

THE IMPACT OF LAND CERTIFICATION ON SOIL
CONSERVATION PRACTICES- A CASE STUDY OF ESTIE
WOREDA, AMHARA REGION, ETHIOPIA

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Abstract

The absence of secured land ownership right is one of the main causes of unsustainable land management practices and land degradation. Ethiopian government is trying to certify land owners under its “land registration and certification program”. This research aims to evaluate the impact of this program on soil conservation practices. For this study household- and plot-level survey was conducted in Estie Woreda, Amhara Region, Ethiopia. Propensity score matching technique is used to control for program and self selection bias. Sensitivity test has been used to check how the outcome variables are sensitive to endogenous variables. The result shows that certified land owners worked more on stone terrace, soil bund, and stone-soil terrace compared to uncertified farmers.

Key words: Land degradation, Land certification, Propensity score matching, investment on soil conservation practices.

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1. Background and Justification of the Problem

Agriculture, which depends mainly on land, is the back bone of an economy for developing countries. In Ethiopia, agriculture takes the largest share in terms of its contribution to gross domestic product (GDP), generation of employment opportunities, export earnings, supplies of raw material for agro-based domestic industries and national food security (Abegaz and Bekure, 2009; Tenaw *et al.*, 2009). In spite of this fact, agricultural production has declined in many developing countries because of degradation of agricultural land (Kabubo-Mariara, 2006).

With reference to developing countries like Ethiopia agricultural production is declining due to land degradation which leads to food insecurity and makes the countries highly dependent on food aid (Kassie *et al.*, 2011; Shiferaw and Holden, 2000; Tesfaye, 2008).

The problem of degradation of the soil stock and loss of production potential is severe in the highlands of Ethiopia that affects 88% and 75% of the human and livestock populations respectively (Shiferaw and Holden, 1999). It is estimated that, the annual average rates of soil erosion on croplands at national level is 42 t/ha and the annual average soil erosion induced productivity decline is 2.2% (Hurni, 1993).

Some evidences show that, lack of secure land ownership right becomes one of the main causes for this unsustainable land management practices and thereby to land degradation problem (Giri, 2010; Knox and Meinzen, 1999; Tenaw *et al.*, 2009). However, there are also other research findings which disprove the importance of land security to sustainable use of land (Kahsay, 2011; Tesfaye, 2008).

Recently, Ethiopian government has realized that lack of land security has been affecting sustainable land management practices and it has been trying to promote land conservation by granting certificate to land holders in the country (Tesfaye, 2008; Adenew and Abdi, 2005). Checking the impact of this program on land management practices calls a research. This paper takes a step toward filling this gap by evaluating the improvement gains on the adoption of soil conservation practices associated with the program.

2. Literature review

Theoretical Review

Deininger (2003) and Besley (1995) briefly explained that property rights affect economic growth in different ways. First, formalized land use rights enhance tenure security which promotes long-term investment in land. Farm households' investment that enhances the long-term viability of agricultural production depends significantly on the expectations regarding the length of time over which the farmers might enjoy the benefits which mostly are long-term (Ghebru and Holden, 2008). Second, land entitlement may reduce an ownership uncertainty which improves smooth functioning of the land market. This ultimately increases farm level efficiency as factor-ratio adjustment can now be channeled through land markets. And third, it facilitates access to (informal) credit or informal collateral arrangement which may remove liquidity constraints and enable farmers to use the appropriate variable inputs that increase farm level efficiency.

Empirical Review

Kabubo-Mariara (2006), Tefera and Holden (no date), Mwakubo (2002), and Birungi and Hassan (no date), Holden, Deininger and Ghebru (no date) are some of the researchers who conducted researches to investigate the link between land security and land management practices. Their findings show that security of tenure is indeed important for the adoption of land conservation practices.

On the contrary some studies have shown that tenure security (land certification) has not significant impact on soil conservation practices. Kahsay (2011) and Tesfay (2008) conducted a research to investigate the effects of land tenure system on soil conservation practice. Their studies proved that land tenure security (certification) is not a factor in farm households' decisions to adopt soil conservation practices.

Despite the theory, evidences from those researches indicate that the link between tenure security and investment on soil conservation activities are contradictory and inconclusive.

3. Research methodology

Sampling Methods

The first step in the sampling procedure involved selecting study villages based on purposive sampling so as to get relatively large number of uncertified household sample size. The second step involved selecting the sample households randomly from the two purposely selected villages to arrive at the total number of households which were visited. Finally, 250 households, with 921 plots, were selected in these two villages.

Data Collection Methods

The main data collection method is questionnaire survey. Structured questionnaires were used to collect household and plot level primary data from the sampled households and their plots. The questionnaires were designed to fit into the objectives of the study. Before finalizing a questionnaire, discussion was done with a local supervisor so as to refine them. Pre-testing of the questionnaire was conducted in order to check its reliability and validity.

Methods of Data Analysis

Propensity score matching techniques were used to construct a matched control sample of uncertified farms that are very similar to the certified farms in terms of observable characteristics. The impact of certification on soil conservation practice is the difference of the average value of investment on soil conservation practice between certified and the matched uncertified plots. This can be presented by the following equation.

Let Ch denotes the dummy variable such that $Ch = 1$ if the h^{th} house hold is certified and $Ch = 0$ if the h^{th} household is uncertified. And let $Yh = 1$ and $Yh = 0$ represents the values of long run investment on soil conservation for certified and uncertified households. X represents a set of observable characteristics believed to affect both program participation and the outcome. Then the mean impact on the treated; Average Treatment effect on the Treated (ATT) can be written as;

$$ATT = E[Yh(1)/X, Ch = 1] - E[Yh(0)/X, Ch = 1]$$

However, only $E(Y_h(1)|Ch = 1)$, the average outcomes of the treated conditional on being in a treated area, and $E(Y_h(0)|Ch = 0)$, the average outcomes of the untreated, conditional on not being in a treated area, are observed. The missing data here relates to the counterfactual mean, $E(Y_h(0)|X, Ch = 1)$. We use the mean outcome of the untreated $E(Y_h(0)|X, Ch = 0)$ as a proxy for the above counterfactual mean.

Different methods are used to match the certified and the uncertified land on the basis of the propensity score. In this paper, stratification and kernel matching methods were used. To check whether the mean difference in propensity score and covariates in each block have been eliminated, the paper used the balancing test.

If there are unobserved variables that simultaneously affect the decision to obtain the certification and the outcome variable, a selection or hidden bias problem due to unobserved variables might arise. In this study Rosenbaum bounds were calculated to check the sensitivity of our results to the failure of the assumption of endogeneity is not a problem (Kassie, Zikhali, Pender, and Köhlin, 2011).

Specification of Variables

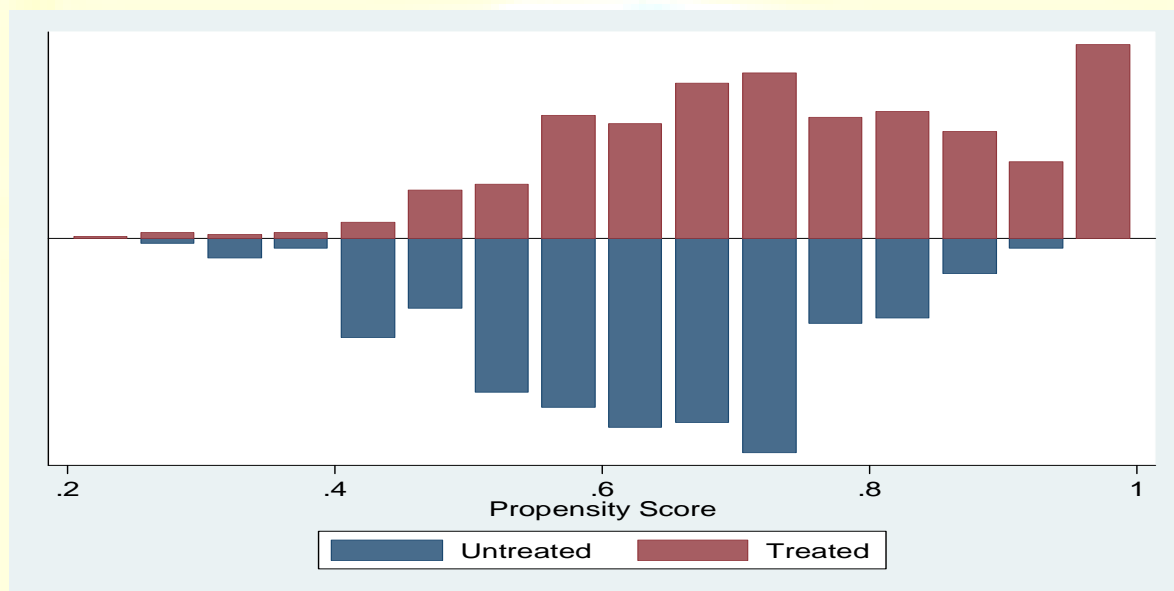
The variables of this study can be categorized into dependent variables (outcome variable), treatment variable and independent variables (observable characteristics). The dependent variables are soil conservation practices which include stone terrace, soil bund, stone-soil bund, cutoff drain and tree plantation. The treatment variable is certification and the independent variables include factors which are expected to affect both the probability of getting the treatment (certification) and investment on soil conservation practice.

4. Result and discussion

Estimation of the Propensity Scores and balance tests

The basic reason behind using propensity score matching (PSM) is to match certified plots with uncertified ones to create two identical groups of plots. It shows that the balancing property between these two groups is satisfied.

Existence of good common support must also be satisfied for validity of PSM. The graph shown proves the existence of this good common support.



Using different matching techniques, the following sections estimate the average difference of investment on soil conservation practices between the treatment group and the matched control group.

Impacts of Land Certification on Stone-Terrace

The result of stratification matching method shows that land certification does have a significant positive impact on stone-terrace investment. The average effect of the treatment on stone terrace is 21.4 percent. Positive impact of certification on stone terrace at one percent level of significance was obtained by Kernel matching method. There is 18 percent increase in soil terrace investment due to certification (table 1).

Table 1. ATT estimation with Different Matching Methods for Stone-Terrace

Matching method	No. of certified plots	No. of uncertified plots	ATT	Std. Err.	t
Stratification Matching	655	266	0.214	0.029	7.257
Kernel Matching	655	266	0.180	0.038	4.666

Impacts of Land Certification on Soil Bund

Using the previous matching methods the average treatment effect on soil bund has been estimated. The result of stratification method indicates that certification significantly increase this conservation practice at 1 percent significance. The lever of soil bund practice is 12.5 percent higher for certified plots. Like other matching method the result of kernel matching also shows significant positive impact of certification at 1 percent significance. Certified households makes 12.5 percent higher soil bund investment on their plot (table 2).

Table 2. ATT estimation with Different Matching Methods for Soil Bund

Matching method	No. certified plots	No. uncertified plots	ATT	Std. Err.	t
Stratification Matching	655	266	0.125	0.017	7.188
Kernel Matching	655	266	0.125	0.016	8.034

Impact of Land Certification on Stone-Soil Terrace

Stone-soil terrace is one of the commonly used soil conservation techniques. The results of different estimators show that ATT is positive and significant at 1% level of significance. Investment on stone- soil terrace is 13.2 percent and 12.1 percent higher among certified using stratified and kernel matching methods, respectively(table 3).

Table 3. ATT estimation with Different Matching Methods for Stone-Soil Terrace

Matching method	No. of certified plots	No. of uncertified plots	ATT	Std. Err.	t
Stratification method	655	266	0.132	0.082	4.751
Kernel method	655	266	0.121	0.029	4.188

Impacts of Land Certification on Cutoff Drain

The regression result shows that land certification does not have significant impact on cutoff drain practice in both matching method (table 4).

Table 4. ATT estimation with Different Matching Methods for Cutoff Drain

Matching method	No. of certified plots	No. of uncertified plots	ATT	Std. Err.	t
Stratification method	655	266	-0.028	0.104	-0.266
Kernel method	655	266	0.022	0.042	0.512

Impact of Land Certification on Tree Plantation

Tree plantation is one of soil conservation methods practiced by farmers. To evaluate the impact of land certification on tree plantation, the researcher follows similar matching methods. The result of the t- statistics shows that certification has insignificant impact on tree plantation (table 5).

Table 5. ATT estimation with Different Matching Methods for Tree Plantation

Matching method	No. of certified plots	No. of uncertified plots	ATT	Std. Err.	t
Stratification method	655	266	0.024	0.022	1.067
Kernel method	655	266	-0.003	0.035	-0.096

Sensitivity Test

The sensitivity test results of Mantel-Haenszel's bound (mhbounds) show that endogeneity is unlikely to change the ATT for stone terrace, soil bund, stone-soil terrace and tree plantation, but it is likely to change results for cutoff drain practice.

5. Conclusion

The findings of this research proved that certification significantly increases soil conservation investment on stone-terrace, soil-bund, and stone-soil terrace and it has insignificant impact on tree plantation. However, it is difficult to make a correlation between certification and cut of drain practice. Because, the sensitivity test shows that cutoff drain practice is sensitive to unobservable factors.

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