Objectives' alignment between members and agricultural cooperatives

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Abstract: The commitment of members reduces as an agricultural cooperative grows larger. Using a multinomial logit model, we explore how the alignment of members' objectives and those of cooperatives influence member commitment. Our study is based on a sample of 3,205 members of a French multipurpose cooperative. We show that the availability of outlets and supplies to members strengthens it. Furthermore, the adoption of new agricultural practices has a small but significant effect. Other determinants, such as farm organization, or geographical distance to the cooperative headquarters reinforce member commitment.

KEYWORDS: Agricultural Cooperatives; Member Commitment; Farm Innovation;

JEL code: Q13; C35

1. Introduction

The role of agricultural cooperatives is often highlighted in a context of crisis as a way to better balance bargaining power in the agri-food chain. Farmers can either better negotiate prices and quantities in the market through producer organizations (horizontal concentration) or they can form marketing cooperatives to benefit from scale economies and to add value to their members' raw product through innovation and product quality (vertical organization) (Sexton and Lavoie, 2001). To succeed and to meet these goals, agricultural cooperatives need to strengthen their relationships with their members. However this can be challenging when they grow larger and become more complex organizations (Nilsson *et al*., 2009). Indeed, large agricultural cooperatives face a heterogeneous membership which leads them to implement specific mechanisms for collective decisions that can substantially increase costs. They often use the "one man, one vote" principle as a voting scheme. However, in this case, since the median member preferences may not coincide with the mean member preferences, a majority voting scheme might lead to inefficient decisions because the cooperative strategy is not supported by the whole membership. This issue can be exacerbated when some members combine to influence decisions in favor of their own interest (Hansmann, 1988). As a consequence, investor-owned firms (IOF) can prove to be a more efficient organizational structure when membership is heterogeneous (Hart and Moore, 1996). Bontems and Fulton (2009) reinforce this result by showing that the cooperative organizational form is only efficient when not only are the members' goals aligned but also there is no aversion to unequal income redistribution. The objectives' alignment between members and the cooperative reduces informational costs whereas an IOF faces them when it extracts rents from its suppliers. The main issue for cooperatives is to be able to differentiate themselves from IOF and value membership commitment as argued by Fulton (1999, p.418): "*member commitment is critical because it is a measure of how well a co-op is able to differentiate itself from an investor-owned firm (IOF)*." It is thus crucial to focus on member commitment and determine which factors reinforce it. Besides determining those factors, we question how the alignment of the objectives of both members and the cooperative influence member commitment as underlined by Bontems and Fulton (2009) and Fulton (1999). In other words, the goal alignment associates the farmer's choices with the cooperative strategies. This alignment might influence how a member participates in the cooperative and increases its commitment. Because we choose to thoroughly examine the links between members and their cooperative, we use a unique dataset from a large multipurpose cooperative in France. This allows us to confront our results that are based on farmers' choices to the results found in the studies that explore attitudinal determinants (Barraud-Didier *et al.*, 2014; Hernandez-Espallardo *et al.* 2013; Österberg and Nilsson, 2009). Furthermore, we will explore and discuss how innovation can be used as a specific

instrument to align the objectives between the cooperative and its members. The large multipurpose cooperative has recently implemented a new leading strategy based on farm innovation to meet members' demand. The spread of innovative practices would then represent the best illustration of goal alignement between members and the cooperative.

In this paper, we assess the alignment of objectives between the cooperative and its members through four factors: the farm organization, the farm distance to the cooperative headquarters, the availability of outlets and supplies to members and the offer of new agricultural practices. We find that the availability of outlets and supplies has the strongest effect on the economic involvement of the farmers. We also show that farm innovation has a small but significant effect. The adoption of new agricultural practices reinforces the choice of a high economic involvement.

In the following section, we present a literature review covering the key determinants of membership commitment and our hypotheses about goal alignment. Next, we describe our empirical model. In Section 4, we present our results, and Section 5 concludes.

2. Determinants of member commitment

Member commitment includes two dimensions (Barraud-Didier *et al*., 2014; Fulton, 1999; Österberg and Nilsson, 2009; Trechter *et al.*, 2002). First, members can be more or less economically involved as they may not deliver all their products to the cooperative. We will refer to this dimension later on using the term "economic involvement". Second, they may not always strongly participate in cooperative governance (annual meeting attendance, voting participation). As members become more heterogeneous and as cooperatives depart from their founding project, member commitment decreases (Nilsson *et al*., 2009). This decline may then lead to a loss in competitiveness as agricultural cooperatives might lose market shares. For instance, members might leave them because input prices are no longer low enough or output prices are not high enough. Indeed, Hernandez-Espallardo *et al*. (2013) found empirically that the price paid to farmers determined their satisfaction with the cooperative and their intention to continue their membership. The economic involvement of their members is thus a critical issue for cooperatives because it directly affects the level of business sales each year. High economic involvement increases a cooperative's benefits and allows investment or higher returns to members. Hernandez-Espallardo *et al.* (2013) also showed that other determinants highlighted by the transaction cost theory (safeguarding, performance evaluation and adaptation) played an even more relevant role in explaining the members' satisfaction with their cooperative and their desire to continue as members. First, members value all safeguarding measures, such as a secure outlet for their raw products in the short and long run. Second, members value their ability to get the information necessary to keep control over the board of directors. Third, members value the cooperative services as it helps them to meet market requirements and better face

society evolution, for example through the use of more environmental friendly farm practices. The adoption of new agricultural practices may not only favor new practices in accordance with public regulation but they may also improve farm efficiency and create value at the downstream level. Moreover, it can increase member loyalty and play an important role by renewing the cooperative ethos.

Several studies have examined the determinants of member commitment within the cooperative (Barraud-Didier *et al.*, 2014; Cechin *et al.*, 2013; Hansen *et al.*, 2002; Österberg and Nilsson, 2009). Barraud-Didier *et al.* (2014) showed that the two levels of commitment, economic involvement and governance participation, are not necessarily linked. Previous studies have extensively examined how attitudinal determinants influence membership and, more specifically, they have emphasized the role of trust (Barraud-Didier *et al.*, 2012; Hansen *et al*., 2002; Morrow *et al*., 2004; Nilsson *et al*., 2009; Österberg and Nilsson, 2009*)*. Indeed, Roe *et al.* (2004) found that farmers who state that trust in the contractor is important in starting a contractual relationship prefer cooperative forms. Among other key determinants, some are related to the characteristics of the cooperative, such as its size and complexity (Nilsson *et al.,* 2009). Other determinants are associated with the characteristics of the farms or farmers. ***Farm size*** has a positive impact on both participation in governance and economic involvement (Bhuyan, 2007; Gray and Kraenzle, 1998; Klein *et al*., 1997). Pozzobon and Zylbersztajn (2011) demonstrated that the ***distance*** between the farm and the cooperative headquarters negatively influences the level of participation in governance. Many studies have also paid attention to member's ***age*** because of potential intergenerational conflicts. Incumbent members may fear that new members take advantage by free riding the existing investment made by the cooperative and thus the cooperative may underinvest (Rey and Tirole, 2007). Österberg and Nilsson (2009) showed that a member's age is not correlated to any cooperative commitment. However, they also showed that older members may disagree with the implementation of new business practices in the cooperative. For Klein *et al.* (1997), older farmers tend to be more economically involved than younger ones. Trechter *et al.* (2002) found that member commitment diminishes with the level of ***education***, which Bhuyan (2007) confirmed. However, they also indicated that when a cooperative provides education or when members serve or have served on the board of directors or cooperative committee, the level of member commitment is positively affected.

3. Empirical model

3.1. Data

Our study is based on a sample of 3,205 members of a large French multipurpose cooperative located in Western France. A dataset involving more cooperatives could have been useful for the scope of the study but a lot of information would have been lost in the

confidentiality compromise among cooperatives. As a consequence, we have used a database with highly detailed members' information from one of the 10 largest agricultural cooperatives in France. The database provides information on various socioeconomic member attributes in 2013. The cooperative differentiates itself from other agricultural cooperatives by orientating its strategy toward farm innovation. Summary statistics are given in Table 1.

Table 1 about here

Economic involvement is measured using the ratio of *delivered outputs* to *possible outputs*. *Delivered outputs* represent the number of different outputs that a member delivers to the cooperative. *Possible outputs* denote the number of different outputs that a member could deliver to the multipurpose cooperative[1]. Using this measure of economic involvement, the cooperative has reinforced the equality principle among members. It has favored the members who deliver all the outputs that can be delivered regardless of the volume of sales channeled through the cooperative. When farmers produce several outputs, they must decide the number of different outputs they would like to deliver to the multipurpose cooperative. In our sample, the members of the cooperative produce 2.47 outputs on average and deliver 1.84 outputs to the cooperative.

We take into account the farm's *legal status* to consider that several associates may run farms. This aspect is not often examined in the literature. We distinguish four dummies to take into account that farms do not always have a sole owner; some are limited liability companies, others are partnership organizations. The variable *Individual farmers* means individual farm or sole owner. *EARL* often relates to farms managed by the owner's spouse, they are limited liability companies. *GAEC* represents farms that are run by several associates (family members or not). *Various* represents all other forms of French farm legal status, they are little used in the agricultural sector. We expect that individual farmers to be more economically involved in their cooperative since the associates of other farms may want to diversify their vertical relationships (output deliveries and input supplies).

Distance is the distance between the farmstead and the cooperative headquarters. Members are located approximately 87 kilometers from the cooperative headquarters. One quarter of the members have a farm that is located less than 45 kilometers from the headquarters.

[1] The number of existing outputs is higher than the number of possible outputs which is higher than the number of delivered outputs.

In order to take into account for non-member farmers, we measure the density of farmers of a canton who are members of the cooperative. The *canton member density* variable is a *proxi* to capture the social interactions between member and non-member farmers. The variable is constructed using the agricultural census of 2010. It measures by *canton* the number of members over the number of censed farmers in 2010. By doing so, we do not take into account the evolution of agricultural structure between 2010 and 2013 but we assume that it is marginal and similar on every point in the cooperative area. On average, 18% of the farmers of the territory are members of the cooperative for at least half of their activities. The maximum is reached by a canton where 70.8% of the farmers are committed members.

Territorial presence denotes how well the cooperative is established in its territory. We measure this by the ratio of *possible outputs* to *existing outputs* where *existing outputs* denote the number of all the outputs the member produces. A ratio equal to one means that the cooperative offers all the activities the members need. As the ratio decreases, it means that the cooperative is less established in its territory because it does not provide either enough outlets or enough input supplies to its members. On average, the ratio is 0.95. The cooperative is strongly established in its territory but, for 10% of the cooperative members, one third of their outputs cannot be delivered to the cooperative. Even in these cases where the *territorial presence* variable is lower to 1, members can have an *economic involvement* equal to 1 because they are unable to deliver to the cooperative all the products they get on their farm.

Innovation relates to the number of new agricultural practices that members implement on their farm. Each of the new agricultural practices corresponds to a subscribed cooperative service. The multipurpose cooperative offers 16 innovative agricultural practices, of which members implement 1.79 on average.

Formation is a special kind of service which was offered by the cooperative. The service constituted in a one-day formation for fuel-efficient agricultural machinery driving techniques. Only 1% of our population assisted to the formation.

Supply services variable is related to the number of premium supply contract that a member has subscribed during the year. These contracts offer higher prices for the outputs in exchange to higher facilities for cooperative logistic to pick up outputs. These contracts are only available for animal products. The cooperative offers two kinds of supply services but only 0.09 supply services are on average contracted by members.

We also include *membership duration*. In the cooperative we studied, when the legal status of a farm changes (for example, by becoming larger through land purchase, a new activity or the entry of a new associate), the farm is regarded as a new member which

means that shorter membership durations may not unambiguously characterize new members.

We use dummies to take into account farm specialization using *specialization in animal production*, *specialization in crops* and *mixed farming*. In our sample, more than half of the farms are mixed farms (59%) and a third specializes in crops (33%). Only 8% of the farms are specialized in animal production.

In addition to these variables, we use a measure of farm size through the amount of *agricultural area* and the size of the *forage area*. Contrary to previous variables, *agricultural area* and *forage area* are only available for *individual farms*. This specificity is linked to the cooperative policy regarding member information needs. As a consequence, the effect of farm size could only be integrated under the individual farm subsample. For the 1830 *individual farmers* of our sample, agricultural area represents on average 101,53 ha and *forage area* measures 36,86 ha. According to the official statistics of the French Ministry of Agriculture, the individual farms from our sample are much larger than the French average farm size of 2013 (61 ha) and the average farm size of the cooperative region (Agreste, 2015).

3.2. The model

We examine what determines a member's choice about his/her economic involvement in the cooperative using a multinomial probit model (Greene, 2003). A member's utility U_{ij} that is associated to alternative j when the member i has a choice among k alternatives is the sum of a deterministic component V_{ij} that depends on the regressors x_i ($x_i \in X$) and an unobserved random component ε_{ij}.

$$U_{ij} = V_{ij} + \varepsilon_{ij}$$

x_i are case-specific regressors as $V_{ij} = x_i\beta_j$. X is the variable ensemble including our interest variable (i.e. innovation, formation and supply service) and control variable (e.g. distance, the number of existing outputs, the cooperative territorial presence, legal status, a constant, etc.). The introduction of control variable captures a portion of the member population heterogeneity and reduces endogeneity issues. The utilization of the multinomial probit model allows ignoring the assumption that the ε_{ij} terms follow an independently and identically standard type-1 extreme value distribution. Here, we assume that ε_{ij}'s follows a multivariate normal distribution and are correlated across choices.

Farmers have three economic involvement alternatives. Note that economic involvement is based on the number of activities that each member undertakes with the cooperative, which means that this ratio does not capture any information on the farm's size or on member's sales generated with the cooperative. Furthermore, we only examine

the active membership of the cooperative. The cooperative defines an active member as a member whose economic involvement is greater than 0.5. Active members represent approximately 90% of the total sales made by the members' activities. First, they can choose a low economic involvement (alternative 1) which means that the ratio of *delivered outputs* to the *possible outputs* is 0.5. Their second alternative is an intermediate level of economic involvement, the ratio of *delivered outputs* to the *existing outputs* is between 0.5 and 1. And their last alternative (alternative 3) is a high economic involvement where the ratio of *delivered outputs* to the *existing outputs* is equal to 1. We assume that the farmers choose their economic involvement in order to maximize their utility U_{ij}. In our sample, 608 farmers choose a low economic involvement (alternative 1), 714 farmers choose an intermediate economic involvement (alternative 2) and the remaining farmers have a high economic involvement (alternative 3). Note that we do not use a continuous variable for economic involvement variable as members tend to be at both extremities.

We observe the outcome $y_{ij} = j$ when the alternative *j* gives the highest utility among all the alternatives. It follows that

$$\Pr(y_{ij} = j) = \Pr(U_{ij} \geq U_{ik}), for\ all\ k$$

Where $0 \leq \Pr(y_{ij} = j) \leq 1$ and $\sum_{j=1}^{3} \Pr(y_{ij} = j) = 1$

The issue of economic involvement is analyzed by likelihood maximization through a multinomial probit model. In a multinomial probit model, the probability of a member *i* choosing an economic participation *j* is given by a

$$p_{ij} = \int_{w=-x}^{\frac{U_j - U_1}{(\sigma_j^2 + \sigma_1^2 - 2\sigma_{1j})^{\frac{1}{2}}}} \phi(w) \times \Phi\left[\frac{(U_j - U_1)}{[(\sigma_j^2 + \sigma_1^2 - 2\sigma_{1j})(1 - r_j^2)]^{\frac{1}{2}}} - \frac{w r_j}{(1 - r_j^2)^{\frac{1}{2}}}\right] dw$$

Where *j* stands for the level of economic involvement (low, intermediate, high). The base outcome is when members choose a low economic involvement. r_j represents the correlations between the ε_{ij} differences function of σ_k and is a function of σ_j (where σ_j enter in the distribution of the ε_{ij}). Indeed, considering that there are three alternatives, we have $\text{cov}\begin{pmatrix}\varepsilon_1 \\ \varepsilon_2 \\ \varepsilon_3\end{pmatrix} = \begin{pmatrix}\sigma_1^2 & & \\ \sigma_{12} & \sigma_2^2 & \\ \sigma_{13} & \sigma_{23} & \sigma_3^2\end{pmatrix}$. In our case, we can write, for example, $r_2 = (\sigma_2^2 - \sigma_{12} - \sigma_{23} + \sigma_{13})/[(\sigma_1^2 + \sigma_2^2 - 2\sigma_{12})(\sigma_2^2 + \sigma_3^2 - 2\sigma_{23})]^{1/2}$ (. In addition, $\phi(\ )$ and $\Phi(\ )$ represent the normal density and distribution function.

We compute semi-elasticities for each regressor to assess the effects of a relative change in the k^{th} regressor on the probability that alternative j is the outcome.

4. Results

4.1. Member commitment and the alignment of objectives between members and cooperatives

Using four multinomial probit models, we determine what factors influence the economic involvement of members. In Model 1, we only measure the effect of our interest variables. Models 2, 3 and 4 correspond to addition of control variable. Model 4 is the most complete model. Table 2 gives the estimated coefficients with their significance levels. In order to both consider farm size and to conduct some robustness checks, we compute a multinomial probit model over a more homogenous subsample: individual farms. The results for this subsample are provided in the Appendix.

Table 2 about here

The semi-elasticities (E_{jk}) and marginal effects (M_{jk}) of Model 4 are given in Table 3.

Table 3 about here

It seems that membership duration has a small positive effect on economic involvement. The probability of a member choosing a low level of economic involvement decreases with membership duration ($E_{duration,1} = -0.005$). This effect is particularly important for the first years of membership as indicated by the measures of the squared variable. This result is surprising because it is in accordance with previous research (Trechter *et al.*, 2002). It could suggest that new members choose to test the cooperative quality at the first stage with only few activities and to choose to increase their involvement in the second stage. This result could also reflect the preference of younger farms (which have a higher probability to be member of the cooperative for low number of years) for market diversification. However, as our measure is imperfect and the effects are not highly significant, we should be careful with it.

We now explore in more depth how the alignment of objectives between the cooperative and its members influences member commitment. We focus more specifically on the links between the farmers and the cooperative. First, farms face major structural changes. Not only are they growing larger, but most of them also have more than one manager because

of the development of incorporated forms of legal organization. As expected, the probability of a member choosing a high level of economic involvement decreases with the farm's legal status (EARL, GAEC or various) because either the farm associates might not share the same preferences about the cooperative organizational forms or they might prefer to diversify their partnerships. The increase in partnerships forms among farms challenges cooperative organization because it often makes it more difficult to align the objectives between farmers and the cooperative. However, there are many differences according to farm status. GAEC which involves several associates has a lower probability of choosing a high economic involvement ($ME_{gaec,3} = -0.09$), and a higher probability of choosing a low economic involvement ($ME_{gaec,1} = 0.08$) , compared with individual farmers. EARL, which often relates to spouses on a farm, has a lower probability of choosing a high level of economic involvement ($ME_{earl,3} = -0.03$) compared to individual farms. Each associate can thus develop his/her own competence and specialization on the farm. Fulton (1999) emphasized the role of ideology in sustaining membership commitment. Yet, the associates who own a farm might not all share the same preference for cooperative forms. Therefore, the farm associates may want to diversify their outlets in order to satisfy all of them. In addition, they might choose several clients and/or suppliers. For an agricultural cooperative, these changes in farm structure might lead to fewer committed members.

Second, geographical distance can disminish membership commitment (Pozzobon and Zylbersztajn, 2011). Agricultural cooperatives, along with other agri-food firms, are merging and becoming larger companies. Their territorial area is thus wider. Member farms might then be located far away from the cooperative headquarters and might feel more distant from the decision making. Distance from the cooperative headquarters does not affect the probability of a member choosing a low level of economic involvement. The semi-elasticity of a change in distance on the probability that a member chooses a low economic involvement $E_{distance,1}$ is not significant. However, it affects the intermediate and high levels. As the distance between the farm and the cooperative increases, the probability of a member choosing an intermediate level of economic involvement decreasingly increases ($E_{distance,2} = 0.11$ and $E_{distance^2,2} = -0.001$). Similarly, it is more likely that a member has a higher level of economic involvement when distance to the cooperative headquarter decreases ($E_{distance,3} = -0.171$ and $E_{distance^2,3} = 0.001$).

The effect of *canton member density* on member commitment is negligible. Thus, we could assume that external variables play a minor role on membership commitment and that our variables are sufficient to explain member commitment.

Furthermore, the multipurpose cooperative might not offer all the marketing outlets or all the inputs members need. The variable *territorial presence* captures this effect and it appears to be the main determinant of the economic involvement in the cooperative. The

availability of outlets or supplies offered by the cooperative is another dimension of the alignment of objectives. The agricultural cooperative might choose to select its activities in each area, and thus it might not provide all the outlets and supplies its members need. In the vicinity of the headquarters, the multipurpose cooperative will offer a large choice of services. However, in the areas far from the headquarters, the cooperative might only keep the most profitable or the largest activities. As a consequence, in those areas, members might be forced to diversify their suppliers or clients. We find that when the cooperative increases the number of outlets and supplies available to its members (the variable territorial presence increases from 0 to 1), the probability of a member choosing a high economic involvement significantly decreases ($E_{territorial\ presence,3} = -0.93$). This result might seem surprising; however, we suggest a possible explanation. When the cooperative is not well established in a region, the choice of being economically involved does not only rely on economic and rational criteria; cooperative ideology might then play an important role. In the core area of the multipurpose cooperative, a farmer may choose to become a member because the cooperative organization represents the dominant firm. However, these farmers might not share the cooperative ideology and values. In this situation, economic criteria might strongly influence their choice; whereas, in the low cooperative territorial presence area, the cooperative may favor the most profitable outlets or the most efficient activities. As a consequence, the cooperative is more appealing for farmers. It is more likely that members will be more economically involved with the cooperative.

In addition, several variables explore the effect of farm diversification on members' economic involvement. Farms can be multi-output oriented. We show that there is no linear effect of the multi-output orientation of members' farms on their economic involvement. The presence of multi-outputs increases the probability of a member choosing an intermediate level of economic involvement ($E_{existing,2} = 0.11$) and decreases the probability of a member choosing a high level of economic involvement ($E_{existing,3} = -0.10$). Members are less likely to choose a high economic involvement as multi-output orientation enhances the opportunity to diversify the members' marketing channels. However, the farm specialization increases the probability of choosing a high level of economic commitment. The effect is greater when farms specialize in crop production.

Our subsample analysis on the individual farmer population brings similar results regarding previous variables. However, we find opposite results to Bhuyan (2007), Gray and Kraenzle (1998) and Klein *et al*. (1997) for the effect of farm size. We find that, as agricultural area increases, the probability of choosing a high level of economic involvement decreases and probability of choosing a low level of economic involvement increases. The semi-elasticity that a member chooses to have a high economic involvement

decreases by 0.0004, and the semi-elasticity of choosing a low economic involvement increases by 0.0006. We could suppose that larger farms from our sample have higher incentives to diversify their sales. Indeed, portfolio strategy in order to lower the market risk is more interesting for larger farms (Pope and Prescott, 1980). We also could measure farm size through business sales but, contrary to other studies, we only have the information on sales with the considered cooperative, not with the others IOF and cooperative partners. The econometric estimation would have suffered from this endogeneity issue.

4.2. Focus on innovation and member commitment

Innovation is a leading strategy for the multipurpose cooperative. As a consequence, when farmers choose to adopt new agricultural practices, their objectives are aligned with the cooperative ones. We intend to check whether, according to the results found by Klein *et al*. (1997), more innovation involves a higher observable farmers' commitment. The adoption of new agricultural practices can allow members to develop closer relationships with their field representatives who guide them toward technical changes. And thus, a member may feel more committed to the cooperative by subscribing to these services, and may increase his/her economic participation. Furthermore, as the development of the R&D's research on new agricultural techniques is consecutive to members' demand, we expect a higher commitment for members who adopt these techniques. We find that innovation plays a small but significant role in economic involvement. The adoption of new agricultural practices through the purchase of cooperative services increases the probability of choosing a high level of economic involvement ($E_{innovation,3} = 0.03$) and decreases the probability of choosing a low level of economic involvement ($E_{innovation,1} = -0.02$). The results from the subsample (Tables A.1 and A.2) give some complementary insights into innovation. Innovation is not a significant determinant for individual farmers. This result might be linked to the farmers' time constraints. An individual farmer might not have enough time to acquire skills to implement these new practices. We also find that new agricultural practices contribute to increasing the level of economic involvement for the farms that produce both crops and animal production since these farms could diversify more easily their partnership. Innovation might then be a vector of the alignment of goals between the farm and the cooperative through closer relationships with the field representatives. The effect is reversed for the farms that do not benefit from a high cooperative territorial presence. Those farmers only benefit from a reduced choice among all the available new practices as the cooperative has already made a selection of outlets and supplies in those areas.

It would be interesting to further examine how innovation can be a possible force for strengthening membership involvement. To date, there has been little research examining the role played by farm innovation. Karantininis *et al.* (2010) actually showed that the

organization of the agri-food industry (in terms of vertical integration and contractual arrangements) matters for innovation. Agricultural cooperatives are a specific coordination scheme and, when they are involved in innovation, welfare can be improved. Giannakas and Fulton (2005) demonstrated that agricultural cooperatives increase the rate of innovation while reducing the price of agricultural inputs. Drivas and Giannakas (2010) also found a positive effect on innovation activity when consumer cooperatives exist in the market. These two theoretical studies underline the role of cooperatives, as compared to IOF, in innovation in the market. However, they did not examine how innovation affects membership commitment. To our knowledge, few studies have examined the interaction between economic involvement and innovation. Only, Klein *et al.* (1997) showed that farmers who believed that cooperatives offered more innovative services were more economically involved in these cooperatives. Here, we highlight the role of farm innovation in strengthening member commitment. However, we were only able to use cross-sectional data from 2013 since the new agricultural practices have only recently been implemented in the cooperative. As, innovation is a long-term strategy, it would be interesting to further investigate how farm innovation spreads among all the members and how it affects economic involvement over years using panel data.

The *formation* variable has no impact on the probability to choose an economic involvement model. Indeed, if the theoretical impact indicates a higher propensity to engage for formed farmers (who share the cooperative concerns), the offered formation has only been done by 1% of the population.

The *supply services* variable has a similar role as the *innovation* one. The subscription to a supply service linearly increases the probability to be in a higher economic involvement level ($E_{supply\ services,3} = 0.23$). The subscription to a supply service decreases the probability to be in the lowest economic involvement level ($E_{supply\ services,1} = -0.21$). Indeed, innovation is a special kind of services which have been offered by the cooperative in order to differentiate from its concurrence through "greener" production. Anticipation of higher prices coupled with cost reduction is supposed to substantially increase the activity margins. However, the expected effect for supply services on activity margins is the same: supply service subscribers increase their expected utility and could have incentives to increase their economic involvement in order to benefit from the whole potential of these services.

5. Conclusion

We examine what influences member commitment in a large multipurpose cooperative that faces heterogeneous membership in order to better understand the links between members and their cooperative. As the alignment of objectives is a key issue to increase cooperative efficiency, we examine four factors that may have an influence on member commitment.

We find that the availability of outlets and supplies has a strong effect on members' economic implication. However, we find that a reduced choice of activities has a positive effect on member commitment. In addition, we showed that the adoption of innovative agricultural practices plays a small but significant role in the level of members' economic commitment. It increases the probability of choosing a high level of economic involvement and decreases the probability of choosing a low level of economic involvement. Other determinants, such as farm organization, the distance to the cooperative headquarters, member sales with the cooperative, and the multi-output farm strategy, have an effect on the level of member commitment. Among these determinants, only the multi-output farm strategy and the distance to the cooperative headquarters do not have a linear effect on economic involvement. It is more likely that members who produce several outputs choose an intermediate level of economic involvement. Distance does not influence the probability of members choosing a high level of economic involvement whereas it does affect the probability of choosing a low or an intermediate level of economic involvement.

This empirical study provides new insightful results. First, we focus on the relationships between the cooperative and its members that the reason why we use data from a large multipurpose cooperative. It allowed us to get information on members' choices and to confront our results with those obtained through surveys. Second, the study provides promising results about how farm innovation can play a key role in aligning members' goals with the ones of the cooperative. Future research would examine how innovation spreads among members and whether it reinforces member commitment over time.

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Table 1. Summary statistics

(N = 3205)	Mean	Std dev	Q1	Median	Q3
Economic involvement	0,84	0,21	0,67	1	1
Innovation	1,8	1,59	1	1	3
Formation	0,01	0,12	0	0	0
Supply services	0,09	0,3	0	0	0
Existing outputs	2,48	1,24	1	2	3
Farm specialization					
Mixed farming	*0,59*	*0,49*	*0*	*1*	*1*
Specialization in crops	*0,33*	*0,27*	*0*	*0*	*1*
Specialization in animal production	*0,08*	*0,47*	*0*	*0*	*0*
Legal status					
Individual farmers	*0,31*	*0,46*	*0*	*0*	*1*
EARL	*0,38*	*0,49*	*0*	*0*	*1*
GAEC	*0,23*	*0,42*	*0*	*0*	*0*
Various	*0,08*	*0,27*	*0*	*0*	*0*
Territorial presence	0,94	0,15	1	1	1
Membership duration	17,27	10,71	7	17	25
Distance (100km)	0,9	0,56	0,47	0,79	1,28
Canton member density	0,18	0,12	0,05	0,15	0,27

Table 2. Estimation of the multinomial probit models

	Model 1			Model 2			Model 3			Model 4		
Economic involvement	Low *(Ref)*	Med.	High	Low *(Ref)*	Med.	High	Low *(Ref)*	Med.	High	Low *(Ref)*	Med.	High
Innovation		0,114 ***	-0,008		0,047	0,146 ***		0,056 ***	0,023		0,191	0,1154 ***
		(0,026)	(0,024)		(0,029)	(0,028)		(0,027)	(0,024)		(0,031)	(0,028)
Formation		0,086	-0,103		-0,049	0,253		0,038	-0,057		-0,006	0,314
		(0,343)	(0,331)		(0,357)	(0,349)		(0,349)	(0,335)		(0,36)	(0,349)
Supply services		1,084 ***	0,641 ***		0,84 ***	1,401 ***		0,895 ***	0,789 ***		0,746 ***	1,467 ***
		(0,168)	(0,165)		(0,179)	(0,177)		(0,17)	(0,167)		(0,181)	(0,179)
Existing outputs					0,723 ***	-0,188 **					0,618 ***	-0,214***
					(0,055)	(0,05)					(0,059)	(0,053)
Farm specialization												
Mixed farming					*Ref*	*Ref*					*Ref*	*Ref*
Specialization in crops					0,862 ***	1,871 ***					0,97 ***	2,131 ***
					(0,162)	(0,128)					(0,18)	(0,139)
Specialization in animal					0,271	0,74 ***					-0,042	0,806 ***
production					(0,203)	(0,152)					(0,207)	(0,159)
Legal status												
Individual farmers					*Ref*	*Ref*					*Ref*	*Ref*
EARL					0,064	-0,108					0,081	-0,131
					(0,12)	(0,101)					(0,127)	(0,104)
GAEC					-0,357 ***	-0,501 ***					-0,27 *	-0,547
					(0,137)	(0,122)					(0,143)	(0,125)
Various					-0,305	-0,334 **					-0,267	-0,365 **
					(0,206)	(0,163)					(0,213)	(0,166)
Territorial presence								2,345 ***	0,507 **		2,712 ***	-1,926 ***
								(0,428)	(0,252)		(0,523)	(0,297)
Membership duration								0,046 ***	0,013		0,034 *	0,026 **

								(0,014)	(0,011)		(0,016)	(0,013)
Membership duration ²								-0,001 ***	-0,0004		-0,001 *	-0,0008 **
								(0,0003)	(0,0003)		(0,0004)	(0,0003)
Distance								1,32 ***	0,95 ***		0,344	-0,702 **
								(0,378)	(0,26)		(0,405)	(0,302)
Distance ²								-1,304 ***	-0,188 *		-0,65 ***	0,227 *
								(0,114)	(0,114)		(0,22)	(0,13)
Canton member density								-0,047	0,95 ***		-0,316	-0,308
								(0,388)	(0,313)		(0,439)	(0,357)
Const		-0,194 ***	0,928 ***		-2,289 ***	0,712 ***		-2,742 ***	-0,466		-4,46 ***	2,839 ***
		(0,062)	(0,054)		(0,182)	(0,153)		(0,493)	(0,315)		(0,639)	(0,419)
Number of observation	3205			3205			3205			3205		
Log likelihood		-2983,56			-2325,98			-2748,67			-2200,66	
LR chi2		98,98 ***			1020,91 ***			332,32 ***			1069,07 ***	

*, **, *** signifiance level at 10%, 5% and 1%

Table 3. Average change in the probability of choosing a low, intermediate or high level of economic involvement (Model 4)

Economic involvement	Low	Intermediate	High
Semi-elasticities			
Innovation	-0,018 ***	-0,011 ***	0,029 ***
Formation	-0,034	-0,029	0,063
Supply services	-0,207 ***	-0,02	0,227 ***
Existing outputs	-0,126	0,111 ***	-0,098 ***
Territorial presence	0,054	0,574 ***	-0,928 ***
Membership duration	-0,005 **	0,003	0,002
Membership duration ²	0,0001 ***	-0,0007	-0,0001
Distance	0,057	0,113 **	-0,171 ***
Distance ²	0,0001	-0,001 ***	0,001 ***
Canton member density	0,07	-0,063	-0,007
Marginal effects			
Farm specialization			
Mixed farming	*Ref*	*Ref*	*Ref*
Specialization in crops	-0,294 ***	-0,046 **	0,34 ***
Specialization in animal production	-0,087 ***	-0,078 ***	0,165 ***
Legal status			
Individual farmers	*Ref*	*Ref*	*Ref*
EARL	0,01	0,024	-0,033 *
GAEC	0,077 ***	0,009	-0,086 ***
Various	0,056 **	-0,007	-0,049 *

*, **, *** signifiance level at 10%, 5% and 1%

Appendix

Table A1. Estimation of the multinomial probit model on individual farm subsample			
Economic involvement	Low *(Ref)*	Med.	High
Innovation		0,032	0,136 ***
		(0,041)	(0,036)
Formation		0,093	0,219
		(0,432)	(0,419)
Supply services		0,643 ***	1,28 ***
		(0,232)	(0,224)
Existing outputs		0,543 ***	-0,142 **
		(0,077)	(0,069)
Farm specialization			
Mixed farming		*Ref*	*Ref*
Specialization in crops		0,515 *	2,071 ***
		(0,268)	(0,19)
Specialization in animal production		-0,712 **	0,129
		(0,315)	(0,235)
Agricultural Area		-0,0039 ***	-0,0035 ***
		(0,0014)	(0,001)
Forage Area		0,0018	0,0012
		(0,0021)	(0,0017)
Territorial presence		2,748 ***	-1,33 ***
		(0,684)	(0,391)
Membership duration		0,036 *	0,017
		(0,0214)	(0,016)
Membership duration ²		-0,0011 *	-0,0007 *
		(0,0005)	(0,0004)
Distance		0,735	-0,555
		(0,661)	(0,445)
Distance ²		-0,112 **	0,0034 *
		(0,054)	(0,002)
Canton member density		0,075	0,108
		(0,,586)	(0,463)
Const		-4,31 ***	2,092 ***
		(0,844)	(0,551)
Number of observation	1830		
Log likelihood	-1255		
LR chi2		533,18	

*, **, *** signifiance level at 10%, 5% and 1%. Standard errors in brackets.

Table A2. Average change in the probability of choosing a low, intermediate or high level of economic involvement on individual farm subsamble

Economic involvement	Low	Intermediate	High
Semi-elasticities			
Innovation	-0,017 ***	-0,007	0,025 ***
Formation	-0,03	-0,006	0,036
Supply services	-0,182 ***	-0,019	0,201 ***
Existing outputs	-0,016	0,092 ***	-0,077 ***
Agricultural Area	0,0006 ***	-0,0002	- 0,0004 *
Forage Area	-0,0002	0,0002	0,0001
Territorial presence	-0,01	0,521 ***	-0,511 ***
Membership duration	-0,004	0,004	0,0002
Membership duration ²	0,0001 **	-0,0001	-0,0001
Distance	0,02	0,16 **	-0,177 **
Distance ²	0,0001	-0,01	0,0014 ***
Canton member density	-0,017	0,0015	0,015
Marginal effects			
Farm specialization			
Mixed farming	*Ref*	*Ref*	*Ref*
Specialization in crops	-0,26 ***	-0,108 ***	0,372 ***
Specialization in animal production	0,027	-0,116 ***	0,089 **

*, **, *** signifiance level at 10%, 5% and 1%