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Abstract: This article aims at evaluating and analysing the production efficiency of farms (FF) in the locality of Zoetele, South Cameroon. From a sample of 62 FF, we first estimate a model of Data Envelopment Analysis with constant and variable returns to scale, then a censored TOBIT model enabling therefore to identify factors of efficiency. Two main outcomes result from this study. First of all, we can see that on average, the level of technical efficiency of FFs is 44.60% when returns to scale are constant, and 67.80% when return to scale are variable. This shows off possibilities of efficiency substantial gains. Secondly, the farm size and the production destination impact negatively on the technical efficiency. Finally, the adherence to a peasant organisation and age improve it. From those results, we estimate that if one wants to improve the efficiency of the FFs, it would be interesting that the FFs organise themselves into associations in order to benefit from experience sharing, and government and nongovernmental organisations (NGO).

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Introduction

In Cameroon, agricultural sector accounted for 75% of the primary sector and employ around 60% of the labor in 2009. The agricultural sector also generates foreign exchange accounting for 55% of the total of exports (MINADER, 2005). The sector indisputably occupies a strategic place in the national economy in terms of wealth creation, foreign exchange earnings, employment generation, social stability, food security, food self-sufficiency and poverty alleviation, especially amont those living in rural area. According to the Millennium Development Goals (MGDs), the government has set up programmes to increase producers' incomes by about 4.5% per annum in to ensure poverty reduction by half in 2015, households' food security (MINADER, 2005) The improvement of family farms (FF) efficiency may help in the fulfillment of these goals. Indeed, the agricultural production growth rate is influenced by three main factors: the volume and type of resources mobilised in production, the technology status, and the efficiency with which those resources are used. The aforementioned efficiency of resources helps identify possibilities of production growth without supplementary financial resources and it is also a source to productivity growth (Datt & Ravallion, 1998; Nkamleu, 2004).

Koopmans (1951) and Debreu (1951) were the first to work on the concept of efficiency. Koopmans set up a measure of the concept of efficiency and Debreu tested it empirically. Debreu (1951) set up the coefficient of the use of resources, which gives a numerical evaluation of the loss associated to non-optimal situation. However, Farrell (1957) is the first to clearly define the concept of economic efficiency and to distinguish the concept of technical efficiency from the concept of allocative efficiency. He did also show an approach for the estimation of efficiency frontiers, starting from the idea that available information on a given activity should enable an estimation of the "best practice envelope" for that activity.

The notion of efficiency therefore represents three main components which are: technical efficiency [1], allocative efficiency [2] and economic efficiency[3] (Bravo-Ureta & Pinheiro, 1997).

[1] According to Farrell (1957), the technical efficiency measures the manner according to which a firm (here an FF) chooses the quantities of inputs that fall into the process of production given the proportions of utilisation of factors. Hence, the farm is technically efficient if for a given level of factors and products used, it is possible to increase the quantity of a product without increasing the quantity of one or more factors, or without reducing the quantity of another product.

Considering the criteria of the origin of the family income and whether labour force is assigned to the farm or not, Oliveira (1997) distinguishes three categories of family farms: those with a productive function, those which serve as labour reserve and those which rely mainly on social transfers for a living (monetary resources other than incomes from the farm or external activities of the family members). However, it is indispensable to precise like Gastellu (1980) that "the African family farm is different from the European family farm". The author substitutes the term "community" which he finds more convenient than "unity", because it depicts more the privileged exchanges that unite individuals of a same group. That is also the definition kept by Kleene (2007) for whom the African family farm is a family team of workers cultivating together, at least a main field to which are linked or not, one or more secondary fields of variable importance depending on the case and having their own decision centres.

Numerous works on the efficiency of farms, both in developing and developed countries, show that farmers are not often able to use their technical potentialities and/or allocate inefficiently their productive resources (Bravo-Ureta & Evenson, 1994; Nkamleu, 2004; Nyemeck & al., 2004, 2008; Latruffe, 2005; Nuama, 2006; Fontan, 2008). So far, few studies have been based on Cameroon. Hence, this study analyses the technical efficiency of FFs in the locality of Zoetele in South-Cameroon, using the method of Data Envelopment Analysis (DEA) and then identifies factors that explain observed inefficiencies using the model of the censored TOBIT.

Such an analysis is very rich because it can contribute to enlighten the government in targeting, and on the potential effects of different programmes set up in the agricultural sector. Following this introduction, this article presents the methodology and the analysis tools. Then the results are presented on the distribution of indices of technical efficiency, and factors that explain inefficiencies. The paper comes up with some conclusions and policy recommendations

2. Materials and Methods

Sample and data

Data were collected during an investigation made while the programme for the Improvement of Agro Pastoral Family Farms Competitiveness (IAPFFC)[4] was running in April and May 2010. Data collected related to FFs cultivating groundnuts and maize. That was due to its importance in the region. In fact, it is one of the farming systems that is mostly practiced in the study area. Among the issues that were investigated during the survey are:

The farming system practiced in relation to the inputs and outputs quantities; structural characteristics of the FF households and Accessibility of the villages during the rainy season. In the survey, 62 FFs were sampled by simple random sampling of three villages from the locality of Zoetele. The respondents were drawn from Ntsimi (19), Otetek (21) and Ebamina (22).

The Data Envelopment Analysis (DEA) method

Data analysis was carried out with the DEA method Blancard and Boussemart (2006) asserted that this approach is particularly adapted to the modelling of a multi input-multi output primal technology, without going through the dual cost function, presupposing the absence of technical inefficiency. It is about a method taking into consideration only hypothesis of free disposition of inputs and outputs, and of convexity for the whole production. It does not set any functional form of production and cost functions as imperative.

The DEA method enables us to identify an efficient set that can serve as reference for efficient farms. Efficient farms have inputs and outputs similar to those of inefficient farms. Hence, they can serve as reference. The purpose of DEA is to construct a non-parametric envelopment frontier over the data points such that all observed points lie on or below the production frontier (Coelli, 1996). Efficient farms are located on the production frontier which indicates the maximum production which can be made using different combinations of factors for a given technology. In literature, the most used two variants of the DEA method are: the Constant Return to Scale (Charnes et al., 1978) model which supposes constant returns to scale (CRS model) and the BCC (Banker et al. 1984) model which supposes variables returns to scale (VRS model).

Following Coelli (1996), suppose there is a set of information on K inputs and M outputs for each

[2] It is the optimal combination, or in the best proportion of resources given their relative prices (Amara and Romain, 2000). A farm is therefore declared allocatively efficient if at a given level of production, the cost of factors is minimum.

[3] The economic efficiency, generally known under the name of "total efficiency" is jointly determined by technical efficiency and allocative efficiency. It is the product of those two types of efficiency. An agricultural farm is then said to be economically efficient if it is at the same time technically efficient and allocates efficiently its productive resources.

[4] In french : « programme d'Amélioration de la Compétitivité des Exploitations Familiales Agropastorales (ACEFA) ».

N farms. Information from the i-th farm is represented by column vectors x_i and y_i respectively. Matrixes of inputs X with dimension KxN, and of outputs Y with dimension MxN regroup information related to all the farms. The ratio approach is an intuitive way to introduce the DEA method. For a given farm, the ratio measures the technical efficiency, and a set of constraints is placed for the ratio of each farm to be always less than or equal to 1. The mathematical program used for the CCR ratio is:

$$\max_{u,v}(u'y_i / v'x_i),$$
$$s/c \quad u'y_j / v'x_j \leq 1 \quad j = 1, 2, \ldots, N \quad (1)$$
$$u, v \geq 0.$$

Where u is a vector of dimension Mx1, and v is a vector of dimension Kx1, representing respectively the weights of the outputs and the inputs determined by solution of the problem: that is to say, by the data of all the farms used as reference set. Since that type of ratio allows an infinite number of solutions, Charnes and Cooper (1962) developed a fractioned linear program. The latter selects a representative solution in each equivalence class and the dual linear program which is associated is:

$$\min_{\theta,\lambda} \theta$$
$$s/c - y_i + Y\lambda \geq 0$$
$$\theta x_i - X\lambda \geq 0$$
$$\lambda \geq 0$$

(2)Where θ is a scalar that gives the measure of the technical efficiency of the considered farm, λ is a vector (N, 1) of constants called multipliers. They indicate the way that farms combine together to create the frontier to which the i-th farm will be compared, according to Farrell definition (1957). The problem is solved N times, one time for each farm in the sample, and generates N optimal values of θ and λ.

In the DEA program (2), the performance of a producer is evaluated in terms of the producer capacity to reduce his vector of factors up to the level of the best practice that has been observed.

However, the hypothesis of constant returns is really adapted only if the enterprise operates at an optimal scale (Ambapour, 2001). That is not always the case (imperfect competition, financial constraints...). This remark led Banker et al. (1984), to propose a model that enables to determine if the production is happening in an area of increasing returns, constant returns or decreasing returns.

Hence, the CCR model can be modified then considering the hypothesis of variable returns to scale. We just have to add a constraint $N1'\lambda = 1$ to the previous programme. We have:

$$\min_{\theta,\lambda} \theta$$
$$s/c \quad -y_i + Y\lambda \geq 0$$
$$\theta x_i - X\lambda \geq 0 \quad (3)$$
$$N1'\lambda = 1$$
$$\lambda \geq 0$$

Where $N1$ is a dimension vector Nx1 made of 1s.

The difference between the technical efficiency index obtained with the DEA model type CRS, and the one from the same farm obtained with the DEA model type VRS constitutes a good measure of scale efficiency for the considered farm.

Furthermore, this model enables the decomposition of the technical efficiency into total technical efficiency and pure technical efficiency. The hypothesis of constant returns to scale leads to the determination of the total efficiency; whereas the hypothesis of variable returns to scale leads the determination of pure efficiency.

The used DEA model integrates three inputs and two outputs.

The inputs: inputs were categorized into three namely: Farm size (hectare), Labour (man/day)[5] and Capital (XAF)[6]. The choice of those variables is justified by the fact that they are commonly used for the estimation of agricultural production frontiers in developing countries (Kalirajan 1981, 1984; Kalirajan and Shand 1986; Bravo-Ureta and Evenson 1994).

The outputs: outputs were categorized into two: output A (kilogram)[7] and output B (kilogram)[8]. Moreover, basing ourselves principally on two arguments taken from the literature, we keep an input orientation of the DEA model. According to Coelli (1996), the chosen orientation is function of inputs and outputs quantities that farmers are able to control. In fact, farmers are best able to control inputs: labour (work), farm size (land) and capital (cost of assets

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[5] It will be evaluated in terms of work volume, and expressed in man/day. The volume is obtained by proceeding to an aggregation of the work of every person, weighed by coefficients given by the Food and Agriculture Organisation (adult man=1, adult women=0.75, children younger than 14 and old men=0.5).

[6] It is the sum of both the invariable and the variable capital. The invariable capital in this study concerns the total value of the assets used (depreciation of the assets), while the variable capital refers to the cost of consumed inputs (seeds).

[7] Amount of groundnuts produced by farmers in the 2009/2010 farming season.

[8] Amount of maize produced by farmers in the 2009/2010 farming season.

used and cost of seeds); than the outputs that are from the agricultural production. Finally, the choice of one specific orientation or another has only a slight influence on the obtained scores, and consequently on the ranking of the production units.

The Tobit model

The TOBIT model belongs to the family of models with limited dependent variable. They are models in which the dependent variable is continuous, but only observable on a certain interval. Hence, these are models that are found halfway between qualitative variable models and the linear regression model where endogenous variable is continuous and observable. However, these models are also called censored regression models[9] or truncated regression models[10].

A censored TOBIT model helps explain the inefficiencies. Indeed, the choice of that model is justified by the fact that the dependent variables that will be the inefficiency indexes (1-efficiency), are continuous and include values in the range [0 1[.

The model can be represented like this:

$$\begin{cases} Y_i = X_i\beta + u_i \\ avec \begin{cases} \mathrm{Y_i = Y_i^*}\ si\ \mathrm{Y_i^*} \succ 0 \\ \mathrm{Y_i = 0 \text{ if not}} \end{cases} \end{cases}$$

(4)

In relationship (4);

- X_i is a vector of explanatory variables,
- β is a vector representing parameters to estimate,
- Y_i is a latent variable that can be considered as the threshold from which X_i affect the efficiency of a FF.

The “inefficiency” dependent variable in the frame of this study continues to be limited to zero. Considering that perturbations u_i are identically distributed following a normal distribution $N\left(0,\ \sigma_u^2\right)$, the estimation of the above censored TOBIT model is done through the maximisation of the probability logarithm which is:

$$\log L = \sum_{i=1}^{n} \log\left[1 - \Phi\ X_i\beta/\delta\right] + \sum_{i=1}^{n} \log\left(\frac{1}{\sqrt{2\pi\delta}}\right) - \frac{\sum_{i=1}^{n}\left(Y_i X_i \beta\right)^2}{2\delta^2}$$

(5)

[9] A regression model is said to be censored when one has at least observations of explanatory variables on the whole sample.

[10] On the other hand, a regression model is said to be truncated when all the observations of explanatory variables and of the dependent variable, showing out of a certain interval are totally lost.

Where **n** represents the number of observations, and **δ** the standard deviation.

The complete empirical form of the TOBIT model that we are going to estimate is the following:

$$Y_i = \beta_0 + \beta_1 AGE + \beta_2 EDUCATION + \beta_3 TRAINING + \beta_4 SIZE + \beta_5 PO + \beta_6 DESTPROD$$

Therefore, variables that are likely to explain inefficiency (and to affect the efficiency) of the FFs of the sample are presented in the following table:

Table 1: Variables used in the study of the determinants of efficiency

Variable	*Definition*	*Measure*
AGE	Age of the farmer	Continuous variable
EDUCATION	Level of education of the farmer	Binary variable (1 = Primary and 0= secondary)
TRAINING	Training in agriculture	Binary variable (1 = Yes and 0= No)
SIZE	Farm size	Continuous variable
PO	Adherence to a peasant organisation	Binary variable (1 = Yes and 0 = No)
DESTPROD	Destination of production	Binary variable (1 = Auto consumption and 0 = Sale + Auto consumption)

In this section, the results obtained from data analysis are presented and discussed as outlined below. Three sections are used in the presentation as follows: firstly, the characteristics of the FFs, secondly, the levels of efficiency estimates; finally, the determinants of efficiency of the FFs.

Socio-economic Characteristics of Farmers

From table 2, on average, the sampled family farms produce 172.34 Kg of groundnuts. However, we notice a huge disparity among FFs. This can be linked to the variability of endowment of FFs in with resources. We also notice huge disparities in the production of maize of FFs. Added to the variability of endowment of FFs with resources, the use of improved seeds by a specific FF can explain that disparity.

The inputs of land, labour and capital have respectively average values of 0.72 ha, 115.60 m/d and XAF 36057.24. The average family farm leader is about 46 years old. For the farming system studied, half of the FFs were producing only for family consumption.

Concerning the level of education, majority of the FFs heads have been to the primary school. Less than half of FFs heads belonged to peasant organisations (PO) (37.10%). FFs heads that had some form of trainings in agriculture represent around the quarter of the sample(25.80%).

Table 2: Summary statistics of farmers' characteristics

Variable	*mean*
Amount of groundnuts (kg)	172.34
Amount of maize (kg)	81.02
Labor (man/day)	115.60
Size (ha)	0.72
Capital (xaf)	36057.24
Age (years)	46
Education (Binary variable)	0.45
Training (Binary variable)	0.26
OP (Binary variable)	0.37
DESTPROD (Binary variable)	0.55

Technical Efficiency Analysis

The average level of technical efficiency obtained for the farmers is 0.446. In other words, an efficient use of all the inputs would lead on average to a reduction of inefficiency by 55.4%, while maintaining a constant production volume. This result shows a relatively low level of average efficiency of FFs practicing a system of farming based on groundnuts a

Considering variable returns on scale, it comes out that the average level of pure technical efficiency of the FFs of the sample is 0.678. This means that on average, they can reduce by 32.2% the use of the factors of production while maintaining the same level of production.

Hence, the maximum values of technical efficiency obtained (higher than 0.8) shows that some of the farmers are very effective and close to the production frontier. These FFs which have a high level of efficiency can serve as reference to improve globally the efficiency of the studied area.

The DEA method enables also to detect among the factors of production that are used, those in particular that are used in excess. The "inputs slack" tally to the additional excess of the use of each factor, in percentage of their used level (table 3). This percentage represents, in addition to the potential reduction depicted by the level of technical efficiency (proportional reduction applying to all the factors), the potential supplementary reduction of considered factor of production (meaning proportional).

For the whole sample, land is on average the most used factor in excess. The additional excess of land is 10.9%. Therefore, the FFs could reduce their use of land by 55.5% on average, which means 44.6% (proportional reduction depicted by the technical efficiency) plus 10.9% (non proportional reduction depicted by the additional excess, applying only on the land factor), whilst producing at the same level. This result reflects the overuse of land previously mentioned, and may be justified by the abundance of the resource.

Concerning labour, the FFs could on average reduce their use of this factor by 50.05%; whereas an average reduction of capital of 53.83% would be possible with the same level of production.

The FFs of the Nsimi and Ebamina villages show a noticeable overuse of capital and labour factors, compared to those of Otetek village. Nevertheless labour is the less used compared to the others (on average 5.45% against 10.9% and 7.23%).

Table 3: Additional excess of factors (total technical efficiency), percentage of the level of factor used

	Total sample	*Ebamina*	*Nsimi*	*Otetek*
Size (%)	10,90	13,05	10,10	9,38
Labour (%)	5,45	5,27	6,47	4,71
Capital	7,23	7,35	8,79	5,67

Determinants of Technical Efficiency

The results of the econometric estimation (table 4) show that we can distinguish two categories of variables: insignificant variables (level of education and training in agriculture) and significant variables (age, farm size, peasant organisation, destination of production).

Talking about education, the main reason that explains the obtained result is the fact that formal education in Cameroon does not integrate knowledge on agricultural practices and techniques hence, the human capital produced by school is slightly useful to agriculture. The result is shared by Gurgand (1993; 1997), in the case of the Ivorian agriculture. He observed that education does not impact positively on the technical efficiency of agricultural production. On the other hand, data collected in Africa are often less reliable than those from Asia for instance. Despite that, the widely accepted hypothesis is that there is a qualification effect in agriculture that cannot be rightfully generalised in sub-Saharan Africa. However, the positive sign of the parameters explaining inefficiency means that those parameters have a negative effect on efficiency. The coefficient of the level on education being positive, we can conclude that cultivation leaders with a primary school education are less efficient than the ones with a secondary and higher school education.

Training in agriculture does not contribute significantly (p>0.10) to the explanation of technical efficiency in the total sample. Indeed, this counter intuitive result can be explained with various reasons. The nature of trainings in agriculture and their length enable us to understand the situation. Also, the low representation in the sample of the FFs leaders who have been through an agricultural training (less than 25%) may explain this result. Added to that, trainings in agriculture in the southern part of Cameroon are generally organised in the form of seminars to farmers. The seminars are based principally on income generating farming systems (cocoa, coffee, palm oil...) On the same hand, these seminars are sometimes too theoretical and are not accompanied by practical examples due to financial and time constraints. Nevertheless, the minus sign of the coefficient associated with the training variable means that training in agriculture has a positive impact on efficiency, but insignificantly.

Variables that explain significantly the technical efficiency of FFs in the sample are: the age of the FF heads, the farm size, the membership to a peasant organisation and the destination of the production.

The minus sign of the coefficient affected to the cultivator age translates the fact that the variable impacts positively on the technical efficiency of the family farms of the sample. Here, the oldest cultivation leaders are more efficient than the young people. This result is explained by the experience of the oldest people. Indeed, the average experience of the sample in the practice of agriculture is 20 years. The culture system based on groundnut and maize of the locality of Zoetele in South Cameroon is therefore practiced for some cultivators, during the whole of their life. The result is in contradiction with Coelli and Fleming (2004) remark for whom; younger cultivators are more efficient than older cultivators. According to the authors, younger people are more disposed to accept new technologies and vulgarisation. Besides, an analysis of marginal effects shows that all things being equal, a variation of the age by a year would cause a variation of the probability to be inefficient by 0.54%.

Results also suggest in disagreement with intuition that, the smallest cultivations are the most efficient all things being equal. Indeed, in the sample, we demonstrated by analysing the scale efficiency the existence of a huge waste due to the excessive use of land. This means that cultivators are not able to use efficiently their resources when the farm size is big. This can be explained by the gender of the FFs leaders who are in majority females and consequently do not have the labour force necessary for an efficient production. The quasi-elasticity obtained indicates that a variation of a unit of the farm size would cause a variation of the probability to be inefficient by 13.02%. The negative relationship between the size of the cultivation and technical efficiency was also depicted by Chirwa (1998) in the case of Malawi. Other studies on the contrary show the positive influence of the size of the cultivation of technical efficiency (Thiam and al., 2001; Nyemeck and al., 2004; Latruffe, 2005).

The membership to a peasant organisation affects positively the technical efficiency. In Cameroon, since the crisis on the 80s the government encourages cultivators to put themselves together. It is in fact the only way for cultivators to benefit from control, subventions and counsels of the government (ACEFA programme which is replacing progressively the National Programme for Agriculture Vulgarisation and Research "NPAVR"), and from Non Governmental Organisations (NGO). This notice confirms the results of the literature according to which, social capital: membership to a peasant organisation being a component, has a positive impact on technical efficiency (Nuama, 2006; Audibert, 1997). Indeed, the communal organisation enables the resolution of problems such as labour force and access to credit which are factors that improve the technical efficiency of cultivators (Helfand and Levine, 2004). Technical efficiency gains linked to membership to a peasant organisation are 11.44%.

It also comes out from the analysis of the determinants of technical efficiency that, the FFs whose production destination is auto consumption are less efficient than those, which in addition to auto consumption sell their production. The sale constraint obliges cultivators to be more efficient and to better manage their resources. As a matter of fact, efficiency gains of FFs whose production destination is auto consumption and sale are 21.23%.

Coming to the end of the investigations, it comes out that there are possibilities of substantial efficiency because the FFs can on average reduce the use of the factors of production by 55.4% when returns on scale are constant and by 32.2% when returns on scale are variables, while keeping the same level of production, all things being equal. This result confirms the idea according to which the agricultural sector both in developed countries and in those who are not, suffers from inefficiency (Bravo-Ureta and Evenson, 1994; Nyemeck and al., 2004, 2008; Latruffe, 2005; Fontan, 2008).

Table 4: factors explaining the nefficiencies of the FF

Variables	Coefficients	P>|t|	dy/dx
Age	-.00539273**	0.013	-.0053927
Education	.01629497	0.758	.016295
Training	-.03812419	0.543	-.0381242
Size	.13019005**	0.031	.13019
OP	-.11444569**	0.047	-.1144457
DESTPRO	.21229597 ***	0.000	.212296
Constant	.6320591 ***	0.000	
Sigma	.20117245***		

Number of obs = 62; LR Chi2(6) = 26.79; Prob > chi2 = 0.0002

3 left-censored observations; 59 uncensored observations; 0 right-censored observations

Notes:
*, **, *** denote statistical significance at the usual confidence levels.
Dependent variable: Level of inefficiency of FFs

Conclusion and Recommendations

The analysis of efficiency determinants suggests that the factors level of education and training in agriculture do no contribute significantly to the explanation of technical efficiency. However, whereas age and membership to a peasant organisation improve technical efficiency, the farm size and auto consumption as destination of production affect it negatively.

Based on those results, our study puts the accent on suggestions at two levels: at the level of the government and at the level of FFs.

To the government: we suggest on a hand the promotion of the creation of agricultural peasant schools that would enable the improvement of the managerial talents of cultivators, and hence make them more efficient in the use of available resources. On the other hand, we suggest to all corporate interveners of the agricultural sector to organise training seminars that could take into consideration systems of culture in association, more precisely food-producing cultures. Besides, it would be interesting that those seminars be more practical and spread over a long period in order to give to cultivators the opportunity to better understand the teachings that are given.

To the family farms: we suggest that they should regroup themselves for them to benefit from the sharing of experience on a side, and from government and nongovernmental organisations (NGO) subventions on the other side. That is why we think that it would be interesting to pursue this study by focusing specifically on the relationship between efficiency and social capital based on agricultural cultivations in developing countries in general, and in Cameroon in particular.

References

1. Amara N & Romain R, 2000. Mesure de l'efficacité technique : Revue de la littérature. Département d'économie agroalimentaire et des sciences de la consommation, Université Laval, Québec.
2. Ambapour S, 2001. Estimation des frontières de production et mesures de l’efficacité technique. Document de Travail 02, BAMSI, Brazzaville.
3. Audibert M, 1997. La cohésion sociale est-elle un facteur de l’efficience technique des exploitations agricoles en économie de subsistance? Revue d’Economie du Développement 3: 69-90.
4. Banker RD, Charnes A & Cooper WW, 1984. Some model for estimating technical and scale innefficiencies in data envelopment analysis, Management Science 30: 1078-1092.
5. Blancard S & Boussemart JP, 2006. Productivité agricole et rattrapage technologique : le cas des exploitations de grandes cultures du Nord-Pas-de-Calais, Cahiers d’Economie et Sociologie Rurales 80: 6-28.
6. Bravo-Ureta BE & Evenson RE, 1994. Efficiency in agricultural production: the case of peasant farmers in easten Paraguay, Agricultural Economics 10: 27-37.
7. Bravo-Ureta BE & Pinheiro AE, 1997. Technical, Economic and Allocative Efficiency in Peasant Farming: Evidence from the Dominican Republic, Cahiers d'économie et sociologie rurale 44, 29-59.
8. Charnes A & Cooper WW, 1962. Programming with Linear Fractional Functionals, Naval Research Logistics Quarterly 9: 181-185.
9. Charnes A, Cooper WW & Rhodes E, 1978. Measuring the efficiency of decision making units, European Journal of Operations Research 2: 429-444.
10. Chirwa WE, 1998. Stochastic production functions and technical efficiency of farmers in southern Malawi”, Working Paper, n° WC/04/98.
11. Coelli T & Fleming E, 2004. Diversification economies and specialisation efficiencies in a

mixed food and coffee smallholder farming system in Papua New Guinea, Agricultural Economics 31: 229-239.
12. Coelli T, 1996. A guide to DEAP version 2.1: a data envelopment analysis (Computer) program. Centre for efficiency and productivity analysis working paper, University of New England, Australia.
13. Datt G & Ravallion M, 1998. Farm productivity and rural poverty in India, Journal of Development Studies 34(4): 62–85.
14. Debreu G, 1957. The coefficient of resource utilization, Econometrica 19: 273-292.
15. Farrell MJ, 1957. Measurement of production efficiency, Journal of Royal Statistical Society 120: 253-281.
16. Fontan C, 2008. Production et efficacité technique des riziculteurs de Guinée : une estimation paramétrique stochastique, Economie Rurale 308: 19-35.
17. Gastellu JM, 1980. Mais, où sont donc ces unités économiques que nos amis cherchent tant en Afrique ? cah, ORSTOM, sér. Sci. Hum 17: 3-11.
18. Gurgand M, 1993. Les effets de l'éducation sur la production agricole : application à la Côte d'Ivoire, Revue d'Economie du Développement 4: 37-54.
19. Gurgand M, 1997. L'éducation est-elle rentable dans l'agriculture ? Une approche duale appliquée à la Côte-d'Ivoire, Cahier d'Economie et Sociologie Rurales 42: 114-144.
20. Helfand SM & Levine ES, 2004. Farm size and the determinants of productive Efficiency in the determinants of productive efficiency in the Brazilian Center-West, Agricultural Economics 31: 241-249.
21. Kalirajan K & Shand RT, 1986. Estimating location specific and farm specific technical efficiency: an analysis of Malaysian agriculture, Journal of Economic Development 11: 147-160.
22. Kalirajan K, 1981. An econometric Analysis of yield variability in paddy production, Canadian Journal of Agricultural Economics 29: 283-294.
23. Kalirajan K, 1984. Farm-specific technical efficiencies and development policies. Journal of Economic Studies 11: 3-13.
24. Kleene P, 2007. Qu'est-ce que l'exploitation agricole familiale en Afrique ? In Brossier J, Devèze JC & Kleene P, Exploitation agricoles familiales en Afrique de l'Ouest et du Centre, Quae.
25. Koopmans TC, 1951. An analysis of production as an efficient combination of activities, in TC, Koopmans (Ed) Activity analysis of production and allocation, Cowles Commission for Research in Economics, Monograph n°13, Wiley, New York, 33-97.
26. Latruffe L, 2005. Les exploitations Polonaises à la veille de l'élargissement : efficacité des facteurs de production et structure financière, Cahier d'économie et sociologie rurale 74 : 6-25.
27. MINADER (Ministère de l'Agriculture et du Développement Rural), 2005. Document de stratégie de développement du secteur rural. Document de travail, Cameroun.
28. Nkamleu GB, 2004. L'échec de la croissance de la productivité agricole en Afrique Francophone, Economie Rurale 279: 55-67.
29. Nuama E, 2006. Mesure de l'efficacité technique des agricultrices de cultures vivrières en Côte-d'Ivoire, Economie rurale 296: 39-53.
30. Nyemeck JB, Tonyè JN, Wandji N, Nyambi G & Akoa M, 2004. Factors affecting the technical efficiency among smallholder farmers in a slash and burn agriculture zone of Cameroon, Food Policy 24: 531-545.
31. Oliveira BF, 1997. Les agricultures familiales au Portugal, Option Méditerranéennes 12: 187-200.
32. Thiam A, Bravo-Ureta BE & Rivas TE, 2001. Technical efficiency in developing country agriculture a meta-analysis. Agricultural Economics 25: 235-243.

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