Member Participation in Cooperative Governance:
Does Heterogeneity Matter?

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ABSTRACT

The motivation for this study is the observed loss of competitiveness of agricultural cooperatives comparing to investor-owned firms. One important cause of this is the costs of decision making which cooperatives face. Not only democratic costs but also agency costs are likely to be more severe in a cooperative than do in an investor-owned firm. Then, a challenge cooperatives face is to minimize decision making costs. In particular, two aspects of cooperatives affect the ability with which they can control democratic and agency costs: the level of heterogeneity and the level of member participation. These two variables play a very relevant role in this study. The level of heterogeneity affects the level of member participation in cooperative governance, and this last one affects decision making costs (democratic and agency costs). By means of theory building research, in the first part of the study, we develop a measurement of heterogeneity based on grouping, with the aim of showing the presence (absence) of dominant groups and the size of the minorities. It ranks cooperatives from homogeneous to more heterogeneous based on both cooperatives and members characteristics. Five levels of heterogeneity are identified. In the second part of the study, by extending the work of other authors, we develop a model that predicts a non-linear relation between heterogeneity and member participation. Two propositions have been developed in order to examine whether member participation is related to some aspects of heterogeneity. Previous research has not compared differences in member participation between homogeneous and heterogeneous cooperatives. The first proposition examines the relation between level of heterogeneity and member participation attending general assemblies, while the second examines the relation between heterogeneity and member participation at the board of directors. The first proposition has been examined by means of scatter plots and the second by means of logistic regression. With regard to proposition 1, the results were in line with the theoretical model developed in the study which postulates that there is a non-linear relation between member participation and level of heterogeneity. With regard to proposition 2, the results significantly supported the proposition for the relation between one type of cooperative heterogeneity (size of producer groups) and board participation. The present study provided some theoretical, methodological and managerial contributions. For instance, the present study has developed a method, called grouping, for measuring the level of heterogeneity in cooperatives. It is important to measure heterogeneity, because it is a significant source of conflict of interests between members. No previous studies have been identified which have operationalized the concept of heterogeneity. Additionally, the present study has contributed to insights about how cooperative heterogeneity and level of member of member participation at the general assembly are related. Gaining an accurate picture of this relation is important, because both heterogeneity and member participation are sources of decision making costs.

1. INTRODUCTION

The motivation for this study is the observed loss of competitiveness of agricultural cooperatives comparing to investor-owned firms in terms of decision making costs (Gorton & Schmid, 1999; Hansmann, 1999; Bijman, 2002). Not only democratic costs (Staatz, 1987; Zylbersztajn, 1994; Bijman, 2002) but also agency costs (Gorton & Schmid, 1999) are likely to be more severe in a cooperative than do in an investor-owned firm. Then, a challenge cooperatives face is to minimize decision making costs. In particular, two aspects of cooperatives affect the ability with which they can control democratic and agency costs: the level of heterogeneity and the level of member participation. These two variables play a very relevant role in this study. The level of heterogeneity affects the level of member participation in cooperative governance, and this last one affects decision making costs (democratic and agency costs). The research question that leads the present study is the following: *What is the relation between level of heterogeneity and level of member participation in the governance of agricultural cooperatives?* We have chosen agricultural cooperatives to look for evidences for this study. Agricultural cooperatives may encounter significant heterogeneity both within the firm (e. g., number of products or product qualities received) and amongst its members (e. g., farm size).

A heterogeneity measurement model that ranks cooperatives from homogeneous to heterogeneous taking into account both cooperatives and members characteristics is developed in the first part of the study.

In the second part, we examine whether heterogeneity matters for member participation in cooperative governance. This is because member participation is not costless.

2. LITERATURE REVIEW

2.1 Heterogeneity

Cooperatives may encounter significant heterogeneity both amongst its members and within the firm. Explaining each type of heterogeneity is the focus of this section.

Member's heterogeneity. Members may differ in terms of: (1) their individual characteristics; and (2) their farm's characteristics.

Regarding to *individual characteristics*, members may differ mainly in terms of: (a) demographic characteristics (e. g., age, educational level, amongst others); (b) economic characteristics (e. g., percentage of non-farm income, business objectives, risk preference, amongst others); and (c) beliefs (e. g., cooperative principles, collective action, individual member identity as associated with cooperative membership, life satisfaction with farming, equitable treatment among members, amongst others).

Regarding to *farms' characteristics*, members may differ mainly in terms of farm size, farm technology efficiency, geographic distance from the farm to the headquarters, number of different commodities produced, number of different inputs purchased, amongst others.

Cooperative's heterogeneity. Within the firm, characteristics which cooperatives may differ are mainly related to: the number of products or product qualities received, percentage that each product or product qualities represent in the annual revenues of the cooperative, percentage of members who deliver each product or product qualities, amongst others.

The main view of this study is that homogeneous cooperatives may have either homogeneous or heterogeneous members, and heterogeneous cooperatives may have either heterogeneous or homogeneous members (see Table 1).

As a result, it can be expected that the more heterogeneous the members of a cooperative, the more the interests of the members (or group of members) conflict with each other. These conflicts of interest are likely to adversely affect the collective decision making process in the cooperative (e. g., at the general assembly), as various groups attempt to influence this process in order to benefit themselves, rather than the cooperative as a whole.

Table 1 – Different levels of heterogeneity regarding cooperative and member's characteristics

Cooperative characteristics	Members characteristics
Homogeneous (e. g., a honey cooperative)	*Homogeneous* (e. g., all members deliver around the same volume and quality of honey to the cooperative)
Homogeneous (e. g. a soybeans cooperative)	*Heterogeneous* (e. g., members deliver different volume of products to the cooperative, i. e., there are both smallholders and large farmers delivering soybeans)
Heterogeneous (e. g., a cooperative that receives grains, pigs, and dairy)	*Heterogeneous* (e. g., members deliver different volumes and combinations of products)
Heterogeneous (e. g., a cooperative that receives pigs, and dairy and where pigs represent 50% of the cooperatives revenues and dairy represents 50%)	*Homogeneous* (e. g., all members deliver both pigs and dairy and around the same volume)

These conflict of interests are likely to arise because members are heterogeneous but cooperative generated benefits are homogeneous (because the traditional cooperative principles, e. g., equally treatment, democratic nature). For example, members who produce top quality products, and, as a consequence, have more production costs due higher technology efficiency employed (who, in general, are a minority in the cooperative) receive mostly the same benefits as members who produce standard quality products (who, in general, are a majority in the cooperative). All of these levels of heterogeneity, and as a consequence, of conflicts of interests, bring potential costs to the decision making of democratic, collective actions as cooperatives are.

Heterogeneity may also affect decision making at the board of directors. With heterogeneous membership, board members are more likely to be 'captured' by interest groups (e. g., smallholders, or soybeans-supplying members) within the cooperative.

2.2   Member participation in cooperative governance

Members may participate in all of the three main cooperative governance bodies: (1), attending general assemblies; (2), holding a position in the board of directors; (3), holding a position in the executive board. Participation is highly variable amongst cooperatives, i.e. it is much higher in some cooperatives than in others.

A higher level of member participation may increase democratic costs in a cooperative, as more members participate in the collective decision making process (at the general assembly or at the board of directors). At the same time, a higher level of member participation may reduce agency costs, as more members monitor management.

3.   RESEARCH DESIGN

The objective of the present study is threefold: (1), to develop a heterogeneity measurement model that ranks cooperatives from homogeneous to heterogeneous taking into account both cooperatives and members characteristics; (2), to examine whether there are differences in level (i. e., percentage) of member participation attending general assemblies across more homogenous and more heterogeneous cooperatives; (3), to examine whether there are differences in characteristics of members holding a position in the board of directors across more homogenous and more heterogeneous cooperatives (e. g., whether large farmers participate more).

To achieve the first objective, a qualitative approach by means of theory building research (see part 1 further) has been taken in order to develop a heterogeneity measurement model. To achieve the second research objective, results from the qualitative research have been examined by means of scatter plots. To achieve the third research objective, results from the qualitative research have been examined by means of logistic regression.

Part 1 - Qualitative approach: heterogeneity measurement

In order to develop our heterogeneity measurement, and, then, to shape our propositions, we have used theory building research (Eisenhardt, 1989) approach. It is a process of inducting theory using case studies from specifying the research questions to reaching closure. It uses the main steps such as follows: (1), specifying research questions and the main concepts to shape the initial design of the theory; (2), selecting the cases; (3), developing research instruments; (4), generating data; (5), analyzing data; (6), developing propositions. Each one of the steps is described in the next sections.

Specifying research questions and concepts. The main research question at the beginning of the present study has been *"What is the relation between level of heterogeneity and level of member participation in the governance of agricultural cooperatives?"* Based on the literature review, we can distinguish between two different types of heterogeneity's characteristics: (a), cooperative's characteristics; and (b), members' characteristics. The present study uses the following heterogeneity's characteristics as proxies to explain differences in member participation in cooperative governance: (1), percentage of each product in the total (agribusiness) revenues of the cooperative; and (2), percentage of members who deliver each product, as proxies for cooperative's characteristics; and (3), volume of product delivered by active members, as proxy for members characteristics. These three variables are appropriate in assessing heterogeneity since they are all latent background creating conflicts of interests.

As it has been explained earlier, there are two types of member's characteristics: members' individual characteristics, and farms' members' characteristics. The focus of the present study is on heterogeneous characteristics that are likely to bring conflict of interests to the decision making process. Then, farm's members' characteristics are chosen instead of members' individual characteristics. Heckathorn (1993) argues that more than referring heterogeneity to variations in demographic factors like race, ethnicity, or age; studies of the factors like interest in the public good, resources available to contribute to public goods production, and the cost of those contributions enhance our understanding of the demographic factors. Previous studies on member participation in cooperative governance (e. g., Gray & Kraenzle, 1998; Gripsrud, Lenvik & Olsen, 2000) did not find relationship between member's age and member participation in member meetings.

1) Percentage of each product in the total revenue of the cooperative. A cooperative that has more products representing high percentages in the total revenues is likely to have more conflicts of interests. Particularly, it holds true when farmers are specialized in each product. Gripsrud, Lenvik and Olsen (2000, p. 11) argue that "most agricultural cooperatives have restricted their areas of business to a particular type of product handle to reduce heterogeneity – or rather to reduce the potential conflicts of interests."

2) Percentage of members who deliver each product. Despite this variable has not been used as proxy to heterogeneity in previous studies, we argue that it is important to observe that there may be differences in terms of percentage that each product represent in the annual sales of the cooperative and percentage of members who deliver each product. This differences are likely to bring conflicts of interests to the decision making process when few members delivering a specific product generate more revenues than many members delivering another product.

3) Volume of product delivered by active members. Gray and Kraenzle (1998), for example, have shown that this variable is positively related to member participation attending general assemblies.

Subsequently, the following complementary questions have been defined: What is the relation between cooperative characteristics (e. g., the percentage of each product in the total revenues of the cooperative) and level of member participation in the governance of agricultural cooperatives? What is the relation between farm's members' characteristics (i. e., volume of product delivered by active members) and member participation in cooperative governance?

Selection of cases. For this study, twelve cases (each case forms a cooperative) from Rio Grande do Sul (the most southern state of Brazil) have been selected. Rio Grande do Sul (RS) has been the selected location for this study because of two main reasons. First, RS has been the selected location because it has a large variety of homogenous and heterogeneous cooperatives which is necessary for our study. In RS there are cooperatives that receive and process either only one product (e. g., grapes), or a great variety of products (e. g., grains, dairy, meat, fruit) altogether. Therefore, differences in cooperatives characteristics can be found in the state's cooperatives. In addition, this state is the largest producer of several agricultural products for both the domestic and international market. As a result, a combination of both small and large producers can be found. Therefore, also differences in member characteristics can be found in the state's cooperatives. Second, RS has been the selected location because it is an area where the author has a considerable number of connections (e. g., OCERGS, FECOAGRO, FEARROZ, etc).

Developing research instruments. Despite this stage of the research is qualitative, most of the generated data has been thought to be of quantitative nature. This is because the objective has been to have a set of data that could make possible comparisons amongst cooperatives ranging from more homogeneous to more heterogeneous, given a number of cooperatives' and members' characteristics. Table 2 shows how the variables used to examine the relation between heterogeneity and member participation (at the general assembly and at the board of directors) have been measured.

Table 2 - Main concepts of the research

Bloc	Type	Variable	Concept	Measurement
Member Participation at the general assembly (GA)	Dependent	MPATGA	Level of member participation at the general assembly	Number of members who participate in 2010's GA x 100 /Number of cooperative members
Member participation at the board of directors	Dependent	BOARDLM	Board member delivers large/medium volume (considering the measurement of each cooperative)	1 = Yes 0 = No
Heterogeneity (Cooperative's Characteristics)	Independent	PERCPROD	Share of each product in the total revenues of the cooperative	Percentage of each product
Heterogeneity (Cooperative's Characteristics)	Independent	PERCMEMB	Distribution of members who deliver each product [a]	Percentage of each group
Heterogeneity (Member's Characteristics)	Independent	PERCVOL	Volume of product delivered by active members [b]	% of members who deliver small volume of products; % of members who deliver medium volume of products; and % of members who deliver large volume of products.

Control	MAINPROD	Whether the board member delivers to the cooperative the main product (in terms of revenues) the cooperative receives	1 = Yes 0 = No
Control	NUMBPROD	Number of products which the board member delivers to the cooperative	1 = 1 product 2 = 2 products 3 = 3 products 4 = 4 products

[a] This percentage may reach more than 100% because some members may deliver more than one product to the cooperative.
[b] This is in accordance to the measurement of each cooperative. We have chosen this method because each cooperative has its internal conflicting groups with regard to farm size.

Data generating. Data has been generated thought multiple methods in order to make the contrast possible. They include personal interviews with the elected manager and hired executives of each cooperative; document analysis (in the cooperative records, reports, minutes, and balance sheets); and observations (on cooperatives' websites). The sequence of the steps is the following. First, after developing the research instrument, data from websites of the cooperatives has been generated in order to make triangulation possible in the occasion of the interviews. Then, elected managers and hired executives from 12 cooperatives have been interviewed, and cooperative formal records have been analyzed at the same occasion. The period of this data generating was from 9th July till 3th August, 2010.

Data analyses

A model for heterogeneity measurement called grouping. Cooperatives are collective and democratic firms. It means that they share the same benefits amongst different members. As a consequence, it is likely that there will be groups of members with different characteristics conflicting with each other in the decision making process. Therefore, it is important that the size of the majorities and minorities regarding each of the members' and cooperatives' characteristics be observed. Then, we propose a measurement of heterogeneity based on grouping. The steps taken to determine rankings from homogeneous to more heterogeneous for each one of the heterogeneity selected variables, using grouping, are explained now.

The share that each product represents in the annual sales of the cooperative based heterogeneity has been defined by taking the following steps. First, the share of each product received by a cooperative in the total annual revenues obtained by the cooperative has been calculated. Second, for each cooperative, all products (P) have been ranked from the highest to the lowest weight. Then, two rules have been used to analyze these rankings. The first rule is based in the highest weight (P_1). A cooperative in which one product was responsible for more than 50% of the revenues was considered to be more homogenous than a cooperative in which no single product was responsible for more than 50% of the revenues. The second rule has focused on the second highest weight (P_2). The rule has been used to determine the size of 'minority groups' within cooperatives dominated by one product (i.e. those cooperatives in which one type of product has a weighting of more than 50% in the cooperative revenues). A cooperative with a large minority group has been considered to be more heterogeneous than a cooperative with a small minority group. Figure 1 shows the classification scheme proposed.

Level of heterogeneity	Specification	Category
1	P_1 >50%; P_2 <10%	One dominant party
2	P_1 >50%; P_2 <20%	One majority party and one small minority
3	P_1 >50%; P_2 <30%	One majority party and one significant minority
4	P_1 >50%; P_2 <40%	One majority party and one large minority
5	P_1 <50%	No majority groups

P_1 = weight of main product received by cooperative in total revenues of the cooperatives;
P_2= weight of second largest product

Figure 1 - PERCPROD using grouping heterogeneity measurement

Percentage of members who deliver each product based heterogeneity has been defined by taking the following steps. First, the percentage of members who deliver each product to the cooperative has been calculated. Second, for each cooperative, all the percentages have been ranked from the highest to the lowest weight. Then, two rules have been used to analyze these rankings. The first rule has looked at the weight of the largest group of producers (PG_1) of the cooperative. A cooperative in which one producer group was responsible for more than 50% of the percentage of members was considered to be more homogenous than a cooperative in which no producer group was responsible for more than 50% of the percentage of members. The second rule has focused on the weighting of the second largest group of producers of the cooperative (PG_2). The rule has been used to determine the size of 'minority producer groups' within cooperatives dominated by one producer group (i.e. those cooperatives in which one producer group has a weighting of more than 50% of the percentage of members). A cooperative with a large minority group was considered to be more heterogeneous than a cooperative with a small minority group. Figure 2 shows the classification scheme proposed.

Level of heterogeneity	Specification	Category
1	PG_1>50%; PG_2<20%	One dominant party
2	PG_1>50%; 21%< PG_2<30%	One majority party and one small minority
3	PG_1>50%; 31%< PG_2<40%	One majority party and one significant minority
4	PG_1 >50%; 41%< PG_2<50%	One majority party and one large minority
5	PG_1<50% or PG_2>50%	No majority groups

PG_1 = weight of largest group of producers of the cooperative; PG_2= weight of second largest group of producers

Figure 2 - PERCMEMB using grouping heterogeneity measurement

Volume of product delivered by the members based heterogeneity has been defined by taking the following steps. First, the percentage of members who deliver each volume of products (large, medium, small) to the cooperative has been calculated. Second, for each cooperative, the percentages of farmers who deliver large, medium, and small volume of products of each cooperative have been ranked in this sequence. Then, two rules have been used to analyze these rankings. The first rule has looked at the weight of the large farmers (LF) of the cooperative. What has been observed here is the fact that even though large farmers may be the minority group of the cooperative, they still hold a certain bargaining power against the medium and smallholders because they represent the majority of the cooperative's product's volume. Then, the extent to which large farmers have more or less bargaining power would depend on the size of the medium producers' group (who are the second bargaining group). In that case, the rule of our categorization measurement model has looked at the weight of both large (LF) and medium farmers (MF). A cooperative in which large farmers were more than 50% of the members of the cooperative was considered to be more homogenous. However, as the percentage of medium farmers increases, the bargaining power of large farmers starts to decrease. Figure 3 illustrates the classification scheme proposed.

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Level of heterogeneity	Specification	Category
1	LF > 50% or LF < 50%; MF > 50,1%	One dominant group
2	LF< 50%; 0% < MF< 12.4%	One bargaining group and one small minority
3	LF< 50%; 12.5% < MF< 25%	One bargaining group and one significant minority
4	LF< 50%; 25.1% < MF< 37.5%	One bargaining group and one large minority
5	LF< 50%; 37.6% < MF< 50.1%	No majority groups

LF = Large Farmers; MF = Medium Farmers
Figure 3 – PERCVOL using grouping heterogeneity measurement

Data Results using grouping heterogeneity measurement model. Results of each one of the selected variables of heterogeneity (PERCPROD, PERCMEMB, PERCVOL) analyzed by means of the grouping measurement are presented in Table 3.

Table 3 - Levels of heterogeneity using Grouping measurement of heterogeneity

Cooperative	PERCPROD	PERCMEMB	PERCVOL	AVERAGE
COOP-C	2	2	1	4,3
COOP-E	3	2	2	5,7
COOP-B	2	3	2	5,7
COOP-F	3	2	3	6,0
COOP-G	3	3	2	6,7
COOP-I	3	4	1	7,3
COOP-L	3	4	1	7,3
COOP-D	2	5	1	7,3
COOP-J	5	3	4	9,3
COOP-H	4	5	3	10,0
COOP-K	4	5	4	10,3
COOP-A	5	5	3	11,0

Considering the level of heterogeneity with regard to the percentages of all products a cooperative receives in the total revenues of the cooperative, the variable PERCPROD (see Column 2) says the following. There are not cooperatives with one dominant party only (i. e., level 1). Instead, some cooperatives COOP-C, COOP-B, and COOP-D) have one majority party and one small minority (i. e., level 2), being those the most homogeneous of the sample. Some of them (COOP-E, COOP-F, COOP-G, COOP-I, COOP-L) have one majority party and one significant minority (i. e., level 3), some of them (COOP-H and COOP-K) have one majority party and one large minority (i. e., level 4). Finally, the variable says that two cooperatives (COOP-J and COOP-A) have no majority groups, being the most heterogeneous ones with regard to the percentages of all products a cooperative receives in the total revenues of the cooperative.

Research results regarding the level of heterogeneity using grouping measurement model (Table 3) show that, in the average, there are cooperatives more homogeneous (e. g. COOP-C, COOP-E, COOP-B), cooperatives not so homogeneous and not so heterogeneous (COOP-F, COOP-G, COOP-I, COOP-L, COOP-D), and cooperatives more heterogeneous (COOP-J, COOP-H, COOP-K, COOP-A).

4.   PROPOSITIONS

Following the discussion presented earlier, the general proposition and other 2 ones can be now formulated.

General proposition: *The level of member participation in cooperative governance (y) is related to the level of heterogeneity (x).*

Regarding to the relation between level of heterogeneity *(x)* and level of member participation at the general assembly *(y)*, the literature on cooperatives has two veins. According to a group of authors, there is a linear relation between level of heterogeneity and level of member participation in cooperative governance. The more heterogeneous members a cooperative has and the more heterogeneous a cooperative is, the more the interests of the various constituents (group of members) are likely to conflict, resulting in various groups actively attempting to control the decision making process in the cooperative (Hansmann, 1996; Hendrikse & Bijman, 2002; Kalogeras *et al*, 2009). According to another group of authors (e. g., Österberg & Nilsson, 2009) when the cooperative is more heterogeneous, members may feel that cooperative business has become so complex (e. g., large cooperatives have often multipurpose activities, whereby many members are interested in only a specific branch of business) that they may not understand them, have little knowledge of them, and are alienated from them. As a result, they do not participate.

The present study extends the work of these and other authors by modeling a non-linear relationship between heterogeneity and member participation. The model predicts that members have a stronger incentive to participate when heterogeneity increases, as long as there is a dominant group. When there is a dominant group and the cooperative is homogenous (category 1 cooperative, i. e., x_1), there is less incentive for members to participate because the interests of the members are aligned *(y_1)*. When there is a dominant group and the cooperative is heterogeneous (category 4 cooperative, i. e., x_4), members have the strongest incentive to participate to protect their interest *(y_4)*: members from the dominant group to protect its interest and the large minority groups because they want to prevent the dominant group from taking control over the cooperative. Without a dominant group (category 5 cooperative, i. e., x_5) there is less incentive to participate because there is less threat of exploitation by the majority group, and member participation starts to fall again *($y_5=y_1$)*. Figure 4 gives you an idea about this relation.
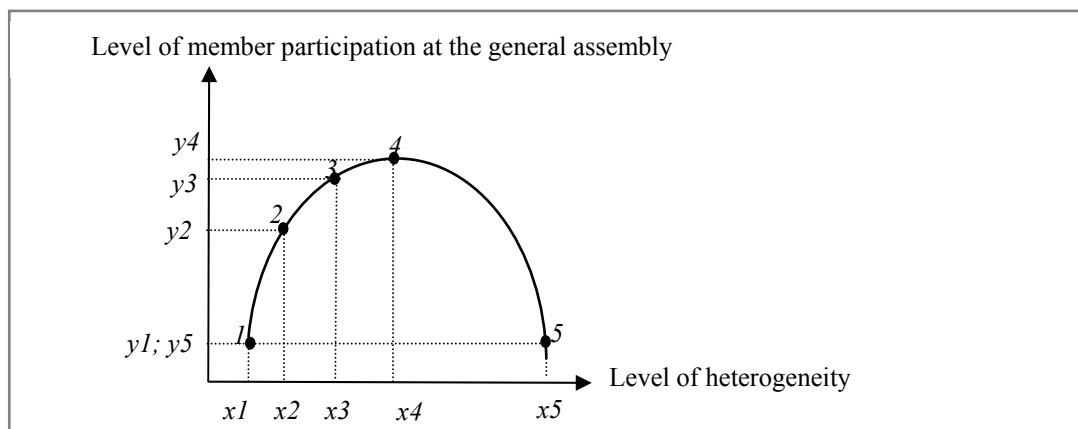

Figure 4 – Relation between level of heterogeneity and level of member participation at the general assembly

Then, the following proposition arises:

Proposition 1: *When the cooperative is more homogeneous, the level of member participation at the general assembly is low. When the level of heterogeneity increases, the level of member participation at the general assembly increases. When the cooperative reaches certain level of heterogeneity the level of member participation at the general assembly decreases.*

With regard to the relation between level of heterogeneity and level of member participation holding a position in the board of directors, one can observe that when cooperatives encounter significant heterogeneity both within the firm and amongst its members, it is expected that increased differences result in higher conflicts of interests in the decision making process. Staatz (1987) observes that as a result of the diversity of member interests some kinds of cooperative members (e. g., large farmers) may demand to be involved controlling the cooperative. For example, serving as an elected officer in order to protect their interests (i. e., balancing the demands of small producers who control the majority of the votes in the cooperative) (Chithelen, 1985; Banerjee *et al,* 2001). Farm size is the most explicative variable for member participation in cooperative governance (Gray & Kraenzle, 1998; Iliopoulos & Cook, 1999). This is because "the diffusion of political power as a result of the one-person, one-vote principle raises the possibility that a majority of members who may contribute only a small part of the patronage and capital may approve policies that exploit the minority of larger patrons who own the non-revenue-bearing capital" as observes Cook (1994, p. 49). We expected that probability that larger farmers participate in the board is highest for the most heterogeneous cooperatives that still have a dominant group. Then, the following proposition arises:

Proposition 2: *The more the level of heterogeneity (e. g., in terms of volume) increases, the more medium and large farmers participate in the board of directors.*

Part 2 - Quantitative approach
So far, we have done the qualitative part of the research where, by means of theory building research (Eisenhardt, 1989) we have developed a heterogeneity measurement. From now on, this heterogeneity measurement serves as a basis for a quantitative examination of the relation between level of heterogeneity and level of member participation in cooperative governance.

Methods of analysis. Two methods of analysis (scatter plot, and logistic regression) have been thought to be used to examine the propositions (1 and 2, respectively) of this study.

Scatter plot. A scatter plot is a type of mathematical diagram using Cartesian coordinates to display values for two variables for a set of data. It is a useful tool when we wish to see how two comparable data sets agree with each other. One of the most powerful aspects of a scatter plot, however, is its ability to show nonlinear relationships between variables. Relations may be positive (rising), negative (falling), or null (uncorrelated). A line of best fit (i. e., a trend line) can be drawn in order to study the correlation between the variables. The more the two data sets agree, the more the scatters tend to concentrate in the vicinity of the trend line; if the two data sets are numerically identical, the scatters fall on the trend line exactly.

Logistic regression. According to Hair *et al,* (2006), amongst the available dependence techniques (e. g., multiple regression analysis, discriminant analysis, logistic regression, analysis of variance, multivariate analysis of variance, conjoint analysis), logistic regression is the appropriate one to be used when the dependent variable has only two groups (i. e., binary). The two groups can represent, for example, characteristics. If the characteristic is, for instance, farm size, logistic regression represents the two groups of interest as a binary variable with values of 0 and 1, where either one group can be assigned the value of 1 (e. g., larger farmers) and the other group the value of 0 (e. g., smaller farmers). Logistic regression differs from multiple regression, for instance, in being specifically designed to predict the probability of an event occurring (i. e., the probability of an observation being in the group coded 1).

5.   RESULTS AND ANALYSIS

Table 4 presents the results of the researched cooperatives regarding level of member participation attending general assemblies.

Table 4 – Level of member participation at general assemblies in researched cooperatives

Cooperative	Level (%) of member participation at general assemblies
COOP-G	2
COOP-F	3
COOP-C	3
COOP-E	4
COOP-L	4
COOP-A	5
COOP-D	7
COOP-H	8
COOP-I	12
COOP-B	17
COOP-K	40
COOP-J	41

Table 4 shows that the level of member participation in most cooperatives is low; in only two of the 12 cooperatives do around 40% of the members attend general assemblies. For the majority of the cooperatives, only between 2-17% of the members attend general assemblies. The average of member participation attending general assemblies in researched cooperatives is 12%.
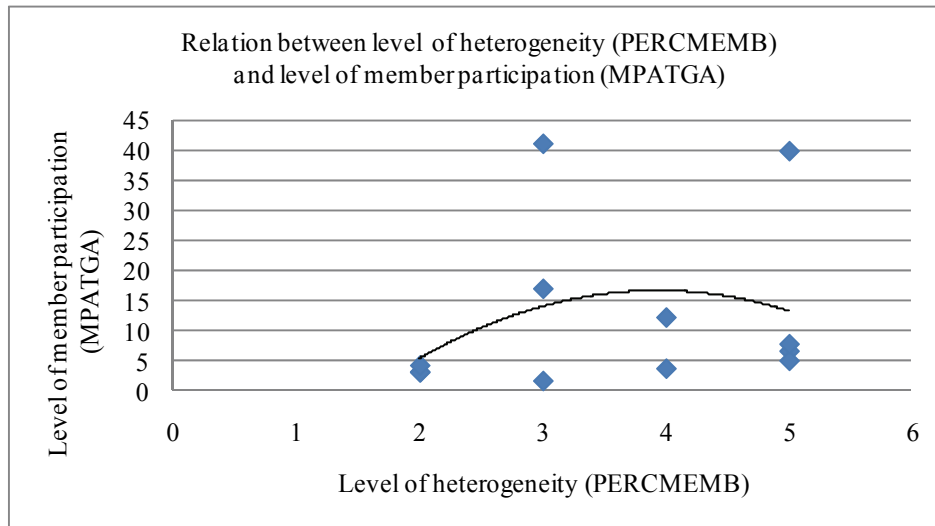
Relation between heterogeneity and member participation at the general assembly. The relations between each heterogeneity variable (PERCPROD, PERCMEMB, PERCVOL) as well as and the average and member participation attending general assemblies (MPATGA) are presented in figures 5 to 8 respectively.
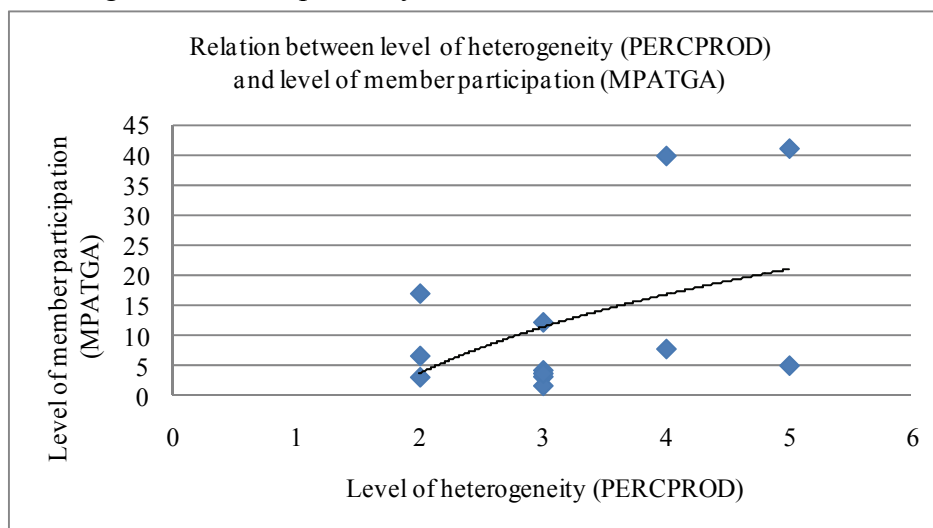
Figure 5 – Research results for the relation between level of heterogeneity (PERCPROD) and level of member participation (MPATGA)
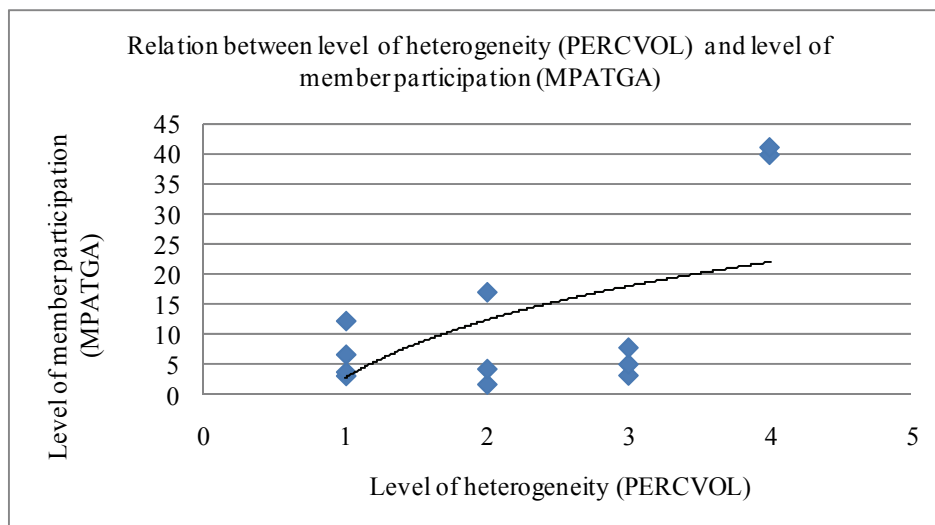
The scatter plot of Figure 5 shows that level of member participation at the general assembly is positively related with the heterogeneity variable 'PERCPROD' (i. e., levels of cooperative heterogeneity with regard to the size of the main product in relation with the size of the minorities), as it is expected. It does show that when the level of heterogeneity is low (e. g., level 2), level of member participation is low (around 3-7%), as it is the case of COOP-

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C (2, 3%), and COOP-D (2, 7%) and. It shows also that when the level of heterogeneity increases (e. g., level 3), the level of member participation increases (around 12%), as is the case of COOP-I (3, 12%). It shows that when the level of heterogeneity reaches a certain level (e. g., 5), the level of member participation decreases as is the case of COOP-A (5, 5%). Considering the whole sample, the degree of correlation between the two variables is moderated (≈0.50).
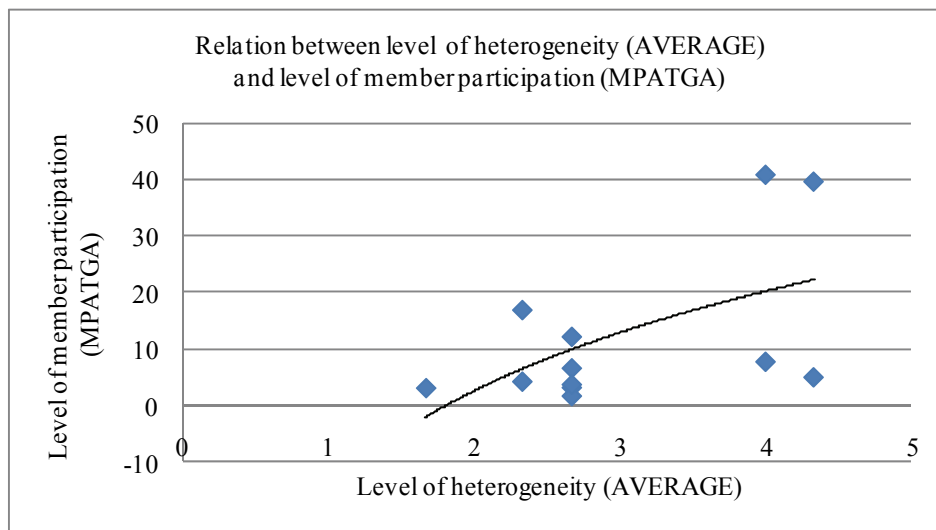

Figure 6 – Research results for the relation between level of heterogeneity (PERCMEMB) and level of member participation (MPATGA)

The scatter plot of Figure 6 shows that level of member participation at the general assembly is positively related with the heterogeneity variable 'PERMEMB' (i. e., levels of cooperative heterogeneity with regard to the size of the largest group of producers in relation to the size of the minorities), as it is expected. It does show that when the level of heterogeneity is low (e. g., level 2), level of member participation is low (around 3-4%), as it is the case of COOP-F (2, 3%), COOP-C (2, 3%) and COOP-E (2, 4%). It shows also that when the level of heterogeneity increases (e. g., level 3), the level of member participation increases (around 17%), as is the case of COOP-B (3, 17%). It shows that when the level of heterogeneity reaches a certain level (e. g., 5), the level of member participation decreases (5-8%) as is the case of COOP-A (5, 5%), COOP-D (5, 7%), and COOP-H (5, 8%). Considering the whole sample, the degree of correlation between the two variables is weak (≈0.20).

Figure 7 – Research results for the relation between level of heterogeneity (PERCVOL) and level of member participation (MPATGA)

The scatter plot of Figure 7 shows that level of member participation at the general assembly is positively related with the heterogeneity variable 'PERVOL' (i. e., levels of member heterogeneity with regard to the size of the bargaining groups in relation to the size of the majority), as it is expected. It does show that when the level of heterogeneity is low (e. g., level 1), level of member participation is low (around 3-7%), as it is the case of COOP-C (1, 3%), COOP-L (1, 4%), and COOP-D (1, 7%). It shows also that when the level of heterogeneity increases (e. g., level 2), the level of member participation increases (around 17%), as is the case of COOP-B (2, 17%). However, it does not show that when the level of heterogeneity reaches a certain level (e. g., 5), the level of member participation decreases. Considering the whole sample, the degree of correlation between the two variables is good (≈0.70).

Figure 8 – Research results for the relation between level of heterogeneity (AVERAGE) and level of member participation (MPATGA)

The scatter plot of Figure 8 shows that level of member participation at the general assembly is positively related with the heterogeneity variable 'AVERAGE' (i. e., average level heterogeneity considering grouping as a heterogeneity measurement model), as it is expected. It does show that when the level of heterogeneity is low (e. g., level 1.67), level of member participation is low (around 3%), as it is the case of COOP-C (1.67, 3%). It shows also that when the level of heterogeneity increases (e. g., level 2.33), the level of member participation increases (around 4%), as is the case of COOP-E (2.33, 4%). It shows also that when the level of heterogeneity increases (e. g., level 2.67), the level of member participation increases (around 7-12%), as is the case of COOP-D (2.67, 7%), and COOP-I (2.67, 12%). It shows that when the level of heterogeneity reaches a certain level (e. g., 4.33), the level of member participation decreases as is the case of COOP-A (4.33, 5%). Considering the whole sample, the degree of correlation between the two variables is moderated (≈0.60).

Discussion. Despite PERCVOL, the other heterogeneity variables (PERCPROD, PERCMEMB, AVERAGE) using data from grouping measurement of heterogeneity showed the relation suggested by proposition 1. The degree of correlation found between the heterogeneity variables and the dependent variable was either weak (PERCMEMB), or moderate (PERCPROD, AVERAGE), or good (PERCVOL).

Relation between heterogeneity and member participation at the board of directors. Tables 5-7 present the results obtained from estimating logistic regressions to explain the heterogeneity determinants of the probability that board members are either medium or large farmers. Each of these regressions compares the relationship of one alternative heterogeneity variable (PERCPROD, PERCMEMB, PERCVOL) and the control variables (MAINPROD, NUMBPROD) with the probability that board members are either medium or large farmers. Note that as these variables are categories (level 1, 2, 3, 4 and 5), we created dummy variables for them, as one can see in the logistic regressions. For instance, Table 4 shows only the variables PERCPROD-3, PERCPROD-4, and PERCPROD-5 because of two reasons: (1), there were no cooperatives classified at level 1 with regard to PERCPROD (see Table 3); and (2), the (STATA) program dropped the variable PERCPROD-2 at the estimation.

Table 5 – Logistic regression using data from grouping heterogeneity measurement (PERCPROD)

Dependent variable: **Probability board member is either medium or large volume deliver (y)**				
Number of observations: **149**				
Variable	*Coef.*	*Std. Err.*	*P>|z|*	*Odds Ratio*
PERCPROD-3	0.1977	0.4406	0.654	1.219
PERCPROD-4	0.4009	0.4896	0.413	1.493
PERCPROD-5	-0.3331	0.5036	0.508	0.717
MAINPROD	1.2641	0.6983	0.070	3.540
NUMBPROD	0.2918	0.2112	0.167	1.339
Constant	-1.9538	0.8141	0.016	
Overall model fit				
Log Likelihood	-97.866599	*Sensitivity*	70.67%	
LR chi^2	10.82	*Specificity*	45.95%	
Prob > chi^2	0.0551	*Correctly classified*	58.39%	
Pseudo R^2	0.0524	*Area under ROC curve*	0.6311	

The results of this logistic regression (Table 5) show that cooperative heterogeneity in terms of percentage of each product in the cooperatives' revenues using grouping measurement (PERCPROD) does not appear to significantly influence the probability that board members are either medium or large farmers. In other words, probability that board members are either medium or large farmers is not related to whether a cooperative has a unique product representing a high percentage in the total revenues or not.

Table 6 – Logistic regression using data from grouping heterogeneity measurement (PERCMEMB)

Dependent variable: **Probability board member is either medium or large volume deliver (y)**				
Number of observations: **149**				
Variable	*Coef.*	*Std. Err.*	*P>|z|*	*Odds Ratio*
PERCMEMB-3	0.5049	0.4916	0.304	1.657
PERCMEMB-4	2.3483	0.8699	0.007	10.468
PERCMEMB-5	0.3596	0.4580	0.432	1.433
MAINPROD	1.5091	0.7200	0.036	4.522
NUMBPROD	0.1903	0.2038	0.350	1.210
Constant	-2.3175	0.8787	0.008	
Overall model fit				
Log Likelihood	-93.722646	*Sensitivity*	60.00%	
LR chi^2	19.11	*Specificity*	62.16%	
Prob > chi^2	0.0018	*Correctly classified*	61.07%	
Pseudo R^2	0.0925	*Area under ROC curve*	0.6854	

Results of this logistic regression (Table 6) suggest that PERCMEMB-4 is positively, and strongly (1%) statistical significant (*P value =0.007*) related to the probability that board members are either medium or large farmers. This result suggests, as expected, that probability that board members are either medium or large farmers is related to whether the cooperative has a level of heterogeneity category 4 (i. e., when the cooperative has one majority party and one large minority of percentage of members who deliver each product). The magnitude of the change in probability due to PERCMEMB-4 is the following: when the variable PERCMEMB-4 increases by one point, the odds that the probability that the board member is either medium or large increases by 947%.

Table 7 – Logistic regression using data from grouping heterogeneity measurement (PERCVOL)

Dependent variable: **Probability board member is either medium or large volume deliver (y)**				
Number of observations: **149**				
Variable	*Coef.*	*Std. Err.*	*P>|z|*	*Odds Ratio*
PERCVOL-2	-0.9954	0.4897	0.042	0.370
PERCVOL-3	-1.6446	0.5133	0.001	0.193
PERCVOL-4	0.5925	0.5727	0.301	1.808
MAINPROD	0.7795	0.7580	0.304	2.180
NUMBPROD	0.5642	0.2439	0.021	1.758
Constant	-1.5505	0.7986	0.052	
Overall model fit				
Log Likelihood	-89.048316	*Sensitivity*	64.00%	
LR chi^2	28.45	*Specificity*	72.97%	
Prob > chi^2	0.0000	*Correctly classified*	68.46%	
Pseudo R^2	0.1378	*Area under ROC curve*	0.7398	

Results of this logistic regression (Table 7) suggest that heterogeneity in terms of PERCVOL_2 and PERCVOL_3 is negatively related to the probability that board members are either medium or large farmers, with statistical significance at 5% (*P value = 0.042*) and at 1% (*P value = 0.001*), respectively. As a contrary to what the proposition do, this result suggests that the more the level of heterogeneity decreases (when there is one bargaining group, LF<50%, and either a small or a significant minority, 0<MF<25%) the more the medium and large farmers participate in the board of directors.

Discussion. We have estimated logistic regressions (Tables 5-7) to examine the (grouping) heterogeneity determinants of the probability that board members are either medium or large farmers. Each of these logistic regressions compared the relationship of one heterogeneity variable (PERCPROD, PERCMEMB, PERCVOL) and the control variables (MAINPROD, NUMBPROD) with the probability that board members are either medium or large farmers. In the first model (Table 5), all the dummies used as predict variable for PERCPROD did not show significance. In the second model (Table 6), one dummy (PERCMEMB-4) used as predict variable for PERCMEMB was found significant at 1%. In the third model (Table 7), despite the fact that two dummies used as predict variables for PERCVOL (PERCVOL-2 and PERCVOL-3) were found significant at 5% and 1%, respectively, they showed a opposite relation than the one suggested by the proposition.

Therefore, according to the assessment of the significance of the coefficients, the second model is the one which the predictors better explained the dependent variable. So, PERCMEMB-4 is a good predictor to explain the probability that board members are either medium or large volume deliver.

6. CONCLUSION

A challenge cooperatives face is to minimize decision making costs. This study has examined the relationship between two aspects of cooperatives that affect the ability with which they can minimize these costs: the level of heterogeneity and the level of member participation in cooperative governance.

In the first part of the study, a proposed measurement of heterogeneity based on grouping, with the aim of showing the presence (absence) of dominant groups and the size of the minority (minorities) has been developed. Measuring heterogeneity based on grouping means that the cooperatives are placed into various groups based on certain criteria, for example, the size of the largest group (e. g., the rice produces) and the size of the second largest group in the cooperative (e. g., soybeans producers). In total, five different categories have been distinguished, which rank cooperatives from homogeneous to more heterogeneous: (1), *one dominant party:* the cooperative's largest group of producers (e. g., rice producers) is responsible for over 50% of the total revenues and none of the other groups (e. g., soya producers, pig producers) is responsible for more than 10% of the total revenues; (2), *one majority party and one small minority:* the cooperative's largest group is responsible for over 50% of the total revenues and none of the other groups is responsible for more than 20% of the total revenues; (3), *one majority party and one significant minority:* the cooperative's largest group is responsible for over 50% of the total revenues and none of the other groups is responsible for more than 30% of the total revenues; (4), *one majority party and one large minority:* the cooperative's largest group is responsible for over 50% of the total revenues and none of the other groups is responsible for more than 40% of the total revenues; (5), *no majority groups:* none of the groups is responsible for more than 50% of the total revenues.

In the second part of the study, this ranking of cooperatives was used to examine the relation between heterogeneity and member participation at the general assembly (by means of scatter plots), and at the board of directors (by means of logistic regression).

With regard to proposition 1, the results of the scatter plots showed that member participation at the general assembly increases with higher levels of heterogeneity until heterogeneity reaches a certain level where the cooperative lacks a dominant group. Cooperatives placed into category 1-4 showed increased member participation when one shifts from one category to the next; i. e., a cooperative in category 3 has higher member participation than a cooperative in category 2, and a cooperative in category 4 has higher member participation than either group. However, the member participation starts to fall again in the cooperatives in category 5, where no single producer group has a dominant share in the total revenues. These results are in line with the theoretical model developed in the study which postulates that there is a non-linear relation between member participation and level of heterogeneity (Figure 4).

With regard to proposition 2, the results significantly supported the proposition for the relation between one type of cooperative heterogeneity (size of producer groups, i. e., PERCMEMB) and board participation. When the heterogeneity in the size of producer groups increases (i. e., when the size of minority group increases relative to the dominant group), the probability that larger farmers participate is highest (i. e., in category 4 cooperatives). The results did not support the proposition either with regard to member heterogeneity (farm size, i. e., PERCVOL) and with regard to the other type of cooperative heterogeneity distinguished (product groups, i. e., PERCPROD).

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