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Niee Foning, Maxime and Kane, Gilles Quentin and Ambagna, Jean Joël and Fondo, Sikod and Abayomi Oyekale, Samuel

Faculty of Economics and Management, University of Yaounde II, Cameroon, Faculty of Economics and Management, University of Yaounde II, Cameroon, Sub-regional Institute of Statistic and Applied Economics, Faculty of Economics and Management, University of Yaounde II, Cameroon, Department of Agricultural Economics and Extension, North-West University Mafikeng Campus

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## The effect of incomplete land tenure contracts on agricultural investment and productivity in Cameroon

Maxime Nee Foning<sup>1\*</sup>, Gilles Quentin Kane<sup>2</sup>, Jean Joël Ambagna<sup>3</sup>, Fondo Sikod<sup>4</sup>  
and Abayomi Samuel Oyekale<sup>5</sup>

<sup>1</sup> Faculty of Economics and Management, University of Yaounde II, Cameroon. <sup>2</sup> Collaborative PhD Programme, African Economic Research Consortium (AERC), Faculty of Economics and Management, University of Yaounde II, Cameroon. <sup>3</sup> Faculty of economics and management, University of Yaounde II, Sub-regional Institute of Statistic and Applied Economics, Cameroon.

<sup>4</sup> Faculty of Economics and Management, University of Yaounde II, Cameroon. <sup>5</sup> Department of Agricultural Economics and Extension, North-West University Mafikeng Campus, Mmabatho 2735 South Africa. e-mail: maximefoning@gmail.com, kanegilles@yahoo.fr, joelambagna@rocketmail.com, Fsikod2002@yahoo.com, asoyekale@gmail.com

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### Abstract

The aim of this paper was to analyse the effects of secure land tenure contracts on agricultural productivity. These effects will be highlighted through investment. Data from the third Cameroonian household survey (ECAM III) was used to estimate a binary choice model and productivity equation by instrumental variables. Firstly, the results suggest that there is a moral hazard in the investment behaviour of sharecroppers. This result could support the hypothesis of a holdup problem, which would reduce the incentives for agricultural households to make optimal investments. Secondly, the insecurity of land tenure contract would reduce the probability of purchasing modern equipment by about 0.44 and reduce the probability of using fertilizer by about 0.21. However, these investments determine the differences in term of productivity among agricultural household. Thus, the sharecroppers are less productive because they invest less than landlords. Therefore, it seems necessary to implement institutional mechanisms that can help to release the constraints on land access and to ensure the respect for rights and obligations between all the actors involved in agricultural leases.

**Key words:** Security of land tenure contracts, moral hazard, sharecroppers, holdup.

### Introduction

Agriculture remains the engine for economic growth in Cameroon. With a contribution around 25-30% of gross domestic product (GDP), the agricultural sector employs about 50% of the active population<sup>10</sup>. The sector's contribution to national wealth has remained consistent. In 2006, agriculture contributed up to 55% of exports, a significant part of the foreign exchange resources of the country<sup>18</sup>. However, the recent food crisis in 2008, which was characterised by simultaneous and sudden rise of prices, shows the fragility of productive system, which is unable to follow the evolution of domestic demand.

Indeed, even though the country has significant natural resources such as the arable land, access to this land seems to be an additional burden on agricultural households. Only 17% of irrigable land is used and 26% of arable land is cultivated in Cameroon<sup>20</sup>. In addition, conflicts and land pressures accentuate agricultural households tenure insecurity in Cameroon<sup>17</sup>. The majority of Cameroonians, especially those in rural areas, appear as simple "squatters" on their own land<sup>2</sup>. Only 150,000 land titles have been issued since 1974, while an estimated potential is about 3,000,000<sup>4</sup>. Only 5% of those who have title their land were peasants. Also land titles issued are often questioned for irregularities while we can observe that many land titles are sometimes delivered to different owners for the same parcel. This land ownership plunges households in a situation of uncertainty and tenure insecurity. In one hand, the confusion created by the multiplicity of legal norms emphasises land disputes between

indigenous and non-indigenous. On the other hand, the dispute between the state and rural communities may occur<sup>17</sup>. The challenge is, thus, to ensure an optimal allocation of agricultural land and security on land tenure contract for farmers. Moreover, for many agricultural households who do not have arable land, the conclusion of land tenure contracts is often the only way of access to land, implying an agency relationship between land owners (principal) and those who exploit (agent).

In Cameroon, population pressures combined with the high rate of urbanisation generate competitions for land that undermine the security of contracts as long as owners are tempted to renegotiate these contracts for benefited new profit opportunities. Such threat could negatively affect investment and productivity of agricultural households. Insofar as the incompletes contracts<sup>+</sup> may lead farmers to make sub-optimal investment level due to the risk of crowding out on their parcel<sup>13</sup>. One may thus wonder if there is a relationship between the security of land tenure contract, productivity and agricultural investment.

The empirical literature on the effects of land contracts on agricultural investment and productivity is abundant. Insofar as agricultural investments are specific assets, the choice of making such investments largely depends on the land tenant insurance on the sustainability of his contract. Then, Jacoby and Mansuri<sup>13</sup>

+ A contract is said to be incomplete if it is impossible for one part to anticipate various contingencies that may affect the terms of this contract, to write the terms of this contract and to enforce them.

show that, as long as the landlord cannot commit in the credible way to the sustainability of the contract, specific investments are non-optimal. Additionally, these investments are reduced as long as the risk of crowding increase and also the insecurity on land tenure contract increases. The contractual instability generated by the uncertainty over the renewal of the contract can lead to a moral hazard that would reduce investment of tenant. The authors add that such instability is inherent in the nature of this kind of contracts and affects both the tenancy and sharecropping.

On the other hand, Banerjee and Ghatak <sup>7</sup> have constructed a model to formalise the contractual relationship between a landlord and a tenant. The authors consider that the termination of tenure contract can be used as an incentive mechanism. Indeed, the landlord will use the threat of a termination of contract to force the tenant to make optimal choices, which can ensure to avoidance of this eventuality. Under certain conditions, it appears that the risk of crowding may even lead to an improvement in the productivity of the tenant. The situation is similar to a repeated game between a principal and an agent. In addition, the principal has the ability to punish the agent in the event of inappropriate behaviour. Kassie and Holden <sup>15</sup> showed that if the productivity of the farmer could assure the contract renewal, tenure security is necessary to ensure that farmers make optimal investments.

The implications of the type of agrarian contracts on resource allocation have been subject to numerous investigations. The authors tried to highlight the existence of Marshallian inefficiency and instability effects of different type of contract. Laffont and Matoussi <sup>16</sup> found that sharecropper provides less effort than landlord and their productivity is therefore significantly lower. For Acharya <sup>1</sup>, sharecropper and tenant intensively use less inputs than landlord.

Banerjee *et al.* <sup>7</sup> explicitly addressed the security of land tenure contracts and stability of tenure. The authors conducted a quasi-experimental study in eastern Bengal. Following a land reform, which aimed to increase the bargaining power of tenant, the authors tried to evaluate the consequences on the farmer's efficiency. The results indicate an increase in productivity of sharecropper; this appears as the result of the increase of their bargaining power.

Jacoby and Mansuri <sup>13</sup> were interested in the specific investments made by households in different type of land tenure contractual in Pakistan. The authors highlighted the problem of holdup. Indeed, they showed that investments in organic fertilizers are lower for sharecropper parcel than for landlord parcel. Moreover, Gavian and Fafchamps <sup>11</sup> in a case of Niger also achieved similar results. Jacoby and Rozelle <sup>14</sup> showed that the insecurity of agrarian contracts, which is associated with high risk of expropriation reduces investment in organic fertilizers in China. The authors also found that, to ensure the security of tenure would lead to substantial economic efficiency gains. Arcand *et al.* <sup>3</sup> in the case of Tunisia have also found that the type of land tenure contract was an important determinant of the efficiency allocation of inputs.

Deininger and Jin <sup>9</sup> led to the same conclusions and confirmed the hypothesis of Marshallian inefficiency in Ethiopia. The authors also established that land tenure insecurity explains the suboptimal behaviour of tenant. Bandiera <sup>5</sup> observed that the growing of trees and regular harvest are certainly expensive but help to maintain soil fertility and reduce soil erosion. There is some kind

of gain that is not wholly owned by the tenant. Additionally, the lands used by the landlord are more likely to have maintained trees. Thus, the Marshallian inefficiency as well as the insecurity of agrarian contracts seems to affect the behaviour and performance of agricultural households.

The aim of this paper was to analyse the effects of incomplete contracts on agricultural investment and productivity in the case of agricultural households in Cameroon. Using data from the third Cameroonian household survey in 2007 (ECAM III), we estimated a binary choice model and productivity equation by instrumental variables.

## Materials and Methods

**The data:** The data use for this study are from the third Cameroonian household survey in 2007 (ECAM III) by the National Institute of Statistics. Of the 1645 agricultural households in the sample, 1428 are landlords and 217 are sharecroppers. The sample covers six regions that make up the study area such as the Centre, Littoral, extreme-North, West, South-West and North-West. The choice of these regions can be justified by the fact that the mean of population density of each region are higher than the national mean. In addition, the agricultural household is the unit of analysis.

**The model:** In this paper, the effects of the incompleteness of land tenure contracts will be highlighted by comparing the behaviour of landlords and sharecroppers same as in the study of Jacoby and Mansuri <sup>13</sup>. The estimation strategy will require two steps. In the first step, a binary choice model will be estimated in order to assess the relationship between investment decisions and the type of land tenure contract to identify a potential moral hazard associated with insecure land tenure contracts <sup>9, 11, 13</sup>.

In the first step, the investment equation is given as follows:

$$I_{ij} = \alpha C_i + \beta X_i + \delta + \varepsilon_i \quad (1)$$

where  $I_{ij}$  refers to investment  $i$  made by household  $j$ . Two types of investment are retained (modern equipment and soil improvement).  $C_i$  represents the type of household (landlord or sharecropper),  $X_i$  is a vector of household characteristics and land they operate,  $\varepsilon_i$  is a random disturbance,  $\alpha$  and  $\beta$  are parameters to be estimated,  $\delta$  is the constant.

Note that the parameter  $\alpha$  captures the moral hazard and measures its effect on investment. The introduction of the feature vector  $X_i$ , which represents the control variables, helps to solve the problem of unobserved heterogeneity household.

In the second step, a productivity equation was estimated using the technique of instrumental variables. The fitted values of investments were introduced in the second equation in order to link agricultural productivity and investment. This second equation is specified as follows:

$$Y_i = \theta_0 + \theta_1 Q_i + \theta_2 Z_i + \theta_3 \hat{I}_{ij} + \eta_i \quad (2)$$

where  $Y_i$  denotes productivity,  $Q_i$  is other inputs used in the production process,  $Z_i$  is the characteristics of households and their parcel that can influence productivity and  $\hat{I}_{ij}$  the fitted value of investment  $i$ ,  $\eta_i$  is a random disturbance with the usual assumptions.

Furthermore, although the two-stage least squares would result in consistent estimators, this procedure does not take into account

all the information provided by the different equations in the model. So the joint estimation procedures lead generally to more efficient estimators<sup>8</sup>. For the instrumental variables, we used the Conditional Mixed Process (CMP) according to Roodman<sup>19</sup>, which takes into account all the information available in each equation.

### Results

The choice of a joint estimation procedure is justified since it is observed that there is a significant correlation between the residuals of the two equations. The one-step estimation procedure would lead to biased results because *atanrho\_12* statistics and *atanrho\_13*, *atanrho\_23* are significantly non-zero at the 5% .

**Security of land tenure contracts and investment:** The results of the investment equation show a negative effect of sharecropping contract on the probability of making investments in terms of modern equipment and soil improvement (Table 1).

There is, therefore, a moral hazard in the investment behaviour of sharecroppers. This result supports the hypothesis of a holdup problem that would reduce the incentives for agricultural households to make optimal investments. Indeed the holdup is due to the risk for sharecropper to be crowd out by the landlord, which can lead to relatively low levels of productivity. Additionally land tenure contracts insecurity caused by the risk of non-renewal of the lease would lead to moral<sup>12</sup>.

In Cameroon, the holdup assumption could be explained by the fact that landowners can renegotiate their contract when the value of land increase in order to maximise their profit, which will in turn result in a potential insecurity of land tenure contracts. Also the lack of land market can explain this insecurity. In fact, the existence of land market could increase the mobility of farmers and reduce the insecurity. Then, the analysis of the maginal effects suggest that the insecurity of land tenure contracts led to reduced probability of acquiring modern equipment to 0.44 and the probability of using fertilizer to 0.21 (Table 2 and 3).

In addition, education has no effect on the decision to acquire the modern equipment, but the more educated have a greater propensity to use fertilizer to improve soil quality. When the head of agricultural household is the man, the propensity to invest is

**Table 1.** The determinants of investment.

Variable	Modern equipment		Soil improvement	
	Coefficient	Standard deviation	Coefficient	Standard deviation
Sharecropping	-0.4488241***	0.1145146	-0.2143068**	-0.2143068**
Income	0.0010585***	0.0002972	0.0007077**	0.0007077**
Education				
Primary	-0.0416281	0.1035993	0.2884425***	0.2884425***
Secondary	0.0107865	0.1256422	4560431***	4560431***
Higher	0.126191	0.1280944	0.2359893	0.2359893
Agecm	0.0014381	0.0027457	-0.0019357	-0.0019357
Sexcm	0.4223627***	0.0937632	0.0513987	0.0513987
Farm size	0.0387598***	0.0089745	0.036207***	0.036207***
Health	0.1305147	0.0867621	-0.0056259	-0.0056259
Actprinc	1390144	0.0957306	0.0931982	0.0931982
Region				
Extreme-north	-0.4208019***	0.1404054	0.8271175***	0.8271175***
Littoral	0.5889426***	0.150897	0.0858542	0.0858542
West	0.1210372	0.1208122	1.014491***	1.014491***
South-west	0.3011322**	0.1373502	-0.2148043	-0.2148043
North-west	0.4811019***	0.1423328	0.8238217***	0.8238217***
Constant	-1.58815***	0.2501697	-0.916100***	-0.916100***

Note: \*, \*\*, \*\*\* significant at 10%, 5% and 1%, respectively. For region and education variable, the centre region and non-education are references, respectively.

**Table 2.** Marginal effect of the probability of acquire modern equipment.

Variable	Marginal effect	Level of significance (%)
Sharecropping	-0.4488241	1
Sexcm	0.4223627	1
Farm size	0.0387598	1
health	0.1439753	10
Income	0.0010585	1
Extreme-north	-0.4208019	1
Littoral	0.5889426	1
South-west	0.3011322	5
North-west	0.4811019	1

**Table 3.** Marginal effect of the probability of use fertilizer.

Variable	Marginal effect	Level of significance (%)
Sharecropping	-0.2143068	5
Farm size	0.036207	1
Primary	0.2884425	1
Secondary	0.4560431	1
Income	0.0007077	5
Extreme-north	0.8271175	1
North-west	0.8238217	1

greater than when it is the women. The landlords of bigger farms invest more and use more fertilizer than those with small farms. This result can be explained by the fact that large size farmers, unlike the smaller size farmers are guided by profit maximisation and production is primarily for selling.

The regional specificities suggest that agricultural households from littoral, South-West and North-West invest more in acquiring modern equipment than those from the centre region. Also, the agricultural households from North-West, West and extreme-North have a higher propensity to use fertilizers than their counterparts from centre region. This last result can be justified by the relative scarcity of arable land in these regions compared to the centre region, requiring intensification in land use and therefore the use of chemical fertilizers to increase yields. However, a further study seems to be necessary to compare farm households from these different regions and avoid econometric problems such as selection bias and endogeneity which could invalidate the results.

**Investment and agricultural productivity:** The productivity equation suggests that the acquisition of equipment and the use of fertilizers significantly improve the agricultural performance (Table 4). The agricultural households who acquire modern equipment have the means of productivity of CFA 168,000 which is higher than others. Similarly, agricultural households who use fertilizer have higher productivity on average CFA 196,000 than others. Additionally, an increase of CFA 1 expenditure on input variable lead to rise in productivity of CFA 0.71.

In the light of these results, it appears that the productivity differences among agricultural households are significantly determined by investment behaviour. We can therefore, conclude that the sharecroppers are less productive because they invest less than landlord. This result is similar to which achieved by Laffont and Matoussi<sup>16</sup> and Acharya<sup>1</sup>. Thus, sharecroppers feel less secured and provide less effort than landlord that could explain the cons productive behaviour.

**Table 4.** Results of productivity equation.

Variable	Coefficient	Standard deviation (robust)	Z Statistics
<b>Instruments</b>			
EQUIP	168.3704***	25.82026	6.52
AMSOL	196.411***	68.76837	2.86
<b>Education</b>			
Primary	17.13344	12.57799	1.36
Secondary	-28.42818	18.28318	-1.55
Higher	11.07871	51.96422	0.21
<b>Input</b>			
Agecm	0.7198646***	0.1452577	4.96
Labour	-0.0967098	0.4981356	-0.19
Sexcm	0.5643319	1.120281	0.50
Farm size	-10.52356	14.3727	-0.73
health	-19.71125***	5.177538	-3.81
Actprinc	19.88785	13.43488	1.48
Region	16.36167	12.34643	1.33
<b>Region</b>			
Extreme-north	-99.64409***	29.56415	-3.37
Littoral	-46.83407	28.97975	-1.62
West	-93.06285***	35.10723	-2.65
South-west	-43.39166*	24.91257	-1.74
North-west	-165.0171***	34.17867	-4.83
Constant	129.6104***	46.31271	2.80
<b>Diagnostic tests</b>			
Insig_1	5.374192***	0.1286619	41.77
atanhrho_12	-0.2843781***	0.0849811	-3.35
atanhrho_13	-0.5052343**	0.2187058	-2.31
atanhrho_23	0.1872825***	0.0573596	3.27
sig_1	215.7654	27.76079	-
rho_12	-0.2769522	0.0784628	-
rho_13	-0.4662237	0.1711669	-
rho_23	0.1851231	0.0553938	-
Mixed-process regression	Number of obs = 1645		
Log pseudolikelihood =	Wald chi2(17) = 139.87		
-12895.947	Prob > chi2 = 0.0000		

rho<sub>ij</sub> represents the coefficient of correlation between the residuals of the equation i and j. atanhrho is the Fisher transformation of the correlation coefficient given by:  $\text{atanhrho} = 1/2 * \ln((1+\text{rho})/(1-\text{rho}))$ .

Moreover, the household affluence and the farm size are key determinants of the investment decisions. The inverse relationship between farm size and land productivity is confirmed suggesting that there is inefficiency in the use of the land.

On the other hand, the productivity differences between regions seem to be very significant. Thus, agricultural household from the extreme-North, West, South-West and North-West seem to be less productive than those in the centre region. This can be mainly due to the existence of significant distortions and market imperfections in the input market.

### Conclusions

This paper suggests the existence of significant differences in terms of investment and thus productivity between sharecroppers and landlords, giving special importance to the security of land tenure contracts for agricultural households. Thus, it seems necessary to implement institutional mechanisms and reforms in order to alleviate the constraints on access to land and to ensure respect for the rights and obligations between the different actors involved in agricultural leases.

Additionally for this study, it seems to be necessary in terms of perspectives to investigate about the phenomenon of land grabbing and its effects on agricultural productivity in the case of devolving countries, which are mainly concerned by the problem of food security. Also, the problem of inequality and inequity in land distribution, corruption in the land sector and its implications for land investments, land market imperfections and their

consequences, etc. seems to be very important.

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