

EFFECT OF LANDOWNERSHIP BY WOMEN ON HOUSEHOLD FOOD SECURITY IN BENIN

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Abstract

This research examined the effect of landownership by women on household food security in Benin. This research aims also to determine factors that influence women ownership of land in Benin. The data used comes from the Global Analysis of Vulnerability and Food Security survey (AGVSA, 2017), endogenous switching regression is used. The results estimated reveal a positive and significant effect of women's landownership on household food security. The results reveal also that the factors that significantly and positively influence women land ownership are age, level of education (none), household size, agricultural empowerment index, access to credit and status of dwelling place (family property). The results point to the very important role of landownership by women in solving food insecurity in rural Benin.

Key words: Benin, food security, landownership, women

JEL Codes : C34, D13, J16, O13, Q15, Q24

1. Introduction

Many studies that have analysed national policies and programmes aiming for meeting foods needs in developing countries highlight the important role of women in agricultural production and food security (Chapoto et al., 2011, FAO, 2012a). According to the Food and Agriculture Organization of the United Nations (FAO, 2012), reducing the constraints faced by women farmers such as land, credit, fertilizers, new technologies and extension services could increase farm yields by 20-30%. This would have led to increased total agricultural production in developing countries, such as Benin, from 2.5 to 4% (World Bank, 2012 ;FAO, 2012).

The State of Food Security and Nutrition in the World 2021 report estimates that 720 million to 811 million people faced hunger in 2020 – 161 million more than in 2019. Nearly 12% of the world's population (928 million people) was in a situation of severe food insecurity in 2020, i.e. 148 million more than in 2019. No region of the world was spared. All sub-regions of Africa and Latin America and the Caribbean, and most sub-regions of Asia, show an increase in the prevalence of undernourishment in 2020 compared to 2019, the highest increase strong being observed in West Africa. Globally and in every region, the prevalence of food insecurity is higher among women than among men (FAO, 2021).

West Africa is the part of the continent where inequalities between men and women are among the strongest. According to the FAO, in 2018, women who represent 80% of the agricultural workforce, themselves estimated at 60% of the population, suffer inequalities and discrimination in their family, community and economic life, particularly with regard to, access and control over productive resources (AU & FAO, 2018). Social norms and cultural barriers are slowing progress in access to land under way in West Africa. According to the report of Bimonthly Information Bulletin of Regional Observatory of Rural Land in West

Africa (ORFAO) produced in February 2022; in Benin, only 20 women out of 130 heirs counted during the field survey (i.e. 15.2%) are heirs and have access to land. The areas inherited by the latter are relatively smaller than those obtained by men. To carry out their agricultural activities, women have access to land by usufruct (48.7%) and by rental (76.5%).

In Benin, the agricultural sector occupies at least 70% of the labour force, contributes nearly 36% of GDP formation and provides about 88% of Benin's export earnings (MAEP, 2018). However, food insecurity is still a concern in Benin. The study on the Comprehensive Food Security and Vulnerability Analysis (AGVSA, 2017) showed that 10% of the population investigated were food insecure. About 74% of households in food insecurity belong to the poorest household groups in the population. They spend more than 65% of their budget on their food costs (AGVSA, 2017). Rural households are more affected by food insecurity (12% moderate and 1% severe) than urban households (7% moderate). There is slightly more food insecurity among female-headed households (12%) than their male counterparts (9%), especially in rural areas (AGVSA, 2017).

Women represent 51.2% of the population in Benin according to the fourth General Population and Housing Census (RGPH4, 2013). The government of Benin has understood this need for facilitating and safeguarding access to and use of land and strengthening women's economic empowerment in the agricultural and rural sector through the New Alliance for Food Security and Nutrition (Badiane et al., 2018). Several initiatives are being implemented with development partners to promote access to land ownership in rural Areas in Benin.

Alessandra (2013) show that women's empowerment in agriculture has become a frequently cited goal of rural development, aimed at reducing household vulnerability to poverty and food insecurity. As a result, the theme of our research is the effect of landownership by women on household food security in Benin.

In this study, our research questions are as follows: i) What are the factors that influence women ownership of land in Benin ? and ii) What is the effect of women ownership of land on household food security in Benin ? The study will provide information that could be useful to the work of the Government of Benin and its partners such as the World Food Programme (PAM) to facilitate the implementation and progress towards achieving SDG2 for the eradication of hunger, and the improvement of nutrition in Benin (PAM, 2018). More, the objective of this research is to analyse the effect of landownership by women on household food security in Benin. Thus, the specific objectives are i) to determine factors that influence women ownership of land in Benin and ii) to estimate the effect of women ownership of land on household food security in Benin. The sections that follow present the literature review followed by the research methodology. Then, the presentation of the results. Finally, the conclusion and the political implications.

2. Literature Review

This section includes on the one hand with the definition of certain concepts related to our research theme and on the other hand addresses the theoretical and empirical research carried out in connection with this theme.

2.1 Definition of Concepts

Food Security Index:

The Consolidated Food Security Indicator Approach (CARI) approach was developed by World Food Programme to understand food security in all its dimensions. It therefore combines this ensemble of food security indicators into a single indicator called the Food Security Index, which presents the overall status of the population's food security (Benin-

AGVSA-Report-2017, Page 21 and 24). The Food Security Index is therefore constructed from current food consumption (in our study this is the food consumption score); an indicator measuring economic vulnerability (i.e. the share of food expenditure) and the indicator of livelihood-based survival strategies (Benin- AGVSA-Report-2017, Page 21 and 24). Based on CARI, each household surveyed is classified according to a composite food security index (Food Security Index) in four (04) categories: food secure, marginally food secure, moderately food insecure and severe food insecure.

In our study, to obtain a binary variable, the outcome variable which is household food security index is thus classified into two (02) groups (Adepoju et al., 2015; Agada & Igbokwe, 2016). Since household food security index is already calculated in the database, we have just created a binary variable by putting in a first group households identified as being food security and the second group households in a state of food insecurity. The group of food secure households is composed of strictly food secure households and marginal food secure households. The group of food insecurity households consists of households with moderately and severe food insecure.

Women landowners:

Women landowners include urban and rural women who own land in their households (AGVSA, 2017). They have the capacity and the skill to cultivate the land they have in their possession either individually, or with their children, or by soliciting labor in case the area of the land is too large. They have the decision-making power and management over all the fruits from the agricultural production of their land according to Article 42 of Law No. 2017-15 which governs the Land and State Code in Benin. There is no information on the quality of land that women landowners own and how they own it.

2.2 Theoretical Review

Women make essential contributions to agriculture and rural livelihoods. While their access to productive resources, such as land and capital, is often constrained, yet, women play a large role in food crop production (Chapoto et al., 2011). Women are restricted in their access to productive resources such as land, agricultural inputs, and extension services. Particularly land, a major input in agricultural production, is disproportionately controlled by men in all regions of the world (Carmen & Magdalena, 2003; Quisumbing et al., 2003). Abrahamsson (2013) shows that in Zambia the difference between men and women in access to land, is structural and is the result of unequal access to resources, which have given men more power and influence. There are significant gender gaps in ownership of assets, especially with regard to land, its control and decision-making about its use (FOWODE, 2012). Women farmers cannot easily access land because of the costs involved, cultural norms and overlapping land rights (FOWODE, 2012). Women-headed households have low levels of cultivatable land compared to men-headed households (FOWODE, 2012; Hill & Vigneri, 2014). Land tenure insecurity is widespread for women, as men tend to own the land and to exclude widows from ownership (Alinyo & Leahy, 2012; FOWODE, 2012).

Savath et al. (2014) observe the importance of land as an essential asset for rural livelihoods and nutritional security because of its importance for paving the way for the wellbeing of the households. In Nicaragua and Honduras, Katz & Chamorro (2002), found that families spend more on food when the woman of the house own land. A study in Ghana showed that when women own a larger share of the household's farmland, families allocate a larger proportion of their household budget to food (Doss, 2006). Furthermore, when women own land, their food purchasing decisions are likely to benefit the household's food security and their children's nutritional status (World Bank et al., 2008). Santos et al. (2014) indicate that land

rights have a direct link to the increasing food production and food security of the households. Empowering rural women to produce more food for local consumption and local markets is believed to be the best path to reduce household vulnerability to poverty and food insecurity by increasing agricultural incomes and food availability (Baiphethi & Jacobs, 2009). This argument has been advanced because women play key roles in the achievement of all 4 pillars of food security in rural areas, as producers of food, income earners and caretakers of household food and nutrition security (Bob, 2002; Alessandra, 2013). By empowering women in agriculture, rural households can have sustainable ways of feeding themselves and get income from selling the surplus produced, thereby becoming less vulnerable to both poverty and food insecurity (ActionAid International, 2011). Women's 'empowerment in agriculture' is one of the most important dimensions of empowerment for rural women as rural households are largely dependent on agriculture for their livelihoods which, in turn, is crucial for reducing household vulnerability to food insecurity (Sraboni et al., 2014; Sharaunga et al., 2015).

Agricultural feminization is widespread in low-income countries in Sub-Saharan Africa. Most residents of low-income countries still live in rural areas and agriculture employs more than half of the workforce. Although women's share of employment in agriculture exceeds the share of male employment, lack of land ownership, water and other production inputs often limits women's productivity and leaves them in extreme poverty (Croppenstedt et al., 2013). Then, the feminization of poverty is partly explained by agricultural feminization. Although the agricultural sector's share of employment declines during urbanization, the relative proportion of women working in agriculture is increasing (Lastarria-Cornhiel, 2008). Women farmers normally work on small plots and are less productive in terms of production per unit of land, if we look at variations within the household or between household variations. It suggests that the lack of agricultural production inputs, such as land ownership, fertilizers explains the gender productivity gap (Croppenstedt et al., 2013).

2.3 Empirical Review

In Bangladesh, accounting for potential endogeneity of empowerment, Sraboni et al. (2014) found that increased female empowerment in agriculture is positively associated with calorie availability and dietary diversity at the household level. They point out that forms of agriculture that are more favorable to women are more favorable to food security at the household level. A preliminary study of a land purchase program in the Indian state of Andhra Pradesh, which provided beneficiaries with plots of land of up to one acre, found that beneficiary households experienced significantly higher levels of food security: 76% of beneficiary households reported having two meals a day, compared to only 50-57% of non-beneficiary households (Prosterman et al., 2009). Data analyzed by the OECD Development Centre show that countries where women lack rights or opportunities to own land have on average 60% more malnourished children than countries where women have some or equal access to land (OECD, 2012). Women's land rights are found to promote development by empowering women, increasing productivity, and improving welfare (Allendorf, 2007).

Moreover, studies have found that increases in female landholdings are associated with increases in household food expenditure (Katz & Chamorro, 2002). When women own land, their children are less likely to be severely underweight (Allendorf, 2007). There is a positive relationship between the amount of assets, including land, which a woman possesses at the time of marriage and the share of household expenditures devoted to food (Quisumbing & Maluccio, 2003). Abebaw et al. (2010) using a propensity score matching method to control for differences before the intervention, examined the impact on household dietary calorie intake of an integrated food security program (IFSP), which had implemented in northwestern Ethiopia by two non-governmental organizations. The estimated results provide evidence that IFSP has a positive and statistically significant effect on dietary calorie intake. In particular,

the IFSP increased physical dietary caloric intake by 30% among beneficiary households. However, we also found that the IFSP has a different impact depending on family size, land ownership and gender of the household head. Asitik & Abu (2020) used extended probit regression with endogenous treatment to account for potential endogeneity of empowerment and food security and found that when women have access to cultivable land, their households have less chances of having severe or moderate hunger. Empirical analysis indicates that women's access to legal and family rights in households increases their bargaining power over resource use and food choices, which significantly and negatively reduces their food insecurity (Wei et al., 2021).

Sharaunga et al. (2015) used the Household Food Insecurity Access Scale (HFIAS) to identify the food security status of 300 primary female-headed households in Msinga, South Africa. Finally, the Ordered Logit model was used to identify the dimensions of women's empowerment that influence their household food security status. It was found that households headed by women with higher levels of economic agency, physical capital empowerment (including the land) were more likely to be food security. They have found also that women's empowerment in agriculture reduces the likelihood that their households will be vulnerable to food uncertainty. Harris-Fry et al. (2015) use multinomial logistic regression to measure the relationship between selected determinants of household food security and months of adequate household food provisioning. Among the determinants found are land ownership, women's literacy, all significantly reduced the risk of food insecurity. Furthermore, Tossou & Igue (2022) analyzed the effect of women's agricultural empowerment on the household food security index in Benin. Their results showed that the women's agricultural empowerment index including the land they own is positively correlated with the household food security index. Thus, the likelihood of a household being food secure increases when women's empowerment in agriculture increases. Women's agricultural empowerment increases the household food security index by 3.97 percentage points. Their results also revealed that the level of education of women and the area of sown land increase the household food security index. On the other hand, Harris-Fry et al. (2020) showed that women's share of land owned did not increase the percentage of household budget spent on food.

3. Research Methodology and Database

This section present the database used in the estimates, the research methodology and the definition of the variables used in this research.

3.1 The database

The data used come from the global analysis of vulnerability and food security (AGVSA) survey organized in july-august 2017 by the National Institute of Statistics of Benin in collaboration with the World Food Programme. It is a nationally representative survey at the departmental and residential levels. The number of households that was surveyed amounted to 14952, of which 3020 were female-headed households and 11932 male-headed households.

The survey collected information on household's demography characteristics, food consumption, agriculture and livestock, shocks and household survival strategies. The section 7 of the questionnaire focuses on questions related to agriculture, specifically the questions that whether the household practiced subsistence farming or gardening during the last crop year 2016 and whether the women in the household own their own parcel of land. For the purpose of this study, we will restrict the sample to the households that practiced agriculture during the last crop year 2016. About 6,502 households practised agriculture during the last campaign prior to the survey. We focus on farm households where women in the household

own land (1,366) and those in which household women are not (5,136). About 21% (1,366) of farm households had women owning land.

3.2 Theoretical Framework for Analysis

According to neoclassical theory, women own land if the land provides them with net economic benefits (Scherr, 2000; Kabunga 2012). Thus, the analysis of women's land ownership is based on the principle of rationality of economic agents and particularly the hypothesis of maximizing utility. Otherwise, following the work of Kemeze et al. (2018), women's land adoption can be analyzed as part of utility maximization theory. The rational behavior of the woman farmer leads her to own land that gives her more utility. Let U_{i1} be the utility derived from landownership and U_{i0} the utility that derives from non-landownership. The difference in utility between landownership and non-landownership is noted U_i . The woman in the household i will decide to be a landowner when it gives her greater utility than in the case of non-landownership. Mathematically, we will have:

$$U_i = U_{i1} - U_{i0} > 0 \tag{1}$$

Since its utilities are not observable, this preference of choice of the women of household can be represented by the latent variable A_i^* for landownership:

$$A_i^* = \beta Z_i + \mu_i \tag{2}$$

$$A_i = \begin{cases} 1 & \text{if } A_i^* > 0 \\ 0 & \text{if } A_i^* < 0 \end{cases}$$

With A_i the landownership variable that takes the value 1 for land adopters and 0 for land non-adopter women, Z_i is a vector of characteristics of women of household supposed to influence the decision of landownership by women and μ_i the term error.

The outcome variable (household food security index) is considered a linear function of the binary variable of women's participation in landownership with the other explanatory variables.

The model of the impact of landownership by women on household food security index is presented as follows:

$$Y_i = \delta_1 X_i + \delta_2 A_i + \varepsilon_i \tag{3}$$

With Y_i the household food security index i , X_i are the explanatory variables, δ_i are the parameters to be estimated, ε the error term.

Also, for the achievement of our results, we use endogeneous switching regression (ESR), because of the selection bias due to unobservable characteristics.

3.3 Method of Analysis

To analyze the effect of landownership by women on household food security, we draw on the work of Ahimbisibwe et al. (2020) who used endogeneous switching regression (ESR) to analyze the impact of an agricultural innovation platform on household well-being in Uganda. The advantage of endogeneous switching regression (ESR) is that it simultaneously estimates the probability of ownership and its impact on food security. The endogenous switching

regression (ESR) model consists of one treatment selection equation and two separate outcome equations for the outcome variable of interest that are conditional on the selection criterion.

The treatment selection equation is defined by a probit model. In our study, the ESR model consists of a probit model for both landownerships by women and household food security index. The type of treatment to be evaluated in our research is likely to be endogenous as it could be influenced by observable factors. Indeed, land ownership is voluntary and could depend on the decision of the women themselves. The choice to own an area of land regardless of the mode of access may not be random. Problems of selectivity can arise because a woman's choice to buy a certain area of land for example can be guided by unobserved factors. For example, a woman may own land by inheritance, gift or purchase according to certain criteria (eligibility) or unobserved factors. A woman's choice to own land in any way may also be guided by her motivation or ability to manage or her skill to cultivate the land, which are not observed. In such cases, these unobservable factors are also correlated with household food security index. The resulting potential endogeneity can therefore bias coefficients estimated by Ordinary Least Squares, if these endogeneity problems are ignored. What motivates the use of the endogenous switching regression (ESR) is that it allows for unsuspected estimates. This model makes it possible to control for selection bias due to observable and non-observable factors (Lokshin & Sajaia, 2004; Asfaw et al., 2012). Thus, to obtain consistent estimators, our study also used the estimation by endogenous switching regression (ESR).

The endogenous switching regression involves separate estimates for the two groups of women: women landowners and women non landowners. Therefore, landownership becomes the selection criterion indicating the regime (landowner or non-landowner) to which women belong. The pattern of participation in landownership is defined by equation (2).

Following this equation, the food security index of household is observed for both groups of women (Maddala, 1983; Asfaw *et al.*, 2012):

$$\text{Regime 1: } Y_{1i} = \alpha_1 X_{1i} + v_{1i} \quad (\text{Participants}) \quad (4)$$

$$\text{Regime 2: } Y_{2i} = \alpha_2 X_{2i} + v_{2i} \quad (\text{Non participants}) \quad (5)$$

Where Y_i is the household food security index i , X_i a vector of exogenous variables and v_i is the term of random disturbance for each group.

Unobserved variables affecting the probability of landownership by women could also affect household food security index, so that the error term in equation (2) and equations (4) and (5) can be correlated. To account for this, equations (2), (4) and (5) were estimated simultaneously using the maximum likelihood (ML) method. Indeed, Lokshin and Sajaia (2011) describe the `switch_probit` command, which implements the maximum method to fit the model of the binary choice with binary endogenous regressors. In addition, these approaches require potentially cumbersome adjustments to derive consistent standard errors. The `switch_probit` command, on the other hand, implements the full information ML method to simultaneously estimate the binary selection and the binary outcome parts of the model to yield consistent standard errors of the estimates. This approach relies on an assumption of joint normality of the error terms in the selection and outcome equations. This technique remains an effective approach and also derives the average treatment effects: the average effects of treatment on the treated and on the untreated and the marginal treatment effects.

The ESR model can be used to compare the expected outcomes of women landownership participants (a) and non-participants (b), as well as the expected outcomes in terms of household food security status in the case of counterfactuals (c) that beneficiaries have not adopted and (d) that non-beneficiaries have adopted (Di Falco et al., 2012). These measures are essential to explain the differences in household food security status outcomes between the two groups of women.

Table 1. Conditional Results, Treatment and Heterogeneity Effects

Subgroups	Decision		Treatment effects
	Participants	Non-participants	
Participants	(a) $E(y_{1i} Z_i = 1)$	(c) $E(y_{2i} Z_i = 1)$	TT
Non participants	(d) $E(y_{1i} Z_i = 0)$	(b) $E(y_{2i} Z_i = 0)$	TU
Heterogeneity effects	BH ₁	BH ₂	TH

Note1: (a) and (b) represent the observed outcomes of household food security index; (c) and (d) represent the expected outcomes of household food security index of the counterfactual.

Note 2: TT: Effect of treatment on the treated; TU: Effect of treatment on the untreated; BH₁: Basic heterogeneity effect for participants; BH₂: Basic heterogeneity effect for non-participants; TH: Transient heterogeneity effect.

The effect of treatment on the treatment group (TT) is expressed in equation (6) as the difference between cases (a) and (c):

$$TT = (y_{1i}|Z_i = 1) - (y_{2i}|Z_i = 1) \quad (6)$$

Similarly, the effect of treatment on the untreated is defined as follows:

$$TU = (y_{1i}|Z_i = 0) - (y_{2i}|Z_i = 0) \quad (7)$$

The study differentiates between treatment effects and the effects of baseline heterogeneity. The basic heterogeneity effect is expressed by equation (8) women who have adopted land. This represents the difference between cases (a) and (d):

$$BH_1 = (y_{1i}|Z_i = 1) - E(y_{1i}|Z_i = 0) \quad (8)$$

For non-participants, the basic heterogeneity effect can be expressed as the difference between cases (c) and (b):

$$BH_2 = (y_{2i}|Z_i = 1) - E(y_{2i}|Z_i = 0) \quad (9)$$

Finally, the effect of transitory heterogeneity is calculated (equation 10). This makes it possible to determine whether the impact of landownership by women is more or less important for adopters of land and non-adopters of land compared to the counterfactual scenario.

$$TH = TT - TU \quad (10)$$

3.4 Definition of Study Variables

The descriptions of the variables believed to influence food security and included in the empirical model are given in Table 1. These variables include agricultural forms of female empowerment and other socio-economic characteristics of households. The socio-economic characteristics of the household that are likely to influence food security include household size, age of the woman in the household, level of education and place of residence (Albert et al., 2004; Adepoju et al., 2015; Tossou & Igue, 2022).

The dimensions of women's empowerment in agriculture also include the practice of irrigation and the use of agricultural inputs that affect agricultural production. All of these

dimensions of women's agricultural empowerment influence sustainable agricultural productivity and reduce food insecurity (Quisumbing et al., 2001; Tossou & Igue, 2022). As a result, seeds, organic fertilizers, chemical fertilizers, herbicides and insecticides are considered in our study as agricultural inputs likely to increase agricultural production and thus reduce household food insecurity. It should be remembered that an index linked to the agricultural empowerment of women has calculated. The index calculated refers to the use of agricultural input by the woman in the household and the practice of irrigation. All these variables related to the use of different agricultural inputs and irrigation practice are all binary.

The role of access to credit in relation to household food security and land ownership should also be examined. The areas of sown land are thus considered as agricultural assets and used among our explanatory variables (Tossou & Igue, 2022).

The instrumental variables refer to the occupancy status of the household dwelling. We used two instrumental variables, the women who live with their households in a family property and those who live with their households where they are owners. We present the description of the variables that are used in this research in Table 2.

Table 2. Description of the Variables

Variables and description	Unit
The variable dependent	
The food security index combines a ensemble of food security indicators into a single indicator called the Food Security Index, which presents the overall status of the population's food security.	0= Food insecurity 1= Food security
The treatment variable	
Women landowners : women who own their own plots of land in the household	0=No 1=Yes
The explanatory or controls variables	
Age : the age of the head of household	Years
Education level: the level of education of the woman in the household	0=None, 1=Primary and 2=At least Secondary
Urban rural : the residence of milieu	0=Urban 1=Rural
Household size : the number of members in the household	Number of persons
Areas of land sown: the superficies / size of land cultivated	0= Less than 1 hectare to 1.99 ha 1= 2 hectares and more
Agricultural empowerment index: use of agricultural input and irrigation practice	Agricultural empowerment index value
Access to credit: Has your household borrowed (in cash or in kind) in the last 12 months ?	0=No 1=Yes
Instrumental variables	
The occupancy status of the dwelling: Family property	0=No 1=Yes
The occupancy status of the dwelling: Owner	0=No 1=Yes

Source: Household survey, AGVSA (2017).

4. Results and Discussion

The results of descriptive statistics and the effect of women's land ownership on household food security in Benin using different estimation approaches are presented. The results of the descriptive statistics are presented in Table 3. The proportion of women who own their own plots of land is on average 21%. More than half of households (88%) are food secure. However, there are disparities between households, as shown by the standard deviation of 0.33. Indeed, on average; 41.4% of households are food secure; 46.43% are marginally food secure; 11.18% in moderate food insecurity and 1% in severe food insecurity. The women in the households were on average about 46 years old. The minimum age is 16 and the maximum age is 100. On average, most women in households had no level of formal education (71%); 18% have primary education and 11% have at least secondary education. The majority of women live in rural areas (74%). The average household size was about 8. On average, 39% of women have an area of cultivated land ranging in size from less than one hectare to less than two hectares. More than half of the women (61%) have an area of sown land with an average size of 2 hectares or more. Women in the household have on average two agricultural assets out of five agricultural inputs and irrigation. Some have up to 6 agricultural assets (five farming inputs and irrigation). Other women, on the other hand, have no agricultural assets. The agricultural inputs used are organic fertilizers, chemical fertilizers, herbicides, improved seeds and insecticides. On average, 36% of women with their households live in family property. The majority of women (63%) on average live with their husbands where they own property. On average, only 30% of women have access to credit.

Table 3. Descriptive Statistics

Variables	Average/ Proportion	Stat Dev	Minimum	Maximum
Landownership by women	0.21	0.41	0	1
Food Security Index	0.88	0.33	0	1
Age	46.47	14.12	16	100
Education level (None)	0.71	0.46	0	1
Education level (Primary)	0.18	0.39	0	1
Education level (At least Secondary)	0.11	0.31	0	1
Urban rural	0.74	0.44	0	1
Household size	8.22	5.14	0	86
Land size cultivated (Less than 1 hectare (ha) – 1.99 ha)	0.39	0.49	0	1
Land size cultivated (2 ha and more)	0.61	0.49	0	1
Agricultural empowerment index	1.69	1.33	0	6
Status of the dwelling place (Family property)	0.36	0.48	0	1
Status of the dwelling place (Owner)	0.63	0.48	0	1
Access to credit	0.30	0.46	0	1

Source: Using data from AGVSA (2017).

The results of the Endogenous Switching Regression (ESR) model assessing the effect of women's land ownership on household food security in Benin are presented in Tables 4 and 5. Table 4 shows the results of the effect of women's land ownership on household food security and presents the results of the selection equation.

The results of the selection equation reveal that the factors that significantly and positively influence women land ownership are age, level of education (none), household size,

agricultural empowerment index, access to credit and status of the dwelling place of household (family property).

The variables used as instruments are binary and reflect the status of the place of residence of the household or the type of residence inhabited by the household. The status of the dwelling place of household takes two forms; family property and owner. Thus, some women live with their husbands in a family property. Other women, on the other hand, live in houses owned by their husbands. Therefore, we hypothesize that this variable could influence women's decision to own land (relevance criterion) but is unlikely to have a direct effect on the household food security index (exogeneity criterion). Moreover, the fact that the woman in household knows that she lives in a house where her husband owns or in a family property does not directly influence household food security index. Such a woman's household with this knowledge may not decide to own land for agricultural purposes in the household. This is what explains why it is not enough to know the state of your home to start exploiting it. In short, the status of dwelling place of woman in the household can influence her to become landowner but does not directly influence household food security index. The exogeneity hypothesis states that the instrument will only indirectly affect the food security index through its effect on the probability of owning land. Although this hypothesis cannot generally be tested, we can argue that the selected instruments can be considered exogenous.

Table 4. Effect of Landownership by Women on Household Food Security in Benin Following the Endogenous Partition Model (Selection Equation)

Landownership by women (1/0)	Selection equation	
Age	0.0045***	(0.0013)
Education level (None) (Primary) (At least Secondary)	0.0952**	(0.0476)
Urban rural	-0.0253	(0.0708)
Household size	-0.0065	(0.0407)
Land size cultivated (Less than 1 hectare (ha) – 1.99 ha) (2 ha and more)	0.0075**	(0.0034)
Land size cultivated (Less than 1 hectare (ha) – 1.99 ha)	-0.0325	(0.0398)
Agricultural empowerment index	0.0532***	(0.0137)
Access to credit	0.0798**	(0.0383)
Status of the dwelling place (Family property) (Owner)	0.4759**	(0.2427)
Constant	0.4023	0.2499
Constant	-1.6694***	(0.2542)
Log likelihood: -5648.1435 Wald chi2(15) = 67.23 Prob > chi2 = 0.0000		
Observations : 6 502		

Source: Using data from AGVSA (2017).

Notes: Significant mean differences are indicated with *** p<0.01, ** p<0.05, * p<0.10. Robust standard errors are in parentheses.

The results in Table 5 show that the Wald chi2 value is significant at 1%, indicating that the model is globally significant. Thus, the model presents a good fit with the explanatory variables. The non-significance of the test of the likelihood ratio of independence (0.4781) between the equations reveals that the errors of the treatment equation and those of the outcome are not correlated. Since the errors are not correlated then there is no sign of endogeneity. Moreover, Durbin (p = 0.2680) and Wu-Hausman (p = 0.2684) endogeneity tests confirm that the variables are exogenous.

The estimated parameters of the household food security index model for women landowners and non-landowners are reported in Table 6. This table also illustrates the factors that significantly influence the household food security index.

For women landowners, the area of land sown (2 hectares and more) and the agricultural empowerment index are the factors that significantly and positively affect the household food security index.

As for women who do not own land, the level of education (primary level), the rural environment and the area of land sown (less than one hectare - 1.99 hectares) are the factors that significantly and negatively influence the security index household food.

Table 5. Effect of Landownership by Women on Household Food Security in Benin According to the Endogenous Switching Regression Model (Outcome Equation)

Dependant variable Food Security Index	Outcomes models			
	Participants		Non-participants	
Age	0.0065	(0.0049)	-0.0025	(0.0018)
Education level (None)				
(Primary)	-0.3476	(0.2655)	-0.3021***	(0.0852)
(At least Secondary)	-0.2160	(0.2139)	-0.0539	(0.0832)
Urban rural	-0.1552	(0.1128)	-0.2004***	(0.0740)
Household size	0.0075	(0.0112)	0.0011	(0.0054)
Land size cultivated (Less than 1 hectare (ha) – 1.99 ha)				
(2 ha and more)	0.2743***	(0.1006)	-0.1245**	(0.0610)
Agricultural empowerment index	0.1725***	(0.0448)	0.0534	(0.0410)
Access to credit	0.0400	(0.1252)	-0.0536	(0.0463)
Constant	0.5619	2.4448	1.2209***	(0.2759)
rho_0 : -0.7275 (0.3592) **				
rho_1 : 0.1626 (1.3049)				
Log likelihood: -5648.1435 Wald chi2(15) = 67.23 Prob > chi2 = 0.0000				
Observations: 6 502				
Test des équations indépendantes de Wald (rho1=rho0=0) : chi2(2) = 1.48 Prob > chi2 = 0.4781				

Source: Using data from AGVSA (2017).

Notes: Significant mean differences are indicated with *** p<0.01, ** p<0.05, * p<0.10. Robust standard errors are in parentheses.

The household food security index under the real and counterfactual conditions is shown in Table 6, respectively. Cells (a) and (b) represent the expected household food security index results observed under the real conditions and (c) and (d) correspond to the counterfactuals. The household food security index of women landowners (a) is 0.879 and that of non-landowners (b) is 0.81. The difference between the two groups is 0.069. The last column of Table 6 presents the effects of land ownership by women on household food security index. In counterfactual (c), the household food security index of women landowners increases significantly by 0.49. The transient heterogeneity effect is positive (TH=0.55), implying that the effect of landownership on food security index is significantly higher for women who participated in landownership than for those who did not attend. This involves implementing policies to encourage and continue women's participation in land ownership. The last row of Table 6, which takes into account the potential effect of heterogeneity in the sample, reveals that women who actually participated in the land ownership program would have a higher food security index (0.877) than women who do not participate in land ownership (0.39) in

counterfactual cases (c) and (d). We conclude that there are significant heterogeneity factors showing advantages in favor of participants in women's land ownership over non-participants.

Table 6. Impact of Landownership by Women on Household Food Security: Conditional Results, Treatment and Heterogeneity Effects

Subgroups	Decision		Treatment effects
	Participants	Non-participants	
Participants	(a) 0.879 (0.0008)	(c) 0.39 (0.0025)	TT = 0.49 (0.0015) ***
Non-participants	(d) 0.877 (0.0006)	(b) 0.81 (0.0012)	TU = -0.06 (0.0008) ***
Heterogeneity effects	BH1 0.07 (0.0003) ***	BH2 -0.49 (0.0014) ***	TH = 0.55 (0.0017) ***

Notes: Significant mean differences are indicated with *** p<0.01, ** p<0.05, * p<0.10. Standard errors are in parentheses.

Source: Using data from AGVSA (2017).

The estimation of the impact on household food security index under the real and counterfactual conditions shows that participation in women's land ownership positively and significantly affects household food security index for women landowners. The results estimated in the endogenous partition regression (ESR) reveal a positive and significant effect of women's land ownership on household food security. Our results converge with those of Asitik & Abu (2020) who found that when women have access to arable land, their households are less likely to have severe or moderate hunger. In addition, empirical analysis of the research of Wei et al. (2021) indicates that women's access to their legal and family rights in households increases their bargaining power over resource use and food choices, which significantly and negatively reduces their food insecurity. This result is consistent with the research of Prosterman et al. (2009). Their research was based on a land purchase program in the Indian state of Andhra Pradesh, which provided beneficiaries with parcels of land up to one acre. The study found that recipient households had experienced significantly higher levels of food security: 76% of recipient households reported having spent two meals a day, compared to only 50 to 57 percent of non-recipient households. Thus, empowering women in agriculture more accurately with land ownership reduces the likelihood that their households are vulnerable to food insecurity and thus improves the state of food security of the household. Moreover, this result is also conformable with the research of Santos et al. (2014) which indicates that land rights are directly related to the increase in food production and household food security. Furthermore, Tossou & Igue (2022) found through the results of their estimations that the women's agricultural empowerment index including the land they own is positively correlated with household food security index. Women's agricultural empowerment increases household food security index by 3.97 percentage points.

5. Conclusion and Policy Implications

This research analysed the effect of landownership by women on household food security in Benin. Despite the existence of much work in the literature on agriculture and food security in Benin, the link between the dimensions of food security and land ownership is little discussed according to the gender aspect. Thus, the objectives pursued are the determination of factors that influence women land ownership in Benin and the estimation of effect of women ownership of land on household food security.

The results estimated reveal a positive and significant effect of women's land ownership on household food security. The results reveal also that the factors that significantly and positively influence women land ownership are age, level of education (none), household size,

agricultural empowerment index, access to credit and status of dwelling place (family property).

In light of our results and in order to improve the level of household food security in Africa and more specifically in Benin, political decision-makers should favor and encourage many women to acquire not only land but also large areas of land through applicable policies and reforms. Then, policymakers must also put in place communication systems to encourage more women's access to agricultural inputs and the practice of irrigation. Finally, policy makers must increase opportunities for women to access credit.

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References

- ActionAid International (2011). *What Women Farmers Need: A blueprint for action*. A l'adresse <https://actionaid.org/publications/2011/what-women-farmers-need-blueprint-action>
- Abebaw, D., Fentie, Y., & Kassa, B. (2010). The impact of a food security program on household food consumption in Northwestern Ethiopia: A matching estimator approach. *Food Policy*, 35(4), 286-293. <https://doi.org/10.1016/j.foodpol.2010.01.002>
- Abrahamsson, S. (2013). *Agricultural Productivity, Land Access and Gender Equality: Based on a minor field study conducted in Zambia 2013*. <http://urn.kb.se/resolve?urn=urn:nbn:se:lnu:diva-37044>
- Adepoju, A., Laudia, O., & D, A. (2015). The role of women in household food security in Osun State, Nigeria. *International Journal of Agricultural Policy and Research*, 3, 104-113. <https://doi.org/10.15739/IJAPR.032>
- Agada, M., & Igbokwe, E. (2016). Influence of Food Culture and Practices on Household Food Security in North Central Nigeria. *Journal of Food Security*, 6.
- AGVSA (2017). Analyse Globale de la Vulnérabilité et de la Sécurité Alimentaire (AGVSA), République du Bénin, INSAE ; Rapport_AGVSA_VF_2017.pdf (instad.bj)
- Ahimbisibwe, B., Morton, J., Feleke, S., Alene, A., Abdoulaye, T., Wellard, K., Mungatana, E., Bua, A., Asfaw, S., & Manyong, V. (2020). Household welfare impacts of an agricultural innovation platform in Uganda. *Food and Energy Security*, 9. <https://doi.org/10.1002/fes3.225>
- Albert, jose ramon, Albert, G., Collado, P., & Monina, P. (2004). *Profile and Determinants of Poverty in the Philippines*.
- Alessandra Galie. (2013). Empowering Women Farmers: The Case of Participatory Plant Breeding in Ten Syrian Households. (2013). *Frontiers: A Journal of Women Studies*, 34(1), 58-92.
- Alinyo, F., & Leahy, T. (2012). Designing food security projects: Kapchorwa and Bukwo, Uganda. *Development in Practice*, 22(3), 334-346.
- Allendorf, K. (2007). Do Women's Land Rights Promote Empowerment and Child Health in Nepal? *World Development*, 35(11), 1975-1988. <https://doi.org/10.1016/j.worlddev.2006.12.005>
- Asfaw, S., Shiferaw, B., Simtowe, F., & Lipper, L. (2012). Impact of modern agricultural technologies on smallholder welfare: Evidence from Tanzania and Ethiopia. *Food Policy*,

- 37(3), 283-295. <https://doi.org/10.1016/j.foodpol.2012.02.013>
- Asitik, A. J., & Abu, B. M. (2020). Women empowerment in agriculture and food security in Savannah Accelerated Development Authority zone of Ghana. *African Journal of Economic and Management Studies*, 11(2), 253-270.
- AU and FAO (2018). *Leaving no one behind: Empowering Africa's rural women for Zero Hunger and shared prosperity - World | ReliefWeb*, à l'adresse <https://reliefweb.int/report/world/leaving-no-one-behind-empowering-africas-rural-women-zero-hunger-and-shared-prosperity>
- Badiane, O., Collins, J., Dimaranan, B., Ulimwengu, J., & IFPRI. (2018). *An Assessment of the New Alliance for Food Security and Nutrition* [Technical Report]. NEPAD. <https://akb.au.int/handle/AKB/2634>
- Baiphethi, M. N., & Jacobs, P. T. (2009). The contribution of subsistence farming to food security in South Africa. *Agrekon*, 48(4), 459-482. <https://doi.org/10.1080/03031853.2009.9523836>
- Bob, U. (2002). Rural African Women, Food (In) Security and Agricultural Production in the Ekuthuleni Land Redistribution Project, KwaZulu-Natal. *Agenda: Empowering Women for Gender Equity*, 51, 16-32.
- Carmen Diana Deere and Magdalena León (2003). Empowering Women: Land and Property Rights in Latin America (Pittsburgh, PA: University of Pittsburgh Press, 2001), pp. xxv+486, \$24.95, pb. *Journal of Latin American Studies*, 35(2), 429-431. <https://doi.org/10.1017/S0022216X03446816>
- Chapoto, A., Jayne, T. S., & Mason, N. M. (2011). Widows' land security in the era of HIV/AIDS: Panel survey evidence from Zambia. *Economic Development and Cultural Change*, 59(3).
- Croppenstedt, A., Goldstein, M., & Rosas, N. (2013). Gender and Agriculture: Inefficiencies, Segregation, and Low Productivity Traps*. *World Bank Research Observer*, 28(1), 79-109.
- Di Falco, S., Veronesi, M., & Yesuf, M. (2011). Does Adaptation to Climate Change Provide Food Security? A Micro-Perspective from Ethiopia. *American Journal of Agricultural Economics*, 93(3), 829-846. <https://doi.org/10.1093/ajae/aar006>
- Doss, C. (2006). The Effects of Intrahousehold Property Ownership on Expenditure Patterns in Ghana. *Journal of African Economies*, 15, 149-180. <https://doi.org/10.1093/jae/eji025>
- FAO. (2012a). « Investir dans l'agriculture pour un avenir meilleur » : la situation mondiale de l'alimentation et de l'agriculture 2012, Rome : FAO, www.fao.org/publications/sofa/2012/en/
- La situation mondiale de l'alimentation et de l'agriculture 2012 - Résumé (fao.org)
- FAO, I. (2021). *The State of Food Security and Nutrition in the World 2021: Transforming food systems for food security, improved nutrition and affordable healthy diets for all*. FAO. <https://doi.org/10.4060/cb4474en>
- Gender policy brief for Uganda's agriculture sector*. (2012). Forum for Women in Democracy (FOWODE).
- Harris-Fry, H., Azad, K., Kuddus, A., Shaha, S., Nahar, B., Hossen, M., Younes, L., Costello, A., & Fottrell, E. (2015). Socio-economic determinants of household food security and women's dietary diversity in rural Bangladesh: A cross-sectional study. *Journal of Health, Population, and Nutrition*, 33, 2. <https://doi.org/10.1186/s41043-015-0022-0>
- Harris-Fry, H., Nur, H., Shankar, B., Zanello, G., Srinivasan, C., & Kadiyala, S. (2020). The impact of gender equity in agriculture on nutritional status, diets, and household food security: A mixed-methods systematic review. *BMJ Global Health*, 5(3), e002173. <https://doi.org/10.1136/bmjgh-2019-002173>
- Hill, R. V., & Vigneri, M. (2014). Mainstreaming Gender Sensitivity in Cash Crop Market Supply Chains. In A. R. Quisumbing, R. Meinzen-Dick, T. L. Raney, A. Croppenstedt, J. A. Behrman, & A. Peterman (Éds.), *Gender in Agriculture* (p. 315-341). Springer

- Netherlands. https://doi.org/10.1007/978-94-017-8616-4_13
- Kabunga, N. S., Dubois, T., & Qaim, M. (2012). Yield Effects of Tissue Culture Bananas in Kenya: Accounting for Selection Bias and the Role of Complementary Inputs: Yield Effects of Tissue Culture Bananas in Kenya. *Journal of Agricultural Economics*, 63(2), 444-464. <https://doi.org/10.1111/j.1477-9552.2012.00337.x>
- Katz, E., & Chamorro, J. (2002). *Gender, land rights, and the household economy in rural Nicaragua and Honduras*. <https://resourceequity.org/record/3091-gender-land-rights-and-the-household-economy-in-rural-nicaragua-and-honduras/>
- Kemeze, L. S., Mensah-Bonsu, A., Egyir, I. S., Amegashie, D. P. K., & Nlom, J. H. (Éds.). (2018). *Impact of Bioenergy Crop Adoption on Total Crop Incomes of Farmers in Northern Ghana: The Case of Jatropha Curcas*. <https://doi.org/10.22004/ag.econ.302438>
- Lastarria-Cornhiel, S. (2008). *Feminization of Agriculture: Trends and Driving Forces*. 25.
- Lokshin, M., & Sajaia, Z. (2011). Impact of Interventions on Discrete Outcomes: Maximum Likelihood Estimation of the Binary Choice Models with Binary Endogenous Regressors. *The Stata Journal*, 11(3), 368-385. <https://doi.org/10.1177/1536867X1101100303>
- Maddala, G. S. (1983). *Limited-Dependent and Qualitative Variables in Econometrics*. Cambridge University Press. <https://doi.org/10.1017/CBO9780511810176>
- MAEP. (2018). Plan Stratégique de Développement du Secteur Agricole. République du Bénin. Ministère de l'Agriculture de l'Élevage et de la Pêche, à l'adresse Ben184002.pdf (fao.org)
- OECD (2012). *Do discriminatory social institutions matter for food security?* <https://data.landportal.info/node/52527>
- ORFAO (2022). Accès et contrôle des femmes et des jeunes au foncier. Bulletin d'information Bimestriel de l'Observatoire Régional du Foncier Rural en Afrique de l'Ouest (ORFAO) Numéro 03 | Février 2022 www.uemoa.int/sites/default/files/bibliotheque/bulletin_dinfo_orfao_n03_fev_2022.pdf
- PAM (2018). Examen Stratégique National Faim Zéro au Bénin, Rapport Final, Version provisoire, Juillet 2018. <https://docs.wfp.org/api/documents/WFP-0000103371/download/>
- Prosterman, R. L., Mitchell, R. G., & Hanstad, T. M. (Éds.). (2009). *One billion rising: Law, land and the alleviation of global poverty*. Leiden University Press.
- Quisumbing, A., R. A., ed, Meinzen-Dick, R., & Suseela, R. (2001). *Empowering women to achieve food security*:
- Quisumbing, A. R., & Maluccio, J. A. (2003). Resources at Marriage and Intrahousehold Allocation: Evidence from Bangladesh, Ethiopia, Indonesia, and South Africa*. *Oxford Bulletin of Economics and Statistics*, 65(3), 283-327. <https://doi.org/10.1111/1468-0084.t01-1-00052>
- Santos, F., Fletschner, D., Savath, V., & Peterman, A. (2014). Can Government-Allocated Land Contribute to Food Security? Intrahousehold Analysis of West Bengal's Microplot Allocation Program. *World Development*, 64(C), 860-872.
- Savath, V., Fletschner, D., Peterman, A., & Santos, F. (2014). *Land, Assets, and Livelihoods: Gendered Analysis of Evidence from Odisha State in India* (SSRN Scholarly Paper N° 2405717). <https://doi.org/10.2139/ssrn.2405717>
- Scherr, S. J. (2000). A downward spiral? Research evidence on the relationship between poverty and natural resource degradation. *Food Policy*, 25(4), 479-498. [https://doi.org/10.1016/S0306-9192\(00\)00022-1](https://doi.org/10.1016/S0306-9192(00)00022-1)
- Sharaunga, S., Mudhara, M., & Bogale, A. (2015). The Impact of « Women's Empowerment in Agriculture » on Household Vulnerability to Food Insecurity in the KwaZulu-Natal Province. *Forum for Development Studies*, 42(2). <https://doi.org/10.1080/08039410.2014.997792>
- Sraboni, E., Malapit, H. J., Quisumbing, A. R., & Ahmed, A. U. (2014). Women's Empowerment in Agriculture: What Role for Food Security in Bangladesh? *World*

- Development*, 61, 11-52. <https://doi.org/10.1016/j.worlddev.2014.03.025>
- Tossou, J. U., & Igue, C. B. (2022). *Assessing the effects of women empowerment: Women employment and entrepreneurship in poverty alleviation in Bénin*. LAP LAMBERT Academic Publishing.
- Voluntary Guidelines on the Responsible Governance of Tenure of Land, Fisheries and Forests in the Context of National Food Security*. (2012). FAO. <https://doi.org/10.4060/i2801e>
- Wei, W., Sarker, T., Roy, R., Sarkar, A., & Ghulam Rabbany, M. (2021). Women's empowerment and their experience to food security in rural Bangladesh. *Sociology of Health & Illness*, 43(4), 971-994. <https://doi.org/10.1111/1467-9566.13273>
- World Bank, Food and Agriculture Organization, & International Fund for Agricultural Development. (2008). *Gender in Agriculture Sourcebook*. The World Bank. <https://doi.org/10.1596/978-0-8213-7587-7>
- World Development Report (2012): Gender Equality and Development: Main report*. (s. d.). [Text/HTML]. World Bank, à l'adresse <https://documents.worldbank.org/en/publication/documents-reports/documentdetail/492221468136792185/Main-report>