Collective Action in Agriculture: The Case of Wine-grape Farmer Cooperatives in Chile∗

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Abstract

Studies show that organizing in cooperatives or farmer associations provides benefits to farmers such as access to high-value markets and increased competition. These could help them (especially small-holders) increase the price they receive for their produce. In this paper, we investigate why wine-grape farmers in Chile are not organizing and reaping the potential benefits of collective action.

Organizing in farmer cooperatives is a way of integrating small-holder farmers into high-value markets. While cooperatives have expanded in the world in the past decades, Chile is an exception in terms of the incidence of wine-grape farmer cooperatives. For example, in Chile there are a total of 5 active wine-grape cooperatives. In a random sample of 184 wine-grape farmers, we observe 18% of farmers participating in cooperatives. So, why aren't most small-holder farmers organized in wine-grape cooperatives in Chile, as they usually are in the rest of the world?

In an environment with high-transaction costs, we would expect farmer associations to fill market gaps. We explore this question based on the theory of collective action and cooperative formation, and empirically investigate the determinants of participation in wine-grape cooperatives including variables representing transaction costs. Our results indicate that higher transaction costs increase the probability of participating in wine-grape farmer cooperatives.

Introduction

Farmers in Chile are not organizing and reaping the potential benefits of collective action, such as access to high-value markets and increased competition. These could help them (especially small-holders) increase the price they receive for their produce. We investigate this issue in the wine-grape market in Chile.

In the past decades there has been a change in consumer preferences in the world towards high-quality products. This has posed challenges but also opportunities for small-holder and less educated farmers (SFs) in developing countries (Reardon and Barrett, 2000; Reardon and Berdegué, 2002; Anderson, 2004). However, there are barriers that restrict SFs' participation in these markets such as access to credit, education, and the scale of production. Contract farming and cooperatives are possible ways of integrating these farmers into high-value markets (Reardon and Barrett, 2000; Hellin et al., 2009; Torero et al., 2010). In fact, contract farming and cooperatives have expanded in the world in the past decades (Reardon and Barrett, 2000). In terms of wine-grape contracting, Chile is no exception. In a random sample of 184 wine-grape farmers, most farmers have either explicit or implicit contracts with their buyers to sell their wine grape. However, Chile is an exception in terms of the incidence of wine-grape farmer cooperatives. For example, in Chile there are a total of 5 active wine-grape cooperatives (Ministerio de Economía, 2016).[1] In our data, we observe 18% of farmers participating in 2 of these cooperatives and in a couple of farmer associations that are not cooperatives (henceforth, we use the term "cooperatives" to refer to both cooperative and non-cooperative associations).[2] So, why aren't most SFs organized in wine-grape cooperatives in Chile, as they usually are in the rest of the world?

Some potential explanations are, first, that the historical and institutional setting in Chile inhibited cooperative formation. Second, that trust among farmers is insufficient to form coop-

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[1] In the Ministry's cooperative database there appear 6 active wine-grape coopertives. However, I understand from interviews conducted in the field, that one of these cooperatives was bought by Concha y Toro in 2008. So, in reality there are only 5 active wine-grape cooperatives in Chile.

[2] For comparison purposes, in Perú there are approximately 78 coffee-farmer associations and 22 cocoa-farmer associations. The latter export about 70% of the total volume of cocoa beans. In Argentina, agricultural cooperatives contribute to about 6% of GDP and wine cooperatives have a market share of about 13%. In Chile, wine-farmer associations export about 0.2% volume of total bottled wine and 1% volume of total bulk wine exported (Confederación Cooperativa de la República Argentina, 2006; De la Cerda, 2011; Mogrovejo et al., 2012).

eratives, for example, farmers may fear that because of the free-rider problem some will benefit out of the "contributions" of the rest of the members. Finally, that cooperatives exist only where transaction costs are sufficiently high so that cooperatives help to fill market gaps. In this paper we will focus on this last hypothesis (hereafter, the "transaction cost" hypothesis).

There has been some work exploring the historical and current state of farmer associations in Chile from which we draw some of the historical and institutional evidence that will serve as background information (Berdegué, 2001; Pérez et al., 2003; Nayan et al., 2012).

In an environment with high-transaction costs including, for example, high costs of transportation, scattered markets, and high risks associated with the marketing of perishable products, we would expect farmer associations to fill market gaps (Holloway et al., 2000). Although the wine-grape sector seems to have all of these characteristics, cooperatives have not developed as in other places. We explore why this is occurring based on the theory of collective action and cooperative formation and empirically investigate the determinants of participation in wine-grape cooperatives.

Our findings indicate that being more isolated and having less market infrastructure increases the probability of being part in a wine or wine-grape cooperative. These results provide evidence in favor of the transaction cost hypothesis.

Historical Background

Cooperatives in Chile emerged from the labor sector spontaneously in the late 1800's with the purpose of improving workers' rights. The first agricultural cooperatives were registered at the beginning of the 1900's. A cooperatives' law was enacted in 1924 and in 1927 a Department of Cooperatives was created by the government. In 1939 the government created the Chilean Economic Development Agency (CORFO) whose mission was to promote industrialization in different economic sectors. This favored growth of cooperatives in rural areas including the wine sector. From 1964 to 1970 cooperatives were promoted by the Chilean government. After the military coup in 1973 many cooperatives were intervened by the government especially those with popular orientation. Later with neoliberal policies and the early 1980's economic crisis, many cooperatives went into bankruptcy. After this crisis and together with the neoliberal policies, many cooperatives became more market oriented. From Chile's return to democracy in 1990 until today, cooperatives have been characterized by their autonomy from the government and, at the same time, cooperatives have not been a priority for the government (Pérez et al., 2003).

In Chile there are a total of 5 active wine-grape cooperatives. Three of these cooperatives are located in the Maule valley, one is located in the Metropolitan Region, and another one is located in the Atacama Region. The number of members in each cooperative ranges from 17 to 426. All of these cooperatives, with the exception of one, were formed between 1940 and 1960 (Ministerio de Economía, 2016). So, most wine-grape cooperatives have been resilient to different policies and economic crises.

Theoretical Framework

Relative to the huge literature on collective action problems in the context of private provision of public goods (no exclusion, no rivalry) and management of common pool resources (no exclusion, rivalry) (Ostrom, 1990), the firm startup context can generally be thought of as a club good problem (exclusion, no rivalry). We think of a firm (where the good or service generates externalities of some kind) as more like a public good than a common pool resource. It is far from a pure public good, however, because members can choose to exclude new potential members from joining. If the benefits a cooperative generates are completely external (e.g. good or service is exactly the same, but the presence of a cooperative increases competition), then the cooperative is a pure public good.

In a missing market context, however, consumers (or farmers) cannot access the good if they do not participate in the cooperative.[3] In this case, at the time the cooperative is formed, members can choose to write a contract that excludes anyone from accessing goods of the cooperative if they are not initial contributors. Of course, *ex post*, members want to renege on this commitment and let everyone in so that the fixed cost can be spread more widely. But if everyone knows commitment is not possible, then nobody wants to contribute.

Sociologists have proposed that a critical mass is needed for collective action (Marwell and Oliver, 1993), which could be reinterpreted as the need of a minimum number of members to cover initial costs of cooperative formation (Hueth and Moschini, 2014; Hueth, 2016). This, combined with the potential problem of free riding generated due to the public good nature of cooperatives, may prevent cooperative formation in the absence of exogenous policies encouraging it.

Cooperative formation has usually been studied in economics from an industrial organization perspective including imperfect competition and cooperatives' potential pro-competitive effect but almost no work has been undertaken to explicitly link collective action and cooperative formation (Sexton and Sexton, 1987; Hueth, 2016). Hueth (2016) is recently attempting to do this for the case of cooperative formation in the United States. In fact, he develops a model of endogenous

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[3] "Consumers" is a very general term here that can represent any type of patron member.

cooperative formation based on Cornelli (1996) to solve collective action problems. In cases where a profit-maximizing firm chooses not to enter a market, he shows that the cooperative enterprise may endogenously arise as an efficient response to providing goods and services or, in other words, to fill the missing-markets' gap. Cooperatives can extract greater surplus from members compared to investor-owned firms (Hueth and Moschini, 2014). Hueth (2016) argues that this occurs because cooperative ownership can reduce frictions generated due to an information asymmetry combined with imperfect commitment. However, since this form of ownership is costly in other ways, it is Pareto efficient only when there is a "missing market."

In the model Hueth (2016) proposes, he compares a profit-maximizing monopolist and a cooperative firm. Since the main objective of these two types of firms differs, the conditions under which the good or service will be provided differ as well. Here we briefly present his results and incorporate a fixed transaction cost that may affect the provision of the good.

In both cases we consider two periods and N patrons (or users) of a good or service. They demand one unit of this good or service which is produced at zero marginal cost after incurring fixed costs $K > 0$ and $t > 0$. We are assuming that a portion of the total fixed costs of forming a cooperative has to do with transaction costs and denote it by t.[4] The valuation of the good or service by each patron is v_i and we assume they hold common beliefs about the distribution of these valuations from which each patron value is independently drawn.

A profit-maximizing monopolist will produce the good or service if $(1 + \beta)\Pi(p^*) \geq K + t$, where $\beta < 1$ is the discount factor and p^* is the optimal price the monopolist chooses after maximizing expected profits $\Pi(p)$. However, since there is a missing market, the monopolist cannot charge a uniform price in each period. So, the monopolist can request *ex ante* contributions from patrons and produce the good whenever these contributions are sufficiently high. We consider the mechanism in which patrons reveal their true valuations to the firm in exchange of a probability of accessing the good. So, the promised utility has to satisfy incentive compatibility. Let $R(v)$ be a monotone strictly increasing function representing the marginal revenue contribution from selling

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[4]Once the cooperative is formed, a set of variable transaction costs becomes relevant. For example, being remotely located can affect the fixed cost of forming a cooperative as well as variable costs when the cooperative is formed.

to a patron with valuation v under truthful valuation reporting and define v^* as the solution to $R(v^*) = 0$. Under these assumptions, the monopolist will produce and sell a good if

$$(1 + \beta) \sum_{i=1}^{N} \mathbb{1}\{v_i \geq v^*\} R(v_i) \geq K + t \quad ,$$

where $\mathbb{1}$ is an indicator function. Then, the firm will request *ex ante* contributions to patrons and choose to produce only when those contributions are sufficiently high to cover all the fixed costs. In addition, the firm will only provide access to the good or service to patrons whose individual valuation is sufficiently high i.e., those with valuations $v_i \geq v^*$.

Considering the case of a cooperative firm that maximizes patron welfare, rather than profit, and assuming $\tilde{v}$ is the solution to $\tilde{v} + R(\tilde{v}) = 0$, the cooperative will choose to produce when

$$(1 + \beta) \sum_{i=1}^{N} v_i + \lambda R(v_i) \geq (1 + \lambda)(K + t) \quad ,$$

where $\lambda = \mathbb{1}\{\sum_{i=1}^{N} v_i + R(v_i) < K + t\}$. This means that the cooperative may accept members whose valuations are not high enough and use other members' valuations to subsidize those members. However, if $\sum_{i=1}^{N} v_i + R(v_i) < K + t$, the cooperative cannot afford these subsidies, but the cooperative could still produce.

So, considering the cooperative's objective, production can occur over an expanded range of valuation profiles compared to a profit-maximizing firm. This in turn will make production more likely for the cooperative firm that for the profit-maximizing firm under a setting where the profit maximizing firm is not likely to enter, i.e. a missing market setting (see Hueth, 2016, for more details).

A testable implication of this model is that under a setting with higher (fixed) transaction costs, cooperatives are more likely to emerge. If that is the case, we would expect to observe higher transaction costs to be associated with higher participation in cooperatives.

Summarizing, cooperatives have elements of a public good and there are incentives to free ride, especially at the time of cooperative formation. Indeed, for a cooperative to be formed, consumers (or future members) need to cover initial fixed costs. So, there is a minimum number of consumers needed to put capital to cover those costs. Nevertheless, once the cooperative is created members cannot be excluded from accessing the cooperative's goods or services and

potential members benefit from the externality generated by the presence of the cooperative in the market (due to greater competition for an undifferentiated good). So, there is an incentive for potential members to wait until other agents cover the initial fixed costs and then join the cooperative, delaying or impeding cooperative formation. However, if there is sufficient demand for these goods or services—assumed to be privately known to consumers, cooperatives may be created to fill the missing-markets' gap.

In the case of wine-grape cooperatives, if there is no market available, or located sufficiently close, for farmers to sell their wine-grapes, farmers themselves may invest in forming a cooperative that buys wine-grapes and, possibly, makes and markets wine.

Data and Methods

To study cooperative formation empirically, one would need data before and after formation, and formation is usually difficult to predict (unless it is exogenously encouraged through, for example, specific policies). Therefore, we do not propose to study cooperative formation empirically *per se* but instead, we study the determinants of participation in farmer associations at one point in time, given the cross-sectional nature of our data. We still base the analysis on the prediction obtained from the theoretical model that in a setting with higher (fixed) transaction costs, cooperatives are more likely to emerge. So, we expect to observe higher transaction costs to be associated with higher participation in cooperatives.

Our empirical analysis is close in spirit to the analysis conducted by Holloway et al. (2000). These authors explore the impact of household-level transaction costs and production techniques on participation in governmentally-created milk groups, through milk marketing. Their results indicate that transaction costs play an important role in participation. They conclude that milk groups can enhance participation of farmers by providing better market access. We believe that cooperatives may also provide market access for wine-farmers that are isolated. Their analysis is based on a regression of marketable surplus on transaction and other characteristics. We instead estimate the determinants that affect the probability of being member in a wine-grape cooperative on transaction cost measures. We particularly care about indicators of the spatial nature of cooperatives that may affect transaction costs such as measures of isolation. Along those lines, Sexton (1990) (theoretically) studies cooperatives' pro-competitive effect and indicate the importance of the location of cooperatives relative to investor-owned firms.

We estimate the following empirical model using a logistic distribution,

$$\Pr(participation = 1 | \mathbf{x}) = \frac{e^{\mathbf{x}'\gamma}}{1 + e^{\mathbf{x}'\gamma}} \quad ,$$

where the probability of participation equal to one refers to the probability of being member in a wine-grape cooperative, $\mathbf{x}$ is a vector of regressors, and γ is a vector of parameters. The set of regressors $\mathbf{x}$ are variables representing transaction costs and other controls. As variables

representing transaction costs, we include regional characteristics such as measures of isolation and valley of production.

If the transaction cost hypothesis holds, we would find that the more isolated farmers and the farmers with less market infrastructure are more likely to participate in farmer associations. We measure isolation as distance from the main highway. Being far from the market increases the cost of transportation, so we expect to find a positive and significant coefficient on this variable. The valley of production may represent differences in transportation and market infrastructure between the two valleys considered in this project. Anecdotal evidence suggests that the Maule valley has poorer infrastructure. Assuming this is true, we would expect a positive and significant coefficient in the dummy variable for the Maule valley. Other controls that we include in this regression are: education of the farmer, measures of competition such as number of buyers, and indicators of the technology of production such as crop-management practices.

The data for this analysis comes from a survey of 184 randomly-sampled wine-grape farmers located in two wine valleys of Chile, Colchagua and Maule, collected during 5 months in the 2011-2012 season. These valleys were originally chosen because they are representative of Chilean wine production including heterogeneous types of contracts. We collected data mainly on farmer and farm characteristics, characteristics of the vineyard and crop-management practices, characteristics of the current and past contracts, investments made throughout the history of the crop, and participation in wine-grape farmer associations.

Results

Based on the empirical strategy outlined above, we conducted Logit regressions of the probability of participating in a wine-grape farmer cooperative on measures of isolation and the valley of production. As measures of isolation we considered distance to the main highway, number of alternative buyers, and having more than one buyer in the season. We controlled for characteristics of the farmer such as education and wealth. We begin by presenting descriptive statistics of the variables used in the estimations. Then, we present the main results.

Table 1: Descriptive statistics

	Mean	Standard dev.
Member of a wine or wine-grape farmer association	0.181	0.386
Distance from farm to the main highway (km)	39.315	26.092
More than one buyer last season	0.136	0.344
Number of alternative offers	1.238	2.053
Maule valley	0.473	0.501
Log of total area (ha) of one farm	3.285	1.593
Household head education (years)	10.945	5.443
Observations	184	

From the descriptive statistics presented in Table 1, considering the main variables used in our estimations, we observe that 18% of the farmers in the sample are members of a wine-grape cooperative. The average distance to the main highway is 39 kilometers. Fourteen percent of the sampled-farmers have more than one buyer and, of those, 36% are members in a wine-grape cooperative. When selling their wine-grape last season, farmers had on average 1.2 alternative offers from potential buyers. About half of the farmers are located in the Maule valley, the rest are located in Colchagua.

The results, presented in Table 2, indicate that higher distance to the main highway increases the probability of participating in a wine-grape farmer cooperative by 0.3 percentage points. While this magnitude is small, distance to the main highway is significant at 5% level, leaving everything else constant, and is robust to different specifications.

In terms of the number of wine-grape buyers, according to our hypothesis, having more buyers decreases the chances of forming a cooperative. But according to these results, once the

Table 2: Determinants of the probability of being part of a cooperative

	Co-op 1	Co-op 2	Co-op 3	Co-op 4
Distance to the main highway (km)	0.003**	0.003**	0.003**	0.003**
	(0.001)	(0.001)	(0.001)	(0.001)
More than one buyer last season	0.130*	0.129*		
	(0.072)	(0.073)		
Number of alternative offers	0.001		0.001	
	(0.009)		(0.010)	
Maule valley	0.224***	0.230***	0.238***	0.243***
	(0.056)	(0.054)	(0.056)	(0.055)
Log of farm area (ha)	-0.015	-0.014	-0.010	-0.010
	(0.022)	(0.020)	(0.021)	(0.020)
Household head education (years)	0.007	0.008	0.009	0.010
	(0.006)	(0.006)	(0.006)	(0.006)
Observations	176	179	176	179

Notes: *$p<0.10$ ** $p<0.05$ *** $p<0.01$. Estimated using a logit model with robust standard errors. Average marginal effects reported. Standard errors are in parenthesis. Regressions include a constant term.

cooperative is formed, having more than one buyer increases the farmers' chances of being part of a cooperative by 13 percentage points, leaving all else unchanged. These could be indicating that some other reasons, besides transaction costs, are affecting farmers' participation in a cooperative. For example, farmers that are more isolated maybe also more subject to risk. Maybe the cooperative is allowing farmers to smooth the risk they face through diversification of buyers.

The results also show that producing in Maule valley increases the chances of participating in a wine-grape farmer cooperative compared to Colchagua valley by around 23 percentage points. The Maule valley is less developed in terms of marketing and physical infrastructure (e.g., higher percentage of unpaved roads) than the Colchagua valley.

So, we find evidence in favor of the transaction cost hypothesis. In other words, being more isolated and having less market infrastructure increases the probability of being part in a wine or wine-grape cooperative. This is consistent with the model prediction that higher transaction costs are associated with higher participation in cooperatives.

Conclusion

Our findings suggest that cooperatives will arise in areas that are more isolated and where market infrastructure is scarce. While these results do not fully respond the bigger question as to why cooperatives have not developed as much in Chile compared to other countries, they still contribute to evidence the fact that cooperatives will emerge in areas where transaction costs are higher. Of course, if transaction costs are too high, no firm will emerge.

Other results that may be worth exploring in future studies are that, according to our predictions, having more buyers will decrease the chances of forming a cooperative. However, we find that when a cooperative is already formed, having more buyers increases the chances of being a member in a cooperative. These could be indicating that some other reasons, besides transaction costs, are affecting farmers' participation in a cooperative. For example, farmers that are more isolated maybe also more subject to risk and the cooperative may allow farmers to smooth the risk they face through diversification of buyers. We acknowledge in the introduction that more hypotheses may be explaining the formation or lack of formation of cooperatives in Chile. It would be worth exploring some of those other hypotheses.

An obvious limitation of this work is that we cannot observe cooperative formation *per se*. It would be interesting to conduct experimental work where we can elicit valuation by potential buyers (patrons) of a good or service and play an adaptation of a voluntary contributions mechanism experiment where potential members contribute voluntarily to finance a public good. We would expect valuations to be correlated with contributions and as long as a minimum number of patrons contributes, in which case the good would be financed.

This study may highlight the need for institutional changes designed to promote farmer associations which can improve market access for the disadvantaged farmers.

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