What is the Impact of Increased Women's Land Rights on Nutrition? A Study of Ethiopia's Land Reform

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Abstract

Increased women's land rights are associated with improved household outcomes such as better child health and increased proportion of budget spent on food. However, the effect estimates from existing studies are likely to be biased because women who have secure land tenure are different from women without such tenure on unobserved characteristics that affect the outcomes under study. I address this shortcoming by exploiting regional variation in women's land rights generated by Ethiopia's land certification program. In one state land certificates were issued only to the household head (typically male) whereas certificates were issued jointly to household heads and spouses in three other states. Using panel data from rural households, I find that the joint-certificate program was accompanied by decreases in spending on men's clothing and, in regions with relatively low women's status prior to the land reform, increases in food budget share.

I. Introduction

Researchers and international organizations have argued that increased land tenure security is an important tool for promoting development and improving the welfare of the poor (Acemoglu, Johnson, and Robinson 2001; Binswanger, Deininger, and Feder 1995; Sen 2001). The case for promoting land rights is particularly strong for women since in most countries women are less likely to own land, have smaller plots, and farm less lucrative crops (World Bank 2011). Additionally, researchers find that increased women's land rights are associated with improved household outcomes such as increased proportion of budget spent on food (Doss 2006), better child health (Allendorf 2007), increased women's earnings (Peterman 2011), reduced domestic violence (Panda and Agarwal 2005), *inter alia*. In this paper, I examine the impact of increased women's land rights on intra-household resource allocation. Specifically, I study how programs that increased land tenure rights of rural Ethiopian households affected household expenditure and whether there were different effects based on how inclusive of women a land rights program was.

Research on the causal effects of increased land rights has largely examined the household as a single unit. However, land rights can accrue differentially to individuals within a household and often it is the male household head who bears the title to the household's land assets. Further, the few studies that have examined individual- rather than household-level land rights are mostly correlational. The effect estimates from these studies are likely to be biased

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because of the potential endogeneity of land tenure security. Women who have secure land tenure are different from women without such tenure on observed and unobserved characteristics. For example, they may be more informed about their rights. Consequently, measures of women's land rights in the household are likely to be correlated with other characteristics that affect allocation of resources within the household and thereby bias effect estimates.

I address these shortcomings by using data from a 15-year panel study of households in rural Ethiopia and exploiting variation in women's property rights generated by Ethiopia's land certification program, which was conducted in four regions in the country at different times between 1998 and 2005. In one of the regions, land certificates were issued only to the household head (usually a man) whereas certificates were issued jointly to household heads and spouses in the remaining regions. The land certification program thus provides a plausibly exogenous natural experiment with which to examine effects of increasing land tenure security either to a household head only or to both the household head and his spouse. Ethiopia also serves as an important case study because it has one of the world's highest rates of malnutrition. In 2004, 47% of children under five were stunted (low height-for-age) and 37% were underweight (low weight-for-age)(Rajkumar, Gaukler, and Tilahun 2011)The case for stronger land rights for women may be enhanced if women's land rights influence how households allocate their resources towards food.

To understand how the increasing women's land rights shifts bargaining power in the household, I examine whether the jointly-issued certification programs had different effects from the household head-issued program on expenditures on four private goods—men's clothing, women's clothing, boys' clothing and girls' clothing. I then examine how the land certification

programs affected expenditure on food and other household goods to provide insight on the impact of women's land rights on nutrition. While land certification increases women's de jure land rights, it might not improve their de facto rights if prevailing cultural attitudes and practice impede women's property rights (Joireman 2008; Bhaumik, Dimova, and Gang 2014). I therefore examine whether the jointly-issued land certificates had different or no effects in regions where women had relatively low economic and social independence prior to the land reforms.

II. Conceptual Framework

Land rights increase security of tenure, which in turn induces a wealth effect since they increase incentives for investing in more agricultural and land-related inputs (Besley 1995), and reduce the time and other resources spent by households on defending their claims to land (Field 2007). Additionally, formal land rights enhance access to credit since the land can serve as collateral (Feder and Feeny 1991). Furthermore, the registration system that accompanies land titling programs provides a publicly available registry of land information, which reduces the costs of trading land rights to renters or buyers (Deininger, Ali, and Alemu 2011).

An additional impact of increasing women's land rights predicted by the collective household model of Chiappori (1992), which is outlined in Appendix A, is changes in within-household distribution of resources. According to the model, variables referred to as distribution factors have an impact on how a household allocates its resources between various commodities without changing the household members' preferences or the household's budget constraint. Essentially, a distribution factor alters the bargaining power balance in the household; increased bargaining power enables a household member's preferences to weigh more in the household allocation decision.

How would Ethiopian women allocate household resources if they had more bargaining power? This question can be answered directly by eliciting women's preferences or indirectly by observing how household allocations change when women's bargaining power improve. Quisumbing and Maluccio (2003) examine how the value of land and livestock that Ethiopian couples bring into their marriages influences household allocations and find that greater value of women's assets is accompanied by a larger share of household expenditure on food and less on education. The researchers also find some suggestive evidence that greater value of women's assets increases the share of household budget spent on health.

The potential distribution factor that is of interest in this paper is the inclusion of women as co-holders of land tenure rights. However, a policy that assigned land tenure rights to a household head and spouse in a household that previously held no tenure rights may have a wealth effect as well as an intra-household distribution effect. Therefore, the ideal study to examine the effect of land rights on intra-household allocation of resources would randomly assign male-headed households that live on land they do not own to one of three conditions: 1) receive land title that is in the household head's name; 2) receive land title that is in both the household head and his spouse's name; or 3) receive no land title. The following effects would then be observed:

[1] $E[\boldsymbol{Y} \mid \text{Head-only title}] - E[\boldsymbol{Y} \mid \text{No title}]$

[2] $E[\boldsymbol{Y} \mid \text{Joint title}] - E[\boldsymbol{Y} \mid \text{No title}]$

where $\boldsymbol{Y}$ is a vector of the household budget allocation across different types of goods that a household may purchase. Equation [1] is the causal effect of receiving land title that is in the household head's name. Equation [2] is the causal effect of received land title that is in both the

household head and his spouse's name. The causal effect of interest then becomes the difference between [1] and [2]:

[3] $E[\boldsymbol{Y} \mid \text{Joint title}] - E[\boldsymbol{Y} \mid \text{Head-only title}]$.

The intuition is that households where only the head received the land tenure rights and those where the head and spouse received tenure rights experience the wealth effect of increased land rights. The observed differences in household allocation between these two groups of households can then be attributed to the differential distribution effects of head-only versus joint land tenure rights. In the absence of the experimental ideal, I exploit the plausibly exogenous variation in land tenure generated by Ethiopia's land certification program.

III. Institutional Background

A. *Land Ownership in the Pre-reform Period*

All land in Ethiopia was nationalized in 1975, following the establishment of a military communist regime. The regime also set up peasant associations at the community level to implement agricultural and development policies, including allocation of land to households. Under this regime, land was allocated primarily based on household size. Households could not sell or mortgage or rent out the land. Hiring of labor was also illegal. The law, however, allowed for children to inherit parents' land. During the period 1975-1991, as the amount of land available for allocation became inadequate, more land was appropriated from rich households and given to new households.

The military regime was ousted in 1991 and the new government introduced changes in land policy. Land renting and hiring of labor were allowed but selling and mortgaging of land were still not permitted. Land redistribution, with the exception of one region, was also stopped. The new regime, in 1995, also divided the country into 9 ethnically based and politically

autonomous regional states and 2 cities. Different land reform programs conducted in the regions thereafter present variation that I exploit in this paper. I focus on the four largest region states.

B. *Land Registration and Certification*

In 1998-99, the Tigray region implemented a low-cost land registration and certification exercise that covered 80% of the rural households. The process involved identifying owners of plots, inspection and demarcation of plot boundaries with consensus elicited from plot owners and owners of neighboring plots, and registration of plot information in a land registry book. Households were issued certificates in the household head's name and were provided perpetual user rights to the land.

Other regions learned from the Tigray experience and embarked on similar land certification exercises. Amhara region began the certification of land in 2003 followed by Oromia and Southern Nations, Nationalities, and Peoples' Region (SNNP) later in 2003 and 2005. In Amhara, Oromia and SNNP regions, certificates were issued jointly to the household head and spouse, presenting variation in land tenure security by gender that could be exploited.

Ethiopia's land reform has been lauded for its speed and cost-efficiency (Deininger et al. 2008). The program was decentralized and operated at the village level, which allowed rapid progress with majority of rural households covered within 2-3 years of the start of the implementation. The use of unpaid elected committee members, local tools for demarcation and measurement of plots such as ropes and handwritten land registry books kept the cost of the program low (Holden, Deininger, and Ghebru 2011). Deininger et al. (2008) estimate that the program cost 1 USD per plot which was much lower than the on-demand land titling approach adopted in other countries, e.g. in Madagascar where it cost 150-350 USD to complete official land titling procedures (Jacoby and Minten 2007).

In Table 1, we see that the program was rapidly implemented with over 5 million land certificates granted to rural households by 2005. Certificates were issued with minimal expense to households. Program coverage was highest in Tigray where 89%-95% of households received certificates. Program coverage was lowest in SNNP. However, majority of households in SNNP that did not have certificates by 2007 had been registered and were only waiting to receive a certificate (Holden and Tefera 2008).

C. *Literature on the Effects of Ethiopia's Land Reforms*

Several studies have examined the impacts of Ethiopia's land reforms. Holden, Deininger, and Ghebru (2011) find that the Tigray region land certification increased participation of households in the land rental markets, either as tenants or landlords. Holden and Ghebru (2011) compare female-headed households to male-headed households in Tigray region and find that consumption expenditures and land productivity increased more in female-headed households. Holden, Deininger, and Ghebru (2009) also find that the Tigray region land certification had positive effects on land productivity, investment in trees, and maintenance of soil conservation structures. Deininger, Ali, and Alemu (2011) also examine the Amhara region land certification program and find that the program increased rental market participation, land-related investment, and perceived land tenure security.

Studies have also examined households' perceptions of the land reform. Bezabih, Kohlin, and Mannberg (2011) find that the Amhara region land registration increased farmers' trust towards formal institutions. Holden and Tefera (2008) surveyed households in Oromia and SNNP regions. They found that 60% of households believed having a land certificate would reduce conflicts regarding transferring land to children. Seventy five percent believed that the

program increased the tenure security of women, with 50% of men as well as women responding that land would be shared equally in case of divorce.

This paper makes two contributions to the literature on Ethiopia's land reforms. First, I examine how the reforms affected intra-household resource allocation. Second, I examine whether there were differential impacts of the reform based on whether certificates were issued jointly or to the household head alone.

IV. Data

I use household panel data from the Ethiopian Rural Household Survey (ERHS) for the period 1994-2009. ERHS surveyed 1477 households from the four major regions in Ethiopia. ERHS households were randomly sampled from 15 villages. These villages had been selected so that all major agroclimatic zones of the country were included. The surveys were conducted twice in 1994 and once in 1995, 1997, 1999, 2004, and 2009. When the first four waves were fielded (1994-1997), none of the regions had issued any land certificates. By the fifth wave (1999) 1 region had issued certificates to household heads. By 2004, 2 other regions had issued certificates jointly to household heads and spouses. By the last wave (2009), the fourth (and last) major region had issued certificates jointly to head and spouse. ERHS data are therefore suitable since they sufficiently cover the period before and after the land reform.

ERHS obtained demographic information for all household members at every wave. I restrict the data to households that had a male household head and at least one spouse in the pre-reform period, i.e. before 1998. This restriction yields a sample of 1061 households. I also use the households' demographic information to determine the number of men, women, boys (males aged 0-17 years) and girls (females aged 0-17 years) at every wave.

ERHS collected data on household expenditures in the previous week on food as well as food consumption from the household's own farming output, from gifts, in kind wages, and loans. While food purchases clearly represent an outlay of household resources, consumption of non-purchased food also presents an opportunity cost. I therefore include the market value of non-purchased food in determining a household's allocation to food. ERHS also collected data on expenditures in the prior four months on: clothes, shoes and fabrics for men, women, boys, girls and babies; modern medical treatment, modern medicines, and traditional medicine and healers; and school fees and other educational expenses. I sum up these individual expenditure items to determine total expenditure on clothing, healthcare, and education. ERHS also has information on expenditures on fuel, taxes, ceremonies, voluntary contributions, furniture, and other durable and consumable goods. Total household consumption is then determined as the sum of all expenditures, including the market value of non-purchased food. I convert expenditures to 2009 constant prices using the Consumer Price Index for Ethiopia. I also express all expenditures in per month terms. I obtain the shares of a household's budget allocated to food, clothing, healthcare and education by dividing the consumption within respective budget categories by total household consumption.

Agricultural characteristics allow me to include a measure of agroclimatic shocks in the analysis. I observe the white teff, black teff, barley, wheat, maize, and sorghum output of each household, which I sum to obtain total output of the major cereals. ERHS also obtained the number and type of each household's livestock which are used to determine the number of livestock units, a value that succinctly represents the total amount of livestock.

Literacy is considered an important dimension of empowerment and has been linked to a variety of maternal and child health outcomes (Charmes and Wieringa 2003; Dexter, LeVine,

and Velasco 1998; Gallaway and Bernasek 2004; Levine and Rowe 2009). Literacy may be particularly important for land rights since it enables landholders to verify that their names are on land certificates. ERHS collected information on the reading ability of all household members. I compute the village-level literacy rates for men and women as the proportion of married men and married women in each village who can read. I then compute the ratio of women's to men's literacy rates for each village by dividing the women's village-level literacy rate by that of men. I categorize households into two groups based on whether their village-level women-to-men literacy rate ratio is above or below the average. I consider women living in villages with a below-average women-to-men literacy rate ratio to have relatively lower social and economic status.

V. Empirical strategy

My objective to study the effect of increasing women's land rights on bargaining power and on household resource allocation. A common approach to study changes in bargaining power is to examine expenditures on a private assignable good(s). A good is considered assignable if it is consumed by a household member who is known to the researcher. Since cultural norms and fit considerations limit sharing of clothes across gender or age groups, I can assume that expenditure on men's, women's, boys', or girls' clothing represents expenditure that is assigned to those particular groups. I use a panel fixed effects empirical strategy to compare clothing expenditures before and after the certification programs. Using OLS, I estimate

[4] $$E_{ht} = \beta_0 + \beta_1 \text{HeadOnlyCert}_{ht} + \beta_2 \text{JointCert}_{ht} + \zeta_t + \eta_h + \varepsilon_{ht}$$

with E being the proportion of household *h* 's clothing expenditure at time *t* that is spent on either men, women, boys, or girls; HeadOnlyCert is an indicator equal to 1 if the household is in Tigray region and is observed after the region's land certification program; JointCert is an

indicator equal to 1 if the household is in one of the remaining regions (Amhara, Oromia and SNNP) and is observed after its region's certification program. ζ_t and η_h are year and household fixed effects respectively. ε_{ht} is an error term. Because repeated observations within households are correlated and so too are observations within regions, I use a block bootstrap technique clustered on region and with 500 repetitions to compute standard errors (Bertrand, Duflo, and Mullainathan 2004). The coefficient β_1 is the estimated causal effect of the head-only certificate program on household expenditure. Coefficient β_2 is the estimated causal effect of the jointly-issued certificate programs on household expenditure. The data is sufficient to uniquely identify β_1 and β_2 since each household has at least one observation before and after the implementation of land certification in any of the regions. The effect of interest is the difference between β_1 and β_2, which is an estimate of the effect of joint land certification that is in addition to the head-only land certificate program.

The validity of the empirical strategy relies on several features. First, the household fixed effects controls for both observed and unobserved time-invariant household characteristics. Therefore, differences between households in variables related to both household allocation and the timing and nature of the land reforms that are constant over time are adjusted for. As shown in Table 2, households in Tigray were smaller in size, had older heads, had fewer spouses per head and were poorer than the joint-certificate regions prior to the land reforms. Household fixed effects control for such heterogeneity to the extent that it is time-invariant. Since households exposed to the joint certificate programs had younger household heads, a concern is that these households may have different demographic trajectories, e.g. by bearing more children, which could be correlated with the introduction of the certification programs. In subsequent models I examine if results are robust to controlling for the age of the household head and number of men,

women, boys, and girls in the household. Agroclimatic shocks including pests, disease and extreme weather events may also influence the results if they are correlated with the rollout of land certification. I therefore include controls for number of livestock units and the previous year's household output in kilograms of major cereals. A shortcoming of including time-varying controls is that they may attenuate the estimates of interest if the controls mediate the effects of the land certification on consumption. In this case, these models can serve as lower bounds of effect estimates.

Second, since the land reforms were triggered by changes at the federal and region level, they can be considered exogenous to the households. Consequently, the concern with the strategy is with region-level time-varying confounders. These would be region-level factors that influence household allocation and that systematically varied with the timing of the land reforms. For example, we would be concerned if other women-empowerment programs accompanied the land reforms. To verify that the estimated effects were part of the land certification program and not the result of other programs or existing trends, I plot means of expenditure by time. Figure 1 shows that clothing expenditure shares in the two types of regions followed similar trends in the pre-reform period, and it is only after the rollout of certification programs that we see considerable divergence across regions. Conducting the analysis without adjusting for inflation or after adjusting for inflation using village-level food prices does not affect the results, which suggests that results are not driven by differences in inflation rates across regions. I present only results that are adjusted for national-level inflation.

To examine whether increased land tenure rights had different effects for women with high versus low status relative to men, I estimate a model that is similar to [4]:

$$[5] \quad \mathrm{E}_{ht} = \tilde{\beta}_0 + \tilde{\beta}_1 \mathrm{HeadOnlyCert}_{ht} + \tilde{\beta}_2 \mathrm{JointCertHiStatus}_{ht} + \tilde{\beta}_3 \mathrm{JointCertLoStatus}_{ht} + \tilde{\zeta}_t + \tilde{\eta}_h + \tilde{\varepsilon}_{ht}$$

where JointCertHiStatus is an indicator equal to 1 if the household is in a village with above average women-to-men literacy ratio and is observed after its region's certification program. JointCertLoStatus is an indicator equal to 1 if the household is observed in a village with below average women-to-men literacy ratio and after its region's certification program. Coefficient $\tilde{\beta}_2$ is the estimated causal effect of the joint certificate programs on expenditures in high women's status villages and $\tilde{\beta}_3$ is the corresponding estimate for the certificate program in villages where women have low status. The difference between $\tilde{\beta}_1$ and $\tilde{\beta}_2$ and that between $\tilde{\beta}_1$ and $\tilde{\beta}_3$ will differ if women's status before land registration influenced the impact of the program on intra-household dynamics.

In my second set of analyses I examine how changes in bargaining power due to increased land rights influence household consumption. I fit model [5] to study consumption of food clothing, healthcare, and education. I estimate two sets of models. The first set explores the effect of land certification on log-transformed levels of consumption, which provides estimates of the percentage change in consumption. The second set examines the effect on the share of household consumption that is spent on food, clothing, healthcare and education, and is used to examine changes in intra-household resource allocation. The two sets of models also reveal whether results are robust to functional form.

VI. Results

Table 3 presents results for the effect of land certification programs on the share of clothing budget spent on men, women, boys, and girls. Model 1 controls for household fixed effects and year of observation, and shows that exposure to the land certification program in Tigray, where certificates were issued only to household heads, was associated with a small (1.5%) and statistically insignificant decrease in share of clothing budget allocated to men. The

corresponding estimate for regions where certificate were issued to both the household head and spouse is a much larger (4.3%) decrease that is statistically significant. The difference in effects between the two types of regions is statistically significant and suggests that inclusion of women in the land certificates reduced spending on men's clothing. Model 2 adds time-varying controls for households' demographic and agricultural characteristics, and yields slightly stronger results. Model 3 examines the impact of land certification on women's share of the clothing budget and reveals that spending on women's clothing in regions where certificates were issued jointly fell in relation to spending where certificates were issued to household heads only. However, the difference in modest and it disappears in Model 4, which controls for households' demographic and agricultural characteristics. Models 5 and 6 examine effects on boys' clothing expenditures and both show that inclusion of women on the land certificate did not affect estimates of the impact of land certificate on boys' spending. Model 7 shows that joint land certification increased the proportion of clothing budget spent on girls by 4% relative to head-only certification. This estimate remains statistically significant and unchanged after controlling for households' demographic and agricultural characteristics. Overall, the results in Table 3 indicate that increased women's land tenure rights reduced men's bargaining power and shifted resources away from men to children.

In Table 4, I investigate whether there are differences between villages where women had relatively high status from those where they had low status as measured by the pre-reform women-to-men literacy rate ratio. There are no differences observed in effects between these two groups, which suggests that inclusion of women on the land certificates reduced men's bargaining power for women regardless of their pre-reform relative status to men. This result

also provides some reassurance that the results observed are not a reflection of pre-existing abilities of women with high status.

Next, I examine how women utilized their improved bargaining position by examining the effect of the land certification program on log levels of monthly consumption of food, clothing, healthcare, and education. The allocation of resources in the household is a function of prices and the household member's bargaining position and individual preferences. Since the results so far indicate that the bargaining position of women of both high and low status improved relative to men's and we can assume that there were no differences in changes in prices across villages with different pre-reform women's status, differences in the effect of women's land rights in villages with low versus high women-to-men literacy will reflect differences in the women's individual preferences. Model 1 in Table 5 controls for household fixed effects and year of observation, and shows that exposure to the land certification program in Tigray, where certificates were issued only to household heads, was associated with a 12.8% increase in food consumption. In villages where women had relatively high status and where land certificates were issued jointly to household heads and their spouses, land certification was associated with 10.2% increase in food consumption. In the remaining joint-certificate villages, certification was associated with a 0.16% increase in food consumption. None of these increases in food consumption are statistically significant. Model 2 adds time-varying controls for households' demographic and agricultural characteristics which reduce the estimates for Tigray and high women's status joint-certificate villages and increases the estimate for low women's status joint-certificate villages, although the estimates remain statistically insignificant. In models 3 and 4 we see that all land certificate programs increased expenditure on clothing by 29.8%-41.1% but the estimates are not statistically significant. There are also do significant

differences by type of land certification program. As shown in models 5 and 6, exposure to joint certificate programs in villages where women had relatively high status was associated with an increase in healthcare expenditure that was 19.6-20.5 percentage points larger than that observed in the head-only certificate region. The joint certificate program in low women's status villages was associated with even larger (48.2-49.9 percentage-point) difference relative to the head-only certificate region. In Models 7 and 8, we see that the largest increase in education expenditure was observed after the head-only certificate program, whereas the joint certificate program in low women's status villages was accompanied by reductions in education investment relative to other villages.

The results in Table 5 indicate that there were changes in expenditure patterns in all regions as a result of land certification. However, these results combine both the wealth effect and the intra-household distributional effect of land certification. I investigate these intra-household distributional effects directly in Table 6, which models the share of monthly consumption allocated to food, clothing, healthcare and education. Models 1 and 2 show that joint land certification in villages with high women's status was accompanied by a 1.2 to 2.3 percentage point decrease in food share relative to the head-only program whereas joint land certification in the context of low women's status was accompanied by an approximately 5 percentage point increase in food share relative to the head-only program. Models 3 and 4 show that the head-only certificate program was associated with a 2.3 to 2.8 percentage point increase in clothing expenditure compared to changes observed in regions that issued joint certificates. Models 5 and 6 show that joint land certification was accompanied by increases in healthcare share with the largest increase observed in villages where women had low status. Land certification was not associated with changes in education share in any of the regions. These data

are consistent with increased share of food and healthcare as a result of joint land certification in the context of low women's status, and a small increase in healthcare share and a decline in food share after joint certification in the context of low women's status. The results are fairly robust to controlling for time-varying confounders suggesting that sensitivity to agroclimatic shocks are not driving the results.

A. *Robustness Checks*

I conduct further analyses to examine whether the Ethiopia-Eritrea War (May 1998 to June 2000) might be driving the results. The concern here is that Tigray (the Head-only region) lies on border with Eritrea and might therefore have been more affected by the war. However, data from the Annual Agricultural Sample Survey (Central Statistical Authority 1999) suggests that the war had minimal impact on the Tigray region economy since the total area of private peasant land devoted to growing the 20 major crops increased by 13% from 1997-1998 to 1998-1999. Additionally, there was a 42% increase in total crop production in the region in the same period, reflecting a 26% increase in productivity per area of land. Over the same period Amhara region recorded a modest increase in productivity (8%), whereas Oromia and SNNP recorded declines (-4% and -17%, respectively). However, since these data do not tell us what would have happened in the absence of war I conduct one more check. I exclude Tigray households in the village closest to the Eritrean border (Geblen). If the results were driven by the war, I expect that excluding Geblen would change greatly the estimated effects. As we see in Table 7, the war is unlikely to be driving the results since effects of are only slightly affected without Geblen.

VII. Effects on children's anthropometry

My final analysis looks at effects of the land reforms on children's nutrition status using anthropometric indicators. I use data from the 2000, 2005 and 2011 Ethiopian Demographic and

Health Survey (DHS). DHS are nationally representative cross-sectional surveys that are conducted approximately every five years. The surveys collect anthropometric measures from children under five years, demographic characteristics of the children's households as well as test adults for literacy. Since implementation of land reforms in Tigray region begun in 1998, these data do not provide sufficient pre-program observations. To work around this, I examine the nutrition status only for children aged four years old. The intuition is that Tigray children aged four during the 2000 DHS had lived most of their lives prior to the completion of land reforms and therefore their anthropometry would still reflect the pre-reform nutritional conditions. Similarly, four year-old children from Oromia, Amhara, and SNNP surveyed in 2005 would have spent the majority of their lives in the pre-reform period assuming they were born in those regions. Consequently, we can obtain an estimate, albeit a crude one, of the impact of land reforms on children. I exclude children living in the Addis Ababa city-state as well as those living in other urban areas since land reforms were conducted in rural areas and likely had more impact on rural agriculture-based households. I restrict the sample further to households with a male head and where there is at least one woman aged 15-49 years old.

I estimate using OLS the difference-in-difference model:

[5] $$N_{ijt} = \text{RegionType}_j\,\alpha + \text{Post}_{jt}\,\gamma + \text{RegionType}_j * \text{Post}_{jt}\,\delta + X_{ijt}\,\beta + \pi_t + \varepsilon_{ijt}$$

where N_{ijt}, the weight-for-age or height-for-age z-score of child i in region j at year t, is defined as a function of: the region type (a categorical variable indicating head-only land certificate region, joint land certificate region, and regions where no certificates were issued); Post_{jt}, a dummy variable equal to 1 if the child is observed after her region's certification program; the interaction between region type and Post_{jt}; X_{ijt}, a set of demographic characteristics namely gender of the child, total number of children in the household, and the household head's

age*year cohort effect. π_t are year fixed effects and ε_{ht} is an error term. δ is the effect of interest. In order to examine whether there are different effects for children living in clusters (henceforth communities) with high versus low women's status, I stratify my sample into two groups based on whether the child was in a community where the literacy rate ratio comparing women to men was above or below the national average. Since DHS resamples men and women aged 15-49 in ever survey year, estimates of literacy will reflect underlying changes in education and may be correlated with other efforts to increase women's status. I therefore construct the women-to-men literacy ratio using a pseudo-panel of men and women who were aged 15-38 years in 2000 (and 20-43 in 2005 and 26-49 in 2011).

The first two models in Table 8 presents the results for communities where women have low status relative to men. In 2000, children in Amhara, Oromia and SNNP regions had weight-for-age and height-for-age z scores that were approximately 0.26 standard deviations lower than those in Tigray. Children in regions where land certificates were not issued during the study period had lower weight-for-age but higher height-for-age than those in Tigray. The coefficient on the interaction term shows that the implementation of joint land certification was accompanied by large and statistically significant increases in both weight-for-age and height-for-age. The last two columns in Table 8 show the corresponding results for children in communities where women have high relative status. In 2000, the only notable difference in anthropometry for children in such communities is that children regions that had not issued land certificates by 2011 had higher height-for-age scores. Joint land certification in the context of high women's status was not accompanied by any significant changes in height-for-age or weight-for age.

VIII. Conclusion

Drawing on panel data from rural Ethiopia, I examine how land certification programs affected bargaining power and intra-household allocation of resources to food and other expenditures. I exploit the variation in timing and nature of Ethiopia's land reforms to investigate whether issuance of land rights to male household heads or jointly to men and their wives had different effects. I also investigate whether the prevailing status of women matters by comparing effects of women's land rights in villages with disparate women's status. Using the head-only program as a reference for the wealth effect of land reforms and the difference between outcomes of households under the head-only program and those under the joint certification programs as a measure of the distributional effect, I find that joint land certification shifted expenditures away from men's goods and that the pre-reform status of women does not matter in the estimates of the effects on bargaining power. I then examine how women use their increased bargaining power and find that households under the joint certificate land program in the context of low women's status saw increases in food and healthcare expenditure shares. On the other hand, land rights in the context of high women's status were accompanied by declines in food shares but increases in healthcare shares. I also find some suggestive evidence for joint certification coupled with low women's status leading to both increased weight-for-age and height-for-age among children but no effects when coupled with high women's status. These results indicate that increased land rights for women can influence bargaining power and intra-household allocation of resources. However, how women chose to use their improved bargaining position depends on pre-existing conditions. Women with lower status relative to men typically lived in households with smaller proportions of resources allocated to food and they had children with lower weight-for-age and height-for age, and they use their bargaining power to increase

food budget shares and improve the nutritional outcomes of children. Women with higher status already enjoy large food budget shares and have healthier children and perhaps see no need to use their improved bargaining power on nutrition.

Appendix A. Outline of the Collective Household Model

To briefly outline the collective household model, I consider a household that is comprised of a woman *a*, a man *b*, and children *c*. Each individual has his or her own preferences, which are described over the individual's consumption as well as the consumption of other household members. For example, the children's consumption of nutritious food may generate a positive externality for their mother whereas a father's consumption of alcohol may generate negative externalities for the mother. Households consume *K* types of public goods and *k* types of private goods. A good is considered private if it cannot be consumed by more than one person. Let $\boldsymbol{P} = (P_1,..., P_K)$ and $\boldsymbol{p} = (p_1,..., p_k)$ be the *K*- and *k*-vectors of prices for the public and private goods respectively. A household will purchase $\boldsymbol{Q} = (Q_1,..., Q_K)$ and $\boldsymbol{q} = (q_1,..., q_k)$ quantities of public and private goods respectively such that *a* receives $\boldsymbol{q}^a = (q_1^a,..., q_k^a)$, *b* receives $\boldsymbol{q}^b = (q_1^b,..., q_k^b)$, and *c* receive $\boldsymbol{q}^c = (q_1^c,..., q_k^c)$ private goods. The utility function of *a* is denoted $U^a(\boldsymbol{Q},\boldsymbol{q}^a,\boldsymbol{q}^b,\boldsymbol{q}^c)$ and of *b* by $U^b(\boldsymbol{Q},\boldsymbol{q}^a,\boldsymbol{q}^b,\boldsymbol{q}^c)$. For the sake of brevity, I assume that children do not have their own utility functions although nothing in the collective framework precludes the existence of child utility functions. Further, the externalities that occur to parents' utilities from children's consumption may differ from child to child. For instance, parents may derive more positive externality from a son's consumption than from a daughter's consumption.

The household then makes decisions on how to allocate its total expenditure, *x*. A key assumption of the collective model is that the household allocation, denoted $(\boldsymbol{Q},\boldsymbol{q}^a,\boldsymbol{q}^b,\boldsymbol{q}^c)$, is pareto efficient. Thus, for any other allocation, denoted $(\overline{\boldsymbol{Q}}, \overline{\boldsymbol{q}}^{\boldsymbol{a}}, \overline{\boldsymbol{q}}^{\boldsymbol{b}}, \overline{\boldsymbol{q}}^{\boldsymbol{c}})$, that is feasible within the budget constraint, if $U^a(\overline{\boldsymbol{Q}}, \overline{\boldsymbol{q}}^{\boldsymbol{a}}, \overline{\boldsymbol{q}}^{\boldsymbol{b}}, \overline{\boldsymbol{q}}^{\boldsymbol{c}}) > U^a(\boldsymbol{Q},\boldsymbol{q}^a,\boldsymbol{q}^b,\boldsymbol{q}^c)$ it must be that $U^b(\overline{\boldsymbol{Q}}, \overline{\boldsymbol{q}}^{\boldsymbol{a}}, \overline{\boldsymbol{q}}^{\boldsymbol{b}}, \overline{\boldsymbol{q}}^{\boldsymbol{c}}) <$

$U^{b}(\boldsymbol{Q},\boldsymbol{q}^{a},\boldsymbol{q}^{b},\boldsymbol{q}^{c})$ (and conversely). The household allocation problem is therefore the solution to the maximization problem:

$$\max_{Q,q^{a},q^{b},q^{c}} \quad U^{b}(\boldsymbol{Q},\boldsymbol{q}^{a},\boldsymbol{q}^{b},\boldsymbol{q}^{c})$$

$$\text{subject to (1) } \boldsymbol{P}^{T}\boldsymbol{Q} + \boldsymbol{p}^{T}(\boldsymbol{q}^{a}+\boldsymbol{q}^{b}+\boldsymbol{q}^{c}) \leq x$$

$$(2)\ U^{a}(\boldsymbol{Q},\boldsymbol{q}^{a},\boldsymbol{q}^{b},\boldsymbol{q}^{c}) \geq \bar{U}^{a}$$

where $\bar{U}^{a}$ is some utility for individual *a* that is determined by prices ($\boldsymbol{P}$, $\boldsymbol{p}$), total household expenditure *x*, and distribution factors $\boldsymbol{z}$. I.e., the household behaves as if it is maximizing the utility of one member holding the other member's utility at a given level. Conversely, among all household allocations that give some utility $\bar{U}^{b}$ to *b*, the pareto efficient one(s) will give *a* the maximum utility that is feasible. The result from the collective approach is that the household allocation problem is the solution to the maximization problem:

$$\max_{Q,q^{a},q^{b},q^{c}} \quad \mu U^{b}(\boldsymbol{Q},\boldsymbol{q}^{a},\boldsymbol{q}^{b},\boldsymbol{q}^{c}) + U^{a}(\boldsymbol{Q},\boldsymbol{q}^{a},\boldsymbol{q}^{b},\boldsymbol{q}^{c})$$

$$\text{subject to } \boldsymbol{P}^{T}\boldsymbol{Q} + \boldsymbol{p}^{T}(\boldsymbol{q}^{a}+\boldsymbol{q}^{b}+\boldsymbol{q}^{c}) \leq x$$

μ, is a function of prices ($\boldsymbol{P}$, $\boldsymbol{p}$), total household expenditure *x*, and distribution factors $\boldsymbol{z}$. A distribution factor is defined as "any variable that has an impact on the allocation decision process but affects neither preferences nor budget constraints" (Browning, Chiappori, and Weiss 2011). Example distribution factors include, societal norms regarding men's and women's say in the household, and divorce laws. A natural interpretation of μ is in the context of bargaining power. If μ is large then *b*'s preferences dominate and when μ is small, then *a*'s preference matter more.

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Table 1. Land certification program in Ethiopia's four main regions

	Tigray	Amhara	Oromia	SNNP
Year program started	1998	2003	2003	2005
Certificate Type	Head only	Joint	Joint	Joint
Fee for certificate[a]	3 Birr	Free of charge	5 Birr	2 Birr
Households registered by August 2005[b]	632,000 (88%)	2,400,000 (79%)	2,400,000	700,126 (40%)
Households with certificate in				
2000[c]	95%	n/a	n/a	n/a
2003[c]	89%	n/a	n/a	n/a
2006	89%[c],93%[d]	84%[d]	39%[d]	54%[d]
2007		36%-87%[e]	72%-85%[f]	2%-65%[f]
Certificates in man's name alone	71%[d,g]	9%[d]	58%[d], 10%-15%[f]	21%[d], 3%-13%[f]

[a] 1 USD = 8 Birr in 2000-2004
[b] Source: Field visits to regional Ethiopia Environmental Protection Land Administration and Use Authority offices and 24 kebeles (wards) in all four regions (Deininger et al. 2008)
[c] Source: Panel data of 400 households in 16 communities in Tigray region (Holden, Deininger, and Ghebru 2011).
[d] Source: Country-wide panel survey of 2,300 households (Deininger et al. 2008)
[e] Source: 900 households in the East Gojjam zone of the Amhara region (Deininger, Ali, and Alemu 2011).
[f] Source: 600 households in two woredas (districts) in each of Oromia and SNNP (Holden and Tefera 2008)
[g] 14% in woman's name alone

Table 2. Characteristics of ERHS households before land certification (1994-1997)

	Head-only certificate region		Joint certificate region high women-to-men literacy		Joint certificate region low women-to-men literacy	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
Number of men	1.46	(0.76)	1.64	(1.05)	1.69	(1.11)
Number of women	1.43	(0.73)	1.50	(0.98)	1.70	(1.15)
Number of boys	1.78	(1.62)	1.70	(1.48)	1.87	(1.50)
Number of girls	1.57	(1.45)	1.66	(1.35)	1.94	(1.51)
Head's age	52.07	(14.55)	45.85	(15.44)	44.98	(15.15)
Head's occupation						
Farmer	0.89	(0.32)	0.88	(0.33)	0.90	(0.29)
Not working not looking/Disabled	0.06	(0.24)	0.05	(0.21)	0.05	(0.23)
Other	0.05	(0.22)	0.07	(0.26)	0.04	(0.20)
Number of spouses	1.04	(0.19)	1.10	(0.34)	1.22	(0.49)
Total monthly consumption	908.09	(712.83)	1480.96	(1131.42)	1141.31	(1021.75)
Livestock units	1.96	(1.49)	3.87	(4.06)	1.76	(2.32)
Production of major cereals (kg)	193.56	(394.85)	659.78	(936.08)	272.40	(582.36)
Consumption shares						
Food	0.88	(0.11)	0.81	(0.15)	0.76	(0.17)
Clothing	0.04	(0.06)	0.06	(0.08)	0.06	(0.08)
Healthcare	0.01	(0.02)	0.01	(0.06)	0.02	(0.05)
Education	0.00	(0.00)	0.00	(0.01)	0.00	(0.01)
Clothing budget shares						
Men	0.19	(0.30)	0.30	(0.32)	0.28	(0.32)
Women	0.31	(0.37)	0.29	(0.31)	0.30	(0.32)
Boys	0.27	(0.36)	0.23	(0.30)	0.22	(0.29)
Girls	0.23	(0.33)	0.19	(0.27)	0.20	(0.28)
Number of households	80		542		439	

Head-only certificate region = Tigray. Joint certificate regions = Amhara, Oromia and SNNP. Monthly consumption in 2009 Birr constant prices. 1 USD = 9.80 Birr in Jan 2009.

Table 3. Effect of land certification programs on share of clothing expenditure spent on men, women, boys, and girls

	(1) Men's share	(2) Men's share	(3) Women's share	(4) Women's share	(5) Boys' share	(6) Boys' share	(7) Girls' share	(8) Girls' share
HeadOnlyCert	-0.015	-0.008	0.011	0.002	0.014	0.022	-0.010	-0.016
	(0.020)	(0.015)	(0.021)	(0.026)	(0.019)	(0.026)	(0.036)	(0.038)
JointCert	-0.043*	-0.047**	-0.008	-0.008	0.021	0.031	0.030	0.023
	(0.022)	(0.023)	(0.022)	(0.025)	(0.034)	(0.039)	(0.043)	(0.041)
Test of equality								
JointCert - HeadOnlyCert	-0.028***	-0.039***	-0.019*	-0.009	0.007	0.009	0.040***	0.039***
	(0.005)	(0.012)	(0.011)	(0.019)	(0.018)	(0.021)	(0.009)	(0.009)
Household FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
# of men, women, boys, girls	No	Yes	No	Yes	No	Yes	No	Yes
Head age	No	Yes	No	Yes	No	Yes	No	Yes
Cereal output	No	Yes	No	Yes	No	Yes	No	Yes
Livestock units	No	Yes	No	Yes	No	Yes	No	Yes
R^2	0.003	0.011	0.008	0.017	0.008	0.023	0.004	0.022
Number of households	1,051	1,051	1,051	1,051	1,051	1,051	1,051	1,051

Panel fixed effects regression estimated using OLS. Dependent variables in second row; controls in first column. Block bootstrap standard errors clustered on region in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 4. Effect of land certification programs on share of clothing expenditure spent on men, women, boys, and girls

	(1) Men's share	(2) Men's share	(3) Women's share	(4) Women's share	(5) Boys' share	(6) Boys' share	(7) Girls' share	(8) Girls' share
HeadOnlyCert	-0.015	-0.008	0.011	0.002	0.014	0.022	-0.010	-0.016
	(0.019)	(0.014)	(0.017)	(0.022)	(0.020)	(0.027)	(0.033)	(0.033)
JointCertHiStatus	-0.045*	-0.046	0.000	0.000	0.016	0.020	0.029	0.025
	(0.024)	(0.030)	(0.039)	(0.042)	(0.038)	(0.038)	(0.033)	(0.033)
JointCertLoStatus	-0.042*	-0.048**	-0.011	-0.011	0.023	0.036	0.030	0.023
	(0.024)	(0.023)	(0.021)	(0.024)	(0.035)	(0.041)	(0.047)	(0.043)
Test of equality with HeadOnlyCert								
JointCertHiStatus - HeadOnlyCert	-0.027***	-0.040***	-0.022	-0.013	0.009	0.014	0.040**	0.039**
	0.008	0.012	0.015	0.022	0.019	0.024	0.018	0.016
JointCertLoStatus - HeadOnlyCert	-0.030***	-0.038**	-0.011	-0.001	0.001	-0.002	0.039**	0.041***
	(0.005)	(0.017)	(0.033)	(0.032)	(0.020)	(0.016)	(0.019)	(0.011)
Household FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
# of men, women, boys, girls	No	Yes	No	Yes	No	Yes	No	Yes
Head age	No	Yes	No	Yes	No	Yes	No	Yes
Cereal output	No	Yes	No	Yes	No	Yes	No	Yes
Livestock units	No	Yes	No	Yes	No	Yes	No	Yes
R^2	0.003	0.011	0.008	0.017	0.008	0.023	0.004	0.022
Number of households	1,051	1,051	1,051	1,051	1,051	1,051	1,051	1,051

Panel fixed effects regression estimated using OLS. Dependent variables in second row; controls in first column. Block bootstrap standard errors clustered on region in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 5. Effect of land certification programs on monthly log consumption

	(1) Log Food	(2) Log Food	(3) Log Clothing	(4) Log Clothing	(5) Log Healthcare	(6) Log Healthcare	(7) Log Education	(8) Log Education
HeadOnlyCert	0.128	0.078	0.369	0.343	0.032	0.030	0.599***	0.544***
	(0.135)	(0.142)	(0.241)	(0.237)	(0.122)	(0.143)	(0.162)	(0.140)
JointCertHiStatus	0.102	0.078	0.411	0.339	0.237	0.226	0.299	0.296
	(0.193)	(0.181)	(0.347)	(0.321)	(0.149)	(0.180)	(0.403)	(0.376)
JointCertLoStatus	0.016	0.038	0.298	0.327	0.514*	0.530*	0.209	0.220
	(0.186)	(0.188)	(0.424)	(0.385)	(0.270)	(0.309)	(0.215)	(0.186)
Test of equality with HeadOnlyCert								
JointCertHiStatus - HeadOnlyCert	-0.026	0.000	0.042	-0.004	0.205***	0.196**	-0.300	-0.248
	(0.113)	(0.122)	(0.224)	(0.197)	(0.050)	(0.079)	(0.258)	(0.256)
JointCertLoStatus - HeadOnlyCert	-0.112	-0.040	-0.071	-0.016	0.482***	0.499**	-0.390***	-0.324***
	(0.083)	(0.075)	(0.199)	(0.169)	(0.161)	(0.205)	(0.097)	(0.121)
Household FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
# of men, women, boys, girls	No	Yes	No	Yes	No	Yes	No	Yes
Head age	No	Yes	No	Yes	No	Yes	No	Yes
Cereal output	No	Yes	No	Yes	No	Yes	No	Yes
Livestock units	No	Yes	No	Yes	No	Yes	No	Yes
R^2	0.050	0.078	0.075	0.103	0.127	0.130	0.091	0.109
Number of households	1,061	1,061	1,051	1,051	988	985	933	926

Panel fixed effects regression estimated using OLS. Dependent variables in second row; controls in first column. Block bootstrap standard errors clustered on region in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 6. Effect of land certification programs on budget shares

	(1) Food	(2) Food	(3) Clothing	(4) Clothing	(5) Healthcare	(6) Healthcare	(7) Education	(8) Education
HeadOnlyCert	-0.033	-0.038	0.027	0.028	-0.001	-0.000	-0.000	-0.001
	(0.037)	(0.035)	(0.022)	(0.022)	(0.002)	(0.002)	(0.003)	(0.003)
JointCertHiStatus	-0.057	-0.050	0.004	0.000	0.004	0.004**	-0.001	-0.001
	(0.044)	(0.042)	(0.023)	(0.022)	(0.002)	(0.002)	(0.006)	(0.006)
JointCertLoStatus	0.012	0.011	0.004	0.004	0.014**	0.015**	-0.002	-0.002
	(0.050)	(0.045)	(0.037)	(0.035)	(0.006)	(0.006)	(0.004)	(0.004)
Test of equality with HeadOnlyCert								
JointCertHiStatus - HeadOnlyCert	-0.023	-0.012	-0.023**	-0.028***	0.004***	0.004**	-0.001	-0.001
	(0.029)	(0.027)	(0.010)	(0.010)	(0.001)	(0.002)	(0.003)	(0.003)
JointCertLoStatus - HeadOnlyCert	0.045**	0.049***	-0.023	-0.024*	0.015***	0.015***	-0.002	-0.001
	(0.018)	(0.015)	(0.016)	(0.014)	(0.005)	(0.005)	(0.001)	(0.001)
Household FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
# of men, women, boys, girls	No	Yes	No	Yes	No	Yes	No	Yes
Head age	No	Yes	No	Yes	No	Yes	No	Yes
Cereal output	No	Yes	No	Yes	No	Yes	No	Yes
Livestock units	No	Yes	No	Yes	No	Yes	No	Yes
R^2	0.065	0.078	0.045	0.054	0.015	0.015	0.035	0.039
Number of households	1,061	1,061	1,061	1,061	1,061	1,061	1,061	1,061

Panel fixed effects regression estimated using OLS. Dependent variables in second row; controls in first column. Block bootstrap standard errors clustered on region in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 7. Effect of land certification programs on budget shares, excluding village close to Eriterian border

	(1) Food	(2) Food	(3) Clothing	(4) Clothing	(5) Healthcare	(6) Healthcare	(7) Education	(8) Education
HeadOnlyCert	-0.014	-0.018	0.021	0.021	-0.002	-0.001	-0.001	-0.002*
	(0.031)	(0.029)	(0.016)	(0.016)	(0.002)	(0.002)	(0.001)	(0.001)
JointCertHiStatus	-0.050	-0.043	-0.001	-0.005	0.004	0.004	-0.002	-0.003
	(0.036)	(0.034)	(0.014)	(0.013)	(0.004)	(0.003)	(0.004)	(0.004)
JointCertLoStatus	0.019	0.018	-0.001	-0.001	0.015**	0.015**	-0.003	-0.003
	(0.044)	(0.038)	(0.029)	(0.027)	(0.007)	(0.007)	(0.002)	(0.002)
Test of equality with HeadOnlyCert								
JointCertHiStatus - HeadOnlyCert	-0.036	-0.026	-0.022**	-0.026**	0.006***	0.005**	-0.001	-0.001
	(0.029)	(0.027)	(0.010)	(0.010)	(0.002)	(0.002)	(0.003)	(0.003)
JointCertLoStatus - HeadOnlyCert	0.032*	0.036**	-0.023	-0.023*	0.016***	0.016***	-0.002***	-0.001
	(0.017)	(0.015)	(0.014)	(0.012)	(0.005)	(0.005)	(0.001)	(0.001)
Household FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
# of men, women, boys, girls	No	Yes	No	Yes	No	Yes	No	Yes
Head age	No	Yes	No	Yes	No	Yes	No	Yes
Cereal output	No	Yes	No	Yes	No	Yes	No	Yes
Livestock units	No	Yes	No	Yes	No	Yes	No	Yes
R^2	0.067	0.080	0.046	0.056	0.015	0.016	0.037	0.042
Number of households	1,023	1,023	1,023	1,023	1,023	1,023	1,023	1,023

Panel fixed effects regression estimated using OLS. Dependent variables in second row; controls in first column. Block bootstrap standard errors clustered on region in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 8. Effect of land certification programs on children's anthropometry using DHS data

	Low women's status communities		High women's status communities	
	Weight for age	Height for age	Weight for age	Height for age
Region type				
HeadOnly Certificate	Ref	Ref	Ref	Ref
Joint Certificate	-0.265**	-0.263	0.138	0.087
	(0.125)	(0.200)	(0.088)	(0.137)
No Certificate	-0.107	0.218***	0.190	0.431**
	(0.070)	(0.064)	(0.155)	(0.178)
Post	-0.184***	0.036	0.008	0.276**
	(0.058)	(0.077)	(0.100)	(0.114)
Joint Certificate*Post	0.382***	0.263*	0.079	-0.091
	(0.112)	(0.149)	(0.133)	(0.151)
Child's gender	Yes	Yes	Yes	Yes
Child's birth order	Yes	Yes	Yes	Yes
Head's age*year dummies	Yes	Yes	Yes	Yes
# of household children	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
R^2	0.057	0.063	0.063	0.071
Observations	1,803	1,803	1,328	1,328

Dependent variables in first row; controls in first column. Block bootstrap standard errors clustered on region in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Figure 1. Clothing shares spent on men, women, boys, and girls