# Allocation of Land Tenure Rights in Tigray: How Large Is the Gender Bias?

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ABSTRACT. *This study investigates gender differences in land ownership and use in northern Ethiopia. Female-headed households have 23% smaller owned landholdings and 54% smaller operational landholdings. Household endowments of nonland productive inputs are important, but decomposition analysis shows that differences in observable characteristics such as labor and oxen explain less than half of these differences, whereas the remaining differences can be attributed to differences in returns to these characteristics. The latter suggests a gender bias in land allocation. The main policy recommendation is to strengthen women's opportunities to cultivate their land and continue the process of securing women's tenure rights.* (JEL Q15)

## I. INTRODUCTION

This paper analyzes if and how household headship determines the allocation of tenure rights to arable land in Tigray, in the northern highlands of Ethiopia. Worldwide, women have less access to land compared to men (World Bank 2011), and the same is true in Ethiopia. Although many studies find that female-headed households have smaller landholdings, this paper takes the analysis a step further by decomposing the difference into what can be explained by differences in land availability and observable household characteristics and endowments and what can be explained by the returns to these characteristics and endowments. The differences in returns to characteristics and endowments can be defined as gender bias. The analysis suggests that less than half of the observed difference in landholdings between male- and female-headed households can be attributed to differences in observables.

Widespread social perceptions of women as dependent and men as breadwinners is one reason why men are often seen as the legitimate claimant of land (Agarwal 2003). According to Agarwal (1994a), the gender gap in the control and ownership of property is the main contributor to the gender gap in social status, empowerment, and economic well-being. Investigating what drives the differences in the allocation of tenure rights to land is therefore key to understanding and correcting differences in these outcomes.

In Ethiopia, all land is formally state land, and households have been allocated land on which they are granted limited tenure rights in the form of usufruct rights for the purpose of sustaining a livelihood. The Ethiopian land reform was implemented in the Tigray region in the late 1990s. It aimed to secure access to arable land for peasants without differentiation between genders and to improve tenure security by issuing certificates to landowners (Deininger et al. 2008). However, in Ethiopia, female-headed households are recognized as less tenure secure compared to their male counterparts (Holden and Bezabih 2008), and several studies have found that they have less access to agricultural land (Tadesse and Amare 2000; Teklu 2005; Yigremew 2006; Kebede 2008).

These studies put forward four possible explanations for the gender differences. The first two are rational economic responses, whereas the last two are based on institutional and cultural factors. First, female-headed households are typically divorced or widowed households and smaller in size. The tenure system in Ethiopia aims at allocating land based on livelihood needs, and one can therefore argue that

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smaller households need smaller landholdings. Second, female-headed households have less nonland resources, such as oxen and male labor, and thus they are less able to cultivate the land. Third, the institution of patrilocality (women moving to the husband's village upon marriage) may cause a gender bias because land policies indicate that access to land depends on one's residential area. This implies that women forfeit their chances to acquire land, or have to give up the rights for the land they have, when at the time of marriage they move from their parents' to their husband's village. Women also risk losing access to land if they leave their marriage residence when they become widowed or divorced (Tadesse and Amare 2000; Yigremew 2006). Fourth is the tradition of plough cultivation. In addition to the physical requirements of this activity, there is a social taboo against women ploughing (Teklu 2005; Yigremew 2006; Holden and Bezabih 2008), and the cultural perceptions of women as weak farmers may explain the difference in landholdings.

The objective of this paper is to investigate whether there is a gender-based difference in landholdings in Tigray, and, if so, whether differences in landholdings across households can be explained by differences in household size and nonland resources or if these differences are due to a gender bias toward female-headed households. In addition to comparing simple means of landholdings and running regression analyses to control for determinants of land access, I use the Blinder-Oaxaca decomposition method to estimate the share of the difference that is due to observable household differences in endowments and characteristics and the share that is due to differences in returns to the endowments and characteristics as a measure of gender bias. I use data collected from 370 households in 17 villages across the Tigray region in 2006.

## II. TENURE RIGHTS AND GENDER

### Conceptual Issues

Tenure rights are a set of rules and norms that determine who can use what resource, under what conditions, and for how long (FAO 2009). Tenure rights define to what extent a household or an individual can gain access to the benefit streams generated by land and provide a set of benefits that have positive impacts on livelihood outcomes, as well as other factors that can further improve livelihood, such as access to credit, bargaining power, and social status for rural households (Agarwal 1994b).

Two measures of landholdings are used in this paper: owned and operational landholdings. The category of *owned* landholding is the area of land to which the household has ownership rights. Such landholdings include the owned land the owners use themselves and the owned land they rent out for a tenant to use. *Operational* landholding is the area of land the household used for cultivation in the 12 months prior to the survey. Such landholdings include land owned and not rented out and additional rented land.

### Empirical Evidence on Gender Bias in Access to Land

In this paper, gender bias is measured as the difference in returns to observable endowments and characteristics, analogous to the definition of *gender discrimination* in the labor literature (Jones and Kelley 1984). A growing body of literature has documented a gender bias in the use of agricultural inputs (Udry 1996; Chen, Bhagowalia, and Shively 2011), asset ownership, and welfare outcomes, both within and across households around the world (Agarwal 2003; Quisumbing and Maluccio 2003; Deere and Doss 2006). Worldwide, female farmers have less access to land (World Bank 2011), and studies on ownership and control of land have found gender inequalities in countries in Latin America (Deere and Leon 2003), Africa (Udry 1996; Bomuhangi, Doss, and Meinzen-Dick 2011), and Asia (Estudillo, Quisumbing, and Otsuka 2001; Agarwal 2003).

Agarwal (2003) emphasizes social perceptions to be the reason why men are recognized as the legitimate claimant of land. Boserup (1970) argued that due to physical strength, men on average have an advantage in farming compared with women, resulting in a specialization of production along gender lines in societies that have traditionally practiced plough

cultivation. The perception of women as "weak farmers" is also widespread in Ethiopia. In addition to the cultural taboo against women ploughing, women have less access to agricultural extension services (Pender and Gebremedhin 2008; Ragasa et al. 2012).

There are three main sources of access to arable land: the state, the family, and the market (Agarwal 2003), and these are also the dominant sources of access to land in Ethiopia (Yigremew 2006). In her study from India, Agrawal (2003) found access through all three sources to be gender biased.

In Ethiopia, all land ultimately belongs to the state, but the land certification process was started in the late 1990s to secure the land tenure rights of peasants. Article 4(1) of the national Rural Land Proclamation states: "Without differentiation of the sexes, any person who is willing to personally cultivate land shall be allotted rural land sufficient for his maintenance and that of his family" (cited by Frank 1999, 8). Household size has been the main criterion for land allocations since 1975 (Holden and Yohannes 2002), and Ethiopia is one of the countries with the most equitable distribution of land. However, systematic differences across households remain. Yigremew (2006) found that the administrative reallocations have not fully met the equity requirements in rural land policies and that female-headed households have smaller landholdings. These results are also supported by the countrywide study by Kebede (2008).

The state can distribute land in a number of different ways. If titles are issued to an individual, such as the head of the household, other members of the household might be denied rights to the land (World Bank 2005). The practice of registration varies throughout Ethiopia. In some regions, the names of both spouses are on the certificate, whereas in Tigray, land is registered in the name of the household head only. The responsibility to allocate land from the state lies with the Peasant Associations, functioning as local community governments. Administrative redistribution by the state has been the most important mechanism of access to land for peasants (Yigremew 2006), but since 1997, land redistributions have been limited (Holden, Deininger, and Ghebru 2011).

The second source of access to land is through transfers within the family. Such transfers can take two different forms: first, *intergenerational* transfers in the form of either inheritance after parents' death or intervivos transfers, such as land gifts upon marriage or anticipated inheritance. The other form of transfer within the family is *intrahousehold* allocation of plots to specific members (de Janvry et al. 2001). The family as a source of land is of great importance, especially when land markets are poorly developed or large-scale redistributive land reforms are not feasible (de Janvry et al. 2001). Intrahousehold allocation of land is not very relevant to Ethiopian households because men and women generally do not cultivate plots individually, but intergenerational transfers may become increasingly important as the number of reallocations decreases.

When examining patterns of parental transfers of assets and marriage in Ethiopia, Fafchamps and Quisumbing (2005) found that brides receive less land and other assets than grooms from their parents upon their first marriage and that women inherit less upon the death of their parents, but also that there are regional differences. The Tigray state land law ensures inheritance, to increase security and further investment in land, but it also limits it, to prevent land from becoming subdivided into pieces that are too small to be economically viable. Land should be given to the one child (usually only one child qualifies) without land or any other sources of income that stayed with the parents (Haile et al. 2005). This law makes married women less likely to inherit land because the custom of patrilocality leads women to move away from their parents' village to live with their husband's kin (Fafchamps and Quisumbing 2005). For the purpose of this study, the state and the family are not treated separately, given that by far most of the land a household owned at the time of data collection was allocated by the state.

The market is the third main source of access to land, either in the form of a sales market or a rental market. Land sales are still il-

legal in Ethiopia after the passage of the new land law in 1997, but land rentals are common, with short-term sharecropping contracts dominating the market (Holden, Deininger, and Ghebru 2011). A common feature of this market in Ethiopia, contrary to the rental market stereotype, is a reverse tenancy system with *poor landlords* and *rich tenants.* Tenants are typically the households that have better access to other important farming inputs such as male labor and oxen. In the presence of imperfect factor markets for labor and oxen, land is rented in to equalize marginal productivities of the different inputs across farms (Deininger, Ali, and Alemu 2008). Female-headed households are commonly poor in these assets, which—in addition to the physical requirements and social taboo against women ploughing the land—leads female-headed households to rent out their land more often and engage in sharecropping arrangements with male-headed households (Tadesse and Amare 2000; Teklu 2005; Yigremew 2006; Kebede 2008; Holden and Bezabih 2008; Holden, Deininger, and Ghebru 2011). Although lack of nonland resources is an important determinant for renting out one's land, for male- as well as female-headed households, the relative abundance of these resources is not necessarily a determining factor for renting-in behavior. In a study from Amhara, the neighboring region, Ghebru and Holden (2008) found that the relative amount of labor available in a household did not explain leasing-in behavior, and they suggest that potential female tenants are rationed out of the market, even if they have the oxen necessary for farming.

## III. STUDY SITE AND DATA

### Setting

The Ethiopian land reform of 1975 made all land the property of the state. To provide land for new households and maintain a more or less equal distribution, follow-up redistributions were required, thus creating a situation of high tenure insecurity. Renting out land increased the risk of losing land in redistributions because it could be perceived as a lack of both cultivation ability and need for land. Tenure insecurity also reduced the incentives to invest in land (Deininger and Jin 2006). To address the tenure insecurity, a new law was passed in 1995 allowing regional governments to be responsible for land administration (Deininger et al. 2008). The Tigray regional state responded by proclaiming the state legislation for land management in 1997, and the number of land redistributions was reduced. The proclamation aimed to provide higher tenure security, reduce instances of litigation and dispute, and facilitate land transactions through the rental market. All land continued to be owned by the state, and selling land was still not allowed. Perpetual rights for access and withdrawal, management, and exclusion were given to households, and tenure right holders were given the right to make short-term land rental contracts as a limited right for alienation. Plots were measured and demarcated, land registry books established at district levels, and one-page handwritten certificates with information about the soil quality, location, and size of the plots were issued in the name of the household head. The method was low cost, and by 1999 more than 80% of the rural households in Tigray had land certificates (Holden, Deininger, and Ghebru 2011).

### Data

The household and individual response data were collected in Tigray over the period June to August 2006 with the help of 27 local bilingual enumerators and are part of a panel data set started in 1997/1998. The sampling method for the data was administered at two levels. At the village level, there was stratified sampling, taking into account agricultural potential, population pressure, access to irrigation, and access to the market. At the household level, 25 households were randomly sampled from each village. Despite the fact that the data set is part of a panel, some of the specific data used in this paper were collected in the 2006 round only, and thus, the analysis is limited to cross-section analysis. Due to attrition, the number of households from each village varied in the 2006 round, and the total

TABLE 1
Overview of Data at the Household and Individual Levels

| | Household-Level Data | | Individual-Level Data | |
|---|---|---|---|---|
| | Female Headed | Male Headed | Females | Males |
| Previously divorced | 27 | 70 | 61 | 41 |
| Previously widowed | 53 | 66 | 66 | 31 |
| Neither divorced nor widowed | 23 | 118 | — | — |
| Total (of which are presently unmarried) | 103 (99) | 254 (33) | 127 | 72 |

number of households was reduced to 370. Due to missing information for some of the households, the number included in the analysis was further reduced to 357 (Table 1).

The war between Eritrea and Ethiopia in 1998–2000 left many widows behind in the villages. In addition, the fact that husbands are relatively older than their wives leaves more female widows than male widows. Divorce is also a common phenomenon in the region, and the share of female-headed households in the sample is 29%. This includes households where the female head has never been married and four households where the husband resides off-farm.

In each of the 370 households, the household head and (if married) the spouse were interviewed (separately) and asked whether they had been married before. The individuals who had been through either a divorce or death of spouse are included in a sample of individuals. The individual-level data are included in the analysis to study allocation of land after household dissolution. Most single heads of male- and female-headed households are part of this group, given that most of these are either divorced or widowed, but also there are individuals that remarried and were part of a new household at the time of the interview. Some individuals were dropped from the sample due to missing information, and the total sample of the previously divorced or widowed consists of 199 individuals.

## IV. HYPOTHESES

In this paper, gender bias is defined as a preference for one sex over the other in the allocation of tenure rights for land from the state, the family, and the market. This bias exists when the same characteristics and endowments are valued more highly for male-headed households compared to female-headed households. The latter is an important qualification when seeking to control for any systematic differences between male and female-headed households, for example, that a smaller household size might justify less land being allocated to that household.

Given that most female heads of households are either divorced or widowed, the allocation of land upon household dissolution is a potentially important determinant of female-headed households' landholdings. The land proclamation of 1997 states that men and women should receive equal shares of household land upon divorce (Deininger et al. 2008). It also strengthens women's rights in the case of a husband's death. To guide the empirical analysis, the following hypotheses are tested:

*Hypothesis 1.* Gender has no impact on the allocation of land upon household dissolution due to divorce or death of spouse.

*Hypothesis 2.* Female headship has no impact on the size of a household's owned or operational landholdings, after controlling for observable differences in endowments and characteristics.

## V. ESTIMATION STRATEGY

Gender differences in landholdings, household characteristics, and endowments are identified by comparing means between households headed by males and by females, as well as between subgroups of these households. An ordered probit model is developed to determine whether men and women receive different shares of household land in the case

of death or divorce. These estimation results are used to address whether household dissolution is a main driver of the gender differences in landholdings. Further, ordinary least squares (OLS) regression models are estimated to control for observable endowments and characteristics, including village fixed effects. The differences in landholdings are decomposed to estimate how much of the landholdings can be explained by differences in the observable endowments and characteristics and how much can be explained by the returns to the same endowments and characteristics.

**Allocation of Land upon Household Dissolution**

The previously divorced/widowed respondents were asked how much land they received upon household dissolution. The alternatives were all, more than half, half, less than half, and nothing. Ordered probit models were developed to analyze the probability of a respondent receiving a particular share of land. For each individual, $i$, there is an underlying response variable $Y^*_i$. The regression model takes the following form:

$$Y^*_i = \boldsymbol{\beta}'\mathbf{X}_i + \varepsilon_i, \quad [1]$$

where $\mathbf{X}_i$ is a vector of explanatory variables discussed further below, $\boldsymbol{\beta}$ is a vector of regression parameters, and $\varepsilon$ is the random, normally distributed disturbance term with constant variance and zero mean. $Y^*_i$ is not observed, but an indicator variable $Y_i$ is observable, and this variable follows the sign of $Y^*_i$:

$$\begin{aligned} Y_i &= 1 \text{ if } Y^*_i \le 1 \text{ (if receive no land)},\\ &= 2 \text{ if } 1 < Y^*_i \le \mu_2 \text{ (if receive land, but less than half)}\\ &= 3 \text{ if } \mu_2 < Y^*_i \le \mu_3 \text{ (if receive half the land)}\\ &= 4 \text{ if } \mu_3 < Y^*_i \le \mu_4 \text{ (if receive more than half but less than all)}\\ &= 5 \text{ if } \mu_4 \le Y^*_i \text{ (if receive all the land)}, \end{aligned} \quad [2]$$

where the $\mu$ values are unknown threshold parameters, or cut points, that are estimated using the $\beta$ values. Therefore, the probabilities of receiving land in different degrees are as follows:

$$\begin{aligned} &\text{Prob}\,[Y=1] = \Phi(-\boldsymbol{\beta}'\mathbf{X}_i),\\ &\text{Prob}\,[Y=2] = \Phi(\mu_2 - \boldsymbol{\beta}'\mathbf{X}_i) - \Phi(-\boldsymbol{\beta}'\mathbf{X}_i),\\ &\text{Prob}\,[Y=3] = \Phi(\mu_3 - \boldsymbol{\beta}'\mathbf{X}_i) - \Phi(\mu_2 - \boldsymbol{\beta}'\mathbf{X}_i),\\ &\text{Prob}\,[Y=4] = \Phi(\mu_4 - \boldsymbol{\beta}'\mathbf{X}_i) - \Phi(\mu_3 - \boldsymbol{\beta}'\mathbf{X}_i),\\ &\text{Prob}\,[Y=5] = 1 - \Phi(\mu_4 - \boldsymbol{\beta}'\mathbf{X}_i). \end{aligned} \quad [3]$$

$\Phi$ is the cumulative normal distribution function, and the sum of the abovementioned probabilities is equal to one. To obtain estimates of the $\beta$ and $\mu$ values, the log-likelihood function is maximized (Greene 2002) with White's (1982) robust standard errors.

To test the hypothesis regarding allocation of land upon household dissolution, the sample of the 199 *individual* responses was used. Matching in the marriage market is not random (Fafchamps and Quisumbing 2005), and neither is divorce. Tilson and Larsen (2000) found that 45% of all first marriages end in divorce in Ethiopia and that early age at marriage and childlessness increased the likelihood of divorce. Furthermore, allocation of land from the state is dependent upon marriage; thus, some choose to marry to receive land. Couples that did not receive land upon marriage are more likely to divorce. Due to these factors, respondents with no land in their previous marriage were omitted from the sample. This omission does not fully solve the problem of the nonrandomness of marriage and divorce, but due to a lack of data regarding the previous marriage, this is as far as the data set allows for a partial correction of this selection bias.

To capture the potential effect of the land reform, a dummy variable indicating whether the household dissolution happened before or after *certification* in the village is included in the models. In Tigray, certificates are issued in the name of the household head only, and the updating of certificates after a household dissolution is incomplete. Thus, women do not necessarily receive a certificate for the land they receive upon divorce, and widows tend to inherit the certificate issued in the name of their deceased husband rather than an updated certificate in their name. Whether or how this practice matters for the allocation of

TABLE 2
Overview of Variables and Descriptive Statistics

| Variable | Description | Obs. | Mean | Std. Dev. |
|---|---|---|---|---|
| *Household Level* | | | | |
| Sex of the hh head | Dummy variable indicating the sex of the household head, 0 = male, 1 = female | 357 | 0.29 | |
| Household size | Total number of members in the household | 357 | 5.07 | 2.50 |
| Age hh head | Age of household head (in years) | 357 | 54.72 | 14.39 |
| Oxen | Number of oxen the household owns | 357 | 0.92 | 0.99 |
| Male wf | Male workforce, number of men aged 15 to 64 | 357 | 1.40 | 1.17 |
| Female wf | Female workforce, number of women aged 15 to 64 | 357 | 1.34 | 0.87 |
| Owned holding | Area of land the household has owner rights to, in tsimdi | 357 | 3.84 | 2.71 |
| Operational holding | Area of land the household use for cultivation, in tsimdi | 357 | 3.80 | 3.41 |
| Per cap owned hold | Per capita owned landholding in tsimdi (Owned landholding/ Household size) | 357 | 1.04 | 0.06 |
| Per cap oper hold | Per capita operational landholding in tsimdi (Operational landholding/Household size) | 357 | 0.91 | 0.06 |
| Literacy | Dummy variable indicating whether the household head is literate, 0 = no, 1 = yes | 357 | 0.32 | |
| Dependents | Number of household members aged below 15 and above 64 | 357 | 2.34 | 1.64 |
| Divorcee | Dummy indicating whether the household head has been divorced, 0 = no, 1 = yes | 357 | 0.27 | 0.45 |
| Oxen dummy | Dummy indicating whether the household have one or more oxen, 0 = no, 1 = yes | 357 | 0.57 | |
| Village | Dummy variables indicating which village household is located in | | | |
| *Individual Level* | | | | |
| Land received | Share of land received upon household dissolution, 1 = no land, 2 = some, but less than half, 3 = half, 4 = more than half but less than all, 5 = all | 199 | 2.79 | |
| Dissolution after cert | Dummy indicating when the dissolution happened, 0 = before certification, 1 = after | 199 | 0.36 | |
| Sex of the respondent | Dummy variable indicating the sex of the respondent, 0 = male, 1 = female | 199 | 0.64 | |
| Literacy | Dummy indicating whether the respondent is literate, 0 = no, 1 = yes | 199 | 0.17 | |
| Reason dissolution | Dummy variable indicating the reason for household dissolution, 0 = death, 1 = divorce | 199 | 0.51 | |
| Stayed in the village | Dummy indicating whether the respondent stayed in the village after the divorce/death of spouse, 0 = no, 1 = yes | 199 | 0.76 | |

*Note:* One tsimdi is approximately 0.25 ha.

land between the spouses upon divorce or death is uncertain.

Land is an immobile asset, and according to Tigray law, land rights can be lost if the holder of the user rights moves away from the village. Thus, if the respondent was expected to move after the dissolution, he or she was expected to receive less land upon divorce or death of spouse. Respondents without relatives in the village might have been more likely to move away. Given the tradition of patrilocality, this is particularly true for women. A variable to control for this is included in the model, taking a value of 1 if the respondent stayed in the village after the household dissolution. All variables included in the models are listed in Table 2 under the individual-level variables.

The models are run on three different samples: male respondents only, female respondents only, and a pooled sample with both males and females. In the last models, a dummy variable indicating whether the respondent is male or female is included to capture potential gender differences. Land is split differently upon divorce and death, but due to

the limited number of responses, the sample cannot be split further to allow for separate models for divorced and widowed respondents.

**Gender Bias in Landholdings**

To test the second hypothesis, two measures of landholdings are used: owned landholding and operational landholding. The size of the owned landholdings reflects how much land the household accesses through the state and the family, whereas the size of the operational landholdings reflects how the household is adjusting the amount of land it cultivates through the rental market. As the number of reallocations of land is limited in Tigray, the market is becoming a more important source of access to land for rural households, and thus operational landholding forms the variable of main interest in this paper.

Three approaches are used to identify and explore the gender bias in landholdings. First, the simple means of household landholdings are compared to determine whether there are significant differences between female- and male-headed households. Second, OLS regressions are used to correct for observable differences between the two groups of households. The dependent variable is the total household landholding. Several factors can potentially influence the landholdings of rural farmers, and by estimating OLS models, these variables can be controlled for. A list of the variables is included under the household-level variables in Table 2. A dummy variable of headship is included in the model to test the hypothesis of gender differences in landholdings after controlling for the household and geographical variables. To control for village fixed effects, village dummies are included. In addition to a pooled model, models are run separately for male- and female-headed households. A chi-square test is performed to test whether the coefficients are significantly different across the separate models. To correct for heteroskedasticity, robust standard errors are estimated, referring to a minimum ignorance estimator (White 1982).

The main dependent variable in the models is the total household landholding, not per capita landholding. Although need for land and ability to cultivate it have been determinants for land allocation from the state (Holden, Deininger, and Ghebru 2011), reallocations have been limited in Tigray since 1997. Thus, looking at land per capita in 2006 can be misleading when we are interested in the allocation of land across households and not household welfare per se, as the landholding per capita for a household will change over time depending on the household life cycle. However, the robustness of the findings on total household landholdings is explored by running the same models with per capita landholding as the dependent variable.

While empirical studies typically treat family size as given in the short term, this variable can be endogenous in the longer term, particularly in the models for owned landholding. Thus, the relationship between the household size variables and landholdings should be interpreted with caution, without implying too much about the direction of causality. This is also recognized by Jayne et al. (2003) in their study of land distribution in Africa.

The third approach used is the Blinder-Oaxaca technique to decompose the landholding differences and estimate how much of the differences can be explained by differences in observable characteristics and endowments and what can be explained by differences in returns to these characteristics and endowments (Blinder 1973; Oaxaca 1973). Jones and Kelley (1984) determine discrimination to exist when the same bundle of productivity-related characteristics is valued differently between men and women. Thus, the measure of discrimination and gender bias is the residual remaining after controlling for the differences in observable characteristics and resource endowments. This measure will depend on how well the model is specified and the level of measurement error. A share of what is measured as gender bias might be due to unobservable characteristics other than gender, but by including the variables known to influence landholdings, the residual measured will give an indication of the degree of the gender bias.

In the decomposition analysis, separate regressions are estimated for male-headed (m) and female-headed (f) households:

$$Y_m = \mathbf{X}_m\boldsymbol{\beta}_m + \varepsilon_m,\ E(\varepsilon_m) = 0, \quad [4]$$

$$Y_f = \mathbf{X}_f\boldsymbol{\beta}_f + \varepsilon_f,\ E(\varepsilon_f) = 0, \quad [5]$$

where $Y$ is the landholding, $\mathbf{X}$ is a vector of the observed characteristics and endowments also included in the OLS models, $\boldsymbol{\beta}$ contains the slope parameters, and $\varepsilon$ is the error term with zero expectations. The mean difference in landholdings ($\bar{D}$) can be expressed as the difference in the linear prediction at the gender-specific means of the regressors:

$$(\bar{D}) = \bar{\mathbf{X}}_m\hat{\boldsymbol{\beta}}_m - \bar{\mathbf{X}}_f\hat{\boldsymbol{\beta}}_f. \quad [6]$$

Following Jones and Kelley's (1984) and Jann's (2008) application, this expression can be rearranged and decomposed into three parts:

$$(\bar{D}) = (\bar{\mathbf{X}}_m - \bar{\mathbf{X}}_f)\hat{\boldsymbol{\beta}}_f + \bar{\mathbf{X}}_f(\hat{\boldsymbol{\beta}}_m - \hat{\boldsymbol{\beta}}_f) + (\bar{\mathbf{X}}_m - \bar{\mathbf{X}}_f)(\hat{\boldsymbol{\beta}}_m - \hat{\boldsymbol{\beta}}_f). \quad [7]$$

The first part of the right-hand side of equation [7] measures the share of the landholding differentials that can be explained by differences in observed characteristics and endowments between male- and female-headed households. This is also referred to as the endowment effect.

The second part measures the share of the differences that is due to differences in the coefficients, meaning the returns to characteristics and endowments. This is often referred to as the *unexplained* difference and is commonly used as a measure of discrimination. This term also captures all potential effects of unobserved group differences. For example, skills are unobserved in the model but may vary across the groups. With respect to operational landholdings, differences in returns to characteristics and endowments may also reflect a rational response to differences in agricultural skills and not only gender bias per se. Although the main critical variables believed to be important for agricultural productivity are included in the model, we cannot rule out that there are systematic differences between male- and female-headed households. Therefore, the measured bias should be considered as an upper level.

The third part is an interaction term taking into account the fact that differences in endowments and coefficients occur simultaneously between male- and female-headed households and are a measure of the difference between valuing the observed endowments at female-headed households' returns rather than male-headed households' returns. Jones and Kelley (1984) recommend keeping this term separate unless specific arguments can be made for adding it to the measure of discrimination. In this paper, the interaction term is treated separately.

## VI. RESULTS AND DISCUSSIONS

### Differences in Endowments and Characteristics

There are significant differences in key characteristics between male- and female-headed households in Tigray (Table 3). Most female-headed households are the result of household dissolution, because of either divorce or death of the husband; thus, the households are on average smaller compared to male-headed households. In addition, female heads are on average younger, and their literacy rate is much lower (12% vs. 40%). Female-headed households are also significantly poorer in land and important nonland productive assets, for example, male and female labor and oxen ownership.

Even though most female-headed households in Tigray are the result of household dissolution, the differences in owned and operational landholdings remain (0.9 and 2.1 tsimdi,[1] respectively) when comparing unmarried male- and female-headed households as well. The reason for the dissolution matters for how the household land is shared. In the case of a divorce, land is split between the husband and wife. In the case of death of one of the spouses, the land is usually either kept in full by the surviving spouse or split between the surviving spouse and the deceased spouse's children and/or other family. We observe that households where the head is pre-

[1] One tsimdi is a local measure based on the area a pair of oxen can plough in a day, and is approximately 0.25 ha.

TABLE 3
Comparison of Means between Male- and Female-Headed Households for All Households and Subgroups

| | Mean Values for All Households | | | | |
|---|---|---|---|---|---|
| Variable | Male | Female | Difference | *t*-Value | *N* (m+f) |
| Household size | 5.80 (0.15) | 3.29 (0.19) | 2.50 (0.26) | 9.60*** | 254+103 |
| Age hh head | 55.7 (0.85) | 52.2 (1.54) | 3.49 (1.67) | 2.09** | 254+103 |
| Oxen | 1.16 (0.06) | 0.31 (0.06) | 0.85 (0.11) | 7.97*** | 254+103 |
| Male wf | 1.71 (0.07) | 0.62 (0.09) | 1.09 (0.12) | 8.76*** | 254+103 |
| Female wf | 1.40 (0.06) | 1.18 (0.08) | 0.21 (0.10) | 2.11** | 254+103 |
| Owned holding | 4.10 (0.18) | 3.19 (0.22) | 0.91 (0.31) | 3.91*** | 254+103 |
| Operational holding | 4.50 (0.22) | 2.07 (0.22) | 2.43 (0.38) | 6.44*** | 254+103 |
| Per cap owned hold | 0.91 (0.06) | 1.35 (0.13) | −0.44 (0.12) | −3.59*** | 254+103 |
| Per cap oper hold | 0.96 (0.07) | 0.76 (0.11) | 0.21 (0.13) | 1.66* | 254+103 |
| | Mean Landholding Size for Subgroups of Households | | | | |
| Variable | Male | Female | Difference | *t*-Value | *N* (m+f) |
| *Mean Value for Presently Unmarried Households* | | | | | |
| Owned holding | 4.01 (0.47) | 3.14 (0.22) | 0.87 (0.47) | 1.84* | 33+99 |
| Operational holding | 4.08 (0.50) | 1.95 (0.22) | 2.13 (0.48) | 4.44*** | 33+99 |
| Per cap owned hold | 1.40 (0.18) | 1.37 (0.13) | 0.03 (0.25) | 0.10 | 33+99 |
| Per cap oper hold | 1.34 (0.20) | 0.75 (0.11) | 0.63 (0.23) | 2.69*** | 33+99 |
| *Mean Value for Households Where Head Is Previously Divorced* | | | | | |
| Owned holding | 3.66 (0.28) | 2.24 (0.26) | 1.42 (0.49) | 2.91*** | 70+27 |
| Operational holding | 3.56 (0.31) | 1.16 (0.26) | 2.40 (0.52) | 4.60*** | 70+27 |
| Per cap owned hold | 0.80 (0.09) | 0.91 (0.17) | −0.12 (0.18) | −0.64 | 70+27 |
| Per cap oper hold | 0.78 (0.09) | 0.41 (0.11) | 0.36 (0.17) | 2.19** | 70+27 |
| *Mean Value for Households Where Head Is Previously Widowed* | | | | | |
| Owned holding | 4.04 (0.34) | 3.52 (0.36) | 0.52 (0.50) | 1.03 | 66+53 |
| Operational holding | 4.14 (0.49) | 2.49 (0.35) | 1.65 (0.63) | 2.60** | 66+53 |
| Per cap owned hold | 1.09 (0.12) | 1.68 (0.22) | −0.59 (0.24) | −2.48** | 66+53 |
| Per cap oper hold | 1.09 (0.15) | 0.99 (0.20) | 0.10 (0.24) | 0.43 | 66+53 |

*Note:* Standard error of the mean in parentheses.
* $p<0.10$; ** $p<0.05$; *** $p<0.01$.

viously divorced have smaller landholdings compared to households where the head is previously widowed. Previously divorced male-headed households have 9% smaller owned landholdings compared to widowers, whereas previously divorced female-headed households have 36% smaller owned landholdings than widows. In other words, the gender difference is much larger when divorced (and land must be shared with the spouse) than when widowed (the survivor keeps all the land or shares with the children).

When comparing all households, female-headed households have significantly larger per capita owned landholding. This is not surprising, given that the per capita owned landholding is negatively correlated with household size (correlation value –0.45), indicating that the smaller households have on average more land per capita.

Sharecropping is the traditional form of land rental, and the most common contract is 50% output sharing, that is, the landlord receives half of the crop after the harvest without providing any nonland inputs, such as seeds and labor (Table 4). A higher share of female-headed households is renting out household land, and few of these households participate in the market as tenants. This is also reflected in the gender differences in operational landholdings, shown in Table 3. Female-headed households have less than half the operational landholdings compared to male-headed households. The difference is

TABLE 4
Percent of Households that Participate in the Land Rental Market and Contract

| Variable | Male Headed | | | Female Headed | | | All | | |
|---|---|---|---|---|---|---|---|---|---|
| Renting out land (landlord) | | 21 | | | 45 | | | 28 | |
| Renting in land (tenant) | | 38 | | | 8 | | | 29 | |
| Type of land rental contract | | | | | | | | | |
| Fixed rent (cash) | | 1 | | | 1 | | | 1 | |
| Fixed rent (kind) | | <1 | | | 0 | | | <1 | |
| Sharecropping (output after deduction of input costs) | | 5 | | | 1 | | | 3 | |
| Sharecropping (output only) | | 91 | | | 97 | | | 93 | |
| | 50% | 33% | 25% | 50% | 33% | 25% | 50% | 33% | 25% |
| Share of output to landlord | 57 | 16 | 23 | 66 | 14 | 20 | 60 | 15 | 22 |

particularly large for the households where the household head is previously divorced; female-headed households have less than a third of the mean operational landholding of male-headed households. Renting in and out land is a way to adjust the operational landholding to the need for agricultural land and productive inputs available at the household level. Thus, we should expect the per capita landholding to be less correlated with household size. This is supported by the data, as the correlation value for operational landholding is less than half compared to owned landholding ($-0.1863$). The negative correlation value still indicates that smaller households have larger operational landholdings, but the gender differences in operational landholdings remain at the per capita level; female-headed households have 22% smaller per capita operational landholdings.

**Allocation of Land upon Divorce or Death**

To explore what drives the differences in landholdings between male- and female-headed households, I start by analyzing what happened with the household land upon household dissolution. I use the sample of the 199 individual responses. Figure 1 illustrates the share of household land received upon death or divorce by men and women in the sample, before and after the certification process.

Overall, a higher share of the male respondents received more than half of the household land upon divorce or death of spouse, compared to the female respondents before the certification process, whereas the opposite is true after the certification. In addition, a higher share of the female respondents received no land after the certification, but that is true also for the male respondents.

On average, 17% of the individual respondents are literate and 51% are previously divorced (Table 2), but there are gender differences. Compared to the male respondents, fewer female respondents are literate (32% vs. 8%), and a smaller share is previously divorced (57% vs. 48%), indicating that a higher share of the female respondents is widowed. Looking at the shares of male and female respondents that stayed in the village after the divorce or death of spouse, we observe the effect of the tradition of patrilocality. Whereas 17% of the men left the village, 28% of women did so. The difference is particularly large when comparing individuals who have been divorced; 24% of the men and 49% of the women left the village after a divorce.

To control for the different characteristics, ordered probit models were used. A positive coefficient indicates a higher probability that a respondent with the particular characteristic received more land upon divorce or death of a spouse (Table 5).

Overall, men were not more likely to receive more land upon household dissolution (sex of the respondent variable is insignificant). The dummy variable included to capture the effect of the certification is nonsignificant in the model with female respondents, whereas it is positive and significant for male respondents and in the pooled sample with both male and female respondents. This result

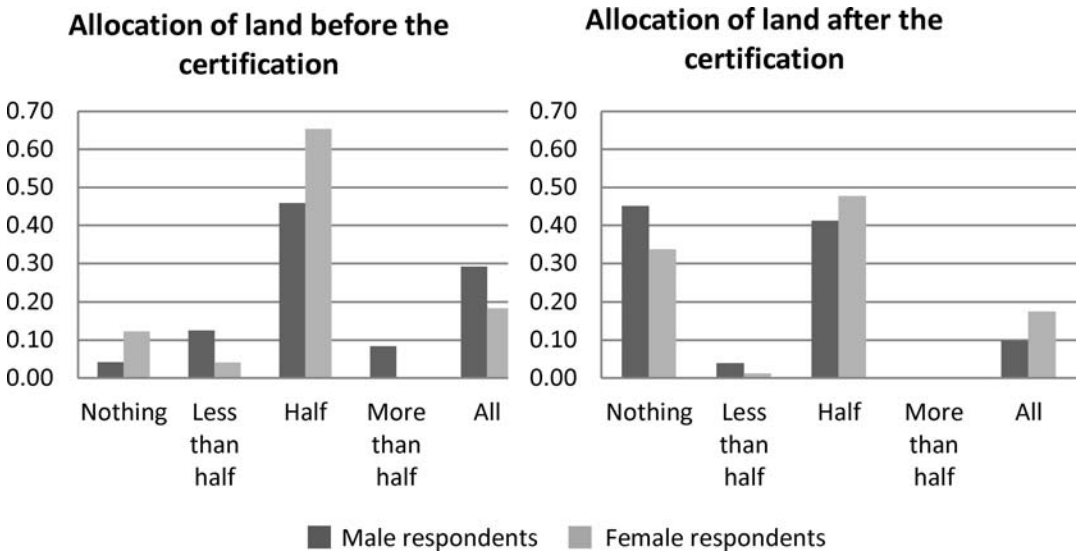


FIGURE 1
Share of Land Received upon Divorce or Death of Spouse

TABLE 5
Ordered Probit Models on Share of Land Received upon Household Dissolution

| Variable | Males | Females | All |
|---|---|---|---|
| Sex of respondent (0 = male, 1 = female | | | 0.03 (0.18) |
| Dissolution after cert (0 = no, 1 = yes) | 0.89*** (0.28) | 0.31 (0.21) | 0.53*** (0.16) |
| Literacy (0 = no, 1 = yes) | − 0.33 (0.31) | − 0.41 (0.36) | − 0.35 (0.24) |
| Reason dissolution (0 = death, 1 = divorce | − 0.84*** (0.29) | − 0.77*** (0.22) | − 0.81*** (0.18) |
| Stayed in the village (0 = no, 1 = yes) | − 0.03 (0.34) | 0.61** (0.26) | 0.39 (0.21) |
| *N* | 72 | 127 | 199 |

*Note:* Heteroskedasticity robust standard error in parentheses. Dependent variable: Share of land received upon divorce or death of spouse (1 = nothing; 2 = less than half, more than nothing; 3 = half; 4 = less than all, more than half; 5 = all).
** $p < 0.05$; *** $p < 0.01$.

indicates that men were likely to receive more land upon household dissolution after the certification reform compared to before the reform. The positive effect for men runs contrary to the intentions stated in the land reform, and the result should be interpreted with caution. Changes occur over time, and the change that the certification variable captures could also reflect changes over time that are not linked to the reform.[2]

[2] A possible way to correct for this in the model would be to include the exact year of household dissolution in addition to the certification variable, but this information was not collected at the time of field work.

The effect of the certification reform also appears to contradict the findings shown in Figure 1, and this emphasizes the importance of controlling for the reason for the dissolution. A divorce rather than the death of the spouse decreased the probability that the respondent received more land in all models, in line with previous results. The variable indicating whether the respondent stayed in the village after the divorce or death of spouse is positive and significant in the first model for female respondents. This variable captures the effect of patrilocality: women are often expected to move back in with their blood relatives after a household dissolution. To test for endogeneity of the decision to stay or leave, models are run excluding this variable (not included in the table). This did not change the significance levels or sign of the other variables in the models, and the estimates in the models included in Table 5 are robust.

**Estimation of the Gender Bias**

The potential determinants of access to land vary systematically between male- and female-headed households (Table 3). The OLS regressions explore to what extent these differences drive the gender differences in landholdings. Because there might be systematic differences in terms of where male- and female-headed households reside, the model controls for village fixed effects. Several of these village dummy variables are significant, indicating that there are geographical differences across the study area. Whether the household has oxen or not might be endogenous, and to check for reverse causality between landholding and oxen, an alternative model specification excluding the oxen dummy variable is included as a robustness check (Appendix Table A1).

Each model of total household landholding was run on three different samples: the complete sample of all households (*pooled*), a subsample of male-headed households only (*male hhh*), and a subsample of female-headed households only (*female hhh*). The results suggest that female-headed households have smaller owned and operational landholdings compared to male-headed households after controlling for household size, nonland resources, previous divorce, and local land availability. The negative marginal effect of female headship is relatively large and robust over alternative model specifications for total household landholdings. The female work force and the total number of dependents in the household are not significant in any of the models, indicating that household size as such is not significantly correlated with access to land.

The experience of a previous divorce has a large negative effect ($-1.2$ tsimdi) on the amount of land female-headed households own, but there is no significant effect for male-headed households. A chi-square test confirms that the coefficients are significantly different at the 10% level. The gender difference is not necessarily a result of a biased allocation of land upon divorce. This result may also reflect that male-headed households are more likely to be compensated for "the lost land" through additional land allocations from the Peasant Associations and/or through intergenerational transfers, whereas female-headed households are less likely to be allocated land and to inherit land from parents, particularly if they moved to the husband's village upon marriage and stayed there after the divorce.

A notable difference between male- and female-headed households is the returns to age in the models explaining the size of owned landholdings. While returns to age is positive (0.032) in the model for male-headed households, it is negative ($-0.034$) for female-headed households. There are at least three alternative explanations for this gender-differentiated age effect. First, older female-headed households may give relatively more land to children. Such female heads of household may give children more land because they are expected to do so and to be included as a member of the child's household to be taken care of in the future, or it can be a rational solution due to a lack of male labor as a husband is missing and sons become ready to form their own households. However, the difference between male workforce available in households headed by older females (age 65 and above) and other female-headed households is small ($-0.03$) and not significant, lending no support to the relative lack of male

TABLE 6
Estimated Coefficients from OLS Models for Owned and Operational Landholdings

| | Owned Landholdings | | | Operational Landholdings | | |
|---|---|---|---|---|---|---|
| Variable | Pooled | Male hhh[a] | Female hhh[a] | Pooled | Male hhh[b] | Female hhh[b] |
| Sex hh head (0 = male, 1 = female) | −0.657** | | | −1.534*** | | |
| | (0.304) | | | (0.378) | | |
| Age hh head (number of years) | 0.009 | 0.032** | −0.034* | −0.012 | 0.002 | −0.026 |
| | (0.008) | (0.011) | (0.018) | (0.010) | (0.014) | (0.021) |
| Literacy (0 = no, 1 = yes) | −0.045 | 0.129 | −0.409 | −0.289 | −0.141 | −0.430 |
| | (0.268) | (0.263) | (1.000) | (0.346) | (0.352) | (1.238) |
| Dependents (<15, >64) | −0.029 | −0.067 | 0.102 | 0.039 | −0.002 | 0.174 |
| | (0.072) | (0.077) | (0.132) | (0.093) | (0.107) | (0.153) |
| Male wf (men aged 15–64) | 0.461*** | 0.406*** | 0.564** | 0.495*** | 0.489** | 0.344 |
| | (0.110) | (0.120) | (0.255) | (0.183) | (0.221) | (0.257) |
| Female wf (women aged 15–64) | 0.112 | 0.204 | −0.300 | −0.036 | −0.027 | −0.099 |
| | (0.117) | (0.129) | (0.306) | (0.167) | (0.220) | (0.234) |
| Divorce (0 = no, 1 = yes) | −0.401 | −0.329 | −1.165*** | −0.938*** | −1.004*** | −1.466** |
| | (0.206) | (0.259) | (0.432) | (0.271) | (0.354) | (0.521) |
| Oxen dummy (0 = no, 1 = yes) | 0.297 | 0.189 | 0.816* | 1.811*** | 1.743*** | 2.186*** |
| | (0.270) | (0.314) | (0.472) | (0.358) | (0.460) | (0.525) |
| Village | 16 village dummies included in the analysis but left out of the table | | | | | |
| Constant | 3.076** | 1.910 | 5.258*** | 1.641 | 1.036 | 1.080 |
| | (0.962) | (1.173) | (1.268) | (1.070) | (1.052) | (1.153) |
| *R*-squared | 0.506 | 0.576 | 0.535 | 0.463 | 0.480 | 0.448 |
| *N* | 357 | 254 | 103 | 357 | 254 | 103 |

*Note:* Robust standard errors in parentheses. hhh, household head; OLS, ordinary least squares.

[a] The estimated coefficients for Age of hh head, Female wf, and Divorce are significantly different across the separate models for owned landholdings. The respective chi-square test statistics: $chi^2(1) = 11.76$, Prob > $chi^2 = 0.0006$; $chi^2(1) = 2.92$, Prob > $chi^2 = 0.0877$; $chi^2(1) = 3.43$, Prob > $chi^2 = 0.0642$.

[b] None of the estimated coefficients are significantly different from each other across the separate models for operational landholdings.

* $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.

labor as an explanation. Second, female-headed households might have lost land in previous land allocations, whereas male-headed households have gained land. If that is the case, this result could indicate a higher status for older males than for older females and a gender bias in the reallocation of land. Lack of data makes it hard to explore this relationship, but previous studies have suggested that female-headed households are more tenure insecure (Holden and Bezabih 2008; Holden, Deininger, and Ghebru 2011), and it is a reasonable assumption that higher perceived insecurity is due to a higher risk of losing one's land. Third, the gender bias might have decreased over time, that is, younger women have been able to keep more land after household dissolution. The results presented in Table 5 do not support this notion. There is no significant effect of the variable controlling for whether the dissolution happened before or after the certification in the ordered probit models for the female respondents. An interaction variable was added to the OLS model for female-headed households, shown in Table 6, to test for the effect of being older and previously divorced, but the variable was not significant. Another possibility is that younger female-headed households have been allocated more in land reallocation or inherited more from their parents compared to female-headed households that were formed a long time ago, which might be a positive effect of the land reform, but a lack of data limits the possibility to test for this effect.

While male-headed households have larger owned landholdings in total, female-headed households have larger per capita holdings. This is mainly driven by their smaller household size. In the regression for owned landholdings per capita, there is no significant effect of the gender of the household, whereas the household size variables are all negative and significantly correlated with per capita owned landholdings (Appendix Table A2). Per capita landholding can be a measure of

land scarcity, but with respect to household agricultural produce and livelihoods, operational landholdings are more important.

Operational landholding is affected by the household's position in the land rental market, and the market can help adjust the operational landholding to the household's needs and endowments. Access to nonland resources, such as oxen and total male work force, are potentially important determinants of behavior in the land rental market. The marginal effects of ownership of oxen and the amount of male labor available indicate that there is some adjustment, but even after controlling for these nonland agricultural inputs, the negative impact of female headship is more than twice as large for operational landholdings compared to owned landholdings.

The results from the operational landholding at per capita level support the finding of a gender difference in operational landholdings (Appendix Table A2). Everything else constant, female-headed households have on average 0.46 tsimdi less land per capita. This is a huge difference given that the sample mean per capita operational land is only 0.91 tsimdi.

This result supports the findings obtained from other studies that indicate the rental market is not a source of access to land for female-headed households, but that they rather are renting out land. The tendency that female-headed households are more likely to rent out all or a share of their land may reflect a rational response to differences in skills and capacity between male- and female-headed households. These variables are unobserved and not controlled for in the models. Previous studies have found, after controlling for plot quality, that plots operated by female-headed households are less productive compared to plots operated by male-headed households (e.g., Holden, Shiferaw, and Pender 2001; Pender and Gebremedhin 2008). This lower productivity may motivate female-headed households to rent out their land to more productive male tenants. On the other hand, studies of the land rental market in Ethiopia have also found that productivity is lower on plots rented out by female-headed households (Holden and Bezabih 2008; Ghebru and Holden 2012). This lower productivity may be due to the relatively lower bargaining power of female-headed households in the land rental market. Due to female-headed households' tenure insecurity and economic dependency, they are less able to screen tenants and have limited power to evict them (Holden and Bezabih 2008; Ghebru and Holden 2012). Both factors may adversely affect the tenants' effort and reduce the potential gain for female-headed households when renting out land. Thus, the gender differences in operational landholdings may not fully be explained as a rational response for female-headed households to rent out their land.

The results of all three models for operational landholdings indicate that those who are previously divorced have less land, in line with the previous findings obtained when comparing simple means of landholdings across previously divorced male- and female-headed households as well. The oxen dummy variable has a large and significant effect in all models, whereas male workforce is not significant for female-headed households. There is, however, no statistically significant difference in the coefficients across the separate models.

The results of the OLS models indicate that access to land through the state/family and the land rental market is influenced by more or less the same variables. The exception is the effect of oxen holding. Oxen holding does not appear to have a significant impact on land accessed through the state (owned landholdings), whereas it does have a large and highly significant effect on land accessed and disposed through the market (operational landholdings).

The results from the OLS models are in line with the results of previous studies, suggesting that female-headed households own less land and that the market is not a source of *access* to land for female-headed households in Tigray. The results of the models also suggest that not all the difference can be explained by differences in observable characteristics, endowments, and local land availability. To divide the differences in landholdings between male- and female-headed households into a share that can be explained by the observable differences and what can be explained by the *returns* to these observables, the mean differences are decom-

TABLE 7
Decomposition of Landholding Differences

| | Owned Landholding | Operational Landholding |
|---|---|---|
| Mean landholdings male-headed households | 4.100 (0.182) | 4.496 (0.228) |
| Mean landholdings female-headed households | 3.188 (0.235) | 2.067 (0.241) |
| Mean difference | 0.911*** (0.297) | 2.429*** (0.332) |
| *Decomposition Estimates* | | |
| Observed endowments | 0.529 (0.499) | 1.278** (0.516) |
| Return to endowments | 0.695* (0.372) | 1.657*** (0.489) |
| Interaction | − 0.312 (0.559) | − 0.506 (0.650) |
| Number of observations | 357 | 357 |

Robust standard errors in parentheses.
* $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.

posed as shown in equation [7]. The results are presented in Table 7.

In the first panel, the mean predictions of male- and female-headed households' landholdings and the differences are reported. The results in the second panel indicate how much of the observed differences in landholdings is due to differences in observable endowments and characteristics and how much is due to differences in returns to the endowments. The first term, *observed endowments,* reflects the predicted mean increase in female-headed households' landholdings if they had the same endowments as male-headed households. The second term, *return to endowments,* reflects the level of gender bias, that is, changes in female-headed households' landholdings when applying the male-headed households' coefficients to the female-headed households' endowments. The interaction term is a measure of the difference between valuing the *observed endowments* term at female-headed household's returns rather than male-headed household's returns.

The results indicate that gender bias may account for as much as 57% and 56% of the differences in owned and operational landholdings, respectively. As expected, there is no evidence of a gender bias in per capita owned landholdings, while the gender bias in operational landholdings is confirmed by the per capita decomposition (Appendix Table A3).

## VII. CONCLUSION

Gender differences in landholdings in Ethiopia have been explained by differences in household characteristics and endowments, particularly household size, male labor, and oxen ownership. In addition, institutional factors such as patrilocality and plough cultivation have been emphasized as possible explanations. By decomposing the differences in landholdings, the analysis in this paper shows that observable characteristics and endowments matter, but they explain less than half the difference. The remaining difference in owned and operational landholdings can be explained by gender bias, measured by differences in returns to the observable characteristics and endowments, as well as by unobservable factors.

The observed gender bias can be explained in several ways. The reform, with its land certification and proclamation targeting enhanced gender equality, did not eradicate the gender bias with respect to households' allocation of land. Whereas previously divorced female-headed households have less land, male-headed households seem to be able to compensate for the lost land through allocations of land from the state or the family and through the land rental market.

Linked to this is the perception of female farmers as "weaker." The reason for their constraint in farming their land can be due to lack of skills, physical requirements, a social taboo

against women ploughing, or a combination thereof. The result is the same: male-headed households seem to be preferred as landowners and operators, and female-headed households are more likely to rent out their land. Targeting the social taboo could be a first step for national policy makers and local Peasant Associations to ensure that women who would like to cultivate land are not harassed or stigmatized in any way. Improving women's access to agricultural extension services could be a second step. If the reason is lack of physical capacity, on the other hand, measures to improve functioning on nonland input markets, such as the hiring of oxen and male labor, is one possibility to reduce the difference caused by differences in household endowments.

The Ethiopian land rental market is characterized by poor landlords and rich tenants, contrary to the rental market stereotype. Further improving the tenure security for households renting out land would be a positive policy intervention. There are laws regulating how much land a household can rent out, as well as the length and payments specified in the rental contract. Households breaking these laws are in danger of losing the rights to their land. Such limitations in the land rental market might increase landlords' tenure insecurity, making them less able to screen tenants and use threat of eviction as a means to increase productivity on the land they rent out (Holden and Bezabih 2008). Limitations in the land rental market are likely to affect female-headed households more than their male counterparts. Whether renting out one's land rather than operating it oneself is the preferred option for female landlords or not, the fact is that they rent out land more often and also rent out a larger share. There are few nonagricultural livelihood opportunities for women in rural areas, and thus putting limitations on the land rental market will harm female-headed households.

Other studies from Ethiopia have found that a certificate for the landholdings has a positive impact on tenure security in general (e.g., Deininger and Jin 2006; Holden, Deininger, and Ghebru 2011). A smaller share of female-headed households holds a certificate for their land, and there is a lack of updating of certificates after a household dissolution, both of which might have a gender-biased impact on tenure security, distribution of land when a household dissolves, and female-headed households' ability to protect their rights to keep the land in the case of a land conflict. The last policy recommendation concerns the certificate itself. For now, only the household head is registered as the "owner" of the land. This has been emphasized in other studies as a constraint for the spouse's access to and control of land, and including the names of both the husband and the wife on the certificate could give more secure rights to women when a household dissolves and improve female-headed households' tenure security in areas with slow or nonexistent updating of issued certificates.

Too little research is conducted on the different titling systems in Ethiopia to draw strong conclusions on the negative impacts of nonjoint titling, and therefore, a comparative study of the impact of certification on gender and the allocation of land tenure rights for land across the regions in Ethiopia is needed. Furthermore, a study of the dynamics of changes in household land would be useful to yield insight into how male- and female-headed households gain and lose access to land from the state, their families, and the market over time.

## APPENDIX A

TABLE A1
Estimated Coefficients from OLS Models for Owned and Operational without Oxen

| Variable | Owned Landholding | Operational Landholding |
|---|---|---|
| Sex of the hh head (0 = male, 1 = female) | − 0.772*** (0.290) | − 2.164*** (0.390) |
| Age of hh head (number of years) | 0.009 (0.008) | − 0.011 (0.011) |
| Literacy (0 = no, 1 = yes) | − 0.070 (0.264) | − 0.375 (0.350) |
| Dependents (< 15, > 64) | − 0.014 (0.068) | 0.142 (0.093) |
| Male wf (men aged 15–64) | 0.487*** (0.106) | 0.644*** (0.156) |
| Female wf (women aged 15–64) | 0.121 (0.116) | − 0.030 (0.177) |
| Divorcee (0 = no, 1 = yes) | − 0.421** (0.207) | − 1.085*** (0.291) |
| Village | 16 village dummies included in the analysis but left out of the table | |
| Constant | 3.194*** (0.976) | 1.641 (0.917) |
| *R*-squared | 0.470 | 0.376 |
| *N* | 359 | 357 |

Robust standard errors in parentheses. OLS, ordinary least squares.
* $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.

TABLE A2
Estimated Coefficients from OLS Models for Owned and Operational Per Capita Landholdings

| Variable | Owned Landholding | Operational Landholding |
|---|---|---|
| Sex of the hh head (0 = male, 1 = female) | − 0.060 (0.136) | − 0.463*** (0.167) |
| Age of hh head (in number of years) | 0.009** (0.003) | 0.000 (0.004) |
| Literacy (0 = no, 1 = yes) | 0.128 (0.156) | 0.156 (0.184) |
| Dependents (< 15, > 64) | − 0.231*** (0.034) | − 0.229*** (0.045) |
| Male wf (men aged 15–64) | − 0.178*** (0.034) | − 0.140*** (0.043) |
| Female wf (women aged 15–64) | –0.267*** (0.048) | − 0.253*** (0.059) |
| Divorcee (0 = no, 1 = yes) | − 0.145* (0.076) | − 0.220** (0.097) |
| Oxen dummy (0 = no, 1 = yes) | 0.081 (0.100) | 0.512*** (0.140) |
| Village | 16 village dummies included in the analysis but left out of the table | |
| Constant | 2.027*** (0.566) | 1.148*** (0.346) |
| *R*-squared | 0.521 | 0.322 |
| *N* | 359 | 357 |

*Note:* Robust standard errors in parentheses.
* $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.

TABLE A3
Decomposition of Per Capita Landholding Differences

| | Owned Landholding | Operational Landholding |
|---|---|---|
| Mean landholdings, male-headed households | 0.910*** (0.060) | 0.970*** (0.069) |
| Mean landholdings, female-headed households | 1.351*** (0.136) | 0.758*** (0.241) |
| Mean difference | − 0.440*** (0.149) | 0.212 (0.142) |
| *Decomposition Estimates* | | |
| Observed endowments | − 0.455 (0.302) | 0.205 (0.306) |
| Return to endowments | 0.035 (0.149) | 0.559*** (0.186) |
| Interaction | − 0.021 (0.298) | − 0.552* (0.326) |
| Number of observations | 357 | 357 |

*Note:* Robust standard errors in parentheses.
* $p < 0.10$; *** $p < 0.01$.

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