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The Land Certification Program and Off-Farm Employment in Ethiopia

Mintewab Bezabih Ayele and Eyerusalem Siba

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Abstract

Strong property rights have long been touted as key to increased performance of the rural economy in developing countries. Indeed, in an overwhelmingly agrarian economy like Ethiopia, with state ownership of land, increased land tenure security of individual farmers is expected to play a significant role in factor allocation within and beyond the agricultural sector. This paper analyses the impact of a land certification program on farmers' off-farm participation, based on household-level panel data collected in the Amhara Region of Ethiopia. Identification of the program's impact relies on the sequential nature of its implementation and application of the Difference-in-Differences strategy. Our results suggest that certification is a significant determinant of participation in major off-farm employment activities. The program's effect is not shown to depend on size of landholdings.

Key Words: off-farm employment, land certification, farm size, Ethiopia

JEL Codes: Q15, Q18, C35

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The Land Certification Program and Off-Farm Employment in Ethiopia

Mintewab Bezabih Ayele and Eyerusalem Siba*

1. Introduction

Small-scale agriculture is a major employer in many poor countries. Ethiopia is no exception. The heavy dependence on small-holder and low-productivity agriculture makes a large share of the population vulnerable to weather and production-related shocks. Land certification has been one strategy to increase productivity. In addition, diversification of livelihood, particularly toward off-farm activities, has been suggested as a means of reducing vulnerability, as well as transforming the overall economy (Ellis 2000; Barrett et al. 2001; Lanjouw and Lanjouw 2001). This paper evaluates the extent to which a land certification program in Ethiopia impacts participation in off-farm employment of rural households in the central highlands of Ethiopia. Knowing this would inform policymakers concerning the welfare gains from land right reform programs as a result of efficient allocation of land and labor resources to more productive use, and could reduce private efforts to guard land rights as well as improve the general effectiveness in promoting structural transformation and improved land rights.

Participation in off-farm activities may be driven by both push and pull factors. Households may be pushed into alternative livelihoods due to food insecurity, for example, or pulled into such activities due to demand from other sectors.[1] A household's ability and need to engage in off-farm activities thus depends to a large extent on its endowment of labor, land and other productive resources (Woldehana and Oskam 2001; Holden et al. 2004; Shi et al. 2007). Farmers' ability to participate in off-farm

* Mintewab Bezabih Ayele, London School of Economics, email: mintewab.bezabih@port.ac.uk. Eyerusalem Siba, Brookings Institute.

[1] In settings where farming is associated with low profits and high risk, "distress-push" diversification may motivate off-farm participation. In such instances, the non-farm sector serves as insurance against diminishing returns to assets and as risk management in the agricultural sector (Barrett et al. 2001; Block and Webb 2001; Rijkers and Söderbom 2013). Diversification due to "demand-pull" factors, on the other hand, is often motivated by seasonal and interpersonal aggregation of household income and consumption, as well as economies of scope in livelihood diversification (Davis 2003). In addition, participation in off-farm employment may depend on the ability to participate, e.g., human and physical capital endowments (Woldehana and Oskam 2001; Van den Berg and Kumbi 2006; Bezu and Barrett 2012).

employment may also be determined by the level of tenure security, because in settings where the land ownership system is characterized by tenure insecurity, leaving the farm may be associated with a risk of losing the land (Do and Iyer 2008; Deininger et al. 2008; Field 2007; Jin and Deininger 2009; De Janvry et al. 2015; Deininger et al. 2015).

Ethiopia's current land tenure system makes for an ideal case to study the effect of improved tenure security on off-farm participation, for two main reasons. First and foremost, the land rights for Ethiopia's farming masses have been associated with inherent tenure insecurity, partly caused by the fact that farmers hold only usufruct rights to land and all land is formally owned by the state (Crewett et al. 2008). Second, the country has recently implemented a land certification program aimed at reducing tenure insecurity resulting from the system of usufruct land rights.

Accordingly, the central hypothesis of this paper is that land certification enhances tenure security, which in turn enhances participation in off-farm employment. Tenure security may affect incentives to engage in off-farm activities, both directly and indirectly. The direct effect consists mainly of a reduction in the expected cost of being away from the land (i.e., a reduction in the risk of land loss through redistribution).[2] The indirect effects operate via farm-level intensification, such as investments in soil conservation (Holden et al. 2009; Deininger et al. 2011; Goldstein et al. 2015) and increased use of external inputs (Holden and Yohannes 2002) and land consolidation (De Janvry et al. 2015). While the direct effect is expected to be positive, farm-level intensification may affect off-farm participation both positively and negatively. On the one hand, farming intensification may lead to an increased need for labor on the farm, and this naturally reduces the amount of labor available to engage in off-farm activities (either due to own-farm intensification or due to land consolidation by other farmers). For instance, Deininger et al. (2015) find that land rental markets transfer land to land-poor, labor-rich and more productive producers in six Sub-Saharan African countries. If investment in the farm increases efficiency, on the other hand, this may free up labor for participation in off-farm employment.

[2] If off-farm activities are interpreted as a signal of excess landholdings by the government, and if the government has the right to redistribute land, farmers may avoid productive off-farm activities. If land certification reduces the insecurity related to being away from the farm, we thus may expect an increase in productive off-farm engagements, as individuals would no longer be constrained by the repercussions of tenure insecurity.

Our study is closely related to a few previous studies investigating the association between tenure security and non-farm employment (Jin and Deininger 2009; Zhang et al. 2004; Deininger et al. 2012 on China; Deininger et al. 2008 on India; and Do and Iyer 2008 on Vietnam).[3] Using a household panel dataset, Jin and Deininger (2009) investigate the contribution of a land rental market to occupational diversification, where the likelihood of renting out land is associated with income diversification and migration in China. The positive relationship between off-farm employment opportunities and the likelihood of renting out land is also found in Zhang et al. (2004). Exploiting cross-state variation in land rental restrictions, using a household panel dataset, Deininger et al. (2008) find that the land rental market is more active in locations with high levels of non-farm activities in India.[4]

Unlike the above studies, our study is primarily interested in non-farm employment as an outcome variable and employs a measure of tenure security that is more general than increased rental markets, which is only one of the many outcomes of land certification programs.

The study most closely related to ours is by Do and Iyer (2008) and De Janvry et al. (2015), who investigate the impact of a land certification program using the DiD approach. As in our study, their identification strategy relies on the non-uniform timing of the land certification program across these countries. While Do and Iyer (2008) find an increase in the time spent on non-farm activities and in the proportion of cultivated area devoted to multi-year crops (i.e., their measure of long-term agricultural investment) in Vietnam, De Janvry et al. (2015) find increased likelihood that households will have a migrant member, despite no change in total cultivated land area due to land consolidation, in rural Mexico. Both of these results support the hypothesis that land tenure security facilitates efficient allocation of land and labor resources to their efficient use. Our study adds to the literature because the role of tenure security for off-farm employment participation is largely overlooked in the African literature. While Do and Iyer (2008) estimate extensive margins, using the share of non-farm labor in total

[3] Similarly, Field (2007) show that land titles increased labor supply in urban Peru as a result of reduced need for guard labor. Moreover, De Janvry et al (2015) find that land certification program in Mexico during the period 1993-2006 led to increased migration (reportedly for work reasons) from rural areas.

[4] Lohmar (1999) also found that tenure insecurity, as measured by percentage of households with land changes due to village-wide relocation, is negatively associated with the probability of participation in off-farm activities.

household labor, our results estimate intensive margins, using the information whether or not a household has any member participating in paid off-farm activities.

In this empirical study, we use survey data obtained from the Amhara National Regional State of Ethiopia, containing information on household-level off-farm employment participation, to estimate the effect of the land certification program on off-farm participation. We further analyze the heterogeneity of the treatment effect by farm size and availability of adult labor. The empirical strategy follows the Differences-in-Differences method widely employed in impact assessment studies and exploits the gradual implementation of the certification program. Our results indicate that off-farm activities are positively responsive to land certification, with around an 80 percent chance of increasing off-farm participation. In addition, the program's effect on participation is found not to be heterogeneous across land holders of varying size.

The rest of the paper is organized as follows. Section 2 provides background information on the development of land tenure policies and the certification program in Ethiopia. Section 3 provides information on the datasets used for the analysis and discusses descriptive evidence. Section 4 provides a methodological discussion on the estimation strategy and presents the econometric models used. Baseline results together with their robustness checks are presented in Section 5. Finally, Section 6 concludes and discusses policy implications of the study.

2. The Land Tenure System in Ethiopia and the Land Certification Program: Background

2.1. Evolution of Land Tenure Policies in Ethiopia

Under the feudalistic system characterizing Ethiopia's political and economic landscape until 1975, the elite held all land and farmers' tenure security hinged upon the quality of tenant-landlord relations. The feudalistic system was ended and replaced by a socialist state (Derg) in 1975 with the overthrow of Emperor Haile Selassie. Under the Derg, all land was nationalized and redistributed to farmers via peasant associations.[5] Eligibility and access to land was contingent on a physical presence on the land. Land rights were defined on a usufruct basis with no transfer rights to sell, lease, mortgage or

[5] Peasant associations were local-level administrative organs mandated to handle land-related matters during the Derg regime.

sharecrop.[6] Due to increasing population pressure, government land redistribution was frequently implemented, and the maximum landholding per family was set at ten hectares. Taken together, the system was characterized by a very high level of tenure insecurity, including a ban on land rental activities that is believed to have effectively prevented any migration or pursuit of alternative livelihoods for rural landholders (Kebede 2002; Adenew and Abdi 2005).

In 1991, the Derg was overthrown and replaced by the Ethiopian People's Revolutionary Democratic Front (EPRDF). The 1995 constitution introduced a few improvements in tenure security, e.g., a requirement that a farmer exposed to expropriation have the right to compensation for any investments made on the land and an extension of the time farmers were allowed to lease out land. However, the new government, to a large extent, maintained the land policy of the Derg: land was defined as public property, which farmers were forbidden to sell or to use for other means of exchange, and farmers were required to leave the land if it was needed for public purposes. As a consequence, the 1995 constitution is believed to have only partially resolved the tenure insecurity problems of rural land holders (Adenew and Abdi 2005).

In an effort to enhance tenure security and improve utilization of land, further steps were taken by the federal and regional governments of Ethiopia. In particular, the Rural Land Administration and Use Proclamation was drafted in 1997 (and revised in 2005 by the Ministry of Agriculture and Rural Development) to give farmers who hold title certificates the right to pass land rights on to their family members, to lease out plots to other farmers and investors based on the land administration rules without being displaced, and to use land as collateral (Adenew and Abdi 2005). In 2002, the regional states received greater legislative powers, enabling them to form their own land-related policies, and new regional structures for land administration (such as the Environmental Protection Land Use and Administration Authority, EPLUA) were established. The main objectives of the certification program were to improve tenure security through land registration and titling, to promote better land management and investment, and to reduce conflicts among farmers over land boundaries and user rights.

[6] Transfer via inheritance was allowed, but only to immediate family members and only if permission from the peasant association had been acquired.

2.2. The Land Certification Program in Ethiopia

The Ethiopian land certification program commenced in the Amhara region in 2003/2004. The program is a variant of the land legislation programs that many African countries have been implementing since the 1990s to remedy some of the perceived shortcomings of existing systems. It differs from traditional land reform programs in terms of the relatively low cost of implementation and the participatory nature of the program. By 2007, over 5 million farm households are believed to have received certificates to their land holdings in four regions of Ethiopia (Deininger et al. 2011; Adenew and Abdi 2005).[7] The cost has been estimated to be about 1 USD per farm plot or 3.5 USD per household (Deininger et al. 2008). Given that conventional titling cost up to about 150 USD per household in Madagascar (Jacoby and Minten 2007), the Ethiopian program indeed can be argued to be low-cost.

The implementation of the program is conducted through Land Administration Committees (LACs) at the *woreda*[8] level in five distinct steps. First, an awareness-raising meeting regarding the purpose and organization of land registration and certification is conducted between the *woreda* and *kebele* administration and farmers. In the second step, Land Administration and Use Committees (LACs) are elected and trained. During the third step, individual households' plots are identified and demarcated jointly by LAC members, the designated household and households with neighboring fields. In the fourth step, the registration information is entered on forms and any outstanding conflict is passed to courts; the result of the land adjudication is then presented to the public for a month-long verification in order to allow for corrections. In the final step, the book of holdings is registered. The legal status of the holding is registered by the woreda's EPLAUA head, together with the LAC chairperson. Certified households are provided with a document which typically includes the names and photographs of the household head and spouse, the size and location of the land holding, and the neighbors of the demarcated land of the household (Adenew and Abdi 2005; Olsson and Magnérus 2007; Palm 2010).

The certificates provide farmers with written user rights to demarcated pieces of land. Essentially, the certificates provide titling short of full-fledged ownership. As

[7] Tigray, Oromia and SNNP are the other regions covered by the certification program.

[8] The kebele is the smallest administrative unit in Ethiopia, while the woreda is the next largest, formed of a collection of kebeles.

indicated by Holden et al. (2011) and Bezabih et al. (2016), the certification significantly increased land rental activities. In an ongoing study, Bezabih et al. (2016) also show that certification has the effect of increasing internal migration. Transferability of land across families remains unaffected, as in the previous regimes land bequeathing and dividing up of land among family members was practiced. While the certification allows long-term leasing of up to 25 years, there is no provision for sale, and the inability to transform land to a liquid asset reduces its usefulness as collateral.

Previous impact evaluation studies of the certification program indicate that the program has boosted farmers' perceptions of tenure security and has improved land rental market participation of female-headed farm households (Bezabih et al. 2016). The program's impact has been assessed in relation to agricultural productivity (Holden et al. 2009; Deininger et al. 2011; Bezabih et al. 2016) and land-related investments such as soil and water conservation (Holden et al. 2009; Deininger et al. 2011). However, to our knowledge, no study has previously analyzed the extent to which the land certification program has affected rural households' participation in off-farm activities.

3. Data and Descriptive Statistics

To implement the analysis, we use panel data constructed from rural household surveys, collected during the 2000, 2002, 2005 and 2007 cropping seasons.[9] The surveyed households are located in two zones (South Wollo and East Gojjam) of the Amhara National Regional State, a region that encompasses part of the northern and central highlands of Ethiopia. The choice of the two zones is intended to reflect the agro-ecological diversity within the region, with East Gojjam having high agricultural potential and less rugged topography, and enjoying a more reliable rainfall pattern, than South Wollo.

The rural household survey was designed independently of the implementation of the certification program, and therefore includes households that were covered by the certification program and those that were not. The last round of the survey, conducted in

[9] This multi-year survey was conducted by the Ethiopian Development Research Institute and Addis Ababa University, in collaboration with the University of Gothenburg, and with financial support from the Swedish International Development Cooperation Agency (Sida) since 2000. In addition to these institutional bodies, the last survey round in 2007 was conducted in collaboration with the World Bank. Futhermore, the last two rounds of the survey include two more kebeles from each of the two zones.

2007, was designed to gather information on the features of the certification program that enable analysis of the impact of the program on different variables of interest.

By the time the fourth round was conducted in 2007, all of the kebeles had completed the registration process and, with the exception of a few kebeles, most households had received the certificate. We start the analysis using the 2000 survey round as our baseline. As a robustness check, we also use 2005 as a baseline and restrict the sample to include only the last two rounds, though there are shortcomings to using the 2005 round as a baseline survey.[10]

The sample consists of a panel of 1500 households (for 2000 and 2002 survey rounds) randomly selected in 12 kebeles and 1740 households (for the 2005 and 2007 survey rounds), with two more kebeles.[11] The survey contains detailed information on off-farm employment participation and socioeconomic and physical farm characteristics, as well as land certification. The construction of the certification, off-farm employment and other explanatory variables are discussed below.

3.1. The Certification Variable

The certification program is characterized by a gradual rollout, where certification in each kebele occurs in a rapid campaign style. The gradual rollout implementation was adopted because the initial plan of simultaneously reaching all woredas (and kebeles) within the region could not be realized.[12] Our measure of certification is defined at a kebele level, where a household is considered "certified" if that particular household belongs to a certified kebele. A given kebele is considered certified if the initial

[10] As the implementation of the land certification program had already started in some of the study kebeles by 2005 (Deininger et al. 2011), the choice of 2005 as a baseline may, thus, lead to attenuation bias as the program had already started to take effect. Alternatively, it could upward bias the results if early adopters were negatively impacted. This can happen due to the time lag between land registration and distribution of certificates (Deininger et al. 2011).

[11] A total of 5013 observations were employed in the analysis after accounting for missing observations and observations corresponding to measurement errors corresponding to some variables, which had to be dropped.

[12] This is reported to be due to shortages in financial and manpower resources to reach all kebeles and woredas simultaneously. Hence, instead of simultaneous reach-out, it was decided that kebeles and woredas would be reached sequentially. Informal conversations held with EPLUA officials, the body responsible for the implementation of the program, confirmed that the sequential implementation was done on a random basis. Moreover, because the kebeles included in the survey were randomly selected within each zone, the kebeles certified earlier belong in the same random group as those certified later.

demarcation of fields in the kebele by the land administration committee was completed at least 12 months before the last round of the survey in 2007 (Deininger et al. 2011). The essence of this is to ensure that sufficient time has elapsed for the effects of the program to be realised. As the issuance of the certificates in many cases takes 15 months to two years starting from the time the program was introduced (Deininger et al., 2011), having a cut-off of 12 months is actually a much longer period than that if the initiation period were accounted for. As a results, the estimates would represent the lower bounds of the program impact.

3.2. Participation in Off-Farm Activities

Participation in off-farm activities is a binary variable, which represents the outcome of participation in any off-farm employment activity. The variable takes the value of one if any members of the household engage in any off-farm activity, and the value zero if there was no participation in any such activity.[13] To dig deeper into the nature of off-farm employment, activities are grouped into six categories. The first two categories include *farm worker* (paid agricultural activities on other people's farms) and *free worker* (labor-sharing arrangements where people contribute labor freely but also expect the favor back in terms of labor contribution). The third category, *professional work (skilled)*, includes teaching, mechanics, driving, clerical jobs, administrative work, health work, building and crafts making. In the fourth category, *unskilled* off-farm activity includes household help, shop keeping, security guard, and other miscellaneous activities. The fifth category is *food-for-work* – a program where participants are involved in public infrastructural development such as building conservation structures, dry-weather roads, or tree planting, and are paid in kind. Food-for-work is widely practiced in the more food-insecure zone of South Wollo. Further, because it is a targeted intervention, only the poorest of households are likely to participate in it. The 'other' miscellaneous categories are also not associated with actual payment but are usually non-

[13] The share of off-farm income in household income could serve as an alternative measure of off-farm participation, allowing for estimation of extensive margins. However, household income from all sources is not consistently reported in all the four rounds of our dataset (i.e., income is reported in cash in some cases and in kind in other cases) and income from some sources (remittances) are missing for some rounds. For these reasons, we do not use share of income from off-farm activities as a dependent variable.

agricultural jobs (e.g., priesthood).For our purpose, however, we exclude all unpaid off-farm activities such as labor sharing arrangements (*Free worker*).[14]

Table 1 presents the distribution of individuals across different off-farm activities for the pooled, treatment and control categories, based on observations in the years 2000, 2002, 2005 and 2007. As Table 1 shows, around 20 percent of the households had a household member engaged in off-farm activities in the major off-farm categories which we refer to as paid off-farm employment. The mean difference results show that engagement in traditional labor sharing and food-for-work activities is significantly higher for the treatment groups. For all the other off-farm employment types, there is no significant difference between the treatment and control groups of households.

Around 49 percent of the households participate in traditional labor sharing activities, while 12 percent are in food-for work activities and 11 percent belong in the unskilled work category. The rest, skilled work, paid agricultural work, and other work, account for 4 percent, 2 percent, and 1 percent, of off-farm employment, and can be considered as minor categories. The difference between control and treatment villages is significant in traditional labor sharing, unskilled work and food for work categories.

3.3. Other Control Variables

The relevant summary statistics for our control variables are presented in Table 2. The first panel of the table contains summary statistics for the pooled sample, while the second and third panels depict statistics for certified and non-certified villages, respectively. The statistics presented are for the baseline year (2000).

As can be seen in Table 2, the average age of the household head in the sample is about 32. 13 percent of the surveyed households have a female head of household. The share of female-headed households is slightly higher in treated villages (16 percent) compared to non-treated villages (14 percent). About half of the households have an illiterate household head (53 percent and 54 percent in certified and non-certified villages, respectively). Households have, on average, two females and two males of working age (above 15 years) and 4.6 livestock (tropical livestock units).

[14] However, we include food-for-work in the analysis because the Productive Safety Net Programme (which has now replaced food for work in Ethiopia) is shown to contribute to welfare increases for some households (Andersson et al. 2011; Berhane et al. 2014).

Because physical farm characteristics may influence labor demand on the farm, we also include variables related to soil and land. As can be seen in Table 2, the average land holding per household is 1.2 hectares. On average, the share of fertile plots is about 0.31, and the share of plots with fertile soil is slightly and significantly higher for certified households than for non-certified households. However, there is no significant difference in the size of the farm between certified and non-certified households.

4. Empirical Strategy

In order to estimate the effect of the certification program on engagement in off-farm activities, we employ the Differences-in-Differences (DiD) method. The DiD method is suitable for identifying the effects of a random program intervention when there is information on the variables of interest before and after the introduction of the program.[15] Such a program typically targets a certain group of individuals (treated group), while the remaining group of individuals (control group) is not exposed to the program (Wooldridge 2002). In our case, the approach measures the impact of the land certification program by comparing the change in off-farm participation and off-farm activity choice of households in certified kebeles (treatment group) with the corresponding change for households in non-certified kebeles (control group).

The hypothesized relationship between certification and participation in off-farm employment is represented by Equation (1).

$$\Pr(R_{it} = 1) = \alpha_o + \alpha_1 P_i + \alpha_2 T_t + \alpha_3 P_i * T_t + \alpha_4 X_{it} + \alpha_i + \varepsilon_{it} \qquad (1)$$

where $R_{it}$is a dummy variable identifying the respondent household i's off-farm participation status at time t. $P_i$is a dummy variable identifying whether or not the respondent household is located in a treated kebele. T_t represents a time dummy equal to one for the post-program period and zero otherwise. The coefficient of the interaction variable $P_i * T_t$, referred to as the *post-treatment* variable in subsequent sections and the results tables, thus captures the impact of certification. Finally, X_{it} is a vector of other control variables, including socioeconomic and physical farm characteristics, that have

[15] Other recent identification strategies used include randomized allocation of land titles in Benin to estimate impacts on long-term investments (Goldstein et al. 2015) and a randomized field experiment of land tenure formalization in Tanzania to estimate residents' willingnes to pay for land titles.

potential effects on off-farm participation; α_i represents time-invariant household-specific characteristics; and ε_{it} denotes the error term.

The parameters of interest in Equation (1) are α_1, α_2 and α_3. $\alpha_1$represents pre-existing differences in off-farm participation between the treated and control groups in the baseline year, while α_2 represents the change in off-farm participation in the control and treatment villages between the baseline year and 2007. Our major parameter of interest is α_3, which captures by how much the likelihood of off-farm participation changed in the treated villages, as compared to the control group.

We expand Equation (1) to incorporate the potential impact of farm size. The role of farm size is represented by a variable that measures a household's total landholdings and the interaction of farm size with the *post-certification* variable, denoted by F_{it} and $P_iT_t * F_{it}$, respectively. In Equation (2), the direct effect of farm size on off-farm participation is captured by α_4, whereas $\alpha_5 \neq 0$ captures the heterogeneous impact of the certification among holders of various sized farms due to the association between tenure security and farm size.

$$\Pr(R_{it} = 1) = \alpha_o + \alpha_1 P_i + \alpha_2 T_t + \alpha_3 P_i * T_t + \alpha_4 F_{it} + \alpha_5 P_i T_t * F_{it} + \alpha_6 X_{it} + \alpha_i + \varepsilon_{it} \quad (2)$$

The choice of panel data estimator determines how we account for unobserved household-specific time-invariant characteristics, represented by α_i. While the fixed effect estimator enables removal of the unobserved household-specific effect through data transformation, the binary nature of our dependent variable leads to a serious loss of observations. As a result, we follow Mundlak's (1978) approach of incorporating the relationship between the time-varying regressors k_{it} and the household fixed effect (α_i). This approach allows for controlling for unobserved heterogeneity by adding the means of time-varying covariates, also known as the pseudo-fixed effects or the Mundlak-Chamberlain's Random Effects Model. In particular, α_i can be approximated by a linear function:

$$\alpha_i = a\bar{k}_i + \eta_{it}\,, \eta_{it} \sim iid(0, \sigma_\eta^2) \quad (2a)$$

Substituting expression (2a) in Equation (2) gives the estimable Equation (3):

$$\Pr(R_{it} = 1) = \alpha_o + \alpha_1 P_i + \alpha_2 T_t + \alpha_3 P_i * T_t + \alpha_4 F_{it} + \alpha_5 P_i T_t * F_{it} + \alpha_6 X_{it} + a\bar{z}_i + \psi_{it} \quad (3)$$

4.1. Randomness of Treatment and Control Kebeles and the Common Trend Assumption

The proper identification of the program impacts using the DiD estimator relies on the randomized choice of treatment and control kebeles. In our case, if the choice of kebeles certified early in the process is systematically related to factors that may affect our outcome variable, the measurement of the treatment impact may be biased. In order to evaluate the degree of randomness in implementation, we examined the criteria behind the choices. To establish whether the sampling of treated and control kebeles in the survey was random, a simple test was conducted in terms of the difference in the location of kebeles relative to the main road/nearest town. These variables could serve as a measure of remoteness, representing access to information, technology, and markets. Accordingly, the average distance of the nearby town from the treatment and control kebeles is calculated to be 69.5 and 72.5 minutes, respectively, as per our survey data.[16] The average distance from a nearby main road is also about 24 and 37 minutes for the treatment and control kebeles, respectively. These figures provide no indication that the treatment and control kebeles differ significantly in terms of access to information, technology and markets.

The validity of the DiD approach also relies on the assumption of a parallel trend in certified and non-certified kebeles, which could be invalidated by the presence of unobservable time-variant differences. For this, we employ common-trend assumption analysis. The common trend assumption asserts that, in the absence of the treatment, one would expect parallel movement between the treatment and control groups, essentially attributing the effect of changes in the treatment group to the program only.[17]An ideal test for this parallel movement would be to assess whether, in the absence of the program, the trends in the two groups would have been identical. However, this is unobservable, implying that the common trend assumption is fundamentally untestable after the

[16] It should be noted that proximity to roads is a mere indicator of a set of confounding factors that affect the decision to participate in off-farm employment. As we discuss below, the test for the common trend assumption is a more formal way of assessing the randomness in the choice of the treatment and control kebeles. It should also be noted that, given modern telecommunication technology, e.g., internet, social media etc., one may question the role of physical distance, especially in access to information. However, modern communication coverage remains minimal and even those "traditional" types of modern communication such as telephone access remain road-side based.

[17] Violation of the common trend assumption implies that the effect of certification may not be identified because there are underlying factors that cause the variable of interest to respond differently in the control and treatment villages.

introduction of the program. As an alternative, it is possible to test whether there were common trends in the treatment and control villages in the period *before* the introduction of the program. To this effect, we used two methods: comparing the average outcomes after controlling for a range of explanatory variables, and testing for "placebo" effects.

In order to do so, Equation (3) is estimated with different intercept terms for each year and for each treatment category, using data for periods prior to the commencement of the certification program. The presence of parallel trends is supported by the absence of differences in the intercept terms between control and treatment villages over all the periods. The results for the common trend assumption test are presented in Section 5.2.

5. Results

In this section, we present the results of our empirical analysis. We start by discussing the results of the decision to participate in off-farm activities, where the 2000 round is used as a baseline, followed by our findings for the analysis using 2005 as a base year, as a robustness check. The final subsection presents the results of the common trend analysis.

5.1. Off-Farm Employment Participation—Main Results

Table 3 presents the results from the analysis of the off-farm participation equation. We start our analysis by presenting conditional logit estimates of participation in off-farm employment in the first panel of the table (Columns 1 and 2). In the second panel, Columns 3-6, we introduce the Mundlak-Chamberlain's Random Effects Model.[18]

We find that certified households (measured by residing in the treated village and interacted with the period after the introduction of the certification program) are more likely to participate in off-farm employment. The coefficient of certification conditional on farm size, although negative, is not significant (Column 2). Concerning the rest of the covariates, we find that, although there is an increasing trend in participation over time, female-headed households are less likely to participate in the off-farm sector, whereas younger household heads are more likely to participate in off-farm activities. While total land size does not matter for participation, the share of plots with fertile soil is found to

[18] Because we are running a correlated random effects logit (in Columns 3-6), marginal effects are not valid (because they assume that the individual effect is zero). Consequently, Table 3 displays coefficient estimates in all specifications.

increase the likelihood of participating in the off-farm sector. The availability of adult labor is also a significant and positive predictor of participation in off-farm employment. Of all the control variables, households' livestock assets and number of male adults have inconsistent impacts across estimations: significant impact in the random effects estimation and insignificant impact in the Mundlak's fixed-effects estimations.[19]

5.2. Robustness Checks—Common Trend Analysis

To test for any statistical difference in the trend between certification and non-certification households and kebeles, we perform a test of "placebo effects", which enables us to examine whether there appear to be placebo treatment effects amongst households in the treated villages before the program was introduced. We do this by limiting the sample to the pre-certification information in the survey years 2000, 2002 and 2005. In each regression, we use a full set of control variables, kebele fixed effects and Chamberlain-Mundlak effects.[20] The presence of a parallel trend would be indicated by the lack of a significant difference in the estimated coefficient of placebo treatments for the above three years. The presence of a significant difference would be an indication of the violation of the common trend assumption.

The results of the placebo effect analysis are presented in Table 4. As can be seen in Table 4, we do not find significant differences in the placebo coefficients, for all the years, except 2002-2005, which is weakly significant. The results therefore indicate that, overall, these results are supportive of the common trend assumption, and hence, validate causal interpretation of the results. Using the same data as Deininger et al. (2011), Bezabih et al. (2016) also find that the common trend assumption is largely not violated.

6. Conclusions

Given the pivotal importance of the land tenure system in rural economic dynamics, the land legislation programs implemented in many African countries since the 1990s have received due attention in the literature. Specifically, there have been considerable efforts to analyze the effects of such programs on agricultural productivity,

[19] The appendix shows the results from estimations using 2005 as the control year and the results are fairly similar to those in Table 3.

[20] Results of the common trends regressions are presented in the appendix.

land market participation and investment across Africa (e.g., Pinckney and Kimuyu 1994; Jacoby and Minten 2007; Ali et al. 2011).

The Ethiopian Land Certification Program has spurred a considerable amount of research, in particular on the impact of the program on agricultural investment and productivity (e.g., Deininger et al. 2011; Holden et al. 2011, 2012; Bezabih et al. 2016). However, to our knowledge, this is the first paper that assesses the effect of the program on off-farm participation. More specifically, we estimated the effect of the land certification program on participation in off-farm employment, using data from the Central Highlands of Ethiopia. We base our hypothesis on the positive link that has been shown between the land certification program and tenure security (Deininger et al. 2011). Given that tenure insecurity induces aversion toward leaving the land in pursuit of employment activities outside the farm, promoting tenure security could, in many situations, be expected to have positive off-farm employment consequences.

The empirical results emanating from the panel logit off-farm participation model suggest land certification has a positive impact on the tendency to engage in off-farm work. These results remain robust across different specifications and cut-off years for the implementation of the program. The results, however, provide little support for the presence of heterogeneous effects of the certification program depending on farm size.

While the paper is the only study to assess the impact of the program on activities outside of agriculture, there is a need to take further strides to fully understand the role of such institutions in influencing the generation of dynamic off-farm activities as a pool factor. Specifically, in the face of the critical role that institutional structures play in transforming agricultural landscapes and overall economic development, an obvious research next step is to characterize, both theoretically and empirically, the nature of non-farm activity generation and its interactions with institutional reforms, such that the conditions for positive and negative interactions are clearly understood.

As discussed in various sections, the lack of variation in off-farm participation patterns across years has limited our ability to use various estimators and necessary corrections for the estimated coefficients. Another shortcoming is the fact that we do not use off-farm income shares or extensive analysis of off-farm activity choice in our analysis, as opposed to just participation in off-farm employment, all due to data limitations. As Ethiopia is a country with low mobility and very weak off-farm sectors, such lack of variation is expected. Further, the fact that our sampling only covers two zones in one region also contributes to the lack of heterogeneity. Future studies which rely on longer panels and larger spatial coverage will increase flexibility in the use of data-intensive estimators and flexible use of variables.

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Tables

Table 1. Descriptive Statistics—Off-Farm Participation for All the Survey Rounds

	Pooled		Control		Treatment			
	Mean	Std.dev	Mean	Std.dev	Mean	Std.dev	Diff	p-value
Paid off-farm	0.200	0.400	0.213	0.006	0.175	0.008	-0.175	0.038
Individual activities								
Agricultural work (paid)	0.020	0.140	0.018	0.133	0.021	0.142	-0.003	0.694
Traditional labor sharing (free)	0.494	0.500	0.320	0.467	0.546	0.498	-0.226	0.000
Skilled work	0.040	0.196	0.036	0.186	0.041	0.199	-0.005	0.574
Unskilled work	0.111	0.314	0.153	0.360	0.099	0.299	0.054	0.000
Food for work	0.116	0.320	0.016	0.126	0.145	0.352	-0.129	0.000
Other work	0.012	0.110	0.014	0.119	0.012	0.107	0.003	0.606
N	5169		3359		1810			

Note: Paid off-farm represents participation in off-farm activities, including all off-farm activities reported in the survey and listed in the individual activities categories, other than traditional labor sharing.

Table 2. Descriptive Statistics of the Explanatory Variables Used in the Regressions for the Baseline Years (year=2000)

	Pooled		Control		Treatment			
	Mean	Std.dev	Mean	Std.dev	Mean	Std.dev	Diff	p-value
Household characteristics								
Age of head of household	31.58	17.68	31.47	17.75	31.92	17.50	-0.447	0.7154
Female head of household	0.151	0.335	0.147	0.301	0.161	0.344	-0.0132	0.5945
N male adults in household	1.561	0.541	1.602	0.973	1.428	0.891	0.173	0.007
N female adults in household	1.424	0.726	1.435	0.747	1.388	0.655	0.0475	0.3460
Household head is illiterate	0.535	0.499	0.533	0.499	0.507	0.501	0.0266	0.4530
N livestock owned by household	4.651	3.580	4.762	4.313	5.172	5.171	-0.409	0.1939
Land characteristics								
Share of land with fertile soil	0.310	0.350	0.331	0.350	0.248	0.295	0.082	0.002
Size of land holdings (ha)	1.119	1.857	1.005	1.668	1.468	1.247	-0.463	0.000
N	1281		965		316			

Note: Similar to the findings by Deininger et al. (2011), for some of the variables, the mean differences between treatment and control groups of households are statistically significant.

Table 3. Decision to Participate in Off-Farm Activities: Random Effect and Mundlak's Fixed Effect Estimators

dependent variable: paid off-farm	Random effects		Mundlak's fixed effects**			
	(1)	(2)	(3)	(4)	(5)	(6)
Hh in the certified village(treatment)			-0.8750***	-1.0117***	-0.8740***	-1.0094***
			(0.2758)	(0.2956)	(0.2758)	(0.2957)
Post_certification (treatment*year_2005)	0.8330*	0.9831	0.8394**	0.8783**	0.9567**	0.9858**
	(0.4898)	(0.6264)	(0.3486)	(0.3498)	(0.4076)	(0.4058)
Post_certification (treatment*year_2007)				0.2554		0.2525
				(0.1927)		(0.1927)
Total land area*post certification		-0.0345			-0.0273	-0.0252
		(0.0422)			(0.0509)	(0.0499)
Year effect_2002	1.8589***	1.8554***	1.8253***	1.8267***	1.8218***	1.8234***
	(0.3700)	(0.3698)	(0.1248)	(0.1248)	(0.1249)	(0.1249)
Year effect_2005	0.1790	0.1720	0.2135	0.2236	0.2059	0.2163
	(0.4171)	(0.4231)	(0.1439)	(0.1440)	(0.1445)	(0.1446)
Year effect_2007	0.5432**	0.5403**	0.5804***	0.5130***	0.5751***	0.5089***
	(0.2300)	(0.2297)	(0.1571)	(0.1656)	(0.1574)	(0.1657)
Female headed household	-0.3945**	-0.3930**	-0.4070***	-0.4105***	-0.4060***	-0.4096***
	(0.1611)	(0.1604)	(0.1268)	(0.1269)	(0.1269)	(0.1269)
Age of household head	-0.0116***	-0.0116***	-0.0119***	-0.0118***	-0.0119***	-0.0118***
	(0.0030)	(0.0030)	(0.0029)	(0.0029)	(0.0029)	(0.0029)
N male adults in hh	0.0617**	0.0635***	-0.0158	-0.0174	-0.0124	-0.0143
	(0.0245)	(0.0245)	(0.0861)	(0.0861)	(0.0863)	(0.0864)
N female adults in hh	0.0952**	0.0954**	0.1513*	0.1519*	0.1525*	0.1530*
	(0.0401)	(0.0401)	(0.0834)	(0.0834)	(0.0834)	(0.0834)
N female adults in hh	-0.0173	-0.0172	-0.0373	-0.0346	-0.0370	-0.0344
	(0.0809)	(0.0809)	(0.0883)	(0.0884)	(0.0883)	(0.0884)

Total land area	-0.0026	-0.0002	-0.0006	0.0003	0.0015	0.0023
	(0.0133)	(0.0151)	(0.0123)	(0.0123)	(0.0129)	(0.0129)
TLU livestock owned	-0.0258**	-0.0258**	0.0139	0.0139	0.0137	0.0138
	(0.0121)	(0.0121)	(0.0165)	(0.0165)	(0.0165)	(0.0165)
Share of plots with fertile soil	0.2433*	0.2431*	0.2096*	0.2031*	0.2103*	0.2038*
	(0.1376)	(0.1378)	(0.1174)	(0.1177)	(0.1175)	(0.1177)
Constant	-1.4199***	-1.4220***	-1.3830***	-1.3687***	-1.3825***	-1.3683***
	(0.2131)	(0.2123)	(0.2059)	(0.2062)	(0.2059)	(0.2062)
lnsig2u						
Constant	-11.5467	-11.5478	-11.5437	-11.5417	-11.5449	-11.5429
	(8846.7480)	(8879.6668)	(13.0603)	(13.0728)	(13.0504)	(13.0633)
Chamberlain-Mundlak effects	NO	NO	YES	YES	YES	YES
Kebele fixed effects	YES	YES	YES	YES	YES	YES
Standard errors clustered at kebele level	YES	YES	NO	NO	NO	NO
chi2	476.0332	2878.6806	612.0964	613.4011	612.3519	613.6018
N	5013	5013	5013	5013	5013	5013

* Significant at 10 percent; ** significant at 5 percent; *** significant at 1 percent.

** We have attempted clustering standard errors at a kebele level for four estimators: logit-fixed effects, conditional logit (which is similar to fixed effects logit), Mundlak' fixed effect logit, and random effects logit. The first two failed because we lost around 2062 observations due to lack of variation in the dependent variable across the different rounds. For Mundlak's fixed effect, wild bootstrapping estimation failed, as we got a warning sign indicating that more than 10 percent of the iterations have failed, along with a suggestion to use a more suitable estimator. Kebele-level clustering for Mundlak's fixed effect was also a problem because the number of variables is greater than the number of clusters and the variance-covariance is not of full rank. The result was that we had a missing chi square and p values corresponding to the Wald test. In other words, we cannot test the hypothesis that all the parameters are jointly zero. The only instance in which we were able to conduct kebele clustering properly was when we did it for the random effects specification.

Table 4. Common Trends Assumption Test

	MAJOROFF-FARM	
	Chi square	p-value
2000-2002	0.06	0.8049
2000-2005	0.84	0.3593
2002-2005	4.45	0.0348

Note: the test statistics and p-values represent the test of the null hypothesis of no common trend. The tests are based on the regression results in Appendix B.

Appendix A. Decision to Participate in Off-Farm Activities Based on Observations from 2005 and 2007

	(1)	(2)	(3)	(4)
paid_off_farm				
_ltreatment_1			-1.6581***	-1.6671***
			(0.3743)	(0.3756)
Post_certification (treatment*year_2007)	1.6452***	1.6343***		1.6428***
	(0.6192)	(0.5913)		(0.2901)
landarea*post_certification		0.0074		0.0104
		(0.0304)		(0.0340)
year_2007	-0.0310	-0.0340	-0.0271	-0.0306
	(0.4453)	(0.4543)	(0.1351)	(0.1356)
Female headed household	-0.3888**	-0.3881**	-0.3959**	-0.3947**
	(0.1708)	(0.1707)	(0.1832)	(0.1832)
Age of household head	-0.0065	-0.0065	-0.0063	-0.0063
	(0.0054)	(0.0054)	(0.0039)	(0.0039)
N male adults in hh	0.0539	0.0534	0.0700	0.0679
	(0.0423)	(0.0433)	(0.1399)	(0.1400)
N female adults in hh	0.0999*	0.0994	0.1349	0.1340
	(0.0599)	(0.0606)	(0.1343)	(0.1344)
N female adults in hh	-0.2064	-0.2069	-0.2263*	-0.2271*
	(0.1498)	(0.1502)	(0.1225)	(0.1225)
Total land area	0.0090	0.0076	0.0093	0.0074
	(0.0096)	(0.0124)	(0.0153)	(0.0168)
TLU livestock owned	-0.0859***	-0.0858***	-0.0435	-0.0435
	(0.0257)	(0.0257)	(0.0351)	(0.0350)
Share of plots with fertile soil	0.3862**	0.3857**	0.2247	0.2222
	(0.1921)	(0.1925)	(0.1720)	(0.1722)
Constant			-1.3760***	-1.3680***
			(0.2715)	(0.2727)
Chamberlain-Mundlak effects	YES	YES	YES	YES
Kebele fixed effects	YES	YES	YES	YES
chi2	185.6089	209.8284	209.8607	209.7480
N	2862	2862	2862	2862

* Significant at 10 percent; ** significant at 5 percent; *** significant at 1 percent.

Appendix B. Chamberlain-Mundlak Pseudo Treatment Regression Results

	(1)	(2)	(3)
PAID OFF-FARM			
Hh in the certified village(treatment)	-2.8841***	-0.9729***	-1.4388*
	(0.7318)	(0.3037)	(0.7857)
Treated, year 2000	0.6949**	-0.4598**	
	(0.2925)	(0.1839)	
Control, year 2000	-0.7504***	0.1263	
	(0.1710)	(0.1189)	
Treated, year 2002	2.6944***		1.9995***
	(0.2620)		(0.2345)
Control, year 2002	1.1009***		1.8513***
	(0.1433)		(0.1523)
Treated, year 2005		-0.1012	-0.6949**
		(0.1812)	(0.2925)
Control, year 2005		-0.3909***	0.7504***
		(0.1225)	(0.1710)
Female headed household	-0.4460***	-0.3991***	-0.4460***
	(0.1569)	(0.1163)	(0.1569)
Age of household head	-0.0189***	-0.0188***	-0.0189***
	(0.0038)	(0.0028)	(0.0038)
N male adults in hh	-0.0100	0.0784	-0.0100
	(0.1077)	(0.0850)	(0.1077)
N female adults in hh	0.1845*	0.0279	0.1845*
	(0.1068)	(0.0820)	(0.1068)
N female adults in hh	0.1088	-0.0440	0.1088
	(0.1083)	(0.0832)	(0.1083)
Total land area	0.0009	-0.0092	0.0009
	(0.0143)	(0.0123)	(0.0143)
TLU livestock owned	0.0236	0.0271*	0.0236
	(0.0185)	(0.0160)	(0.0185)
Share of plots with fertile soil	0.0233	0.4242***	0.0233
	-0.5988**	1.1398***	-1.3492***
Chamberlain-Mundlak effects	YES	YES	YES
Kebele fixed effects	YES	YES	YES
	(0.2449)	(0.1935)	(0.2445)
chi2	546.2864	388.7513	546.2864
N	3484	3584	3484

* Significant at 10 percent; ** significant at 5 percent; *** significant at 1 percent.