The Economic Research Guardian – Vol. 7(1)2017
Semi-annual Online Journal, www.ecrg.ro
ISSN: 2247-8531, ISSN-L: 2247-8531
Econ Res Guard 7(1): 2-23

AN ANALYSIS OF WELFARE EFFECT OF MARKET PARTICIPATION OF SMALLHOLDER FARM HOUSEHOLDS IN GUINEA

Alhassane Camara
International Food Policy Research Institute, West and Central Africa Office, Dakar, Senegal
E-mail: papalhas@gmail.com, a.camara@cgiar.org

Abstract
Limited empirical studies on agricultural commercialization effect at household level are not conclusive because of the difficulty in setting up a convincing empirical causal relationship. In addition, their outcomes are heavily specific to location and policy environment, which makes almost any generalization impossible. This paper contributes to this literature by investigating the potential welfare impact of smallholder farmers' participation in the cereals market in Guinea. Fitting an Endogenous Switching Model to the national household survey data, results show that the participation significantly increases household income. For poor and land-constrained smallholders, commercialization seems to be profitable. In the context of increasing population, rapid urbanization and high incidence of poverty, this research adds evidence that supports an agricultural transformation in Guinea through market-orientation as the cornerstone of rural development and poverty alleviation.

Keywords: Market participation, Agricultural commercialization, Endogenous Switching Model, Welfare

JEL classification: I30, Q12

1. Introduction

Over the last 15 years, Africa's western region has witnessed one of the highest population annual growth rates (2.72%), and this trend is expected to continue until 2050, followed by rapid urbanization. In Guinea, one of poorest countries within the region,[1] the same trend was recorded as the population has increased 2.33% over the period 2000-2015. According to United Nations (2014)

[1] According to the National Institute for statistics (INS, 2012), the poverty rate shifted from 53% in 2007 to 55,2% in 2012.

projections, the country's population will continue to grow at almost the same pace during the next 15 years, and about 45% of Guinean people will live in urban areas by 2030.

These figures show major opportunities for local farmers because of the rising domestic and regional demand for food and a change in the food system (Pingali, 2006; Reardon et al., 2013; Tschirley et al., 2013). These opportunities may be beneficial for the country if it achieves a successful transition in the agriculture sector, by which the system switches from a semi-subsistence-oriented one to one that is more productive and commercialized (market-oriented) (Barett, 2008; Timmer, 1988).

However, although the Ebola Virus Disease (EVD) crisis[2] intensified costs of access to the market, agriculture in Guinea[3] suffers from longstanding constraints that (i) make local farmers unable to keep up with the rising food demand of its population, and (ii) constrain the country to rely on imports[4] to meet the gap. Overall, the agricultural sector in Guinea is mainly characterized by the rainfall system and low mechanization. In addition, the local input market (such as fertilizers, improved seed, etc.) is tight, and even if farmers get access to it, they incur high transportation costs due to the remoteness of production zones and the lack of adequate infrastructures (USAID, 2006, 2015).[5]

In the cereals subsector, the driver of Guinea's agriculture,[6] these constraints are particularly binding. The subsector value-chain analysis by USAID (2015) shows that 84% of rice farmers and 98% of maize farmers report using no fertilizers, and 69% of rice producers do not apply crop protection inputs, while only 0.2% of them use improved seeds. Despite these constraints, it is worth noting that there still is a considerable share of domestic cereals demand that is covered by local producers. This share shifted from 0.87 during 2008-2010 to 0.93 over the period 2011-2013 (FAOSTAT, 2017).

Theoretically, agricultural commercialization is an agricultural transformation process in which farmers shift progressively from consumption-oriented subsistence production towards market- and

[2] This started in 2013 and ended in 2015. In the short term, the Ebola crisis in Guinea led to 12,000 jobs lost in the transport sector and over 40,000 jobs lost in the potato sector (USAID, 2015). WHO (December, 2015), recorded 2,536 deaths in Guinea and 3,804 have been declared: http://apps.who.int/ebola/current-situation/ebola-situation-report-23-december-2015

[3] The sector includes only crops, culture and hunting; it employs 80% of the labor force and represents 12% of the GDP. Source: annual statistics reported by the National Office for Statistics in 2013 and 2014: http://www.stat-guinee.org/index.php/documents-publies/annuaire-stat.

[4] According to FAOSTAT (2017), over the period 2011-2013, cereals imports increased at a rate of 7.04% per year. Cereals include millet, rice, maize and sorghum. This group represents the main item in Guinea's consumption basket (specifically, rice is the most consumed food item in Guinea). Shepherd (2007) and Beyene (2014) depict the same figures for sub-Saharan Africa.

[5] In general, inputs are imported from foreign countries by private firms (individual or societies), projects or government, in collaboration with development partners. Most of input sales outlets are based in Conakry (the capital city of the country) and other urban areas away from production zones where the quality of roads is bad. Another explanation of higher costs of inputs in Guinea is linked to fluctuation and continuing depreciation of the local currency (USAID, 2006).

[6] Agricultural production is broadly driven by cereals -- a production of 3.3 million tons over 2.8 million hectares. The cereals sub-sector is mainly led by rice and maize production that represent, respectively, 58.1% and 20.4% of cereals production, and 57.8% and 18.9% of land devoted to cereals crops. Annual statistics reported by National Office for Statistics in 2013 and 2014: http://www.stat-guinee.org/index.php/documents-publies/annuaire-stat

profit-oriented production systems (Pingali and Rosegrant, 1995). It is important to remember that (i) agricultural commercialization is not restricted to specialization in cash crop production because it is also about the production of marketable surplus of staple food crop like cereals,[7] and that (ii) most analyses on agricultural commercialization make little difference between market-orientation (profit maximizing) and market participation (utility maximizing), which are the two components of agriculture commercialization. Therefore, we assume in this paper, that agriculture commercialization and market participation are equivalent: market participation is described as the process of offering crop for sale and using purchased inputs.[8]

For a long time, literature on agricultural commercialization of smallholder farmers has mostly focused on identifying constraints that prevent farmers from being market-oriented, *i.e.,* to sell output or buy input (Goetz, 1992; Winter-Nelson and Temu, 2005; Azam et al., 2012; Martey et al., 2012; Mmbando et al., 2015).[9] As a consequence, there are limited empirical studies that determine the commercialization extent and effects (von Braun and Kennedy, 1994; Jaleta et al., 2009).[10]
In theory, von Braun and Kennedy (1994) consider that agricultural commercialization can produce positive and negative effects at household, societal and global levels. At the household level, positive effects of commercialization of agricultural commodities result in the rising of household income, which improves household health and nutrition status. Arguments that support such a position follow two directions: (i) commercialization is a means to enhance household income, therefore, it helps purchase a diversified mix of goods and services such as health care, better housing, etc., or increase the current market basket and (ii) by increasing the food consumption budget, commercialization is supposed to increase the food intake of household members.

Empirical studies in African countries[11] have highlighted the positive effect of market participation on household welfare. Recently, Hichaambwa et al. (2015) assess the welfare impact of smallholders' participation in the horticulture market in Zambia. Their findings show that commercialization significantly increases household income, particularly for poor and land-constrained farmers. In Kenya, Muriithi and Matz (2015) show that participation in the domestic market enhances both household income and ownership of assets.

However, agricultural commercialization has also faced criticism for exposing farmers to more complex market risk, jeopardizing household food security, and degrading land through intensification processes (von Braun and Kennedy, 1994; Pingali and Rosegrant, 1995). Despite the existence of a potential negative effect of agricultural commercialization, it is worth noting that many of the theoretically possible problems of commercialization for household-level food security and nutrition derive from 'if statements' such as: if food crops are replaced by nonfood cash crops in the production program…, and, if markets are not well integrated…, and, if landless farm laborers are

[7] Due to the existence of multiple failures in the food market in developing countries, farmers are constrained to diversify their production into staple food and cash crops (Pingali et al., 2005).
[8] See Muricho (2015) for more discussions.
[9] This is not an exhaustive list.
[10] Cited by Zhou et al. (2013)
[11] In the African context, IFPRI evidenced that commercialization led to increased productivity, increased household income through market participation and employment and improved consumption diversity, among other things. These studies include Kenya, Gambia, Rwanda (von Braun and Kennedy, 1994).

replaced by less labor-intensive production… then the resulting employment and price effects may have adverse impacts on the food security of this population group (Braun and Kennedy, 1994). Furthermore, Zhou et al. (2013) make a synthesis by saying that the positive results generally outweigh the criticisms and strengthen the need for commercialization.

Finally, it is important to bear in mind that in most empirical study cases, effects of market participation are inherent or specific to location and policy environment, and therefore generalization based on the detailed case studies may lead to excessive extrapolation from special circumstances (von Braun and Kennedy, 1994; Strasberg et al., 1999).[12] On the other hand, assessment of the impact of smallholder commercialization on household welfare is not conclusive, owing to the difficulty to set up a convincing causal relationship (Maertens et al., 2012; Muriithi and Matz, 2015).
Considering the above observations and the location of previous studies (mostly in eastern and southern Africa, Asia), this study contributes to the empirical literature by investigating the potential welfare impact of agricultural commercialization at the household level in the Western Africa context. To our knowledge, there are very limited studies specific to that region; the small existing literature specific to the region dates from the end of 1980s.[13]
Specifically, we analyze the impact of participation of smallholders in the cereals market on household income in Guinea, assuming that income is one of the most important variables correlated with welfare outcomes such as household consumption expenditure, health and nutrition status. The Guinea case is remarkably interesting, as the country is one of the most endowed in term of natural resources[14] within the region while it still faces one of the highest incidences of poverty (55.2% at the national level, 64.7% in rural areas[15]). Therefore, this research is also useful for policy makers who seek evidenced-based strategies[16] that promote rural development and poverty alleviation.

The paper is organized as followed: Section 2 presents the conceptual framework, Section 3 describes the methodology and data, Section 4 exposes results, and the conclusion is presented in Section 5.

[12] Specifically, characteristics of location (environment) determine the nature and source of commercialization in agriculture (output side, input side, or both), and the level of off-farming activities. These factors, in turn, may affect the extent of commercialization and its impact at the household level.
[13] IFPRI investigated the impact and drivers of agriculture commercialization in several developing countries including Gambia and Sierra Leone (two countries of west Africa region) in the end of 1980s (von Braun and Kennedy ., 1994).
[14] The country benefits from better climatic conditions and soil quality in agriculture; it also has many mining resources like bauxite, gold, diamond, etc.
[15] INS (2012)
[16] Since the beginning of the 2000s, the country has experienced national plans called DSRP-I, DSRP-II, DSRP-III. The main objective of these strategies is to alleviate poverty and promote rural development. http://www.srp-guinee.org/

The Economic Research Guardian – Vol. 7(1)2017
Semi-annual Online Journal, www.ecrg.ro
ISSN: 2247-8531, ISSN-L: 2247-8531
Econ Res Guard 7(1): 2-23

2. Conceptual framework

Our conceptual framework follows that of Khonje et al. (2015) in studying the impact of technology adoption on households' welfare. Here, we argue that the decision to participate in the market occurs when the associated utility (U_p) is higher than that of non-participation (U_{np}). Specifically, let's assume D* to be the difference between these utilities, and the participation results when D*>0. However, D* is not an observable variable, as utilities cannot be measured directly. Following Alene et al. (2008), utilities in market participation analysis can be a function of net returns and households' characteristics. Therefore, D* can be expressed as a function of utility components:

$$D_i^* = \alpha Z_i + \varepsilon_i, \text{ with } D_i = \begin{cases} 1, & if\ D_i^* > 0 \\ 0, & otherwise \end{cases}, \quad (1)$$

with D a dummy variable (0 or 1) for participation in the market. Z is a vector that includes households and farm-level characteristics (including net return); ε is the error term, and α is the vector of parameters to be estimated.

As commercialization is supposed to increase household welfare through increasing farm income, we assume that household total income is a linear function of market participation (dummy variable) and other explanatory variables:

$$Y_h = \beta X_h + \gamma D_h + \eta \quad (2)$$

with Y standing for total income. X is a vector of explanatory variables, η is the error term, and β, γ are parameters to be estimated. The accurate impact of participation on the outcome variable is measured by γ if farmers are randomly assigned to sellers and non-sellers groups. However, participation is not a random process among farmers (sellers and non-sellers) as the farmer can make a decision (on his/herself) to participate in the market, given a set of characteristics and market information. This may result in systematic difference between sellers and non-sellers (D and X are not orthogonal) (Khonje et al., 2015; Hichaambwa et al., 2015)

In the literature, the propensity score matching (PSM) proposed by Maertens and Swinnen (2009) may be used to deal with structural differences. However, in a PSM framework, unobservable factors (motivation and individual skills, for example) that can influence simultaneously farmers' production and marketing decisions and household income, are ignored and the returns (coefficients) to characteristics are supposed to be the same for participants and non-participants (Khonje et al., 2015; Hichaambwa et al., 2015). Following Khonje et al. (2015), we assume that the Endogenous Switching model proposed by Maddala (1983) is suited to deal with systematic differences issues between groups when assessing impact of participation.

The Economic Research Guardian – Vol. 7(1)2017
Semi-annual Online Journal, www.ecrg.ro
ISSN: 2247-8531, ISSN-L: 2247-8531
Econ Res Guard 7(1): 2-23

3. Methodology and data

3.1. Endogenous switching model

In the endogenous switching model, market participation is analyzed as regime shifters. Following Lokshin and Sajaia (2004), the model can be presented as:

$$\textbf{Regime 1}: \; y_{1i} = \beta_1 X_{1i} + \eta_{1i} \quad \text{if} \quad D_i = 1 \qquad (3)$$

$$\textbf{Regime 2}: \; y_{2i} = \beta_2 X_{2i} + \eta_{2i} \quad \text{if} \quad D_i = 0 \qquad (4)$$

$$D_i = \begin{cases} 1, & if \; \alpha Z_i + \varepsilon_i > 0 \\ 0, & if \; \alpha Z_i + \varepsilon_i \leq 0 \end{cases}, \qquad (5)$$

X_{1i}, X_{2i} are vectors of exogenous variables, β_1, β_2 are vectors of parameters, and η_{1i}, η_{2i}, ε_i are random disturbance terms having normal distribution with mean vector zero and covariance matrix:

$$\Omega = \begin{bmatrix} \sigma_\varepsilon^2 & \sigma_{1\varepsilon} & \sigma_{2\varepsilon} \\ \sigma_{1\varepsilon} & \sigma_1^2 & . \\ \sigma_{2\varepsilon} & . & \sigma_2^2 \end{bmatrix}, \qquad (6)$$

with σ_ε^2 standing for the variance of error term in the selection equation, and σ_1^2 et σ_2^2 are variances of the error terms in the continuous equations. $\sigma_{1\varepsilon}$ is the covariance of ε_i and η_{1i} ; $\sigma_{2\varepsilon}$ is covariance of ε_i and η_{2i} . The covariance between η_{1i} and η_{2i} is not determined, as y_{1i} and y_{2i} are not observed simultaneously. We can assume that σ_ε^2 is equal to 1 (α is estimable up to the scalar factor). According to Khonje et al. (2015), it is important to have instrument variables included in Z in addition to other explanatory variables in the participation equation, in order for the Endogenous Switching model to be identified. Following previous studies,[17] we run both probit and regression models in order to identify variables that affect participation but do not influence income. As a result, age, system of crop culture[18] (rainfed or irrigated system) and share of hired agricultural labor are variables that influence market participation without affecting income. However, we assume that age may be a key determinant of income. Therefore, we use share of hired agricultural labor and system of crop culture (dummy variable) as instrument variables.

Under given assumptions on distribution of disturbances terms (joint normality of the error terms in the binary and continuous equations), the model presented above can be estimated using the Full-

[17] Hichaambwa et al. (2015) and Khonje et al. (2015).
[18] This variable does not significantly influence income at 5% but it does at 10%.

Information Maximum Likelihood (FIML). This approach can fit binary and continuous parts of the model to yield consistent standard errors (Lokshin and Sajaia, 2004).
Estimation of the model's parameters allows us to compute following conditional expectations:

$$E(y_{1i} \mid D_i = 1, x_{1i}) = x_{1i}\beta_1 + \sigma_1\rho_1 f(\alpha Z_i) / F(\alpha Z_i) \quad (7)$$

$$E(y_{1i} \mid D_i = 0, x_{1i}) = x_{1i}\beta_1 - \sigma_1\rho_1 f(\alpha Z_i) / \{1 - F(\alpha Z_i)\} \quad (8)$$

$$E(y_{2i} \mid D_i = 1, x_{2i}) = x_{2i}\beta_2 + \sigma_2\rho_2 f(\alpha Z_i) / F(\alpha Z_i) \quad (9)$$

$$E(y_{2i} \mid D_i = 0, x_{2i}) = x_{2i}\beta_2 - \sigma_2\rho_2 f(\alpha Z_i) / \{1 - F(\alpha Z_i)\} \quad (10)$$

with ρ_1, ρ_2 being correlation coefficients between ε_i and η_{1i} ; and between ε_i and h_{2i} .Following Khonje et al. (2015), the computed conditional expectations can be used to estimate the average treatment effect of the treated (ATT), *i.e.*, the average difference in outcomes of participants (sellers) with and without market participation. This can result in the following:

$$ATT = E(y_{1i}|D_i = 1, x_{1i}) - E(y_{1i}|D_i = 0, x_{1i}) \quad (11)$$

More precisely, the ATT corresponds to the difference between equations (7) and (8).

3.2. Data

We use national household survey data (ELEP), conducted by the "Institut National de la Statistique de la République de Guinee (INS, 2012)". Data were collected February through April 2012. The sample frame is the list of enumeration areas and households identified in the general population and housing census in 2010. A two-stage stratified random sampling was used:

- At the first stage, enumeration areas (ER) are chosen (336 in urban areas and 180 in rural areas).
- At the second stage, 12 households are chosen in each urban area and 20 households are chosen in each rural area.

Thus, the initial sample size is about 7632 households (4032 in urban areas, 3600 in rural areas), but finally 7571 households are surveyed, as some households did not participate into the survey.

The Economic Research Guardian – Vol. 7(1)2017
Semi-annual Online Journal, www.ecrg.ro
ISSN: 2247-8531, ISSN-L: 2247-8531
Econ Res Guard 7(1): 2-23

Table 1 - Structure of the sample (number of households)

Households surveyed	
rural	3575
urban	3996
Ensemble	
7571	
Regions	
Boke	880
Conakry	1183
Faranah	831
Kankan	792
Kindia	991
Labe	896
Mamou	736
Nzerekore	1263
Ensemble	7571

Source: INS (2012)

Fields covered by data include education, wealth, consumption expenditure, housing, employment, income, prices, etc.
We focus our analysis on rural areas where most of the poor live, with agricultural activities as main source of income. Further, we restrict our sample to cereals producers,[19] who represent the majority of farmers in rural zones.[20]

Household income in the dataset includes farm income (sales), off-farm income including livestock income, incomes from formal and informal activities, wages and public transfers.
Descriptive statistics of the sample study are presented in Table 2. The table reveals that Guinean smallholder households are generally poor, with the mean total household income of 5,383,530 in local currency ($808.22) per year. Roughly 49% of farmers are sellers in cereals market, with the mean sales of 947,940 in local currency ($142.32) per year.[21] The mean total cultivated land is 2.76 hectares, while that of total agricultural land endowment is 3.80 hectares. There is a low use of fertilizers and other chemicals in the Guinea agriculture sector. Indeed, only 18% of farmers use fertilizers, with an average cost of 86,880 in local currency ($13.04) per ha; more than half of farmers hire labor at least at one step in farming activities, with an average labor cost of 238,790 in local currency ($35.85) per ha. Furthermore, the average volume of external labor is 34% of total labor

[19] They also may produce other crops such as roots and tubers, vegetables, etc.
[20] In the dataset, after dealing with missing data and outliers, we get 3,694 agricultural households out of 4,277, initial farm households. Over 3,694 farm households, 77% live in rural areas. Roughly 96% of rural farm households are cereals producers; which correspond to sample of 2, 752 rural cereal producers.
[21] The mean is calculated over the entire sample (including both sellers and non-sellers).

used by farmers.[22] The mean cereals production is 1.25 tons, cultivated over a mean surface of 2.13 ha allocated to food production.[23]

The table also shows that the rainfed system is the common system used in farming activities: only 8% of farmers employ an irrigation system. 48% belong to farmers' organizations and 16% own income from livestock. The average cereals price is 6,450 in local currency (approximatively $0.97) per kg, which is slightly above the average price of agricultural commodities,[24] revealing that market-orientation in the cereals sector may be motivated by the high relative price of cereals.
The demographic composition of households shows that men head most households and that the mean age of household heads is 50 years old. This figure may result from the rural exodus issue by younger people who leave villages for cities to have better life conditions. Generally, the average size of a household is approximatively 7. Dependents (children less than 5 years old and adults older than 59 years old) represent more than ¼ of the members, while only 5% of household members are involved in off-farm activities.

Finally, Nzerekore (23%), Kindia (20%) are regions that have 43% of the country's farmers, and the spatial distribution of farmers in others regions (except Faranah) seems to be uniform.

[22] In the dataset, the volume of labor is measured in terms of number of persons working in the fields.
[23] For the remainder, food production includes tubers and roots, in addition to cereals.
[24] The average price of agricultural commodities is a mean of prices of all agricultural commodities.

Table 2 - Descriptive statistics of the study sample

Variable	Description	Mean	SD
Rvetot	Total income ('000 LCU)	5383.53	16217.38
hage	Age of household head	50	14
hgender	1 if household head is a male, 0 otherwise	0.90	0.30
Dpem	Share of off-farming workers in the household	0.05	0.12
Depenfant5	Share of dependents in the household	0.28	0.18
Surfo	Surface owned by the household (ha)	3.80	7.87
Livestock	Owned unit of livestock (number)	2.61	7.46
totSup	Total cultivated land	2.76	3.78
OP	1 if household belongs to farm organization, 0 otherwise	0.48	0.50
off_incom	1 if household has livestock income, 0 otherwise	0.16	0.37
phl	1 if household hires agricultural labor	0.61	0.49
pphl	Share of hired labor in total agricultural labor	0.34	0.34
SystCul	1 if household uses rainfed system, 0 otherwise	0.92	0.27
ratioPrix	Ratio of cereals price over the average of agricultural prices	1.20	0.07
psel	1 if household sells cereals in a market, 0 otherwise	0.49	0.50
prdKg_c	Cereals production (tons)	1.25	2.62
hhsize	Household size	6.46	2.72
Rprix_kg	Average cereals price ('000 LCU)	6.45	0.33
Incsale	Cereals sales ('000 LCU)	947.94	14371.06
Labcost	Labor costs per ha (000 LC)	238.79	268.80
Inpuse	1 if household uses fertilizers, 0 otherwise	0.18	0.39
cersup	Surface land allocated to food production	2.13	3.08
Inpcost	Inputs costs per ha (000 LC)	86.88	218.98
Boke	1 if household resides in Boke, 0 otherwise	0.12	0.33
Faranah	1 if household resides in Faranah, 0 otherwise	0.09	0.28
Kankan	1 if household resides in Kankan, 0 otherwise	0.12	0.32
Kindia	1 if household resides in Kindia, 0 otherwise	0.20	0.40
Labe	1 if household resides in Labe, 0 otherwise	0.12	0.33
Mamou	1 if household resides in Mamou, 0 otherwise	0.11	0.32
Nzerekore	1 if household resides inNzerekore, 0 otherwise	0.23	0.42
Observations		2752	

Source: Author

Descriptive statistics by cereals market participation are presented in Table 3. To see whether participants and non-participants are distinct based on vector of characteristics, we perform multiple-sample tests for mean vectors with heterogenous variances across groups (see Krishnamoorthy and

Yu, 2004). The test shows a Fisher statistic of 9.04 with a p-value of 0.000. As a result, we reject the null hypothesis and conclude that the means of variables are likely different between the two groups. Furthermore, the table shows that average total income is higher among market participants than among non-participants. Is this partly due to participation in the cereals market? Answering this question is the main purpose of this study.

Market-oriented farmers (participants) seem to be relatively more endowed in terms of production factors and regime shifters. Indeed, within the group of sellers, household heads own more land surface and cultivate more surface, hire more agricultural labor in farming activities, use relatively fewer rainfed systems, and pay relatively less input costs per ha. Those household heads participating in market are relatively younger, and more than half of them belong to farmers' organizations.
Spatial distribution of cereals sellers is not uniform in Guinea. This may be due to differences in agro-ecological characteristics of regions and/or regional differences in transactions costs when participating. Nzerekore (28%), Kindia (27%) and Faranah (12%) are regions that together, comprise a concentration 67% of the country's cereals sellers.

The Economic Research Guardian – Vol. 7(1)2017
Semi-annual Online Journal, www.ecrg.ro
ISSN: 2247-8531, ISSN-L: 2247-8531
Econ Res Guard 7(1): 2-23

Table 3 - Descriptive statistics by cereals market participation (mean, by group)

Variable	Description	Non-Participants (a)	Participants (b)	Difference (b-a)
Rvetot	Total income ('000 LCU)	4959.30	5823.93	864.63
hage	Age of household head	52	49	-2.95
hgender	1 if household head is a male, 0 othervwise	0.89	0.92	0.03
Dpem	Share of off-farming workers in the household	0.07	0.04	-0.03
Depenfant5	Share of dependants in the household	0.28	0.28	0.00
Surfo	Surface owned by the household (ha)	3.61	4.00	0.39
Livestock	owned unit of livestock (number)	3.17	2.02	-1.16
totSup	Total cultivated land	2.71	2.82	0.11
OP	1 if household belongs to farm organization, 0 otherwise	0.42	0.56	0.14
off_incom	1 if household has livestock income, 0 otherwise	0.16	0.17	0.01
phl	1 if household hires agricultural labor	0.53	0.69	0.16
pphl	Share of hired labor in total agricultural labor	0.28	0.41	0.12
SystCul	1 if household uses rainfed system, 0 otherwise	0.95	0.89	-0.06
ratioPrix	Ratio of cereals price over the average of agricultural prices	1.20	1.20	0.00
prdKg_c	Cereals production (tons)	1.13	1.38	0.25
hhsize	Household size	6.40	6.52	0.12
Rprix_kg	Average cereal price ('000 LCU)	6.47	6.43	-0.04
Labcost	Labor costs per ha (000 LC)	228.67	246.87	18.20
Inpuse	1 if household use fertilizers, 0 otherwise	0.19	0.18	0.00
cersup	Surface land allocated to food production	2.10	2.17	0.07
Inpcost	Inputs costs per ha (000 LC)	87.92	85.80	-2.13
Boke	1 if household resides in Boke, 0 otherwise	0.13	0.11	-0.02
Faranah	1 if household resides in Faranah, 0 otherwise	0.05	0.12	0.07
Kankan	1 if household resides in Kankan, 0 otherwise	0.17	0.06	-0.11
Kindia	1 if household resides in Kindia, 0 otherwise	0.14	0.27	0.13
Labe	1 if household resides in Labe, 0 otherwise	0.17	0.08	-0.09
Mamou	1 if household resides in Mamou, 0 otherwise	0.15	0.07	-0.07
Nzerekore	1 if household resides in Nzerekore, 0 otherwise	0.19	0.28	0.09
Multiple sample tests for mean vectors				
	F(26,1560.1)	9.04		
	Prob > F	0.00		
Observations		1404	1348	

4. Results

Following Lokshin and Sajaia (2004), the switching model presented above is estimated using the Full-Information Maximum Likelihood (FIML). This approach fits binary and continuous parts of the model with consistent standard errors. The estimated model is globally significant with robust standard errors.[25]

4.1. Determinants of market participation

As expected, agricultural factor endowment at farm household level is a key determinant of market orientation. Indeed, estimation results (see Table 4) indicate that the higher the owned land surface, the higher the likelihood it is to get a farm to be market-oriented. Results also reveal that hiring agricultural labor and using an irrigation system in farming activities influence the market orientation positively. In fact, hired labor may help to solve the issue of the lack of family labor supply during a peak season (Kaur, 2012) or during production stages requiring intensive labor, such as weeding or plant preparation (Parker et al., 2009). Therefore, it helps to keep or increase the farm productivity. On the other hand, the use of an irrigation system can shift up farm productivity through ensuring water management and thus increase the production of marketable surplus.

Adherence to farm organizations also influences market participation positively. Arguments to support that view follow two directions: (i) generally, farmer organizations focus on building marketing and negotiation skills of members, and (ii) they can also play the intermediation role to help members in meeting potential buyers.

The socio-demographic characteristics of households also affect the participation decision. Results indicate that the higher the share of off-farm workers in the household, the lower the probability to get the farm to be market-oriented. This may be due to the fact that off-farming activities can concentrate more productive resources (family labor, liquidity, etc.) to the detriment of farming activities. This results in a decrease of farm productivity. Younger household heads are more likely to be involved in commercialization.

[25] Wald chi2(16) = 287.651; Prob > chi2 = 0.0000; Log (pseudo likelihood) = -1984123.1

The Economic Research Guardian – Vol. 7(1)2017
Semi-annual Online Journal, www.ecrg.ro
ISSN: 2247-8531, ISSN-L: 2247-8531
Econ Res Guard 7(1): 2-23

Table 4 - Determinants of the participation

Variable	Description	Coeff.	
hage	Age of household head	-0.01	***
		(0.00)	
hgender	1 if household head is a male, 0 otherwise	0.06	
		(0.09)	
Dpem	Share of off-farm workers in the household	-0.94	***
		(0.23)	
Depenfant5	Share of dependents in the household	-0.02	
		(0.15)	
lnspos	Log of surface owned by the household	0.16	***
		(0.04)	
Livestock	owned unit of livestock (number)	-0.01	***
		(0.00)	
off_incom	1 if household has livestock income, 0 otherwise	0.12	
		(0.07)	
OP	1 if household belongs to a farm organization, 0 otherwise	0.13	**
		(0.04)	
lratioPrix	log of ratio of cereal price over the average of agricultural prices	-0.48	
		(0.34)	
phl	1 if household hires agricultural labor	0.06	
		(0.10)	
SystCul	1 if household uses rainfed system, 0 otherwise	-0.23	**
		(0.11)	
pphl	Share of hired labor in total agricultural labor	0.33	**
		(0.14)	
Boke	1 if household resides in Boke, 0 otherwise	0.17	
		(0.11)	
Faranah	1 if household resides in Faranah, 0 otherwise	0.879	***
		(0.12)	
Kankan	1 if household resides in Kankan, 0 otherwise	-0.31	**
		(0.12)	
Nzerekore	1 if household resides in Nzerekore, 0 otherwise	0.39	***
		(0.11)	
Kindia	1 if household resides in Kindia, 0 otherwise	0.67	***
		(0.10)	
Labe	1 if household resides in Labe, 0 otherwise	0.03	
		(0.11)	
Cons	Constant	0.35	
		0.36	
		(0.44)	

Note: *** 1%, ** 5%, * 10%
Source: Authors

4.2. Determinants of household income

Agricultural-factor endowment remains the main determinant of Guinean household income in rural areas. Indeed, results (see Table 5) show that the size of agricultural land surface, the level of livestock and the hiring of agricultural labor, influence household income positively. The plausible explanation is that these factors can ensure higher farm productivity, allowing more marketable surplus and then more farm income, conditional on market participation.

The socio-demographic composition of households also exerts influence over income. The higher the share of off-farm workers in the household, the higher the income. Age of household head is a determinant for income of the non-participants group, while it is not a determinant for income of the participants group.

Membership in farmer organizations may be a means to increase household income. Indeed, the reason is that farm organizations can help members to adopt new technology in farming activities, which can increase the production of marketable surplus. As mentioned above, it also plays an important role in helping members to meet potential buyers, or developing marketing skills.
The relative price of cereals affects household income positively. This may be due to the higher relative weight of farm income in rural areas where most farmers produce cereals.

The Economic Research Guardian – Vol. 7(1)2017
Semi-annual Online Journal, www.ecrg.ro
ISSN: 2247-8531, ISSN-L: 2247-8531
Econ Res Guard 7(1): 2-23

Table 5 - Determinants of income

Variable	Description	Non-participants		Participants	
hage	Age of household head	0.01	**	0.00	
		(0.00)		*(0.00)*	
hgender	1 if household head is a male, 0 otherwise	-0.03		0.32	***
		(0.01)		*(0.09)*	
Dpem	Share of off-farm workers in the household	2.37	***	2.54	***
		(0.30)		*(0.29)*	
Depenfant5	Share of dependents in the household	-0.12		0.11	
		(0.18)		*(0.16)*	
lnspos	Log of surface owned by the household	0.15	**	0.20	***
		(0.07)		*(0.05)*	
Livestock	owned unit of livestock (number)	0.02	***	0.02	***
		(0.01)		*(0.01)*	
off_incom	1 if household has livestock income, 0 otherwise	0.39	***	0.18	**
		(0.10)		*(0.08)*	
OP	1 if household belongs to a farm organization, 0 otherwise	0.35	***	0.29	***
		(0.09)		*(0.07)*	
lratioPrix	log of ratio of cereals price over the average of agricultural prices	1.37	*	0.55	
		(0.73)		*(0.34)*	
phl	1 if household hires agricultural labor	0.21	**	0.40	***
		(0.08)		*(0.07)*	
Boke	1 if household resides in Boke, 0 otherwise	0.62	***	0.41	***
		(0.13)		*(0.13)*	
Faranah	1 if household resides in Faranah, 0 otherwise	-0.15		-0.12	
		(0.21)		*(0.13)*	
Kankan	1 if household resides in Kankan, 0 otherwise	-0.05		0.29	
		(0.17)		*(0.20)*	
Nzerekore	1 if household resides in Nzerekore, 0 otherwise	-0.05		0.06	
		(0.15)		*(0.13)*	
Kindia	1 if household resides in Kindia, 0 otherwise	-0.09		0.09	
		(0.17)		*(0.12)*	
Labe	1 if household resides in Labe, 0 otherwise	-0.44	***	-0.52	***
		(0.12)		*(0.16)*	
_cons	Constant	11.71	***	13.04	***
		(0.92)		*(0.45)*	

Source: Author

The Economic Research Guardian – Vol. 7(1)2017
Semi-annual Online Journal, www.ecrg.ro
ISSN: 2247-8531, ISSN-L: 2247-8531
Econ Res Guard 7(1): 2-23

4.3. Potential welfare impact of market participation

In Table 6, we present an estimation of the average difference in total income of participants, with and without market participation. This result is based on conditional expectations that result from the estimation of the switching model presented above.
Results show that the agricultural commercialization significantly increases the income and welfare of smallholder farmers and it also may contribute to poverty reduction. Specifically, our estimations show participation in the cereals market may increase the income of households by 74%. For poor and extremely poor households among cereals sellers, these increases are 74.2% and 41%, respectively. Furthermore, agricultural commercialization may be more profitable for farmers constrained by land. Results show that when this group participates in the market, the potential associated increase in income is about 104%.

Overall, these results are in line with those in the literature that supports positive income effects of agriculture commercialization at the household level in the developing countries (Hichaambwa et al., 2015; Muriithi and Matz, 2015; Zhou et al., 2013; Jaleta et al., 2009; von Braun and Kennedy, 1994). Indeed, for those authors, agricultural commercialization is a means to improve households' livelihoods through raising income and thereby a means to reducing the incidence of poverty. Results presented above confirm these conclusions in the Guinean case, as we show that cereals market participation can help to generate more income for poor and land-constrained households, and thus can contribute to poverty alleviation. Although it is not possible to generalize positive effects of agriculture commercialization from specific case studies, these results add a new evidence in favor of proponents of market-orientation by smallholder farmer households.

Table 6 - Estimation of potential welfare impact of market participation

	Observed coefficient	Bootstrap Std. Err.	P>z	[95% Conf. Interval]	
All cereals sellers					
ATT	0.74	0.01	0.00	0.72	0.076
Poor[1] cereals sellers:					
ATT	0.72	0.02	0.00	0.69	0.75
Extreme poor[2] cereals sellers					
ATT	0.41	0.02	0.00	0.38	0.44
Land poor[3] cereals sellers					
ATT	1.04	0.09	0.00	0.861	1.21

Source: Author

1.In 2012, the poverty line in rural areas was estimated to be 2,601,084 in local currency ($390.48). We use this for the subsample of poor among cereals sellers. Source : INS(2012)
2. In 2012, the food poverty line in rural areas was estimated at 1,485,948 in local currency ($223.08). We use this as a proxy of extreme poverty line to get the subsample of extreme poor among cereals sellers. Source : INS(2012)
3. In 2008, World Bank (2008) indicated that land-poor farmers own less than 0.2 ha per capita in Kenya; we use that threshold to characterize the land-poor farmers in Guinea.

5. Conclusion

From 2007 to 2012, the poverty rate in Guinea shifted from 53% to 55.2%, while in the rural areas where most of population lives, it goes from 63% to 64.7%.[26] Agriculture is mostly practiced in rural areas and represents about 80% of the labor force and 12% of GDP; the cereals subsector (mainly rice and maize crops) is the main driver of agriculture performance.
In this context, combined with increasing population and a rapid urbanization, the agricultural transformation through switching from semi-subsistence to more a productive and market-oriented system, is a necessary pathway in Guinea in order to (i) keep up with the increasing demand of the population and reduce dependency on imports and (ii) promote better life conditions in rural areas by raising income as well as households' welfare.

Literature on smallholder farmers' commercialization has paid more attention to identifying constraints that prevent smallholders from being market-oriented, *i.e.*, to sell output or buy input (Goetz, 1992; Winter-Nelson and Temu, 2005; Azam et al. 2012; Martey et al., 2012; Mmbando et al., 2015).[27] This results in limited empirical studies on determining the commercialization extent and effects (von Braun et al., 1994; Jaleta et al., 2009). Furthermore, the existing empirical studies on the welfare impact of agricultural commercialization are not conclusive, owing to the difficulty in setting up a convincing empirical causal relationship (Maertens et al., 2012; Muriithi and Matz, 2015), and the results of these studies are specific to location and policy environment (von Braun et al., 1994; Strasberg et al., 1999). Therefore, it is almost impossible to attempt any generalization of agricultural commercialization effects from specific case studies.
The purpose of this study is to contribute to the existing limited literature on the welfare effect of agricultural commercialization in western Africa's region, by investigating the effect of the cereals market participation by Guinean smallholder farmer households.

We fit the Endogenous Switching Model with Guinean national household survey data (INS-ELEP, 2012). Results indicate that the agricultural factor endowment (owned land size, labor, livestock) and the socio-demographic composition of households (age of household heads, number of off-farm workers in household) are key determinants of both smallholder farmers' market participation and households' income. Furthermore, adherence to farmer organizations and the use of irrigation systems exert positive influence on market participation, and adherence to farmer organizations is also an income determinant.

The assessment of the commercialization potential effect reveals, in general, that it has a positive and significant impact on household income, as well as that it can contribute significantly to poverty and extreme poverty alleviation. In addition, results also show that commercialization can be more profitable for farmers who are constrained by land.
Taken together, these results support the view that agricultural commercialization can be a cornerstone of rural development and poverty alleviation in Guinea (Pender and Alemu, 2007).

[26] INS (2012).
[27] This is not an exhaustive list.

Therefore, for decision-makers who seek evidence-based strategies that can get millions of Guineans out of poverty, the development of access to the market by smallholder farmer households is crucial. Such a development involves (i) the improvement of transportation infrastructures (roads, etc.) and the market information system, which can help to reduce transaction costs at households level and (ii) the enhancement of farm productivity by facilitating access to production shifters such as fertilizers, improved seed, promoting irrigation systems and establishing an institutional framework that can help ensure better management of agricultural land.

References

Alene AD, Manyong VM, Omanya G, Mignouna HD, Bokanga M, Odhiambo G (2008). Smallholder market participation under transactions costs: Maize supply and fertilizer demand in Kenya. *Food Policy*. 33(4): 318-328.

Azam MS, Imai K, Gaiha R (2012). Agricultural Supply Response and Smallholders Market Participation: the Case of Cambodia. Discussion Paper (DP2012-09). Research Institute for Economics and Business administration, Kobe University, Japan

Barrett C (2008). Smallholder Market Participation: Concepts and Evidence from Eastern and Southern Africa. *Food Policy*. 33 (4): 299-317.

Beyene A (2014). Small farms under stress play a huge role for Africa: smallholder agriculture and emerging global challenges.Uppsala, Sweden: The Nordic Africa Institute. Retrieved from http://www.diva-portal.org/smash/get/diva2:748754/FULLTEXT01.Pdf.

FAO (Food and Agriculture Organization). (2017). FAOStat database on agricultural trade. Rome. http://faostat.fao.org/site/535/

Gebremedhin B, Jaleta M (2010). Commercialization of Smallholders: Does Market Orientation Translate into Market Participation? Improving Productivity and Market Success (IPMS) of Ethiopian Farmers Project Working Paper 22. Nairobi, Kenya, ILRI

Goetz SJ (1992). A Selectivity Model of Household Food Marketing Behavior in Sub-Saharan Africa. *American Journal of Agricultural Economics*. 74(2): 444-452.

Hichaambwa M, Chamberlin J, Sitko N (2015). Determinants and welfare effects of smallholder participation in horticultural markets in Zambia. *African Journal of Agricultural and Resource Economics*. 10(4): 279-296.

Institut national de la statistique; Ministère du plan; République de Guinée (2012). Enquête Légère pour l'Evaluation de la Pauvreté (INS-ELEP-2012), Rapport final.

Jaleta M, Gebremedhin B, Hoekstra D (2009). Smallholder commercialization: processes, determinants and impact. International Livestock Research Institute, Discussion paper (18).

Kaur S (2014). Nominal Wage Rigidity in Village Labor Markets. Center for Development Economics and Policy, Columbia University, Working Paper: CDEP-CGEG WP No. 14.

Khonje M, Manda J, Alene AD, Kassie M (2015). Analysis of Adoption and Impacts of Improved Maize Varieties in Eastern Zambia. *World Development.* 66: 695-706.

Krishnamoorthy K, Yu J 2004. Modified Nel and Van der Merwe test for the multivariate Behrens–Fisher problem. *Statistics & probability letters.* 66(2): 161-169.

Lokshin M, Sajaia Z (2004). Maximum likelihood estimation of endogenous switching regression models. *The Stata Journal.* 4(3): 282-289.

Maddala GS (1983). Limited-dependent and qualitative variables in econometrics. Cambridge: Cambridge University.

Maertens M, Swinnen J (2009). Trade, standards, and poverty: evidence from Senegal. *World Dev.* 37 (1): 161-178.

Maertens M, Minten B, Swinnen J (2012). Modern Food supply chains and development: evidence from horticulture export sectors in Sub-Saharan Africa. *Develop. Policy Rev.* 30 (4): 473-497.

Martey E, Al-Hassan RM, Kuwornu JKM (2012). Commercialization of smallholder agriculture in Ghana: A Tobit regression analysis. *African Journal of Agricultural Research.* 7(14): 2131-2141.

Mmbando FE, Edilegnaw ZW, Lloyd JSB (2015). Determinants of smallholder farmers' participation in maize and pigeonpea markets in Tanzania. *Agrekon.* 54 (1): 96-119.

Muricho GS (2015). Determinants of agricultural commercialization and its impacts on welfare among smallholder farmers in Kenya. Thesis submitted in partial Fulfillment of the requirement for the Degree of Doctor of philosophy in Economics at the school of Economics, University of Nairobi.

Muriithi BW, Matz JA (2015). Welfare effects of vegetable commercialization: Evidence from smallholder producers in Kenya. *Food Policy.* 50: 80-91.

Parker DC, Kathryn HJ, Maction KK (2009). A qualitative study of the impact of HIV/AIDS on agricultural households in southeastern Uganda. *International Journal of Environmental Research and Public Health.* 6(8): 2113-2138.

Pender J, Alemu D (2007). Determinants of smallholder commercialization of food crops: Theory and evidence from Ethiopia. IFPRI Discussion Papers, No. 75. International Food Policy Research Institute (IFPRI), Washington DC, USA.

Pingali P, Khwaja Y, Meijer M. (2005). Commercializing Small Farm: Reducing Transaction Costs. ESA Working Paper No. 05-08. Agricultural and Development Economics Division, Food and Agriculture Organization of the United Nations.

Pingali P (2006). Westernization of Asian diets and the transformation of food systems: Implications for research and policy. *Food Policy*. 32(3): 281-298.

Pingali PL, Rosegrant MW (1995). Agricultural Commercialization and diversification: processes and policies. *Food Policy*. 20(3): 171-185.

Shepherd AW (2007). Approaches to linking producers to markets (Agricultural Management, Marketing and Finance Occasional Paper (13). Rome, Italy: Food and Agriculture Organization of the United Nations.

Strasberg PJ, Jayne TS, Yamano T, Nyoro J, Karanja D, Strauss J (1999). Effects of Agricultural Commercialization on Food Crop Input use and productivity in Kenya. Michigan State University International Development Working Papers No. 71. Michigan, USA.

Timmer CP (1988). The Agricultural Transformation. In H. Chenery and T.N. Srinivasan, (Eds.), Handbook of Development Economics. Vol 1. Amsterdam: North-Holland, 275-331.

Tschirley D, Reardon T, Minten B, Haggblade S, Timmer CP, Liverpool-Taise S (2013). The Emerging 'Quiet Revolution' in African Agrifood Systems . Addis Ababa: Designing for the 21st Century; Nov. 25/26 2013, African Union Conf. Center, Addis Ababa, Ethiopia.

United Nations, Department of Economic and Social Affairs, Population Division (2014). World Urbanization Prospects: The 2014 Revision, custom data acquired via website.

United States Agency for International Development (2006). Situation et perspectives des intrants agricoles en Guinée : Phase 1.

United States Agency for International Development (2015). "Guinea Value Chain Analysis." Leveraging Economic opportunities, Report #22.

Von Braun J, Kennedy E (eds.) (1994). Agricultural commercialization, economic development and nutrition, IFPRI, Johns Hopkins University Press, Baltimore Maryland.

Winter-Nelson A, Temu A (2005). Impacts of prices and transactions costs on input usage in a liberalizing economy: Evidence from Tanzanian coffee growers. *Agricultural Economics*. 33(3): 243-253.

World Bank. (2008). World Development Report: Agriculture for Development. Washington, DC: The World Bank.

Zhou S, Minde IJ, Mtigwe B (2013). Smallholder agricultural commercialization for income growth and poverty alleviation in southern Africa: A review. *African Journal of Agricultural Research*. 8(22): 2599-2608.