Gendered Effects of Land Ownership on Household Food Security and Welfare: Empirical evidence from Uganda

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Abstract

In this paper, we examine the gendered effects of landownership on household food security and welfare, using nationally representative data from three waves (2013/14, 2015/16 and 2018/19) of the Uganda National Panel Survey. First, we construct the Household Dietary Diversity Score (HDDS) and Months of Adequate Household Food Provisioning (MAHFP) to measure food security, but also use the number of meals per day and household consumption expenditure to proxy for household welfare. Secondly, we run a correlated random effects model for each of the four outcomes. After controlling for numerous factors – such as drought, floods, and family labour – the results suggest that secure land tenure by females significantly and positively affects household food security and welfare. More precisely, it enhances the MAHFP, HDDS, number of meals per day and household consumption expenditure. Therefore, policies – such as issuance of joint land certificates to both spouses which extend ownership beyond mere user rights – geared towards improving land tenure security among households, particularly for women, will enhance the country's food security and general household welfare. Such efforts are in tandem with Sustainable Development Goals, one, two, and five.

Keywords: Land Ownership, Gender, Food Security, Welfare

JEL Codes: Q15, A10, Q18, I31

1 Introduction

Ensuring food security and improving welfare is a top priority for the global sustainable development agenda.[1] However, despite the increased funding on food production interventions, countries in sub-Saharan Africa are still finding it difficult to improve food security and welfare. This suggests that increasing funding alone is not sufficient because food production systems face several constraints such as land insecurity, scarcity and ownership inequality.[2] Yet secure access to land is crucial for agriculture development, agricultural production and productivity, food security and poverty reduction (Lawry et al. 2017; Landesa, 2012).

Globally, about two billion people experience moderate or severe food insecurity, although the world produces enough food to feed all the 7.5 billion people. FAO (2019) indicates that women are more food insecure than men. Hunger is rising in most parts of Uganda, which puts people at a greater risk of malnutrition and poor health because they lack regular access to nutritious and sufficient food. Uganda has a global hunger index of 30.6 and consequently ranks as 104th out of 117 countries. Furthermore, the prevalence of severe food insecurity in the total population has increased from 17.5% between 2014 and 2016 to 21.7% between 2018 and 2020 (FAO, IFAD, UNICEF, WFP & WHO, 2021). More recently, the COVID-19 pandemic has greatly exacerbated food insecurity in several districts in Uganda. Moreover, Uganda is the 15th most vulnerable country to climate change and the 38th least ready country according to the World Food Programme (2019). Yet vulnerability to food insecurity is heightened by land tenure and ownership insecurity (World Food Programme, 2019).

The increasing hunger underscores the need to fast-track efforts of achieving the Zero Hunger target by 2030 through addressing some of the additional constraints, especially those concerning land. Land scarcity is increasingly important in Africa due to the; (i) increase in population growth, (ii) hikes in food and energy prices, and (iii) high demand for land by investors (Holden, 2020). Also, the growing rural and urban population in Uganda suggests that more food is needed, implying that more land needs to be allocated to food production.[3] Furthermore, Muriisa et al. (2013) indicate that most Ugandans are becoming landless due to the rampant land evictions that are exacerbating the pre-existing inequalities and vulnerabilities. Equally increasing, is the encroachment and grabbing of land, especially in urbanizing areas, as well as expropriation and

[1] Food security is the state of having secure and sustainable access to sufficient food for an active and healthy life (Maxwell and Wiebe, 1999).

[2] In addition, Holden and Otsuka (2014) report that insecure land tenure systems are common in sub-Saharan Africa. Land tenure is the system of rights and institutions that governs access to and use of land and other resources (Maxwell and Wiebe, 1999).

[3] The arable land increased from 5.6 million hectares (26.5% of land area) in 2000 to 6.9 million hectares (34.4% of land area) in 2018 while arable land per individual decreased from 0.22 to 0.16 hectares per person during the same period. Thus the amount of land available for food production per person is decreasing, which has implications for food security– as many people, especially smallholders turn into net buyers of food.

redistribution by the state for private investment or (re)settlement of disaster or conflict-affected people. Inequality in land ownership not only challenges livelihoods but also undermines the productive capacity of the population (FAO, 2019). This subsequently results in food insecurity, especially as demonstrated by increases in hunger.

This paper examines the gendered effects of land ownership on household food security and welfare in Uganda to support government policy in improving food security and welfare. Specifically, the study examines (i) the gendered effect of land ownership on household food security in Uganda, (ii) the gendered effect of land ownership on household welfare in Uganda, and (iii) the alternative pathways through which household food security and welfare in Uganda are affected. Previous Ugandan studies such as Muriisa et al. (2013), Sseguya et al. (2017) and Mwesigye et al. (2020) overlooked the effect of gender when examining the nexus between land ownership and food security and welfare. Yet a gender lens is crucial for understanding the dynamics around land rights, ownership and usage which affect household food security and welfare (FAO, 2002).

Muriisa et al. (2013) examined the effect of land deals and land grabbing on rural development without incorporating the effect of food security, whereas Sseguya et al. (2017) examined social capital dimensions in household food security, without a gender comparative analysis and did not explore land ownership issues. In addition, Mwesigye et al. (2020) used one wave of the 2015/16 Uganda National Panel Survey (UNPS) data to study the effect of female land rights on land management and agricultural productivity, yet the study did not incorporate the effect on household welfare. Overall, these studies used cross-sectional analyses. We attempt to close these gaps by following a longitudinal analysis that employs three waves of the UNPS (2013/14, 2015/16 & 2018/19). We also adopt a diverse range of measures of household food security (household dietary diversity score and months of adequate household food provisioning) and welfare (the number of meals per day and household consumption expenditure) to ascertain the consistency of the effect of land ownership.

Further still, the study adopts and modifies Maxwell and Wiebe's (1999) conceptual framework to establish the link between land ownership and food security and welfare. To empirically estimate the gendered effects of land ownership on household food security and welfare, we adopt econometric approaches that are applicable to count and continuous outcome variables.

We report two main sets of results – descriptive and empirical. First, female-headed households are more food insecure and have fewer number of meals per day compared to male-headed households. In addition, female-headed households mainly acquire new parcels by purchasing while male-headed households acquire new parcels through inheritance and gifts. These findings could be explained by the norms and customs that favor male inheritance to female inheritance

and often give user rights to women but rarely extend ownership rights to them. Second, we find strong evidence that land tenure security by a female household member significantly and positively impacts both household food security and welfare. We also find that weather risks such as drought negatively and significantly affect both food security and welfare. For instance, drought reduces the number of meals per day in a household and consequently the general household welfare.

The results suggest that land ownership greatly varies among men and women, thus making the comparison and contrasting of the respective effects worthwhile. For instance, in most areas of Uganda, women rely on conjugal co-ownership of land, which is only applicable as long as the couple stays married (Friends of the Earth-Uganda, 2012). However, it is worth noting that in most households, food security lies in the hands of the women as men concentrate on cash crops. Therefore, the issue of land ownership and the entire land tenure system is important if the second sustainable development goal (SDG 2) which aims at achieving zero hunger is to be realized.

Therefore, to support government policy in improving food security and welfare, this study contributes to the body of literature that argues for land tenure reforms in sub-Saharan African countries and other developing countries with tenure systems similar to Uganda's. Considering that the literature shows women as major contributors to food security through their engagement in the growing of food crops, we argue for more land ownership rights for women. Notably, improved food security directly feeds into efforts geared towards achieving SDG 2 of zero hunger by 2030. The fact that a secure land tenure system positively and significantly improves general household welfare, implies that policies in this regard will also help the country to achieve other SDGs such as SDG one, which is about achieving zero poverty and launching the country to a higher growth trajectory.

The paper proceeds as follows: Section 2 presents a synthesis of views about the general concepts about land tenure, household food security and welfare, while section 3 presents the data sources and section 4 highlights the methods adopted for this study. Section 5 presents results, their explanation and discussion, and section 6 provides the conclusion plus key policy implications.

2 Land Tenure, Household Food Security and Welfare

Land tenure and food security research traditionally proceeded along two separate strands (Maxwell & Wiebe, 1999). Land tenure research focused on the nexus between land tenure, resource use, agricultural production and income generation while food security research focused on the relationship between income, food consumption, and nutrition status (Maxwell & Wiebe, 1999). Transcending this divide, several studies examined the effects of land ownership on household food security and welfare, guided by different theoretical underpinnings.

Earlier studies focusing on land tenure and food security assume that there is a linear relationship starting from access to resources, production, income generation, consumption and nutrition status (see Maxwell & Weibe [1999]).[4] Holden and Ghebru (2016) and Maxwell and Wiebe (1999) highlight some of the studies that demonstrate the importance of land tenure security in ensuring food security. For instance, different strands of literature emphasize the nexus between land tenure security and agricultural production and productivity (Feder and Feeny, 1991; Besley 1995; Deininger et al. 2008).

Indeed, emerging issues around the debate of land ownership and food security include gender inequalities in terms of ownership (Ali et al., 2014; Ajala, 2017; Doss and Meinzen-Dick, 2020), the rampant land evictions and the ever-growing population that has created more pressure on land thus impacting food security. Other studies have highlighted the impact of climate change on food security (Mubila et al., 2011; Holden, 2020; Glazebrook et al., 2020). Recent studies find that gender plays a key role in ensuring tenure and food security, especially given that women are mainly responsible for household food security as emphasised by Ochieng et al. (2014), Holden and Ghebru (2016) and Palacios-Lopez et al. (2017).

Agarwal (1994) argued that women tend to have weaker land rights than men within households and female-headed households tend to have weaker land rights than male-headed households. Also, Deininger (2010) shows that interventions to boost agricultural productivity may be counterproductive unless traditional land rights and land access by vulnerable groups, especially women, are considered. Previous studies provide evidence that efforts to ensure tenure security such as joint titling and joint land certification have enhanced food production and food security (Ali et al., 2014; Holden & Bezu, 2014, Newman et al., 2015).

Importantly, land scarcity is growing in many parts of Africa and land markets are emerging and becoming more active (Holden et al., 2010). It is worth noting that population growth has also put a lot of pressure on customary tenure systems (Holden and Otsuka, 2014; Holden, 2020; Mwesigye et al, 2017). Uganda has experienced several evictions of smallholder farmers from their land (Muriisa et al., 2013) in favor of other big investments and large-scale farmers of commercial crops. This has happened despite available evidence (Abafita & Kim, 2014) indicating that food security is a multidimensional concept with multi-faceted consequences and that targeting smallholder farmers is critical in achieving the zero hunger target by 2030.

Besides land tenure security, other factors such as the experience in farming activities, off-farm incomes, non-farm incomes, soil and water conservation practices also significantly affect household food security (Beyene & Muche, 2010). Using a geographical discontinuity design with spatial fixed effects Ali et al. (2014) studied the environmental and gender impacts of land tenure

[4] Maxwell and Weibe (1999) report that four strands of literature focusing on (i) tenure security and productivity, (ii) farm size and productivity, (iii) agricultural commercialization and resource conservation and degradation, support the conventional link.

regularization in Africa and uncovered the fact that female-headed households suffer from high levels of tenure insecurity. Importantly, Glazebrook et al. (2020) challenge the male model of agricultural development and argue that women's farming approaches can be more sustainable. They further postulate that women farmers are always undervalued, yet they work harder, with fewer resources, and for less compensation. Consequently, these gender biases compromise the food sovereignty of women.

Maxwell et al. (2014) believe that proper measures of food security are always critical especially for purposes of early warning, assessment of the current as well as prospective status of at-risk populations and the monitoring and evaluation of programs. Food security measures include the food consumption score, the household dietary diversity score, and self-assessed measures of food security, among others. Furthermore, Doss et al. (2015) put forward sex-disaggregated land ownership indicators; for example, the percentage of women or men who are landowners where ownership can be individually or jointly. This is calculated, for instance, as the number of women landowners divided by the total number of women. Importantly, in this case, the unit of analysis is an individual; however, it can be adjusted accordingly.

Notably, there is still scanty literature on land ownership and food security with a gender perspective for Uganda. Studies like Muriisa et al. (2013) have examined land deals and land grabbing and rural development in Uganda without incorporating the effect of food security. Others like Sseguya et al. (2017) have examined social capital dimensions in household food security, without a gender comparative analysis. It is in this regard that our study seeks to close these gaps in the literature in the Ugandan context, by leveraging studies such as Doss et al. (2014), Maxwell and Weibe (1999), Ali et al. (2014), Djurfeldt (2020) as well as Ajala (2017) that have greatly interrogated the issue of land ownership, food security, and gender. In analyzing food security, land ownership and gender, different methodologies have been adopted which range from review of literature as adopted by Djurfeldt (2020), and Maxwell and Weibe (1998), qualitative analysis, to quantitative techniques such as principal component analysis that was adopted by Sseguya et al (2017). Other studies such as Ali et al. (2014) combine more than one of these techniques in their analysis.

2.1 Conceptual Framework

Land is a key factor of production. It is widely conceptualized as a static resource endowment to be allocated to agricultural production and income generation. In addition, increased agricultural productivity as a result of a secure land tenure leads to improved welfare, income, food security and nutrition (Mwesigye et al., 2020; Melesse and Awel., 2020; Mwesigye et al., 2017). According to Maxwell and Wiebe (1999), the link between land and food follows a linear framework that begins with access to resources (i.e. land) and proceeds causally through production, income generation and consumption decisions to nutritional status (see Figure 1).

<<<Figure 1 Here>>>

Figure 1, suggests a causal logic that flows from left to right, implying that direct land policy opportunities improve food security, especially in places like Uganda where food security is a recurrent problem, which is often exacerbated by the porous tenure institutions.

We however, acknowledge the fact that the framework presented in Figure 1 is quite simplistic and does not fully recognize the complexity of the elements and links illustrated. In addition, food consumption and nutritional status do not adequately capture the complexities surrounding food security. Therefore, to understand how households gain access to land and how the different forms of access to land affect food security and welfare while incorporating gender, we expand the aforementioned framework to capture the various complexities. In this regard, we construct measures of food security and welfare, i.e. the HDDS and MAHFP to measure food security, whereas, number of meals per day (including breakfast), and household consumption expenditure (Ugandan Shillings) proxy for household welfare. Further still, we are curious to find out whether the linkages between land and food can operate in the opposite direction.

While expanding the framework, we incorporate the land ownership environment in Uganda and the anticipated final household food and welfare outcomes (see Figure 2). Households or household members with secure land ownership such as those owning a parcel certificate (i.e. either certificate of title, certificate of customary ownership or certificate of occupancy) are expected to be more food secure and thus enjoy improved welfare, whereas those without any form of parcel certificate are expected to suffer from food insecurity and consequently experience low welfare. There is always a fear of investing in land whose ownership is not certain or might be disputed by someone at any time in the future.

<<<Figure 2 Here>>>

3 Data

The study uses data from three waves of the Uganda National Panel Survey (i.e. 2013/14, 2015/16 and 2018/19), which is collected under the World Bank's Living Standards Measurement Survey (LSMS) – Integrated Survey on Agriculture (ISA) project. We choose the three waves mainly due to the sample refresh that happened with the UNPS 2013/14 where one-third of the initial UNPS sample was refreshed to balance the advantages and shortcomings of panel surveys. Consequently, the study does not utilize the first three waves that were collected before the 2013/14 wave, for consistency. The LSMS-ISA data is a rich, nationally-representative panel dataset that contains a wide range of socio-economic information. The survey collects information using the household, agriculture, community, and woman modules from about 3,000 households in each wave. The agricultural module provides details at the plot and parcel level, which includes parcel characteristics, such as parcel certification and land ownership rights, among other variables.

Important to note is that agricultural data is collected through two household visits – six months apart – to account for the two agricultural seasons experienced in most of Uganda. The household module collects information on the number of meals per day in a household, food scarcity experiences, household consumption habits, as well as other household characteristics.

First, we present the definitions of variables while highlighting the nature of each (see Table 3.1). Secondly, we present descriptive statistics – disaggregated by the gender of the household head – accompanied by t-test results to ascertain the significance of mean differences (see Table 3.2). We further present descriptive statistics for the entire pooled data (see Table 3.3).

<<<Table 3.1 Here>>>

The three outcomes of the; MAHFP, HDDS, and number of meals taken in the household per day fall under count data. Both MAHFP and HDDS have an upper bound of 12 since they range from zero to 12, whereas, the number of meals consumed by a household in a day does not have a specific prior upper bound. The number of meals per day (including breakfast) and household consumption expenditure in Ugandan Shillings (UGX) proxy household welfare.

Months of Adequate Household Food Provisioning (MAHFP)

To construct the MAHFP, we follow the same procedure as that put forward by Bilinsky and Swindale (2010). The indicator focuses on the desired outcome of improved household food access – improved household food consumption – which depends on the ability of the household to obtain food from their own production, stocks, among other means.

We consider 12 months of the year as January (A), February (B), March (C), April (D), May (E), June (F), July (G), August (H), September (I), October (J), November (K), and December (L). It is worth noting that the indicator ranges from 0 to 12. Precisely, this follows the responses from the question of *"Were there months, in the past 12 months, in which you did not have enough food to meet your family's needs?"* The months in which the household was unable to meet the food needs are coded 1 (one) and 0 (zero) otherwise. Therefore, we calculate the MAHFP for each household as:

$$MAHFP = 12 - Sum\ (A + B + C + D + E + F + G + H + I + J + K + L)$$

Implying that a household with enough food throughout the year will have MAHFP of 12 as all months will be coded 0 (zero). The right-hand side is the same as twelve months *minus* the total number of months in a year that the household was unable to meet their food needs. The remainder gives the number of MAHFP, which is a count outcome.

Household Dietary Diversity Score (HDDS)

According to Swindale and Bilinsky (2006), household food access is defined as the ability to acquire sufficient quality and quantity of food to meet all household members' nutritional

requirements for productive lives. They argue that for the indicator to better reflect the quality of diet, the number of different food groups consumed should be calculated, rather than the number of different foods consumed. This is so because just the number of foods can be misleading as a household can easily consume four different foods, yet they are all cereals.

To mitigate the shortfalls of such misleading scores, 12 food groups were suggested to calculate HDDS. These include (A) Cereals, (B) Root and tubers, (C) Vegetables, (D) Fruits, (E) Meat, poultry, offal, (F) Eggs, (G) Fish and seafood, (H) Pulses/legumes/nuts, (I) Milk and milk products, (J) Oil/fats, (K) Sugar/honey, and (L) Miscellaneous (Swindale and Bilinsky, 2006). Each food group is assigned a score of one (1) (if consumed) or zero (0) (if not consumed) and the household score ranges from zero (0) to 12. Therefore, the HDDS is equal to the total number of food groups consumed by the household and it is given by:

HDDS = Sum (A + B + C + D + E + F + G + H + I + J + K + L)

Meals per Day

The number of meals taken in the household per day (including breakfast) is directly captured in all the three waves of the data. We adopt the variable to proxy for household welfare.

Household Consumption Expenditure

We also proxy household welfare by the amount of money in Ugandan Shillings (UGX) that the household spends on items consumed both at home and away from home in seven days.

<<<Table 3.2 Here>>>

3.1 Descriptive Statistics

Female-headed households are more food insecure compared to male-headed households (see Table 3.2). This is witnessed through the lower mean of the HDDS, which is 7.0 compared to 7.4 for male-headed households, as well as 10.6 (female-headed) and 11.1 (male-headed) for the MAHFP. Paradoxically, previous studies have shown that women contribute more to food security compared to men, as men tend to concentrate on cash crops. Therefore, it is worth investigating why women who contribute more to food security through higher involvement in food crops unfortunately tend to suffer more from food insecurity compared to men.

On average, female-headed households have fewer meals per day compared to male-headed households. Regarding the acquisition of new parcels, on average, female-headed households mainly acquire new parcels by purchasing whereas male-headed households mainly acquire new parcels through inheritance and gifts. This result is partly explained by the prevailing norms and customs which favor male inheritance to female inheritance.

The average parcel size in acres for female-headed households is 1.1 acres compared to 1.5 acres for male-headed households. Besides this difference in the size of land possessed, female-headed households are more concerned that somebody might dispute their ownership/user rights on the parcel. The results further indicate that the average age of a female household head is 56 years compared to 44 years for the male head. Importantly, the results also suggest that there are more widows than widowers in Uganda. On average female-headed households have fewer members (4 household members) compared to male headed households (5 household members). Consequently, female-headed households have lesser family labour as measured by the number of adults (18-65 years) per acre compared to male-headed households. In addition, on average female-headed households spend less on consumption (UGX 16087.22) compared to male-headed households (UGX 22607.72) and the mean difference is statistically significant at a 1% level of significance and this confirms the low levels of welfare in female-headed households.

<<<Table 3.3 Here>>>

After pooling all the data together (see Table 3.3), descriptive results indicate that on average households in Uganda consume about seven different kinds of foods out of the specified 12 food groups in the HDDS, and go for approximately 10 months with adequate food access out the 12 months in a year. Each household consumes approximately two meals per day – including breakfast – which implies that minus breakfast each household consumes one meal per day on average.

The results further indicate that overall, only 18 percent of female household members have any parcel ownership certificate – whether a certificate of title, certificate of customary ownership or a certificate of occupancy – which reaffirms the prevailing land tenure insecurities in the country. Generally, female household members possess parcel user rights rather than ownership rights. We also see that the most dominant system of land tenure in Uganda is customary (48%) followed by the freehold system (47%), implying that 95% of land in Uganda is owned through customary and freehold land tenure systems. The remaining 5% is shared between mailo land (approx. 2%) and leasehold (approx. 3%) systems.

On acquisition of new parcels, results indicate that majority of the land in Uganda is acquired through inheritance or received as a gift (69%) compared to approximately 30% which is purchased. Important to note is that close to 1% (0.8%) of the land in Uganda is acquired by just walking in, clearing the land and occupying it. The remaining land is acquired through other means like leasing. In addition, close to 7% of Ugandan households are concerned that at some time someone will dispute their ownership of the parcel/land.

The youngest household head is 18 years, whereas the oldest is 98 years of age. Consequently, the results indicate that the average age of the household head is 48 years. On average each household

has about six members – including the household head – with a minimum of one household member in a household and a maximum of 27 members. Further still, majority of Ugandans live in rural compared to urban areas and they are either married monogamously (33%) or have never been married (44%). In addition, 8% are widows or widowers, 6% are divorced or separated, whereas approximately 10% are in polygamous marriages.

4 Methods

In this section, we present the different econometric approaches and techniques that were adopted to achieve the study objectives. We highlight the specific appropriate estimation technique for each outcome variable after comparing it with other possible techniques.

4.1 Estimation Strategy

For us to empirically estimate the gendered effects of land ownership on household food security and welfare, we follow techniques suitable for the three respective count outcomes and the continuous outcome of household consumption expenditure.

We specify the econometric models for MAHFP, HDDS, meals per day, and household consumption expenditure as follows:

$$MAHFP_{it} = \alpha_0 + \alpha_1 Landownership_{it} + X'_{it}\theta + \varepsilon_{it} \quad (4.1)$$

$$HDDS_{it} = \alpha_0 + \alpha_1 Landownership_{it} + X'_{it}\theta + \varepsilon_{it} \quad (4.2)$$

$$MEALS_{it} = \alpha_0 + \alpha_1 Landownership_{it} + X'_{it}\theta + \varepsilon_{it} \quad (4.3)$$

$$LogHouseholdconsexp_{it} = \alpha_0 + \alpha_1 Landownership_{it} + X'_{it}\theta + \varepsilon_{it} \quad (4.4)$$

where $MAHFP_{it}$ is the number of months of adequate household food provisioning for household i at time t as specified in model (4.1). $Landownership_{it}$ is an indicator of land ownership (i.e. 1 if a female household member i has a parcel certificate and zero (0) otherwise, at time t). In addition, θ is the parameter for control variables X (vector of household, parcel and individual characteristics), ε is the error term, α_0 is a constant, and α_1 is the parameter of interest which explains the effect of land ownership on MAHFP. The subsequent models, (4.2), (4.3), and (4.4) follow a similar structure for the aforementioned outcomes. We also carry out a monotonic transformation of logging, on the outcome of household consumption expenditure so as to normalize it. We do so because descriptive statistics unearth its skewness.

The poisson and negative binomial models are among the most popular models for count data. For panel data, either the fixed effects (FE) or random effects (RE) estimator can be adopted, depending on the nature of the data. Although the FE estimator is possible for both poisson and negative binomial models, in general, it is not possible for short panels (Cameron and Trivedi,

2005). Looking at our micro panel of $T = 3$ (3 waves) and a large N, the fixed effects estimator causes estimation challenges. In addition, the estimator suffers from the incidental parameters problem. Importantly, time-invariant regressors will be eliminated by the fixed effects transformation, implying that coefficients of time-invariant regressors cannot be identified. Just like the FE estimator, the RE estimator is possible for both poisson and negative binomial models. In case several complications occur simultaneously such as non-separable individual-specific effects and endogenous regressors, these are most conveniently analyzed in RE or moment-based models (Cameron and Trivedi, 2005).

It is worth noting that in applied work, the poisson regression model is restrictive in two ways: First, it is based on the assumption that events occur independently over time, yet this is not always the case, since in real life the prior occurrence of an event, may raise the probability of subsequent occurrence of the same or similar event. Secondly, the assumption that the conditional mean and variance of Y given X are equal, is too strong, which fails to account for under-dispersion and over-dispersion. Conversely, the negative binomial allows for over-dispersion (Cameron and Trivedi, 1986; Cameron and Trivedi, 2005) and the usual conditional Maximum Likelihood Estimation (MLE) standard errors, t statistics, Wald statistics, and likelihood ratio statistics are asymptotically valid for large N (Wooldridge, 2010). We notice that this is the behavior of our data since $T = 3$ (2013/14, 2015/16 and 2018/19 waves) against a large N. Although, this is not conclusive enough to run the negative binomial for any count variable, tests for over-dispersion and under-dispersion are necessary. Favero et al. (2020) present a new and direct way for identification of over-dispersion as an alternative to the long procedure presented by Cameron and Trivedi (2010), which we implement in this regard without the necessity of first estimating poisson and negative binomial models. We use this test ($H_0 = Equidispersion$) and for the three count outcomes, the probability value of ($P > |t| = 0.000$) prompts us to reject the null hypothesis of equidispersion.

After assessing the merits and shortcomings of the aforementioned models, we now embark on finding out whether they produce reliable estimates in the event of endogeneity. We note that both the poisson and negative binomial model will result in biased estimates. In unobserved effects models, the two kinds of endogeneity for an explanatory variable; (i) correlation with unobserved effects (time constant), and (ii) correlation with innovations (time varying), lead to biased and inconsistent estimates if not adequately addressed (Wooldridge, 2013). Important to note is that, the one common method always applied to control for selection bias and endogeneity is propensity score matching; however, this approach only controls for bias in observable characteristics, yet endogeneity may also be related to unobservable factors. Therefore, in order, to circumvent this shortfall, most studies adopt the Correlated Random Effects (CRE) model. In the CRE model, means of time-varying covariates are included as additional regressors (Schunck, 2013; Kim et al., 2019; Wooldridge, 2013; Wooldridge, 2010). Including the means in the models accounts for any

level two effect that the unobserved term would have. For example, if x is correlated with ε, adding the mean ($\bar{x}$) as a control, makes ε and x conditionally independent from one another.

Consequently, the CRE model solves the endogeneity bias by incorporating the aforementioned cluster means. In addition, it is an appropriate alternative to the standard RE and FE models, because it not only provides within estimates of variables that vary between and within clusters, but also allows for the inclusion of variables that vary only between clusters (Schunck, 2013). In either case, a decomposition of within and between effects in a single model increases flexibility in model setup. This is basically why it is also known as the within-between model. Most importantly, the CRE does not rely on the strong assumption that the individual unobserved heterogeneity is uncorrelated with the independent variables, as it is assumed with a RE model. Therefore, we follow the same procedure and include the means of the household size, family labour, marital status, residence, and the dispute concern over parcel ownership. We do so because the aforementioned variables are expected to vary both between and within clusters (Schunck, 2013).

Finally, in order to capture seasonality and year-specific effects, we include two year dummies, since we have three waves. This is because we suspect that there might be specific effects to the respective years. By controlling for time effects in the model we set out to get the true and non-spurious relationship between the dependent and independent variables. Although modelling time is not the primary concern, time dummies greatly contribute to the reliability and parsimony of the models.

5 Results

In this section, we present the empirical findings of the study as generated by the CRE models for the four respective outcomes (see Tables 5.1).

5.1 Empirical Results

Results in Table 5.1 indicate that holding other factors constant, a female household member having a parcel certificate (i.e. either certificate of title, certificate of customary ownership or certificate of occupancy) significantly and positively affects both household food security (MAHFP and HDDS) and welfare (meals per day and household consumption expenditure). In other words, possession of a parcel certificate by a female house household member increases the MAHFP and HDDS of the household by 0.36 and 0.79 respectively. We also find that possession of a parcel certificate by a female household member is positively associated with household consumption expenditure which is an indication of better household welfare. This is the same direction of effect for the number of meals per day in a household, that is to say, possession of a parcel certificate by a female house household member increases the number of meals consumed in a household by 0.15. In the same regard, it raises household consumption expenditure raises by

0.6%. Specifically, this suggests that having a parcel certificate leads to more food security through consuming more food groups, experiencing more months of adequate food provisioning, more meals per day and consequently better household welfare.

This is so, after controlling for other important factors such as drought experiences, flood episodes, residence (urban or rural), marital status, household size, and family labour (see Table 5.1).

<<<Table 5.1 Here>>>

It is worth noting that, besides parcel certification, both drought and floods experiences stand out to have a strong and negative effect on both household food security and welfare. This re-affirms the importance of weather factors on household food security and welfare.

5.2 Discussion

In this study, we empirically estimate the effects of land ownership on household food security and welfare while being cognizant of gender peculiarities and inequalities. First, the results consistently suggest that female-headed households are worse off compared to male-headed households in terms of both food security and welfare. This implies that any land tenure insecurity will most likely affect women more compared to men. Studies such as Ali et al. (2014), Ajala (2017) and Doss and Meinzen-Dick (2020) have highlighted gender inequalities in terms of land ownership and argue that indeed women are more vulnerable than men. Importantly, even in female-headed households, possession of both ownership and user rights is not guaranteed. This can be partly explained by the prevailing customs and norms that tend to favor male ownership over female ownership. This is also true when it comes to inheritance of land as most Ugandan societies prefer male to female inheritance. It is witnessed through the fact that most family heirs turn out to be males irrespective of their age in relation to females.

Findings show that parcel certification is very low in Uganda because, overall, only 16 percent of parcels have either a certificate of title, certificate of customary ownership or a certificate of occupancy. This creates a loophole for the exploitation of Ugandans and thus increases land disputes as more people get caught in unclear ownership of land. However, this might not necessarily imply that Ugandans do not like formalizing parcel ownership through certification. It might rather be a reflection of other deterrent factors such as high costs involved in the process of certification. For instance, Mwesigye et al. (2020) postulate that titling and leasing are still rare in Uganda mainly because of high costs – such as surveying and demarcation costs – involved in the process of obtaining a land title. Further still, on average female-headed households acquire new parcels by purchasing compared to male-headed households, whereas more male-headed households acquire new parcels through inheritance and gifts. Noteworthy, this does not necessarily imply that females have more money to purchase land than males. It rather means that

females are left with only the option of purchasing land since the prevailing norms and customs rarely give them other options of acquiring land, such as inheritance.

Furthermore, the average parcel size (in acres) for female-headed households is 1.1 compared to 1.5 acres for male-headed households. Besides this difference in the size of land possessed, female-headed households are more concerned that somebody might dispute their ownership/user rights on the parcel. The results also suggest that there are more widows than widowers in Uganda, which raises the vulnerability risk since land ownership or user rights are often guaranteed as long as the husband is still alive. This is directly related to the finding that on average female-household heads are aged 56 years compared to 44 years for the male heads. This implies that, in Uganda women are more likely to live longer than their husbands and their land tenure security needs to be considered even after the death of their husbands.

Further still, there is a clear consensus about land tenure security (as proxied by ownership of a parcel certificate) on household food security and welfare. This finding is consistent for all the four models. Therefore, policies geared towards improving land tenure security among households, particularly female-headed households, will go a long way in not only enhancing the country's food security, but also the general welfare.

The study is not without limitations, for instance, due to data constraints we do not incorporate some variables that exhibited very few observations because of missing values. Including such variables would bias the results, as the sample would cease to be representative. For example, we did not include the highest level of education of the household head since it had many missing data points. Importantly, although our analysis leverages gender of the household head and parcel ownership by female household members, it does not include all dimensions of gender – which make it a social construct. Notwithstanding the above, our findings remain reliable and robust.

6 Conclusion

As one way of enhancing food security and general welfare among households, this study contributes to the body of knowledge that argues for land tenure reforms in sub-Saharan African countries as well as other developing countries with tenure systems similar to Uganda's. Considering that literature shows women as major contributors to food security – through their engagement in the growing of food crops – compared to men who tend to concentrate on cash crops, we argue for more land ownership rights towards women. Important to note is that improved food security directly feeds into efforts geared towards achieving the second SDG of zero hunger by 2030. The fact that a secure land tenure system positively and significantly improves general household welfare, implies that policies in this regard will also help the country to achieve other SDGs such as SDG one, which aims at achieving zero poverty and launching the country to a higher growth trajectory.

Moreover, studies such as Melesse and Awel (2020) and Mwesigye et al. (2020) have already shown that secure land ownership for women increases agricultural productivity, which consequently reduces hunger and improves household welfare. Therefore, the issuance of joint land certificates to both spouses by the government can provide a guarantee of land ownership to women even after their husbands have died. According to Friends of the Earth-Uganda (2012), in most areas of Uganda, women rely on conjugal (bridal) co-ownership of land, which is only applicable as long as the couple stays married. Ironically, in most households, food security lies in the hands of the women. Furthermore, besides advocating for more representation of women on Land Boards, there needs to be a deliberate effort to ensure that women have access to land, not only through purchase, but also through other possible means like inheritance. This can easily be achieved through an act of parliament that stipulates that females also have a right to inherit and fully own land. All this will enable the country to achieve SDG five which aims at achieving gender equality and empowering all women by 2030. Finally, land certification costs should be waived or a deliberate effort to subsidize Ugandans must be prioritized by the government.

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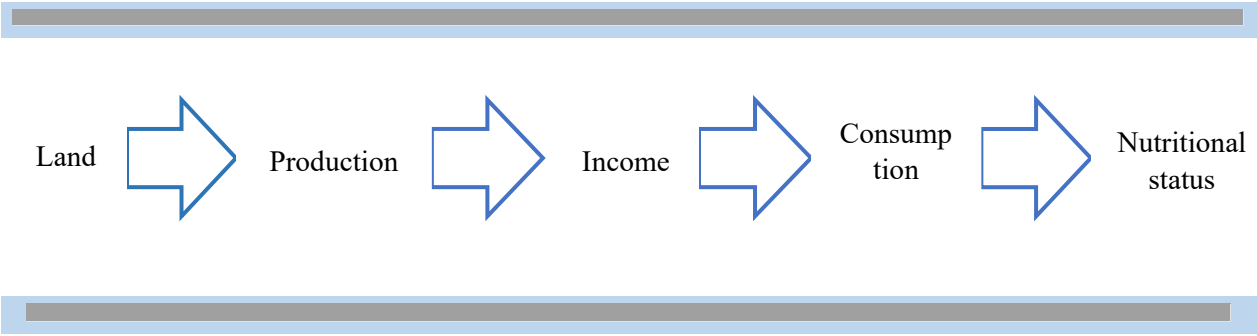
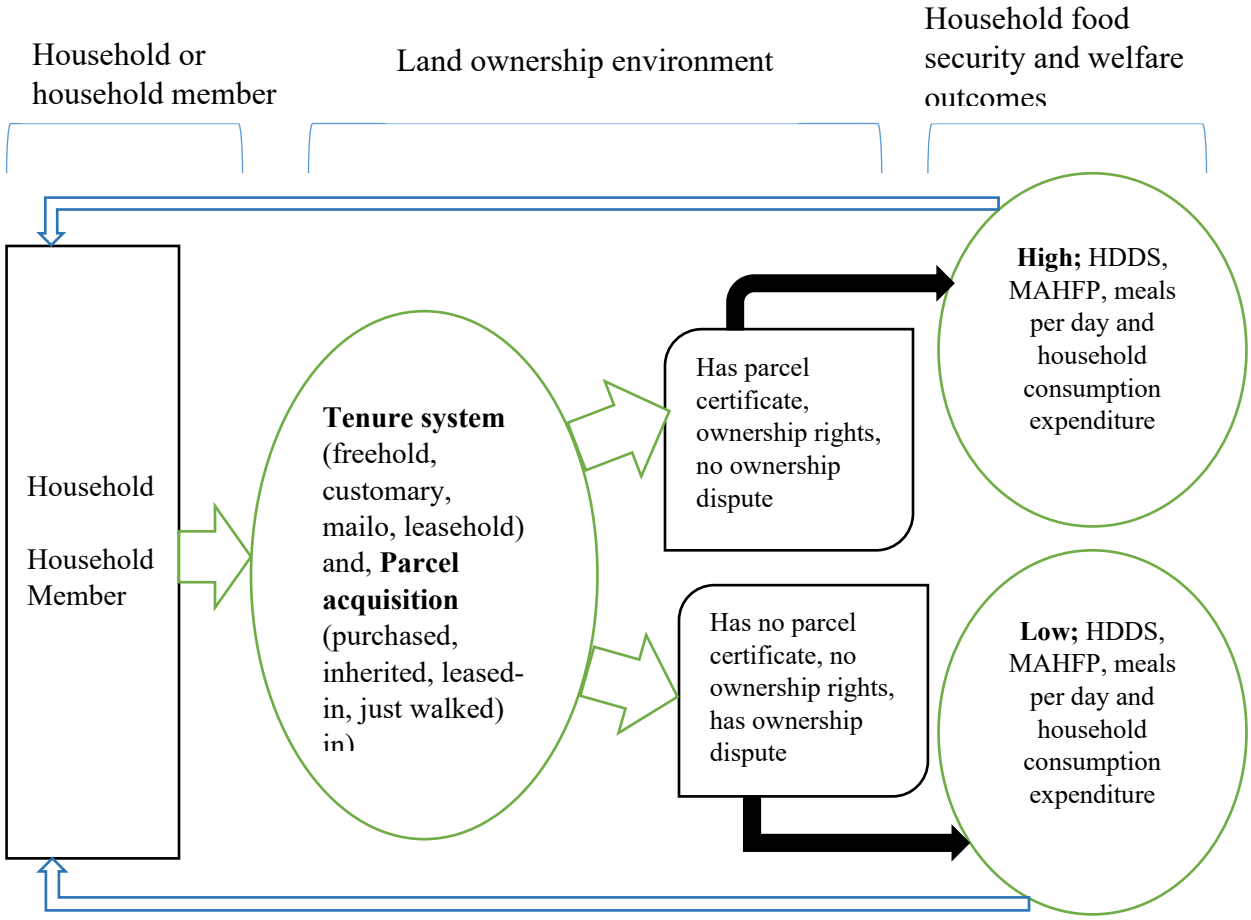
Figures and Tables

Figure 1: The Link between Land and Food Security



Source: Adapted from Maxwell and Wiebe (1999)

Figure 2: The relationship between land ownership and household food security and welfare



Source: Authors' construction, 2021

Table 3.1 Definition of Variables

Variable	Definition	Nature of Variable
Outcomes		
Household Dietary Diversity Score (HDDS) *[0-12]*	The number of different food groups consumed within the household.	Count
Months of Adequate Household Food Provisioning (MAHFP) *[0-12]*	The number of months in a year for which the household was able to adequately meet its food needs.	Count
Number of Meals per day	The number of meals taken in the household per day – including breakfast.	Count
Household Consumption Expenditure (UGX)	The amount of money in Ugandan Shillings (UGX) that the household spends on items consumed both at home and away from home in the past 7 days.	Continuous
Explanatory variables:		
Parcel has a formal certificate (Yes=1)	A parcel with a certificate of title, certificate of customary ownership or a certificate of occupancy.	Binary
Land ownership and access	Do you currently have access to the parcel? "Access refers to ownership rights to the parcel"	Binary
(Yes=1)	Household experienced drought in the past 12 months.	Binary
Residence	Rural=1 Urban=2	Binary
Dispute concern over parcel ownership (Yes=1)	Thinks that there might be a dispute over parcel ownership rights in the next 5 years from a private party.	Binary
Marital status (1-5)	Married monogamously=1 Married polygamously=2 Divorced or separated=3 Widow or widower=4 Never married=5	Categorical
Floods (Yes=1)	Household experienced floods in the past 12 months.	Binary
Family labour	The number of adults (18-65yrs) per acre, in a household.	Continuous
Household size	The number of members in a household.	Continuous

Table 3.2: Descriptive statistics by gender of the household head

Variable	Female-Headed		Male-Headed		t-test
	Mean (A)	Std.Dev.	Mean (B)	Std.Dev.	A – B
Outcomes:					
Household Dietary Diversity Score (HDDS) *[0-12]*	7. 011	2.475	7.368	2.655	-0.357**
Months of Adequate Household Food Provisioning (MAHFP) *[0-12]*	10.595	2.225	11.062	1.775	-0.467 ***
Number of Meals per day (including breakfast)	2.343	0.605	2.434	1.060	-0.090
Household Consumption Expenditure (UGX)	16087.22	16688.36	22607.72	23179.62	-6520.49***
Explanatory variables:					
Parcel has a formal certificate (title, customary ownership or occupancy) (Yes=1)	0.174	0.380	0.118	0.323	0.056***
Land ownership and access (Yes=1)	0.953	0.210	0.979	0.141	-0.026**

Land Tenure System (1-4)					
Freehold	0.432	0.496	0.478	0.50	-0.046
Leasehold	0.045	0.209	0.02	0.141	0.025*
Mailo	0.018	0.134	0.007	0.082	0.011
Customary	0.505	0.501	0.496	0.501	0.009
New Parcel Acquisition (1-4)					
Purchased	0.307	0.462	0.256	0.437	0.050*
Inherited or received as a gift	0.675	0.470	0.725	0.447	-0.050*
Leased-in	0.005	0.069	0.002	0.049	0.002
Just walked in (cleared)	0.014	0.118	0.016	0.127	-.002
Dispute concern over parcel ownership (Yes=1)	0.076	0.265	0.064	0.245	0.011
Parcel size (in acres)	1.124	1.064	1.497	2.188	-0.374*
Drought (Yes=1)	0.390	0.489	0.338	0.473	0.052*
Floods (Yes=1)	0.023	0.151	0.050	0.217	-0.026**
Household size	4.125	2.623	5.318	3.042	-1.192***
Family labour (number of adults (18-65yrs) per acre)	0.683	0.233	0.776	0.373	-0.203*
Marital status (1-5)					
Married monogamously	0.072	0.259	0.709	0.455	-0.637***
Married polygamously	0.152	0.359	0.150	0.358	0.001
Divorced or separated	0.163	0.370	0.073	0.261	0.089***
Widow or widower	0.587	0.493	0.030	0.171	0.557***
Never married	0.027	0.161	0.038	0.190	-0.011
Residence (1=Rural, 2=Urban)					
Rural	0.886	0.318	0.910	0.287	-0.023
Urban	0.114	0.318	0.090	0.287	0.023
Year dummy (2015/16)	0.598	0.491	0.679	0.467	-0.080**
Year dummy (2018/19)	0.197	0.398	0.201	0.401	-0.004

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$ (10%, 5%, 1% level of significance respectively)

Table 3.3: Descriptive Statistics for the Pooled Sample (All data pooled together)

Variable	Mean	SD	Min	Max	N
Outcomes:					
Household Dietary Diversity Score (HDDS) *[0-12]*	7.562	2.342	0	12	3791
Months of Adequate Household Food Provisioning (MAHFP) *[0-12]*	10.824	2.064	0	12	3791
Number of Meals per day (including breakfast)	2.406	0.593	1	4	3741
Household Consumption Expenditure (UGX)	23897.20	22513.37	0	324400	2835
Explanatory variables:					
Female HH member with a formal parcel certificate (Yes=1)	0. 178	0.383	0	1	1844
Land ownership and access	0.971	0.167	0	1	3787
Female member with rights to sell parcel or use it as collateral (Yes=1)	0.842	0.365	0	1	1845
Female HH member with parcel user rights (Yes=1)	0.825	0.380	0	1	1845
Female HH member with parcel ownership rights (Yes=1)	0.620	0.486	0	1	1845
Parcel has a formal certificate (Yes=1)	0.163	0.369	0	1	3790
Land Tenure System (1-4)					
Freehold	0.469	0.499	0	1	2982
Leasehold	0.033	0.179	0	1	2982
Mailo	0.016	0.125	0	1	2982

Customary	0.482	0.50	0	1	2982
New Parcel Acquisition (1-4)					
Purchased	0.295	0.456	0	1	2833
Inherited or received as a gift	0.694	0.461	0	1	2833
Leased-in	0.003	0.053	0	1	2833
Just Walked in (cleared)	0.008	0.090	0	1	2833
Dispute concern over parcel ownership (Yes=1)	0.068	0.252	0	1	3788
Parcel size (in acres)	1.690	4.653	0.01	158	1526
Drought (Yes=1)	0.369	0.483	0	1	3742
Floods (Yes=1)	0.035	0.184	0	1	3742
Household size	6.497	3.064	1	27	3791
Family labour (number of adults (18-65yrs) per acre)	0.867	0.481	0.19	4.41	3783
Marital status (1-5)					
Married monogamously	0.329	0.470	0	1	2482
Married polygamously	0.095	0.293	0	1	2482
Divorced or separated	0.058	0.235	0	1	2482
Widow or widower	0.078	0.268	0	1	2482
Never married	0.440	0.496	0	1	2482
Residence (1=Rural, 2=Urban)					
Rural	0.894	0.308	0	1	3789
Urban	0.106	0.308	0	1	3789
Year dummy (2015/16)	0.598	0.490	0	1	3791
Year dummy (2018/19)	0.252	0.434	0	1	3791

Table 5.1: The Effect of Land Ownership on Household Food Security and Welfare

Variables	**MAHFP**	**HDDS**	**Meals Per Day**	**LogHH Cons Expenditure**
	CRE (dy/dx)	**CRE (dy/dx)**	**CRE (dy/dx)**	**CRE (dy/dx)**
Female HH member with parcel certificate: (Yes=1)	0.360***	0.799***	0.145***	0.0058***
	(0.111)	(0.130)	(0.0352)	(0.0012)
Land ownership and access: (Yes=1)	0.349	0.377	0.0534	0.0002
	(0.290)	(0.356)	(0.0887)	(0.0031)
Drought: (Yes=1)	-1.011***	-0.261**	-0.196***	-0.0022**
	(0.137)	(0.122)	(0.0295)	(0.0011)
Residence (Rural=1): (Urban=2)	0.631	0.790	-0.0360	0.0103*
	(0.525)	(0.569)	(0.127)	(0.0056)
Dispute concern: (Yes=1)	-0.0560	0.396	0.280***	0.0053
	(0.335)	(0.384)	(0.105)	(0.0034)
Marital status (Married monogamously=1): Married polygamously	-0.465**	-0.117	-0.113**	0.0019
	(0.219)	(0.216)	(0.0548)	(0.0018)

Divorced or separated	-0.0210	0.322	-0.0627	-0.0008
	(0.248)	(0.247)	(0.0732)	(0.0026)
Widow or widower	-0.392	-0.106	-0.199***	-0.0032
	(0.276)	(0.287)	(0.0755)	(0.0026)
Never married	-0.353	0.696**	-0.142*	0.0048
	(0.297)	(0.297)	(0.0809)	(0.0029)
Floods: (Yes=1)	-0.277	0.426	-0.180**	0.0008
	(0.313)	(0.298)	(0.0706)	(0.0032)
Family labour (number of adults per acre):	-0.350	0.0184	-0.0399	-0.0005
	(0.234)	(0.132)	(0.0339)	(0.001)
Household size:	-0.105	-0.0192	0.0303	0.001
	(0.0871)	(0.0805)	(0.0215)	(0.0008)
mResidence:	-0.636	-0.0977	0.120	-0.0009
	(0.553)	(0.540)	(0.136)	(0.0056)
mDispute concern:	-0.0214	0.135	-0.270**	-0.0015
	(0.359)	(0.407)	(0.111)	(0.0041)
mMarital status:	0.0508	-0.175**	0.0340	-0.0013
	(0.0787)	(0.0814)	(0.0216)	(0.0008)
mFamily labour (number of adults per acre):	0.418*	0.102	0.0605	0.0002
	(0.223)	(0.136)	(0.0387)	(0.0012)
mHousehold size:	0.0780	0.0923	-0.0270	0.0006
	(0.0868)	(0.0823)	(0.0221)	(0.0008)
Year dummy (2015/16=1):	2.179***	0.0221	0.0901**	-0.0015
	(0.181)	(0.153)	(0.0388)	(0.0011)
Year dummy (2018/19=1):	2.544***	0.277	0.113**	-9.728***
	(0.229)	(0.181)	(0.0463)	(0.0221)
N	**1279**	**1279**	**1277**	**1279**

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$: 10%, 5%, 1% level of significance respectively
Robust Standard errors in parentheses, Marginal effects are estimated at means (*****at means)

Note: **m**Family labour (number of adults per acre); **m**Household size; **m**Residence; **m**Dispute concern; and **m**Marital status; are the respective additional regressors as mean values.