SOME LIKE TO JOIN, OTHERS TO DELIVER. AN ECONOMETRIC ANALYSIS OF FARMERS' RELATIONSHIPS WITH AGRICULTURAL CO-OPERATIVES

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Abstract

In many European countries, farmers are a member of a processing or marketing co-operative, and most of these farmers also deliver their products to that co-operative. However, an extensive dataset of Italian farmers shows that not all members deliver to their co-op, and that there are also non-members that deliver. Using theoretical arguments from the New Institutional Economics literature, a bivariate probit model is estimated to explain co-op membership and delivery jointly. Results show that membership and delivering are indeed related, but also that different factors influence farmers' decisions on membership and delivery.

Keywords: Co-operatives, New Institutional Economics, bivariate probit, Italy

1. INTRODUCTION

In many European countries, farmers join forces in agricultural co-operatives (co-ops) for processing, marketing, or provision of inputs. Usually, farmers join a co-op by becoming a member. Besides this decision on co-operation membership, farmers also decide on where to deliver their products for processing, to the co-operative or to a private processing company. One would expect that members also deliver to their co-op and non-members to private processing companies. However, an extensive dataset on Italian farmers and co-operatives shows that this is not automatically the case. Some co-op members do not deliver to their co-op, whereas on the other hand there are also non-members delivering to co-ops. This leads to a number of interesting research questions. For example, which farmers become member of a co-operative and why? Which farmers deliver to a co-operative and why? Why are co-op membership and delivering not always related? Or even stronger, is co-op membership a determinant of co-op delivery? These research questions are particularly relevant if we look at the role of co-operatives in the Italian food sector. In Italy, about 783 thousands farmers participate in one or more agro-food cooperatives, of which there are more than 12 thousand (Italian Ministry of Agriculture, Food and Forestry, 2009)[1]. In northern Italy, most co-operatives are active in the dairy sector, whereas in southern Italy they arise mostly active in the fruits and vegetables, and the beverage sectors (ISTAT, 2001b). Italian agro-food co-

[1] It is not possible to calculate the exact number of farmers which are members of agro-food cooperatives due to multiple memberships and different fiscal regime and sector of activities. In this case we use the data published by the Italian Ministry of Agriculture, Food and Forestry in 2009 which relate to the information provided by the main umbrella organizations operating in the Italian agro-food sector.

operatives represent a relevant component of the European co-operative movement, being forth in terms of turnover and second in term of employees (Italian Ministry of Agriculture, Food and Forestry, 2009).

Despite the economic importance of agro-food co-ops little research is available that investigates why farmers are a member of and/or deliver to an agricultural co-operative. In this paper, we analyse both separate decisions jointly and there are good theoretical reasons to do so. For example, new institutional economics relates these decisions to farmers' choices on specific governance structures that maximize the return on transactions (i.e. expected residual income), conditional on both transacting parties and product features (Williamson, 1987; Ménard, 2000). Hence, different alternative governance structures (i.e. spot markets, contracts, hybrid forms or hierarchies) can be used in order to maximise the residual income (value) creation (Ménard, 2000; Hendrikse, 2007). This decision is taken mainly in (local) agricultural exchange contexts, where farmers may face a variety of alternative governance solutions with different down-stream parties (Karantininis and Zago, 2001). Given the limited and asymmetric contractual power of farmers, this decision is often modelled as a mixed oligopsony where there is (at least) competition between a co-operative and an investor-owned entity (IOE) (Karantininis and Zago, 2001; Leathers, 2006). Farmers that build up their marketing networks are therefore faced with different typologies of parties, that have implications for their transactions (Hendrikse and Veerman, 2001; Kalogeras et al., 2007; Karantininis, 2007). Contractual and membership relations with co-ops are part of these networking decisions that could substantially differ from networking with an IOE (Staatz, 1987; Hendrikse and Veerman, 2001; Bijman, 2002). This difference is mainly because in an IOE investors are also owners of the firm, whereas within a co-op the users of a firm's services acquired ownership rights (LeVay, 1983; Staatz, 1987). Therefore co-operatives may adopt restrictive rules to regulate membership and service uses (i.e. conditional on the kind and number of owners) (Leathers, 2006). In a co-op owners benefit mainly from using the services, while in an IOE owners benefit from returns on investment. So, while in an IOE the investors hold the residual income rights, in a cooperative these rights are held by the users (LeVay, 1983; Staatz, 1987; Bijman, 2002). The more a member of a co-operative its direct and indirect services, the higher his benefits (Bijman, 2002). Hence, with co-op membership farmers participate to the patronage of the firm and to the decision-making process, becoming residual claimants of the returns from co-op activities (Fulton, 1999). The way members obtain the residual return is not based on their ownership *per se* (as in the equity-based

mechanism of IOE), but on the base of product-delivery (service use) to the co-op (Skykuta and Cook, 2001). The farmer's right to deliver could be dominated by or conditional on the membership status, depending on the contractual mechanism and formal organizational structure of the co-op. Moreover, membership could imply a fixed amount (and/or quality) of production to be delivered. A co-op can also apply price-discrimination rules between members and non members, on the basis of quantity or quality of the delivered products (Lopez and Spreen, 2008).

Following this theoretical arguments the aim of this paper is to empirically analyze the driving factors affecting co-op membership and delivery decisions of farmers in Italy. The paper is organized as follows. Section two describes the different relation farmers can have with a co-op and provides a theoretical framework using elements of New Institutional Economics. Section three discusses the bivariate probit framework that is used in estimation, with special attention to the endogenous dummy variable for co-op membership that is used to explain co-op delivery. Section four describes the dataset used and gives numbers on the different relations that Italian farmers have with co-ops. Results are discussed in section five, and conclusions are drawn in section six.

2. MODELLING FARMERS' DECISIONS TO NETWORK WITH A CO-OPERATIVE

In this study we assume that members of a co-operative can have the right to not deliver (temporarily), thereby incurring the cost of co-op membership but without benefiting from delivery opportunities to the co-op. This could be the case when farmers face production difficulties, or when they are looking for flexible commitment. In the latter case, they may still be interested in being a member of a co-op for reasons other than delivery benefits, such as special fiscal regimes and tax reductions, public support opportunities, or for political and social reasons. Therefore, farmers' networking with a co-op can be modelled as a two- part contract on membership and delivery with the following cases:

a) membership with production delivery (*strong membership*)

b) membership without production delivery (*soft membership*)

c) non-membership with production delivery (*shadow membership*)

d) non-membership and no delivery (*no membership*)

But what are important factors influencing these decisions? In table 1 we present a number of hypotheses and related variables that we consider as the most important in explaining farmers` decisions on co-op membership and product delivery. A basic assumption is that the choice of membership is related to the increase of specificity involved in the transaction. As showed originally by Williamson (1991) and more recently by Ménard (2004; 2007) the decision to use hybrid forms (i.e. relational networks, co-ops) or vertical integration is led by the increase of mutual dependency (specificity) between the involved parties. In this case co-op membership starts to be an attractive solution to carry out transactions the more this mutual dependency increases and the more hierarchy (power and centralized coordination) is required to regulate cooperation and competition within the organization of the transactions (Ménard 2004; 2007; Williamson, 2005)[2]. Hence one way to consider this decision making process is to look at the specificity involved by farmers[3]. We define three dimensions of this specificity by looking at (a) *location specificity*, (b) *asset specificity*, and (c) *relational specificity*.

[Include table 1 here]

The first major dimension refers to the importance of farmer's location in his likelihood to network with a co-op. The specificity of the location is strongly related to the structure of the local markets, the social and institutional characteristics of the context and the degree of geographical isolation. Karantininis and Zago (2001), for example, pointed out that the structure of the local markets (i.e. the number/concentration of competing co-ops and IOEs) is relevant in understanding farmers' likelihood to join agricultural co-operatives. Farmers can join or form a co-op as a local collective reaction to the increasing (monopsonist) bargaining power of IOEs (Cook, 1995). Hence, the fewer alternatives are present for delivering agricultural products the more likely farmers will be member of a co-op and deliver to them.

The second element we consider is the influence of social embeddedness and the institutional environment in farmer networking choices (Williamson, 2000). In this case issues like trust, reciprocity, and attitude to cooperate within a specific social context, as part of the unwritten

[2] Both Ménard (2004) and Williamson (2005) consider the contemporary presence of competition and cooperation a main characteristic of hybrid forms such as producer associations and cooperatives. For a further discussion the reader can refer to Karantininis (2007, pp. 20-23).

[3] To fully understand farmers co-op relationships it is necessary to know in detail the type of mutual dependency involved and to include other dimensions of the relation such as the frequency of transactions, the incentive structures, the degree and type of pooled resources, the uncertainty involved, the type of commitment required. It would be also relevant to know the "nature" of the co-op and how it is perceived by its members, whether or not it is more organized as a hierarchy, thus closer to an IOE type of organization, or more like a relational network or other more flexible type of hybrid forms. For a detailed argumentation see Ménard (2004; 2007) and Ménard and Valceschini (2005). For the purpose of this paper and given the limitation of the available empirical information we were forced to limit our theoretical analysis only to farmer-related specificity issues.

and informal rules, could be relevant to understand network formation and functioning at local and regional level (Fulton, 1999; Karantininis, 2007). In the case of farmers' cooperative networking the presence of such social norms facilitates co-op formation and, moreover, the degree of commitment and loyalty the members put into it (Fulton, 1999; Hansen et al., 2002). Moreover ideology, cultural, political and religious believes are also considered as extremely relevant to explain differences in farmers participation into co-op networking (Jones et al., 1997; Fulton, 1999; Karantininis, 2007). Also the way policy interventions, laws, constitutions and the juridical system regulate farmers' participation in an agricultural co-op (and/or other arrangements) could be relevant since formal constraints or opportunities may influence their networking participation decisions (Van Bekkum, 2001). In this sense the regional legislation can have a major role in determining differences in farmers contractual decisions (Van Bekkum, 2001).

The third element is related to geographical characteristics of farm location (i.e. living in a mountain or remote rural area). Hence *ceteris paribus* our hypothesis is that the more farmers are isolated, the more they are likely to be member and to deliver to a co-op if private-based governance structures (i.e. contracts with local IOEs) are not available locally[4].

Asset specificity and mutual dependency form the second major dimension in determining farmers' likelihood to network with agricultural co-ops. Co-ops have an advantage with respect to transactions that involve specific joint-investments, and when parties are involved in long-term relations (Ménard, 2004). In these cases co-ops can rely on important assets which act as informal safeguards (Karantininis, 2007). Fulton (1999) used the "glue of member commitment" metaphor to describe the relevance of these informal safeguard conditions such as the presence of spontaneous supports and the use of associations (Williamson, 2005). Moreover agricultural co-ops can use other signals than prices to coordinate resource allocation more than IOEs. For example they can rely on reputational effects, reciprocity and trust (Jones et al., 1997; Fulton, 1999). For example members can accept lower prices in a given period in order to gain higher return in the future. At the same time they can be open to non-members delivery, reducing their short-term return.

We use size, specialization/diversification, human capital and organizational complexity as components of farmer's asset specificity. As showed in table 1 we assume a positive relation between increased specificity and farmers' likelihood to participate in agricultural co-ops.

[4] Whether or not a co-op could be an attractive solution for farmers' transactions in a isolated condition is mainly interconnected to and depending on the structure of the local markets.

Note that also a negative relation might emerge if the increased specificity forces farmers to find private parties that are better suited to their needs. In the former case we can argue that a "strategic complementarity" between farmers and co-op exists, while in the latter there are "strategically substitutes".

Finally, we include the relational specificity component to understand how intense the dependency between the farmers' networking activities and the co-op is. In this case if co-op membership is also or mainly used for non-agricultural related issues (i.e. policy-seeking strategies, local social dynamics, etc.), and alternative (social or professional) networks are present, then we expect a lower (higher) likelihood of farmers to be a member of a co-operative if these different networks are substitutes (complements). We also expect that delivery decisions are less affected by these issues compared to membership decisions.

3. EMPIRICAL APPROACH

Since both dependent variables are binary, and assuming that membership and delivery 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. An initial complication is that in the probit equation for delivery, we assume that co-op membership is also an explanatory variable, leading to a probit equation with an endogenous binary regressor. This leads to the following bivariate probit specification:

$$\begin{aligned} &memb^* = x_1'\beta_1 + \varepsilon_1 , && memb = 1 \quad if\ memb^* > 0 , 0\ otherwise \\ &del^* = x_2'\beta_2 + \gamma memb + \varepsilon_2 , && del = 1 \quad if\ del^* > 0 , 0\ otherwise \\ &E(\varepsilon_1) = E(\varepsilon_2) = 0; Var(\varepsilon_1) = Var(\varepsilon_2) = 1; Cov(\varepsilon_1, \varepsilon_2) = \rho \end{aligned} \qquad (1)$$

The latent variables $memb^*$ and del^* can be interpreted as the unobserved propensity to be a co-op member, or to deliver to a co-op, respectively. Both propensities result from a comparison of all benefits and costs of co-op membership and delivery as described in the previous section. These propensities are often interpreted as net utilities (difference between utility of a certain action and a related threshold), of co-op membership and delivery in our case. The covariance term ρ indicates that the equations for co-op membership (*memb*) and delivery (*del*) may be related via their residual terms, i.e. they may have measurement errors, shocks or missing covariates in common. There may also be self-selection of co-op members in delivery. In that case unobservables relating to co-op membership, which are included in ε_1, will also relate to delivery via ε_2. Since membership is also explicitly included in the second

equation, the residual correlation across equations causes *memb* to be endogenous in the equation for delivery.

However, Greene (1998; 2008: 823-824) shows that in full information maximum likelihood estimation of a bivariate probit model, with the second equation having the first dependent variable as endogenous regressor, one can ignore the endogenous nature of that binary regressor and proceed as if there were no endogeneity problem. The reason for this is that in estimation a log-likelihood is maximised that is based on the joint probability distribution defined by the different combinations of the binary variables, whereas least squares or GMM estimation is based on sample moments that do not necessarily converge to zeros. In the log-likelihood the joint probabilities of the four membership cases as described in the previous section appear:

$$
\begin{aligned}
P_{11} &= \Pr(memb=1, del=1) = \Phi(x_1'\beta_1,\ x_2'\beta_2 + \gamma memb, \rho) && \text{strong membership} \\
P_{10} &= \Pr(memb=1, del=0) = \Phi(x_1'\beta_1,\ -x_2'\beta_2 - \gamma memb, -\rho) && \text{soft membership} \\
P_{01} &= \Pr(memb=0, del=1) = \Phi(-x_1'\beta_1,\ x_2'\beta_2 + \gamma memb, -\rho) && \text{shadow membership} \\
P_{00} &= \Pr(memb=0, del=0) = \Phi(-x_1'\beta_1, -x_2'\beta_2 - \gamma memb, \rho) && \text{no membership}
\end{aligned}
\qquad (2)
$$

4. DATA AND SPECIFICATION OF THE MODEL VARIABLES

The data used to estimate the model are from a sample of 15,383 farmers present in the 2006 Italian Farm Accountancy Data Network (FADN). The two dependent variables (co-op membership and delivery) are derived from information on membership of at least one marketing or processing co-op, and revenues from delivering to these co-ops. As showed in table 2 about 1 out of 3 of the farmers within the sample are co-op member. Only 10.4% of the sample farmers have what we defined as “strong membership” (membership plus deliveries), while about 21% of the farmers are “soft member”, 4.1% are “shadow member” and 64.5% of the sample farmers are “non-member”. Interestingly, two-thirds of the co-op members do not deliver to a co-op. On the other hand, of the 2231 farmers that deliver to a co-op, 635 (28.5%) are not a member.

[Include table 2 here]

Based on the conceptual framework presented in section 2 we selected a number of variables that relate to the three dimensions of specificity and that are assumed important in explaining farmers' decisions on co-op membership and delivery. Table 3 presents the descriptive statistics of these explanatory variables. To capture the local market structure we include a number of variables. First, the number of cooperatives in the total number of food firms in the region (*reg_coop_id*) in order to capture the presence and competitive share of co-ops. Second, we consider the number of co-ops in specific food sectors as a ratio to the total number of co-ops and multiplied this by specialisation dummies for farms, since e.g. dairy processing co-ops are only relevant for specialised dairy farms and not for other specialised farms (e.g. olive oil production). This was done for 7 main sectors of the Italian agro-food industry, viz. fruit and vegetables (*d_fruitveg*), meat and fish (*d_meatfish*), vegetable oil (*d_vegoils*), dairy (*d_dairy*), grain (*d_grain*), animal feed (*d_feed*), and drinks and beverages (*d_drink*) productions. The data shows that the concentration of co-ops within Italy is very heterogeneous since the national average is 3.6 co-ops out of 100 food firms, while the maximum concentration is around 11%, for example in Valle d'Aosta, and around 8% in Emilia-Romagna.

The second element we considered to measure local specificity is the social and institutional context in which farmers operate. Therefore, we use the index of agricultural employment at municipal level (*agr_empl*) to approximate a more agricultural oriented area, which we expect to have a higher rate of participation in agricultural co-ops compared to other areas. We also use a dummy variable (*south*) to indicate if the farm is located in the south of Italy or in center-north. The use of this variable is twofold. On the one hand this dummy should capture the relatively weaker co-operative culture showed by southern Italian farmers compared to farmers located in other regions (Menzani and Zamagni, 2009). On the other hand, this dummy is included to represent the socio-economic differences that historically characterize south and north Italy. About 27.3% of the farmers in the sample are located in southern Italy. The third group of variables relates to geographical isolation and also represents interesting socio-economic and cultural information related to the previous issue. We used five dummy variables (*periurb, rur_int, rur_rem, hill, mont*) to indicate whether a farmer is located in a peri-urban, intermediate rural, or remote rural area, and if it operates in a hilly or mountainous zone. The latter distinction is based on a classification provided by the Italian Ministry of Agriculture, Food and Forestry that was used to cluster Italian municipalities during the 2007-2013 round of Rural Development Planning implementation. About 28% of the farmers

operate in peri-urban or rural remote areas, while 34% live in an intermediate rural area. About 20% of the farmers operate in a mountainous zone while 47.2% in a hilly area. The second dimension of specificity we defined is asset specificity. To capture this dimension we use a large number of indicators provided by the FADN relating to (1) size, i.e. agricultural area (*uaa*) and total quantity of fixed assets (*fixasset*), (2) agricultural specialization in different crops and animal-breeding (*arabl_spec, hort_spec, perm_spec, livstock_spec*), (3) diversification such as on-farm processing (*dprocess*) and organic production (*organic*), and (4) human and organization specificity, such as farmer's age (*age*), whether the farm manager works on the farm (*manage*), presence of successor (*success*), use of a business plan (*dev_plan*), use of accountancecy service (*acc_serv*), and total quantity of labour provided by the farm family (*tot_lab*).

[Include table 3 here]

The final group of variables refers to the relational specificity of the co-op. We used information related to farmers' association membership (*ass_prod*), and participation in other type of social networks (*other_netw*). About 52% of the sample is affiliated to at least one farmers' association and 44.3% showed other social networking activities.

5. EMPIRICAL RESULTS

The results of the econometric model are presented in table 4. As stated in section two, a general hypothesis of this study is that farmers' decisions on co-op membership and deliveries to a co-op are related. The estimation results seem to confirm this hypothesis in two different ways. First, endogenous co-op membership in the equation for delivery has a significantly positive impact on delivery. Second, the correlation coefficient of the residuals (ρ) is significantly different from zero, indicating that there is correlation between the unobservables that relate to co-op membership, and those that relate to delivery. This also implies that membership is an endogenous variable in the equation delivery. Both issues underline the need for the bivariate probit specification.

[Include table 4 here]

Besides this general hypothesis on the relation between co-op membership and delivery, in section two we also discussed the impact of three different components of specificity that in general were assumed to affect both co-op membership and deliveries. (see table 1). More specifically, the first hypothesis (H1) states that *location specificity matters* and particularly the structure of the local markets, the social and institutional context, and the degree of geographical isolation matter. Wald tests on the joint significance of the related variables clearly indicate that in general for both co-op membership and delivery location specificity matters. Looking more in detail to the specific variables we see some correspondence but also differences in the impact of these variables on membership and delivery decisions. First, the concentration of co-ops has a significant positive impact on both co-op membership and delivery. So, the more co-ops relative to the number of private processors the more often farmers are member and the more often they deliver. Although this is rather plausible, it need not always be necessary. If there are many co-operatives relative to private food companies, the need to be a member of or to deliver to a co-op may decrease, since the already large number of co-ops will safeguard competitive prices for farmers. To check this argument we also estimated a variant of the model with a quadratic concentration variable added. Although, this resulted in individually insignificant concentration parameters (though jointly significant), indeed the parameters suggest an increasing effect at a decreasing rate of co-op concentration on both membership and delivery.

Looking at the concentration of specific co-ops for different sectors, we see some mixed results. For co-op membership all sector-specific concentration variables are significant, with a larger concentration having negative impact on membership for meat and fish, dairy, and feed products, and a positive impact for higher concentration of fruit and vegetables, vegetable oils, grain and dairy. For delivery only concentration of meat and fish, vegetable oils, dairy, and drinks co-ops have a significant impact.

A second group of variables was used to capture the role of the social context. To be settled in an area where the local economy is dominated by agricultural activities (*agr_empl*) increases the likelihood of farmers to use a soft membership, i.e. being a member but not delivering. Farmers in southern Italy do not differ co-op membership, but do deliver less to co-operatives. Hence, while the social context is important to explain attitudes towards the co-op movement this is not explained exclusively by a North-Center/South divide. In a more agriculture-oriented area, the presence of a co-op is more likely to attract farmers' membership probably

due to cultural and socio-political reasons and due to co-op local (economic) market power. This interpretation also extends to the third block of variables that refer to the geographical isolation. It is not surprising that membership is more likely in hilly and remote rural areas, where agriculture is the most relevant activity. Interestingly however, delivery is higher in peri-urban and intermediate regions.

The second specific hypothesis (H2) in section two stated that *asset specificity* matters. Again, for both membership and delivery, all variables that were assumed to be related to asset specificity are jointly significantly different from zero. We considered different dimensions like size, specialization, and human capital and organizational specificity. Farm size in terms of acreage does not affect decisions on co-op networking, but farm size in total assets does. Farms with more assets are slightly less inclined to be a member of a co-op, but do deliver more often. Especially the positive relation with delivery confirms the hypothesis that farms that invest a lot may seek safeguards from a co-op. The differences between farmers in different sectors are also interesting. Compared to mixed farms, specialized arable, horticultural, permanent crop farmers are less often co-op member. Only livestock farmer are significantly more often member. All these specialization dummies have a negative impact on delivery. In other words, mixed farms are delivering more often to co-operatives then specialised farms. Specialised farms may have more bargaining power and less need for co-operatives than mixed farms that supply various products.

On-farm processing leads to a slightly higher probability of both co-op membership, and delivery. Organic farmers are not different in their decisions on co-op networking compared to their conventional colleagues. Age, farm ownership and working on the farm, presence of a successor, having a business plan, and using accountancy services all have a positive impact on co-op membership. Most of this indicates that more modern and viable farms often are co-op member. However, with respect to delivery only working on the own farm, and having a business plan has a positive impact on delivery. In other words, most of these modernity characteristics do not seem to lead to co-op delivery.

The final hypothesis (H3) was on *relational specificity*. We expected more synergy (hence complementarity) between an overall inclination to network and membership decisions. The results confirm that both agricultural and social related networking have a significant positive impact on membership decisions.

6. DISCUSSION AND CONCLUSION

How should we interpret the overall findings? Can we give satisfying answers to our initial research questions? What lessons can we draw in terms of policy prescriptions? In this final section we like to focus on this. In the introduction, we posed a number of research questions that we tried to answer using a theoretical framework and the related empirical analysis. One of these questions was whether co-op membership is a determinant of co-op delivery. Based on the empirical analysis we can definitely provide a positive answer to that question. Although in Italy there are many agricultural co-op members that do not deliver to their co-op(s), and vice versa, non-members that do deliver to a co-op, the estimation results show a strong statistically significant effect of co-op membership on delivery. Moreover, co-op membership and delivery are related in unobservables.

For the two other research questions, i.e. which farmers are member of a co-operative and why, and which farmers deliver to a co-operative and why, a simple answer is somewhat harder to give. In this study, we distinguished four types of relations with co-ops: strong membership, soft membership, shadow membership and no membership. Strong membership (membership and delivering) is associated with a higher concentration of co-ops, in particular for farmers that supply to drinks and beverages co-ops in regions that have a high share of those co-ops, on-farm processing, combined management and labour on the farm and having a business plan. Soft membership (member but not delivering) occurs when there is a large share of vegetable oil co-ops, in regions where agriculture is the main economic activity and among livestock farmers. Delivering without membership (shadow membership) happens with large shares of dairy co-ops and for farms with a large quantity of fixed assets. Finally, our results indicate that non-membership is associated with a large share of co-ops in the meat and fish sector, and among arable and horticultural farms.

After answering these questions we also want to underline some limitations of this study. First, due to data limitations we couldn't investigate (and hence formulate theoretical hypotheses) on the role of other dimensions that are theoretically considered as fundamental in explaining farmers' membership and delivery decisions, such as uncertainty and frequency of the transactions between farmers and co-ops. Second, the FADN dataset was too limited to give us detailed information on the specific relationship between each farmers and the different type of co-ops he has a relation. Third, due to the cross-sectional nature of the data, dynamics (i.e. temporarily and occasional delivering behaviour) could not be analyzed. Fourth, no information was available to understand the organization of the various co-ops, the type of

contracts and requirements they use, the level of commitment they are looking for, the role of voting and participating in the decision-making process. From the farmers' size we don't know the farmers' willingness to participate, his motivations, how much time is dedicated to co-op relationships, how many alternatives are effectively present in the business environment, the presence of any path-dependency issues.

In Italian policy debates, farmers' participation in agro-food co-ops has been strongly encouraged as a means to enhance agricultural market conditions, thereby strengthening related rural development strategies. In the former case, co-ops are seen as a way to increase farmers' contractual power within the food chains, especially where intense coordination is needed and where processing is involved. Co-ops are also considered as local agencies for rural development. This is reflected in the significance of indicators for remote rural and hilly areas, and in the complementarity effects with other networks. However, our study underlines that also business characteristics have to be considered and that specificity should be take into account in order to understand farmers' relations with agricultural co-ops.

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Table 1 – Driving factors which shape farmers' decision to network with a co-op

Hypotheses	Type of factor	Factor	Impact on membership	Impact on delivery
H1: Location specificity matters	Local market structure	Co-op concentration in the location area	(+++)	(+)
		Specialization of cooperatives operating in the area	(++)	(+)
	Social and institutional context	Region/area of location	(+/-)	(+/-)
	Geographical isolation	Location in a mountain area	(+/-)	(+/-)
		Location in a rural area	(+/-)	(+/-)
H2: Asset specificity matters	Size	Farm size in economic and physical terms	(+/-)	(+/-)
	Specialization	Type and degree of agricultural specialization	(+)	(+)
	Human capital and organizational specificity	Manager's age	(+)	
		Type of management	(+/-)	(+/-)
		Successor	(+/-)	(+/-)
		Family contribution to labor force	(+/-)	(+/-)
H3: Relational specificity matters	Other networking activities	Membership in agricultural related association	(+)	
		Membership in non-agricultural related association	(+)	

Table 2. Frequency of co-op membership and delivery in the sample

Membership of co-operative	Delivery to co-operative		
	No	Yes	*Total*
No	9,929	635	*10,564*
Yes	3,223	1,596	*4,819*
Total	*13,152*	*2,231*	*15,383*

Source: INEA, 2006

Table 3. Descriptive statistics of the variables used in the model

Variables			Mean	S.D.
Membership	coop_memb [(a)]	1 if farmer is a member of a processing and/or marketing co-op	0.3132	0.3521
Delivery	del_coop [(a)]	1 if farmer delivers to a processing and/or marketing co-op	0.1450	0.4638
Local market structures	reg_coop_id [(d)]	index of concentration marketing and processing coop at regional level	0.0360	0.0222
	d_meatfish [(a),(d)]	index of correspondence between regional co-op specialization and farm orientation in producing meat and fish products	0.0195	0.0444
	d_fruitveg [(a),(d)]	index of correspondence between regional co-op specialization and farm orientation in fruit and vegetables productions	0.0064	0.0336
	d_vegoils [(a),(d)]	index of correspondence between regional co-op specialization and farm orientation in producing vegetal oils	0.0383	0.0866
	d_dairy [(a),(d)]	index of correspondence between regional co-op specialization and farm orientation in dairy products	0.0900	0.0214
	d_grain [(a),(d)]	index of correspondence between regional co-op specialization and farm orientation in grain production	0.0028	0.0096
	d_feed [(a),(d)]	index of correspondence between regional co-op specialization and farm orientation in feed production	0.0073	0.0136
	d_drink [(a),(d)]	index of correspondence between regional co-op specialization and farm orientation in drink production	0.0893	0.1483
Social and institutional context	agr_empl [(c)]	Index of agricultural employment at municipal level	0.0537	0.0404
	south [(b)]	1 if farm is located in southern Italy	0.2732	0.4456
Geographical isolation	periurb [(b)]	1 if farm is located in a peri-urban municipality (AREA B) according to National Strategic Document on Rural Development	0.2847	0.4513
	rur_int [(b)]	1 if farm is located in a rural intermediate municipality (AREA C) according to National Strategic Document on Rural Development	0.3400	0.4737
	rur_rem [(b)]	1 if farm is located in a remote rural municipality (AREA D) according to National Strategic Document on Rural Development	0.2812	0.4496
	hill [(a)]	1 if farm is located in a hilly area	0.4719	0.4992
	mont[(a)]	1 if farm is located in a mountainous area	0.2014	0.4010
Size	uaa [(a)]	Utilized Agricultural Area	35.002	79.114
	fixasset [(a)]	Total fixed assets	8,710	23,531
Specialization	arabl_spec[(a)]	1 if farm is specialized in arable crops	0.2181	0.4130
	hort_spec[(a)]	1 if farm is specialized in horticulture	0.0734	0.2608
	perm_spec[(a)]	1 if farm is specialized in permanent crops	0.3004	0.4584
	livstock_spec[(a)]	1 if farm is specialized in animal breeding	0.2319	0.4222
	dprocess[(a)]	1 if on-farm processing activities are present	0.312	0.4633
	organic[(a)]	1 if organic productions are present	0.0637	0.2444
Human capital and organizational specificity	age[(a)]	Farmer's age	54.05	13.74
	manag[(a)]	1 if manager is also employee in the farm	0.9067	0.2908
	succes[(a)]	1 if a successor is present	0.05714	0.2321
	dev_plan[(a)]	1 if farm followed a business plan for development	0.495742	0.4999
	acc_serv[(a)]	1 if farm used an accountancy service	0.0702	0.2556
	tot_lab[(a)]	Total number of AWU provided by family members	2.017	3.0954
Other networking activities	ass_prod[(a)]	1 if farm is a member of a farmer association	0.5204	0.4996
	other_netw[(a)]	1 if farm is a member of other networks	0.4429	0.4967

Source: (a) INEA, 2006; (b) Italian Ministry of Agriculture, Food and Forestry, 2007 (c) ISTAT, 2001,a (d) ISTAT, 2001,b

Table 4. Results of the bivariate probit model

Variables		Membership		Delivery	
		Coeff.		*Coeff.*	
Membership	*memb*	-	-	2.003	(0.084) ***
Intercept	*int*	-1.648	(0.087) ***	-1.913	(0.095) ***
Location specificity (X_1)					
Local market structures	*reg_coop_id*	2.781	(0.680) ***	2.276	(0.831) ***
	d_meatfish	-3.849	(0.498) ***	-1.582	(0.566) ***
	d_fruitveg	1.046	(0.499) **	0.773	(0.885)
	d_vegoils	1.128	(0.205) ***	-1.143	(0.320) ***
	d_dairy	-0.371	(0.096) ***	0.508	(0.106) ***
	d_grain	6.250	(1.432) ***	0.846	(1.776)
	d_feed	-3.967	(1.075) ***	1.798	(1.264)
	d_drink	1.618	(0.127) ***	0.418	(0.176) **
Social and institutional context	*agr_empl*	2.305	(0.281) ***	-1.973	(0.342) ***
	south	-0.006	(0.030)	-0.395	(0.042) ***
Geographical isolation	*periurb*	0.080	(0.046)	0.087	(0.059) **
	rur_int	-0.031	(0.046)	0.122	(0.060) **
	rur_rem	0.196	(0.053) ***	-0.057	(0.070)
	hill	0.082	(0.035) **	-0.021	(0.042)
	mont	0.011	(0.048)	0.045	(0.061)
Wald test H1: $\boldsymbol{X_1} = 0$		556.50 ***		322.28 ***	
Asset specificity (X_2)					
Size	*uaa*	0.0002	(0.0002)	0.0000	(0.0003)
	fixasset	-0.002	(0.001) **	0.003	(0.001) ***
Specialization	*arabl_spec*	-0.099	(0.040) **	-0.269	(0.053) ***
	hort_spec	-0.591	(0.074) ***	-0.596	(0.121) ***
	perm_spec	-0.436	(0.059) ***	-0.040	(0.073)
	livstock_spec	0.440	(0.070) ***	-0.019	(0.082) ***
	dprocess	0.066	(0.026) **	0.118	(0.033) ***
	organic	-0.065	(0.046)	0.026	(0.057)
Human capital and organizational specificity	*age*	0.002	(0.001) ***	-	-
	manag	0.188	(0.043) ***	0.100	(0.056) *
	succes	0.120	(0.047) **	0.001	(0.053)
	dev_plan	0.454	(0.024) ***	0.159	(0.037) ***
	acc_serv	0.230	(0.040) ***	-0.045	(0.050)
	tot_lab	-0.008	(0.005)	-0.019	(0.007) ***
Wald test H2: $\boldsymbol{X_2} = 0$		608.37 ***		96.14 ***	
Relational specificity (X_3)					
Other networking activities	*ass_prod*	0.346	(0.022) ***	-	-
	other_netw	0.213	(0.022) ***	-	-
Wald test H3: $\boldsymbol{X_3} = 0$		307.57 ***			
ρ		-0.631 (0.056) ***			
Wald test $\chi^2(60)$		5987.02 ***			
N		15383			

*** significant at 1%; ** significant at 5%; * significant at 10% level