

THE PROPENSITY TO COOPERATE AMONG PEASANT FARMERS IN ALGERIA: AN ANALYSIS FROM BIVARIATE APPROACH

Mohamed Amine Benmehaia

Department of Rural Economics, National Higher School of Agronomy, Algeria
Email: amine_benmehaia@yahoo.fr

Fatima Brabez

Department of Rural Economics, National Higher School of Agronomy, Algeria

Abstract.

This paper analyzes farmers' decision to transact with the cooperatives, i.e., the propensity to cooperate. We aim to empirically analyze the driving factors affecting both cooperative membership and purchasing decisions of farmers in Algeria. The survey data was conducted within the National Program of Research including 625 sampled farmers. The study distinguishes four types of participation according to farmers' decision of membership and purchasing inputs. The empirical results from the Bivariate Probit regression model suggest that specialization, human capital, access to services, and geographic location are significant factors that influence farmers' propensity to cooperate and participation behavior as a devoted membership. This empirical finding has important implications for Algerian policy-makers in their efforts to promote efficient agricultural markets through producer cooperatives and other agricultural policies.

Key Words: Cooperatives, memberships, inputs purchase, asset specificity, farming, Algeria

JEL Codes: P13, Q12, Q13.

1. Introduction

Despite the economic importance of agricultural cooperative in rural development, little research is available that investigates the implications of farmers for cooperatives membership in Algeria. In this paper, we analyze farmers' decisions to transact with the cooperatives, i.e., the propensity to cooperate. Arguments for a consistent analysis of the decision-making process are found in the New Institutional Economics literature.

Frequently, farmers join an agricultural cooperative by becoming a member. Besides this decision on membership, farmers also decide on where to purchase inputs from their cooperative or from private firms present in the local market through a spot market contract. One would expect that cooperative members purchase inputs from their cooperative and non-members from private firms. Nevertheless, the data shows that this is not necessarily the case. Some cooperative members do not purchase inputs from their cooperative, whereas on the other hand, there are also non-members purchase inputs from the cooperative. This leads to a number of interesting research questions. For instance, what determines of participation in cooperatives? Why are cooperative membership and purchasing decision not always related? And to what extent is cooperative membership a determinant of input purchase decision?

The aim of this paper is to empirically analyze the driving factors affecting cooperative membership and purchasing decisions of farmers in Algeria. The empirical results from the

bivariate Probit (BVP) regression model suggest that human capital, farm size, farm status, specialization, and geographic location are significant factors that influence farmers' propensity to cooperate and participation behavior. This empirical finding has important implications for Algerian policy-makers in their efforts to promote efficient agricultural markets through producer cooperatives and other agricultural policies.

The paper is organized as follows. Section 2 describes some theories using arguments from new institutional economics, and presents briefly some facts on the agricultural cooperatives in Algeria. Section 3 discusses the analytical framework for the farmer's decision on the cooperative membership, and presents the hypotheses. Section 4 describes the research methodology. Results are discussed in Section 5, and conclusions are drawn in Section 6.

2. An Overview of Theories and Facts on the Agricultural Cooperatives

Basically, the cooperative is an association of firms or households for business purposes i.e., an economic institution through which economic activity is conducted in the pursuit of economic objectives (Philips, 1953). Despite the multitude of theoretical frameworks recently elaborated for the analysis of the agricultural cooperatives, the New Institutional Economics (NIE)¹ provides helpful analytical tools to examine the agricultural cooperatives behavior in different institutional environments. The NIE argues that organizations have developed because markets are imperfect and thereby give rise to transactional risks. Particularly high risks are implied when uncertainty is substantial or when one of the parties to the exchange has made transaction-specific investments.

More Specifically, the Transaction Costs Theory (TCT) is mostly considered. This approach has been largely applied in economic organization of agricultural sector in the last three decades. The TCT offers an advanced conceptual framework to explain different features of contractual arrangements in agriculture (Allen & Lueck, 1993, 2004, 2008; Roumasset, 1995; Cook et al., 2008; Chavas, 2008). It advances that the organization of agricultural production is largely determined by the efforts made to economize on transaction costs.

In the TCT, the cooperative is defined as a form of vertical integration². It has been characterized as hybrid governance structure, that is to say, an intermediate form between the "market and hierarchy" continuum, i.e., on one pole of the continuum, there is market governance, which is based on prices as the main information signals used for independent decision making on investments. On the other pole of the continuum, there is hierarchy, which is based on authority, and implies the allocation of resources through formal rules.

The central characteristic of hybrids is that they maintain distinct and autonomous property rights and their associated decision rights on most assets, which makes them different from integrated firms. However, they simultaneously involve sharing some strategic resources, which requires a tight coordination that goes far beyond what the price system can provide and thus makes them distinct from pure market arrangements (Ménard, 2007).

We briefly summarize key findings of the growing literature on agricultural cooperatives as follows: (i) cooperatives help improve farmers' economic welfare and market competitiveness; (ii) cooperatives exert scale effects and lower an individual household's risk and transaction costs in market competition; (iii) cooperatives foster a local agricultural economy with distinct regional characteristics. According to Ménard (2007), the pillars of hybrid arrangements (as a cooperative) are: (i) pooling resources; (ii) the significance of contracts among cooperators; (iii) the competition conditions. Indeed, cooperative membership can provide material and immaterial benefits.

Material benefits include holding decision rights on the use of cooperative assets and decreasing the risk of hold-up or lock-in situations. They derive from the control (ownership) on cooperative assets which reduces the risk of being held-up or locked-in (Sykuta & Cook, 2001; Hendrikse & Bijman, 2002) and also include rent redistribution mechanisms due to non-market

benefits of being a member, for example due to tax reductions and fiscal incentives (Sexton, 1990; Tennbakk, 1995; Cook, 1995). Besides, immaterial benefits are related to concepts such as loyalty, trust and reciprocity, which are principally related to the “ideological side” of the cooperative mechanism (Cook, 1995; Fulton, 1999; Karantininis, 2007; Fehr et al., 2007; Bon-tems & Fulton, 2009). When a cooperative participates in the political engagements, such as political party and sponsorship organizations, it also provides ‘political’ benefits to members (Karantininis, 2007).

Cooperatives’ economic function is to integrate vertically their members into the marketing and supply chain, either upstream (a purchasing cooperative) or downstream (a marketing cooperative) (Sexton, 1986; Sexton & Sexton, 1987).

In real word, it seems that the global integration of the agricultural sector has been paralleled by its liberalization in many developing countries, leading to privatization of state enterprises, dismantling of state interventions and often higher levels of foreign investment in domestic food retailing and production (Bijman et al., 2011). However, increasing demand for coordination among layers throughout the agrifood system point to a different role in which cooperative organizations may have a unique advantage (Sykuta & Cook, 2001).

In Algerian context, various types of cooperatives were established (since 1971) as a system of state-directed instruments in an attempt to modernize agriculture and to socialize the rural economy. The State-Directed Cooperatives (SDC) were considered as germ cells to create new forms of social life (Trautmann, 1986). But since the agrarian revolution in 1971, the cooperative system show deficiencies, and the agrarian legislation fails, until now, to create autonomous production units. Indeed, the conclusion of Trautmann (1986) that the cooperative farmers have actually become wage earners of the state is valid for present time. The survival type of cooperative during last fourteen years is the farm services-supply cooperatives, which purchase in volume, process or formulate, and distribute farm inputs such as seed, fertilizer, feed, chemicals, farm equipment, hardware, building supplies, and different kind of services (as information access). It is perhaps true that the SDCs remain unattractive, but it is noteworthy to remark the long absence of large-scale private cooperative in the Algerian agricultural sector. Farmers have developed a special perception of a cooperative. Actually, the cooperative is perceived as subscription for state supports. Individual private-initiative for cooperative formation is consequently weakened.

In the last decade, we can observe some legislative reforms and rectifications in terms of cooperatives promotion. But it seems that they are still ineffective, perhaps because that the recent smooth agrarian reforms are not appropriate for the institutional configuration of rural Algerian society. Another explanation can arise, in terms of property rights approach, is that the source of cooperative inefficiency is the inherent weakness in the ownership structure within cooperatives (Porter & Scully, 1987).

To better understand the role of cooperatives in the Algerian rural economy, it is important to accurately identify the factors influencing farmers’ behavior and willingness to participate in agricultural cooperatives. Several studies, in different contexts, have found that multiple variables have a significant impact on farmers’ adoption of innovative agricultural practices (specialized markets and cooperatives). The main findings from previous research suggest that the following factors have significant effects: education and experience (human capital), farm size, membership in professional organizations, specialization (and diversification), family labor availability and socio-demographic characteristics. That’s why we will develop a theoretical framework in order to analyze the farmer’s behavior and its determinants for the cooperative membership.

3. Theoretical Framework

We can formalize the decision on being a member of cooperative (C_1) or not (C_0) as a

double discrete decision-making problem (Masten & Saussier, 2002; Bogetoft & Olesen, 2004; Masten et al., 1991; Joskow, 2008; Williamson, 1991):

$$C = \begin{cases} C_0 & \text{if } EU(C_0) \geq EU(C_1) \\ C_1 & \text{if } EU(C_1) > EU(C_0) \end{cases} \quad (1)$$

where $EU(C_0)$ and $EU(C_1)$ represent the expected utility associated with the corresponding contractual choices. The choice C shows that cooperative membership is chosen if the expected utility from membership exceeds the expected utility from not being a member. Similarly to equation of the choice C , we formalize the decision-making on input purchasing (S_1) or not (S_0) in the following way:

$$S = \begin{cases} S_0 & \text{if } EU(S_0) \geq EU(S_1) \\ S_1 & \text{if } EU(S_1) > EU(S_0) \end{cases} \quad (2)$$

where $EU(S_0)$ and $EU(S_1)$ represent the expected utility of purchasing inputs from a cooperative, and from a local markets, respectively. The equation of the choice S shows that a purchasing contract is chosen if the utility from purchasing from a cooperative exceeds the utility from purchasing from local agricultural markets. Combining the decisions on membership and input purchasing, farmers' transactions with a cooperative can be modeled as a governance structure in which the following four combinations are possible: (i) Membership with input purchasing contract (devoted membership); (ii) Membership without input purchasing contract (backhanded membership); (iii) Non-membership with input purchasing contract (expedient membership) and (iv) Non-membership and no purchasing contract (rebuffing the membership), as shown in Table 1.

Table 1. The Decision Matrix for Farmers' Transactions with A Cooperative

Decisions		Membership decision (C)	
		C ₁	C ₀
Purchasing decision (S)	S ₁	Devoted membership $EU(C_1, S_1 X, Z) = EU(X, Z)$	Expedient membership $EU(C_0, S_1 X, Z) = EU(X, Z)$
	S ₀	Backhanded membership $EU(C_1, S_0 X, Z) = EU(X, Z)$	Rebuffing membership $EU(C_0, S_0 X, Z) = EU(X, Z)$

Under the case of rebuffing the membership, cooperative do not show significant advantages over local agricultural markets in offsetting the potential for hold-up and lock-in problems. Expedient membership with a cooperative becomes attractive when the transaction is more asset-specific. Increased specificity increases the advantage of a cooperative in coordinating input purchasing channels from members without incurring higher contractual costs. In this case, farmers do not heavily participate in decision-making process and benefits are primarily due to inputs purchasing related services (Ménard, 2007). With growing specificity, backhanded membership becomes an attractive governance solution, whereas farmers benefit from membership due to the strategic control over cooperative assets, therefore avoiding hold-up or lock-in problems, and related rent distribution policies which are disconnected from purchasing obligations (Bontems and Fulton, 2009).

Devoted membership is typical for highly specialized transactions between the farmer and the cooperative. This is the case of a quasi-integrated cooperative, which shows a competitive advantage over local agricultural markets due to the capacity to coordinate transactions in supply chains (e.g. quality) and stimulate highly specific investments with relatively low contractual costs (Ménard & Valceschini, 2005; Ménard, 2004, 2007).

We hypothesize that if the degree of specificity increases, more vertically integrated solutions are necessary. Asset specificity is considered as the major feature in determining a farmer's likelihood to transact with agricultural cooperative (Hendrikse & Bijman, 2002a, 2002b). The degree of asset specificity essentially depends on the specialization, scale and type of farms. Specialized farms have more specific assets than diversified ones. This increases the dependence between farms and upstream channels.

The geographical characteristics of a region are an element of asset specificity. In these regions, agricultural markets are limited in size and access to information, and therefore first movers can create a sort of natural monopoly and externalities. This increases the uncertainty and specificity of the farmers' transactions.

In line with the findings by Cook (1995) who argues that farmer join or form a cooperative in reaction to the increasing bargaining power in agricultural markets at local level. Specificity of location is also determined by the institutional environment (Williamson, 2000). Likewise, the presence of social norms can facilitates cooperative formation and the degree of commitment and loyalty of the members (Fulton, 1999; Hansen et al., 2002). Besides, ideological, cultural and political preferences are also relevant to explain differences in farmers' participation in cooperative (Fulton, 1999; Karantininis, 2007). Consequently, we assume a positive relation between increased asset specificity and farmers' likelihood to participate in agricultural cooperative. We control for asset specificity by using variables related to size, specialization (diversification), human capital (his age, education, and relational networks as a proxy), and role of family labor, and we control for site specificity and the impact of institutional environment by considering the location in an urban, peri-urban, or isolated rural zone.

4. Research Methodology

4.1. Data

The data used in this research were collected from the random survey of farmers in Algeria. The data collection was conducted within the National Program of Research on Agricultural Cooperatives Performance. We collected 625 valid questionnaires in five districts across the country, among which Mascara was attributed to the Western region; Blida and Bouira were defined as the Central region; Setif and Biskra are in the Eastern region.

The questionnaire contained questions about the characteristics of farmers, including their age, education level and households features. The survey focuses also on the farmers' production and activities, such as cropped area, agricultural income, product varieties, costs, etc. Furthermore, the survey inquires about farmers' knowledge of local cooperative organizations and their participatory behavior.

4.2. Model Specification

Both decisions of membership and purchasing from a cooperative are based on a comparison of the benefits and costs of alternative contractual choices. Unfortunately, as commonly experienced in similar decision making processes on contractual choices, not all benefits and costs are measurable or available (Masten et al., 1991; Masten & Saussier, 2002; Joskow, 2008). Therefore, we follow the empirical approach suggested by Williamson (1991) and derive base predictions of organizational form from the observable characteristics of the transaction rather than from the (unobserved) costs and benefits. This is often denoted as reduced-form analysis of contractual choice (Masten et al., 1991). Although its limitations, the reduced-form approach is the only possible econometric solution given the unavailability of data related to direct costs and benefits of the contracts.

We assume a linear relationship between relevant attributes X of the contractual relationship and the expected utility of non-membership $EU(C_0)$ and membership $EU(C_1)$ as :

$$EU(C_0) = \alpha_0 X + \varepsilon_0 \quad \text{and} \quad EU(C_1) = \alpha_1 X + \varepsilon_1 \quad (3)$$

where ε_0 and ε_1 are residual terms. A similar linear structure is assumed between the expected utility of purchasing and non-purchasing from a cooperative and the attributes Z that relate to this utility. We obtain:

$$EU(S_0) = \beta_0 Z + \zeta_0 \quad \text{and} \quad EU(S_1) = \beta_1 Z + \zeta_1 \quad (4)$$

The formulation of these relationships in terms of probabilities it can be defined as:

$$P(C = C_1) = P(EU(C_1) > EU(C_0)) = P(\varepsilon < (\alpha_1 - \alpha_0)X) \quad (5)$$

$$P(S = S_1) = P(EU(S_1) > EU(S_0)) = P(\zeta < (\beta_1 - \beta_0)Z) \quad (6)$$

First, we assume that the membership and inputs purchasing decisions are made independently. Hence, we analyze the cooperative membership decision as a non-sequential behavior isolated from another decisions making process. By doing so, we take the farmers' membership in cooperatives as a separate single equation for the observed phenomena (which is a binary dummy variable by nature). Consequently, we use the Logit model specification with sample selection in order to determine the factors influencing farmers' cooperatives membership. Based on the first expressions, the Logit model can be written as follows:

$$P(C=1 | X) = \Gamma(\alpha'X) = [e^{\alpha'X} / (1 + e^{\alpha'X})] \quad (7)$$

where X is a vector of explanatory variables, α' is a vector of coefficient parameters and $\Gamma(.)$ represents the logistic cumulative distribution function.

Next, assuming that membership and inputs purchasing decisions are closely related with similar observed and unobserved determinants as described in the previous section, a bivariate Probit model is the natural estimation framework since it provides more efficient estimates than separate single equation Probit or Logit models.

Based on the last expressions, the bivariate Probit model can be written as follows:

$$P(C=1 | X) = \varphi(\alpha X) = \alpha X + \varepsilon \quad (8)$$

$$P(S=1 | Z, C) = \varphi(\beta Z, \gamma C) = \beta Z + \gamma C + \zeta \quad (9)$$

with $E(\varepsilon) = E(\zeta) = 0$; $\text{Var}(\varepsilon) = \text{Var}(\zeta) = 1$ and $\text{Cov}(\varepsilon, \zeta) = \rho$. For this model specification, $\varphi(.)$ represents the standard normal distribution function. The eventual problem of the endogeneity of C in second equation is avoided by the fact that the log-likelihood estimation is maximized for the joint probability distributions. The BVP model enables us to model farmers' decisions to choose more than one contract simultaneously (Greene, 1996; 2003).

4.3. Explanatory Variables

Based on the theoretical framework presented in Section 3, we selected a number of variables that relate to the dimensions of specificity that are important in explaining farmers' decisions on cooperative membership and input purchasing. Table 2 presents the descriptive statistics of these explanatory variables.

Asset specificity: The first dimension of specificity is asset specificity. To capture this dimension, we use a number of indicators relating to (i) farm size by the agricultural area (*FARM_SIZE*) and total amount of fixed assets (*ASSETFIX*), (ii) agricultural specialization (*DAIRY, SHEEP, CHIKEN, HIVE, HORTIC, PALM, EXTEN_CROP, PLASTIC*), (iii) on-farm diversification through an entropy index (*DIVERS*), and (iv) human capital indicators, such as farmer's experience (*AGE*), the farmers' educational level (*EDUCAT*)³, his household size

(*HOUSEHOLD*), and the use of labor provided by the farm family (*FAM_LAB*). Besides, in order to capture the relational specificity, we use information on farmers' membership of associations (*ASSOC*), and participation in other types of social networks (*NETWORK*). The final group of variables refers to the farm ownership structure. We use four dummies to reflect the dominant existing structures (*PRIVATE*, *TENANCY*, *SHARECROP*, *STATECOL*).

Locational specificity: The second dimension of specificity is locational specificity. To capture the impact of locational specificity, we include a number of variables related to geographical isolation. We use five dummy variables (*URBAN*, *PERIURB*, *ISOLAT*, *HILLY*, *PLAIN*) to indicate whether a farmer is located in urban, peri-urban, isolated rural areas and if he operates in a hilly or plain zone. Also, we use the location of farmers in the districts (*BOUIRA*, *BLIDA*, *SETIF*, *BISKRA*, *MACSARA*).

5. Empirical Results and Discussions

Table 2 shows the cross-tabulation for cooperative membership and input purchasing in the sample. About 40% of farmers within the sample are cooperative member. Only about 11% of the farmers have what we define as devoted membership, while about 30% of the farmers are backhanded members, 9% have expedient membership and 50% of the sample farmers repulse any relationship with cooperatives, "Rebuffing membership". Interestingly, three-fourths of the cooperative members do not purchase from their cooperatives. On the other hand, of the 20% that purchase from cooperatives, only around 9% are not a member.

Table 2. Cross-tabulation for cooperative membership and input purchasing in sample

Decisions		Cooperative Membership		Total
		[0]	[1]	
Input Purchasing	[0]	312 (49,92%)	186 (29,76%)	498 (79,68%)
	[1]	59 (9,44%)	68 (10,88%)	127 (20,32%)
Total		371 (59,36%)	254 (40,64%)	625 (100%)

Table 3 shows the descriptive statistics of the explanatory variables. As shown in Table 3, the age of the farmer is about the average of 52 years, and over 60% of them have an educational level of primary or secondary school. About 37% of households employ family labor by having an average of 8 working individuals. Regarding the fixed asset ownership, the average of total fixed assets (in monetary current terms) is about 7,7 million Dinars (in national currency)⁴.

Approximately 42% of the respondents raise dairy cows, 3% raise dairy sheep, 11% are broilers, 11% are beekeepers, 21% have horticultural crops, 23% have palm date crops, 12% plant extensive grain crops, 72% plant vegetable crops under greenhouse (plasticulture). We mention that these farming activities could be overlapped. Consequently, a diversification index was computed. The entropy index shows an average of 0.25 ranges from 0 (256 specialized farm) and 1 (7 extremely diversified farm). About 19% participate in professional associations, and 53% of the respondents have a well-developed relational network.

On the locational side, we mention that there is a relative uniformity in the sample size among the four selected provinces. We have 18.9% from Bouira province, 19.6% from Blida province, 21.4 from Setif province, 18.8 from Biskra, and 21,3 from Mascara province. On one hand, in terms of distance from the city, the farms situated in urban areas represent 27%, and those situated in peri-urban areas are about 56,8%, whereas, those situated in isolated regions represent 16,2%. On the other hand, in terms of the geographical location in the region,

we have 32,4% of sampled farms situated in hilly zone, and 46,1% situated in plains zone, the remained proportion is devoted the different other geographical locations. Finally, on the side of the farm ownership status, we have 48,6% on the total sampled farms representing the private individual-family farms, 13,6% of rented farms, 8,5% as sharecropped farms, and 29,4% as collective state-owned farms.

Table 3. Descriptive Statistics of the Explanatory Variables in The Model

Variable	Definition	Mean	S.D.
Asset Specificity			
<i>DAIRY</i>	1 for dairy farm, 0 otherwise	0.423	0.494
<i>SHEEP</i>	1 for sheep farm, 0 otherwise	0.038	0.192
<i>CHICKEN</i>	1 for chicken farm, 0 otherwise	0.113	0.317
<i>HIVE</i>	1 for beekeeping farm, 0 otherwise	0.113	0.318
<i>HORTIC</i>	1 for horticultural farm, 0 otherwise	0.219	0.414
<i>PALM</i>	1 for palm date farm, 0 otherwise	0.233	0.423
<i>EXTEN_CROP</i>	1 for extensive crops farm, 0 otherwise	0.120	0.325
<i>PLASTIC</i>	1 for plasticulture farm, 0 otherwise	0.720	0.449
<i>DIVERS</i>	Entropy index for diversification	0.253	0.265
<i>FARM_SIZE</i>	Farmland area (hectares)	15.003	23.930
<i>ASSETFIX</i>	Total fixed assets (local currency)	77 076	107 546
<i>AGE</i>	Farmers' age (years)	52.347	13.384
<i>EDUCAT</i>	Educational level (Polynomial variable)	1.622	1.306
<i>HOUSEHOLD</i>	Farmers' household size	8.408	4.052
<i>FAM_LAB</i>	1 for the use of family labor, 0 otherwise	0.370	0.444
<i>ASSOC</i>	1 if he is member in association, 0 otherwise	0.192	0.394
<i>NETWORK</i>	1 if he participate in social networks, 0 otherwise	0.537	0.498
<i>PRIVATE</i>	1 if he operate on his own farm, 0 otherwise	0.486	0.500
<i>TENANCY</i>	1 if he operate as a tenant, 0 otherwise	0.135	0.184
<i>SHARECROP</i>	1 if he operate as a sharecropper, 0 otherwise	0.085	0.389
<i>STATECOL</i>	1 if he operate on State-owned farm, 0 otherwise	0.294	0.455
Locational Specificity			
<i>BOUIRA</i>	1 if farmer in Bouira district, 0 otherwise	0.189	0.299
<i>BLIDA</i>	1 if farmer in Blida district, 0 otherwise	0.196	0.411
<i>SETIF</i>	1 if farmer in Setif district, 0 otherwise	0.214	0.471
<i>BISKRA</i>	1 if farmer in Biskra district, 0 otherwise	0.188	0.341
<i>MASCARA</i>	1 if farmer in Mascara district, 0 otherwise	0.213	0.477
<i>URBAN</i>	1 if farmer in urban area, 0 otherwise	0.270	0.444
<i>PERIURB</i>	1 if farmer in peri-urban area, 0 otherwise	0.568	0.443
<i>ISOLATED</i>	1 if farmer in rural isolated area, 0 otherwise	0.162	0.446
<i>HILLY</i>	1 if farmer in hilly zone, 0 otherwise	0.324	0.330
<i>PLAIN</i>	1 if farmer in plain zone, 0 otherwise	0.461	0.239

Another interesting finding from the survey results is that the historical failure of cooperatives could have stimulated negative impressions toward participation in cooperatives by farmers. About 60% of the respondents indicated that they chose not to participate in cooperatives

mainly because of the painful memories of mandatory participation in the agrarian reforms and collectivization movements in the period of 70s. Only about 40% of the respondents have actually participated in a cooperative organization, and half of the participants purchase less than 20% of their inputs from cooperatives.

Estimation results and measures to assess the goodness of fit for both model 1 and model 2 are reported in Table 4. Both models show higher significance level concerning the McFadden R-squared, the Log-likelihood ratio, the correctly predicted cases, and, for only the BVP, the Rho coefficient. Hereby we discuss the impact and significance of each explanatory variable in the two empirical models.

Several explanatory variables related to farmer characteristics show a significant impact on the propensity to cooperate of sampled farmers. It seems that being a large farm (as for *FARM_SIZE* or for *ASSETFIX*) decreases the likelihood to participate in cooperatives membership (Rebuffing membership). Whereas, small farmers are likely to contracts their inputs from cooperatives (Backhanded membership). These results indicate that the large farms found the transactions with cooperative (both in membership or purchasing inputs) less efficient. The policy implication here is to focus on promoting and encouraging small farmers to participate in cooperatives.

Regarding the crops types, and therefore farm diversification, results indicate that farms specialized in sheep, broiler, beekeeping, horticulture, palm, extensive grain crops and plasticulture farming are more likely to participate in cooperatives, but, except for sheep growers and plasticulture farming (having a devoted membership), all of theses farming activities are less likely to purchase their inputs from cooperatives (Expedient membership). The dairy cows growers present a negative significant effects in both models, i.e., they are less likely to participate in cooperatives membership and for purchasing their inputs (Rebuffing membership).

The diversification variable (entropy index) presents a highly significant negative effect in both models, but in the input purchasing decision. This result implies that the more diversified farms show a strong willingness to purchase inputs from cooperatives without a strong participation in cooperative membership (Expedient membership).

If we refer to explanatory variables related to human capital issues, it is interesting to highlight that a negative effect of educational level (*EDUCAT*) and social networks (*NETWORK*) leads to a lower participation of farmers in cooperatives membership, while the opposite is found in case of inputs purchasing decisions (Expedient membership). Whereas the participation in professional associations leads to higher implication of farmers in both membership and purchasing contracts from their cooperatives (Devoted membership). This result implies that farmers who have higher educational degrees and a developed relational networks may know more about cooperatives and might be more willing to accept new production and marketing channels.

Besides, the farmer's age also matter. Oldest farmers are more likely to participate in cooperatives. They are more willing to participate in both membership and purchasing contracts (Devoted membership). Hence this result concludes that membership is favorable to the older age group resulting in the potential shortage of younger members. As a result, there will be implications on the governance and decision making in cooperatives. The government and the cooperatives managers should focus on sensitization of younger farmers on the benefits of being members of cooperatives so that they can have a clear understanding and be fully informed on the potential of cooperatives. It is found also that large households (*HOUSELOLD*) and farms with the use of family labor (*FAM_LAB*) are less likely to participate in cooperative membership and inputs purchase (Rebuffing membership).

Table 4. Results of maximum-likelihood estimates of the Logit and the BVP models

Explanatory Variables	The Logit Estimation for Membership		The Bivariate Probit Estimation			
			Membership		Input Purchase	
<i>COOP</i>					0.659	(3.286)***
Asset Specificity						
<i>DAIRY</i>	-1.439	(4.308)***	-0.034	(5.556)***	-0.803	(-4.113)***
<i>SHEEP</i>	1.340	(5.340)***	0.341	(3.585)***	0.271	(1.355)
<i>CHIKEN</i>	1.957	(1.282)	0.655	(2.922)***	-0.389	(-1.759)*
<i>HIVE</i>	1.011	(4.300)***	1.116	(5.012)***	-0.489	(-2.336)**
<i>HORTIC</i>	0.743	(0.558)	0.326	(1.230)	-0.728	(-3.216)***
<i>PALM</i>	1.632	(8.835)***	1.157	(4.733)***	-0.391	(-1.208)
<i>EXTEN_CROP</i>	1.504	(4.899)***	0.646	(2.657)**	-0.615	(-2.470)**
<i>PLASTIC</i>	1.859	(6.282)***	0.116	(1.483)	0.186	(9.429)***
<i>DIVERS</i>	-2.728	(-2.519)**	-2.303	(-4.543)***	2.111	(2.904)***
<i>FARM_SIZE</i>	-0.017	(-1.196)	-0.002	(-1.264)	0.009	(4.447)***
<i>FARM_SIZE</i> ²	0.015	(4.428)***	0.008	(5.310)***	-0.349	(-2.536)**
<i>ASSETFIX</i>	-0.969	(-2.493)**	-0.006	(-3.375)***	-0.009	(-0.776)
<i>FAM_LAB</i>	-1.007	(-0.123)	-0.985	(-0.722)	-0.763	(-5.298)***
<i>HOUSEHOLD</i>	-0.050	(-2.542)**	-0.044	(-3.057)***	-0.046	(-2.713)***
<i>AGE</i>	0.181	(2.242)**	0.031	(5.989)***	0.010	(1.924)*
<i>AGE</i> ²	-0.004	(-1.275)**	-0.064	(-2.156)*	-0.555	(-1.227)
<i>EDUCATION</i>	-0.088	(-1.772)	-0.041	(-1.178)	0.142	(3.627)***
<i>ASSOC</i>	1.135	(2.952)***	0.666	(4.151)***	0.909	(6.832)***
<i>NETWORK</i>	-1.591	(-7.762)***	-0.472	(-4.121)***	0.578	(5.332)***
<i>PRIVATE</i>	1.654	(5.310)***	0.668	(2.263)**	0.354	(1.044)
<i>TENANCY</i>	-0.584	(-1.541)	-0.373	(-1.437)	-0.119	(-0.429)
<i>SHARECROP</i>	0.473	(2.259)**	0.213	(0.664)*	-0.019	(-0.053)
<i>STATECOL</i>	0.654	(4.021)***	0.595	(1.953)*	0.354	(1.028)
Locational Specificity						
<i>BOUIRA</i>	-1.339	(-2.543)**	-0.550	(-3.121)***	1.055	(5.800)***
<i>BLIDA</i>	-1.633	(-6.719)***	-1.206	(-9.729)***	0.122	(0.789)
<i>SETIF</i>	0.979	(2.632)***	0.954	(7.658)***	-0.537	(-3.360)***
<i>BISKRA</i>	0.997	(3.421)***	0.424	(3.807)***	-0.141	(-1.168)
<i>MASCARA</i>	1.129	(3.140)***	1.079	(9.066)***	0.035	(0.271)
<i>URBAN</i>	0.150	(0.171)	0.255	(1.036)	-0.547	(-2.170)**
<i>PERIURB</i>	1.861	(2.172)**	0.450	(1.826)*	-0.130	(-0.525)
<i>ISOLATED</i>	-2.621	(-3.063)***	-0.044	(-2.316)**	0.038	(0.677)
<i>HILLY</i>	1.988	(2.240)**	0.619	(2.925)***	0.197	(7.239)***
<i>PLAIN</i>	0.216	(2.556)**	0.098	(2.189)**	0.089	(1.689)
McFadden R2	0.487		0.487			
Log-likelihood	-215.478		-634.756			
Cor. predicted	83.1%		83.4%			
Rho coef.	-		0.261			

Regarding the farm ownership status, private individual-family farms and state-owned collective farms show highly significant positive effects on the participation in cooperatives membership. These two dummies for farm status show also positive effects on inputs purchasing decision (Devoted membership). On the other hand, the tenancy and sharecropped farms show a negative impact on the likelihood of farmers for both models, i.e., tenants (Rebuffing membership) and sharecroppers (Backhanded membership) are less likely to transact with cooperatives.

Finally, farm location also matters. More specifically being located in one of the regions of West, where increases the likelihood to participate in both membership and purchasing contracts (Devoted membership), while the East region presents a likelihood for a backhanded membership, and the Central region for an expedient membership. However, the location in urban (*URBAN*), peri-urban areas (*PERIURB*) increases farmers' likelihood to participate in cooperative membership without a significant likelihood for purchasing contracts (Backhanded membership). On the contrary, being located in isolated rural areas present likelihood for an expedient membership. In hilly and plain zones, farms are more likely to participate in both membership and purchasing contracts. Therefore, cooperatives should promote policies aimed at assisting the farmers who live far from the urban areas, such as by providing transport to facilitate access to different types of services. These empirical results corroborate the recent empirical literature on the determinants of cooperatives memberships in different contexts (Hudson & Herndon, 2002; Karami & Rezaei, 2005; Hovelaque et al., 2009; Österberg & Nilsson, 2009; Pascucci et al., 2011; Othman et al., 2012; Zheng et al., 2012).

From the discussions and the implications driven from these empirical results, and according to the depicted theoretical framework, we can establish the following conclusions. A devoted membership in agricultural cooperatives for the Algerian settings is more likely for following specificities: being on cheap or plasticulture specialization, a memberships in professional associations, private or state-collective farm ownerships, being on the Western region, hilly or plain zones. We point out that farm specialization seems to have a strong impact on cooperative decision behavior. Farmers who rebuffing the participation in cooperatives have the following criterions: larger farm and households (employing family labor), or operate as a tenants. Hence, the major policy implication drawn from this study insist on the fact that, in order to promote a development of agricultural cooperatives in Algerian context, the government should take into account both the asset and the locational specificities. Especially for the specialization, human capital, and the access to services and infrastructures.

6. Concluding Remarks

This paper analyzes the involvement of farmers in cooperatives using survey data from the Nation Research Program in Algeria. The analysis focuses on the determinants of farmers' memberships and decision to contracts for inputs purchase. We utilized a Bivariate Probit regression model with sample selection to study farmers' determinants of participation in cooperatives. The empirical results from our analyses suggest that specialization, human capital, access to services, and geographic location are significant factors that influence producers' participation behavior in cooperatives.

Our research shows that farmers' participation behavior is closely related to their perception of professional cooperatives, and that educational attainment is an important factor critical to farmers' participation in cooperatives. However, promoting a devoted membership, the government should increase its efforts in promoting and publicizing the benefits of participation in cooperatives in more effective ways. Future studies could extend our work by expanding the scope of the analysis to include regional and national data, which could provide more insight on the performance of Algerian agricultural policies in expanding growth in the agricultural sector.

Acknowledgements:

This study was partially supported by the National Research Program and the CNEPRU financed by the Ministry of Higher Education and Scientific Research. We would like to thank the Research Team – managed by Professor Brabez, for their help in the field survey for this study.

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¹ For the foundations of the NEI, see Williamson (2000, 2010). For the empirical foundations, see Sykuta (2008), Masten and Saussier (2002), Masten, Meehan and Snyder (1991) and Allen and Lueck (2008).

² The vertical integration in agriculture is a strategy used by farms to gain control over production stages in order to increase its power in the marketplace, reduce costs and earn higher income

³ The educational level is captured by a polynomial variable, it equal to 0 if the farmer have no education, 1 for primary education, 2 for secondary education, 3 for Lycée level, and 4 for an university degree

⁴ Which is about 70 thousands USD