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Abstract

Several studies have shown that the land registration and certification reform in Ethiopia has been implemented at an impressive speed, at a low-cost, and with significant impacts on investment, land productivity, and land rental market activity. This study provides new evidence on land productivity changes for rented land and on the welfare effects of the reform. The study draws on a unique household panel, covering the period up to eight years after the implementation of the reform. We find that land productivity after the reform has increased more on rented plots with female landlords as compared to male landlords indicating that, particularly, female landlords' land rights have been strengthened. Furthermore, real household consumption expenditures per adult equivalent have increased with the duration of land certificate ownership, most significantly so for female owners of land certificates.

Key words: Land registration and certification, land rental market participation, land productivity, welfare impact, gender, Ethiopia.

JEL-code: Q15.

1. Introduction

Earlier studies on the impacts of land certification in Ethiopia have identified significant positive investment and land productivity effects (Holden et al., 2009; Deininger et al., 2008), a significant reduction in land border disputes (Holden et al., 2010), and a significant enhancement of land rental market activity (Holden et al., 2011; Deininger et al., 2011). Especially female-headed households appear to have become more tenure secure after receiving land certificates and have thus become more willing to rent their land through share-cropping contracts. These effects should also contribute to poverty reduction, but this has not yet been investigated thoroughly, and, therefore, this is the novel contribution of this paper.

This study has two related objectives that will fill gaps in the existing literature. First, the study will assess whether the increased land rental activity due to land certification is associated with higher land productivity on rented land, particularly for land with female landlords. An earlier study by Holden and Bezabih (2008) revealed that land productivity was lower for land owned by female landlords than on land owned by male landlords. They also found significant Marshallian inefficiency in the land rental market dominated by sharecropping in the Amhara region of Ethiopia. This study, therefore, first investigates whether a similar productivity difference can be detected in the Tigray region and whether land certification has contributed to reducing such inefficiency in land use, if it is found to exist before certification.

Second, the study aims to measure the welfare effect of the land certification at the household level based on household panel data from the Tigray region, where the land certification process was first implemented in Ethiopia. The data covers the period of 1997-2006, from one year before the registration and certification reform was implemented till almost eight years after. Welfare effects may be delayed both because productivity impacts of investments may be delayed and grow over time and because of the consumption smoothing behavior of households. In order to identify such delayed and gradually increasing effects the duration of land certificate ownership was considered, while welfare was measured by real household consumption expenditure per adult equivalent.

The study identified improved land productivity after the reform on rented land of female-headed households as compared to male households. Furthermore, welfare improvements by years of land certificate ownership were significant and positive, especially for females.
The paper is organized as follows. Part two provides an overview of land tenure reforms in Ethiopia since 1975. Part three gives an overview of studies on welfare impacts of land tenure reforms in general as well as of earlier studies on tenure insecurity and land certification in Ethiopia. Data and methods of analysis are presented in part four, followed by the presentation of the results and discussion in part five, and then the conclusion.

2. The Ethiopian land tenure reforms

Ethiopia experienced a radical land tenure reform in 1975 when all land was made state land. User rights to land were then distributed to individual households in each community (peasant association) in an egalitarian way by providing each household with a fair share of each major land quality class in the community (Rahmato, 1984). The allocation depended on household size. Land sales, mortgaging, and rentals were illegal and so was the hiring of labor. The maximum farm size was set to 10 ha and all resident households in the community had the constitutional right to land. This was based on a 'land to the tiller' ideology inspired by experiences under the feudal tenancy system before the reform and radical reforms in other countries. The reform thus resembled the reform in China but was less violent. The feudal landlords in Ethiopia were not killed but were left with less than 10 ha of land and lost all power as they were excluded from local leadership positions. Collective farming was also promoted in the peasant associations but did not succeed and was gradually phased out. Meanwhile such land was gradually distributed to individual households as the population increased, and new households that needed land were formed. To maintain the egalitarian land distribution further, land redistributions took place by taking land from the most land-rich households and giving it to the new households when other communal land was no longer available. This created a zero-sum game with enhanced tenure insecurity with possible negative investment and productivity effects (Alemu, 1999; Deininger and Jin, 2006; Holden and Yohannes, 2002).

Then, the civil war in Ethiopia ended in 1991 when the military regime was overthrown and the new government, originating from the Tigray region, was established. Eritrea was separated out

as an independent country. A more market friendly land policy was introduced allowing land renting (short term contracts) and hiring of labor, but selling and mortgaging of land remained illegal. Continuation of the use rights also required continuing residence in the community and implied an obligation to farm the land (Rahmato, 2003). Land redistributions were also halted with a few exceptions (Ege, 1997). Stronger legal powers were devolved to the regional level. A new Federal Land Proclamation was put in place in 1997 (FDRE, 1997) and provided the basis for establishing regional land laws that were consistent with the federal land proclamation.

Tigray region was the first region to have its own regional land proclamation (TRS, 1997). These new land laws formed the basis for implementing regional rural land registration and certification. This first started in the Tigray region in 1998 and followed in the Amhara region in 2003, in the Oromia and SNNP regions in 2004, and in many other regions since then. Tigray region implemented a low-cost land registration and certification reform and covered more than 80% of the rural households during 1998-99. The war with Eritrea interrupted the process and delayed its completion. The rapid implementation was possible due to the low level of technology used (it required limited training and budget), the high level of local participation by (minimizing the administrative costs) and motivation, and the focus on only land allocated to individual households, thus avoiding communal lands as well as pastoral areas. Land registration involved identifying the owners and neighbors of each individual plot, jointly inspecting and identifying or demarcating the plot borders, and having the owners and their neighbors agree on these. A form was filled out for each plot, which included this information as well as the plot location (by name), plot size (using local measurement methods and units), and land quality class. The information was registered in land registry books where each household had a number. Each household was then provided a certificate which contained this same information for each of their farm plots. The certificate was issued in the name of the head of the household. It provided perpetual user rights to the land.

The three most populated regions, Amhara, Oromia, and SNNP, followed up with a very similar approach to land registration and certification from 2003 and onwards, and by 2006 more than 20 million plots and 6 million households had received land certificates (Deininger et al., 2008). The cost of the certification was estimated to be as low as 1USD per plot and 3.5USD per farm

household, compared to the cost of 150USD in Madagascar which uses the land titling upon demand approach (Deininger et al., 2008; Jacoby and Minten, 2007).

3. Literature review

Welfare effects of land reforms

We define land tenure reform as a formal change in a land tenure rights regime that also may include changes in the duties and restrictions of land rights holders. With this broad definition, we may identify a vector of sub-categories of land tenure reforms including: redistributive land reforms; classical land titling reform; low-cost land registration and certification; formalization of customary land rights; and changes in rights and duties of land rights holders. This study focuses only on a sub-category of land reform, which is the low-cost land registration and certification reform in Ethiopia that aimed to strengthen the use rights of land holders while still restricting their transfer rights. These restrictions included prohibition of land sales and mortgaging while short-term renting was allowed and are important information on what types of welfare effects one could expect from this reform.

The three neoclassical focal points of land tenure reforms have included: a) the tenure security and investment effect; b) the transferability and allocative efficiency effect; and c) the collateralization or credit access effect (Besley, 1995; Brasselle et al., 2002). The land rights restrictions in Ethiopia imply that we can only expect the first two types of effects to be potentially significant in Ethiopia as a result of the low-cost land registration and certification. In addition to the productivity effects, many land reforms also emphasize achieving distributional effects. This has also been an important argument for new land reforms focusing on the legal empowerment of the poor and has been promoted by the Commission for Legal Empowerment of the Poor, UN-Habitat, and the World Bank, not to mention many of the national land redistributive reforms, including the radical reforms, land-to-the-tiller reforms, and market-assisted land redistributions (Deininger, 2003; Cotula and Mathieu, 2008; Singh, 2009). However, many land reforms have not succeeded in empowering the poor, rather to the contrary; they have seen many unintended effects such as elite capture and have resulted in further marginalization of the poor (Benjaminsen et al., 2009; Otsuka, 2007; Toulmin, 2009). Toulmin (2009) argues that most African governments do not have the administrative capacity to

implement land registration and titling of land; however, given the sharp increases in the demands for land, there is a need for a decentralized system for land registration and certification. Such systems may, however, also be vulnerable to elite capture and corruption. It is, therefore, not obvious that such systems will be more able to deliver land tenure reforms that benefit the poor.

It has long been agreed that improving the asset base of the poor helps reduce their poverty (Besley and Burgess, 2000). Many studies have revealed an inverse farm size-land productivity relationship, and, based on this, it has been advocated that the redistribution of land from large land holders to small land holders could contribute to efficiency as well as equity (Binswanger et al., 1995). The many challenges that redistribute reforms face, and the mixed experiences with their implementation and impacts, however, imply that no consensus has been achieved on whether such land reforms could be a useful policy instrument for poverty reduction.
While there are quite a few studies on investment effects of land reforms, very few rigorous quantitative studies exist on welfare impacts of land reforms. This is because such studies require comprehensive data from before and after the reforms and because they need to control for the endogeneity of access to rights (Besley and Burgess, 2000). Feder and Nishio (1999) found positive impacts of land registration and titling on income and land values in Thailand. Lopez (1996) also found a positive net return in the form of household income to land registration and titling in Honduras minus the cost of titling as 600USD per title. Migot-Adholla et al. (1991) found no significant impact of land registration and titling on land productivity and investment in Ghana, Rwanda, or Kenya and concluded that land registration and titling is unlikely to be economically worthwhile in much of sub-Saharan Africa. Galiani and Schargrodsky (2009) found a positive effect of land titling on investment in human capital in a study in Buenos Aires.
While the focus on welfare effects of redistributive land reforms tends to be on the households that have received additional land, the study on the effects of land registration and titling or certification, like in Ethiopian, is rather the opposite; the study is on the effect of not having the risk of losing land through future redistributions. While such a reform that strengthens existing rights has negative effects on potential gainers of land from redistributions, they may have impacts beyond a zero-sum game if they contribute to enhanced investment and land use efficiency. An impact is also that households themselves, to a larger extent, have to bear the

costs of family size increases since such increases no longer provide the basis for claims for additional land. This implies that the land's potential role as a safety net for the landless and near landless may have been reduced while, at the same time, alternative safety net programs have been strengthened. It is also possible that such landless and near landless households can gain access to land through the land rental market if this market has been enhanced by the land registration and certification. Below, we review the evidence of impacts from the Ethiopian land registration on investment, productivity, and land rental market activity.

Impacts of land certification in Ethiopia

Deininger et al. (2008) assessed the early impacts of low-cost land registration and certification using a large cross-section dataset from Ethiopia. They estimated the cost of registration and certification to be about 1USD per farm plot or 3.5USD per household, while about 20 million plots and 6 million households had received land certificates within a period of seven years.

Holden et al. (2009) used household plot panel data from 1998, 2001, and 2006 from the Tigray region in Northern Ethiopia to estimate investment and productivity effects of land certification while controlling for the potential endogeneity of land certificate allocation. The study focused only on owner-operated plots and therefore did not capture potential benefits from increased productivity on rented land due to land certification. This implies that it focused only on the tenure security-investment-productivity effects of certification. The study revealed that conservation technologies on owner-operated plots with land certificates were better maintained than conservation technologies on plots without land certificates. Land certification was also found to enhance tree planting on owner-operated land. Land productivity was found to be more than 40% higher on owner-operated plots with land certificates than on owner-operated plots without land certificates. Ghebru and Holden (2011), using a different sample of owner-operated plots with and without land certificates, found that the productivity increase related to land certification was due more to an outward shift in the production frontier than a reduction in technical inefficiency; the levels of technical inefficiency were similar for certified and uncertified plots while overall productivity was higher for certified plots.

Holden et al. (2010) found that land registration and certification lead to better plot border demarcation and a significant reduction in plot border disputes using data from 400 local conflict

mediators in 27 communities from the Tigray region. This is also a clear indication of improved tenure security for owners of land because the risk of encroachment by neighbors has been reduced.

Holden et al. (2011) investigated the impacts of gender and land certification on land rental market participation and degree of participation in the Tigray region. Using four rounds of a balanced household panel covering sixteen communities over the period from the year before the reform and up to 7-8 years after the registration and certification, they found a significant increase in the land rental market activity. Female-headed households with land certificates had become more willing to rent out their land and did so0 significantly more after land certification. However, the study did not assess the welfare effects of the improved allocative efficiency of the land rental market. Some other studies may, however, give some indications of what these effects may be.

Holden and Bezabih (2008), using household plot panel data from the Amhara region in Ethiopia, found that land productivity was significantly lower on owner-operated as well as rented plots with female landlords as compared to male landlords. They found that female landlords (usually widows or divorced women) were less able to obtain efficient tenants due to higher eviction costs, particularly related to in-law tenants that were less productive. Strengthening of the land rights for women through land certification may therefore make female landlord households more willing to rent their land and make them able to find more efficient tenants and this should also have welfare improving effects as they share the productivity gains with the tenants through sharecropping contracts. The improved allocative efficiency of the land rental market should, therefore, potentially lead to higher production efficiency and welfare gains both for the tenant and landlord through transfer of land to more efficient producers. This study will assess whether land registration and certification has had such an effect in the Tigray region. Deininger et al. (2011) used a four round household panel data from the Amhara region to estimate the early impacts of land certification on tenure security, investment, and land rental activity. Meanwhile, several other studies have tried to identify the impacts of investments in soil conservation in Ethiopia (Shiferaw and Holden, 1999; Shiferaw and Holden, 2001; Gebremedhin and Swinton, 2003). These studies have identified the delayed productivity effect of soil

conservation to be an important reason for underinvestment in conservation, although in the Tigray region there appeared to be stronger short-term effects of conservation due to the moisture conservation effect of soil conservation measures. Severe land degradation and low investment levels have been important reasons for government interventions to promote such investments. Large scale programs have, therefore, promoted such investments, especially through Food-for-work programs and the more recent Productive Safety Net Program that also covers much of the Tigray region. Individual households' responsibilities have been more to maintain and improve such structures that have been introduced through these programs. With this in mind, it is not surprising that investment effects resulting from land certification also can be delayed.

4. Theory and hypotheses

We assume that households aim to maximize their welfare given the constraints they face, and this includes making inter-temporal choices that involve inter-temporal trade-offs. Households face shock and risks that may cause their incomes as well as their resource access to fluctuate over time, while their basic needs need to be satisfied in every period of time in order for them to survive. This implies that they will typically aim to smooth consumption over time to compensate for periods of lack by depleting their asset base to maintain their consumption in such periods while this asset base is rebuilt in periods with more favorable outcomes.

Tenure security over assets provides an opportunity for investment and asset resource allocation that enhances future expected welfare flows from this asset base. Land certification should, therefore, enhance investment and future expected welfare from the asset base. Such tenure security provided by land certificates should also make it possible to rent out land to more productive households for households that are less productive themselves because they have limited access to complementary resources that are important for land productivity. With land renting dominated by sharecropping, both parties of the sharecropping contract benefit from productivity increases on sharecropped land.

Drawing on this basic theoretical framework and the earlier studies of the reviewed land certification in Ethiopia, we formulate the following hypotheses for empirical testing in this study:

H1) Land certification has contributed to enhanced land productivity over time on rented land, especially for female-headed households.

H2) Land certification has enhanced household welfare over time.

H3) Land certification has also enhanced household welfare of female-headed households that depend more on renting out their land.

The testing of these hypotheses will fill important gaps in the existing literature and contribute to create a more complete picture of the overall impacts of low-cost land certification in Ethiopia.

5. Data and estimation methods

The data used in this study comes from a survey that sampled 400 households in 16 communities in the Tigray region. The first round survey took place in 1998, just before the land registration and certification reform was implemented. The sample villages were stratified to capture the main variation in market access, population density, irrigation access, and zonal agro-ecological variation in the highland areas of the region where most of the population lives. The survey, as well as the land certification reform, did not include the lowland, mainly pastoral, areas of the region. Data were collected not only for a wide range of household level variables but also for each farm plot of households, including land characteristics, input use, investments, and outputs.

The households were resurveyed in 2001, 2003, and 2006 and this gives a four round household panel that is used for the analysis at the household level. The surveys used the same format for the data collection of household expenditures and plot level production in the different rounds. Household expenditures were deflated using a local consumption price index generated for a typical basket of consumer goods. Household adult equivalents were calculated based on the standardized energy intake of household members by age and gender.

Land productivity estimation on rented land

For the plot level analysis, data from 1998, 2001, and 2006 were used. Plot level data for 2003 were dropped because they were severely affected by drought in that year. Land productivity was measured by the value of crops produced on a plot in a year. Land productivity is assumed to be a function of the plot, farm, and household characteristics. Our analysis first focused on whether there was any productivity differences between rented plots of male- and female-headed

households before and after the land certification, based on the identification of such differences in another region of Ethiopia by Holden and Bezabih (2008). Plot level data were used for this purpose to estimate the following model year by year.

1) $q^r_{pht} = \alpha_{0t} + \alpha_{1t} A^r_{pht} + \alpha_{2t} S^r_{ht} + c^r_{ht} + u^r_{pht}$

q^r_{pht} is the log of the output value on the rented out plot *p* of household *h* in a specific year *t*, A^r_{pht} is a set of plot characteristics for the rented plots, S^r_{ht} is a dummy variable for the sex of the owner of the rented out plot, c^r_{ht} represents unobservable household and farm characteristics that are controlled using household random effects, and u^r_{pht} is the error term. It was not possible to use household fixed effects in this estimation because many households rented out only one plot. This formulation is also more flexible than a model that forces the parameters to be constant over time. In particular, we hypothesized (H1) the parameter on the sex of the household head to change over time.

To control for selection bias (due to observables), propensity score matching was used to compare the land productivity of rented out plots of male and female households before and after certification. The balancing requirement was satisfied in these estimations and the common support requirement was invoked. The same approach was attempted for the comparison of rented out plots with and without certificates within years after certification, but this attempt failed since the balancing requirement could not be satisfied because there were very few rented out plots without land certificates.

A further test for selection bias due to unobservables was implemented by use of a Heckman selection model. No significant selection bias was detected with this model. The results are presented in Appendix A, Table A1.

Welfare impact models

For the analysis of the possible welfare effects of land certification, we were able to use the full four rounds household level panel. Some attrition was experienced, such that our analysis is based on a balanced household panel of 292 households for which we have complete data for all variables in all years. While this could potentially lead to attrition bias, our tests did not reveal

any such significant bias in the models presented in this paper, where household fixed effects were used to control for unobserved household heterogeneity.

The welfare effects of land certification are not likely to appear immediately after a reform and they may grow stronger over time. It may therefore be appropriate to use an indicator variable capturing this accumulation effect. For this purpose, we used the time period (in years) that the individual households have possessed their land certificates.
The specification of the estimated model is as follows:

$$y_{ht} = \beta_0 + \beta_1 A_{ht} + \beta_2 CY_{ht} + \beta_3 S_{ht} + \beta_4 D_t + \beta_5 CY_{ht} * S_{ht} + \beta_6 OP_{ht} / A_{ht} + \vartheta_h + e_{ht},$$

The dependent variable (y_{ht}) was specified as the real (deflated) value of total household annual expenditure per adult equivalent. A_{ht} is the farm size per adult equivalent, CY_{ht} is the number of years the household has had its land certificate, S_{ht} is a dummy for the sex of household head, D_t is a vector of year dummies, OP_{ht} / A_{ht} is the operational holding size divided by the own holding size, ϑ_h is the unobservable time-invariant household, farm, and village characteristics that can be controlled for using household fixed effects, and e_{ht} is the error term. Models were run with and without the interaction term between the sex of household head and years with certificate variables to assess whether a difference in impacts between male- and female-headed households could be detected. Models without and with the ratio between operational and own holding sizes were also run to assess the impact of land rental market participation.

The impact of certification is identified with the years with certificate variable which can capture a delayed and gradual effect of land certification, if it exists. This also resembles a pipeline approach were variation in the timing of allocation of certificates is utilized to identify the impacts. This variation in timing was caused primarily by administrative constraints. The year dummy variables are a control for the general trend effect such that the effect of certification on those households that received certificates can be identified (test of hypothesis 2). A further test of the impact of certification on female- vs. male-headed households is achieved with the interaction variable between the years with certificate and sex of household head variables. Hypothesis 3 is tested with this variable. The tests rest on there not being any varying unobservable time variables causing households with certificates to have a stronger trend in

welfare improvement than households without certificates (common trend assumption). The same assumption is required for female vs. male landlord households. We cannot think of any such variables that would cause stronger welfare improvement over time for female landlord households.

Finally, the model specifications allow for the assessment of whether changes in land rental market participation are associated with welfare changes and changes in the land endowment per adult equivalent (caused by changes in household composition or land endowment). We would expect that increases in operational holding are associated with welfare improvements, while a reduction in land endowment per adult equivalent (e.g. due to an increase in household size) is associated with a reduction in household welfare.

6. Results and discussion

Land productivity on rented out land

Table 1 provides a comparison of land productivity on rented-out and owner-operated plots of male and femal landlord households by year with simple t-tests. Productivity was measured as log-transformed output value. Gendered land productivity differences are weakly significant in 1998(10% level) and more significant in 2001, but become insignificant for rented out plots in 2006.

Table 2 provides information about the number of plots by rental status, certificate status, and year. As can be seen, the number of rented out plots with certificates was small and we were unable to perform a proper assessment of productivity differences between rented out plots with and without certificates using propensity score matching.

The results of the propensity score matching for rented out plots of female versus male landlord households, with kernel and nearest neighbor methods that control observable plot characteristics are presented in Table 3. The balancing requirement was satisfied and common support was invoked to eliminate potential outlier observations. The results show that, after controlling for observables, the productivity differences between rented out plots of female- and male-headed households in 1998 have become highly significant with female-headed households having lower

land productivity on their rented out plots. The same finding was found in 2001, about two years after land certification. However, in 2006, the land productivity on rented out plots of female-headed households is no longer lower than that of male-headed households. This may be an effect of the land certification since it may take some time from the reform till it starts to affect the ability of landlord households to either select better tenant households or to enforce better management by existing tenants. Based on this, we are not able to reject hypothesis 1. This is consistent with the findings by Holden et al. (2011) that female-headed households have become more willing to rent out land after land certification. Land certification may have strengthened their bargaining power in relation to land rental contract partners.

The results of the parametric econometric models of land productivity on rented plots, using household random effects to control for household unobservables, are found in Table 4. As can be seen, the results are similar to those found with propensity score matching. The sex of household head variable turned from significant at 5% and negative in 1998, to significant at 10% and negative in 2001, and to insignificant in 2006. Further tests with Heckman selection and pooled OLS models are presented in Appendix Table A1. Together, these findings demonstrate that the key results are robust to alternative specifications. Female-headed households who rent out their land seem to have become able to achieve higher land productivity on their rented out land after land certification.

Welfare effects of land certification

Table 5 provides descriptive statistics for variables included in the regressions for households with and without certificates. It can be seen that, on average, the welfare levels are higher for households with certificates. About 20% of the households were female-headed and a larger share of female-headed households (22.5%) had land certificates. Households with certificates also had smaller farm sizes, on average, than households without certificates.

Table 6 shows descriptive statistics by year for the same key variables. Average household welfare improved over time, the share of female-headed households also increased over time (influenced by the Eritrea-Ethiopia war), and average farm sizes declined over time. These time trends may, therefore, explain much of the variation between households with and without certificates, as seen in Table 5. Careful econometric analysis is required to control for these

trends and to gain more reliable estimates of the welfare effects of land certification. The years with certificate variable and the interaction variable between years with certificate and sex of household head are used to obtain such welfare impact measures and test whether such impacts are different for female- and male-headed households. Table 7 presents the results of the welfare impact models with two-way fixed effects. Household fixed effects were used to control for time invariant unobserved household, farm, and village heterogeneity while year dummies were used to control for time-specific effects.

Model 1 is without the interaction variable and the operational land/own farm size variable. The years with certificate variable is significant at 10% and with a positive sign, possibly indicating a positive effect of land certification on household welfare. The sex of household head variable is significant at 1% and with a positive sign indicating that female-headed households have a higher welfare level than male-headed households after controlling for time-invariant observable and unobservable differences. The farm size per adult equivalent variable was also significant at 1% and with a positive sign showing the importance of land for household welfare.

Model 2 includes the interaction effect between years with land certificates and sex of household head. The interaction variable became significant at 5% and with a positive sign while the two variables' separate effects became insignificant. The coefficient for the years with certificate variable was reduced from 41.7 to 32, while the coefficient on the interaction variable was close to 35 which may imply that the welfare effect of land certification on female-headed households is about double that for male-headed households. The coefficient on the sex of household head variable switched from 148 to close to zero, possibly indicating that the whole positive gender effect is linked to land certification. The farm size per adult equivalent variable became even more highly significant (0.1%) and positive in this specification.

Models 3 and 4 deviate from models 1 and 2 only because they include the operational farm size/own farm size ratio variable. This was done as a robustness check and to assess whether adjustments in the land rental market had any impact on household welfare. The results show that adjustments toward larger operational holding relative to own holding was associated with positive welfare gains. None of the other significant effects in models 1 and 2 had any dramatic

changes in models 3 and 4. The coefficients of the key variables increased slightly and so did some of the significance levels. We interpret the results as solid evidence of positive welfare effects of land certification, particularly for female-headed households. This implies that we cannot reject hypotheses 2 or 3.

As an additional robustness check, we ran models 1 to 4 again after removing the years with certificate variable. The results are included in Appendix Table A2. With this change, the annual dummy variables all became highly significant and positive. The interaction variable between sex of household head and years with certificate (implying that we have assumed that this effect is insignificant for male-headed households) in models 2 and 4 became significant at 1% and with coefficients in the range 42.6-43.9. These coefficients represent an increase in household welfare of about 7% for each additional year that households have kept their certificates. These welfare impact estimates are also close to the land productivity impacts found by Holden et al. (2009) using the same household panel.

Overall reflections of the significance of land certification

One may question why we find such positive effects of the Ethiopian land registration and certification program given that many other land reform programs have failed to meet their objectives or to produce significant positive welfare effects. Such projects have often been implemented in a top-down way, without sufficient recognition of local rights and without sufficient broad-based information campaigns, and this has often resulted in a race for the rights that has favored the powerful elites (Easterly, 2008; Deininger et al., 2011; Benjaminsen et al., 2009; Jacoby and Minten, 2007). Important reasons for the success of the Ethiopian land certification include: a) broad local participation in the implementation which also contributed to the low cost; b) no local elite existed that was against the reform or that could resist or control the process; c) the past policy with land redistributions had created tenure insecurity and there was a demand for the reform; and d) Ethiopia has quite strong local institutions in the form of peasant associations that were able to support the land registration and certification process.

7. Conclusions

Our study provides new evidence on the productivity and welfare impacts of low-cost land certification in Ethiopia. Land productivity of the rented land of female landlords appears to have

improved relative to that of male landlord households after the certification. This is consistent with the findings of Holden et al.(2011) that land certification has enhanced tenure security and land rental market participation especially by female landlord households. It is also consistent with the findings of Deininger et al. (2011) who also found that land rental activity was stimulated by land certification.

In order to identify the possible delayed impact of land certification on household welfare, measured as real consumption expenditure per adult equivalent, we used the duration of ownership of land certificates in a four round household panel data covering the period from just before certification and up to seven years after certification. After controlling for unobserved household and farm heterogeneity using household fixed effects, the duration of certificate ownership was significant and positive, especially for female-headed households. These results were robust to alternative specifications. The welfare measure increased by about seven percent per year of ownership for female-headed households, and this is reasonable given that Holden et al. (2009) estimated that land certification has enhanced land productivity by about 45 percent on owner-operated land in the same study areas. Our study provides evidence of significant tenure security-investment and transferability/allocative efficiency effects resulting from the low-cost land certification, and the second effect has been particularly important for the welfare improvement of female landlords, who constituted a large share of landlord households.

The study also reveals that household welfare is highly dependent on the farm size per adult equivalent of the households, demonstrating the high dependence on farming and high welfare costs of population growth if off-farm income opportunities and migration cannot be facilitated. The majority of the households in the studied areas are net buyers of food and strongly dependent on employment through the Productive Safety Net Program. The strong restrictions on land transfer rights that are included in the revised land proclamation of 2006 (TRS, 2006) include that no more than 50% of the land that can be rented out. These restrictions also state that the land will be confiscated without compensation from households that have migrated and been away for more than two years. This is likely done to increase the burden on the government's productive safety net program and reduce the chance that households will be able to graduate

from this program. With continued population growth and technological stagnation in agriculture, poverty will get worse unless new off-farm employment opportunities emerge.

References

Alemu, T. (1999). Land Tenure and Soil Conservation: Evidence from Ethiopia. PhD-dissertation. Göteborg University, Göteborg.

Benjaminsen, T. A., Holden, S. T., Lund, C. and Sjaastad, E. (2009). Formalisation of land rights: Some empirical evidence from Mali, Niger and South Africa. *Land Use Policy* 26: 28–35.

Besley, T. (1995). Property rights and investment incentives: theory and evidence from Ghana. *Journal of Political Economy* 103(5): 903–937.

Besley, T. and Burgess, R. (2000). Land Reform, Poverty Reduction, and Growth: Evidence from India. *Quarterly Journal of Economics* 115(2): 341–388.

Binswanger, H. P., Deininger, K. and Feder, G. (1995). Power, Distortions, Revolt, and Reform in Agricultural Land Relations. In J. Behrman and T. N. Srinivasan, eds., *Handbook of Development Economics* 3. North-Holland, Amsterdam.

Brasselle, A.S., Gaspart, F. and Platteau, J.-P. (2002) Land tenure security and investment incentives: puzzling evidence from Burkina Faso. *Journal of Development Economics* 67: 373–418.

Cotula, L. and Mathieu, P.(eds.) (2008). Legal empowerment in practice: using legal tools to secure land rights in Africa. FAO and IIED, London.

Deininger, K., D. A. Ali, S. T. Holden and J. Zevenbergen. (2008). Rural land certification in Ethiopia: Process, initial impact, and implications for other African countries. *World Development* 36: 1786-1812.

Deininger , K., Ali, D.A. and Alemu, T. (2011). Impacts of Land Certification on Tenure Security, Investment, and Land Market Participation. *Land Economics* 87: 312-334.

Deininger , K., and Jin, S. (2006). Tenure Security and Land-related Investment: Evidence from Ethiopia. *European Economic Review* 50:1245-1277.

Easterly, W. (2008). Institutions: Top down or bottom up? *American Economic Review, Papers and Proceedings* 98(2): 95-99.

Ege, S. (1997). The Promised Land: The Amhara Land Redistribution of 1997. SMU-rapport 5/97. Centre for Environment and Development, Norwegian University of Science and Technology, Dragvoll, Trondheim.

FDRE (1997). *Federal Rural Land Administration and Utilization Proclamation*. Federal Democratic Republic of Ethiopia. 89/1997.

FDRE (2005). *Federal Rural Land Administration and Utilisation Proclamation*. Federal Democratic Republic of Ethiopia. 456/2005.

Feder, G. and Nishio, A. (1999). The benefits of land registration and titling: economic and social perspectives. *Land Use Policy* 15(1): 25-43.

Galiani, S. and Schargrodsky, E. (2009). Property Rights for the Poor: Effects of Land Titling. Working paper no. 7, Ronald Coase Institute, St. Louis, Missouri.

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.

Holden, S.T., and Bezabih, M. (2008) Gender and Land Productivity on Rented Out Land: Evidence from Ethiopia, in: Holden ST, Otsuka K, Place F (eds), *The Emergence of Land Markets in Africa: Assessing the Impacts on Poverty, Equity and Efficiency.* Resources For the Future Press, Washington, D.C., p. 179-196

Holden, S. T., and H. 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.

Holden, S. T., Deininger, K. and Ghebru, H. (2009). Impacts of Low-cost Land Certification on Investment and Productivity. *American Journal of Agricultural Economics* 91(2): 359–373.

Holden, S. T., Deininger, K. and Ghebru, H. (2010). Impact of land registration and certification on land border conflicts in Ethiopia. Paper presented at the World Bank Annual Conference on Land Policy and Administration in Washington DC April 26-27, 2010.

Holden, S. T., Deininger, K. and Ghebru, H. (2011). Tenure Insecurity, Gender, Low-cost Land Certification and Land Rental Market Participation. *Journal of Development Studies* 47(1): 31-47.

Jacoby, H. G. and Minten, B. (2007). Is Land Titling in Sub-Saharan Africa Cost-Effective? Evicence from Madagascar. *The World Bank Economic Review* 21(3): 461-485.

Lopez, R. (1991). Land titles and farm productivity in Honduras. Department of Agricultural and Resource Economics, University of Maryland, College Park, MD.

Migot-Adholla, S., Hazell, P., Blarel, B. and Place, F. (1991). Indigenous land rights systems in sub-Saharan Africa: a constraint on productivity? *The World Bank Economic Review* 5 (1): 155-175.

Otsuka, K. (2007). Efficiency and Equity Effects of Land Markets. Chapter 51. *Handbook of Agricultural Economics* 3: 2671-2703

Rahmato, D. (1984). Agrarian Reform in Ethiopia. Scandinavian Institute of African Studies, Uppsala.

Rahmato, D. (2003). Access to resources and livelihood insecurity. Forum for Social Studies, Addis Ababa.

Shiferaw, B. and Holden, S. T. (1999). Soil Erosion and Smallholders' Conservation Decisions in the Highlands of Ethiopia. *World Development* 27(4): 739-752.

Shiferaw, B. and Holden, S. T. (2001). Farm Level Benefits to Investments for Mitigating Land Degradation: Empirical Evidence from Ethiopia. *Environment and Development Economics* 6: 335-358.

Singh, N. (2009). Fighting rural poverty, inequality and low productivity through legal empowerment of the poor**.** *The Journal of Peasant Studies* 36(4): 871-892.

Toulmin, C. (2009). Securing land and property rights in sub-Saharan Africa: The role of local institutions. *Land Use Policy* 26(1): 10-19.

TRS (1997). *Rural Land Administration and Utilization Proclamation*. Tigray Regional State, Ethiopia.

TRS (2006). *Rural Land Administration and Utilization Proclamation No.97/2006*. Tigray Regional State, Ethiopia.

Table 1. Land productivity on owner-operated and rented out plots by sex of household head and year

Year -->		**1998**	**1998**	**2001**	**2001**	**2006**	**2006**
Sex of household head		Owner-operated	Rented out plots	Owner-operated	Rented out plots	Owner-operated	Rented out plots
Male-	Mean	6.766	6.641	6.930	6.930	7.378	6.954
Headed	St.err.	0.039	0.100	0.027	0.091	0.034	0.105
(m)							
	N	619	83	951	96	737	61
Female-	Mean	6.588	6.322	6.605	6.408	7.117	7.074
Headed (f)	St.err.	0.120	0.166	0.102	0.149	0.062	0.109
	N	73	31	86	48	230	72
t-test, f<m	t-value	1.41	1.65	3.0736	2.9967	3.701	-0.7943
Prob(f<m)		0.0815	0.0525	0.0014	0.0018	0.001	0.7858

Note: Land productivity is log-transformed from the value of crops produced on the land. f=female, m=male

Table 2. Number of plot observations by renting out and certificate status by year

		Year and Rented out dummy					
		1998		2001		2006	
		0	1	0	1	0	1
Certificate,	0	552	115	167	22	201	31
1=Yes	1	0	0	721	122	647	108

Table 3. Yield comparison on rented out plots of female and male landlords, matching on observable plot characteristics

Year	Matching method	Number of treated observations: Female landlords	Number of control observations: Male landlords	ATT	Std. Err.	t
1998	Kernel	31	59	-0.602	0.208	-2.892
1998	Nearest neighbor	31	25	-0.790	0.246	-3.216
2001	Kernel	48	90	-0.478	0.191	-2.499
2001	Nearest neighbor	48	34	-0.549	0.236	-2.325
2006	Kernel	70	56	0.072	0.176	0.407
2006	Nearest neighbor	70	35	0.094	0.198	0.474

Note: Kernel matching based on bootstrapped standard errors with 300 replications.

Table 4. Factors correlated with land productivity on rented out plots, Models with household random effects and village fixed effects by year

Explanatory variables	1998	2001	2006
Sex of household head	-0.545**	-0.356*	0.022
(1=female, 0=male)	(0.226)	(0.214)	(0.164)
Homestead plot dummy	-0.101	0.177	0.059
	(0.215)	(0.317)	(0.263)
Plot size, tsimdi	-0.336***	-0.208**	-0.124
	(0.126)	(0.092)	(0.09)
Soil depth shallow	-0.21	-0.361	0.04
	(0.311)	(0.262)	(0.187)
Soil depth medium	0.04	-0.223	-0.019
	(0.271)	(0.191)	(0.204)
Flat slope	-0.118	0.143	0.376
	(0.329)	(0.337)	(0.356)
Low hill slope	0.098	-0.029	0.426
	(0.289)	(0.278)	(0.414)
Mid hill slope	-0.191	-0.386	0.599
	(0.50)	(0.456)	(0.453)
Soil type Cambisol	-0.149	0.15	0.127
	(0.217)	(0.287)	(0.177)
Soil type Vertisol	0.011	-0.36	-0.087
	(0.279)	(0.235)	(0.17)
Soil type Regosol	-0.446*	0.476**	-0.361
	(0.253)	(0.233)	(0.253)
Distance to plot from home	-0.002	0.007***	-0.001
(Minutes walk)	(0.003)	(0.002)	(0.002)
Village fixed effects	Yes	Yes	Yes
Constant	7.623***	7.257***	6.717***
	(0.571)	(0.48)	(0.405)
Number of observations	114	144	131
Rho	0.157	0.451	0.301
R-squared, overall	0.414	0.423	0.393

Significance levels: * indicates p<0.10, ** indicates p<0.05, *** indicates p<0.01, **** indicates p<0.0001. Cluster robust standard errors.

Table 5. Descriptive statistics for key variables by households having certificate or not, all years

Have certificate	Statistic measure	Real consumption expenditure per adult equivalent, Eth. Birr	Years with certificate	Sex of household head, 1=female, 0=male	Operational farm size/Own farm size	Own farm size, ha
No	Mean	624.208	0.000	0.158	0.990	1.088
	St.error	32.872	0.000	0.018	0.047	0.063
	N	400	400	400	400	400
Yes	Mean	759.538	4.578	0.225	1.014	0.938
	St.error	19.318	0.090	0.015	0.020	0.031
	N	768	768	768	768	768
Total	Mean	713.192	3.010	0.202	1.006	0.989
	St.error	17.069	0.087	0.012	0.021	0.030
	N	1168	1168	1168	1168	1168

Table 6. Descriptive statistics for key variables by year, all households

Year	Statistic measure	Consumption expenditure per adult equivalent	Years with certify-cate	Sex of household head, 1=female, 0=male	Operational farm size/Own farm size	Own farm size, ha
1997	Mean	534.917	0.000	0.127	0.974	1.137
	St.error	37.321	0.000	0.020	0.058	0.082
	N	292	292	292	292	292
2000	Mean	658.130	1.394	0.120	1.041	0.980
	St.error	27.634	0.040	0.019	0.044	0.053
	N	292	292	292	292	292
2003	Mean	765.889	4.009	0.260	1.015	0.933
	St.error	31.201	0.093	0.026	0.019	0.042
	N	292	292	292	292	292
2006	Mean	893.833	6.639	0.301	0.995	0.908
	St.error	36.084	0.149	0.027	0.036	0.052
	N	292	292	292	292	292
Total	Mean	713.192	3.010	0.202	1.006	0.989
	St.error	17.069	0.087	0.012	0.021	0.030
	N	1168	1168	1168	1168	1168

Table 7. Welfare effects of land certification with household fixed effects models

Explanatory variables	Model 1	Model 2	Model 3	Model 4
Years with certificate	41.695*	32.527	42.423*	32.998
	(24.12)	(24.55)	(24.17)	(24.58)
Sex of household head	148.87***	0.26	154.24***	1.01
Female=1, male=0	(53.99)	(70.26)	(54.23)	(69.92)
Farm size per adult equivalent	103.58***	105.65****	104.70****	106.92****
	(31.32)	(31.14)	(31.49)	(31.32)
Sex of household head*Years with certificate		34.990**		36.170**
		(14.87)		(14.82)
Operational holding size/Farm size			41.813***	44.817****
			(13.51)	(13.14)
Dummy for year=2000	79.815	86.353	76.197	82.695
	(62.67)	(63.11)	(62.74)	(63.16)
Dummy for year=2003	64.677	85.492	59.562	80.711
	(123.6)	(124.65)	(123.95)	(124.96)
Dummy for year=2006	78.627	96.415	72.237	90.166
	(184.37)	(185.53)	(184.78)	(185.92)
Constant	378.64****	394.73****	335.75****	349.30****
	(40.79)	(38.36)	(44.17)	(42.18)
Prob > chi2	0.000	0.000	0.000	0.000
Number of observations	1168	1168	1168	1168
R squared	0.156	0.163	0.159	0.166

Significance levels: * indicates p<0.10, ** indicates p<0.05, *** indicates p<0.01, **** indicates p<0.0001. Cluster robust standard errors.

Appendix A.

Table A1. Land productivity on rented out plots: Heckman selection and pooled OLS models

	Heckman selection model		OLS
Explanatory variables	**Second stage: Productivity on rented out plots**	**First stage probit model: Decision to rent out plot**	**Cluster robust standard errors**
Dummy for year=2001	0.192	-0.095	0.196
	(0.147)	(0.099)	(0.170)
Dummy for year=2006	0.145	-0.121	0.155
	(0.210)	(0.149)	(0.189)
Sex of household head	-0.338	0.576***	-0.434**
Female=1, male=0	(0.207)	(0.099)	(0.189)
Sex of household head*Dummy for 2001	-0.119		-0.119
	(0.236)		(0.257)
Sexof household head*Dummy for 2006	0.522**		0.518*
	(0.244)		(0.284)
Years with certificate	0.002	-0.009	0.004
	(0.026)	(0.018)	(0.024)
Plot size	-0.255***	0.050	-0.261***
	(0.045)	(0.034)	(0.053)
Soil depth shallow	-0.048	0.083	-0.048
	(0.109)	(0.083)	(0.120)
Soil depth medium	-0.058	-0.01	-0.061
	(0.112)	(0.085)	(0.107)
Flat slope	0.004	-0.012	-0.024
	(0.155)	(0.126)	(0.167)
Low hill slope	0.123	0.032	0.107
	(0.154)	(0.126)	(0.160)
Mid hill slope	0.152	0.159	0.122
	(0.221)	(0.180)	(0.24)
Soil type Cambisol	0.116	-0.037	0.122
	(0.123)	(0.092)	(0.111)
Soil type Vertisol	0.11	-0.045	0.112
	(0.121)	(0.092)	(0.127)
Soil type Regosol	-0.286**	-0.044	-0.288*
	(0.125)	(0.097)	(0.156)
Distance to plot from home	0.001	0.007***	0.001
	(0.001)	(0.001)	(0.001)
Age of household head		0.003	
		(0.002)	
Education of household head		-0.152***	
		(0.054)	
Log of female labor force		0.190**	
		(0.086)	
Log of male labor force		-0.259***	
		(0.076)	

Log of oxen endowment		-0.303***	
		(0.115)	
Log of other livestock endowment		-0.460***	
		(0.082)	
Farm size, tsimdi		-0.024**	
		(0.012)	
Constant	6.845***	-0.779***	7.088***
	(0.343)	(0.249)	(0.267)
Athrho		0.153	
		(0.153)	
Ln sigma		-0.148***	
		(0.039)	
Number of observations	389	2621	389
R-squared			0.17
Log likelihood		-1364.789	
Chi2		73.77962	
Prob		2.15E-09	
Rho		0.1522949	

Significance levels: * indicates p<0.10, ** indicates p<0.05, *** indicates p<0.01, **** indicates p<0.0001.

Table A2. Welfare effects of land certification with household fixed effects models, models without the years with certificate variable

Explanatory variables	Model 1	Model 2	Model 3	Model 4
Sex of household head	154.289***	-28.114	159.462***	-27.792
Female=1, male=0	(54.5)	(70.1)	(54.79)	(69.78)
Farm size per adult equivalent	105.901***	107.797***	106.997***	109.067****
	(32.89)	(32.49)	(33.06)	(32.66)
Sex of household head*Years with certificate		42.606***		43.869***
		(14.95)		(14.93)
Operational holding size/Farm size			39.596***	43.837****
			(13.39)	(12.95)
Dummy for year=2000	138.299****	130.601****	135.840****	127.651****
	(36.68)	(36.83)	(36.62)	(36.79)
Dummy for year=2003	231.554****	212.217****	229.470****	209.337****
	(40.47)	(41.39)	(40.48)	(41.5)
Dummy for year=2006	354.983****	302.649****	353.503****	299.459****
	(43.25)	(43.25)	(43.28)	(43.36)
Constant	374.877****	395.474****	334.195****	351.045****
	(41.26)	(38.44)	(44.7)	(42.25)
Prob > chi2	0.000	0.000	0.000	0.000
Number of observations	1168	1168	1168	1168
R squared	0.148	0.158	0.15	0.161

Significance levels: * indicates p<0.10, ** indicates p<0.05, *** indicates p<0.01, **** indicates p<0.0001. Cluster robust standard errors.