started at 8:00 in Room 1. Session 2 subjects arrived until 11.00 and gathered in Room 2. Supervisors made sure all Session 2 subjects were in Room 2 before Session 1 ended. Session 1 ended around 12:00. While all session 2 subjects were in Room 2, session 1 subjects were led to Room 3 where they were paid. Experiment room was cleaned and settings changed for Session 2. Session 1 subjects went home. Session 2 subjects entered Room 1. Session 2 ended around 15:00. The experiment was conducted in Amharinja, which is the local language spoken.

5.Results

239 and 238 subjects participated in the non-mediator (voluntary agreement) and mediator (non-intervention-agreement) treatments, respectively. In table 1, we present the descriptive results from the experiment. First, it should be noted that 30.7% opted for mediator when that option was available. The equal share (claiming 2 tilms) was chosen by 43.1% and 38.7% in the two treatments respectively.⁸ The remarkable difference is in the proportion choosing more than 2 tilms, which was 56.9% in the voluntary agreement treatment while only 30.7% in the no-intervention-agreement treatment. By using Wilcoxon-Mann-Whitney test, we test the null hypothesis of no difference in claim between voluntary agreement and no-intervention-agreement given mediator was not chosen. We can reject the null hypothesis at 5% significance level (p-value=0.038). Thus, among the subjects in the treatment where

⁸ If we include the implicit choice of equal share reflected by the choice of mediator, then the sum of these two amount to 69% choosing equal split of the contested land in the mediator treatment.

mediator could be chosen, they claim differently than those who did not have the opportunity to choose a mediator. As shown in table 1, it is particularly the fraction claiming four that has decreased.

Table 1: Land claim with and without mediator option

	Land claim – without mediator option	Land claim – with mediator option	Land claim (conditional on not choosing mediator)
M (Choose mediator)	n.a.	30.7%	n.a.
0	0.0%	0.0%	0.0%
1	0.8%	0.0%	0.0%
2	43.1%	38.7%	55.8%
3	22.6%	12.2%	17.6%
4	33.5%	18.5%	26.7%
Observations	239	238	165

Econometric Results

In this section we attempt to relate choices in each treatment with socio-economic characteristics of subjects and their belief about the choice of their partners in the experiment. We perform a Probit regression for the choice of mediator and ordered Probit regressions for the units of land claimed (excluding *Mediator* choices when that option is available). The belief variables are based on incentivized guesses that subjects made about the action of their anonymous partner in the other room. The other socio-economic information is drawn from a household survey conducted few months before the experiment took place, as a fourth wave of the Ethiopian Environmental Household Survey (EEHS) from which we randomly selected our subjects. Table 2 below presents the summary of the variables we use in our regressions. The explanatory variables can be grouped in the following categories: First we include a number of standard socio-economic characteristics (gender, age and literacy of head of household, household size and assets, and location). These are controls for both preferences

and behavior in an experimental situation. Secondly, we include land related variables such as parcels owned (expected to increase both experience and risk of land related conflict), expectation on the effect of certification on land conflict, and a dummy for concern for land related conflict). This is followed by a number of trust variables, since a cooperative behavior is expected to depend on general or specific trust. Finally, the explanatory variables include dummies reflecting the beliefs that the players had regarding what their counterpart would choose in the game.

Table 2: Summary of Explanatory Variables

Variable	Description	Mean (Std. Dev)	Min	Max
<i>Male</i>	Dummy variable for gender (1=Male)	0.79	0	1
<i>Age</i>	Age in years	47.62 (12.41)	20	70
<i>Literate</i>	Dummy variable for literacy	0.39	0	1
<i>HH_size</i>	Total number of household members	5.41 (2.02)	1	12
<i>East Gojam</i>	Dummy for Zone (1= East Gojam, 0=South Wollo)	0.50	0	1
<i>Asset index</i>	Principal component index of major assets owned by the household	47.28 (126.75)	0.348	1886
<i>Parcels owned</i>	Number of parcels of land owned by the household.	4.78 (2.29)	1	18
<i>Certificate</i>	Dummy for belief about the effect of land certificate on land conflicts (1= if the subject believes certificate reduces land conflicts).	0.90	0	1
<i>Conflict concern</i>	Dummy for concern about land-related conflict (1=if the subject is concerned about land related conflicts)	0.21	0	1
<i>Trust general</i>	Trust in people in general (in a range of 5 where 1=completely untrustworthy and 5= completely trustworthy)	2.49 (0.943)	1	5
<i>Trust trade</i>	Trust to trade transaction partners (in a range of 5 where 1=completely untrustworthy and 5= completely trustworthy)	2.42 (1.03)	1	5
<i>Trust Woreda</i>	Trust to the Woreda administration (in a range of 5 where 1=completely untrustworthy and 5= completely trustworthy)	3.32 (1.027)	1	5
<i>Belief Mediator</i>	Dummy for belief of Mediator (1= if guess of partner's choice is <i>Mediator</i> , 0 otherwise)	0.17	0	1
<i>Belief Conflict</i>	Dummy for belief of conflict (1= if guess of partner's choice is a claim greater than 2, 0 otherwise)	0.28 (0.452) ¹ 0.49 (0.501) ²	0	1
<i>Belief cooperation</i>	Dummy for belief of cooperation (1= if guess of partner's choice is a claim of 2, 0 otherwise)	0.54 (0.499) ¹ 0.51 (0.501) ²	0	1

¹For the sample with Mediator ²For the sample without Mediator

The results are summarized in table 2.

The ordered probit results of claim in the treatment where there was no mediator are presented in the first results column. Note that here we do not have the belief mediator variable as the *Mediator* option does not exist. As expected, people who expect their partners to claim more than half also tend to claim more than half. Moreover, people from the Eastern Gojam Zone tend to claim significantly more than those who live in Southern Wollo Zone. This could be because of other important differences between the two zones that our data does not capture. One such difference could be in the actual experience of people with land conflict: there is higher incidence of land conflicts in Eastern Gojam than in Southern Wollo. We also find land claim to increase with literacy when there is no mediator option. It is important to compare this result with the insignificant coefficient in the mediator case (second column): when the *mediator is* available, there is no difference in the choice between illiterate and literate subjects once they skip mediation. That is, while the effect of literacy in the voluntary agreement game is to increase land conflicts, it only decreases the possibility of mediation in the no-intervention agreement game without increasing the likelihood of land conflicts.

The last column holds the Probit estimation results on what affects whether a subject chooses a mediator option or not. We observe that compared to people who expect cooperation, those who expect conflict and mediator tend to go for mediator. Older subjects and those who exercise caution in trade transactions are also more likely to call the mediator. On the other hand, those who are literate and wealthier seem to choose to claim land instead of calling a mediator.

Table 3: Regression results

Explanatory Variable	Dependent Variable		
	<i>Claim when there is no Mediator option</i>	<i>Claim when there is Mediator option</i>	<i>Mediator</i>
<i>Male</i>	-0.262 (0.251)	-0.414 (0.279)	0.073 (0.272)
<i>Age</i>	0.003 (0.007)	0.015 (0.010)	0.020** (0.010)
<i>Literate</i>	0.379** (0.193)	-0.304 (0.233)	-0.474* (0.260)
<i>HH size</i>	-0.0003 (0.042)	0.076 (0.059)	-0.047 (0.060)
<i>East Gojam</i>	0.470*** (0.181)	-0.068 (0.239)	-0.310 (0.240)
<i>Parcels owned</i>	-0.064 (0.040)	0.021 (0.051)	0.003 (0.051)
<i>Asset index</i>	-0.0007 (0.0005)	0.0002 (0.001)	-0.005** (0.002)
<i>Trust general</i>	-0.046 (0.092)	-0.108 (0.121)	-0.066 (0.126)
<i>Trust trade</i>	0.042 (0.091)	0.096 (0.106)	-0.318*** (0.110)
<i>Trust Woreda</i>	0.082 (0.080)	0.029 (0.102)	0.142 (0.106)
<i>Conflict concern</i>	-0.044 (0.198)	0.043 (0.264)	-0.441 (0.298)
<i>Certificate</i>	0.269 (0.296)	0.099 (0.404)	-0.225 (0.370)
<i>Belief of Mediator</i>	-	0.657 (0.379)	1.867*** (0.310)
<i>Belief of conflict</i>	0.593*** (0.165)	0.873*** (0.244)	0.725*** (0.251)
<i>Constant</i>	-	-	-0.670 (0.837)

Standard errors in parentheses

***significant at 1% level, **significant at 5% level, *significant at 10% level.

6. Conclusion

Land reform, with the objective to reduce conflict, increase investment and subsequently agricultural productivity, is today a major intervention in many countries, involving individuals, NGO's, governments and donors, as well as billions of dollars in loans and aid. It

is therefore not surprising that the implementation of such programs also range from informal to formal, from voluntary to mandatory and from very cheap to very expensive (for the individual and/or for the government).

The objective of this paper was to investigate a specific and potentially inexpensive form of policy that could help define property rights and promote respect for borders among neighbors, namely agreements between farmers, with the option of not involving the government. As a benchmark, we used voluntary agreements and we compared this to a case where it was possible to choose a no-intervention-agreement, given the existence of a (government backed and more costly) mediator institution.

First, we conducted a theoretical analysis that showed that, under certain assumptions, the introduction of a mediator institution would change the equilibrium in a game over contested land. It would increase the likelihood of a voluntary agreement, in the light of government intervention, which is what we here label a no-intervention agreement.

The theoretical analysis was followed-up with a one-shot negotiation game which captures the most salient features of the border situation in rural Ethiopia. It was carried out in 8 poor farm villages with 30 participants in the without moderator game and 30 in the with moderator game in each village. The results show that a significant proportion (43%) of the respondents was ready to choose a voluntary agreement even without a mediator institution. Still, the 57% claiming more than half of the contested land, indicate a strong potential for land conflict. This proportion was brought down to 31% with the introduction of a mediator institution. In the experiment, such an institution is found to both decrease the number that go for conflict by claiming more than half of the contested land, and to have a substantial proportion, 56%, that choose a no-intervention agreement. The introduction of a voluntary mediator institution

could therefore be an interesting low-cost intervention in the early stages of a formalization of land rights.

References

Acemoglu, D., Johnson, S. Robinson, J.A. (2001) The colonial origins of comparative development: an empirical investigation. *American Economic Review*, 91(5) 1369-1401.

Coase, R. (1960) The Problem of Social Cost. *Journal of Law and Economics*, 3(1) 1–44.

Deininger, K. and Jin, S. (2006). Tenure security and land-related investment: Evidence from Ethiopia. *European Economic Review*, 50 (5):1245-1277.

Feder, G., and Noronha, R. (1987). Land Rights Systems and Agricultural Development in Sub-Saharan Africa. *World Bank Research Observer*, 2(2):143-169

Friedman, J., Jiminez, E., and Mayo, S.K. (1988). The demand for tenure security in developing countries. *Journal of Development Economics*, 29(2):185-198.

Gebremedhin, B. and Swinton, S. M. (2003). Investment in soil conservation in northern Ethiopia: the role of land tenure security and public programs. *Agricultural Economics*, 29 (1):69-84.

Goldsmith, A.A, (1995). Democracy, Property Rights and Economic Growth. *Journal of Development Studies*, 32(2):157 – 174.

Goldstein, M. and Urdy, C. (2008). The Profits of Power: Land Rights and Agricultural Investment in Ghana. *Journal of Political Economy*, 116 (6).

Gray, L. and Kevane, M. (2006). Evolving Tenure Rights and Agricultural Intensification in Southwestern Burkina Faso. *European Economic Review* 50(5).1245-1277.

Hardin, G. (1968), The Tragedy of The Commons, *Science*, 162:1243-1248.

Hayes, J., Roth, M. and Zepeda, L. (1997). Tenure security, investment and productivity in Gambian agriculture: A generalized probit analysis. *American Journal of Agricultural Economics*, 79:369-382.

Holden, S. and Yohannes, H. (2002). Land Redistribution, Tenure Insecurity, and Intensity of Production: A Study of Farm Households in Southern Ethiopia. *Land Economics*, 78(4):573-590.

Knack, S. and Keefer, P. (1995). Institutions and Economic Performance: Cross-country Tests Using Alternative Institutional Measures. *Economics and Politics*, 7(3):207-227.

Knack, S. and Keefer, P. (1997) Does Social Capital Have an Economic Payoff? A Cross-Country Investigation. *Quarterly Journal of Economics*, 112(4), 1251-1288.

Kung, J.K. (1995). Equal Entitlement versus Tenure Security under a Regime of Collective Property Rights: Peasants' Preference for Institutions in Post-reform Chinese Agriculture. *Journal of Comparative Economics*, 21(1):82-111.

Mekonnen, A. (2009). Tenure Security, Resource Endowment, and Tree Growing: Evidence from the Amhara Region of Ethiopia. *Land Economics*, 85(2):292-307.

Pinckney T.C., and Kimuyu, P.K. (1994). Land Tenure Reform in East Africa: Good, Bad or Unimportant? *Journal of African Economies*, 3(1): 1-28.

Smith, R.E. (2004). Land Tenure, Fixed Investment, and Farm Productivity: Evidence from Zambia's Southern Province. *World Development*, 32(10):1641-1661.

World Bank (2007). *Agriculture for Development*. World Bank Report 2008. Washington D.C. World Bank.