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IMPACT OF LAND SECURITY ON HOUSEHOLD'S AGRICULTURAL PRODUCTIVITY IN BENIN.

ABSTRACT

This paper aims at studying the impacts of land tenure on household's agricultural productivity in Benin. Data used in this study is from EMICOV (Enquête Modulaire Intégrée sur les Conditions de Vie des Ménages) collected in 2012 and covered 626 Benin's farming households. Method used is the Conditional Mixed Process (CMP) technic approach. Results show that land certificate ownership increases by 0.238 the likelihood of investing in agricultural equipment whereas the customary law ownership increases this likelihood by 0.374 compared to households without any land ownership (the squatters). Furthermore, the customary law ownership provides farmers with more security than land certificate ownership in "Collines" region. In terms of policy recommendations, we suggest that public authorities recognize customary laws and reinforce legal land institutions. Finally, a best land market structure could reduce challenges related to land access and inequalities related to land resources distribution.

Keywords: *land security, Conditional Mixed Process (CMP), agricultural productivity, Benin*

Classification JEL: Q15, C35, Q47, N57

1. INTRODUCTION

The land is an immovable property in nature that is a crucial development stake for all nations. It represents one of the economic development cornerstone of all prosperous country. Therefore, in developing countries, land issue is of crucial importance due to the significance incidence of agriculture on economic growth [6].

Benin is a west-African country with non-negligible agricultural potential. In 2013, the agricultural sector has contributed to 32.7 per cent on average to the Gross Domestic Product (GDP) by 75 per cent to government revenues and provided about 70 per cent of employment [14]. An optimal exploitation of the assets of that sector could help to sustain the national economic growth and also to contribute efficiently fighting against food insecurity and poverty. Thanks to the dynamism of that sector, Benin is among the 29 Sub-Saharan African countries that reached the Millennium Development Goals related to reducing by half the prevalence of undernutrition by 2015 [7].

Nevertheless, the productivity level of almost all agricultural products in the country is under the world average. Therefore, returns from the major productions remain low than world average returns. In fact, during the last fifteen years, average returns from the major cereals (maize, rice and sorghum), are respectively 1.2 tons per hectare; 2.4 tons per hectare and 0.9 tons per hectare [27] whereas the world average yield for these cereals are respectively 4 tonnes per hectare; 3.5 tonnes per hectare and 2 tonnes per hectare. Such as, agricultural productions equipment remain rough and traditional tools. Around 76 per of cultivated land are manually done [14].

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Notwithstanding the huge natural potential and agro-ecological of the country, the agricultural activity tramples and permanently encounters land issue. Recent, statistics indicate that arable lands are about 33.26 per cent in 2010 while several farmers are deprived of arable land. In fact, the majority of unexploited land belongs to third parties for speculative goals. Also, due to important number of farmers without land (or with poor soils) and unemployed graduated people involved in the agricultural activities, it is noticed a high concentration[1] of the population in the central part of the country and hence, an increasing of land pressure, potential source of land insecurity for agricultural households [24]. Moreover, with a population of almost 11 million inhabitants, a population growth rate of 2.65 per cent in 2015. The density is around 98 inhabitants per square kilometre. The urbanization programs that are likely to increase the relative scarcity of land, is a crucial issue for agriculture. Land issue remains intact for Beninese farming households. Due to the low rate[2] of land certificates issued compared to the potential available land, legal land institutions appear to contribute to the precariousness of farming households [4].

Regarding the impact of land security on agricultural productivity, empirical results are mixed. On the one hand, authors argue that land security positively affects long-term investment and agricultural productivity. On the other hand, some authors argue that land security is not a key determinant of agricultural productivity. For example, in India, [20] shows that land tenure security significantly increases the probability and intensity of adoption of improved rice technology. Indeed, the author shows that farmers who have land rights (legal or customary) are more likely to adopt improved technologies than tenants-cultivators (partial tenants and pure tenants). In a recent study in Zambia, households with customary tenure are less likely to adopt agricultural diversification and agroforestry than households with legal status [19]. With respect to South African agriculture, [13] find a positive relationship between land security and input use. For Gambian agriculture, [11] conclude that tenure security positively affects long-term investments and productivity of Gambian farmers.

[6] show that among households with customary land tenure, there is a decline in agricultural investment, which leads to lower productivity, especially among zambian women who are not entitled to inheritance. In addition, by studying food insecurity in Thailand, [3] show that tenure security favors investments by farm households and consequently boosts their agricultural production. Similarly, in Burkina Faso, [1] indicate that the strengthening of land rights increases the investment of farm households in rural areas. Finally, in Cameroon, [18] show that land security significantly affects the investment decisions of farming households and consequently their productivity. For the authors, the possession of legal rights and customary rights results in an increase in the probability of acquiring modern equipment by around 0.35 and 0.47 respectively compared to squatters. In a similar vein, a study conducted in Ghana by [9] shows that land-secure certificates holders invest more in the fertility of their soil in order to increase their agricultural productivity.

However, [15] in his study in Malawi concludes that tenure security is not a key determinant of investment and agricultural productivity. Similarly, [21] indicate that land rights do not have significant effects on investments, land use and conservation of soils, use of inputs, and access to credit or agricultural yields. In addition, [22] indicate that the transition from the collective rights system to a system of individual rights in sub-Saharan Africa does not have a significant effect on agricultural productivity. For the authors, agricultural productivity is determined by other factors such as the level of technology, access to credit, the price of products and inputs, market conditions. Finally, [17] shows that despite the insecurity of

[1] Indeed, there are waves of migrations of peasants from western Atacora and southern Benin (departments of Mono / Couffo and Zou, etc.) to central Benin.

[2] One certificate for five hundred inhabitants (1/500 hbts)

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Ethiopia's land tenure, poor people are making substantial investments to increase their agricultural productivity.

Generally, several studies have addressed the issue of land security but few specifically tackled the case of Benin. This paper intends to fill this gap by assessing the impact of land security on the productivity of farming households in Benin. The empirical analysis covers 626 households sourced from EMICOV in 2012 and employs a methodological approach based on Conditional Mixed Process technic. Results show that land certificate ownership increases by 0.238 the likelihood of investing in agricultural equipment whereas the customary law ownership increases that likelihood by 0.374 compared to households without any land ownership (the squatters). Furthermore, the customary law ownership provides farmers with more security than land certificate ownership in “Collines” region.

The remaining part of the article is organized as follows. Section 2 presents the methodology and data. Section 3 presents and discusses the results of the empirical analysis. The conclusion and implications of economic policy are discussed in the last section.

2. METHODOLOGY

Theoretical arguments regarding the relationship between land security and agricultural productivity have been formalized by [8] and [21]. In a problem of optimization of the final wealth of farmers, [8] introduces the land risks captured by the probability of eviction of agricultural households. The authors hypothesize that farmers formulate their investment decision in the purpose of maximizing their final wealth. These farmers have three possibilities including: (1) Invest in capital accumulation through acquisition of machinery, tractors and equipment; (2) choose to invest in landscaping through drainage, soil maintenance, etc. (both types of investment are partially or totally lost in case of eviction); finally, (3) farmers can invest in non-farm assets where land risks do not have an effect. [21] replace the concept of "private property rights" with the notion of "security of property" and derive from the maximization of the final wealth of farmers the first-order conditions below:

$$C = f(X, TS) \quad (1)$$

$$L = f(X, TS, C) \quad (2)$$

$$I = f(X, L, C) \quad (3)$$

$$Y = f(X, L, I) \quad (4)$$

In this system, the endogenous variables are credit (C), land management (L), variable inputs (I) and agricultural yield (Y). Land security (TS), characteristics of farmers and their holdings (X) are assumed to be exogenous.

2.1. Empirical model

Following the work of [21] and [18], we estimate the recursive system of equations presented as follows:

$$E = f(X_1, SF) \quad (5)$$

$$I = f(X_2, E) \quad (6)$$

$$Y = f(X_3, E, I) \quad (7)$$

Where, SF: land security, E: investments, I: variables inputs, Xi: Control variables measuring household characteristics and their plots and Y: Productivity of farm households. We hypothesize that tenure security directly affects investments and indirectly variable inputs because of their complementarity. Investments and variable inputs will subsequently determine the productivity of farm households. To avoid a possible endogeneity bias caused by the unobservable heterogeneity of the farmers, we introduce the vector Xi. As [2] pointed out, land tenure security must be exogenous in order to avoid the endogeneity bias between investment and land security. We choose the specification in structural form instead of the reduced one because it better tests the relative theoretical assumptions between land security, investment and productivity.

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2.2. Source of data

Data used in this study is from EMICOV[3]-2 survey in 2012 by INSAE-Benin throughout the whole Benin's territory. We extracted a sample of 626 farm households from the 6 municipalities of "Collines" department (Bantè, Dassa-Zoumè, Glazoué, Ouessè, Savalou and Savè). This department was chosen because it is one of the departments of the country where agriculture is the main activity. In addition, land issue is a serious in this region because of the high density of the population.

2.3. Description of variables

Since the works of [25] and [21] on tenure security, agricultural households are classified into different categories called "bundle of land rights". This allows the study of the effects of each category on investments and productivity of farm households. Indeed, in their study, [21] constructed categorical variables to capture the level of household tenure security. Based on this study, [18] defined three (03) categories of land security in Cameroon. As [18], we use the three-category categorical variables presented below:

Legal ownership: According to property rights theory, this category confers the highest level of security. It includes farmers who own and have legal certificate upon the farmed land. Household's farm owners of the land they farm have the largest "bundle of land rights". It is assumed that households here have the right to transfer their property since they hold a land certificate (a legal document).

Customary property: Households in this category have a lower level of security than households in the first category (Legal Ownership). Indeed, not having title of legal ownership, the right of transfer property is limited.

Squatter: This category includes households that exploit land that they do not own. These are households that are in free occupation on the land on which they do not have any legal or customary title. Thus, these households are potentially in land insecurity because at any time they can be removed from the land they exploit.

By comparing the performance of squatters (considered potentially in land insecurity) to the performance of other households, we can easily identify the effects of land tenure security. But to avoid a possible endogeneity between land security and investment, it should be ensured that the security of land rights remains exogenous, that is to say that, households have no influence on the "bundle of rights" associated with to each category and the resulting security. According to [21]'s works, the factors that are likely to modify the bundle of individuals' rights are mainly determined by exogenous forces. We therefore consider the security of tenure rights as exogenous.

2.4. Estimation technic

The equation (5) corresponds to choice binary model that relates long-run investments and tenure security (SF). In fact, investment is an indicative variable of modern equipment acquisition that capture the occurrence or not of investments. This equation could be estimated by a probit model. As for equation (6), it relates short-term investments (I), long-term investments and household characteristics as well as the characteristics of their lands. This equation indicates that land security indirectly influences short-term investments through long-term investments because of their complementarity. It represents a classic multiple regression model.

Equation (7) is considered as a Cobb-Douglas production function relating the productivity level (Y) to the investment (E, I). The estimation of such a model does not pose any problem in principle because each of the equations can be estimated individually [10]. However,

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[3] This nationwide survey was funded by the Government of Benin, the Danish Cooperation (DANIDA), the Millenium Challenge Account (MCA-Benin Program), the German Technical Cooperation (GIZ) and the United Nations Program for development (UNDP). Data from this survey are available on the site http://www.ilo.org/surveydata/index.php/catalog/454/study-description

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individually estimating each equation assumes that the error terms of the different equations are independent of each other. Which is not always true in reality.

To fill these gaps, we plan to use the complete information Maximum likelihood method for the estimation of the recursive system. For this purpose, we choose the "Conditional Mixed Process" (CMP[4]) technique developed by [23] which has the merit of being general and of taking into account a greater diversity in the nature of endogenous variables (discrete, censored or continuous). In addition, this technique is more appropriate for recursive models and it allows to take into account the cross-relationships that may exist between different equations. Moreover, [5] indicate that systemic estimation procedures generally lead to more efficient estimates than the individual estimate of each equation. In Benin, barely 5 per cent of agricultural credit requests are satisfied because agricultural activity is considered a risk[5] activity. Beninese farming households use personal savings as well as local solidarity mechanisms to finance their investments. So like [11] and [18], our specification will not take into account the credit equation. Because, we assume that the credit channel is irrelevant to highlight the effects of land tenure security in Benin.

3. RESULTS AND DISCUSSIONS

3.1. Descriptive Statistics

Table 1. Descriptive statistics of variables

Variables	Legal ownership		Customary property		Squatter		Total	
	Mean	Std dev.	Mean	Std dev	Mean	Std dev	Mean	Std dev
Invest	0.49	0.12	0.51	0.22	0.23	011	0.448	0.497
Input	22050	7073	9964.23	4693	8305	3736	11944.69	6872.97
Productivity	3770	2701	4483.62	4369.72	5983.30	5656	4503.68	4258.95
Wealth	-0.44	0.63	-0.35	0.63	-0.46	0.7	-0.40	0.66
Agecm	48.12	15.62	46.36	14.66	43.6	13.77	46.22	14.78
Sexecm	1.12	0.32	1.17	0.38	1.14	0.35	1.15	0.36
Labour	5.37	2.74	5.17	2.48	5.46	2.88	5.28	2.63
Actprinc	0.93	0.21	0.83	0.2	0.56	0.12	0.80	0.39
Area	3.45	1.76	3.44	1.55	3.59	1.59	3.46	1.61
Observations	154		342		130		626	

Source: Author, from EMICOV (2012) data

The results of the descriptive statistics of our analysis are shown in Table 1 above. This table indicates that the average value of production is approximately 13034 kg for the households in the sample. The area sown by Beninese households in the “Collines” department is on averages 3.46 hectares. With regard to agricultural yield, per hectare, its value is 4503 kg / ha. Beninese farmers are in majority smallholders; over 79% of the households in the sample have an area of less than 5 hectares. This indicates a very low level of investment. For 63% of the households studied, the head of the household has no education. Agriculture is the main activity of the head of household (81 per cent of households), and 84 per cent of them are men, their average age is 46 years. The average annual expenditure for variable inputs (seeds, fertilizers, pesticides and other expenses) is about 11,944 FCFA[6] and only 33% of households have modern equipment for practicing agricultural activities.

[4] The CMP is analogous to the generalized probit developed by Amemiya (1978)

[5] Banks are reluctant to finance agricultural activities. Indeed, they consider this activity too risky because of unpredictable climatic hazards. So to protect themselves they require a lot of guarantees from their customers.

[6] The FCFA designates the monetary unit of the country defined by the parity 1 EURO = 655,957 FCFA

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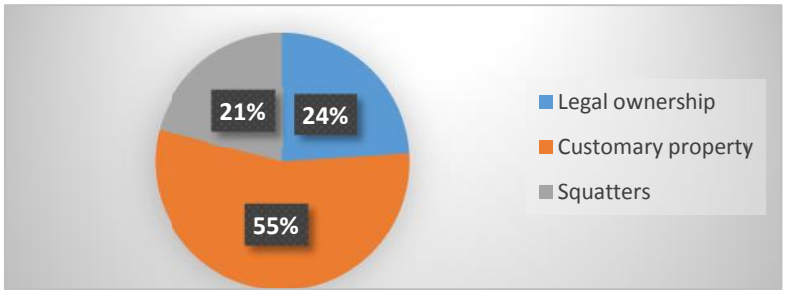

Figure 1. Distribution of households according to their land status
Source: Author, from EMICOV (2012) data

In the "Collines" department, the main form of land ownership is customary property (Figure 1). Customary institutions still occupy a prominent sociological place in households land ownership, especially for households in rural areas. Land title remains largely unknown to households that refer to customary institutions. Only 24 per cent of households hold certificates over lands that belong to them. That rate is 77 per cent for rural households and 23 per cent for urban and semi-urban households. Squatters occupy a significant proportion (21 per cent) of the sample, which highlights the constraints related to land ownership access. In addition, we note that women are disadvantaged with regard to land rights (see appendix, Figure 4).

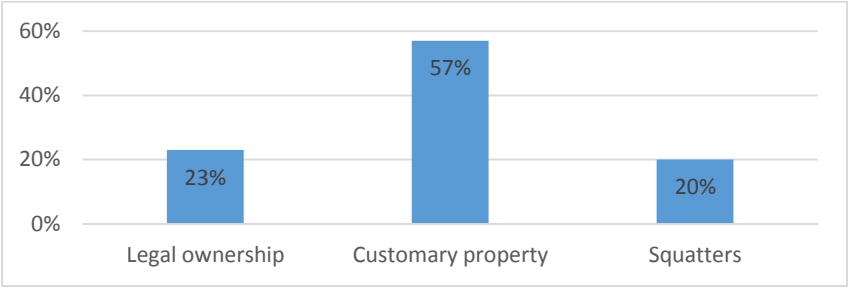

Figure 2. Agricultural Productivity of Benin Households
Source: Author, from EMICOV (2012) data

In the "Collines" area, customary landowners are more productive than other categories of farmers (Figure 2). The areas sown by these households are also greater, and on average they devote more resources to purchase inputs (Table 1). Squatters account for 43 per cent of households with a higher level of education. This result could be explained by the high level of migration of unemployed graduates or the out-of-school youth in the "Collines" department. In fact, these young people practice agriculture by exploiting land that does not belong to them [27]. The proportion of heads of households with primary education is higher for this category (30 per cent), but is 23 per cent and 22 per cent respectively for legal owners and customary owners (Figure 5).

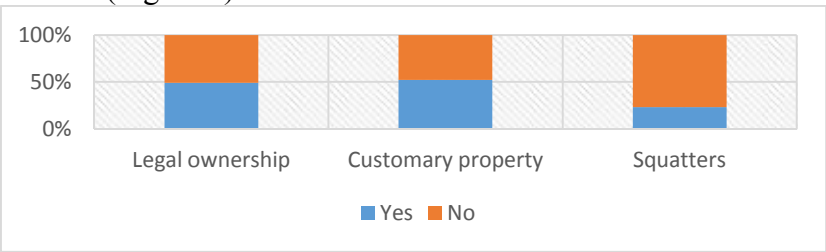

Figure 3. Use of modern equipment by households
Source: Author, from EMICOV (2012) data

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In the Benin context, the proportion of households with modern facilities is higher for customary owners (52 per cent) than for legal owners (49 per cent) and for squatters (23 per cent) (Figure 3). This would mean that customary landowners have as much, if not more, incentives to invest than legal owners.

3.2.Empirical Results

Table 2. Result of the estimation of the investment equation

Variables	Coefficient	Std. dev	Z statistic
Land security			
Legal ownership	0.26 (0.238)***	0.67	3.97
Customary property	0. 81 (0.374)*	0.66	1.31
Squatters	-0.091	0.13	-0.78
Education			
None	0.17**	0.047	-3.88
Primary	-0.025	0.07	0.72
Secondary	-0.051	0.11	0.64
University	0.15	0.20	0.23
Wealth	0.066*	0.405	1.64
Age of household's head	-0.012*	0.01	0.17
Sex of household's head	0.503***	0.97	-5.16
Sown area	0.249***	0.018	13.36
Main activity	-0.042	0.04	-11.16
Municipalities of "collines" department			
Bantè	0.318**	0.12	2.63
Dassa Zoumè	0.261***	0.13	2.13
Glazoué	0.229**	0.11	2.10
Ouessè	0.711**	0.14	5.22
Savalou	-0.43**	0.13	-2.75
Savè	-0.25*	0.16	2.33
Constant	1.56	0.66	23.41

Source : Author from EMICOV (2012) survey
Note: values in parenthesis represent marginal efects of our variables of interest
***, **, * (significativity at 1%, 5%, 10%).

From our empirical results, it appears that land tenure security positively and significantly affects the probability of acquiring modern equipment. The coefficients of the legal and customary property dummy variables are positive and significant at the 5 per cent and 10 per cent thresholds, respectively. For the first equation, the computed marginal effects indicate an expected effect of 0.238 and 0.374 on the probability of acquiring equipment respectively for land certificate ownership and the possession of customary rights.

Indeed, compared to squatters who permanently incur the risk of being ousted, farmers holding legal or customary land certificate are rather reassured and do not hesitate to buy modern equipment to improve their agricultural yields. Contrary to the theory of property rights, Beninese households with customary rights are so reassured that they tend to invest more than farmers with legal ownership. However, communal disparities exist. Agricultural households in Savalou and Savè tend to invest less in agricultural equipment compared to agricultural households in other communes. This can be explained by the fact that these two communes are the poorest of the "Collines" department in Benin.

Land use also positively and significantly affects the propensity to acquire modern equipment, especially when the main activity of the household is agriculture. In fact, large cultivated areas often require abundant labour and relatively important capital for farmers. The age of the head of household negatively affects agricultural investments. This negative sign is

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justified by the stylized facts that indicate that older farmers are more reluctant to adopt new technologies. The household head's sex has a significant effect. In addition, the level of household wealth is a significant determinant of investment, while education does not seem to affect the decision to acquire equipment. Indeed, in Benin, access to credit is difficult for farm households, in most cases, they invest with their own income, usually from previous harvests. In general, only farmers who have saved a portion of the previous sales can purchase equipment.

Table 3. Result of the estimation of the variable input equation

Variables	Coefficient	Std. dev	Z statistic
Investment	45.32***	13.24	2.91
Education			
Primary	7.13	8.25	0.93
Secondary	15.16	10.87	1.22
University	33.98	18.15	4.33
Wealth	0.04***	0.01	5.25
Age of household's head	-0.32	0.25	-2.02
Sex of household's head	7.22	8.22	1.23
Sown area	4.53***	1.12	5.07
Labor	3.92***	0.78	5.18
Main activity	-7.45	7.32	-1.12
Municipalities of "collines" department			
Bantè	22.08	12.22	2.18
Dassa Zoumè	-15.22	9.78	-1.25
Glazoué	28.12	12.34	2.30
Ouessè	29.66	11.14	2.45
Savalou	-10.22	12.96	-0.66
Savè	10.12	13.22	0.80
Constant	2.93	18.70	0.22

Source : Author from EMICOV (2012) survey
Note: values in parenthesis represent marginal efects of our variables of interest
***, **, * (significance at 1%, 5%, 10%).

In the third equation of our recursive model, we capture agricultural productivity by yield per hectare. We assume that production is a Cobb-Douglas type function. Thus, we adopt the log-linear form for its estimation. Results of this equation are summarized in Table 4 below.

Table 4. Result of the estimation of the agricultural productivity equation

Variables	Coefficient	Std. dev	Z statistic
Investment	0.673***	13.24	4.91
Log (input)	0.462***	0.12	13.22
Education			
Primary	0.013	0.25	0.93
Secondary	-0.126	0.07	-0.22
University	0.098	0.15	0.33
Log (Age of household's head)	-0.32	0.25	0.32
Sex of household's head	0.228***	0.02	3.23
Log (Sown area)	-0.433***	0.03	-12.07
Log (Labor)	0.129***	0.27	4.18
Main activity	0.361***	0.37	7.12
Municipality of "collines" department			
Bantè	-0.22**	0.12	2.18
Dassa Zoumè	0.18***	0.08	-1.25
Glazoué	-0.32***	0.07	-2.30
Ouessè	-0.112***	0.07	-1.45
Savalou	-0.422**	0.09	-4.66
Savè	-0.53***	0.08	-9.80
Constant	2.39**	0.25	14.22
Mixed-process regression		Number Of Obs= 626	

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Log likelihood = -429.74	Prob>chi2=0.0000
	LR chi2(19) =1223.05

Source: Author from EMICOV (2012) survey
Note: values in parenthesis represent marginal efects of our variables of interest
***, **, * (significance at 1%, 5%, 10%).

Table 4 presents the estimation results of the agricultural productivity equation. The results indicate that the acquisition of modern equipment has a positive impact on productivity. The age of the head of household as well as the educational variables have no significant effect on agricultural output. However, the gender of the household head and the main (highly agricultural) household activity significantly affect the agricultural productivity of households in Benin. Concerning financial resources devoted to agricultural inputs, their increasing by 10 per cent improves agricultural return by 4.62 per cent. As for the area planted, it negatively affects agricultural productivity. Also, all variables negatively and significantly affect agricultural productivity in all other municipalities except in Dassa Zoumè.

3.3. Discussion of empirical results

Overall, the results of our study indicate that land tenure rights captured by land security positively impact the agricultural productivity of Beninese households by increasing their incentives to invest. In fact, agricultural investments have significantly improved household productivity. In addition, the results indicate that households land certificates owners (legal and customary) are more likely to acquire modern agricultural equipment than households in land insecurity (squatters). In reality, households that hold a land title are completely reassured that the fruits of their investments is guaranteed. While, the squatters fear to be ousted from their exploitation at any time. Our results are similar to those by [18], [6] and [3]. However, contrary to property rights theory, households with customary rights are more productive than those with legal rights in the "Collines" department in Benin. In fact, in this part of the country, few farmers have legal property rights. In addition, the land is considered as an inheritance property that is transmitted from father to son and from generation to generation. Moreover, the level of education is almost low in this region, which could explain the lack of interest of households to hold a legal property right. This result is similar to those of [22], [12] and [21], for whom, the safety of farmers is not exclusively guaranteed by the possession of legal rights. In addition, the Beninese land sector is characterized by visible corruption that is likely to reduce the security benefits that can be expected from holding a land certificate. Indeed, households are rational and they arbitrate between the expected gains and the costs associated with holding a legal land certificate. They therefore take the decision to acquire a land certificate when the expected gains are greater than the costs incurred. Knowing the negative effects of corruption on expected gains, households prefer to settle for customary rights [27].

Our results indicate that communal disparities play an important role in the level of productivity and investment decisions of farming households. Several factors justify these disparities including: unequal access to transport infrastructure and agricultural inputs of farmers, soil quality, and relative price levels of the major factors of production and market imperfections. The level of wealth of households plays a crucial and positive role. Indeed, an improvement in household income allows them to have more financial resources to finance their investments. The area planted has a negative impact on agricultural productivity. In reality, the “Collines” department is characterized by small farms (3 hectares on average). Small farms use more intensively the labour factor than large farms. This result is consistent with that of [26] for whom, due to imperfections in the labour market, there is a negative effect between area and productivity.

4. CONCLUSION

This paper aims at studying the impacts of land tenure on household’s agricultural productivity in Benin. We hypothesize that land security plays a key role in productivity and

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the incentive to invest in households' farm. Data used in this study is from EMICOV (Enquête Modulaire Intégrée sur les Conditions de Vie des Ménages) collected in 2012 and covered 626 Benin's farming households. Method used is the Conditional Mixed Process (CMP) technic approach.

First, our results show that holding of a land title increases the probability of investing in agricultural equipment by 0.238 while the holding of customary rights increases it by 0.374 compared to households without any rights (squatters). In fact, land security directly increases the investment decisions of agricultural households and indirectly the use of agricultural inputs, which, in turn, significantly impacts the level of agricultural productivity. Secondly, we show that the possession of customary rights guarantees the safety of farmers more than the holding of a land title in the "Collines" department in Benin. Administrative burdens, ignorance of the importance of land certificates, costly procedures and corruption that undermines land institutions are factors that explain this result.

In terms of economic policy recommendation, we propose state recognition of customary rights and strengthening of legal land institutions. Lastly, a better structure of the land market would reduce the difficulties related to access to land, and inequalities in the distribution of land resources.

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APPENDIX

Table 5: Description of study variables

Variables	Names	Definitions
		Endogenous
Investment	Invest	Binary variable coded as follows: 1 if the household has modern equipment and 0 otherwise
Inputs	Input	Current operating expenses in FCFA for the purchase of commercial and other inputs (seeds, fertilizers, wage labor)
Productivity	Productivity	The value of the yield per hectare obtained by dividing the total value of production in kilograms by the area harvested
		Exogenous
Expérience	agecm	The age of household's head is retained as proxy of the experience
Education	Educ	The education level of household's head is a qualitative variable that takes four modalities:1 = none, 2= primary, 3= secondary et 4= university
Wealth index	Wealth	Index that varies between -1 and 2 with an average level of richness if -0.5 to 1; poorer if -1 to -0.5 and richer if 1 to 2.
Sexe	sexcm	Binary variable that takes the value 1 if the household's head is a man and 0 otherwise
Labour force	Labor	Variable captured by the number of people who usually worked on the farm
Main activity	Actprinc	Binary variable that takes 1 if the activity of household's head is agriculture and 0 otherwise
Sown area	Area	Sown Area in hectare (ha)
Municipality	Municipality	Dummy which takes 6 modalities: Bantè, Dassa Zoumè, Glazoué, Ouessè, Savalou and Savè

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Ownership security	Secufon	Categorical variable that takes 3 modalities: Legal ownership (prleg), customary property (prcout) et squatter (squat). Indicator variables will be used for this variable.
Productivity is expressed in kg / ha and inputs are in CFA francs		

Source : Author, from EMICOV (2012) data

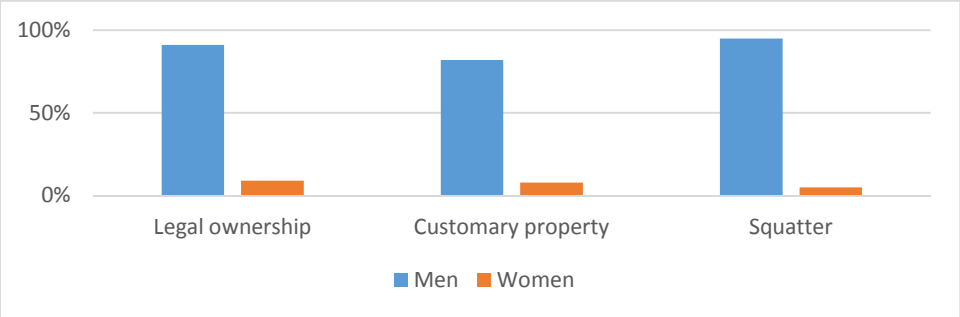

Figure 4: Distribution of land ownership rights by sex of household's head

Source : Author, from EMICOV (2012) data

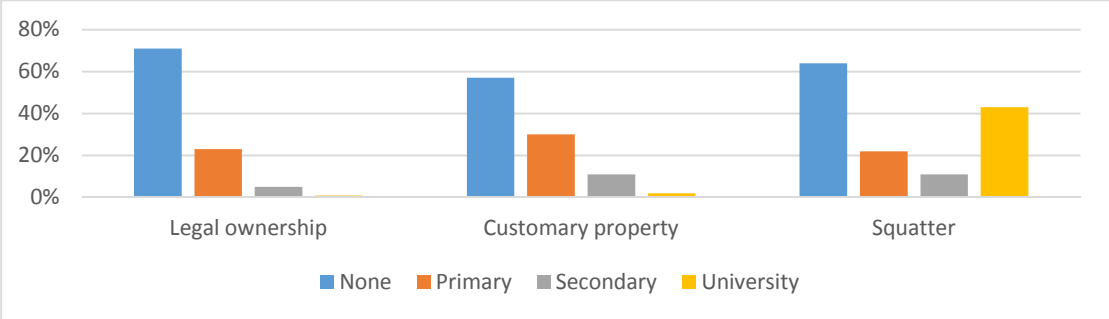

Figure 5: Distribution of Land Ownership Rights by Gender of Household's head

Source : Author, from EMICOV (2012) data

Table 6: Distribution of households by municipality

Municipaly	Observations	Legal ownership	Customary property	Squatters
Bantè	81	26	44	11
Dassa Zoumè	135	34	51	50
Glazoué	109	24	83	2
Ouessè	100	39	44	17
Savalou	119	15	79	25
Savè	82	16	41	25

Source : Author, from EMICOV (2012) data

Table 7: Distribution of the land right of households according to their living environment

	Legal ownership	Customary property	Squatter
Urbun	34	67	34
Rural	120	275	96

Source : Author, from EMICOV (2012) data

Table 8: Distribution of the land right of households according to the level of education

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	Legal ownership	Customary property	Squatter
None	110	200	83
Primary	36	101	28
Secondary	7	38	15
University	1	2	4

Source : Author, from EMICOV (2012) data

Table 9: Some Financing Modalities for Beninese Farm Households

Source 1	Source 2	Source 3	Source 4	Source 5	Source 6	Source 7	Source 8
Employer	Coopérative	Tontine	Mutual credit / banking	Local lender	Beneficence / Family Help	NGOs	Parents / Friends / Neighbors

Source : EMICOV, 2012