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# Factors influencing farmers' participation in groups and the impact of collective marketing on household food security and income in Sahel, Niger

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## Abstract

Organizing farmers into groups has become an important tool through which government and other rural development institutions seek to solve rural poverty and household food insecurity. Using data collected from 1783 households in rural Niger, we assessed the factors influencing farmers' participation to group membership and the impact of collective marketing on household food security and income. The results revealed only few farmers participate to group formation (2.91%) and collective sale (4.6%). The results show that the household size, the quantity of livestock, the farm size, contact with extension services, the possession of irrigated land and access to market influence positively and significantly the farmer's decision to join a group. Meanwhile we employed matching techniques to assess the effect of collective marketing on household food security and income. The results indicate negative impact of collective sale on both household food security and income.

These findings are contrary to most of literatures reporting the benefits of collective sale. The study recommends restructuring of farmer's organizations, the design strategies to improve their functioning through the capacity building of their members in management and awareness in community development to benefit from joining a group or association.

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**Keywords:** Group formation, collective sale, households, Probit, propensity score matching, Niger

**JEL:** Q1, Q130, Q180

## 1.Introduction

A large portion of world's poor still depend on agriculture for their livelihoods. Lack of market access is one of major constraints which impede small scale farmers to earn maximum profit from what they produce to promote rural development. Most of these farmers live in remote areas where infrastructures are not well developed, with high transaction costs that reduce their market participation (Fischer and Qaim, 2012; Barrett, 2008)). According to Aroua et al (2016) the lack of price information and technologies, lack of connection to establish market actors and lack of access to both consumption and production credits are major threats for smallholders to sell their products at high price.

Several studies suggest that farmers can increase their competitive advantage through collective marketing in an increasingly commercialized and integrated world market. Collective marketing can help to improve bargaining power in negotiations with producers, intermediaries and buyers. Farmers through their organizations, cooperatives and other forms can improve production, marketing and livelihoods in general (Fischer and Qaim, 2012; Francesconi and Heerink, 2011). In Cameroon, Kamdem (2016) found that cocoa famers who participated to collective sales received higher price than those who sold individually their products. Indeed, farmer's organization give the potential to their members to enhance market opportunities to have access to better markets and reduce marketing costs (Shiferaw, et al .2006; Kamdem ,2016). Farmer's groups or association have a primary role in facilitating the integration of their members to well-functioning markets where they can sell at high price. We have examples of success for farmers 'organizations in Africa, such as the ginger producer organization of Nowefor of Cameroon, groundnut farmer association of Louga (Fapal) in Senegal, the experience of Mogtedo cooperative of rice producers in Burkina Faso and Cucumber seed market organized by Afebide women in Cameroon. These experiences of farmers 'organizations show that producers can be actors in a context of liberalization, even without a major action plan, support and working capital. Abdul-Rahaman and Abdulai (2019) found that collective marketing participation has a positive and statistically significant impact on farm net revenues of rice farmers in Ghana. The cooperatives managed to secure a higher price for the output marketed by their members at least 7% higher than that obtained by nonmembers in rural Ethiopia (Bernard et al 2008). Fischer and Qaim,(2012) employed propensity score matching method and found positive income effects for active group members in Kenya. Similarly, Ahmed and Mesfin (2017) measured the impact of agricultural cooperative membership and found that joining agricultural cooperatives has a positive impact on the welfare of smallholder farmers in eastern Ethiopia.

Farmers 'group formation and collective marketing are increasingly taking the attention of governments, nongovernment organizations (NGOs) and researchers as a tool to overcome the problems facing farmers and development in low-income countries where agriculture remains the employer of the larger population.

The purpose of this study is to assess the factors influencing farmers 'participation to group membership and the impact of collective marketing on household food security and income. First, we looked at the farmers 'organizations and collective actions in West Africa and in Niger in

particular. Second, we assessed the factors influencing group formation. Finally, we evaluated the impact of collective marketing on household food security and income.

## **2. Farmer organization and collective actions in Niger**

Farmers organizations can play an important role in agricultural product value chains in Africa. Through farmer's organization, farmers have access to farm inputs and necessary information or advice on production systems, where to sell the products at higher price, etc. in West Africa, there are several farmers organization working to strengthening farmers power to acting together. For example, since its creation in June 2000, ROPPA (is an initiative specific to peasant and farmer organizations in West Africa) has positioned itself as a tool for the defense and promotion of family farms which constitute the main agro-silvo-pastoral production system in West Africa. Its operation is based, among other things, on peasant solidarity which gives a place to everyone by associating all categories of Peasant Organizations and Agricultural Producers in each country and which supports peasant organizations and agricultural producers and their members in the recognition of their identity, their rights and roles. Their vision is regional and market integration as a means of developing West African agriculture.

In Niger, the cooperative movement has concerned all socio –economic aspects of rural life. Thus, after independence, Nigerien Credit and Cooperation Union (UNCC) was created whose mission was to ensure the supervision of peasants and the goal of achieving real self-management. Its mandate was to develop within the rural population the spirit of mutuality, cooperation and support to rural communities to facilitate and coordinate their actions. The UNCC was then changed to UNC (National Union of Cooperatives) in 1984. The UNC took training as important tool for development, thus between 1984 and 1996 ,1880 co-operators and 50 cooperative managers were trained. The marketing of agricultural products amounted to approximately 360,700 t in 1984 and 1995 (Bontianti,2008). Then Oher farmers' organization emerged. Few of them are reported here.

The Federation of Unions of Farmer Groups of Niger (FUGPN-Mooriben) is one of the very first farmers' organizations to be freely formed by the farmers themselves, outside the cooperative system controlled by the government and the social structures of Development. The strategies of Mooriben are to strengthen institutional and management capacities; to promote the political services offered to members; to concentrate support on productive and income-generating activities; to improve the economic and decision-making power of women and to develop partnership.

Farmer's Platform of Niger is a framework for the reflection, dialogue and action of farmer organizations in Niger. PFPN includes 25 farming organizations, federations, unions, cooperatives and groups and is represented through a national coordination office as well as many regional, departmental and local coordination offices.

The “Fédération des coopératives maraîchères du Niger” (FCMN-Niya) is an umbrella of farmer organization created in 1996 on the initiative of 11 regional cooperatives. The mission of FCMN-

Niya is to contribute to the improvement of the living conditions of members by building production capacities and guaranteeing a remunerative price, organize and facilitate the production and sale of members' products both nationally and internationally.

the Federation of Unions of Rice Producers Cooperatives (FUCOPRI), an organization created for a mechanism to link members with financial institutions to supply of inputs and group marketing in partnership with the government.

National network of chambers of agriculture of Niger helps rural producers to promote and carry out their projects through giving preference to their organizations and facilitating mobilization of technical support and financial need for agricultural production (plant production, breeding, fish farming, etc.) for better food security, improved income and sustainable production.

All these above structures are initiatives created for the farmers' welfare and rural development in general. In fact, more than 80% of Nigerien population depends on agriculture which generates more than 40% of GDP. Therefore, it is important that Niger government gives more priorities to the sector.

Farmers' organizations are fragile and weak in Niger. When group is created, a potential weakness is linked to its actual mode of operation, and therefore to the difficulties of social, internal and external management of the group. While support and training actions frequently focus on technical and economic issues, it is on organizational aspects that failures are noted, the effects of which only appear gradually, leading to a slow, but sometimes irreversible, decline of the group.

### 3. Data and Methodology

#### 3.1 Household survey

The data come from a farm household survey in Niger conducted during 2019 by the International Institute of Tropical agriculture in collaboration with National Agricultural Research Institute of Niger. The data was collected for the baseline survey for the purpose of implementing the CSAT-Niger project. The survey covered four regions of Niger (Tillaberi, Dosso, Maradi and Zinder) where the project CSAT is being implemented. The project 'Climate Smart Agricultural Technologies (CSAT)' aims to introduce climate-smart technologies and agricultural innovations in the Sahel, Sudan and arid savannah regions of Niger, which will improve livelihoods in rural environment, food and nutritional security

A multistage sampling technique was employed to select villages from each region and households from each village. In the first stage, four regions (Dosso, Tillaberi, Maradi and Zinder) were purposively selected for the project implementation based on the intensity of cereal and legumes production, agro-ecology, accessibility and security. In the second stage, eight communes were purposively selected from each of the selected project region. In the third stage, 5 intervention and 5 non-intervention villages were selected; taking into consideration accessibility, security,

production of the project main target crops and the villagers' willingness to participate in the survey. The final stage is the random selection of the households through the farmers listing and communal consultation forum. Households were selected from intervention and non-intervention villages. A total of 2240 farm-households were interviewed. The sample size was distributed evenly among all the selected regions, thus the sample size per region for the intervention and non-intervention villages was 280 households each. Seven households were sampled from each of the selected 80 villages (intervention and non-intervention) per commune. The sampled households were selected through the farmers listing and stakeholder consultation at the community level.

A well-structured questionnaire was used as main instrument for the data collection.

The data was collected using a pre-tested structured questionnaire by trained and experienced enumerators who have good knowledge of the farming systems and speak the local language.

The questionnaire was designed in French but administered to the respondents in local languages (Hausa and Zarma). All the enumerators and supervisors were trained for an average of 2 days to ensure that are well instructed and familiar with the questionnaire prior to the field survey. The questionnaire contained different modules like Household demographic and socio-economics characteristics, Climate change adaptation, perception and signs, Food insecurity and hunger assessment scale, Adoption of improved practices, Food and non-food expenditure, etc. Finally, the information collected from 1783 households was valid and used for the analysis.

### 3.2 Analyzing factors influencing farmers' adhesion to group membership

Farmers' membership to an organization or group is associated with several benefits. Through farmer organization, farmers have access to farmer inputs and necessary information or advice on production systems, where to sell the products at higher price, etc. Farmers' organization can link members to buyers and help to form contractual arrangements to ensure the smallholders sell their produce at reasonable price to get more profit compare to individual sale.

The individual decision to become member can be modeled in a random utility framework. Thus, group membership can be modeled as a binary choice decision, assuming utility maximization subject to household resource constraints (Manski, 1975, Flischer and Qaim ,2012).

Thus, the farmer will choose to be a member if the utility of being a member of a group ( $U_{1i}$ ) is greater than the utility of not being a member of a group ( $U_{0i}$ ).

Let  $Y^*$  be a latent variable which is a function of utility ( $U_{1i}$ ) expressing the utility that a farmer who is a member of a group and  $U_{0i}$  being that for not being a member.

Then:

$$Y^* = U_{1i} - U_{0i} > 0 \quad (1)$$

and the probability of choosing to be a member of a group is:

$$P_i = P(Y = 1) = P(U_{1i} > U_{0i}), \quad (2)$$

and this can be estimated from:

$$P_i = P(\delta_1 F(Z_{1i}, W_{1i}) + \varepsilon_{1i} > (\delta_0) F(Z_{0i}, W_{0i}) + \varepsilon_{0i}) \quad (3)$$

$$= P(\varepsilon_{1i} - \varepsilon_{0i}) > F(Z_{1i}, W_{1i}) (\delta_1 - \delta_0) \quad (4)$$

$$= P(\mu_1) > -F(Z_i, W_i, \beta) \quad (5)$$

$$= F_i(\beta X_i) \text{ or } Y_i(\beta X_i) \quad (6)$$

Where :  $P(\mu_1)$  = probability function

$\mu_1 = \varepsilon_{1i} - \varepsilon_{0i}$  is a random disturbance term

$\beta = \delta_1 - \delta_0$  is a vector of coefficients that can be interpreted as the net influence of the vector of explanatory variables influencing a farmer to be a member or not.

$F_i(\beta X_i)$  = cumulative distribution function for  $\mu_i$  evaluated at  $\beta X_i$ .

Then we can estimate logit or probit model depending on the assumed distribution that the random term follows, several qualitative choice models such linear probability, logit or probit models, could be estimated (Greene, 2007; Gbetibouo, 2009, Molua, 2012, Funk et al, 2020; Mahmood et al, 2020).

The Probit model is as follows:

$$P(y = 1) = aZ_{ji} + bW_{ji} + \varepsilon_{ji} \quad (7)$$

where a and b are the unknown parameters to be estimated, P is the probability of membership, Z and W are explanatory variables and  $\varepsilon_{ji}$  is a random error.

The marginal effects of the explanatory variables can be computed as:

$$ME_{ijk} = \frac{\partial Pr(y_i=j)}{\partial x_{ik}} = \frac{\partial F_j(x_i, \theta)}{\partial x_{ik}} \quad (8)$$



Coefficients are interpreted as marginal effects relating to utility differences. If a positive coefficient in equation means explanatory variable J has positive effect on utility difference. If the utility difference increases, then a household head is more likely to choose alternative J relative to the benchmark choice. Negative coefficient makes a household head less likely to choose option J.

### 3.3 The effect of collective marketing on household food security and farm income

Our objective here is to assess the effect of farmers' participation to collective sale on household food security (HFS) and household Income (HI). To analyze the impact of collective marketing on household food security and income, we applied matching techniques to estimate the average treatment effect (ATE) of participants at collective marketing. We followed the standard approach of using a propensity score matching (PSM) (Rosenbaum and Rubin, 1983). The Propensity Score Matching (PSM) is used in a program evaluation setting where comparison is made between the outcomes of participants with and without treatment; and has become a popular method to measure the impact of economic policy interventions ( Bernard et al ,2008; Fischer and Qaim, 2012; Kamdem,2016; Verhofstad and Miet,2014 ; Abadi et al ,2018, Wossen et al ,2017; Ahmed and Mesfin,2017; Ofori et al.,2019).The technique consists of building a group of statistical comparison founded on the probability of participating in the program.  $P(X) = \Pr(d = 1/X)$  (Rosenbaum and Rubin,1983).In this study ,we assume that participation to collective marketing is the program. This method assumes that differences between both populations, treated and untreated, come from their individual characteristics and the treatment. If we ignore the differences according to the characteristics, then there remains only the effect of the treatment. The participation in the program (participating in collective marketing) is represented by a random variable.

For each individual  $i$ , we have

$$T_i = 1 : \text{if individual participates in collective marketing}$$

$$T_i = 0 : \text{if individual participates in individual marketing}$$

The effectiveness of the participation in collective marketing is measured by the result variable,  $Y_i$ , known as a latent variable:

$$Y_{Ti} \quad \text{if individual participate in collective marketing} \quad T = 1$$

$T_{NTi}$  if individual participate in individual marketing  $T = 0$

These two variables correspond to the potential results of the participation in collective marketing and individual marketing. For collective marketing participants,  $Y_{Ti}$  is observed while  $T_{NTi}$  is unknown. In this case, the variable  $T_{NTi}$  corresponds to the result, which would have been carried out if participate to individual marketing (counterfactual). For an individual marketing participant, one instead observes  $T_{NTi}$ , while  $Y_{Ti}$  is unknown. The result variable observed for each individual can thus result from the potential variables and the treatment variable (collective marketing) by the following relation

$$Y_i = T_i Y_n + (1 - T_i) Y_{NTi}$$

where only the couple  $(Y_i, T_i)$  is observed for each individual. Thus, the causal effect of treatment is defined for each individual by:

$$\Delta_i = Y_{1i} - Y_{0i}$$

This effect is the difference between what would be the individual's situation if he or she is collective seller and what it would be if he or she is individual seller. Since the estimation of treatment effect for each individual makes the analysis difficult, it is the estimation of two average treatment effects which seems logical:

The average treatment effect of the global population

$$\Delta^{ATE} = E(Y_T - Y_{NT})$$

The average treatment effect for collective sellers

$$\Delta^{ATT} = E(Y_T - Y_{NT} \mid T = 1)$$

These two effects are equal if the result variables are independent of access variable to the marketing methods. In this case, we have:

$$\Delta^{ATE} = \Delta^{ATT} = E(Y \setminus T = 1) - E(Y \setminus T = 0)$$

However, in reality, the decision of treatment determines also the result variable. Indeed, in this case, the estimator formed below by the difference of the average of the result variable is affected by selection bias:

$$E(Y|T = 1) - E(Y|T = 0) = E(Y_T | T = 1) - E(Y_{NT}|T = 0) = E(Y_T | T = 1) - E(Y_{NT}|T = 1) + E(Y_{NT}|T = 1) - E(Y_{NT}|T = 0) = \Delta^{ATT} + \beta^{ATT}$$

where  $\beta^{ATT}$  is the selection bias. This bias is related to the fact that the average situation of collective seller would not have been the same as that of individual seller. Thus, since the counterfactual average of collective seller  $E(Y_{NT}|T = 1)$  is not observed, one must choose a substitute to estimate the average treatment effect of being collective seller (Heckman,1990).

Then, we consider the selection bias as a sample selection problem and apply PSM to estimate the average treatment effect (ATE) of collective sellers on food security and farm income. We estimate the propensity score (PS) as the probability of being a collective marketing participant, using the vector X as conditioning factors (Verhofstad and Maertens, 2014).

$$PS = P(D = 1|X)$$

$$ATE = E[Y(1) - Y(0)] = E[Y(1)] - E[Y(0)]$$

The estimation was made from logit models of participation in collective marketing by controlling all the variables X which affect, meanwhile, the participation and outcome variables.

According to Asfaw et al ,2012), despite the fact that PSM tries to compare the difference between the outcome variables of participants and non-participants with similar inherent characteristics, it cannot correct unobservable bias. Because PSM only controls for observed variables (to the extent that they are perfectly measured).

For robustness purposes, we also estimated the ATT using both inverse-probability weights and nearest neighbor matching techniques.

**Table 1.** Description of statistics the model variables

Variable	Description	Mean	Std. Dev.
<b>Household and farm characteristics</b>			
Gender	Dummy = 1 if household head is male	0.82	0.37
Age	Age of the household head	49.19	13.83
Household size	Total size of the household	10.99	6.32
Farm size	Total size of landholding in hectares	5.14	5.89
literacy	Dummy =1 if head of household can read and write	0.73	1.26

Income	Total household farm income	22071.77	81265.99
Migration	Dummy=1 if head of household migrant	0.48	0.49
irrigated farm	Dummy = 1 if household possess irrigated farm	0.15	0.36
Farm equipment	Total quantity of equipment used in farm production	0.60	1.69
Farming experience	Number of years of farming	27.00	14.63
Total crop production	Total quantity of crops harvested (Kg)	582.99	1465.03
TLU	The number of tropical livestock units (TLU) possessed by the household	1.30	4.13
<b>Institutional factors</b>			
Access to Credit	Dummy = 1 if the household has access to credit	0.33	0.47
Membership	Dummy=1 if household head is member of an organization or an association	0.03	0.17
Contact with extension agent	Dummy = 1 if household contact with public extension services	0.39	0.48
Training	Dummy = 1 if one (at least) household member attended training	0.15	0.35
Access to Market	Distance to the nearest main road (in kilometers)	12.20	15.35
<b>Others</b>			
Drought	Dummy= 1 if experienced drought in last five years	0.29	0.45
Food security	Dummy = 1 if household experience food insecurity	0.46	0.49

## 4. Empirical results and Discussion

### 4.1 Factors influencing participation to group membership

The objective of this section is to assess the factors affecting a household to participate to group membership. The mean differences in characteristics between group participants and non-group participants are reported on Table 2. Though the mean differences of most of the variables are not statistically significant, we can state that the farmers who participate to group membership are much wealthier than non-participants. They tend to have more access to credit and market than non-participants. Particularly, participants seem to receive more training and link to extension services. However, non-participants tend to have more experience in farming and less household size and farm size.

**Table 2:** Mean differences in characteristics between group participants and non-group participants

Variables	All	Participants (N=52)	Non-Participants(1731)	Difference
Gender	0.82(0.001)	0.79(0.007)	0.82(0.001)	- 0.029(0.007)***
Age	49.19(0.04)	48.90(0.25)	49.20(0.05)	-0.29(0.27)
Household Size	10.99(0.02)	12.18(0.14)	10.95(0.02)	1.23(0.12)
Farm size	5.14(0.02)	7.02(0.22)	5.08(0.02)	1.14(0.12)
Literacy	0.73(0.004)	0.71(0.02)	0.73(0.004)	-0.02(0.02)
Access to credit	0.33(0.001)	0.44(0.009)	0.33(0.01)	0.11(0.009)
Farming experience	27.00(0.05)	25.85(0.26)	27.04(0.05)	-1.18(0.29)***
Extension contact	0.39(0.001)	0.52(0.009)	0.39(0.001)	0.13(0.009)
Attended training	0.15(0.001)	0.32(0.009)	0.14(0.001)	0.17(0.007)
Farm income	22071.77(293.47)	26957.05(2149)	21904.81(294.46)	5052.23(1641.64)
Access to market	8.28(0.074)	8.31(0.40)	8.28(0.075)	0.02(0.37)
TLU	1.30(0.014)	1.6(0.08)	1.29(0.015)	0.32(0.08)

Farm equipment	0.60(0'006)	0.83(0.03)	0.59(0'006)	0.24(0.03)
Total crop production	582.99(14.09)	591.54( 70.58)	582.62(14.37)	8.92(70.92)

Note: Standard errors in parentheses.

\*\*\* p < 0.01.

The results of probit estimation of group participation are presented in Table 3. The farm size variable is positive and significant at 1% level suggesting that farmers with larger farm sizes are more likely willing to participate to group membership, a finding that is consistent with the results reported by Bernard and Spielman (2009), Ito et al. (2012), Verhofstad and Maertens (2014) and Ma and Abdulai(2016).

The household size influences positively and significant the probability of household member to participate in group formation. The larger the household size the more likely a member is to join a group. The coefficient of owning irrigated farm is positive and significant indicating that household with irrigated land are more likely to join group membership. In fact, in Niger, especially in farmers settled along the river Niger where government and international partners have developed large scale irrigation schemes for the production rice. The producers are organized in cooperatives in different areas and the elected members manage the production process in each locality with the supervision of government institution called ONAHA under the Niger Ministry of Agriculture. FUCOPRI (The Federation of Unions of Rice Producers ‘Cooperatives) created a mechanism to link producers to local financial institutions for the supply of farm inputs and for collective marketing with the assistance of government institutions. The results revealed also that the contact to extension services has a positive and significant effect on the probability of membership, suggesting that farmers with high extension contact are more likely to participate to group formation, a finding which is consistent the results reported by Bayan (2020). The coefficient of total number of livestock unit exhibits a positive and significant effect. This implies that households with larger number of animals are more likely to adhere membership. Meanwhile access to market affect positively and significantly the probability of households to participate in group formation, finding that is consistent with the results reported by Verhofstad and Maertens (2014). Farmers located very near to main road have better access to markets and can participate to collective marketing and involve in better price negotiation with traders.

**Table 3:** Probit model of factors influencing participation to group membership

Group membership	Coef.	Std. Err.	Marginal effects
Gender	0.099	0.221	0.005
Age	0.003	0.006	0.0002
Household size	<b>0.021**</b>	0.009	<b>0.001**</b>
Farm size	<b>0.053***</b>	0.009	<b>0.003***</b>
Access to Credit literacy	0.175	0.136	0.015
Farming experience	0.0005	0.045	0.0002
Owning irrigated Farm	-0.010	0.006	-0.0007
Extension contact	<b>0.795***</b>	0.121	<b>0.061***</b>
Attended training	<b>0.702***</b>	0.124	<b>0.055***</b>
Income	0.201	0.135	0.014
	-1.00	7.42	-6.56

TLU	<b>0.022**</b>	0.010	<b>0.001**</b>
Access to market	<b>0.025***</b>	0.005	<b>0.002***</b>
Migration	-0.117	0.157	-0.006
Farm equipment	0.036	0.039	0.002
Drought	0.152	0.126	0.013
constant	<b>-3.387***</b>	0.389	
LR chi2(16)	214.28		
Prob > chi2	0.0000		
Log likelihood	-363.34081		
Pseudo R2	0.2277		
Observations	2,522		

Note: \*\*\* p < 0.01, \*\* p < 0.05.

#### 4.2 The effect of collective marketing on household food security and Income

The particular interest in this study is to evaluate the impact of collective marketing on household food security and income. The mean differences in characteristics between collective marketing participants and individual marketing participants are reported on Table 4. The individual sellers are wealthier and have much access to market than collective sellers. They relatively produce more quantity of crops compare to collective sellers. The individual and collective sellers appear to be significantly similar in terms of their number of animals, farm size, extension contact, access to credit and market.

**Table 4:** Mean differences in characteristics between collective marketing and individual marketing participants

Variables	All	Collective sellers(N=82)	Individual sellers (1701)	Difference
Gender	0.89(0.002)	0.76(0.01)	0.90(0.002)	-0.14(0.01) ***
Age	49.14(0.13)	53.03(0.57)	48.96(0.13)	4.06(0.62)
Household Size	11.57(0.05)	11.99(0.21)	11.55(0.05)	0.43(0.27)
Farm size	5.65(0.05)	4.56(0.20)	5.70(0.06)	-1.14(0.28) ***
Literacy	0.92(0.01)	0.16(0.03)	0.96(0.01)	-0.79(0.06) ***
Access to credit	0.32(0.004)	0.09(0.01)	0.33(0.04)	-0.24(0.02) ***
Farming experience	28.49(0.13)	32.49(0.69)	28.29(0.14)	4.20(0.66)
Extension contact	0.44(0.004)	0.20(0.01)	0.45(0.004)	-0.24(0.02) ***
Attended training	0.15(0.03)	0.12(0.01)	0.15(0.03)	-0.03(0.01) **
Farm income	26355.27(774.15)	15237.31(1908.51)	26893.27(805.97)	-11655.96(3688.006) ***
Access to market	8.28(0.07)	7.11(0.21)	8.34(0.07)	-1.23(0.35) ***
TLU	1.52(0.04)	0.95(0.11)	1.55(0.04)	-0.60(0.19) ***
Farm equipment	0.51(0.01)	0.67(0.06)	0.50(0.01)	0.16(0.05)
Total crop production	582.99(14.09)	442.86(47.18)	589.77(14.59)	-146.90(67.14) **
Quantity sold	359.56(10.11)	315.24(38.91)	361.70(10.43)	-46.46(48.21)
Transportation cost	322.86(6.99)	329.55(14.47)	322.53(7.29)	7.02(33.32)

Note: Standard errors in parentheses. , \*\*\* p < 0.01. \*\* p < 0.05.

To assess the effects of collective marketing on household food security, we employed propensity score matching method(logit). The results are presented in Table 5. The outcome variable is Household food security (HFS), indicating household has experienced food insecurity during the last five years. We estimated ATE and ATT using both Propensity score matching and inverse-probability weights matching. The Average treatment effect (ATE) measures the average impact of an innovation on the entire population. It also represents the expected impact on a person selected randomly from the population. The results show that the coefficients of ATE were positive but not significant.

The Average treatment effect on the treated (ATT) determines the average impact of an innovation in the subpopulation of the treated. It also represents the expected impact on a person selected randomly from the subpopulation of the treated. Both The coefficients of ATT are positive and significant at 1% and estimated at 0.09 and 0.02 respectively for propensity score and inverse-probability weights matchings. This indicates that collective marketing collective marketing has positive and significant effect on household food insecurity. These results show households which participate to collective marketing are more likely food insecure compare to households that participate to individual marketing.

**Table 5: Matching estimation of the impact of collective marketing on household Food security**

Matching algorithm	Outcome variable	ATE	ATT
Propensity score	HFS	0.097(0.09)	0.25(0.07)***
inverse-probability weights	HFS	0.02(0.04)	0.17(0.02)***

*Note: Standard Errors in parentheses.*

\*\*\* Significant at 1% level

Similarly, we estimated the impact of collective marketing on household income using propensity score matching method(logit). The results are reported in Table 6. The outcome variable is the total household income in FCFA (West African currency). We estimated ATE and ATT using both Propensity score matching and Nearest neighbor matching. The results show negative and significant effect at 1% level of the estimates of ATE for both propensity score and nearest neighbor matchings on the income. Farmers who sell collectively are more likely to lose their revenues about 13906 FCFA or 21746.88 FCFA than those who sell individually, when a farmer is randomly taken in the total population. Meanwhile the results show the coefficient of ATT is negative and significant for propensity score matching indicating that the farmers that participate in collective sale are more likely to lose about 22633.69 FCFA compare to individual sellers. These results come to support the fact stated above that individual sellers are wealthier than group sellers. This implies that participating in group selling may be a constraint or an issue where you join a group for the purpose to sell your product but not for gaining high benefit.

These findings are contrary to the results of most studies stating the fact that collective marketing can increase their competitive advantage and improve producer price.

The explanation to these findings can be related to the organizational level of the farmers involved in collective marketing, the transaction cost required to take the product to outlet market, the price information and taxes incurred in marketing the product. In fact, in Niger and in Africa in general most of farmers' organizations are not well organized to get more advantages of being in groups and most of the elected members to manage their organizations are corrupted and failed to bring benefits and welfare to their members. For instance, in Western Niger, the cooperative farmers find it difficult to pay the royalties at the end of the rice-growing campaigns, simply because the managers of the cooperatives overtax the producers to try to hide the traces of their embezzled funds (Bontianti,2008). Other studies come to support these findings that producer cooperatives have been characterized by inappropriate political interference, financial irregularities and poor management (Holloway et al., 2000; Karami and Rezaei-Moghaddam, 2005); Ofori et al.,2019, Verhofstadt and Maertens (2014)).

**Table 6:** Matching estimation of the impact of collective marketing on farm income.

Matching algorithm	Outcome variable	ATE	ATT
Propensity score	Income	-13906.18(3160.329) ***	-22633.69(6182.021) ***
Nearest neighbor	Income	-21746.88(3214.387) ***	-6386.978(4271.173)

Note: Standard Errors in parentheses. \*\*\* Significant at 1% level

## Conclusion

In many cases, we believe that organizing stallholders in group, association or cooperative is necessary to supply market because of the fast transformation which undergoes the marketing systems. It is very important to link farmers to market demand. Traditional marketing systems are being replaced by coordinated linkage between farmers, processors, retailers and others.

Using data collected from 1783 households in rural Niger, we examined the factors influencing farmers participation to group and the potential impact of collective marketing on household food security and income. The descriptive results revealed the low participation in groups and collective marketing by the respondents (only 2.91% participate in group formation while 4.6% participate in collective sale). We employed a probit model to identify the factors affecting farmers group adhesion. The results showed that the household size, the quantity of livestock, the farm size, contact with extension services, the possession of irrigated land and access to market influence positively and significantly the farmer's decision to join a group. In fact, in Niger, it is rare to find farmers organized in groups especially for rain fed crops such as millet, sorghum, cowpea and others. Rural development agencies such as government, international organizations and others should put more efforts on infrastructures construction(roads) to facilitate rural people access to market and provide extension advisory services to encourage farmers 'group formation. Farmers



through group come together as one body to take their development in hand. Group membership allows them to discuss their problems and go for alternative solutions. Government and other development institutions will listen to their problems when farmers themselves took their initiative towards changing. The top-down approach was a failure in most government intervention.

We then applied matching techniques to assess the impact of collective sale on household food security and income. The results showed negative effect of collective sale on both household food security and income. The individual sellers are more food secure and wealthier compare to collective sellers. These findings are contrary to most of literatures reporting the benefits of collective sale. In some cases, farmers join together just for the purpose to find output market to sell their products when they face bad sales. Therefore, it is important to organize farmers in association or cooperatives along each value chain especially for the main stable crops. For example, millet is the main stable crop in Niger. Organizing millet producers in association or cooperative to discuss and find ways to solve their problems collectively can improve production and marketing.

The study is too general. It did not concern the producers of a particular crop value chain. We then recommend for further research a similar study for producers of individual crop.

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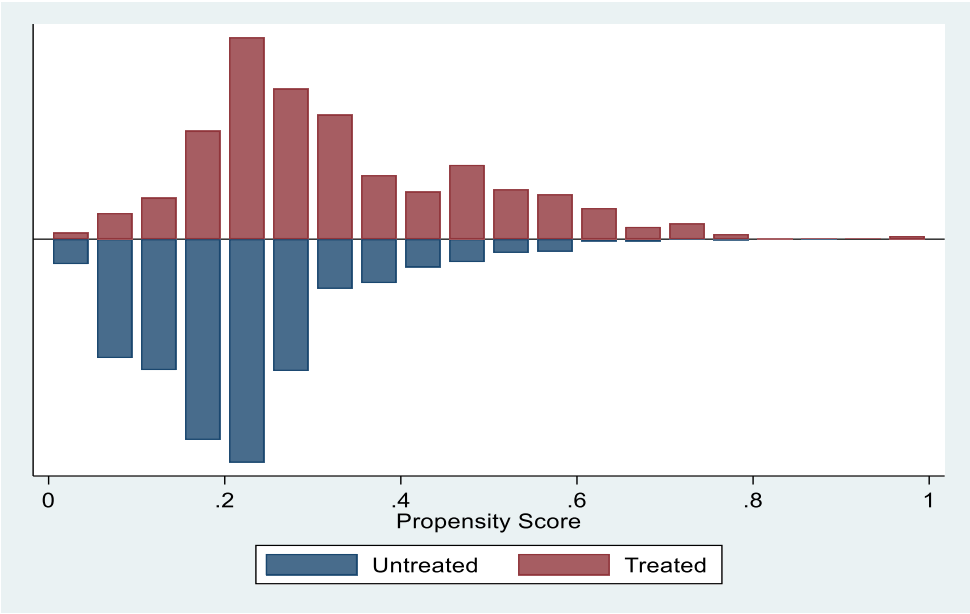
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Appendix

Propensity score distribution



## Density score plot

