ANNA PETRUCHENYA

Essays on Cooperatives

Emergence, Retained Earnings, and Market Shares

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Emergence, Retained Earnings, and Market Shares

Essays over coöperaties:
Ontstaan, ingehouden winst en marktaandeel

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To My Family

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1. Introduction

Cooperatives received significant attention in recent years as an alternative to investor-owned corporations. For example, the UN announced 2012 as the year of cooperatives. Cooperative forms of organizing are also highlighted in several UN sustainable development goals, particularly as means of achieving sustainable and inclusive economic growth. The objective of a cooperative to advance the interests of its member-owners is appealing from a societal perspective, particularly when comparing it with a profit-maximizing objective of an investor-owned firm.

The most recent cooperative statistics indicate that there are over 2.6 million co-operatives in the world with about 1 billion members (International Cooperative Alliance, 2017). Cooperatives employ around 12% of the total employed population in the G20 countries (Roelants et al., 2014).[1] The share of economic activity accounted for by cooperatives has grown throughout the 20th century (Hansmann, 1999). Besides empirical prevalence, there are also theory-driven reasons to study cooperative enterprises. Often classified as hybrids in transaction cost economics, cooperatives lie in between the hierarchies and markets (Menard, 2007). As a consequence, the distinctive governance and the allocation of property rights in a cooperative enterprise has generated substantial research interest around this form of organizing. This thesis adds to the existing body of knowledge about a cooperative enterprise in three ways: (i) by conceptualizing and evaluating different patterns of emergence of cooperatives; (ii) by delineating an efficient allocation of decision rights regarding the profit distribution in cooperatives, from a relational contracting perspective; (iii) and by investigating the determinants of cooperative market shares in the EU.

1.1 Definition of a cooperative enterprise

This thesis focuses on agricultural cooperatives. For the purpose of our analysis, we define a cooperative as an enterprise owned by a society of many independent farmers. The defining feature of a cooperative is the fact that farmers are not only the owners, but also the users of the downstream enterprise.[2] The user role arises due to the presence

[1] The members of the G20 are Argentina, Australia, Brazil, Canada, China, France, Germany, India, Indonesia, Italy, Japan, Republic of Korea, Mexico, Russia, Saudi Arabia, South Africa, Turkey, the United Kingdom, the United States and the European Union (represented by European Comission).

[2] The combination of the ownership and transaction relationships in a cooperative constitutes the first core principle of a cooperative enterprise highlighted by Dunn (1988), i.e. a cooperatives is user owned.

of a transaction relationship between the upstream and downstream parties. This characteristic is crucial when comparing a cooperative to an investor-owned firm (IOF), because farmers, unlike the outside investors, deliver their farm outputs to the downstream firm.

Figure 1.1 visualizes this definition. The squares in the upper part of the figure denote individual farmers, and the square at the lower part of the figure denotes the downstream enterprise, such as a processing plant. The crosses inside the squares indicate the allocation of ownership. Notice that the square at the lower part has no cross. The rest of this section elaborates in more detail on each of these elements of the definition.

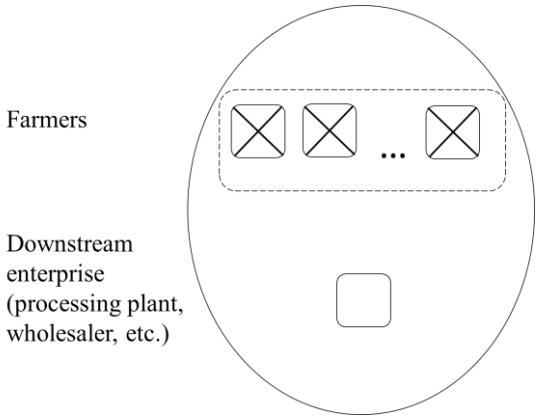


Figure 1.1. A cooperative

The governance of transactions in agricultural markets is interesting from the theory of the firm perspective, where a standard way of delineating a governance structure is to distinguish ownership rights, income rights, and decision rights. First, ownership rights are allocated to the society of farmers in an agricultural cooperative. To illustrate, consider the case of dairy production. A dairy supply chain typically consists of several stages: milk is produced on a dairy farm, transported to a processing plant, where it is processed into a variety of dairy products, which are then packaged and delivered to a retailer. For analytical clarity, this chain can be further reduced to just two stages: an upstream stage, i.e. the production of milk at the farm level, and a downstream stage, i.e. processing, packaging, and delivery of dairy products to the final market. Crudely, there are three possibilities regarding the distribution of ownership rights over the two stages. First, farmers' milk could be sold to a processing plant in a spot market. Such a governance structure, i.e. the *market exchange*, entails that farmers own the upstream stage of production (the farms), and the downstream stage is owned by another party, such as investors or private entrepreneurs. Another possibility is that the ownership is concentrated at the downstream level. Hence, the *backward integration*

implies that the downstream party owns the dairy farms. The third possibility is that farmers *integrate forward*, i.e. they collectively own the downstream processing stage. The latter possibility is the focus of this thesis. The concentration of ownership at the upstream level is depicted in Figure 1.1 by (i) crosses at the upstream stage, i.e. every farmer is also an owner, and (ii) by a large circle, i.e. farmers collectively own the downstream enterprise.

However, the cooperative governance form differs from hierarchy or vertical integration conceptually for at least two reasons. The first difference arises due to the identity of the owner. A cooperative is owned by a society of farmers-owners, as depicted by a dotted line in Figure 1.1. Second, each farmer owns a portfolio of assets. Some assets of farmers' are pulled together to collectively own a downstream enterprise. The remaining assets, such as farms, remain under farmers' individual control and ownership.

1.2 Research questions and positioning of chapters

The natural starting point in studying cooperative enterprises is to ask why and how they emerge. This question is addressed in Chapter 2. The main objective of this chapter is to conceptualize the distinction between bottom-up and top-down emergence of cooperatives. It investigates under which conditions cooperatives arise bottom-up with the initiative of farmers only. It provides an explanation for the emergence of so-called coop-champions, i.e. active farmers who initiate the cooperative formation. Next to that, the role of the outsiders and their types in the top-down emergence of cooperatives is discussed. The distinction is made between a selfish outsider, such as a rent-seeking entrepreneur, and a benevolent type, such as an NGO. Lastly, it formulates the conclusions regarding the efficient governance of cooperative emergence. In the terminology of Cook and Burress (2009), Chapter 2 of this thesis focuses on the first stage of cooperative life-cycle.

Once the patterns of cooperative emergence are delineated, the question of organizational design arises. In characterizing the internal organization of the firm, we refer to Hansmann (1996) by distinguishing between the decision and income rights. The decision rights are about the formal and informal authority, i.e. "who has the control to decide regarding the use of assets". The income rights are about the distribution of value created in the cooperative enterprise. The presence of ownership and transaction relationships has an effect on the allocation of decision and income rights in a cooperative.[3] We study the consequences of this effect in Chapter 3. The focus of the

[3] Decision and income right allocations in a cooperative constitute the second and the third core principles of a cooperative enterprise by Dunn (1988), i.e. cooperatives are user-controlled and user-benefitted.

analysis is the decision regarding the profit distribution in a cooperative and the retained earnings percentage. The share of profit retained by the cooperative enterprise is an important source of internal finance. We study, from an efficiency perspective, the optimal allocation of this decision right between cooperative members and the management, and the effect of such an allocation on the cooperative retained earnings percentage. The repeated, long-term nature of this decision is captured by adopting the relational contracting perspective in the analysis.

Chapter 4 investigates the consequences of cooperative governance on the market structure. It explores the variation in agricultural cooperatives' market shares across countries and sectors in the European Union. The goal of this chapter is to explain why cooperatives are prevalent in some settings but not in others, where settings are distinguished in terms of sector and country. The analysis starts with an observation that cooperative market shares in the European Union are significantly higher in some sectors, such as dairy, and in some countries, such as the North-West of Europe. The main of objective of Chapter 4 is therefore to explain the determinants of varying cooperative market shares across the sectors and countries in Europe.

Chapters 2, 3, and 4 are plotted in Figure 1.2, where the vertical axis represents the level of analysis, and the horizontal axis represents the time of a life of a cooperative. Chapter 2 studies the strategic choices of farmers and the outsiders in the formation of a cooperative enterprise. Hence, it is located at the enterprise level of analysis and at the first stage of a cooperative life-cycle. The analysis of Chapter 3 is also at the enterprise level. The decision regarding cooperative profit appropriation is relevant during all consecutive stages of a cooperative life-cycle. Lastly, Chapter 4 employs a market level perspective by studying the market shares of cooperatives in different sectors in the European countries. Once a cooperative is formed, a value of a cooperative market share may be associated with any stage of a cooperative life-cycle, i.e. it may be the case that some cooperatives are growing while others are mature.

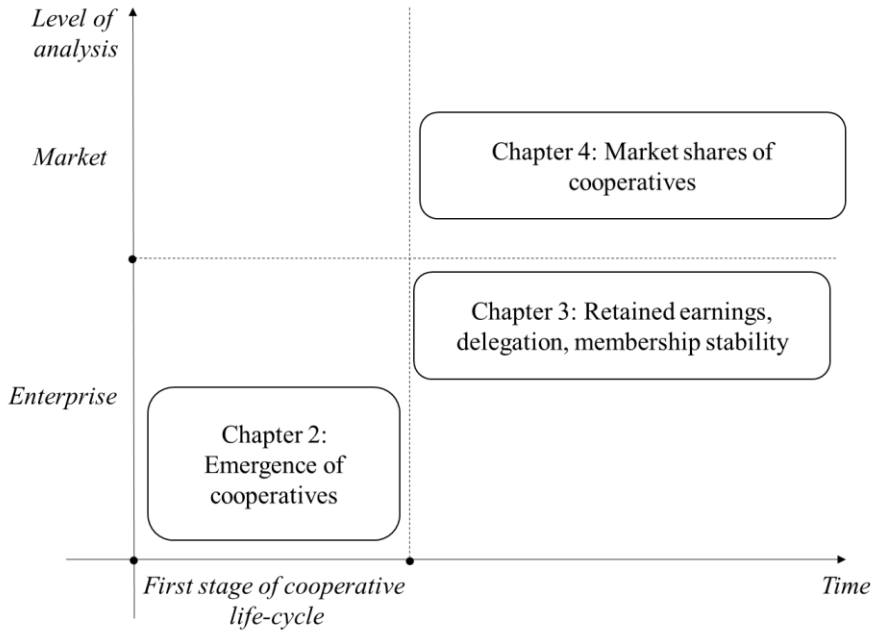


Figure 1.2. Positioning of chapters

The chapters of this thesis are conceptually linked and can be viewed as stages in a game. During the first stage, the type of emergence of a cooperative, i.e. bottom-up or top-down, is determined. The second stage deals with organizational design, i.e. the decision rights regarding cooperative profit distribution are allocated. This has an effect on the retained equity in a cooperative. Lastly, a cooperative market share is viewed as an outcome of the game. Because the game is solved by backward induction, the connection between chapters is evident. The type of emergence determines the type of relational contracts, which develop between the upstream and downstream parties in a cooperative. For instance, an equilibrium path may imply that a bottom-up cooperative is member-controlled, and the real authority is allocated to a manager in a top-down cooperative. The allocation of decision rights determines the equilibrium value of the retained equity in a cooperative, and subsequently, the market share of a cooperative.

The framework regarding the four levels of social analysis by Williamson (2000) is useful when positioning the chapters of this thesis in the broader context. It distinguishes between the embeddedness, institutional environment, governance, and resource allocation levels. A higher level imposes constraints on the level immediately below. For instance, cultural norms and traditions impose constraints on the formal institutions, which in turn put constraints on the governance structure choice. Lastly, the choice of the governance structure affects the decisions regarding the allocation of

resources in organizations. Chapter 4 is based on this theoretical framework and discusses it in more detail.

Table 1.1 positions the chapters of this thesis according to the four levels of the social analysis framework. A large part of the analysis is located at the third level, i.e. the governance of enterprises. It entails the governance structure choice: bottom-up vs. top-down emergence in Chapter 2, member-controlled vs. delegated cooperative in Chapter 3, and cooperative vs. IOF, and consequently the cooperative market share, in Chapter 4. Next, Chapter 3 also investigated the decision regarding the allocation of cooperative profit, i.e. it is concerned with the analysis on the third level - governance. Lastly, the objective of Chapter 4 is to study the determinants of cooperative market shares at all levels of social analysis.

Level of social analysis	Positioning of chapters
Embeddedness	4
Institutional environment	4
Governance	2, 3, 4
Resource allocation	4

Table 1.1. Positioning of chapters according to the four levels of social analysis (Williamson, 2000)

The models in Chapters 2 and 3 do not explicitly model the processes at the embeddedness and institutional environment levels of social analysis. Yet, it is implicitly assumed that the choices at the third level, i.e. governance, are constrained by the higher two levels. For instance, the type of emergence of a cooperative in Chapter 2 is not independent from the cultural, historical, and institutional environments. We reflect this observation by allowing for different ranges of the distance parameter in our model. The distance measure is incorporated to reflect the heterogeneity of farmers. Our assumption is that heterogeneity of farmers determines the horizontal costs of collective action. A theoretical link between homogeneity and trust emphasizes the relationship between the embeddedness level of social analysis and the emergence of cooperatives (the governance level). Chapter 3 establishes the conditions for the stability of relational agreements in cooperatives, which are not isolated from the embeddedness and institutional environment levels. A discounting parameter in the model of Chapter 3 facilitates more stable contracts. We are not concerned with the determinants of the magnitude of a discounting parameter, i.e. the discounting parameter is exogenous in the model. However, differences in cultural and institutional environments may give rise to a variety of impatience rates. For instance, in an environment where the future is characterized by high levels of uncertainty and the possibility of opportunistic behavior,

player may be more impatient. Overall, the game-theoretic analyses in the Chapters 2 and 3 highlight the third level of social analysis, i.e. the governance level. However, the interpretation of the models' predictions cannot be done in isolation form the higher levels of social analysis.

1.3 Methods

Several methods are used to address the research questions raised in this thesis. Chapters 2 and 3 apply game theory. Chapter 2 formulates a non-cooperative game between two farmers and an outsider. The coordination and hold-up problems between farmers are discussed in the context of a cooperative formation. Next to that, the role of the outsider in overcoming these problems is addressed. Two approaches are used in modeling the behavior of different types of outsiders. The selfish nature of an outsider is captured by the "take-it-or-leave-it" type of contract. The benevolent type of an outsider is captured by formulating a bi-form game, i.e. the players non-cooperatively determine whether a cooperative is formed, and a Shapley value is used in allocating the surplus in a cooperative with a benevolent outsider. Hence, this chapter uses the concepts developed in both cooperative (Shapley value) and non-cooperative game theory.

Chapter 3 formulates a non-cooperative game with complete information between the upstream and downstream parties in a cooperative. The upstream party (farmers) is to be viewed as a principal, and the downstream party (cooperative management) is to be viewed as an agent. Hence, it studies the principal-agent problem in the context of the cooperative profit distribution decision. On the one hand, sufficient share of the cooperative profits needs to be allocated downstream to meet the participation and incentive compatibility constraints of the management. On the other hand, sufficient share needs to be returned back to farmers to ensure that the upstream party's participation constraint is satisfied. Lastly, the role of relational contracts is analyzed by specifying an infinitely repeated version of the stage game. Both chapters 2 and 3 formulate the efficiency results, by comparing the total surpluses generated in different governance structures.

Chapter 4 provides a quantitative empirical analysis of cooperative market shares in the European Union. It exploits the data which was collected during the major EU project "Support for Farmers Cooperatives", initiated by the European Commission in 2010. The data on relevant measures is collected at the country level. Because the number of observations in the data set is small, i.e. there were 27 EU member states in 2010, the possibilities for statistical analysis are also limited. Therefore, Chapter 4 reports two types of effect sizes – correlation coefficients and differences in means, and formulates results in terms of associations between variables, and not in terms of causal relations.

1.4 Declaration of contribution

All chapters of this thesis were written by the author. All chapters incorporate the extensive feedback from the promoter. Additionally, feedback from conferences and seminars, as well as the comments of reviewers of scientific journals were integrated. Chapters 2, 3, and 4 are currently under review in management and agricultural journals. The author of this thesis is listed as the first author, and the promoter is listed as the second author.

2. Emergence of Cooperatives and Member Heterogeneity: Bottom-up or Top-Down?

Abstract

The relationship between member heterogeneity and the pattern of emergence of cooperatives is studied in a non-cooperative game with members and an outsider, where members choose to become active, stay passive or leave. Our results show that when the value of the outsider is low and heterogeneity is limited, a cooperative emerges efficiently bottom-up by all members taking an initiative. A coordination problem arises when heterogeneity increases. Only one member takes the lead when heterogeneity is moderate. The game changes to a prisoner's dilemma when heterogeneity is high. With high heterogeneity, no cooperative emerges. We identify the role for a third party by considering a selfish outsider, such as the "dragonheads" in China, and a benevolent outsider, such as NGOs. A top-down cooperative with a selfish (benevolent) outsider is uniquely efficient when the value of the outsider is in the intermediate high (low) range and heterogeneity of members is low (high).

Keywords: Cooperative, emergence, heterogeneity, bottom-up, top-down, collective action

2.1 Introduction

Cooperative governance of enterprises has received considerable attention in recent years. For instance, cooperatives are now recognized as the means for achieving Sustainable Development Goals, set by the United Nations in 2015, particularly Goal 8 on inclusive and sustainable economic growth (UN 2016). The emergence of farmer cooperatives accomplishes an inclusive growth objective when it provides sufficient incentives for farmers to become active. The initiative to become involved in a cooperative may arise from the farmers themselves (bottom-up) or from an outsider (top-down). This chapter conceptualizes the bottom-up and top-down emergence of cooperatives and formulates conclusions regarding the efficient governance of emergence.

Cook and Burress (2009) distinguish five stages of the life-cycle of a cooperative. They are economic justification, organizational design, growth-glory-heterogeneity, recognition and introspection, and choice. In the first stage, economic motives that lead to cooperation between farmers are defined. It is argued that through collective action, farmers are able to improve their socio-economic position in the presence of market failures and corresponding market contracting costs. During the second stage, cooperative principles are formally incorporated into organizational architecture. The latter three stages mark the struggle with vaguely defined property rights due to evolving member heterogeneity. In this chapter, we focus on the first stage of the cooperative life-cycle and examine how member heterogeneity relates to different patterns of emergence of farmer cooperatives. To our knowledge, this paper is the first attempt to model different types of emergence of collective action during the first stage of the cooperative life-cycle.

Hansman (1996) argues that homogeneity of interests among members in farmer cooperatives is crucial because it minimizes the costs of collective decision-making. More generally, the literature on collective action provides many examples of how heterogeneity hampers cooperation (Ostrom 2010). Member heterogeneity is also important in establishing a cooperative because it requires coordination among many members and the associated coordination costs are lower when players are less heterogeneous. Heterogeneity is a variable which has many dimensions. Examples are the number of different commodities produced or inputs purchased by the members, the variance in members' age, the variance in members' educational levels, the differences between members as regards to farm size, the percentage of non-farm income, or the differences between members in terms of business objectives (Iliopoulos and Cook 1999; Höhler and Kühl 2017).

Member heterogeneity is prominent in the theoretical as well as the empirical literature regarding cooperatives. Mérel et al. (2009) summarize the horizontal and

vertical product differentiation literature. Farmers are distinguished by location and/or quality. The empirical literature on cooperatives often refers to heterogeneity.[4] Sexton and Sexton (1987) observe that cooperatives are often formed within local areas. Liang and Hendrikse (2013) identify several reasons why coordination costs are lower for farmers within local areas: similar nature conditions, farmers have the same cultural and economic backgrounds, members have a high degree of kinship and the same dialect. Fernandez (2014) observes that the formation of grain cooperatives in the US was problematic due to the farmers' isolation from each other. We capture the extent of heterogeneity between farmers by one heterogeneity parameter in our model.

Farmer cooperatives may emerge either bottom-up or top-down. We provide a number of examples of each type of emergence. First, there are numerous cooperatives worldwide that emerged bottom-up, solely on the initiative of farmers. For example, starting in 1882, many Danish dairy cooperatives were formed by energetic entrepreneurial farmers (Svendsen and Svendsen 2000). These initiatives led to higher quality of dairy products and also allowed farmers to charge higher prices. Second, cooperatives may arise due to the initiative of coop champions, i.e. individual farmers taking a lead in setting up a cooperative. For example, in 1960, Niel Black, a lifelong champion of dairy farmers in Australia, helped create the Noorat Artificial Breeders Cooperative and became a founding director (Black, 2013). Another example is Brazilian credit cooperative San Roque de Minas, which was established by coop champion Joao Leite as a response to the banking failure. Third, cooperatives may emerge due to some members leaving an existing cooperative and forming one of their own. When a cooperative consists of heterogeneous members, it may become more attractive for high-quality farmers to leave the cooperative and form a smaller homogeneous high-quality cooperative. Such a bee-hive pattern was recently observed in several Swedish cooperatives, which emerged due to members de-associating themselves from larger cooperatives (Hakelius et al. 2013), as well as in the Dutch cooperative The Greenery (Hendrikse 2011). Fourth, LeVay (1983) provides historical evidence of cooperatives that were organized by individuals inspired by the idea of cooperative principles. She argues that the initial stage of formation of a cooperative is not spontaneous but rather a result of a collective perception of an opportunity. According to the 1913 report of the Long Clawson Dairy Ltd., this British cooperative originally started as an intangible myth in the minds of two or three enthusiasts, but consequently turned into a well-performing business (LeVay 1983). Cooperation principles based on Raiffeisen or the Rochdale principles are other examples that may

[4] Sommer et al. (1983) finds significant homogeneity among members of food purchasing cooperatives, which were found to be young, well-educated, ethnically homogeneous, non-affluent, and motivated by low prices, food quality, natural food and co-op philosophy.

have been crucial in the bottom-up formation of cooperatives.[5] Besides economic motives, cooperative members have a sense of "moral certainty" and are concerned with issues such as the environment and genetically modified crops.

Fifth, in various countries, the top-down genesis of cooperatives is initiated by the government.[6] In their study of agricultural cooperatives in Russia, Golovina and Nilsson (2011) find that top-down emergence initiated by the Russian government is common but has proved to be largely unsuccessful. Similarly, empirical analysis of 37 farmer cooperatives in China indicated that cooperatives rarely emerge as a result of bottom-up collective action (Liang and Hendrikse 2013). Rather, Chinese cooperatives emerge due to top-down mechanisms involving entrepreneurs and/or the government. In her historical account of agricultural marketing cooperatives, Fernandez (2014) refers to compulsory top-down wheat cooperatives established by the government in the United States, Australia, and Canada as a response to disruptions caused by World War I. A contemporary example of a mandatory top-down cooperative initiated by the government is the Greek wine cooperative Santo Wines based in Santorini, where all grape-growers are legally obliged to join the wine cooperative (Iliopoulos and Theodorakopoulou 2014). Sixth, as in the case of the northern part of the US, the initiative may also come from associations like the Farmers Union (Olson 1971). Seventh, cooperatives may arise due to an initiative from abroad, such as the strategy of the British Empire to promote cooperatives in its dependent territories in the 20th century (Rhodes 2012). Finally, an initiative to form a cooperative may also originate from a key player. In the south of the Netherlands, cooperatives were often formed with an initiative of highly educated members of local communities, such as lawyers, doctors, or religious persons. For instance, the priest Van den Elsen was responsible for setting up many Dutch cooperatives.

In other instances there is evidence of the non-emergence of cooperatives. In the south of Europe cooperatives emerge much less frequently than in the north (Bijman et al. 2012). Nearly ninety percent of the fruit and vegetable products are marketed by producer organizations in the Netherlands and Ireland, while in countries such as France, Italy, and Spain this share is around fifty percent, and is below twenty percent in countries like Poland, Finland, and Portugal (Bouamra-Mechemache and Zago 2014). The non-emergence of cooperatives is also observed in other regions, such as the Commonwealth of Independent States and Georgia, where cooperatives are expected to

[5] Additionally, Hurt (2017) highlights idealism as an organizational and driving force in American food cooperatives.

[6] The top-down emergence mechanism by the government may also involve the so-called "extension workers" - external agents who communicate with farmers and educate them about new technologies. At least 400,000 extension workers are currently employed in developing countries (BenYishay and Mobarak, 2013; Spielman et al., 2010).

develop as a response to market failures and farmers' needs, but the development of agricultural service cooperatives still lags behind (Sedik and Lerman 2013).

The emergence of cooperatives in agricultural markets is also relevant from a policy perspective. Since the 1970s, the European Union has been continuously providing support for the formation of producer organizations, and cooperatives in particular. Producer organizations in the fruit and vegetables sector can receive financial support to cover initial as well as operational expenses. Yet, despite the presence of extensive outside support, a non-emergence of cooperatives is observed in some regions. Additionally, due to the unequal emergence of producer organizations, the allocation of subsidies across the EU member states is also unequal. For example, producer organizations in the Netherlands acquired around 100 million euros out of the 700 million euros in the subsidies available for the creation of producer organizations in the European fruit and vegetables sector in 2012. Hence, the question arises of whether the emergence of farmer cooperatives is experiencing problems and whether anything could (and should) be done about it (Bouamra-Mechemache and Zago 2014).

In this paper we formulate a non-cooperative game theoretic model to explain why and how cooperatives emerge. We view a cooperative as a group of farmers who voluntarily choose to process collectively. The presence of an outside party allows us to differentiate between top-down and bottom-up types of emergence. A distance measure between farmers is incorporated to reflect their heterogeneity. Our assumption is that heterogeneity of farmers determines the horizontal costs of collective action and therefore the formation of a cooperative. In addition to studying the relationship between farmer heterogeneity and the type of emergence of farmer-to-farmer collective action, our model allows for addressing several sub-questions. First, given the variety of emergence types observed in the empirical literature, we are interested in how to characterize bottom-up and top-down cooperatives and to determine when cooperatives emerge bottom-up or top-down. Second, by differentiating between the active and passive players, we investigate conditions under which coop-champions may arise. Third, we investigate when outsiders arise and whether their type matters to farmers' decisions. The objective of the selfish type of the outsider is to maximize his expected payoff. The benevolent type is concerned with a fair distribution of the cooperative surplus, which is captured by the Shapley value. Finally, we discuss the governance of the emergence of cooperatives from an efficiency perspective. Our main equilibrium results suggest that the bottom-up emergence of cooperatives occurs due to the initiative of both farmers (one farmer) when the value of the outsider (V) is low and the distance parameter (d) is below $1/2$ (between $1/2$ and $2/3$). We also identify the ranges of parameters V and d where different types of outsiders are uniquely efficient. In particular, we find that there is a range of relatively low (high) Vs such that a benevolent

(selfish) outsider is best from the total welfare perspective when heterogeneity of farmers is high (low).

Our paper contributes to five streams of literature. First, by studying different patterns of emergence of cooperatives, we add to a more general discussion on the top-down and the bottom-up formation mechanisms. Easterley (2014) criticizes top-down developments for their flawed goalsetting: they are often motivated by the strategic priorities of sponsoring organizations, and are therefore focused on short-term rather than long-term investments. Yet, in other instances outsider's interventions may create substantial value. By evaluating different emergence patterns from an efficiency perspective, we are able to compare the bottom-up and the top-down emergence in the context of a farmer cooperative.

Second, to study the mechanisms at stake when there is a selfish outsider, we refer to the literature on contracting. One branch of this literature focuses on the range of non-cooperative contracting games, in which the principal makes a take-it-or-leave-it offer to the agent(s) (Segal and Whinston 2003). The principal's profit is typically defined as the difference between the total surplus and the surplus received by the agents. As a result, the principal's rent-extraction motive leads to inefficient contracting outcomes (Segal 1999). Hence, the contracting literature is concerned with finding efficient mechanisms such that the principal maximizes the total surplus. In our model, we investigate the effect of the contract by a selfish outsider on the emergence pattern of cooperatives. Additionally, we examine whether the contract by a selfish outsider gives farmers different incentives compared to a contract by a benevolent outsider.

Third, when conceptualizing the role of a benevolent outsider in supporting farmers' collective action, we contribute to the literature on biform games (Brandenburger and Stuart 2007). The game with a benevolent outsider is a biform game because farmers and the outsider non-cooperatively decide on the governance form in stages 1-4 of the game, and then cooperatively allocate the surplus generated in a top-down cooperative. A fair allocation of cooperative surplus implies that each member receives his marginal contribution, i.e. his Shapley value (Shapley 1988).

Fourth, we contribute to the literature on emergence of organizational forms. There are several answers to the question "why are there so many kinds of organizations?", which was raised in the field of organizational ecology (Hannan and Freeman 1977). Transaction cost theory states that organizations emerge because some transactions are more efficient inside the firm than in markets. Variety of organizational form is observed because transactions differ and "efficiency is realized only if governance structures are tailored to the specific needs of each type of transaction" (Williamson, 1981). More recently, organizational literature emphasized the emergence of new hybrid organizational forms (Makadok and Coff 2009) and the need for new theorizing of novel organizational forms (Puranam et al. 2014). In our paper, with an

objective of studying the collective action of farmers, we rephrase the original question and ask "why are there so many kinds of cooperatives?"

Lastly, the emergence of cooperatives which originate from farmers can be related to the formation of strategic alliances between firms. Strategic alliances are voluntarily initiated cooperative agreements between firms (Gulati 1999). According to the resource-based view, alliances arise because of strategic needs (i.e. payoffs from cooperation are high) and social opportunities (i.e. costs of cooperation are low) (Eisenhardt and Schoonhoven 1996). However, unlike strategic alliances, farmer cooperatives often emerge due to the outsider's initiative and support. Hence, conceptualizing a top-down farmer cooperative requires additional considerations that are not addressed in the alliance literature. We fill in this gap by considering the roles of a third party, selfish or benevolent, in cooperative formation.

The paper is structured as follows. Section 2.2 describes the model, while Section 2.3 presents the equilibrium results. Section 2.4 discusses the predictions of the model in the light of existing empirical evidence about cooperatives worldwide. Section 2.5 concludes and formulates directions for future research.

2.2 Model

We model the emergence of a cooperative as a non-cooperative game with two farmers and an outsider. Figure 2.1 depicts the timing of the events in the game. In the first stage, farmers simultaneously choose the governance structure, i.e. either a setting with (Y) or without (N) the outsider. In the second stage, the outsider chooses a contract specifying a payment to farmer(s). In the third stage, farmer(s) decide to either $Accept$ or $Reject$ the outsider's offer. Finally, in the last stage, farmers choose simultaneously between the actions $Active$, $Passive$, or $Leave$. Choosing $Active$ entails taking an initiative, acting as an enthusiastic leader, and potentially incurring higher costs. The choice $Passive$ implies not taking an initiative and avoiding additional costs. The $Leave$ choice denotes leaving the current market and producing elsewhere. The sequence of decisions follows the convention of game theory and implies that the long-term decisions are made prior to the short-term decisions. Williamson (2000) highlights that the governance structure choice is a long-term decision relative to daily choices of actions.

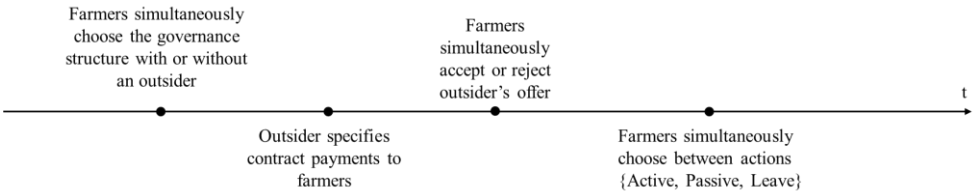


Figure 2.1. Timing of events

Figure 2.2 presents the game in the extensive form. The farmers' choice Yes (No) in the first stage entails the choice of the governance structure with (without) an outsider. The contract by an outsider specifies two (twelve) payments when one (both) farmer(s) choose(s) a governance structure with an outsider. The payments are conditional on the actions of farmers. The last row refers to the subgames [1]-[4], where farmers simultaneously choose between actions $\{Active, Passive, Leave\}$.

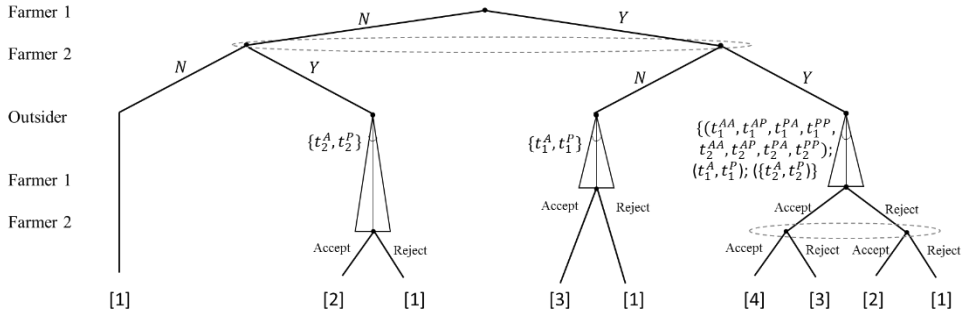


Figure 2.2. The game in the extensive form

Subgame [1] in figure 2.3 presents the payoffs when both farmers choose No in the first stage of the game, i.e. the governance structure without an outsider is adopted. When both players are active, more resources are pulled together. Greater value is generated due to the benefits of collective action such as improved bargaining power and access to input and output markets. Therefore, when a cooperative is formed with an initiative of both farmers, the value generated by a cooperative (8) is greater than when only one farmer initiates the formation (7). Cooperative formation is costly and it is assumed that the horizontal cost of collective action between farmers is a function of farmer heterogeneity. Farmer heterogeneity is represented by the distance measure d between farmers. The total horizontal distance costs are equal to $4d$ when at least one farmer chooses to be active. When both farmers are active, costs and benefits of forming a cooperative are equally shared and each active party receives the payoff of $4 - 2d$. When only one of the farmers is active, he bears the entire horizontal cost $4d$,

but receives a larger share of benefits (4) when compared to the passive player (3). This implies that a payoff to the initiator is equal to $4-4d$; the passive player does not pay for the cost and receives a payoff of 3. When both farmers choose to be passive, no coopeartive emerges and the payoff of each farmer is equal to $2-d$. If one farmer chooses to leave, he earns zero, and the other player receives 1 if he is active and 0.5 if passive. If both leave the market, each player's payoff is equal to zero. V_3 is defined as the value of the outside option of the outsider.

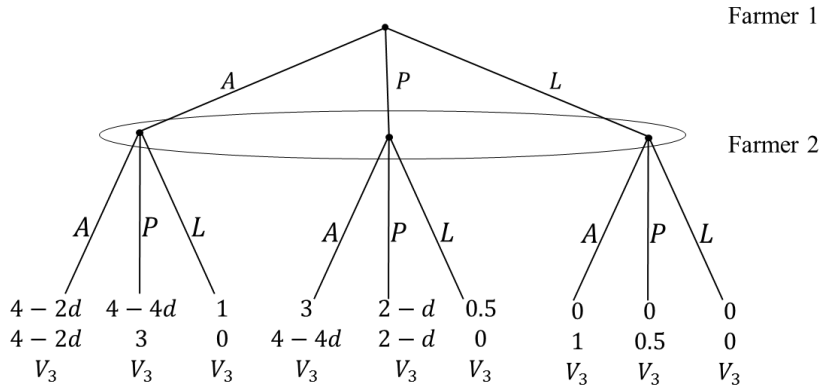


Figure 2.3. Extensive form of sub-game [1] when there is no outsider

Bottom-up emergence of cooperative is defined as a situation when there is no outsider involved in the formation of a cooperative, when both farmers remain in the market and when at least one farmer chooses to be active. So, an initiative is required to ensure bottom-up cooperative formation. Top-down emergence of cooperative is defined as a situation when at least one farmer chooses Yes in the first stage of the game, at least one farmer accepts the outsider's contract to form a top-down cooperative, and at least one farmer chooses $Active$ or $Passive$ in the final stage of the game. All other cases are defined as No-emergence.

When the outsider initiates the formation of a top-down cooperative, he brings additional value to the enterprise such as the access to a new technology, markets, and financial resources. The value of the outsider can also be in the form of specialized knowledge and education which he could offer to farmers. The total value of V is generated when both farmers accept the outsider's contract, and V/2 is realized when only one farmer accepts. The outsider also incurs a vertical cost of a cooperative formation, which depends on the level of the activity of farmers. If both farmers are active, outsider's cost is equal to zero, if one farmer is passive, the cost is equal to c, and if two farmers are passive the cost is equal to $2c$, implying that it is more costly to organize a top-down cooperative with more passive farmers. When a top-down cooperative is formed, the horizontal cost between farmers (a function of d) is therefore

replaced by the vertical cost between the outsider and the farmer(s) (a function of c). The value created by the farmers in top-down cooperative corresponds to their value in a bottom-up cooperative. Two farmers in a top-down cooperative generate $8\ (7, 4)$ when both are active (one is active and one is passive, both are passive). One farmer in a top-down cooperative creates $1\ (0.5)$ when active (passive).

Table 2.1 summarizes the payoffs of the players in terms of the value of each coalition of players in each governance structure. We define $v(.)$ as the value of a subset of the set of players. The value created by a subset of players depends on the choice of each farmer in this subset. We capture this in the definition of $v(.)$ by distinguishing farmers on the choice they make. Define a farmer choosing Active (Passive, Leave) as $A\ (P, L)$, and the outsider as Out. For example, a coalition consisting of only the outsider has a value V_3. A coalition of the two farmers, where one farmer chooses A and the other farmer P, is equal to $v(A, P) = 7 - 4d$. Notice that it does not matter for the value of the coalition whether farmer 1 chooses A and farmer 2 chooses P, or farmer 1 chooses P and farmer 2 chooses A. Finally, $v(Out, A, L) = 1 + V/2$, i.e. the value of a coalition of the three players, with one farmer choosing A and the other farmer choosing L. Notice that $v(Out, A, L) = 1 + V/2$ applies to a setting with a top-down cooperative because a bottom-up cooperative consists of a coalition of two farmers and a singleton coalition of the Outsider.

A bottom-up cooperative is characterized by two coalitions: the two player coalition of the two farmers and the singleton coalition of the outsider. The total value created by the two farmers depends on the choices of action of the farmers. For example, a bottom-up cooperative with one active farmer and one passive farmer results in a total value of $v(A, P) + v(Out) = 7 - 4d + V_3$. A top-down cooperative consists of either one coalition of all players (when both farmers choose Yes in the first stage of the game), or two coalitions (when only one farmer chooses Yes in the first stage of the game). A top-down cooperative with two coalitions entails that there is a singleton coalition with the farmer choosing No in the first stage of the game and a coalition of the other two players. The total value created by the three players depends on the choices of action of the farmers. For example, a top-down cooperative with a farmer choosing No in the first stage of the game and $Active$ in the final stage of the game, and the other farmer choosing Yes in the first stage of the game and $Passive$ in the final stage of the game, results in a total value of $v(A) + v(Out, P) = 1 + 0.5 + V/2 - c$.

Coalitions of	Bottom-up Cooperative	Top-down cooperative
1 player	$v(Out) = V_3$	$v(A) = 1$ $v(P) = 0.5$ $v(L) = 0$ $v(Out) = V_3$
2 players	$v(A, A) = 8 - 4d$ $v(A, P) = 7 - 4d$ $v(A, L) = 1$ $v(P, P) = 4 - 2d$ $v(P, L) = 0.5$ $v(L, L) = 0$	$v(Out, A) = 1 + V/2$ $v(Out, P) = 0.5 + V/2 - c$ $v(Out, L) = V_3$
3 players		$v(Out, A, A) = 8 + V$ $v(Out, A, P) = 7 + V - c$ $v(Out, A, L) = 1 + V/2$ $v(Out, P, P) = 4 + V - 2c$ $v(Out, P, L) = 0.5 + V/2 - c$ $v(Out, L, L) = V_3$

Table 2.1. Surplus of each coalition

We differentiate between two types of outside parties - selfish and benevolent. The objective of the former type is to maximize its own profit. An example of such a type is an independent entrepreneur who is interested in the formation of a cooperative for rent-seeking reasons. This type of behavior is observed in many cooperatives in China, which are formed with an initiative of local elites - the so-called dragonheads - with a purpose of extracting extra rents (Lin and Huang 2007). The benevolent type ensures a fair redistribution of the coalitional surplus. It could exemplify a governmental agency, or a nonprofit organization supporting the creation of a cooperative. For instance, the Dutch NGO Agriterra perceives itself as an altruistic organization (Blokland 2014). It offers farmers advice and support as to how to run their businesses, but also provides financial payments to the cooperatives. US cooperative development program assists farmers in the developing countries. For example, "Farmer-to-farmer" assignments in Senegal provide technical assistance and training in business skills, such as marketing strategies, organizational capacity building, organic farming techniques, and other value addition activities (National Cooperative Business Association 2017). Unique and fair redistribution of the coalitional payoff is characterized by the Shapley value (Shapley 1988). It is determined by the characteristic function embedded in table 1, and is also presented in Appendix 2.1.

The payoffs of the farmers in a top-down cooperative in the subgames [2]-[4] are specified in Appendix 2.1. Subgame [1] characterizes also the final stage of the game when the farmer(s) choosing Yes in the first stage $Reject(s)$ the outsider's offer in the third stage of the game.

2.3 Equilibrium

The subgame perfect equilibrium of the game is determined by backward induction. We distinguish between governance structures with no outsider, with a selfish, and with a benevolent outsider.

2.3.1 Subgame perfect equilibrium when there is no outsider

The subgame perfect equilibrium of subgame [1] is depicted in figure 2.4. We distinguish between three ranges of the distance parameter. When distance costs are low, i.e. $d < 1/2$, the game results in a unique equilibrium with two Active players. Each farmer has sufficient incentives to be active, regardless of the actions of the other farmer. Each active player's payoff $4 - 2d$ cannot be further improved by choosing another action. Therefore, the cooperative emerges bottom-up with the initiative of both farmers. With medium distance costs, when $1/2 < d < 2/3$, the game changes to a coordination game with two pure strategy equilibria. As heterogeneity increases, the value of $4 - 2d$ decreases relative to the constant payoff of 3, earned by a passive player when another player is active. As a result, when heterogeneity is medium, the equilibrium strategy of each player is to remain passive when another player is active, and to be active when another player is passive. This results in a coordination problem and multiple equilibria. In the first (second) equilibrium player 1(2) is active and player 2 (1) is passive. These equilibria are characterized by the formation of a cooperative as a result of one of the players taking a lead. There is also a mixed strategy equilibrium. Each player chooses to be active with probability $(2 - 3d)/(1 - d)$, to be passive with probability $(2d - 1)/(1 - d)$, and to leave with zero probability. When distance costs are high, in particular when $d > 2/3$, the game takes the form of a prisoners' dilemma. Intuitively, it becomes too costly for an active player to take an initiative when another player is passive when heterogeneity is high. Consequently, with high heterogeneity the equilibrium strategy of each player is to remain passive, regardless of the actions of the other player. Both players choose to be passive in the Nash equilibrium, and thus no cooperative emerges. The conclusions of the subgame without an outsider are summarized in Proposition 1.

Proposition 1: In the absence of the outsider, a cooperative emerges bottom-up with two active farmers when d < 1/2, with one active farmer when 1/2 < d < 2/3, and does not emerge when d > 2/3.

Several insights are to be emphasized. First, when no outsider supports the collective action process, the threshold which separates bottom-up emergence from no emergence is $d = 2/3$. When distance is above this threshold, no cooperative is formed because no farmer has an incentive to take the initiative. When distance is below this threshold, horizontal distance costs are lower. Thus, a cooperative can emerge either as a result of the initiative of both farmers ($d < 1/2$) or as a result of one of the farmers taking the lead ($1/2 < d < 2/3$). Figure 2.4 depicts this insight.

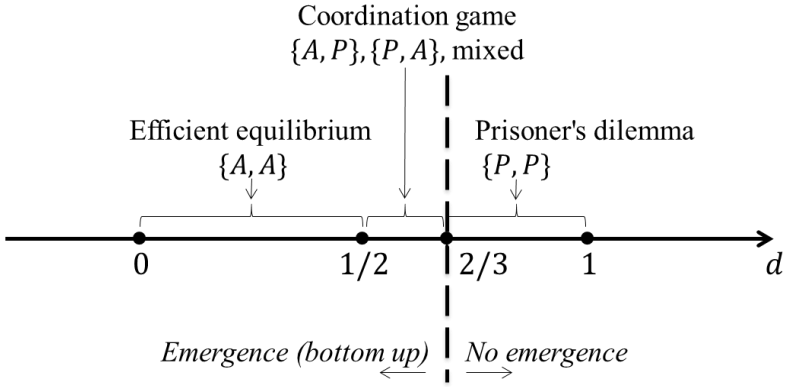


Figure 2.4. Sub-game perfect equilibrium when there is no outsider

Second, the efficiency of the equilibrium depends on the level of heterogeneity. The highest surplus is $8 - 4d$. When farmer heterogeneity is low, this surplus is generated in the unique, efficient equilibrium because it is a dominant strategy for each player to be $Active$. The efficient equilibrium disappears when farmer heterogeneity becomes sufficiently large, i.e. $d > 1/2$. An inefficient equilibrium arises, where the nature of the inefficiency depends on the level of farmer heterogeneity. If farmer heterogeneity is at an intermediate level, i.e. $1/2 < d < 2/3$, then the inefficiency is due to a coordination problem. Payoffs are such that one farmer chooses to be $Active$ in equilibrium, while the other farmer chooses to be $Passive$. Total surplus is equal to $7 - 4d$. If farmer heterogeneity is even larger, i.e. $d > 2/3$, then the game has the structure of the inefficient prisoners dilemma. In this setting it is a dominant strategy for each player to choose $Passive$. Total surplus is reduced to $4 - 2d$. Inefficient equilibria suggest a role for an outsider to increase the surplus generated by bottom-up cooperative.

2.3.2 Equilibrium when the outsider is selfish

We model a situation with an outsider as an ultimatum game. The outsider offers a contract to farmers. The selfish outsider makes a take-it-or-leave-it offer to farmers, and captures all of the additional surplus generated in the top-down cooperative. The entire game with a selfish outsider is solved by backward induction. Equilibrium results in terms of the type of emergence are depicted in figure 2.5 with the distance parameter d and the value V on the axes.

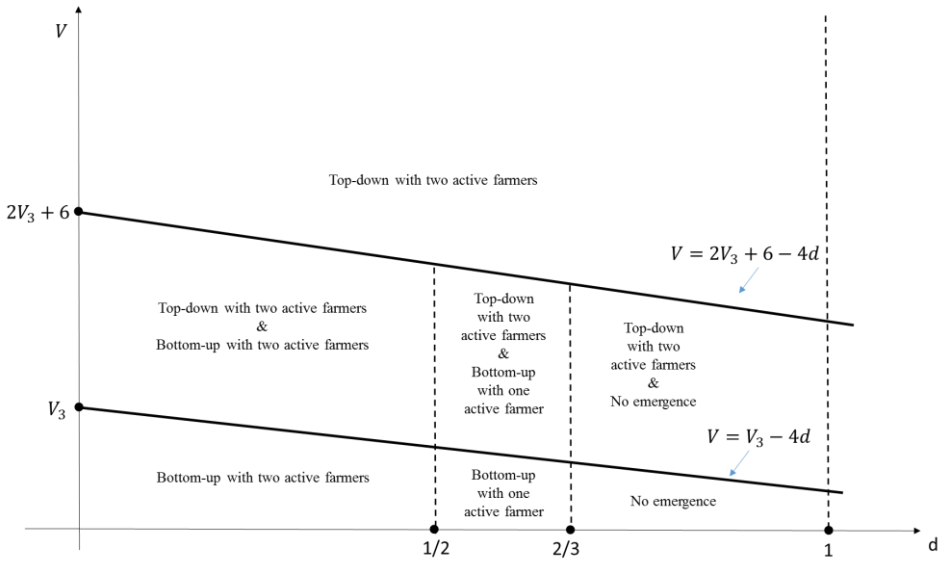


Figure 2.5. Equilibrium emergence of cooperative when the outsider is selfish

Various cases are distinguished. First, the case when the selfish outsider has a high value in a top-down cooperative, i.e. $V > 2V_3 + 6 - 4d$, is depicted in the upper part of figure 2.5. The outsider specifies payments t_i^{jk} and t_l^m, where t_i^{jk} is a payment to farmer i in a top-down cooperative with farmers 1 and 2 choosing actions j and k respectively, and t_l^m is a payment to farmer l in a top-down cooperative with only one farmer choosing action m. To induce farmers to become active in a top-down cooperative, a selfish outsider offers them an amount slightly exceeding their outside option, i.e. the payoff in a setting with no outsider (subgame [1]). These values of the contract variables are presented in table 2.2. For the medium values of the distance parameter d, the payment by the outsider slightly exceeds the value of the mixed strategy equilibrium payoff of the farmers. To discourage passive behavior a selfish outsider offers zero payment if at least one farmer chooses to be passive, i.e. $t_1^{AP} = t_1^{PA} = t_1^{PP} = t_1^P = t_2^{AP} = t_2^{PA} = t_2^{PP} = t_2^P = 0$. The remaining share of the total surplus

is kept by the powerful selfish outsider. A top-down cooperative with a high value selfish outsider always emerges with two active farmers.

	Low d	*Medium d*	*High d*
t_1^{AA}	$4-2d+\varepsilon$	$\frac{4-8d+2d^2+2d^3}{(1-d)^2}+\varepsilon$	$2-d+\varepsilon$
t_1^{A}	$4-2d+\varepsilon$	$\frac{4-8d+2d^2+2d^3}{(1-d)^2}+\varepsilon$	$2-d+\varepsilon$
t_2^{AA}	$4-2d+\varepsilon$	$\frac{4-8d+2d^2+2d^3}{(1-d)^2}+\varepsilon$	$2-d+\varepsilon$
t_2^{A}	$4-2d+\varepsilon$	$\frac{4-8d+2d^2+2d^3}{(1-d)^2}+\varepsilon$	$2-d+\varepsilon$

Table 2.2. Equilibrium payments when the selfish outsider creates high V and farmers are active

Second, a situation when a selfish outsider has medium value, i.e. $V_3-4d<V<2V_3+6-4d$, is shown in the middle part of figure 2.5. The equilibrium contract by a selfish outsider entails $t_1^A=t_2^A=0$, because a top-down cooperative with one active farmer is too costly to a selfish outsider with medium value. Solving the entire game results in multiple equilibria. In the first equilibrium, both farmers choose the governance structure with a selfish outsider in the first stage. In the second equilibrium, both farmers decide on the governance structure with no outsider, i.e. the bottom-up emergence.

Thirdly, the case when the selfish outsider has low value, i.e. $V<V_3-4d$, is depicted in the lower part of figure 2.5. The selfish outsider with low value offers a contract in which every payment is equal to zero because his outside option V_3 always exceeds his payoff in a top-down cooperative. As a result, in the equilibrium both farmers choose the governance structure with no outsider in the first stage, i.e. a top-down cooperative with a low value selfish outsider never emerges.

When the value of the outsider is limited, i.e. $V_3-4<V<V_3$, an increase in the distance parameter d results in the higher likelihood of top-down emergence due to the existence of multiple equilibria. When the distance parameter is high, i.e. $d>2/3$, an increase in the outsider's value V results in more top-down emergence either due to multiplicity of equilibria (V is intermediate) or due to selfish outsider resolving the coordination problem (V is high). Propositions 2a and 2b summarize the equilibrium results regarding the type of emergence when the outsider is selfish.

Proposition 2a: A top-down cooperative with a high (low) value selfish outsider always (never) emerges with two active farmers;

Proposition 2b: When a selfish outsider has medium value, a cooperative emerges either top-down with two active farmers or bottom-up with two active farmers (bottom-up with one active farmer, does not emerge) when d < 1/2 (1/2 < d < 2/3, d > 2/3).

When a top-down cooperative emerges due to the contract by a selfish outsider, it emerges with two active farmers. The payoffs of active farmers in a top-down cooperative with a selfish outsider ($4 - 2d + \varepsilon$) are slightly higher than their outside option, i.e. their payoffs in a setting with no outsider ($4 - 2d$). Farmers' payoffs are negatively related to the distance between them, and are independent of the value of the outsider V. The payoff of a selfish outsider ($V + 4d - 2\varepsilon$) is increasing in both d and V.

2.3.3 Equilibrium when the outsider is benevolent

The objective of the benevolent outside party is to facilitate the creation of a cooperative and to ensure a fair division of the total surplus. The contract by a benevolent outsider specifies the payment(s) to farmer(s) to form a top-down cooperative. To reflect the benevolent nature of the outsider, the Shapley value is used to redistribute the surplus generated in the top down cooperative. The equilibrium result in terms of the type of emergence when the outsider is benevolent and $V_3 = 4$ is depicted in figure 2.6. $V_3 = 4$ is taken for illustrative purposes. Appendix 2 reports equilibrium results for all values of V_3.

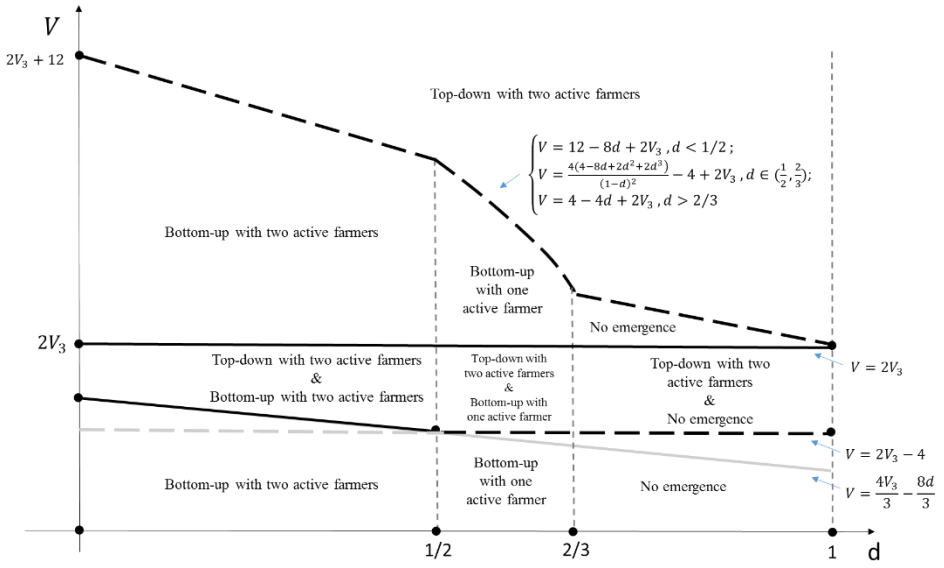


Figure 2.6. Equilibrium emergence of cooperative when the outsider is benevolent and $V_3 = 4$

Similarly to a governance structure with a selfish outsider, we distinguish between high, intermediate, and low ranges of the value of a benevolent outsider. However, the thresholds differ in the two cases. The benevolent outsider has high (intermediate, low) value when $V > 2V_3$ ($\frac{4}{3}V_3 - \frac{8}{3}d < V < 2V_3$, $V < \frac{4}{3}V_3 - \frac{8}{3}d$), as shown by the solid line divisions in figure 6. Equilibrium contract payments from the high value benevolent outsider to the farmer(s) specify the Shapley value of the farmer(s) in a coalition with the outsider, as shown in table 2.3. The medium value benevolent outsider specifies a contract as in table 2.3, except for setting $t_1^A = t_1^P = t_2^A = t_2^P = 0$. As in the case with the selfish outsider, the low value benevolent outsider offers a contract in which every payment is equal to zero because his outside option V_3 exceeds his payoff in a top-down cooperative.

t_1^{AA}	$4 + \frac{V}{4} - \frac{2}{3}d - \frac{V_3}{6}$
t_1^{AP}	$3.75 + \frac{V}{4} - \frac{2}{3}d - \frac{V_3}{6}$
t_1^{PA}	$3.25 + \frac{V}{4} - \frac{2}{3}d - \frac{c}{2} - \frac{V_3}{6}$

t_2^{AA}	$4 + \frac{V}{4} - \frac{2}{3}d - \frac{V_3}{6}$
t_2^{AP}	$3.25 + \frac{V}{4} - \frac{2}{3}d - \frac{c}{2} - \frac{V_3}{6}$
t_2^{PA}	$3.75 + \frac{V}{4} - \frac{2}{3}d - \frac{V_3}{6}$

t_1^{PP}	$2+\frac{V}{4}-\frac{1}{3}d-\frac{c}{2}-\frac{V_3}{6}$
t_1^{A}	$1+\frac{V}{4}-\frac{V_3}{2}$
t_1^{P}	$0.5+\frac{V}{4}-\frac{c}{2}-\frac{V_3}{2}$

t_2^{PP}	$2+\frac{V}{4}-\frac{1}{3}d-\frac{c}{2}-\frac{V_3}{6}$
t_2^{A}	$1+\frac{V}{4}-\frac{V_3}{2}$
t_2^{P}	$0.5+\frac{V}{4}-\frac{c}{2}-\frac{V_3}{2}$

Table 2.3. Equilibrium payments when the benevolent outsider creates high value

Similarly to the case with a selfish outsider, farmers' payoffs in a top-down cooperative with a benevolent outsider are negatively related to the distance *d* between them. However, because of the fair division of costs and benefits captured by the Shapley value allocations, the payoffs of farmers in a top-down cooperative with a benevolent outsider are also negatively related to the value of the outside option V_3 of the outsider, and positively related to the value V of the outsider. This is reflected by the dotted lines in figure 2.6. For instance, when the benevolent outsider creates high value, i.e. $V > 2V_3$, and

$$\begin{cases} V < 4 - 4d + 2V_3 \; for \; d > 2/3 \\ V < \frac{4(4-8d+2d^2+2d^3)}{(1-d)^2} - 4 + 2V_3 \; for \; d \in (\frac{1}{2}, \frac{2}{3}), \\ V < 12 - 8d + 2V_3 \; for \; d < 1/2 \end{cases}$$

it follows that both farmers reject the outsider's contract in the equilibrium and hence a top-down cooperative with the high value benevolent outsider does not emerge. Propositions 3a, 3b, and 3c summarize the equilibrium results regarding the type of emergence when the outsider is benevolent.

Proposition 3a: A top-down cooperative with a high value benevolent outsider emerges with two active farmers when V is sufficiently high.

Proposition 3b: When a benevolent outsider has medium value, a cooperative emerges either top-down with two active farmers or bottom-up with two active farmers (bottom-up with one active farmer, does not emerge) when d < 1/2 (1/2 < d < 2/3, d > 2/3).

Proposition 3c: A top-down cooperative with a low value benevolent outsider never emerges.

2.3.4 Efficient governance of cooperative emergence

This section will address the question which governance structure creates most value. We compare the governance structures - no outsider (N), a selfish outsider (S), and a benevolent outsider (B).

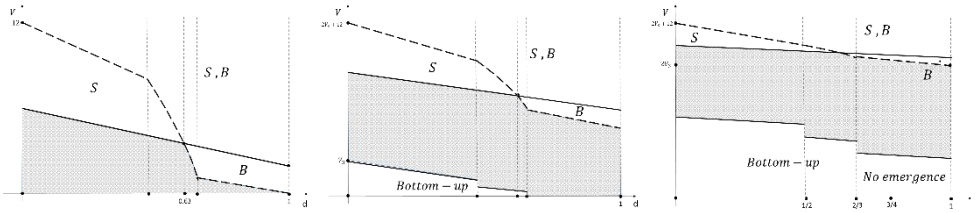


Figure 2.7 Equilibrium governance structures when $V_3 = 0$ (left), $V_3 = 4$ (middle), and $V_3 = 20$ (right)

Figure 2.7 depicts the efficient governance structures for different values of V_3. Several conclusions are formulated. First, bottom-up emergence of cooperative is efficient when V is low relative to V_3. This efficient equilibrium emerges in all three governance structures. Second, there is an intermediate range of $V's$, as depicted by the shaded area in figure 7, such that no governance structure generates an efficient outcome. Third, there's a range of values of V which is relatively

high, i.e.

$$2V_3 + 6 - 4d < V < \begin{cases} 12 - 8d + 2V_3 \; for \; d < 1/2 \\ \frac{4(4-8d+2d^2+2d^3)}{(1-d)^2} - 4 + 2V_3 \; for \; d \in (\frac{1}{2}, 0.63)' \end{cases}$$

(low, i.e.

$$\begin{cases} \frac{4(4-8d+2d^2+2d^3)}{(1-d)^2} - 4 + 2V_3 \; for \; d \in (0.63, 2/3) \\ V < 4 - 4d + 2V_3 \; for \; d > 2/3 \end{cases} < V < 2V_3 + 6 - 4d)$$

and

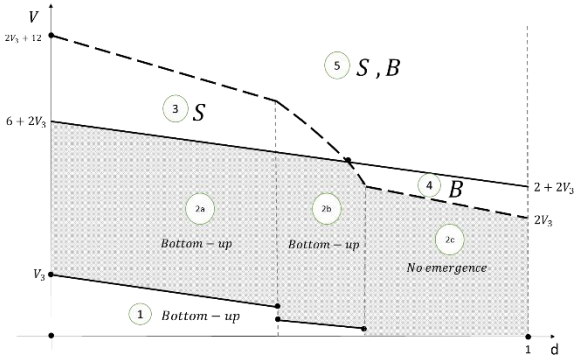
low d's, i.e. less than 0.63

(high d's , i.e. larger than 0.63),

such that the governance structure with a selfish (benevolent) outsider is uniquely efficient. Finally, when the value of the outsider in a top-down cooperative is sufficiently high, the top-down emergence generates the highest surplus, irrespective of the type of the outsider.

The governance structures differ with respect to the sources of inefficiency. For example, all three governance structures generate an inefficient bottom-up equilibrium in area $2a$ in figure 2.8. It is inefficient because the total surplus created by the bottom-up emergence with two active farmers could have been increased if there was a top-

down emergence, i.e. $8 + V > 8 - 4d + V_3$. A governance structure without an outsider is not efficient because a high value of V is forgone. A governance structure with an outsider is inefficient due to a coordination problem, which arises as a consequence of the contract by the outsider. The efficiency result is summarized in Propositions 4 and 5.



Area	N	S	B
1	Efficient	Efficient	Efficient
2a	V is forgone	Coordination	Coordination
2b	V is forgone & coordination	Coordination	Coordination
2c	V is forgone & hold-up	Coordination	Coordination
3	V is forgone or V is forgone & coordination	Efficient	Coordination
4	V is forgone & coordination or V is forgone & hold-up	Coordination	Efficient
5	V is forgone & coordination or hold-up	Efficient	Efficient

Figure 2.8. Sources of inefficiency in governance structures N (no outsider), S (selfish outsider) and B (benevolent outsider) when $V_3 = 4$

Proposition 4: There is an intermediate range of relatively high (low) V's, such that the governance structure with a selfish (benevolent) outsider is uniquely efficient when d is below (above) $\frac{\sqrt{73}-1}{12} \approx 0.63$.

Proposition 5: Bottom-up (top-down) emergence of cooperative is efficient when the value of the outsider is sufficiently

$$\textit{low, i.e. } V < \begin{cases} V_3 - 4d, d \in (0, 1/2) \\ V_3 - 1 - 4d, d \in (1/2, 2/3), \\ V_3 - 4 - 2d, d \in (2/3, 1) \end{cases}$$

$$\textit{(high, i.e. } V > \begin{cases} 12 - 8d + 2V_3, d \in (0, 1/2) \\ \frac{4(4-8d+2d^2+2d^3)}{(1-d)^2} - 4 + 2V_3, d \in (\frac{1}{2}, 0.63) \\ 6 - 4d + 2V_3, d \in (0.63, 1) \end{cases} \textit{).}$$

The structure of the equilibrium contract payments by both types of the outsider implies that when a top-down cooperative emerges in the equilibrium, it emerges with two active farmers. Notice that the comparison of propositions 1, 2, and 3 reveals that a top-down cooperative results in at least as much activity as a bottom-up cooperative. However, the distribution of surplus in a top-down cooperative with two active farmers $(8 + V)$ differs in the two governance structures. Figure 2.9 depicts the payoffs of farmers and a selfish (benevolent) outsider in a top-down cooperative, respectively $F_{1,2}^S$ and S ($F_{1,2}^B$ and B), for different values of parameters V and d, and $V_3 = 4$.

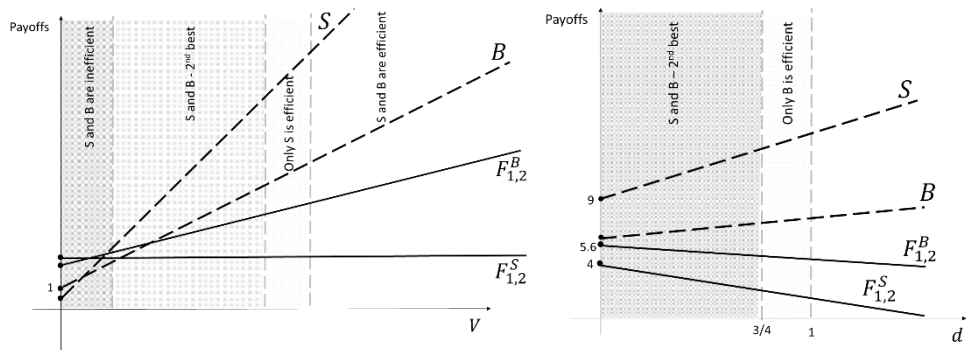


Figure 2.9. Payoffs of the two active farmers and the outsider in a top down cooperative when $V_3 = 4$ and heterogeneity is low, i.e. $d = \frac{1}{4}$ (left), and $V = 9$ (right)

The payoff of a selfish (benevolent) outsider in a top-down cooperative increases by 1 (0.5) when V increases by 1, increases by 4 (1.3) when d increases by 1, and stays constant (increases by 1/3) when V_3 increases by 1. The payoff of active farmers in a top-down cooperative with a selfish (benevolent) outsider decreases by 2 (0.6) when d increases by 1, does not change (increases by 0.25) when V increases (by 1), and does not change (decreases by 1/6) when V_3increases by 1. Figure 2.9 (left) shows that there is a range of parameters, such that governance structure with a selfish outsider is uniquely efficient, but farmers in a top-down cooperative with a selfish outsider are worse off relative to a benevolent case. This range is characterized by a low distance

parameter, and high-intermediate value of the outsider. Hence, for this range of parameters there is a trade-off between efficiency and farmers' payoffs. On the contrary, for the range of parameters, where governance structure with a benevolent outsider is uniquely efficient (depicted on the right of figure 2.9), the fair distribution of total surplus does not create such a trade-off. This range is characterized by a high distance parameter and low-intermediate value of the outsider. Farmers' payoffs are higher in the top-down cooperative with a benevolent outsider, and so is the total surplus.

2.4 Discussion of results

This section discusses the predictions of the model in the light of observations about the different types of emergence of cooperatives.

First, we elaborate on the bottom-up type of emergence. Area 1 in figure 2.10 depicts the range of parameters V and d such that a bottom-up emergence of a cooperative generates the highest total surplus. This occurs for two reasons: (i) due to the low value, which the outsider may creates in a top-down cooperative, and (ii) sufficient bottom-up incentives, given a sufficiently low range of the distance parameter. Consequently, a cooperative emerges bottom-up with two active farmers when $d < 1/2$ and with one active farmer when $1/2 < d < 2/3$.

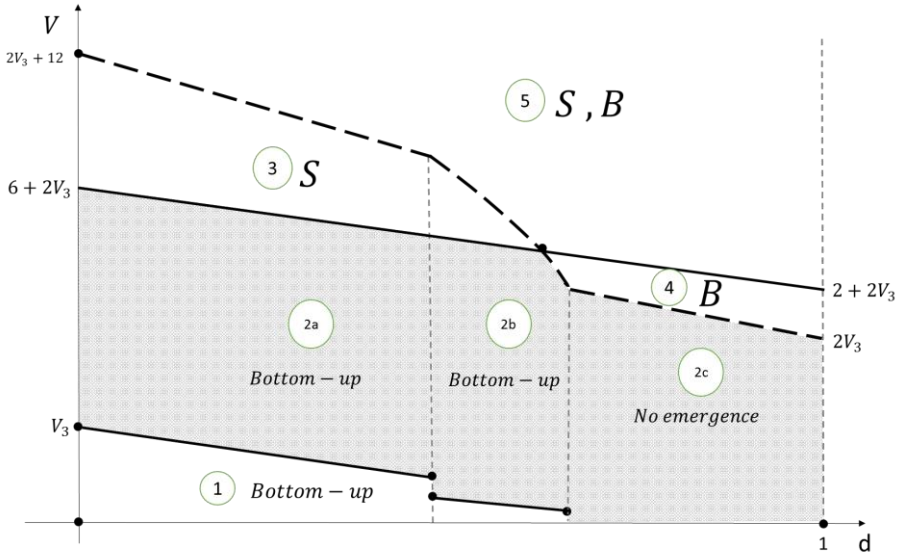


Figure 2.10. Efficient governance of cooperative emergence

The first case corresponds to a situation in Denmark at the end of the 19th century when many dairy cooperatives emerged bottom-up with the initiative of farmer-

members. It is documented that the cooperative movement did not start with the support of the government, philanthropists, landlords, or other outsiders, but was initiated by a group of farmers (Chloupkova 2002). In fact, at the time when the first dairy cooperatives were formed in Denmark, the conservative and anti-socialistic government did not encourage cooperative movement at all (Svendsen and Svendsen 2000). To illustrate, in 1882 the first dairy cooperative in Hjedding was established, financed and managed by the farmers only. Several studies highlight the homogeneity of Danish local communities as one of the key success factors of its early cooperative movement (Larkin 1988; Svendsen and Svendsen 2000; ORourke 2006). To sum up, the empirical observation regarding the emergence of the first dairy cooperatives in Denmark is supported by the predictions of our model: in a setting with low distance parameter, i.e. high homogeneity of local dairy farmers, cooperatives emerged bottom-up without an outsider.

The second case, i.e. the bottom-up emergence with one active farmer when $1/2 < d < 2/3$, applies to the so-called cooperative "champions". They are individuals who initiate the emergence of a cooperative and are willing to invest a larger share of resources and effort into its formation. Empirical descriptions of cooperative champions are scarce. In Australia, Niel Black was referred to as a cooperative champion because he helped to establish the Noorat Artificial Breeders Co-operative and became its founding director in 1960 (Black, 2013). He was able and willing to initiate the formation of this cooperative partly due to his superior knowledge about the dairy sector. Specifically, he studied agriculture at Michigan University in the US, where he learned about artificial breeding, which was not common in Australia at that time. This observation is reflected in our model through an active farmer making the entire contribution for the cooperative formation when another farmer is passive. Then, one contribution of Niel Black as a cooperative champion, when setting up his cooperative, was in a form of his superior knowledge.

Bottom-up emergence is an equilibrium result in areas 2a and 2b. However, it is not an efficient outcome because the total surplus would have been increased if a cooperative emerged top-down. The governance structures with an outsider are also not efficient for these ranges of V and d. A top-down cooperative in a governance structure with an outsider does not emerge because multiple equilibria lead to a coordination problem.[7] An interpretation of this result implies that in some instances top-down

[7] The existence of two pure strategy equilibria in the governance structure with an outsider imply that the players may not be able to coordinate on an efficient equilibrium, i.e. to ensure that a top-down cooperative emerges. An alternative explanation is to refer to the existence of a third equilibrium, i.e. a mixed strategy equilibrium. In that case, an inefficiency arises because a top-down cooperative emerges only probabilistically.

emergence of a cooperative is efficient, but not feasible. Top-down emergence does not occur in the equilibrium because players fail to coordinate on the efficient equilibrium.

No emergence is an equilibrium result when the distance parameter is high and the value of the outsider is low, as depicted by area 2c. Farmer-to-farmer collective action does not emerge due to a hold-up problem. The contract by an outsider leads to a coordination problem. This result is illustrative of a setting in many post-Soviet economies, such as Georgia, where cooperative development in the agricultural sector lags behind (Sedik and Lerman 2013). Consequently, the non-emergence of cooperatives is not efficient because of (ii) the lack of bottom-up incentives, and (ii) an inefficient outsider due to a coordination problem.

Area 3 depicts the range of parameters where a top-down cooperative with a selfish outsider generates most value. It occurs when the distance parameter is below 0.63, and the value of the outsider is relatively high. In this range, the contract by a benevolent outsider is inefficient due to a coordination problem, i.e. a top-down cooperative with a benevolent outsider emerges only probabilistically. In contrast, the contract by a selfish outsider in this range results in the unique equilibrium in which both farmers choose to join a top-down cooperative. Hence, the governance structure with a selfish outsider generates the highest surplus. This range provides an explanation for the existence of the so-called dragonheads in China, i.e. the elites who initiate the formation of cooperatives in local areas with a goal of extracting extra rents (Lin and Huang 2007). The predictions of our model regarding the top-down cooperative emergence by a selfish outsider are in line with the empirical observations about Chinese agricultural cooperatives for at least two reasons. First, area 3 is characterized by a low distance parameter, which is exemplified by the local emergence patterns and low heterogeneity of Chinese farmers. Second, area 3 is characterized by the high value of the selfish outsider, which is exemplified by the superior financial and social connections of Chinese "dragonheads".

Area 4 represents the range where the governance structure with a benevolent outsider is uniquely efficient. It is characterized by a high distance parameter ($d > 0.63$) and relatively low V. In this range, the contract by a selfish outsider generates a coordination problem, which implies that a top-down cooperative with a selfish outsider emerges only with some probability. Hence, the highest surplus of $8 - V$ is achieved with a probability less than one when the outsider is selfish. On the other hand, the contract by a benevolent outsider results in a unique equilibrium, in which both farmers always join a top-down cooperative, and the surplus $8 + V$ is realized with certainty. This result highlights two advantages of the benevolent type of the outsider, such as an NGO, in supporting emergence of collective action. First, there is a range of relatively low $V's$ such that the benevolent type eliminates the hold-up problem between heterogeneous farmers more effectively than a selfish type. Second, when heterogeneity

of farmers is high, a benevolent type requires a lower V to resolve the farmers' hold-up problem than a selfish type. In other words, the benevolent nature of the contract is effective at eliminating the hold-up problem between farmers when their social and spatial heterogeneity is high (d is high), but resources are limited (V is relatively low).

Finally, when the value of the outsider in a top-down cooperative is sufficiently high, i.e. area 5, the top-down emergence generates more value than the bottom-up emergence, irrespective of the type of the outsider. Hence, when an efficient governance structure emerges in the equilibrium, bottom-up cooperatives are predicted not to emerge. This result corresponds with the theoretical prediction of Grossman and Hart (1986) regarding the efficient ownership of enterprises. It proposes that downstream ownership is more efficient, when more value is added at the downstream level. In the context of our model, a top-down emergence is more efficient, when more value is added by the outsider, i.e. V exceeds a certain threshold.

2.5 Conclusion and further research

This paper focuses on studying the relationship between member heterogeneity and the pattern of emergence of cooperatives. By considering changes in only one exogenous parameter, i.e. member heterogeneity, our model provides a novel answer to a question of why "there are so many kinds of cooperatives". First, we provide a conceptual distinction between a bottom-up and top-down cooperative. Bottom-up cooperative emerges with an initiative of two active farmers when heterogeneity is low. When heterogeneity is medium, farmers face a coordination problem. As a result, a cooperative emerges due to an initiative of only one farmer, a coop champion. When no outsider is present and when heterogeneity is high, no cooperative is formed due to a hold-up problem. The role of an outsider is to facilitate the collective action of farmers by replacing horizontal formation costs with vertical costs and by bringing in additional value. A top-down cooperative is formed with two active farmers when the outsider's value is sufficiently high.

Second, we formulate conclusions regarding the efficient governance of emergence of cooperatives. Bottom-up emergence generates the highest surplus when heterogeneity and the value of the outsider is sufficiently low. When the value of the outsider is sufficiently high, top-down emergence is always efficient. We also identify the ranges of parameters V and d where different types of outsiders are uniquely efficient. In particular, we find that the "take-it-or-leave-it" contract by a selfish outsider is most attractive from an efficiency perspective when the value of the outsider is in the high intermediate range and heterogeneity of farmers is low or medium. In the first case, i.e. when heterogeneity is low, a selfish outsider increases the total surplus by bringing in an additional high value. In the second case, i.e. when heterogeneity is medium, he

resolves the coordination problem among farmers. So, a powerful rent-seeking entrepreneur who organizes homogeneous farmers in local areas is a feasible and efficient outcome in some instances. An example of such an outsider is the "dragonhead" who initiates the formation of cooperatives in China. To illustrate, the number of cooperatives in China increased from 26,400 to 1,685,900 between the years 2007 and 2016 (Xu et al. 2017). The contract by a benevolent outsider, such as an NGO, differs from the selfish case because it allocates the cooperative surplus based on a fair rule, i.e. the Shapley value. The difference in the nature of the contract leads to a relative advantage of a benevolent outsider in his ability to resolve the hold-up problem among farmers in a certain range of the parameters V and d. The benevolent outsider is uniquely efficient when the value of the outsider is in the intermediate low range and heterogeneity of farmers is high. Besides, from a distributional perspective, farmers always receive higher payoffs in a cooperative with a benevolent outsider, than with a selfish one. To sum up, we conclude that the type of the outsider matters in the roles of "activating" farmers because each type is associated with a range of parameters where it is uniquely efficient.

Our model also suggests that in some cases no-emergence of cooperatives is an equilibrium result, but it is not efficient. In the governance structure without an outsider, no emergence is a result of a hold-up problem when heterogeneity is high. Hence, in such a setting, if a decision-maker is concerned with increasing efficiency, then the goal is to decrease the distance parameter d to move to a better equilibrium. In the governance structure with an outsider, no cooperative emergence is a result of a coordination problem. It is resolved efficiently only by a selfish (benevolent) outsider when d is below (above) a certain level and V is in a range above (below) a certain value. A benevolent type requires a lower V to resolve a coordination problem than a selfish type.

We propose several directions for further research. First, the current model can be extended in different ways. One extension is to study a case with asymmetric information. Another possibility is to assign more bargaining power to the farmers, and to allow them to offer a contract to different outsiders. Second, in this paper we focused on the first stage of the cooperative life cycle and examined patterns of emergence. For further research it is interesting to integrate further stages of the cooperative life cycle into a model. The relationship between the type of emergence and the consequences during later stages of a cooperative life-cycle is of interest (Chassang 2010; Gibbons and Henderson 2012). In particular, it is worth investigating whether the type of emergence of a cooperative has a long-lasting influence on its performance. For instance, Gibbons identifies relational contracts as one of the most important sources of path dependence (2010). We suppose that different types of relational contracts are developed in bottom-up and top-down cooperatives. Finally, some observers have

doubts about the long-term viability of top-down cooperatives due to the members not initiating the cooperative, i.e. top-down cooperatives are "doomed to fail". Studying this question from the behavioral perspective could contribute to such a discussion. For example, cognitive frames of reference of members in a top-down cooperative will influence their perceptions, inferences, and behavior (Cornelissen and Werner 2014).

Appendix 2.1. The subgames in figure 2.2 for the two types of outsiders

The subgames [2], [3], and [4] in Figure 2.2 when the outsider is selfish are presented in the figures 2.11-2.13. The contract in Figure 2.11 specifies two payments $\{t_2^A, t_2^P\}$ to farmer 2, which depend on his choice of action in the last stage.

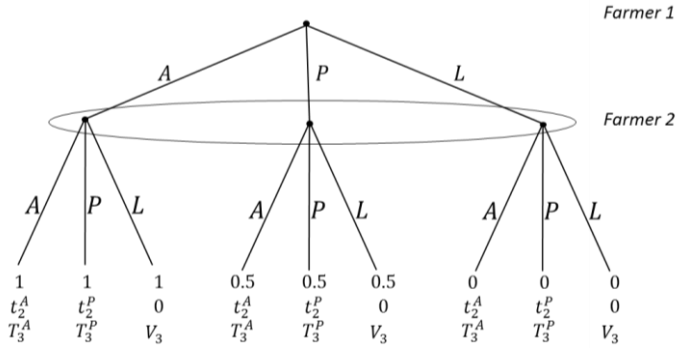


Figure 2.11. Extensive form of subgame [2] in figure 2 when the outsider is selfish

Figure 2.12 specifies two payments $\{t_1^A, t_1^P\}$ to farmer 1, which depend on his choice of action in the last stage.

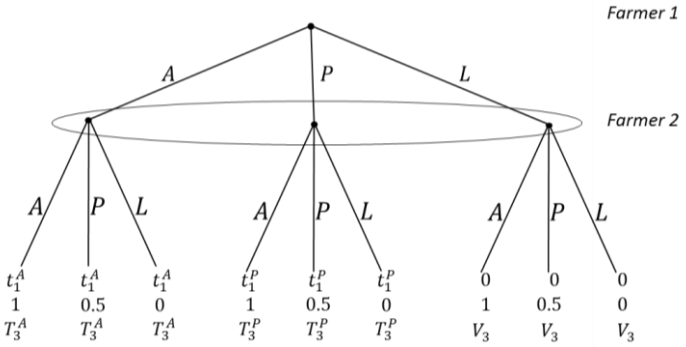


Figure 2.12. Extensive form of subgame [3] in figure 2 when the outsider is selfish

Figure 2.13 specifies twelve payments $\{(t_1^{AA}, t_1^{AP}, t_1^{PA}, t_1^{PP}, t_2^{AA}, t_2^{AP}, t_2^{PA}, t_2^{PP}); (t_1^A, t_1^P); (t_2^A, t_2^P)\}$ to two farmers, which depend on their choice of action in the last stage.

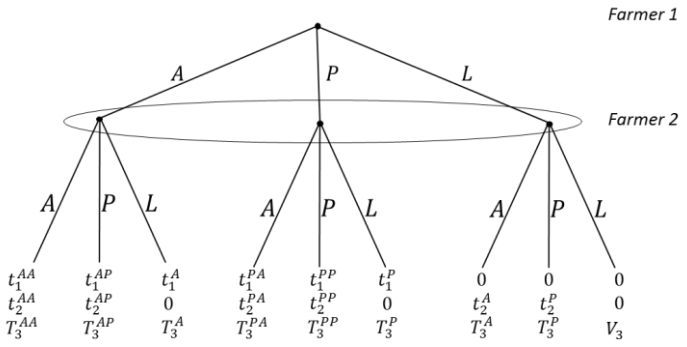


Figure 2.13. Extensive form of subgame [4] in figure 2 when the outsider is selfish

The payoffs in the subgames [2], [3], and [4] in figure 2.2 when the outsider is benevolent are determined by the Shapley value. If both farmers accept the offer, the total surplus is divided among the members of the coalition according to the Shapley value rule. When both players reject the outsider's offer, players play the subgame without an outsider [1], and the outsider earns his outside option V_3. If only one farmer accepts, this farmer forms a coalition with the outsider, i.e. top-down cooperative with only one farmer, in which the total surplus is distributed according to the Shapley value rule. The other rejecting player produces in isolation and receives 1 (0.5) if active (passive). The choices A, P, and L of farmers 1 and 2 entail that there are 9 possibilities. If farmer 1 chooses A and farmer 2 chooses P, then the characteristic function is: $v(A) = 1,\ v(P) = 0.5,\ v(Out) = V_3,\ v(A,P) = 7 - 4d,\ v(Out,A) = 1 + \frac{V}{2}$, $v(Out,P) = 0.5 + \frac{V}{2} - c,\ v(Out,A,P) = 7 + V - c$. The Shapley value is therefore calculated in table 2.4.

Sequence of emergence of grand coalition	Value added by player		
	A	P	Out
$\{A,P,Out\}$	1	$6-4d$	$V-c+4d$
$\{A,Out,P\}$	1	$6+V/2-c$	$V/2$
$\{P,A,Out\}$	$6.5-4d$	0.5	$V-c+4d$
$\{P,Out,A\}$	$6.5+V/2$	0.5	$V/2-c$
$\{Out,A,P\}$	$1+V/2-V_3$	$6+V/2-c$	V_3
$\{Out,P,A\}$	$6.5+V/2$	$0.5+V/2-c-V_3$	V_3

Shapley value	$3.75+\frac{V}{4}-\frac{2}{3}d-\frac{V_3}{6}$	$3.25+\frac{V}{4}-\frac{2}{3}d-\frac{c}{2}-\frac{V_3}{6}$	$\frac{V}{2}+\frac{4}{3}d-\frac{c}{2}+\frac{V_3}{3}$

Table 2.4. Shapley value when farmers 1 and 2 choose actions A and P respectively

Table 2.5 shows Shapley value allocations between the two farmers and the benevolent outsider in all possible 9 coalitions, based on the actions of farmers.

Shapley values in coalitions	Farmer 1	Farmer 2	Outsider
$\{Out, A, A\}$	$4+\frac{V}{4}-\frac{2}{3}d-\frac{V_3}{6}$	$4+\frac{V}{4}-\frac{2}{3}d-\frac{V_3}{6}$	$\frac{V}{2}+\frac{4}{3}d+\frac{V_3}{3}$
$\{Out, A, P\}$	$3.75+\frac{V}{4}-\frac{2}{3}d-\frac{V_3}{6}$	$3.25+\frac{V}{4}-\frac{2}{3}d-\frac{c}{2}-\frac{V_3}{6}$	$\frac{V}{2}+\frac{4}{3}d-\frac{c}{2}+\frac{V_3}{3}$
$\{Out, P, A\}$	$3.25+\frac{V}{4}-\frac{2}{3}d-\frac{c}{2}-\frac{V_3}{6}$	$3.75+\frac{V}{4}-\frac{2}{3}d-\frac{V_3}{6}$	$\frac{V}{2}+\frac{4}{3}d-\frac{c}{2}+\frac{V_3}{3}$
$\{Out, P, P\}$	$2+\frac{V}{4}-\frac{1}{3}d-\frac{c}{2}-\frac{V_3}{6}$	$2+\frac{V}{4}-\frac{1}{3}d-\frac{c}{2}-\frac{V_3}{6}$	$\frac{V}{2}+\frac{2}{3}d-c+\frac{V_3}{3}$
$\{Out, A, L\}$	$1+\frac{V}{4}-\frac{V_3}{2}$	0	$\frac{V}{4}+\frac{V_3}{2}$
$\{Out, L, A\}$	0	$1+\frac{V}{4}-\frac{V_3}{2}$	$\frac{V}{4}+\frac{V_3}{2}$
$\{Out, P, L\}$	$0.5+\frac{V}{4}-\frac{c}{2}-\frac{V_3}{2}$	0	$\frac{V}{4}-\frac{c}{2}+\frac{V_3}{2}$
$\{Out, L, P\}$	0	$0.5+\frac{V}{4}-\frac{c}{2}-\frac{V_3}{2}$	$\frac{V}{4}-\frac{c}{2}+\frac{V_3}{2}$
$\{Out, L, L\}$	0	0	V_3

Table 2.5. Shapley value allocations among the farmers and the benevolent outsider

Appendix 2.2. Equilibrium when the outsider is benevolent and V_3 changes

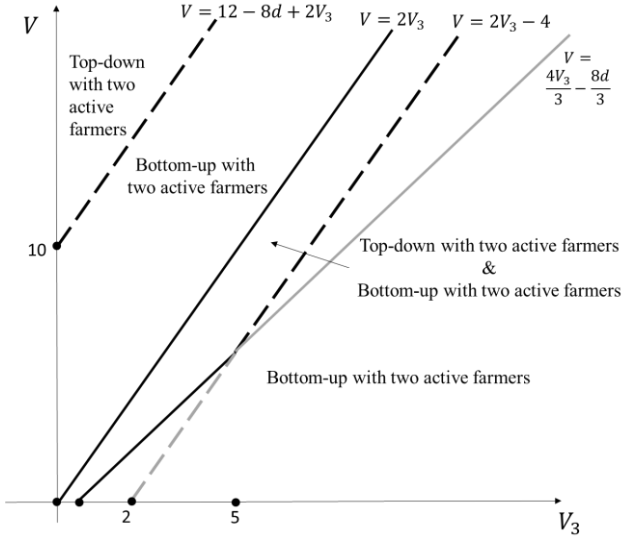


Figure 2.14. Equilibrium emergence of cooperative when the outsider is benevolent and d=1/4

Appendix 2.3. Total surplus evaluation

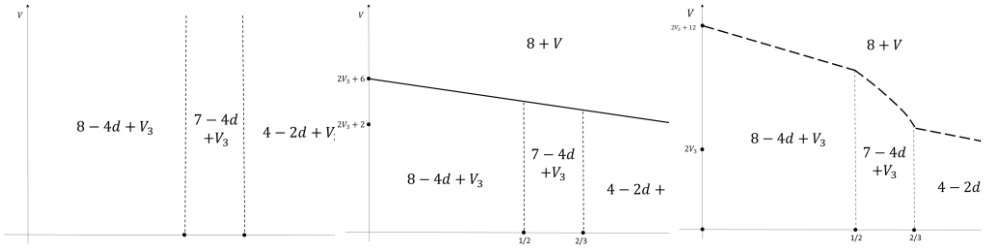


Figure 2.15. Value generated by the bottom-up emergence (left), top-down emergence with a selfish outsider (middle), and top-down emergence with a benevolent outsider (right)

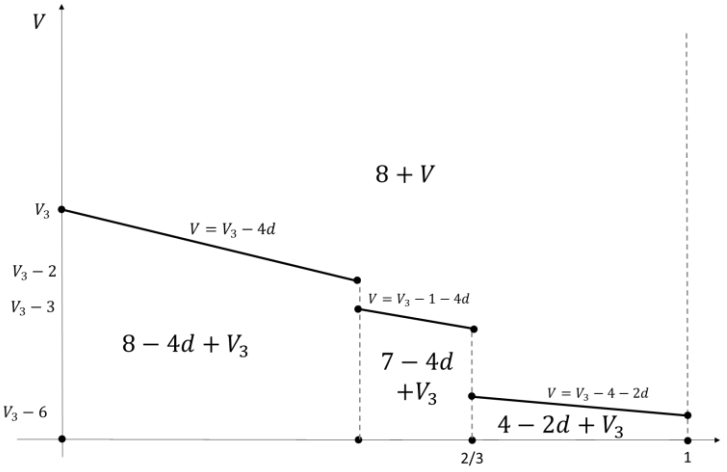


Figure 2.16. Efficient total surplus

3. Retained Earnings, Delegation, and Membership Stability in Cooperatives: A Relational Contracting Perspective

Abstract

Members of a cooperative decide in the annual general assembly meeting regarding the retained earnings percentage. On the one hand, payments to members should be sufficient to satisfy the requirements of the member firms; on the other hand, the share of retained earnings needs to be sufficient to satisfy the needs of the cooperative enterprise. The distribution of profit between the members and the cooperative enterprise is studied in a repeated membership-CEO relationship. The decision right about the distribution of the cooperative profit is either allocated to the farmers or is delegated to the professional management. The results of the one-period setting indicate that the member-controlled governance structure is inefficient due to downstream underinvestment only when the cost of downstream investment is high and the outside option of the management is low. The management-controlled governance structure is always efficient in a one-period setting. In an infinitely repeated setting, there exists a range of the values of retained earnings percentages where the downstream hold-up problem is resolved efficiently. The membership-CEO relationship is most stable when the value added by downstream investment is high, the cost of downstream investment is low, and the outside option of the downstream party and the impatience rate are low.

Keywords: Cooperatives, retained earnings, delegation, relational contracts

3.1 Introduction

An important annual decision in an agricultural cooperative is the distribution of profits between the members and the cooperative enterprise.[8] Members use the financial return from the cooperative to finance their activities, and evaluate it in terms of the attractiveness of being a member of the cooperative. Similarly, retained earnings are not only an important source of finance of a cooperative enterprise, but it determines also its possibilities to invest and its attractiveness as an employer for highly skilled managers.[9] Retained earnings in cooperatives differ across countries, sectors, and time. Chaddad et al. (2005) report that the average retained earnings percentage in cooperatives was around 33%, based on the sample data of 4216 US agricultural cooperatives between 1996 and 2000. There are substantial differences between different commodity groups – in 1985 the retained earnings percentage in the 100 largest US cooperatives varied from 18.1% in dairy and 31.4% in fruits and vegetables cooperatives to 58.3% in rice and 73.5% in sugar cooperatives (Cobia, 1989). Mean values of retained earnings in the 100 largest US cooperatives have increased gradually between 1962 and 1980, from 45.5% to 59.3% (Caves and Petersen, 1986). The percentage of retained earnings in the largest Dutch dairy cooperative Friesland Campina continuously decreased from 60% in 2009 to 45% in 2016. Despite the importance of the retained earnings in cooperatives and the empirical variety, its determinants are not addressed in the cooperative literature. This paper develops a theory addressing the annual choice of retained earnings in cooperatives.

We formulate a non-cooperative game between the upstream (farmers) and the downstream (cooperative management) parties, while taking into account the repeated and long-term nature of interactions between the members and the cooperative enterprise, and by delineating the conditions for a stable membership of a cooperative.

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[8] The allocation of net profit is made among three main categories: patronage refunds, dividends, and unallocated reserves (Cobia, 1989). Patronage refunds are distributions of profit returned to members in proportion to the value of their patronage; dividends are distributions of profit returned to members in proportion to their equity. Retained earnings (unallocated reserves or unallocated equity) is a portion of profit kept by the cooperative to increase its investment capital (equity).

[9] The finance literature highlights the role of retained earnings as an important source of financing. Firms prefer raising capital, first from retained earnings, second from debt, and third from issuing new equity (Myers, 1984; Brealey et al. 2012). From a life-cycle perspective, higher retained earnings may be needed when firms are in an active growth stage (Donaldson, 2000). Additionally, the retained earnings hypothesis states that a firm may voluntarily reduce retained earnings to signal management's confidence in its future earnings (Crawford at al., 2005). Lastly, the change in the retained earnings percentage could be motivated by tax considerations (Myers, 1984).

The first issue highlighted in our model is the decision about the retained earnings in cooperatives. The allocation of the decision right is captured by the choice of governance structure. We characterize a governance structure by the allocation of the decision right to the members or the manager, to decide on the distribution of the cooperative profit. The objective is to study from a relational contracting perspective whether the members of the cooperative or the professional management formulates the proposal about the distribution of profit. Second, we investigate the incentives of the downstream party to invest. Third, in our model we explore the influence of farmers' and management's outside options on the stability of the relationship between the farmers and cooperative management.

The ingredients of the model (delegation, right to take authority away, uncertainty, outside options) are delineated and illustrated by various examples. First, an implication of the relational contracting perspective is that managers' authority can be considered informal because ultimately owners can reassert control if they wish (Baker et al., 1999). It implies that the real authority is "loaned" to the manager. Consider the case of the Dutch cheese cooperative "De Producent", owned by 50 members, located in the Gouda region (Peng, 2017). The general manager is not a farmer member. Instead, he is a professional manager with years of experience in the agricultural industry. The professional manager holds the real authority in the cooperative. Several decision rights are delegated by the farmers to the cooperative management, including the decision about the distribution of profits.

Because the delegation of decision right is informal, the members have a right to reject a manager's proposal and demand a different division of profits, i.e. farmers' decision rights are loaned to the manager, rather than owned by him (Baker et al., 1999). This occurred in the largest Dutch flower cooperative Flora Holland in June 2014. For the first time in cooperative's over 100 years of history, a proposal by the Board of Directors was rejected by the members during the General Assembly meeting (Kras, 2014). The proposal entailed that 50% of the loss which occurred in 2013 (7.4 million euros) be covered by cooperative's own reserves and another 50% (7.4 million euros) be covered by the members. Over 60% of the members who were present at the meeting voted against such a distribution of losses. In the light of our analysis, this outcome is viewed as a change from the delegated governance structure to the member-controlled governance structure.

One of the stylized facts about cooperatives is that they exist in environments characterized by a high degree of uncertainty. For example, a prominent characteristic of the dairy market is the fact that milk prices fluctuate year to year. In the United States, since 1989 the overall trend for conventional milk pay prices has been increasing, while

the prices fluctuated year to year from 12 to 20 USD per cwt[10] (Su and Cook, 2015). The trade-off between providing a stable pay to farmers and maintaining economic sustainability of a cooperative has been addressed in the cooperative literature (see Su and Cook, 2015). The general conclusion is that one of the main functions of cooperatives is to provide a stable pay price to farmers in uncertain environments. Hanish et al. (2012, p. 9) state that "the reason why producers in Europe have chosen the cooperative as "the dairy organization of choice" lies in the internal governance structure and the relation of trust that has been built up over generations coupled with an often market dominating role of the cooperative enterprise promising a relatively safe haven in times of instability".

On the other hand, there are examples of farmers leaving cooperatives and switching to alternative downstream channels. In 2007 almost ten percent of the farmers terminated their membership with Friesland Campina. 650 farmers, of whom 500 were from Germany, switched to supplying milk to a competitor processor Hochwald-Eifelperle, which offered higher prices for the farmers (Agrarisch Dagblad, 2007). In 2015, thirteen percent of the total membership in the Dutch cheese cooperative Doc Kaas (163 farmers) terminated their membership in the cooperative. Such outcomes are interpreted as ending the relational agreements between the members and professional management. By switching to the best alternative outside option, the members forego the long-run benefits of honoring the relationship with the cooperative for the short-term price difference gain.

The profit appropriation decision in a cooperative differs from such a decision in the investor-owned firm (IOF) due to the defining characteristics of a cooperative governance structure. According to Hansmann (1996), one way to define a governance structure is to distinguish ownership rights, income rights, and decision rights. Cooperatives are member-owned, member-benefitted and member-controlled enterprises (Dunn, 1988). The first feature entails that ownership rights in a cooperative are allocated to farmers. As a consequence, a cooperative has no, or limited access to outside equity due to the requirement of member ownership. The share of profits retained by a cooperative is therefore an important source of internal financing for a cooperative enterprise.

The member-benefitted feature of a cooperative implies that farmers are the residual claimants of the cooperative profit. Hence, the decision about the distribution of a cooperative profit is viewed as a trade-off between the immediate monetary payments to members and the long-run benefits to members, resulting from investments in the cooperative enterprise. Immediate benefits to members include payments such as

[10] 1 cwt equals to 50,8 kilograms.

cash patronage refunds and cash dividends. Long-run member benefits from profit distribution in a cooperative include retained patronage refunds, stock, and retained earnings (unallocated equity). Hence, the decision about the appropriation of profit in a cooperative has to address the problem of duality of the cooperative organization form, i.e. members are users as well as owners of the cooperative enterprise. On the one hand, payments to members should be sufficient to satisfy the requirements of the development of the member firms; on the other hand, the share of retained earnings needs to be sufficient to satisfy the needs of the cooperative enterprise.

The presence of the transaction relationship between the owners of a cooperative and the downstream enterprise makes the profit appropriation decision in a cooperative fundamentally different from an investor-owned firm (IOF). There is an inherent conflict between market and member interests in a cooperative (Cook, 1994). The issue of cooperative profit distribution and retained earnings percentage is relevant from the perspective of a cooperative member farmer. First, the cooperative literature suggests that farmers generally have a large personal financial stake in the cooperative (Hendrikse and Veerman, 2001). Farmers often hold memberships in multiple cooperatives. On average, US farmers are members in 2-6 cooperatives (Dunn et al., 1979). As a result, a farmer manages a portfolio of assets, including his farm house, land, equipment, and stake(s) in the downstream cooperative enterprise(s). Farmers may therefore be reluctant to accept a higher retained equity in a cooperative because their objective to maximize their entire portfolio of assets. For instance, it could be the case that the return on investment at the farm is higher than the return on investment at the cooperative enterprise (Staatz, 1987).

The last feature of a cooperative governance structure is member-control. As owners, farmers hold the formal authority in the enterprise. The percentage of profit retained by the cooperative enterprise has a direct effect on the stream of payments received by the member in a given year, and consequently on the farmer's asset management decisions. Therefore, the decision to retain patronage refunds "reflects the desire of the median member and is based on the optimal portfolio choice of the farmer-member" (Knoeber and Baumer, 1983).

At the downstream level, cooperative management is concerned about the profit distribution decision for at least three reasons. First, the survival of a cooperative enterprise is in the CEO's personal interest due to his job security and salary concerns. Second, internal financing through retaining a share of cooperative profit allows a manager to pursue interesting and promising projects and consequently to build a successful managerial career. Finally, a history of managing a successful and growing enterprise is a signal of good managerial skills for the next employer.

This paper highlights the member-controlled feature of a cooperative, i.e. the trade-off in the allocation of the decision rights in a cooperative. We study two

allocations of decision rights in an enterprise owned by member suppliers. The decision right in terms of formal authority is allocated either to the members, i.e. the centralized cooperative (centralized authority), or to the manager of the cooperative enterprise, i.e. the decentralized cooperative (delegated authority).[11] Property rights theory (Grossman and Hart, 1986; Hart and Moore, 1990) argues that this allocation of decision rights is important when future circumstances cannot be completely foreseen and described in a contract. The decision maker has discretion, i.e. residual rights of control, regarding the choice of action in these unforeseen contingencies. They predict that the agents should own the assets when their relationship specific investments add most value. In the cooperative context, Hendrikse and Veerman (2001) conclude that the marketing cooperative is more efficient than a conventional firm when investments in relationship specific assets at the member firms add more value than at the cooperative enterprise.

When, in addition to the ex-ante agreements about future actions, the agreements on transfers of authority are also non-enforceable, relational contracts have been argued to serve as a solution to the incomplete contracting problem of hold-up (Bolton and Dewatripont, 2013). Such contracts represent a type of collaboration sustained by the "shadow of the future" rather than through formally enforced agreements; relational contracts are "agreements so rooted in particulars of the parties' circumstances that they cannot be written down and hence must be self-enforced rather than adjudicated by outsiders, such as courts" (Gibbons, 2010).

The literature explores the role of relational contracts in organizations. The empirical literature consist of (i) anecdotal evidence based on case studies, and (ii) systematic econometric evidence based on larger datasets. The empirical evidence of informal contracts is limited due to difficulties in measuring factors, which drive the use of informal contracts. Such factors include the intertemporal discount rate, outside options of players, and the degree of incentive misalignment. Yet, recent literature provides several examples of empirical tests of the theoretical predictions of relational contracting models in various settings (Gil and Zanarone, 2015). Gil (2011) investigated the issue of profit sharing between distributors and exhibitors in the Spanish movie theatre industry. The empirical results show that distributors are more likely to use formal contracts for movies with high expected revenue in order to lower the chance of opportunistic behaviour by the exhibitors. An empirical study by Macchiavello and Morjaria (2015) on the Kenyan rose export use the spot market price to compute a lower bound to the future value of relationship between the buyer and the seller. The findings

[11] The right to decide about the distribution of profits will have an impact on the residual income right (Hansmann, 2009).

show that the volume of trade is constrained by the value of the relationship, and that the value increases with the age of the relationship between the buyer and the seller.

We argue that the relational contracting approach is important for studying the profit distribution decision in a cooperative because (i) there are long-run repeated interactions between the upstream and downstream parties in a cooperative; (ii) the decision about cooperative profit distribution is made every period, i.e. on the annual basis; and (iii) occasionally the upstream-downstream relation in a cooperative breaks down, i.e. farmers reject proposals and take away delegated authority, farmers or management leave. The presence of the transaction relationship also implies that disinvesting for a farmer-member is problematic, relative to a disinvesting decision in an IOF. Hence, due to members' high switching costs the repeated relationship is particularly important in cooperatives.

The rest of the paper is structured as follows. In section 3.2, the model is delineated. Section 3.3 determines the equilibrium in the one-period setting. Section 3.4 determines the efficient governance structure. Section 3.5 determines the equilibrium in the repeated game. Section 3.6 discusses the results and section 3.7 concludes. The main results suggest that the management-controlled governance structure is always efficient in a one-period setting. In an infinitely repeated setting, the hold-up problem can be resolved in governance structure *I*. The membership-CEO relationship is most stable when the value added by downstream investment is high, the cost of downstream investment is low, and the impatience rate is low.

3.2 Model

Consider a game with complete information between a principal and an agent. The principal is to be viewed as the farmers/upstream party owning the cooperative firm, and the agent as the cooperative manager/downstream party being employed by the cooperative firm. The timing of events is depicted in Figure 3.1. In the first stage, the decision right is allocated. In governance structure *I* (*II*), the decision right about the distribution of the cooperative profit is allocated to the farmers (delegated to the professional management).

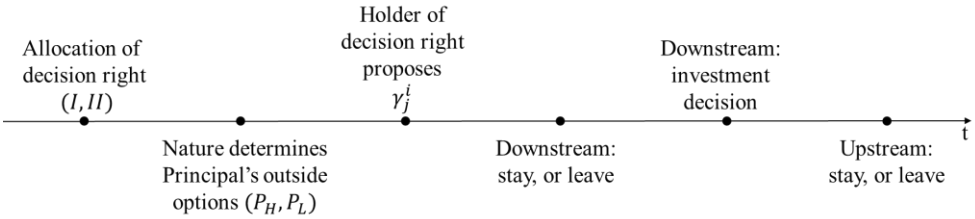

Figure 3.1. Timing of events

In the second stage, Nature determines the outside option P_j for the farmers, where $j = L, H$ and $P_L < P_H$.[12] The difference between P_L and P_H captures the variability of outside options of farmers and reflects the uncertainty in agricultural markets, such as highly volatile milk prices. In the third stage, the holder of the decision right proposes γ_j^i, with $i = I, II$, and $j = L, H$, which specifies a share $\gamma_j^i \in (0,1)$ of the total profits to be paid back to the farmers. Consequently, the share $(1 - \gamma_j^i)$ is the retained earnings percentage to be reinvested in the cooperative enterprise. In the fourth stage, the agent (cooperative manager) decides whether to stay (S) or to leave (L). In the fifth stage the agent (cooperative manager) chooses whether (Y) or not (N) to make a downstream investment. The cost of downstream investment is c, i.e. $c(Y) = c$ and $c(N) = 0$. The level of profit π_Y (π_N) is generated when the manager invests (does not invest) $(\pi_N < \pi_Y)$. Finally, in the last stage the principal decides whether to stay (S) and honour the γ_j^i agreement or to leave (L) the cooperative. In the former case, the profit is distributed according to the proposed γ_j^i rule, i.e. share γ_j^i is returned to the principal, and share $(1 - \gamma_j^i)$ is kept as retained earnings. In the latter case, both players earn their outside options, i.e. P_L or P_H for the principal, and s for the agent.[13] Figure 3.2 depicts the extensive form of the subgame when governance structure I is adopted. The extensive form of the subgame regarding governance structure II is obtained by replacing I by II and is depicted in Appendix 3.1.

[12] Our model assumes that outside options of players are exogenously determined. Endogenous outside options of the CEO are discussed by Edmans and Gabaix (2016), and Gabaix and Landier (2008). Endogenous outside options from the network perspective are studied by Gagnon and Goyal (2017).
[13] The alternative compensation for the agent (cooperative manager) is assumed to be stable due to the competitive labor market for professional management.

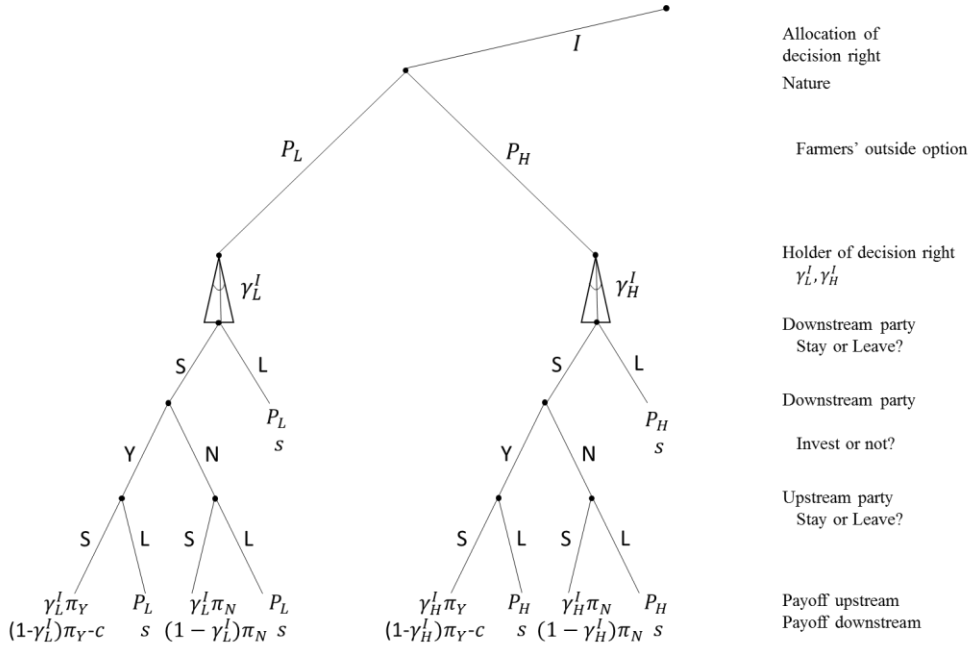

Figure 3.2. Extensive form of governance structure I

3.3 Equilibrium in the one-period setting

The equilibrium of the one period game is determined by backward induction. The equilibrium strategy profile, when governance structure I (II) is adopted, specifies for each observable history P_j the value of the sharing parameter γ_j^I (γ_j^{II}), the strategy of the downstream party (S or N) , and the investment strategy of the downstream party (Y or N), and the strategy of the upstream party ($SS, SL, LS,$ or LL). The SS (LL) strategy of the upstream party in the last stage implies that farmers choose to stay (leave) regardless of the investment decision of the downstream party. The SL (LS) strategy of the upstream party in the last stage implies that the upstream party will stay (leave) only if the downstream party invests, and will leave (stay) otherwise.

In the last stage of the game, the upstream party's decision to leave or stay in the cooperative depends on the value of γ_j^i. Farmers choose to stay in the cooperative only when their share of cooperative profit $\gamma_j^i\pi_k$ $(i = I, II,\ j = H, L,\ k = Y, N)$ exceeds their outside option. This is the upstream party's participation constraint. Hence, farmers' strategy, when the outside option P_j is realized, is

$$(S,S) \text{ when } \gamma_j^i > \frac{P_j}{\pi_N},$$
$$(S,L) \text{ when } \gamma_j^i \in \left(\frac{P_j}{\pi_Y}, \frac{P_j}{\pi_N}\right).$$
$$(L,L) \text{ when } \gamma_j^i < \frac{P_j}{\pi_Y}.$$

The optimal choice of the upstream party is related to the equilibrium value of the sharing parameter γ_j^i in the following way. When the sharing parameter is sufficiently high (either $\frac{P_H}{\pi_N}$ or $\frac{P_L}{\pi_N}$ depending on the realized outside option of farmers), farmers are better off staying in the cooperative, regardless of the investment decision of the downstream party. When the sharing parameter is in the intermediate range ($\left(\frac{P_H}{\pi_Y}, \frac{P_H}{\pi_N}\right)$ or $(\frac{P_L}{\pi_Y}, \frac{P_L}{\pi_N})$), it is only beneficial for farmers to stay if the downstream investment was made. When the sharing parameter is below a certain threshold ($\frac{P_H}{\pi_Y}$ or $\frac{P_L}{\pi_Y}$), farmers are better off going for their outside option, regardless of the investment choice of the downstream party. The participation constraint of the upstream party also depends on the realization of her outside option. Intuitively, the minimum γ_j^i required to satisfy farmers' participation constraint, increases (retained earnings percentage decreases) when the outside options of farmers become more favorable.

In the fourth stage, the incentive compatibility constraint of the downstream party is delineated. The downstream party's investment decision depends on the value of γ_j^i because it determines the share of cooperative profit $\left(1-\gamma_j^i\right)$ which is allocated to the downstream enterprise, i.e. the retained earnings percentage. The decision of the downstream party is also dependent on the actions of the upstream party during the consecutive stage. When the upstream party chooses (S,S) in the last stage, the incentive compatibility constraint of the downstream party is satisfied when $\left(1-\gamma_j^i\right)\pi_Y - c > \left(1-\gamma_j^i\right)\pi_N$. When the upstream party chooses (S,L), the incentive compatibility constraint of the downstream party is satisfied when $\left(1-\gamma_j^i\right)\pi_Y - c > s$. When farmers' strategy is (L,L), the management is indifferent between making an investment or not (Y or N), because both choices result in the same final payoff, i.e. s.

The participation constraint of the downstream party is determined during the third stage. The stay (S) or leave (L) decision of the downstream party depends on the sharing parameter γ_j^i as well as on the actions of players in the consecutive stages. The downstream party will choose to stay only when her payoff from staying, i.e. either $\left(1-\gamma_j^i\right)\pi_Y - c$ or $\left(1-\gamma_j^i\right)\pi_N$, outweighs her outside option s. The downstream party's incentive compatibility and participation constraints are summarized in Table 3.1. The

incentive compatibility constraint (IC) and the first participation constraint (PC 1) of the downstream party determines the maximum value of γ_j^i, i.e. the minimum percentage of retained earnings, which facilitates downstream staying and investment. However, it is possible that when low incentives are provided to the downstream party, i.e. lower retained earnings percentage is proposed, the downstream party may choose to stay, but will not invest. Then, the (low-powered) second participation constraint (PC 2) is specified as $(1-\gamma_j^i)\pi_N > s$, or $\gamma_j^i < 1 - \frac{s}{\pi_N}$.

	Strategy of the upstream party in the last stage		
	(S,S), i.e. $\gamma_j^i > \frac{P_j}{\pi_N}$	(S,L), i.e. $\gamma_j^i \in \left(\frac{P_j}{\pi_Y}, \frac{P_j}{\pi_N}\right)$	(L,L), i.e. $\gamma_j^i < \frac{P_j}{\pi_Y}$
Downstream party's incentive compatibility constraint (IC)	$\gamma_j^i < 1 - \frac{c}{\Delta\pi}$	$\gamma_j^i < 1 - \frac{c+s}{\pi_Y}$	Indifferent between Y and N
Downstream party's participation constraint (PC 1) with investment	$\gamma_j^i < 1 - \frac{c+s}{\pi_Y}$		Indifferent between S and L
Downstream party's participation constraint (PC 2) without investment	$\gamma_j^i < 1 - \frac{s}{\pi_N}$	n/a[14]	Indifferent between S and L

Table 3.1. Downstream party's incentive compatibility and participation constraints

Finally, the choice of the value of γ_j^i depends on the governance structure, i.e. on whether the members or the management hold the decision right. γ_j^{i*} is defined as an equilibrium choice of the sharing parameter. Figure 3.3 depicts the equilibrium values of the sharing parameter in the two governance structures. When governance structure *I* is adopted, members choose the equilibrium value of γ_j^I to maximize their payoff at the end of the period, subject to the constraints of the downstream party. Similarly, when governance structure *II* is adopted, the management chooses the value of γ_j^{II} to maximize their payoff, given the participation constraint of the farmers.

The equilibrium value γ_j^{i*} is contingent on the realization of other parameters in the model, such as the outside options of players. Therefore the categorization of all possible realizations of parameters is needed in order to solve for an equilibrium sharing parameter. Figure 3.3 depicts the classification of all possible cases regarding the

[14] Because of the upstream strategy (S,L), staying without investment is not possible for the downstream party. Hence there is no participation constraint (PC 2) without investment.

outside options of the upstream party. Each case characterizes the attractiveness of outside options and also the variability of outside options of the upstream party. For example, the variability of outside options of farmers, i.e. $P_H - P_L$, is low in case 1, and is high in case 3, because the value of P_H increases relative to P_L. The switching points, i.e. $P_j = \pi_N - \frac{s\pi_N}{\pi_Y}$ and $P_j = \pi_Y - s - \frac{s\Delta\pi}{\pi_Y}$, indicate the ranges where different outcomes occur in the equilibrium. A change in the outside options of players has an effect on the equilibrium choice of the sharing parameter because it (i) changes the participation constraints of players, and (ii) it determines which constraint is binding. Consequently, the equilibrium sharing parameter determines the equilibrium outcome in each governance structure.

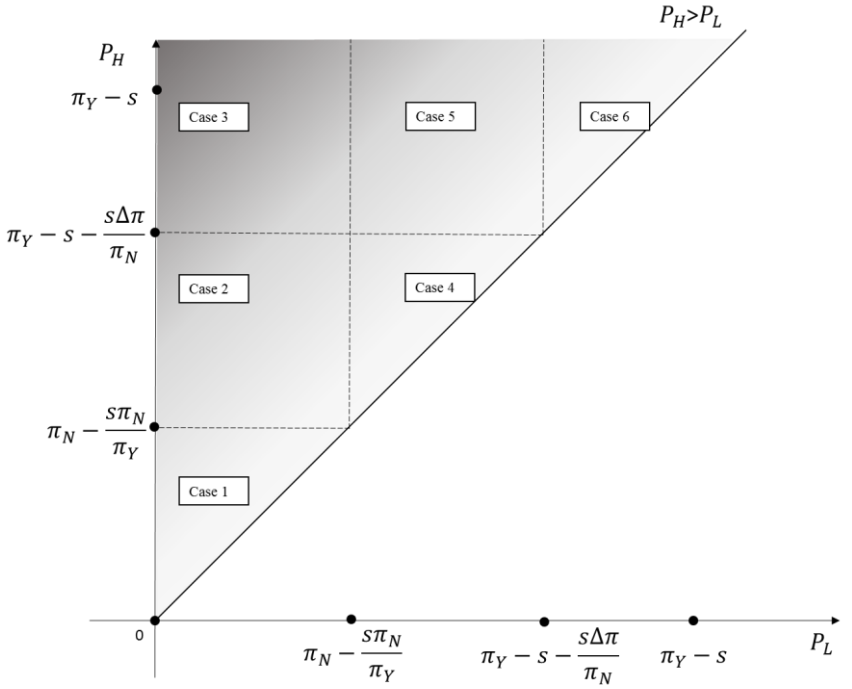

Figure 3.3. Classification of cases regarding the outside options of the upstream party

Equilibrium values γ_j^{i*} for Case 1, i.e. when $\pi_N > P_j + s$ are delineated for each governance structure for different ranges of the cost parameter in Figure 3.4. This case represents a setting where (i) the outside options of the upstream and downstream parties, i.e. P_j and s, are limited, and (ii) variability of outside options of the upstream party is low, i.e. the difference between P_H and P_L is relatively small. The first characteristic implies that leaving a cooperative is relatively (to other cases) unattractive for upstream and downstream parties, because they cannot earn much outside their

relationship. The second characteristic implies that the equilibrium strategies of players are similar in the two observable histories, i.e. regardless of whether good or bad outside options for farmers are realized.

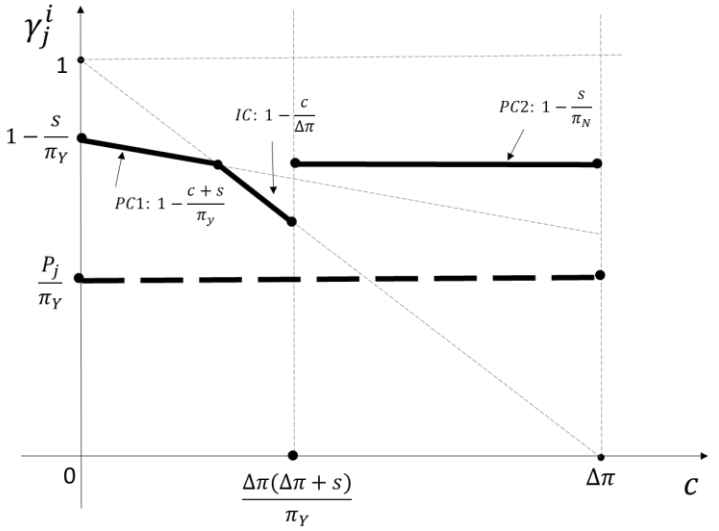

Figure 3.4. Equilibrium γ_j^{i*} in governance structures I and II when $\pi_N > P_j + s$ (solid line depicts γ_j^{I*} and dotted line depicts γ_j^{II*})

First, consider the maximization problem facing the farmers. The final payoff of the upstream party is equal to $\gamma_j^{I*}\pi_Y$ when both the incentive compatibility and the participation constraints of the downstream party are satisfied. This is captured in Figure 3.4 by the area below the two constraints functions, i.e. the incentive compatibility constraint $\gamma_j^i < 1 - \frac{c}{\Delta\pi}$, and the participation constraint $\gamma_j^i < 1 - \frac{c+s}{\pi_Y}$. Both functions are downward sloping because as the cost increases, a larger share of cooperative profit needs to be allocated downstream, i.e. γ_j^{I*} must decrease. When the incentive compatibility constraint is not met, the downstream party may still choose to remain in a cooperative without making the investment. In this case the participation constraint of the downstream party is $\gamma_j^i < 1 - \frac{s}{\pi_N}$, which secures a payoff of $\gamma_j^{I*}\pi_N$ for the upstream party. Lastly, when none of the constraints of the downstream party are met, the upstream party earns her outsider option P_j. To sum up, the equilibrium strategy of the upstream party is to (i) set $\gamma_j^{I*} = 1 - \frac{c+s}{\pi_Y}$ when the cost of downstream investment is very low (PC 1 is binding); (ii) set $\gamma_j^{I*} = 1 - \frac{c}{\Delta\pi}$ when the cost is intermediate (IC is binding), and (iii) to set $\gamma_j^{I*} = 1 - \frac{s}{\pi_N}$ when the cost is high (PC 2 is binding). In the

former two cases, sufficient incentives for the downstream party are provided and the upstream party collects $\gamma_j^{I*}\pi_Y$. In the latter case, providing incentives downstream becomes too costly for the upstream party. Therefore, it sets the sharing parameter just low enough to meet the participation constraint of the downstream party without investment. By collecting $\gamma_j^{I*}\pi_N$, where $\gamma_j^{I*} = 1 - \frac{s}{\pi_N}$, the upstream party is better-off than going for her outside option.

Second, the downstream party chooses γ_j^{II} to maximize her expected payoff subject to the participation constraint of the upstream party. Three possible payoffs of the downstream party are $(1 - \gamma_j^{II})\pi_Y - c$, $(1 - \gamma_j^{II})\pi_N$, and s. As depicted in Figure 3.4, the downstream party maximizes her payoff by setting $\gamma_j^{II*} = \frac{P_j}{\pi_Y}$, which is equal to the participation constraint of the farmers.

The equilibrium values of the sharing parameters in governance structures I and II are calculated for all remaining cases, i.e. when inequality $\pi_N > P_j + s$ does not hold, in Appendix 3.2. The equilibrium sharing parameter in governance structure I, i.e. γ_j^{I*}, is always higher than the equilibrium sharing parameter in governance structure II, i.e. γ_j^{II*}. In other words, the value of retained earnings is higher when the decision right about cooperative profit appropriation is delegated to the management. This result is intuitive and is due to the upstream party being inclined to decrease the retained earnings percentage, for example in favor of immediate cash payments. Proposition 1 summarizes this result.

Proposition 1: The equilibrium retained earnings percentage in governance structure I, i.e. $(1 - \gamma_j^{I*})$*, is always lower than the equilibrium retained earnings percentage in governance structure II, i.e.* $(1 - \gamma_j^{II*})$.

Consequently, given the equilibrium sharing parameters, the equilibrium outcomes of the one period game for all ranges of parameters are delineated. Figure 3.5 depicts equilibrium outcomes in the two governance structures for different ranges of the parameters in the model. Labels 1, 2, and 3 refer to three equilibrium outcomes respectively – both parties stay in the cooperative and management invests, both parties stay and management does not invest, at least one party leaves.

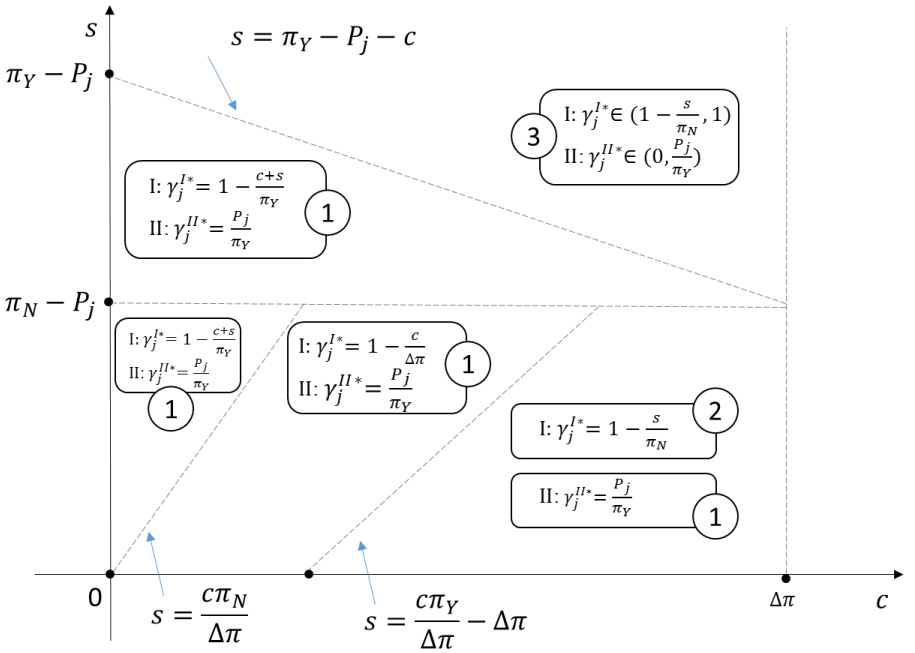

Figure 3.5. Equilibrium outcomes in governances structures I and II

Figure 3.5 also specifies the equilibrium values of the sharing parameter for each governance structure. Propositions 2 and 3 establish the comparative statics results regarding the changes in the cost of downstream investment (horizontal axis) and the value of the outside option of the downstream party (vertical axis). For example, when the cost of the downstream investment and the value of the outside option of the downstream party are sufficiently low ($c < \frac{\Delta\pi(\Delta\pi+s)}{\pi_Y}$ and $s < \pi_Y - P_j - c$), the equilibrium outcome in both governance structures is such that both parties remain in a cooperative, and the downstream party invests. This is due to the equilibrium sharing parameters which satisfy all the constraints of the upstream and downstream parties. However, note that the same outcome is achieved in the two governance structures, but the equilibrium sharing parameters differ. Proposition 2 puts forward an explanation for the different equilibrium outcomes in the two governance structures when the cost of investment is high and the value of the outside option of downstream party is low. It proposes that in a member-controlled cooperative, the upstream party will first propose the equilibrium retained earnings percentage which is sufficiently high to encourage downstream investment. However, when the cost of investment becomes too high, the upstream party will propose in equilibrium retained earnings percentage which is too low. This is because it becomes too costly to satisfy the incentive compatibility

constraint of the downstream party, but satisfying the low-powered participation constraint is still feasible.

Proposition 2: When the outside option of the downstream party is unfavorable, i.e. s is below $\pi_N - P_j$, as the cost of downstream investment increases, the equilibrium retained earnings percentage in governance structure I (II) first increases and then drops for very high c (remains stable).

Proposition 3 suggests that when s and c are sufficiently high, the upstream party will propose the equilibrium retained earnings percentage which is too low in order to encourage the leave choice of the downstream party because the participation constraint becomes too costly, given an increase in s. In contrast, the downstream party will propose the equilibrium retained earnings percentage which is too high in order to encourage the leave choice of the upstream party because this would allow the downstream party to earn her outside option s.

Proposition 3: When the outside option of the downstream party is favorable, i.e. s is above $\pi_N - P_j$, as the cost of downstream investment increases, the equilibrium retained earnings percentage in governance structure I (II) first increases (remains stable) and then drops (increases) for very high c.

3.4 Efficient governance structure

This section evaluates equilibrium outcomes from an efficiency perspective. There are several possible sources of inefficiency in our model. When the equilibrium γ_j^i is too low, i.e. the retained earnings percentage is too high, it may result in an inefficient leaving of the upstream party, inefficient staying of the downstream party and/or overinvestment by the downstream party. On the other hand, when the equilibrium γ_j^i is too high, i.e. the retained earnings percentage is too low, this may result in an inefficient staying of the upstream party, inefficient leaving of the downstream party, and/or underinvestment by the downstream party.

An efficient governance structure is defined as generating the highest total surplus. From the total surplus perspective, an outcome when both parties stay and management invests is always preferred to an outcome when both parties stay and management does not invest because $\pi_Y - c > \pi_N$ by definition. When $s + P_j > \pi_Y - c$, leaving a cooperative is efficient, because more value can be created outside. Efficient

governance structures are depicted in Figure 3.6. The two horizontal lines, partitioning the figure, i.e. $\pi_Y - P_j$ and $\pi_N - P_j$, will shift downward as the value of the outside options of farmers increases. It depicts a setting when the variability of outside options of farmers is high, i.e. $P_H - P_L$ is high. Efficient governance structures for other cases regarding the outside options of farmers are presented in Appendix 3.2.

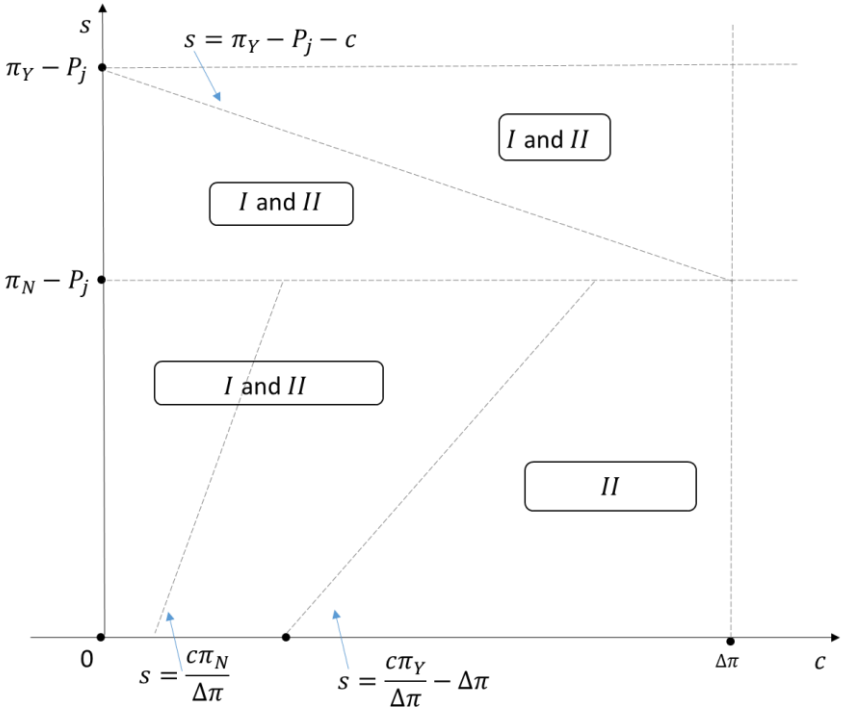

Figure 3.6. Efficient governance structures when the variability of farmers' outside options is high

There exists a range of parameters, such that governance structure *II* is uniquely efficient. In this range of parameters both parties remain in the cooperative, but downstream investment is made only in governance structure *II*. Hence, the source of inefficiency in governance structure *I* is the downstream underinvestment due to insufficient incentives provided in governance structure I. Such a situation occurs when the cost parameter is in the high range, i.e. $c > \frac{\Delta\pi(\Delta\pi+s)}{\pi_Y}$), and the outside option of the downstream party is low, i.e. $s < \pi_N - P_j$. Consequently, an equilibrium sharing parameter γ_j^I provides insufficient incentives for the downstream party to invest because the share of cooperative profit allocated downstream is not sufficient to satisfy the incentive compatibility constraint of the management. This occurs because the upstream party's payoff is maximized only when the low powered participation constraint of the

downstream party is satisfied. Therefore it is the equilibrium strategy of the upstream party to set $\gamma_j^I = 1 - \frac{s}{\pi_N}$ and to collect a share $(1 - \frac{s}{\pi_N})$ of the total surplus π_N. Then, the equilibrium payoffs of the upstream and downstream parties are $\pi_N - s$ and s respectively. As a consequence, the value of $\Delta\pi - c$ is foregone in governance structure I. This result is summarized in Propositions 4 and 5.

Proposition 4: Governance structure II is always efficient in a one-period setting.

Proposition 5: Governance structure I is inefficient due to downstream underinvestment, when the outside option of the management is low and the cost parameter is high.

Downstream underinvestment is the only source of inefficiency in the equilibrium. An inefficient exit of parties never occurs in the equilibrium because there always exists an equilibrium sharing parameter γ_j^i which is sufficiently high for each party to stay. In both governance structures, when staying is efficient, i.e. $\pi_H - c > P_j + s$, it is always true that the proposing party can offer a sharing parameter such that another party receives at least their outside option, i.e. either P_j or s. This is achieved due to the observability of outside options of players and the possibility to condition the value of the retained earnings on the outside options. Hence, our model suggests that too much exit may occur only when there is imperfect information about players' outside options and the retained earnings percentage is rigid. Intuitively, this result suggests that the inefficient exit of farmers or the management may only occur when, following a change in the outside options of players, there is a delay in adjusting the proposed retained earnings percentage accordingly. Overstaying does not occur in the equilibrium for a similar reason. When the outside options of players rise, the total surplus from leaving a cooperative increases. Hence, there exists a turning point where the efficient outcome changes from parties remaining in a cooperative to parties leaving a cooperative. Therefore, even though the rising outside options of players increase their incentives to leave, it does not result in a decrease in efficiency because the total surplus from leaving also increases. Lastly, overinvestment by the downstream party does not occur in the equilibrium because (i) in governance structure I the downstream party is always compensated with an amount equal to the binding incentive compatibility or participation constraint, and hence never creates incentives to overinvest; (ii) in governance structure II, the objective function of the downstream party $((1 - \gamma_j^{II})\pi_Y - c)$ is aligned with the function of the total surplus $\pi_Y - c$, which implies that investment is always efficient.

Next, we delineate the comparative statics result regarding changes in players outside options and an efficient governance structure. Overall, a more attractive outside

option changes the ranking of equilibrium outcomes because leaving a cooperative becomes more efficient when P_j or s increase. In particular, the exit becomes an efficient outcome when $P_j + s > \pi_Y - c$. Whether the efficiency of a governance structure is changed following an increase in an outside option depends on the equilibrium choice of γ_j^i and consequently on the equilibrium outcome. Propositions 6 and 7 summarize this result.

Proposition 6: When the outside option s of the downstream party increases, governance structure I becomes efficient when $c > \frac{\Delta\pi^2}{\pi_Y}$.

The effect of a change in the outside option of the downstream party s is evident from Figure 3.6. An increase in s (depicted on the vertical axis) increases the efficiency of governance structure I for the range of high cost parameter. An equilibrium outcome in governance structure I changes from an inefficient situation where both parties remain in a cooperative but the downstream party does not invest to either (i) an efficient situation when the downstream party invests, when $\frac{c\pi_Y}{\Delta\pi} - \Delta\pi < s < \pi_Y - P_j - c$; or to (ii) an efficient situation when both parties leave, when $s > \pi_Y - P_j - c$. In the first case the change in the equilibrium sharing parameter γ_j^I is due to the switch from the binding low powered participation constraint to a high powered participation constraint. As s increases, the profit maximizing γ_j^I drops for the upstream party and eventually the benefit from not proving downstream investment, i.e. higher γ_j^I, is eliminated. In the second case, as s increases even further, it becomes too costly for the upstream party to satisfy the participation constraints of the downstream party, and therefore it chooses γ_j^I in such a way that the downstream party leaves.

Proposition 7: When the outside option of the upstream party increases from P_j^{old} *to* P_j^{new}*, then governance structure I is*

$$\textit{efficient when} \begin{cases} c > \frac{(\Delta\pi - \pi_N - P_j^{new})\Delta\pi)}{\pi_Y} \\ s \in (\pi_N - P_j^{new}, \pi_N - P_j^{old}) \end{cases}.$$

Figure 3.7 illustrates proposition 7. The range of parameters in proposition 7 characterises a setting with relatively high costs of downstream investment and an intermediate value of the outside option of the downstream party. It follows that an increase in the variability of farmers outside options (P_H increases while P_L is fixed), improves the efficiency of a member-controlled cooperative, i.e. governance structure I. It improves the efficiency of governance structure I for two reasons. The range of

parameters specified in Proposition 7 may be further divided in two ranges. First, when $s < \pi_Y - P_j^{new} - c$, the equilibrium γ_j^I will no longer satisfy the low-powered participation constraint of the downstream party because P_j^{new} exceeds the payoff of the upstream party in a low value cooperative, i.e. $\pi_N - s$. However, for this sub-range of parameters, the payoff of the upstream party in the high value cooperative, i.e. $\pi_Y - s - c$ is higher than P_j^{new}. As a result, the upstream party chooses γ_j^I such that the downstream party invests. Second, when $s > \pi_Y - P_j^{new} - c$, it follows that $\pi_Y - s - c$ becomes lower than P_j^{new}. Therefore, increasing P_j^{new} creates larger incentives for farmers to leave, which in turn increases the total surplus, and the efficiency of governance structure I.

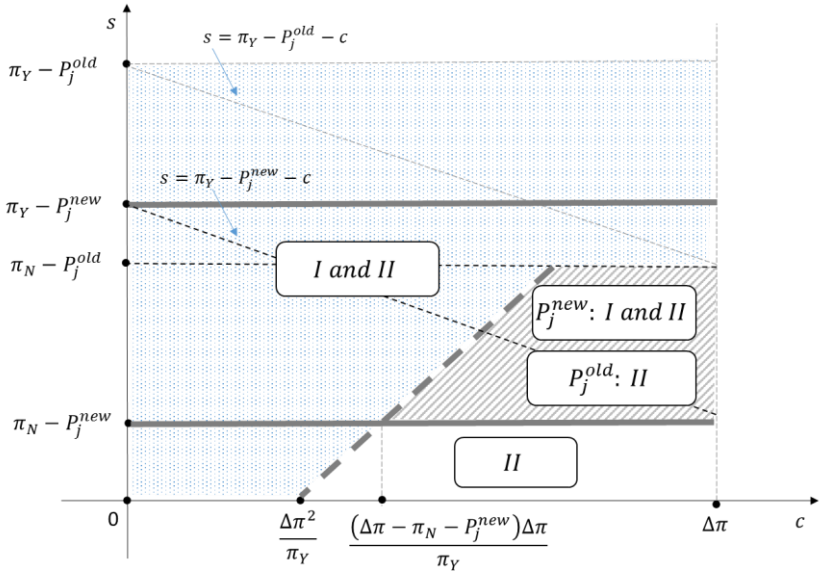

Figure 3.7. Changes in efficiency of governance structure I when P_j^{old} increases to P_j^{new}

There are two ways to address this source of inefficiency in governance structure I. The first way is to change the governance structure from I to II, i.e. to delegate the decision right to decide on the retained earnings percentage to the downstream party. The second way is to rely on a relational contract because there are usually many exchanges between the upstream and downstream parties. It entails possibilities for an informal agreement between the upstream and downstream parties to commit to an efficient outcome. The conditions, under which the relational contract is sustained, are delineated in the next section.

3.5 Equilibrium in the infinitely repeated setting

This section addresses the question of whether the efficiency in governance structure I can be improved in a repeated game. Consider an infinitely repeated version of the stage game depicted in Figure 3.2. We propose that the repeated game approach is relevant for studying the profit distribution decision in a cooperative for at least three reasons. First, the relation between an upstream and a downstream party in a cooperative can be characterized as a long-run repeated interaction. Second, the decision about cooperative profit appropriation (the same stage game) is made every period, i.e. on the annual basis. Third, occasionally the agreements in a cooperative break down, i.e. farmers take away delegated authority by rejecting the proposal, and farmers or management leaving a cooperative.

Suppose, players adopt grim trigger strategies, i.e. cooperate until one party fails to cooperate, which triggers a switch to non-cooperation forever after.[15] Cooperation implies honoring the relational contract, while defection is viewed as breaking the relational contract. If the principal or the agent reneges on the relational contract, the cooperation breaks down forever. Making such an assumption implies that the strongest punishment for deviation is implemented. Hence, it allows for the largest possible set of relational contracts.

Section 3.4 demonstrated that in a one-period setting there is always a range of parameters (low outside option of the downstream party and high cost of downstream investment) where governance structure I is inefficient because the downstream party does not make the downstream investment. Inefficient underinvestment is a consequence of a hold-up problem. Valuable investments of the downstream party are forgone because it is not able to secure a sufficient share of the total surplus in the ex-post bargaining. This occurs due to the allocation of decision rights in governance structure I. The downstream party anticipates a high value of the sharing parameter, and consequently a low retained earning percentage, and therefore chooses not to invest. Such an inefficiency can be resolved in an infinitely repeated setting if both parties can credibly commit to an efficient equilibrium. In particular, such a commitment implies that an upstream party proposes a sufficiently low sharing parameter, or sufficiently high retained earnings percentage, and a downstream party invests.

Denote a relational sharing parameter in governance structure I when P_H and P_L occur, Γ_H^I and Γ_L^I respectively. The relational contract is self-enforcing when the long-run benefits from honoring the relational contract outweigh the short-run gains from deviation for both parties. If the upstream party honors the agreement it earns a stream

[15] According to Sannikov, grim strategies may not be optimal in continuous-time models (Athey and Skrzypacz, 2017).

of payoffs $\Gamma_j^I \pi_Y + \frac{1}{r}(\Gamma_j^I \pi_Y)$, i.e. a share of high cooperative profit every period. If the upstream party deviates from the agreement it earns a stream of payoffs $\gamma_j^I \pi_N + \frac{1}{r}\gamma_j^I \pi_N$, i.e. the share of the low cooperative profit, determined by the spot sharing parameter, in every period. The punishment for deviation of the upstream party is limited due to the distribution of power in governance structure I (the upstream party holds all the power). The dynamic enforcement constraint of the upstream party is satisfied when the long-run benefits of honoring the relational agreement outweigh short-run gains from deviation. The upstream party's dynamic enforcement constraint is therefore

$$\Gamma_j^I \geq \frac{\pi_N - s}{\pi_Y} \text{ [1].}$$

If the downstream party respects the agreement it earns a stream of payoffs $(1 - \Gamma_j^I)\pi_Y - c + \frac{1}{r}((1 - \Gamma_j^I)\pi_Y - c)$, i.e. a share of high cooperative profit minus the cost. If the downstream party deviates from the agreement it earns a stream of payoffs $(1 - \Gamma_j^I)\pi_N + \frac{1}{r}(\,(1 - \gamma_j^I)\pi_N)$, i.e. it gains from not paying the cost in the current period, but receives a lower share, i.e. determined by the spot sharing parameter, forever after. Therefore the dynamic enforcement constraint of the downstream party is

$$\Gamma_j^I \leq 1 - \frac{c(r+1)+s}{r\Delta\pi+\pi_Y} \text{ [2].}$$

The inefficient underinvestment in governance structure I is resolved when there exists a range of parameter such that the relational contract is stable, i.e. conditions [1] and [2] are satisfied. This result is summarized in Proposition 8.

Proposition 8: An infinitely repeated game resolves the inefficient downstream underinvestment in governance structure I when $\frac{\pi_N - s}{\pi_Y} < 1 - \frac{c(r+1)+s}{r\Delta\pi+\pi_Y}$.

As a consequence, when such a range of parameters is non-empty, a sharing parameter in an infinitely repeated setting is always lower than in a one-period setting. So, in a repeated game, there exists a range of feasible retained earnings values which support an efficient equilibrium, and the value of retained earnings is higher relative to a one-period setting. This result is summarized in Proposition 9.

Proposition 9: In governance structure I, the (efficient) equilibrium value of retained earnings in the repeated setting is higher than (the inefficient) equilibrium value of retained earnings in the one-period setting.

The range of parameters for which the efficiency of governance structure *I* is improved in an infinitely repeated setting is depicted in Figure 3.8 as a shaded area. It follows that the upstream party is willing to commit to a lower sharing parameter, and the downstream party is willing to commit to making an investment, when the cost

parameter is in the intermediate range. Yet, there remains a high range of the cost parameter where the relational contract is not feasible, i.e. governance structure *I* remains inefficient even when the repeated long-term nature of interaction is accounted for.

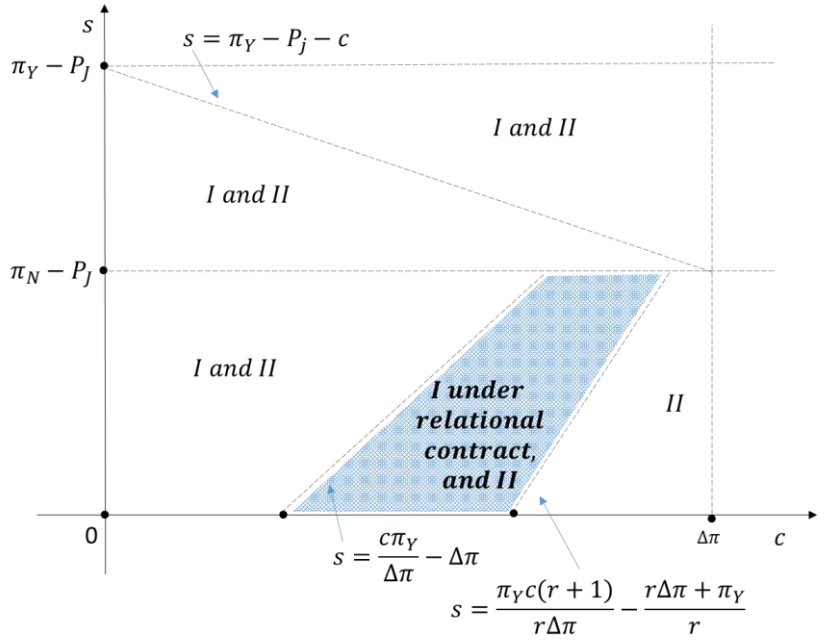

Figure 3.8. Efficient governance structures in a repeated setting

Next, we derive the comparative statics results regarding the parameters which affect the stability of the relational agreement between the parties. As summarized in Table 3.2, the relational contract between the upstream and the downstream party in a cooperative is most stable when the value added by the downstream investment is high, when the cost of downstream investment is low, the outside option of the downstream party is low, and the impatience rate is low.

An increase in the parameter	Meaning	Which participation constraint is affected	Feasible Retained Earnings percentage range
π_Y	Cooperative's profit when downstream party invests;	Both	Expands
π_N	Cooperative's profit when downstream party does not invest;	Both	Shrinks
c	Cost of downstream investment	Downstream	Shrinks

$\Delta\pi$	Value added by downstream investment	Both	Expands
s	Outside option of the downstream party	Both	Shrinks
r	Interest rate	Downstream	Shrinks

Table 3.2. Comparative statics in an infinitely repeated game

To conclude, we find that changing the rules of the game from a one-period to an infinitely repeated setting may improve the efficiency of governance structure I. Our results indicate that when taking into account the long-term repeated interactions between the upstream and the downstream parties, credible commitments to a more efficient outcome can be made. Specifically, the upstream party can credibly commit to a higher percentage of retained earnings in the long-run, and the downstream party can commit to the downstream investment. Many equilibrium outcomes are supported as a Nash Equilibrium in an infinitely repeated setting. In particular, any value of the sharing parameter Γ_j^I in the range $(\frac{\pi_N - s}{\pi_Y}, 1 - \frac{c(r+1)+s}{r\Delta\pi+\pi_Y})$ would support an efficient equilibrium. Hence, the problem of underinvestment in the member-controlled cooperative can be resolved when the interaction between the upstream and downstream parties is infinitely repeated. However, there still remains a range of high values of the cost parameter where the relational contract is not feasible.

3.6 Discussion

To study the retained earnings in cooperatives, a non-cooperative game between the upstream and the downstream parties in a cooperative is formulated. It is then solved for an equilibrium in a one period and an infinitely repeated settings. This section discusses the predictions of the model and the role of players' outside options, uncertainty, profit distribution rejection decisions, delegation, and the repeated nature of interactions in a cooperative.

The equilibrium percentage of retained earnings, and therefore the equilibrium outcome in our model depends on the outside options of players. This is the case because outside options determine the participation constraints of parties. The outside option of the downstream party increases when the competition for managerial talent in a market drives managerial compensation up. The empirical evidence in advanced countries show that increased competition for managers has contributed to a rise in managerial compensation (Fabbri and Marin, 2011; Frydman, 2007). According to Frydman (2007), competition for managerial skills has intensified due to lower mobility costs, i.e. it has become easier for top-managers to switch to a more favorable position when it becomes

available. This claim is supported by two empirical findings. First, starting from around 1970's there was a major shift from firm-specific managerial skills to more general managerial ones for top US executives (Frydman, 2007). Second, there was also a sharp increase in the number of sectoral experiences acquired throughout a typical executive career. Similar shifts are also documented for cooperative managers. For instance, the CEO of the Dutch dairy cooperative FrieslandCampina during 2009-2015, had previously held top-management positions at Unilever (transnational consumer goods company) and moved on to being the CEO of Carlsberg (global beer brewer) in 2016. Hence, the upper part of Figure 3.4 where the outside option of the downstream party is high characterizes a competitive market for managerial talent.

Bénabou and Tirole (2016) show that competition does not only increase the level of compensation, but also changes the structure of compensation towards high-powered incentives. Our results are in line with this prediction. When s exceeds the threshold of $\pi_N - P_j$, i.e. the competition for managers increases, the equilibrium percentage of retained earnings is always higher relative to a case when $s < \pi_N - P_j$. Consequently, up to a certain maximum value of s ($s < \pi_Y - P_j - c$), both the incentive compatibility and participation constraints of the downstream party are satisfied, i.e. she remains in the cooperative and invests. In other words, the upstream party provides high-powered incentives downstream in terms of a sufficiently high retained earnings percentage. When s exceeds the maximum value of $s > \pi_Y - P_j - c$, providing downstream incentives becomes too costly, and the upstream party goes for her outside option instead. Note, that an outcome where the downstream party stays but does not invest, i.e. the low-powered participation constraint is satisfied, does not occur in the equilibrium when the market for managers is competitive, i.e. when $s > \pi_N - P_j$.

The outside option of the upstream party increases when the alternative prices for farmers' output outside a cooperative become more favorable. The rising outside options of farmers have two effects on the efficiency of a member-controlled cooperative. First, it changes the ranking of outcomes for the upstream party in such a way that providing low-powered incentives downstream is no longer attractive. Therefore, in one range of parameters the efficiency of governance structure I increases because high-powered incentives are provided to the downstream party. For the other range of parameters, higher outside option increases the incentive of farmers to exit the cooperative. However, such an increase in alternative prices also increases the total surplus in the outcome, where players exit the cooperative, and consequently improves the efficiency.

Our model also provides an explanation for the observed exit behavior of farmers. An inefficient "too much" exit does not occur in the equilibrium of our model. The reason is that it can only occur when (i) there is imperfect information about the

outside options of farmers and/or when (ii) the retained earnings percentage is rigid. Consequently, in a setting where farmers' outside options are likely to change frequently and by large amounts, our model suggests to leave as much leeway for the retained earning percentage as possible. For example, setting the retained earning percentage fixed for prolonged periods, such as several years, is then likely to result in the "too much" exit of farmers. To illustrate, in 2007 around ten percent of the membership of the dairy cooperative FrieslandCampina switched to an alternative processor in Germany due to more favorable prices. In the light of our model, this exit behavior can be viewed as an inefficient outcome if the retained earnings percentage was rigid and did not allow for an appropriate retained earnings adjustment. As depicted in Table 3.3, FrieslandCampina sets the cooperative profit distribution policy for a period of three years. This interpretation is also supported by the retained earnings percentage decrease in the subsequent years.

Year	Retained earnings, %	Cash performance premium, %	Fixed member bonds, %
2009-2010	60	25	15
2011-2013	50	30	20
2014-2016	45	35	20
2017-2019	55	35	10

Table 3.3. Retained earnings percentage in FrieslandCampina (Annual reports)

One way to view the rejection of management's proposal regarding cooperative profit distribution by the members is to describe it as a switch from governance structure *II*, i.e. delegation, to governance structure *I*, i.e. member-controlled cooperative. So, members retract the real authority from the management. In the light of the results of our model, such a switch is always inefficient because it will result in insufficient downstream investment. However, the interpretation of the rejection decision by the members would be different in a model where most value is created at the upstream stage.

One possible way to deal with the underinvestment inefficiency is to change the governance structure, i.e. to delegate the decision right to the downstream party. Such an allocation of the decision right would result in an increase of the retained earnings percentage, which in turn mitigates downstream underinvestment. This pattern was observed in the Dutch cheese cooperative De Producent, where the manager holds a substantial decision power, including the right to decide on the cooperative profit distribution (Peng, 2017). In the case of FrieslandCampina, the management's proposal regarding cooperative's profit appropriation is formulated annually in February (for the

preceding year). In April, this proposal needs to be approved by the cooperative membership (it is the Board of the cooperative, which functions as a general meeting of cooperative membership).

Alternatively, we investigate whether an efficient outcome can arise in the member-controlled governance structure in an infinitely repeated setting. We find that there exists a range of the values of retained earnings, such that the upstream and downstream parties commit to an efficient equilibrium. In particular, our results suggest that due to the "shadow of the future" the upstream party can commit to raising the retained earnings percentage, and the downstream party can commit to making the valuable downstream investment. We show that the equilibrium percentage of retained earnings in the repeated setting is always larger than in the one-shot game. Hence, our results indicate that a member-controlled cooperative may resolve the problem of insufficient downstream investment. The crucial is that a stable relational contract is built between the members and the management of a cooperative. The membership-CEO relationship is most stable when the value added by downstream investment is high, the cost of downstream investment is low, the outside option of the downstream party is low, and the impatience rate is low. This result highlights the importance of developing long-term oriented agreements between the upstream and downstream parties in a cooperative.

Lastly, we find that even when a relational contract is feasible between the upstream and downstream parties in a cooperative, there still remains a range of parameters, characterized by very high cost of downstream investment and low outside options of farmers, such that governance structure I is inefficient. It is therefore the only range of parameters in our model where delegation of real authority downstream is uniquely efficient.

3.7 Conclusion and further research

Retained equity is one of the main sources of finance in farmer cooperatives due to their limited access to external finance. The decision regarding cooperative's retained earnings percentage differs from such a decision in an IOF because members are the owners and also users of the downstream enterprise. Therefore there exist an intrinsic conflict between market and member interests in a cooperative (Cook, 1994). This paper studies the retained earnings percentage in cooperatives from a relational contracting perspective. It highlights delegation of decision making, the value of the repeated relationship between the members and their cooperative, outside options and uncertainty.

First, we differentiate between two governance structures. In governance structure I (II), the members (management) of a cooperative decide(s) on the distribution of cooperative profit. It is determined by the participation constraint of the upstream party and incentive compatibility and participation constraints of the downstream parties. The first result of our model implies that the equilibrium retained earnings percentage is always lower in a member-controlled cooperative relative to a cooperative where the profit distribution decision is allocated to the downstream management.

Our second result from the one-period setting implies that governance structure II is always efficient due to the alignment between the objective of the downstream party and the total surplus, i.e. the downstream investment determines how much value is created. Governance structure I is inefficient due to the insufficient equilibrium retained earnings percentage. The upstream party faces a tradeoff between providing downstream incentives and capturing a higher share of the value created in a cooperative. Our results suggest that there exists a range of parameters such that the upstream party is better-off by capturing a larger share of a low profit than a lower share of a high profit. This has an implication on the investment decision by the downstream party. Hence, an inefficiency arises due to an underinvestment at the downstream level.

Third, our model adds a novel insight regarding the profit distribution decision in a cooperative by formulating an infinitely repeated version of the stage game and by establishing the stability conditions for the relational contract between the upstream and the downstream parties in a cooperative. In an infinitely repeated setting the efficiency of a member-controlled cooperative improves for some range of parameters. However, the results also indicate that when the cost of downstream investment is very high and the outside opportunities of the management are limited, the relational contract does not resolve the hold-up problem in a member-controlled cooperative.

The outside options of players determine the participation constraints of parties and therefore have an effect on the equilibrium strategies of players. Intuitively, a larger outside option of the upstream (downstream) party decreases (increases) the maximum (minimum) retained earnings percentage required for her to remain in a cooperative. A large value of the outside option of the downstream party serves as a "disciplining" device to an upstream party by forcing her to offer a sufficiently high equilibrium retained earnings percentage. An increase in the outside options of the upstream party increases her incentive to leave, but also increases the total surplus from leaving. As a result, the inefficient "too much" leaving of parties does not occur in the equilibrium because the outside options are perfectly observable, and the retained earnings percentage is flexible and can be made contingent on the outside options.

We highlight several directions for further research. First, the model could be extended by adding and additional upstream investment stage. It would result in an

increased efficiency of governance structure *I* and diminish the attracivelness of govenance structure *II*. The efficiency results in our model are a consequence of the assumption that cooperative profit level is mainly determined by the downstream investments. In a setting where the most value is added at the upstream stage, the reverse result holds, i.e. governance structure *I* is uniquely efficient. This result is in line with the predictions of the property rights theory (Grossman and Hart, 1986; Hart and Moore, 1990), which suggests that ownership should be allocated to the party whose relationship specific investment adds most value. Second, to investigate further the possibility of "too much exit" of parties, one could allow for (i) imperfect information regarding the outside options; (ii) rigidity in adjusting the retained earnings percentage. Third, a transaction relationship between the upstream and downstream parties is not modelled in this chapter. Adding this additional dimension to the relationship between the upstream and downstream parties may influence the allocation of decision rights, equilibrium retained earnings percentage, and consequently the equilibrium outcomes. Fourth, the predictions of the model could be tested empirically by collecting primary data on the retained earnings percentages in cooperatives, by studying the exit behavior of the upstream and downstream parties, as well as by assessing the types of allocations of decision rights within cooperative boundaries. It is also of interest to study empirically the determinants of cooperative retained earnings across sectors, countries, and time. Lastly, the managerial implications of our results can be deliberated further by considering the challenges for the chairman of the cooperative board in explaining the value of the long-term focus to the membership.

Appendix 3.1. Governance structure II

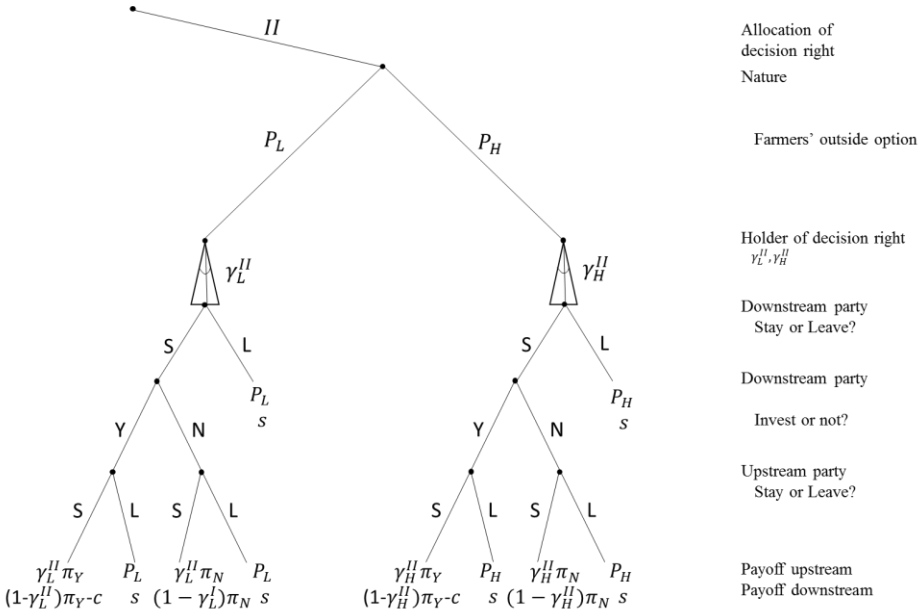

Figure 3.9. Extensive form of governance structure II

Appendix 3.2. Classification of cases, equilibrium γ_j^i and efficient governance structures

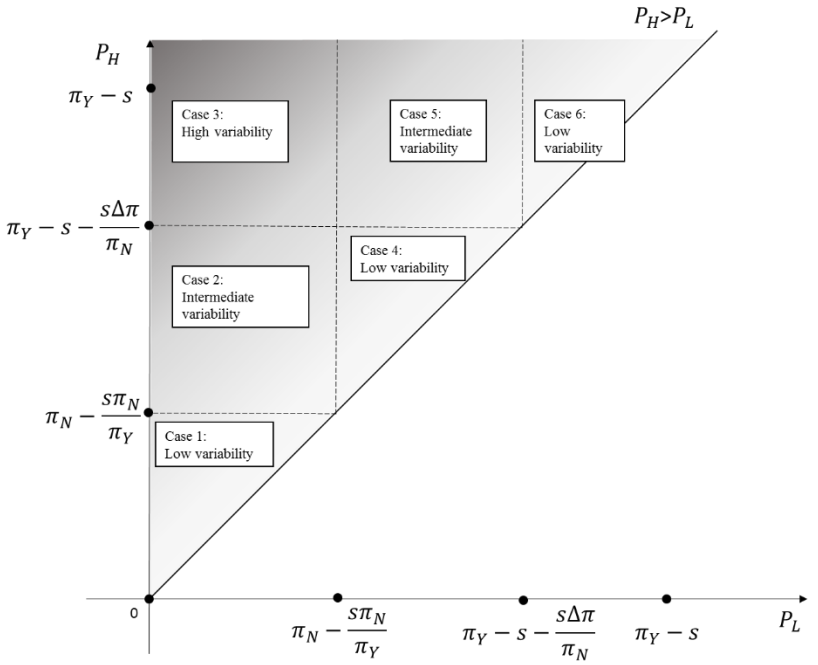

Figure 3.10. Classification of cases regarding the variability of the outside options of farmers

The first step is to determine equilibrium γ_j^I and γ_j^{II} for each case. The upstream (downstream) party chooses γ_j^I (γ_j^{II}) to maximize her final payoff. In general, γ_j^i defines how the total surplus will be split between the upstream and downstream parties. There are three possible values of the total surplus. First, when both parties remain in the cooperative and the downstream party invests, the total value of $\pi_Y - c$ is generated. It can occur in two circumstances. When

$$\begin{cases} \gamma_j^i > \frac{P_j}{\pi_N} \ [PC^{\,UPSTREAM}] \\ \gamma_j^i < 1 - \frac{c}{\Delta\pi} \ [IC^{\,DOWNSTREAM}] \\ \gamma_j^i < 1 - \frac{c+s}{\pi_Y} \ [PC^{\,DOWNSTREAM}\ 1] \end{cases},$$

i.e., when the strategy of the upstream party in the last stage is (S, S), the strategy of the downstream party in the fourth stage is Y, and the strategy of the downstream party in the third stage is S.

The total surplus of $\pi_Y - c(m)$ may also be generated when

$$\begin{cases} \gamma_j^i < \frac{P_j}{\pi_N} \; [PC^{\,UPSTREAM}] \\ \gamma_j^i > \frac{P_j}{\pi_Y} \; [PC^{\,UPSTREAM}] \\ \gamma_j^i < 1 - \frac{c+s}{\pi_Y} \; [IC = PC^{\,DOWNSTREAM}\; 1] \end{cases},$$

i.e., when the strategy of the upstream party in the last stage is (S, L), the strategy of the downstream party in the fourth stage is Y, and the strategy of the downstream party in the third stage is S.

Then, in governance structure I the objective of the upstream party in the above two situations is to choose γ_j^I to maximize $\gamma_j^I \pi_Y$. Similarly, in governance structure II the objective of the downstream party in the above two situations is to choose γ_j^{II} to maximize $\left(1 - \gamma_j^{II}\right)\pi_Y - c$.

The second possible value of the total surplus, π_N, is generated when both parties remain in a cooperative, but the downstream party does not invest. In can only occur in one situation, i.e. when

$$\begin{cases} \gamma_j^i > \frac{P_j}{\pi_N} \; [PC^{\,UPSTREAM}] \\ \gamma_j^i > 1 - \frac{c}{\Delta\pi} \; [IC^{\,DOWNSTREAM}\; is\; not\; met], \\ \gamma_j^i < 1 - \frac{s}{\pi_N} [PC^{\,DOWNSTREAM}\; 2] \end{cases}$$

i.e., when the strategy of the upstream party in the last stage is (S, S), the strategy of the downstream party in the fourth stage is N, and the strategy of the downstream party in the third stage is S. Then, in governance structure I the objective of the upstream party in this situations is to choose γ_j^I to maximize $\gamma_j^I \pi_N$. Consequently, in governance structure II the objective of the downstream party is to choose γ_j^{II} to maximize $\left(1 - \gamma_j^{II}\right)\pi_N$.

The third possible value of the total surplus, $P_j + s$, occurs when the strategy of the downstream party is L and/or the strategy of the upstream party is (L, L). In this case the upstream party earns P_j and the downstream party earns s.

The equilibrium choice of γ_j^I and γ_j^{II} are delineated for case 1 in Figure 3.11. Case 1 implies that $P_L < P_H < \pi_N - s$. Equilibrium outcomes and efficient governance structures for case 2 are depicted in Figure 3.12.

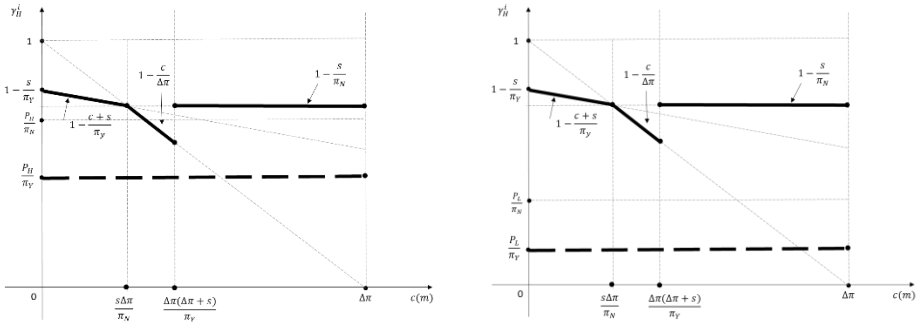

Figure 3.11. Equilibrium γ_j^I and γ_j^{II} for case 2, i.e. when $P_L < P_H < \pi_N - s$

(Solid (dotted) line depicts $\gamma_j^I(\gamma_j^{II})$)

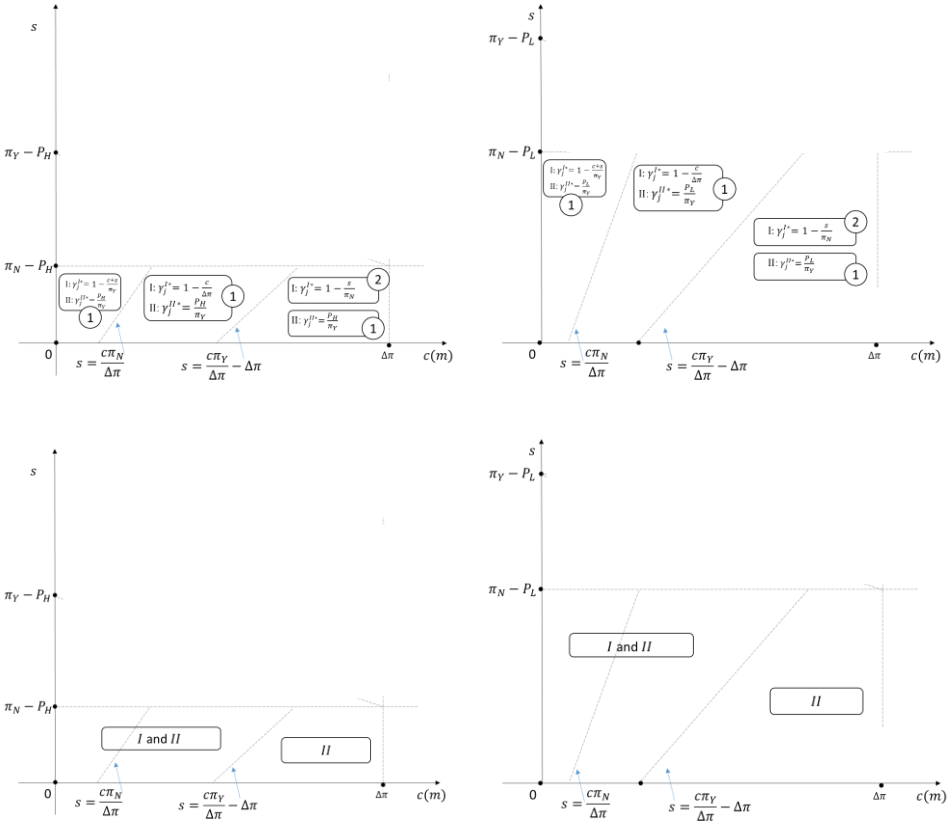

Figure 3.12. Equilibrium outcomes (top) and efficient governance structures (bottom) when P_L (left) and P_H occur, case 2, i.e. when $P_L < P_H < \pi_N - s$

The equilibrium choice of γ_j^I and γ_j^{II}, equilibrium outcomes and efficient governance structures for all other cases are delineated in the same way. The results are depicted in Figure 3.13.

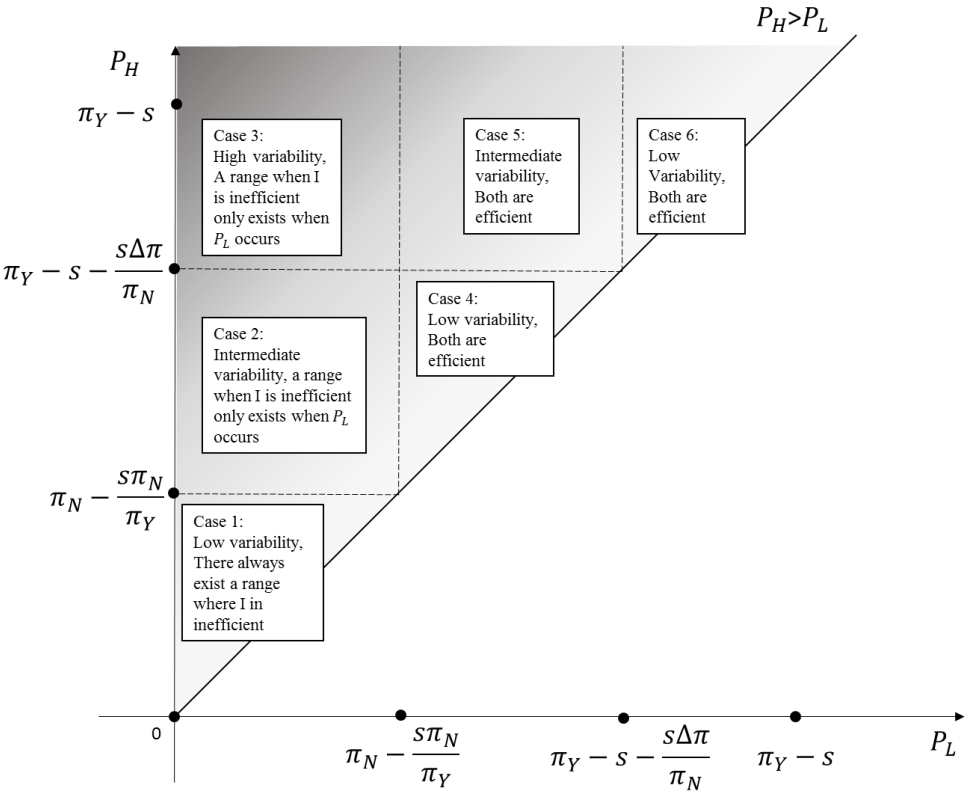

Figure 3.13. Efficient governance structures in all cases regarding the variability of outside options

4. Market Shares of Agricultural Cooperatives in the European Union

Abstract

This paper investigates empirically the market shares of agricultural cooperatives in Europe. We test a number of theoretical predictions regarding the degree of forward vertical integration by using the data from the dairy and sugar sectors in the European Union. Our results indicate that dairy cooperative market shares are higher in countries with high levels of trust, low levels of heterogeneity, and strong contracting institutions. Additionally, dairy cooperative market shares are higher when countries are more milk self-sufficient. Variables measuring country-level differences in embeddedness, institutional environment, governance, and resource allocation are not related to cooperative market shares in the sugar sector. Sugar cooperative market share results from the combination of policy changes and the product differentiation strategy of the investor-owned competitor(s).

Keywords: cooperative, market share, dairy, sugar, European Union

4.1 Introduction

Cooperatives co-exist and compete with investor-owned firms in agricultural markets in the European Union. In some sectors, such as dairy, cooperative market shares are dominant, i.e. 65.3%, while in others, such as sugar and sheep meat, cooperative shares are relatively low, i.e. 18.8% and 7.5% respectively (Table 4.1). Additionally, cooperative market shares are higher in the northwest of Europe than in the southeast (Table 4.2).[16] We study empirically the determinants of cooperative markets shares. The goal of this paper is to explain why the cooperative organizational form is likely to blossom in some environments and not in others, where environments are distinguished in terms of sector and country.[17]

Sector	Mean Coop Market Share	Number of observations
Dairy	65.3	21
Fruit and Vegetables	39.9	21
Olives	33.3	3
Pig meat	30.2	18
Cereals	28.9	17
Wine	27.9	13
Sugar	18.8	16
Sheep meat	7.5	17
Total	32.3	126

Table 4.1. Cooperative market shares per sector in the European Union (Bijman et al., 2012)

[16] The Scandinavian region includes Denmark, Finland, and Sweden. Western EU countries are Austria, Belgium, France, Germany, Luxembourg, the Netherlands, Ireland and the UK. Southern member states include Greece, Italy, Malta, Portugal, Slovenia, Spain, and Cyprus. Lastly, Eastern Europe includes Bulgaria, Estonia, the Czech Republic, Hungary, Latvia, Lithuania, Poland, Romania, and Slovakia.

[17] Cooperative market shares were reported by Bijman et al. (2012) for eight agricultural sectors in twenty-seven EU countries for 2010.

EU region	Mean Coop Market Share	Number of observations
Scandinavia	55.2	14
West	39.2	37
South	36.3	34
East	15.1	41
Total	32.3	126

Table 4.2. Cooperative market shares per region in the European Union (Bijman et al., 2012)

Agricultural sectors may differ with respect to several product characteristics. First, production of agricultural products entails different levels of asset specificity, both at the upstream and downstream levels of production. Some agricultural sectors are characterized by a higher degree of "temporal asset specificity", which implies that the value of a commodity is time-dependent due to its perishability (Masten, 2000). Based on the transaction cost theory, this characteristic has an effect on the efficient asset ownership, i.e. on the degree of vertical integration and the presence of cooperatives.[18] Second, an important characteristic determining contractual relations in agricultural markets is uncertainty (Hardaker et al., 1997). Vertical integration and cooperatives may therefore be viewed as an organizational response to external uncertainty, such as volatile market prices (Carlton, 1979a and 1979b). For instance, dairy farmers expect their dairy cooperatives to smoothen the impact of market price fluctuations (Hanisch et al., 2012). Third, sectors may differ with respect to the supply and demand side. Sectors differ regarding the supply side in terms of product complexity, which is based on the number of intermediate inputs used in production (Blanchard and Kremer, 1997; Levchenko, 2007). Sectors that require joining a large number of inputs to production are more institutions dependent because there are more relationships that can be "potentially distorted due to imperfect institutions" (Levchenko, 2007). The rankings of sectors typically classify agricultural sectors as "least complex" and therefore least institutionally dependent. Sectors also differ regarding the demand side in terms of the possibilities for product differentiation. For example, milk is an important ingredient in dairy as well as pharmaceutical products, while fruits and vegetables show much less product development. Finally, EU countries differ with regards to several characteristics – historical, cultural, legal and institutional factors.

To organize the study of the determinants of cooperative market shares in the EU, we distinguish four levels of social analysis (Williamson, 2000). As depicted in

[18] The relationship between asset specificity and vertical integration was explored empirically in various sectors (footwear, trucking, technology, and housing market) by Woodruff (2002), Baker and Hubbard (2003), Acemoglu et al. (2010), and Gebhardt (2013).

Figure 4.1, the first level is the social embeddedness level. It includes informal institutions, such as norms, customs, and traditions. Informal institutions change very infrequently, between one hundred and one thousand years. We quantify this level by the measures of cultural dimensions, trust, and heterogeneity of a country. The second level, i.e. the institutional environment, includes the formal rules, such as the specification and enforcement of property rights and contract laws. The frequency of change of formal rules is once in every ten to one hundred years. We capture the cross-country variations in the institutional environment by the Rule of Law measures, namely the property rights and judicial effectiveness measures. Additionally, variations in the national cooperative laws are distinguished. The third level deals with the governance of contractual relations. The changes in governance occur more frequently, i.e. every one to ten years. The ways of organizing transactions, such as vertical integration or long-term contracts, can be adjusted periodically. Finally, the fourth level is concerned with market exchange, such as price and quantity adjustments. The changes at this level occur regularly, or even daily. We discuss this level in the context of industry structure, and price and quantity restrictions due to EU regulation of the agricultural sector.

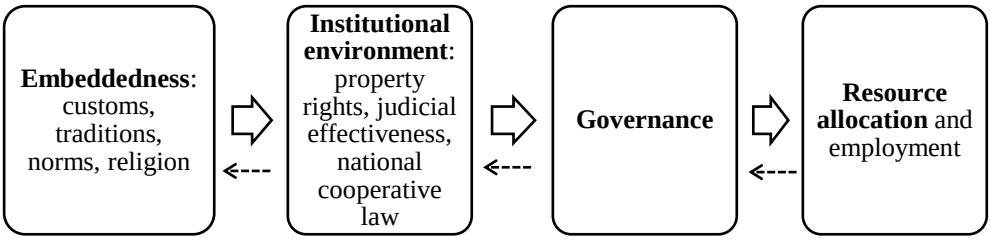

Figure 4.1. Four levels of social analysis (Williamson, 2000)

To determine whether varying cooperative market shares across sectors and countries constitute a "statistical regularity" or a random by-product, we test for the presence of sector and country effects on cooperative market shares.[19] The main results are as follows. We cannot reject the hypotheses regarding the presence of sector and country effects on cooperative market shares. There are large and statistically important differences in cooperative market shares between the dairy sector and other sectors. There are also regional effects. Cooperative markets shares are significantly lower in the Eastern European countries relative to other EU regions. This effect is statistically

[19] One way to test for the presence of sector and country effects is to calculate the standardized differences in means (in cooperative market shares) between groups, where groups are distinguished by sectors and EU regions. When such a difference is statistically different from zero, we conclude that the differences in cooperative market shares across groups are statistically important. Hence, it serves as an evidence for the presence of sector or country effects.

significant and quantitatively large. Overall, the effect of the dairy sector appears quantitatively to be the most important. This result motivates the focus on the determinants of the cooperative market shares in the dairy sector in Section 3. It is then contrasted with the sugar sector, which is characterized by a very low presence of cooperatives.

The empirical literature regarding cooperative market shares is limited. First, Caves and Peterson (1986) studied cooperative market shares in the US in 1983, which were 77% in the dairy sector, and 19% in fruits and vegetables sector. They formulate hypotheses regarding the relations between cooperative market shares and public policies, tax, and antitrust laws. Overall, they conclude that cooperative market shares are higher for crops which are perishable and in capital intensive industries due to cooperative tax advantages. Second, our paper is related to the "Doing Cooperative Business Report", commissioned by the International Cooperative Alliance (Groeneveld, 2016). The objective of the report was to study the elements of the enabling environment for cooperatives. The main findings of the report suggest that cooperatives foster in countries with low power distance, a favorable business environment, good governance conditions, low perceived level of corruption, low income inequality, and high overall state of democracy. Our paper differs from the existing literature for several reasons. The dependent concept studied in the report, i.e. the Cooperative Economy Index, is a broader concept than cooperative market share. [20] The scope of the report is beyond the EU, and covers 33 countries, including countries in North and South America, India, Asia, and Australia. Finally, the scope of the report also goes beyond the agricultural sector. Hence, our paper adds to the discussion about the enabling environment for cooperatives by making a focused contribution about cooperative market shares in the EU dairy and sugar sectors.

Cooperative literature highlights several theoretical reasons for the co-existence of cooperatives and investor-owned firms (IOFs). First, cooperatives and IOFs may co-exist in one market due to a competitive yardstick effect of cooperatives (Sexton, 1990, Liang and Hendrikse, 2016). It implies that the presence of a cooperative in a market puts a limit on the minimum procurement price, paid by a competitor IOF to farmers. Hence, some farmers do not join a cooperative. The co-existence of cooperatives and IOFs is also predicted by the spatial models, where homogeneous farmers are sorted between downstream enterprises (Sexton, 1990; Tribl, 2012). In a Cournot duopsony model with homogenous farmers, Karantininis and Zago (2001), show that the cooperative market share (as measured by the equilibrium number of

[20] The index consists of the weighted average of three ratios: membership penetration of cooperatives relative to total population, cooperative employment divided by total population, and annual gross revenue of cooperatives relative to country's GDP.

farmers in a cooperative) is higher in a closed membership cooperative than in an open membership cooperative.[21] When heterogeneous farmers choose an enterprise, the co-existence of cooperatives and IOFs occurs because a cooperative attracts more of the less efficient farmers. Lastly, from a transaction cost perspective, Hendrikse (2007) explains the co-existence of spot and contract markets with a model of endogenous contract formation and endogenous uncertainty. He argues that the co-existence of the two governance structures is natural due to (i) the costs associated with a spot market and (ii) a contract formation externality. Consequently, the market share of a cooperative increases when the transaction costs associated with a spot market increase.

The rest of the paper is structured as follows. Section 4.2 formulates the hypotheses regarding cooperative market shares. Sections 4.3 and 4.4 test the hypotheses in the European dairy and sugar sectors, respectively. Section 4.5 concludes.

4.2 Hypotheses

An agricultural cooperative is an enterprise owned by an upstream or downstream society of members. A cooperative is viewed as a form of vertical integration, because many farmers own collectively an upstream or downstream enterprise. It differs from vertical integration due to at least two features of the owner. First, the owner is a society of members, where each member has an ownership and transaction relationship with the cooperative enterprise. For instance, the Dutch dairy cooperative FrieslandCampina is collectively owned by almost 19,000 dairy farmers. Second, each member has a portfolio of assets. One of the assets is an ownership stake in the cooperative enterprise. There is no ownership relationship between the other assets of the member and the cooperative enterprise. A cooperative therefore pools some resources of the members to own an upstream or downstream party, while each member remains the sole owner of other assets, such as the farms.[22] This characterization of a cooperative implies that there are at least two sources for the formulation of hypotheses regarding cooperative market share. Given the conceptual similarity between a cooperative and vertical integration, we investigate whether the determinants of cooperative market shares are consistent with the determinants of vertical integration. Additionally, the portfolio of assets of a member may be related to the cooperative market share.

One stream of vertical integration literature has been concerned with investigating the boundaries of the firm, i.e. the determinants of vertical integration

[21] The authors also explore the relation between a cooperative market share and the cost efficiency of farmers, and find that it is neither monotonically increasing nor decreasing. For example, when farmers are very cost-efficient, the share of farmers in a cooperative is very high. This share then decreases up to a certain minimum cost-inefficiency, and then increases again (Karantininis and Zago, 2001).

[22] Cooperative literature defines the consequences of this feature as the portfolio problem (Cook, 1995).

(Geyskens et al., 2006; Lafontaine and Slade, 2013). From the incomplete contracting view, asset specificity is the primary determinant of vertical integration (Grossman and Hart, 1986).[23] Forward vertical integration entails that a supplier employs the assets of the downstream party, and hence becomes a residual claimant regarding the income at the downstream enterprise (Grossman and Hart, 1986; Acemoglu at al., 2010). Another stream of literature studies whether the boundaries of the firm matter, i.e. whether vertical integration is a by-product of other processes (Atalay at al., 2014). The latter literature proposes that the degree of vertical integration may not be a consequence of systematic make-or-buy decisions. Instead, a firm is viewed as an outcome of an "assignment" mechanism which allocates high quality intangible inputs, such as best management, across a "better and / or greater number of production units" (Atalay et al., 2014, p.1141). The organizational capabilities view of the firm then implies that vertical integration is a by-product of firms' efficient transfers of intangible inputs. Hence, the question about sector and country effects on cooperative market shares is resolved, because firm boundaries do not matter.

The ownership and transaction relationship of a member regarding the cooperative enterprise is expected to be one of the determinants of cooperative market share, especially in markets with low margins. The ownership stake of a member represents often a substantial percentage of the total value of the entire portfolio of assets of the member (Hendrikse and Veerman, 2001). A member is therefore reluctant to allow the cooperative enterprise to abandon the input supplied, or the goods or services demanded, by the member. This is called the single origin constraint (Cook, 1997; Deng, 2015). A second implication may be that it has an impact on the product diversification choices of the cooperative enterprise. A member wants to bring his entire portfolio of assets to value, which differs from the composition of assets of the cooperative enterprise. A cooperative enterprise is therefore expected to face requests to provide member services (Feng and Hendrikse, 2012).

In the sections 4.2.1-4.2.4, we organize the hypotheses regarding the determinants of cooperative market shares based on the four levels of social analysis.

4.2.1 Embeddedness

The organization of individual agents in groups and networks influences outcomes of many social and economic interactions. Granovetter (1985) developed an

[23] The real world complexity results in necessarily incomplete contracts, because it is not possible to ex-ante foresee all possible contingencies and describe them in a contract. When a party, engaged in the exchange, made large relationship specific investments it may fear the ex-post opportunistic behavior of the other party due to the "gaps" in the contract. This gives rise to a hold-up problem, because important investments may be forgone. The choice of governance structure, for instance vertical integration, may resolve the hold-up problem by establishing ex-post bargaining positions.

"embeddedness" argument suggesting that existing ties in social networks influence rational economic decisions. In his seminal paper, Greif (1994) shows empirically how cultural aspects, such as religion and collective reputation mechanisms, may result in different societal and economic structures in the Arab world. In Europe, Tabellini (2010) finds that an exogenous component of history-related culture strongly correlates with regional economic development.[24]

High levels of social capital, and trust in particular, are recognized as conditions which foster the development of cooperatives (Svendsen and Svendsen, 2000). Generalized trust reflects the beliefs about to what extent other people in a society are trustworthy, i.e. can be trusted (World Values Survey). It is conceptually different from particularized trust, i.e. trust towards particular groups of people. Therefore, it is possible that high levels of trust develop within small groups (such as a cooperative), while the level of generalized trust is low (such as a country-level measure of generalized trust).

First, a cooperative faces a number of collective action problems due to its characteristics such as joint ownership, collective decision-making and equal distribution of benefits (Valentinov, 2004; Deng, 2015). We argue that the costs associated with these characteristics are lower in environments characterized by high levels of generalized trust. In other words, there are at least three theoretical reasons for a positive relationship between the generalized trust and the cooperative market share in a country. First, one prediction of experimental game theory is the fact that people tend to be "conditional cooperators" when engaging in collective action, i.e. they cooperate when they expect others to cooperate (Axelrod, 1990; Sugden, 1984). Hence, the share of "conditional cooperators" is necessarily larger in an environment with a high level of generalized trust. Second, cooperation based on reputation is more difficult to develop when the membership of a cooperative is large (Sonderskov, 2009). That is because individual members may have private information, which is difficult to obtain for others. They may also not communicate with each other sufficiently often to develop reputation mechanisms, which ensure cooperation. Therefore, a generalized social trust can serve as an alternative source of information about the trustworthiness of others. Third, the relationship between generalized trust and a market share of an enterprise differs between an IOF and a cooperative. The differences between the objectives of a cooperative and an investor-owned firm (IOF), i.e. member benefit versus profit maximization, may create greater trust in the relation between farmers and cooperatives than between farmers and IOFs (Sykuta and Cook, 2001). Trust is relatively more important for the success of a cooperative relative to an IOF because the contracts

[24] Exogenous variation in culture is isolated by using the literacy rate at the end of 19th century, and historical political institutions as instrumental variables.

between suppliers and cooperatives are more relational than between suppliers and IOFs, and cooperatives are more reluctant to impose strict sanctions on the members (Shaffer, 1987). Based on these observations, we propose that cross-country differences in generalized trust scores could explain the variety of cooperative market shares observed across the EU. Hypothesis 1a summarizes the relationship between cooperative market shares and trust.

Hypothesis 1a: Cooperative market shares are higher in countries with high trust scores.

In farmer cooperatives, homogeneity of interests among members is important because it minimizes the costs of collective decision-making (Hansman, 1996). Establishing a cooperative requires coordination among many members and the associated coordination costs are lower when members are homogeneous. On the one hand, homogenous membership may emerge in a homogeneous country. For example, the first dairy cooperative in Denmark was established in 1882, and was financed and managed by the farmers. Several studies highlight the homogeneity of Danish local communities as one of the key success factors of its early cooperative movement (Larkin, 1988; Svendsen and Svendsen, 2000; O'Rourke, 2006). Denmark is also one the most homogeneous countries, based on the Fractionalization dataset by Alesina et al. (2010), as exemplified by low values of ethnic (0.08), linguistic (0.10), and religious (0.23) heterogeneity. Besides, the functioning of a cooperative is negatively affected by the heterogeneity of members due to the issues involving commitment, decision-making, influence and agency costs (Bijman, 2005). On the other hand, a homogenous cooperative may also exist in a country characterized by high heterogeneity. However, the positive relationship between homogeneity and trust also supports a link between a country's homogeneity measure and a cooperative market share. For instance, homogeneity is considered the key correlate with organizational trust in cooperatives (James and Sykuta, 2005).

Homogeneity among suppliers benefits cooperatives more than IOFs for at least two reasons. First, homogeneity of interests among suppliers minimizes the costs of collective decision-making in a cooperative. It is not relevant for the decision-making process in an IOF, because heterogeneity of suppliers in an IOF is not important for the aggregation of financial outcomes. Second, cooperatives may be less able than IOFs to tailor to member heterogeneity due to prevailing egalitarian considerations in cooperatives. It may be less cumbersome for IOFs than cooperatives to deal with the requests of individual farmers. These observations illustrate that the governance of a cooperative is subject to a cultural variable, i.e. the degree of homogeneity of a population in a country. They motivate Hypothesis 1b.

Hypothesis 1b: Cooperative market shares are larger in more homogeneous countries (as measured by low scores of ethnic, linguistic, and religious fractionalization).

4.2.2 Institutional environment

One prediction of the incomplete contracting theory suggests that market failures and weak contracting institutions encourage greater forward vertical integration (Acemoglu et al., 2007). Weak contracting institutions imply difficulties when contracting between citizens, judicial inefficiency, and weak property rights enforcement. Then, forward vertical integration, i.e. cooperative organizational form, serves as a substitute for well-functioning contracting institutions. We therefore expect to see higher cooperative market shares in countries with weak contracting institutions, and especially in contract-intensive industries.[25] Empirically, this hypothesis is supported when higher market shares of cooperatives are associated with countries that score low on the relevant components of the Rule of Law index (property rights and judicial effectiveness). Hypothesis 2a formulates the substitute relationship between contracting institutions and cooperative organizational form.

Hypothesis 2a: Countries with weak contracting institutions have higher market shares of cooperatives.

On the other hand, cooperative organizational form may complement well-functioning contracting institutions when the latter is a necessary condition for the blossoming of cooperatives. Strong contracting institutions may benefit a cooperative more relative to an IOF due to the differences in contracts in the two types of organizations. Sykuta and Cook (2001) claim that the contracts between the farmers and IOFs tend to be more complete in specifying the rights and responsibilities over a broader range of contingencies. This in turn reduces the need to deal with the consequences of incomplete contracts, such as hold-up. Consequently, cooperatives may benefit from strong contracting institutions more than IOFs due to more contractual incompleteness, which cooperatives are subject to. Should a problem arise due to

[25] Agricultural sectors are typically classified as some of the least institutionally dependent. The underlying intuition is that industries that require joining of a large number of inputs to production are more institutions dependent because there are more relationships that can be "potentially distorted due to imperfect institutions" (Levchenko, 2007). For example, Levchenko (2007) ranks fluid milk and creamery butter as 6th and 5th least institutionally intensive industries.

incompleteness of a contract, it is resolved more efficiently in a country with strong contracting institutions. If this is the case, we expect to observe higher market shares of cooperatives in countries with strong contracting institutions. Hypothesis 2b formulates the complementary role of institutions and cooperative organizational form.

Hypothesis 2b: Countries with strong contracting institutions have higher market shares of cooperatives.

A cooperative is generally categorized as a user-owned, user-controlled, and user-benefitted enterprise. However, this categorization does not uniformly translate into the European and national cooperative legislation. Although there have been regulatory attempts to harmonize national cooperative laws across the European Union, they were unsuccessful (van der Sangen, 2012). Legal scholars emphasized several aspects of national cooperative laws, which differ across EU countries. First, there are differences in the cooperative business organizational law with respect to the enforcement of the "one member – one vote" rule. The first part of Hypothesis 2c formulates a claim that a more liberal treatment of the "one-member – one vote" rule is favorable for cooperative market shares. Second, tax law is more favorable towards cooperatives in some countries than in others due to a different degree of exemption from corporate tax. This observation is summarized in the second part of Hypothesis 2c. Third, different regulations exist with respect to the minimum required capital and minimum number of members required at the formation of cooperative. Minimum requirements regarding the size of the membership and the minimum capital investment may prevent new cooperatives from being formed and new members from joining existing cooperatives. This argument is reflected in last part of Hypotheses 2c.

Hypothesis 2c: The market share of cooperatives is higher in countries

(i) where the national cooperative law permits more deviation from the "one member – one vote" rule;

(ii) where cooperatives are subject to a more favorable corporate income tax;

(iii) where the minimum requirement regarding capital and/or number of members at formation are lower.

As emphasized by Williamson (2000), changes in formal institutions occur once every ten to one hundred years. We identify two changes in institutions relevant to the analysis of cooperative market shares. First, nine countries, classified as Eastern European, were all part of the ten countries under the communist regime after World War II (Bulgaria, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland,

Romania, Slovakia, and Slovenia). Unlike other EU countries, most of these countries were subject to the collectivization of the agricultural sector in the second half of the 20th century. Putnam (1993) suggests that there is a correlation between the time of dictatorship and the destruction of trust and cooperation, as well as a tendency in post-communist states to passively rely on the state. Centrally planned economies left little room for entrepreneurship, experiments, and voluntary organization into social groups (Chloupkova et al., 2003, Fukuyama, 1995). Based on these observations and the descriptive data about the quality of institutions, Hypothesis 2d is formulated.

Hypothesis 2d: Cooperative market shares are lower in former communist countries.

Second, three European countries were characterized by the protracted presence of the fascist regime in the 20th century. It lasted for 21 years (1922-1943) in Italy, 36 years (1939-1975) in Spain, and 42 years (1932-1974) in Portugal. Organizational forms that are consistent with the environmental ideology, are more likely to persist (Simons and Ingram, 1997). On the contrary, the democratic governance of cooperatives can represent a rival ideology to a dictatorship. For instance, it is documented that the Franco regime in Spain had the legal right to veto democratic decisions of cooperatives at any time, based on the "Law of Cooperatives of the New State" (Núñez-Nickel and Moyano-Fuentes, 2004). The objective of this law was to strictly control the "ideological purity". The hierarchical governance of the investor-owned firm is more in line with the hierarchical government structure of the fascist regime. Based on the descriptive data about the quality of institutions and seemingly conflicting ideologies of fascist regimes and cooperatives, Hypothesis 2e is formulated.

Hypothesis 2e: Cooperative market shares are lower in countries which were under a prolonged fascist regime in the 20th century.

4.2.3 Governance

The third level of social analysis is concerned with governing the transactional relations. The theory of the firm formulates adaptation as the central organizational problem, and proposes that the role of governance is to establish "order" to mitigate conflict and realize efficiency (Commons, 1932). On the two extremes of the governance structures spectrum are hierarchies and markets. Markets are best for transactions when autonomous adaptations are needed; hierarchies are preferred when bilaterally dependent parties benefit from coordinated adaptation (Tadelis and Williamson, 2013). Then, as suggested by Coase (1937), the governance structure should not be taken as given, but should be derived. As a result, "getting the governance structure right" is the purpose at the third level of analysis. In the context of our analysis, the governance

structure decision implies the choice between a cooperative form and an alternative, such as an IOF.

The governance structure choice needs to account for the fact that managing a cooperative enterprise differs from managing an IOF, and may be more difficult in some cases (LeVay, 1983; Staatz, 1987; Cook, 1994). Residual claims in cooperatives are tied to patronage, rather than to capital investment in IOFs. Differences in property rights allocations between cooperatives and IOFs also imply differences in managerial incentives (Staatz, 1987; Caves and Peterson, 1986; Cook, 1994). In particular, the vaguely defined objective function of a cooperative gives rise to a more complex managerial decision matrix (Cook, 1994). To illustrate, the task of maximizing the return on assets is less complex than the task of maximizing the joint farm and cooperative objective function. As a consequence, a cooperative manager faces a larger set of conflicts, and requires at least four additional qualifications, relative to an IOF manager (Cook, 1994). He highlights being comfortable with complexity, people-oriented resource allocation, multi-stakeholder communication, and having coalition-building skills as additional qualifications required for a cooperative manager.

A large body of empirical literature is concerned with explaining large and persistent total factor productivity differences across firms and countries. A recent empirical study by Bloom et al. (2017) documents that good managerial practices predict a firm's success better than IT, R&D, or employee skills. Several conclusions are emphasized regarding the cross-country variation in management practices (Bloom and Van Reenen, 2010). First, strong product market competition boosts average management practices. Second, multinational companies are generally well-managed in all countries. Third, family-owned and government-owned firms are badly managed. Lastly, firms with more educated workers tend to have better management practices.[26] In addressing the question of whether cooperatives are better managed in some countries than in others, the empirical evidence about the quality of management practices across Europe is useful (Bloom and Van Reenen, 2010). Hypothesis 3a proposes that in a setting with an overall high level of managerial skills, a cooperative firm may benefit from good management practices more than an IOF. This can result in higher cooperative market shares in countries with higher management practices scores.

[26] The World Management Survey measures management practices based on three areas: (i) "monitoring - how well do companies monitor what goes on inside their firms, and use this for continuous improvement; (ii) targets - do companies set the right targets, track the right outcomes and take appropriate action if the two are inconsistent; (iii) incentives - are companies promoting and rewarding employees based on performance, and trying to hire and keep their best employees?" (Bloom and Van Reenen, 2010).

Hypothesis 3a: Countries with higher overall management score are associated with higher market shares of cooperatives.

4.2.4 Resource Allocation

The climate differs across Europe. Therefore, the natural conditions for the development of different agricultural sectors also vary across Europe. In fact, geography could be placed at level zero, above the embeddedness level in the Williamson's levels of social analysis. For the purpose of this paper, we refrain from discussing the relationship between geography, culture, and institutions, and only focus on one consequence of geographical variety, namely country's milk or sugar self-sufficiency. For example, some regions in Europe are referred to as the "milk belt" or "sugar beet belt" due to the favorable climatic conditions for either grassland and livestock, or sugar beet growing.

We propose that a country's degree of self-sufficiency in an agricultural sector has consequences for the industry composition at the country level. One reason is the difference in the objectives of cooperatives and investor-owned firms. The former's objective is to serve members interests, i.e. to collect members' supplies. The latter's objective is profit maximization. Oversupply of products results in a very competitive market, which is not attractive for enterprises in the market, or enterprises considering entry in the market. However, the attractiveness differs between cooperatives and IOFs. Given cooperatives' primary goal of collecting the supply of the members and "operating at cost" principle, they are able to operate with relatively low profit margins, and thus are a fierce competitor to potential new (IOF) entrants (Albæk and Schultz, 1998). Hence, countries with an oversupply of farmers' produce are likely to have high market shares of cooperatives. On the contrary, IOFs enter markets characterized by high prospective profit margins. It is likely to happen when a country is not self-sufficient. Cooperatives may have an entry disadvantage in these markets due to having access to only inside equity. Additionally, a historical observation by Fernandez (2014) suggests that in the 19th and early 20th century marketing cooperatives emerged in exporting countries, i.e. countries with high levels of self-sufficiency, as a response to the opportunistic behavior of traders.

The assurance of output market explanation for forward vertical integration (Carlton 1979a) is more important in settings with an oversupply of farmers' produce. To illustrate, when the upstream market is characterized by an undersupply, there is less need for the upstream party to forward integrate because downstream firms compete for limited supplies. As a result, a setting with an undersupply may have less cooperatives, relative to a setting with an oversupply of inputs. Based on these arguments, Hypothesis 4a is formulated.

Hypothesis 4a: The cooperative market share is higher when a country is more milk (sugar) self-sufficient.

Next, cooperatives and IOFs may differ with regards to their product diversification strategies. For instance, a dairy cooperative can be active in sectors such as fluid and dry milk, butter, ice cream, or pharmaceuticals. The extent of product diversification of a firm is approximated by the number of 4-digit industry codes (SIC, i.e. Standard Industrial Classification). It measures the number of sectors in which a firm operates. Hypothesis 4b claims that the cooperative market share is higher when cooperatives are more diversified than IOFs. When a cooperative adds more value to farmers' products at the downstream level, relative to an IOF competitor, it may capture a higher market share. We construct a measure of firm's product diversification, measured by the total number of SIC codes, i.e. the sum of primary codes (company's primary activity of business, i.e. an activity which generated the highest revenue for that company in a past year) and secondary codes (other revenue producing activities).

Hypothesis 4b: If cooperatives add more value at the downstream level (as measured by the degree of product diversification), then the cooperative market share is higher.

Cooperatives and IOFs are likely to develop different product portfolios due to the differences in the two governance structures. The consequence of the single origin constraint is that a cooperative will not divest the input supplied by member farmers (Cook, 1997; Deng, 2015). An IOF does not face such a constraint because there is no transaction relationship between the owners and the downstream enterprise. Additionally, farmers' objective to maximize the returns on their entire portfolio of assets may have an influence on the diversification decisions of the cooperative enterprise.

One important characteristic of the European agricultural markets is the strict regulation since the end of World War II. The regulation has an influence of the price and quantity decisions in agricultural markets. After the war, Europe was not self-sufficient in terms of food (Masure, 2010). The objective of the Common Agricultural Policy (CAP, 1957) was to provide incentives to maximize agricultural production. By the 1970-1980s, due to high guaranteed prices, large surpluses were produced, which had to be bought by the European Union.

Consequently, to eliminate overproduction EU quotas were introduced in 1984. The production quotas are first allocated per country at the EU level. Next, the quantity is allocated among the producers in each country. Hence, the quantity restrictions in terms of production quotas ultimately stabilized the market structure of these

agricultural sectors overtime.[27] Milk volume restrictions encouraged more efficiency (increasing production per cow). In March 2015 the milk quotas were abolished. It resulted in a significant increase in EU milk production. In combination with lower demand, this lead to a sharp decrease in milk prices in 2015. Similarly, the sugar quota system in the EU ended 30 September 2017.

4.3 Measurements

This section explains the measurements of the variables of the different levels of social analysis. The estimates of dairy and sugar cooperative market shares are obtained from the final report of the "Support for farmers' cooperatives" project (Bijman et al., 2012). It measures the percentage of the value of farm produce (milk or sugar) handled by cooperatives in a country. This measure reflecs the combined market shares of all cooperatives in the sector compared to the cumulative market share of all IOFs in the same sector. The measure is regarding the farm-gate transaction. Country's experts provided an estimate regarding the value of a cooperative market share for each agricultural sector in their country.

The embeddedness level of analysis is captured by cross-country variations in measures of trust and heterogeneity. The generalized trust measure, obtained from the World Values Survey for 2010, captures the extent to which "most people can be trusted" in a country. A higher trust score implies a higher level of generalized trust. The measures of ethnic, linguistic, and religious heterogeneity are obtained from the Fractionalization dataset (Alesina et al., 2003). Each measure reflects the probability that two randomly selected individuals from a population belonged to different ethnic, linguistic, or religious group. It is calculated as one minus the Herfindahl index of group shares, i.e. the shares of different ethnic, linguistic, or religious groups. A higher fractionalization measure implies a higher degree of heterogeneity of a country.

The Index of Economic Freedom (Heritage Foundation, 2017) provides two measures of the quality of contracting institutions, namely the property rights and judicial effectiveness. The former measure captures "the extent to which a country's legal framework allows individuals to freely accumulate private property, secured by clear laws that are enforced effectively by the government" (Heritage Foundation, 2017). The score consists of five equally weighted sub-factors: physical property rights, intellectual property rights, strength of investor protection, risk of expropriation, and

[27] This paper provides a static analysis, because cooperative market shares were measured only in 2010. Given the little variation in the market structures due to the quota system since 1984, time series approach would not add much value, unless it examines time period prior and/or after the quota system. The former approach requires scarce historical data; the latter approach requires more time for the new data to become available.

quality of land administration. A higher score indicates a more effective legal protection of property in a country. The latter measure reflects "the degree of efficient and fair judicial systems, which ensure that laws are fully respected, with appropriate legal actions taken against violations". The score consists of six equally weighted sub-factors: public trust in politicians, irregular payments and bribes, transparency of government policymaking, absence of corruption, perceptions of corruption, and governmental and civil service transparency. A higher score indicates better judicial effectiveness in a country.

In addition to cross-country differences in the quality of contracting institutions, there are also differences in cooperative law across the EU. We capture this variety by four cooperative law measures, which were coded based on the "Support for farmers cooperatives: Legal aspects" report (van der Sangen, 2012). First, the "Favorable cooperative tax" variable captures the extent to which cooperatives enjoy a favorable tax treatment in a country. A score of 2 is assigned to countries where cooperatives are exempt from the corporate income tax. A score of 1 is assigned to countries where cooperatives have the same corporate income regime as IOFs, while some facilities are provided for the deduction of patron dividends paid to the members related to the economic transactions between the cooperative and its members. A score zero is assigned to countries which do not have special tax facilities for cooperatives or have tax facilities that have no impact on the promotion or success of cooperatives. Second, the "Liberal voting rules" variable measures the extend to which cooperatives are permitted to depart from the one member-one vote rule by law. A score of 2 is assigned to countries where the voting rights are liberal and can be attributed to members according to their volume of economic transactions with the cooperative. A score of 1 is assigned to countries that allow cooperatives to depart from the principle of "one member - one vote", but only to a limited degree. A score zero is assigned to countries that do not allow departing from the "one member – one vote rule". Third, the "minimum capital requirement" measure captures the legal requirement regarding the minimum member capital upon the formation of a cooperative in a country. Lastly, the "minimum member requirement" measure reflects the legal requirement regarding the minimum number of members upon the formation of a cooperative in a country.

Historical shocks on the institutional level of analysis are captured by two dummy variables, i.e. communist and fascist regimes. In the former case, a score of 1 is assigned to a country which was under the communist regime after World War II, and a zero score is assigned otherwise. In the latter case, a score of 1 is assigned to a country, which was under the fascist regime for more than 20 years, and a zero score is assigned otherwise.

On the governance level, we classify EU countries according to the general management practices scores from the World Management Survey (Bloom and Van

Reenen, 2010). Management practices are measured based on three areas: (i) monitoring, i.e. how well firms monitor and accordingly adjust processes; (ii) targets, i.e. whether firms set the right targets and take consistent actions; (iii) incentives, i.e. whether performance-based rewards are properly implemented. A higher country's score indicates a better managerial practices in a country.

On the resource allocation level, we first measure a country's degree of milk and sugar self-sufficiency. The former is obtained from a consultancy company CLAL.it. The percentage of a country's milk self-sufficiency is calculated as $\frac{C}{C+I-E}$, where C is the country's total milk deliveries, I is the milk equivalent imports, and E is the milk equivalent exports. A percentage above (below) one t indicates that a country is (not) milk self-sufficient. A country's sugar self-sufficiency is computed in the same way by using FAO statistics for 2010, i.e. a country's sugar self-sufficiency is calculated as $\frac{C}{C+I-E}$, where C is the country's total raw sugar equivalent production, I is the raw sugar equivalent imports, and E is the raw sugar equivalent exports.

Lastly, the degree of product diversification of cooperatives relative to IOFs is calculated for the dairy and sugar sectors per country, by using the industry codes data from Bureau van Dijk database. It is calculated as a difference in means regarding the degree of total diversification. It is measured by the number of 4-digid industry codes. A positive (negative) score indicates that cooperatives are more (less) diversified than IOFs in this country in a given sector.

4.4 Determinants of cooperative market shares in the EU dairy sector

The European dairy sector is traditionally characterized by the high presence of cooperatives. Ten out of the twenty largest European dairy companies are cooperatives (Hanisch et al., 2012). In some countries, the entire dairy market is dominated by cooperatives, such as in Sweden, Ireland, and Finland. In others, cooperatives and IOFs co-exist and the market share of cooperatives varies (Figure 4.2). The differences in cooperative market shares across the EU are statistically significant (differences in means are reported in Appendix 4.4). Overall, the differences in dairy cooperative market shares are statistically significant between the North and South, North and East, West and East, and South and East of Europe.

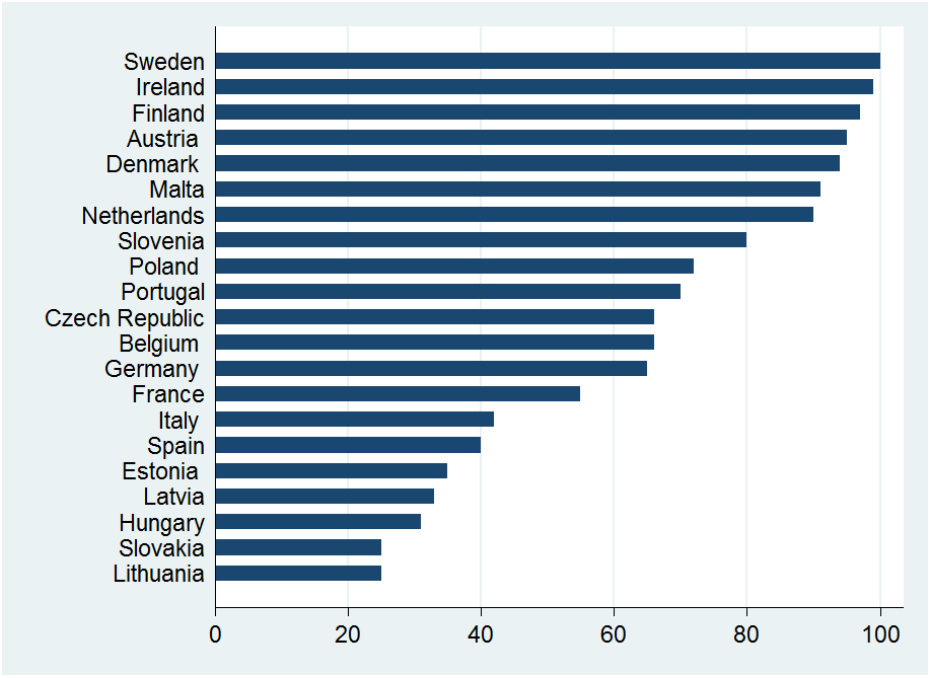

Figure 4.2. Market shares of cooperatives in the dairy market in EU countries, 2010 (Bijman et al., 2012)

A dairy cooperative is an enterprise, collectively owned by many milk suppliers. An investor-owned firm (IOF) is owned by shareholders. They do not have a transaction relationship with the downstream enterprise. Investor-owned firms and cooperatives in the dairy sector differ in contracts, which they offer to dairy farmers. The sources of differences include the duration of the contract, delivered amounts and the flexibility of amounts, price, and information duties (Hanisch et al., 2012). One explanation for the large presence of cooperatives in the dairy sector is the characteristic of the raw product, namely the perishability of milk. This characteristic is labeled as temporal asset specificity in transaction cost theory (Masten, 2000). The dairy sector is characterized by a high degree of temporal asset specificity, which implies that the value of milk is time dependent due to its perishability, and therefore makes forward vertical integration more likely (Masten, 2000). Given their vulnerable position due to the perishability of milk, dairy farmers may choose to integrate forward to limit opportunistic behavior at the downstream level. This argument explains why cooperative dairy market shares are high relative to other sectors. However, it provides no insight regarding the cross-country variation in the cooperative market shares. Additionally, cheese making at the farm was a response of farmers to the perishability problem of milk, long before the first vertically integrated dairy.

Table 4.3 reports the correlation matrix between the dairy cooperative market shares and variables measuring cross-country differences in embeddedness, institutional environment, governance, and resource allocation. Results regarding the social embeddedness level, i.e. trust and heterogeneity, are discussed in subsection 4.3.1. Institutional environment level, i.e. the quality of institutions, national cooperative laws, and historical shocks to regimes are discussed in subsection 4.3.2. Subsection 4.3.3 discusses the governance level, i.e. country-level differences in management practices, and cooperatives' degree of product diversification. Lastly, subsection 4.3.4 discusses country's degree of milk self-sufficiency.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1 Dairy coop market share	1.00															
2 Trust	**0.50***	1.00														
3 Ethnic heterogeneity	**-0.58***	-0.16	1.00													
4 Linguistic heterogeneity	-0.34	-0.07	**0.78***	1.00												
5 Religious heterogeneity	**-0.45***	-0.19	0.16	0.25	1.00											
6 Property rights	**0.55***	**0.42***	-0.10	0.19	0.10	1.00										
7 Judicial effectiveness	**0.57***	0.33	-0.18	-0.04	-0.09	**0.81***	1.00									
8 Voting rule	0.14	0.36	-0.01	0.25	0.27	**0.47***	0.36	1.00								
9 Cooperative tax	0.18	-0.06	-0.18	-0.06	-0.17	-0.01	0.21	0.04	1.00							
10 Min capital	-0.07	-0.15	0.35	0.19	-0.29	-0.13	-0.02	-0.27	**0.39***	1.00						
11 Min members	-0.10	-0.13	-0.14	-0.38	**-0.41***	-0.35	-0.10	-0.31	-0.03	0.28	1.00					
12 Communist regime	**-0.58***	-0.15	0.42	0.14	0.30	**-0.53***	**-0.55***	**-0.42***	**-0.44***	-0.17	0.02	1.00				
13 Fascist regime	-0.23	-0.08	-0.07	-0.11	-0.14	-0.11	-0.17	0.11	-0.02	0.01	0.08	-0.27	1.00			
14 Dairy self-sufficiency	**0.50***	**0.58***	-0.18	0.16	0.05	**0.53***	0.31	0.03	-0.06	-0.23	-0.31	-0.09	-0.39	1.00		
15 Management score	0.01	0.21	0.29	**0.95***	0.55	0.45	0.35	0.75	0.06	-0.53	-0.47	-0.28	-0.38	0.08	1.00	
16 Product diversification	0.26	0.43	-0.17	-0.33	-0.40	**0.52***	**0.51***	-0.23	-0.21	-0.08	0.06	-0.23	-0.23	0.14	0.26	1.00

*p < .05

Table 4.3. Correlation matrix, dairy cooperative market shares and variables measuring embeddedness, institutional environment, governance, and resourse allocation

4.4.1 Embeddedness

First, Figure 4.3 depicts EU countries in terms of dairy cooperative market shares (the horizontal axis), and trust scores (the vertical axis). The trust score measures the extent to which "most people can be trusted" in a country (World Values Survey, 2017). Overall, Scandinavian countries are associated with higher levels of interpersonal trust, relative to other EU countries.[28] As reported in Table 4.3, a statistically significant pairwise correlation coefficient of 0.50 (p-value 0.020) suggests that cooperative dairy market shares are positively correlated with trust.

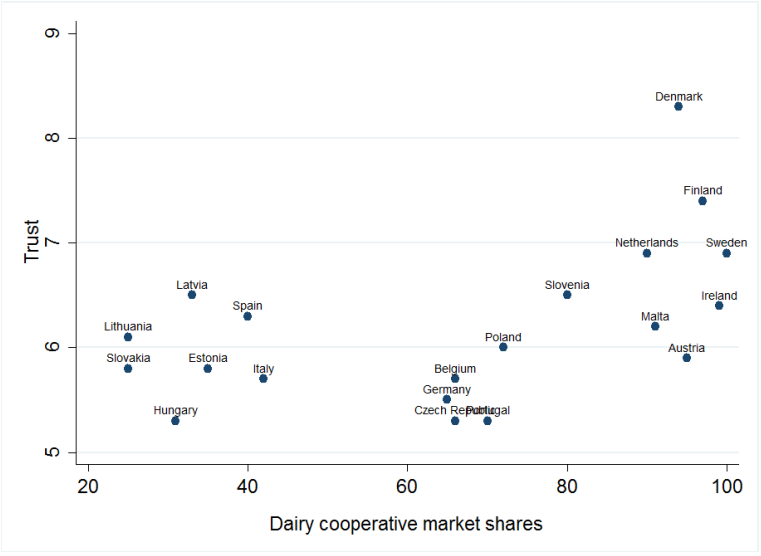

Figure 4.3. Correlation between dairy cooperative market shares and trust

Second, we refer to the degree of ethnic, linguistic and religious heterogeneity in various countries (Alesina et al., 2003).[29] The rankings of countries based on the three heterogeneity measures suggest that Scandinavian countries are the most homogeneous countries, followed by the Southern, Western, and Eastern countries. Pairwise

[28] Appendix 4.5 presents descriptive statistics of the generalized trust variable across EU regions.

[29] Alesina et al. (2003) find that more ethnic fragmentation is more common in poorer countries. Ethnic and linguistic fractionalizations are also associated with negative outcomes in terms of governance quality. In the European Union, the countries with lowest (highest) ethnic and linguistic heterogeneity are Malta and Portugal (Latvia and Luxembourg). On the contrary, religious fractionalization is associated with measures of good governance because measures of religious fractionalization tend to be higher in more tolerant and free countries. In the EU the lowest (highest) religious fractionalization score is in Luxembourg (Netherlands) Appendix 4.6 presents descriptive statistics of the heterogeneity variables across EU regions.

correlation coefficients between cooperative dairy market shares and measures of religious, linguistic, and ethnic heterogeneity are -0.45 (0.039), -0.34 (0.129), and -0.58 (0.006) respectively, with p-values in parentheses (as reported in Table 4.3). Negative and statistically significant pairwise correlation coefficients suggest that cooperative dairy market shares are negatively correlated with religious and ethnic heterogeneity.

To conclude, based on effect sizes in terms of correlation coefficients, we cannot reject Hypotheses 1a and 1b. In particular, cooperative market shares in the EU dairy sector are positively correlated with the cross-county measures of trust, and negatively correlated with religious and ethnic heterogeneity.

4.4.2 Institutional environment

First, we quantify the quality of institutions in the EU countries by using two components of the Economic Freedom index, namely the property rights and judicial effectiveness components. The former component assesses the "extent to which a country's legal framework allows individuals to freely accumulate private property, secured by clear laws that are enforced effectively by the government" (Heritage Foundation, 2017). The latter component, i.e. judicial effectiveness, measures the degree of efficient and fair judicial systems, which ensure that "laws are fully respected, with appropriate legal actions taken against violations" (Heritage Foundation, 2017). The two measures of the quality of institutions indicate that the strongest institutions are in the Scandinavian countries, followed by the Western, Southern, and Eastern countries. Table 4.3 reports the correlation coefficients between measures of institutional quality (property rights and judicial effectiveness) and cooperative dairy market shares, which are positive (0.55 and 0.57), and statistically significant (p-values of 0.001, and 0.07). Thus, Hypothesis 2b (2a) cannot be rejected (is rejected).

The general prediction of the transaction cost economics is that vertical integration is predominant when it is hard to write long-term contracts between upstream and downstream parties. Hence, we expect to observe a higher degree of vertical integration in countries with weak contracting institutions. Yet, we find that dairy cooperative market shares are higher in countries with strong contracting institutions, and this correlation is statistically significant. There are several interpretations of this result. First, determinants of cooperative market shares appear to differ from the determinants of vertical integration, i.e. we observe that in the European dairy sector farmers do not integrate forward in order to economize on costly contracting due to poorly functioning contract institutions. However, this result may also indicate the presence of a third variable, which influences both the quality of institutions and cooperative market shares, and thus drives this positive correlation. Address in final section.

Second, we examine whether country-level differences in cooperative legislature are associated with cross-country variation in the market shares of dairy cooperatives. Descriptive statistics of the national cooperative law measures are presented in Appendix 4.5. As depicted in Table 4.3, pairwise correlation coefficients between the measures of national cooperative law and cooperative dairy market shares are of small magnitude and are not statistically significant. Hence, Hypothesis 2c is rejected.

Third, we study the role of historical shocks, namely the association between the presence of the communist and fascist regimes in a country's history, and cooperative market shares. In addition to correlation coefficients reported in Table 4.3 (-0.58 for communist and -0.23 for fascist regimes), standardized differences in means, reported in Table 4.4, also provide evidence in support of Hypothesis 2d, i.e. a large negative and statistically significant difference in cooperative market shares between countries, which were and were not subject to a communist regime. Relative to the effect sizes measuring the effect of communist regimes, the effect size of the fascist regime is less negative, and is not statistically significant. Hence, it is not possible to rule out the possibility that the effect of the fascist regime on the current cooperative dairy market shares is negligent.

	Effect Size	Estimate	[95% Conf.	Interval]
Communist regime				
	Cohen's d	-1,41	-2,38	-0,41
	Hedges's g	-1,35	-2,29	-0,39
Fascist regime				
	Cohen's d	-0,64	-1,87	0,61
	Hedges's g	-0,61	-1,79	0,58

Table 4.4. Effect sizes measuring the association between the communist and fascist regimes and dairy cooperative market shares

Overall, the results regarding the institutional environment suggest that cooperative organizational form, as measured by dairy cooperative market shares, flourishes in settings where the quality of contractual institutions is high. This claim is further supported by statistically important differences in dairy cooperative market shares between EU countries which were subject to the communist regime and those that were not. This result is puzzling from the transaction cost theory perspective. When viewing a cooperative as a form of forward vertical integration, it predicts a higher degree of vertical integration in settings with poor functioning contracting institutions. Hence, we can conclude that in the dairy sector in the EU, cooperative organizational

form does not function as a response to weak institutions. Lastly, our results suggest that cooperative market shares are not associated with differences in cooperative laws across EU countries.

4.4.3 Governance

Observed cooperative market shares are the results of the governance structure choice at the third level of social analysis. It has been argued that the management of a cooperative enterprise requires an additional set of skills relative to the management of an IOF (Cook, 1994). Hypothesis 3a proposes that cooperatives could benefit from good management more in settings characterized by high overall management quality. The rankings of EU countries based on the management scores are listed in Appendix 4.6 (Bloom and Van Reenen, 2010). The pairwise correlation coefficient between overall management scores and cooperative dairy market shares is 0.0080 (p-value 0.986), which indicates that there is no evidence to support Hypothesis 3a.

Overall, based on the correlation coefficient, we do not find support for the incomplete contracting explanation of cooperative market shares. Variations in management practices do not appear to be statistically important for explaining dairy cooperative market shares.

4.4.4 Resource Allocation

We investigate whether industry composition, captured by a country's milk self-sufficiency score, is related to dairy cooperative market shares (Hypothesis 4a). In other words, we investigate whether the structure of the dairy industry is associated with a particular way of governing transactions between dairy farmers and downstream enterprises, i.e. forward vertical integration or spot exchange. In particular, we are interested to see whether there are statistically significant differences in dairy cooperative market shares in countries which differ with respect to milk self-sufficiency. Table 4.3 reports a statistically significant (p-value of 0.049) pairwise correlation of 0.5 between the degree of a country's milk self-sufficiency and dairy cooperative market share. The standardized difference in means between countries which are dairy self-sufficient (score>100%) and those which are not dairy self-sufficient (score<100%) also indicates that such difference is statistically significant (Table 4.5).

	Effect size
Cohen's d (95% CI)	1.56 (0.33, 2.73)
Henge's g (95% CI)	1.47 (0.31, 2.59)

Table 4.5. Effect sizes measuring the relationship between country's degree of milk self-sufficiency and dairy cooperative market shares. Excluding Sweden and 7 member states, which collect less than 1% of EU total milk deliveries (Latvia, Estonia, Bulgaria, Slovenia, Luxembourg, Cyprus, Malta)[30]

Second, a cooperative's market share could be higher when it is active in more industries, relative to an IOF. As Table 4.3 reports, the correlation coefficient between the measure of cooperative product diversification relative to IOFs and cooperative dairy market shares is positive (0.26) but not statistically significant (p-value 0.258). Table 4.6 indicates that cooperatives in the dairy sector are on average more (less) diversified than IOFs in Scandinavia and in the South of Europe (western and eastern Europe). The comparison of means between groups in Table 4.7 suggests that countries where dairy cooperatives diversify more than dairy IOFs, are not associated with higher cooperative market shares. Hence, Hypothesis 4b is rejected.

	Mean	Std. Dev.
Scandinavia	1,09	1,30
South	0,12	1,29
West	-0,22	0,78
East	-0,31	0,64
Total	7,96E-10	1

Table 4.6. Diversification degree of cooperatives relative to IOFs across EU regions

	Effect size
Cohen's d (95% CI)	0.19 (-0.70, 1.07)
Henge's g (95% CI)	0.19 (-0.67, 1.02)

Table 4.7. Effect sizes measuring the relationship between the measure of cooperative product diversification relative to IOFs and dairy cooperative market shares

To conclude, our results suggest that a country's degree of milk self-sufficiency correlates with dairy cooperative market shares. Differences in diversification strategies of cooperatives are not related to dairy cooperative market shares.

[30] Sweden is excluded from the list because its milk self-sufficiency score is due to highly protected domestic dairy market and high barriers to entry, rather than climatic conditions.

4.5 Determinants of cooperative market shares in the EU sugar sector

The sugar market in the EU is not dominated by cooperatives. As depicted in Figure 4.4, among sugar-producing EU countries, only seven have a cooperative market share exceeding zero. The largest cooperative market shares are observed in the Netherlands, France, and Germany (100%, 62%, and 60% respectively). The five largest sugar cooperatives are Tereos and Cristal Union in France, Royal Cosun in the Netherlands, Acor in Spain, and Cooperativa Produttori Bieticoli in Italy. They have a turnover of 3.8, 1.7, 1.7, 0.14 and 0.27 billion euros respectively. Overall, the average cooperative market share in the EU sugar sector (18.8%) is lower compared to the dairy sector (65.3%).

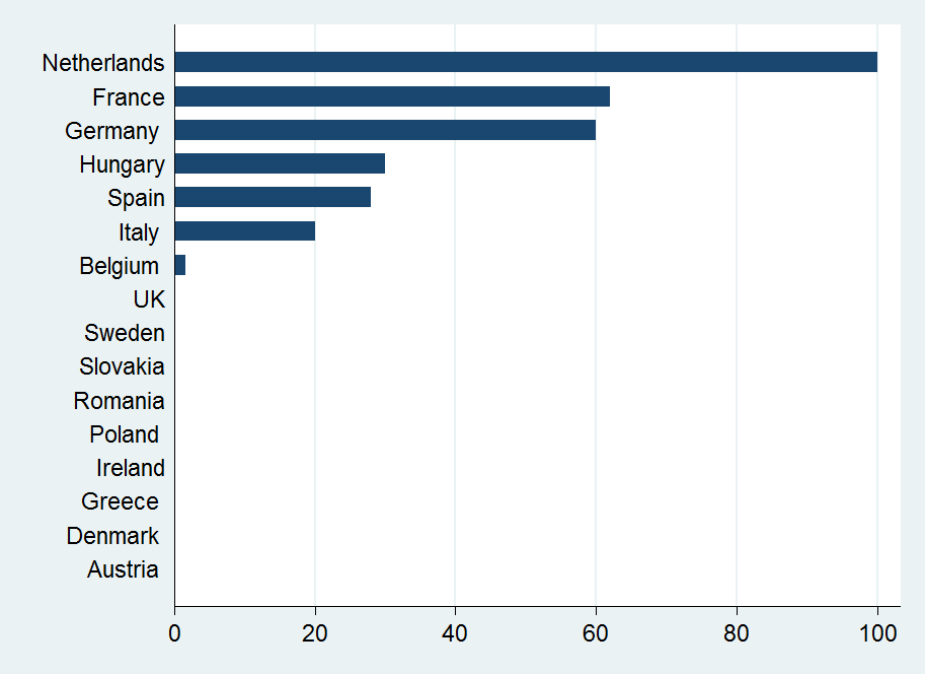

Figure 4.4. Market shares of cooperatives in the national sugar market in EU countries, 2010 (Bijman et al., 2012)

Our paper differs from the "Support for Farmers Cooperatives" sugar sector report by Smit and de Bont (2012) in the way we classify two sugar enterprises in Germany – Südzucker and Nordzucker. As depicted in Appendix 4.1, the "Support for Farmers Cooperatives" report concludes that the market share of cooperatives in

Germany is zero, because both Südzucker and Nordzucker are classified as IOFs.[31] We highlight two features of the cooperative enterprise in this paper. The two features are the transaction and ownership relationships between the upstream (farmers) and downstream (sugar processing enterprise) parties. Hence, when a sugar processing firm is controlled by farmers, who deliver sugar beets to it for processing, we refer to such an enterprise as a cooperative. The majority of shares of Südzucker, which are publicly traded, has always been owned by the southern German sugar beet farmers.[32] Nordzucker is not a publicly listed company. 83.8% are owned by Nordzucker Holding AG, 11.1% - by the Union-Zucker Südhannover GmbH, and 5.1% by other shareholders. A large proportion of the shareholders in Nordzucker Holding AG and Nordzucker AG, as well as the shareholders of UnionZucker Südhannover, are also active farmers who sell their beet to Nordzucker AG (Nordzucker, 2016). Together, these two enterprises account for around 60% of sugar supplied into the German market (Filippi et al., 2012). Hence, there is a 60% cooperative market share in Germany in Figure 4.4.

The zero market shares of cooperatives in the Scandinavian countries are in line with our definition of a cooperative. For example, a sugar plant in Örtofta, Sweden, is owned by Nordzucker and processes around 2 million tons of beet, supplied by approximately 2,000 beet growers, during the campaign. Swedish farmers deliver their inputs to the Örtofta sugar processing plant, but do not have control over the downstream enterprise. Therefore, the share of sugar beets processed at Örtofta plant does not count towards a cooperative market share in the sugar sector in Sweden.

Sugar beet differs from milk with respect to several product characteristics. Sugar beet is a root crop which is sown in the spring. The optimal harvest time is the beginning of September. It is a rotation crop because it is grown on farms in combination with other crops. It is a semi-perishable product, because sugar beet does not need to be transported to the processing plant immediately after harvest. The main role of sugar cooperatives is to process sugar beets and produce (refined) sugar. To prolong the processing campaign, a sugar processing enterprise compensates farmers for an early or late delivery of sugar beets. It turns out that a sugar plant processes sugar beets during six months, i.e. sugar beets can be delivered to the processing plants up to three months before or after the optimal harvest time. This is in contrast with milk, which is very

[31] Four companies share the sugar market in Germany: Südzucker AG (turnover 6.2 billion Euros (2010/2011) and 18,000 employees) and Nordzucker AG (turnover of 1.8 billion Euros and 4,300 employees), followed by family firm Pfeifer & Langen KG (turnover of about 1.2 billion Euros (2010) and 2,300 employees) with 20-30%, and Dutch based Suiker Unie (5-10%), a subsidiary of the Dutch sugar company Koninklijke Coöperatie Cosun U.A. (total turnover of 1,8 billion Euros (2011) and 3,500 employees) (Filippi et al., 2012).

[32] At least 50% of Südzucker is owned by South German sugar beet processing cooperative (Süddeutsche Zuckerrübenverwertungs-Genossenschaft eG (SVZG)).

perishable. Hence, higher cooperative market shares in the dairy sector are in line with the predictions of the incomplete contracting literature, which highlights the role of higher temporal asset specificity in fostering vertical integration.

Agricultural sectors are generally classified as some of the least complex sectors. The measures of product complexity are based on the use of intermediate goods. A complexity measure is equal to zero if there is only one input, and tends to one if the sector uses many inputs in equal proportions (Blanchard and Kremer, 1997). According to the Blanchard and Kremer's (1997) industry complexity measure, sugar is more complex than dairy products with a complexity measure of 0.61 versus 0.57. Other agricultural commodities and corresponding complexity measures are 0.53 for flour and cereals, 0.58 for meat products, 0.62 for fruit and vegetables, and 0.74 for wines. Consequently, agricultural sectors are also some of the least institutionally dependent, because industries that require joining of a large number of inputs to production are more institutions dependent because there are more relationships that can be "potentially distorted due to imperfect institutions" (Levchenko, 2007). To summarize, the transaction cost theory predicts a higher degree of vertical integration in more complex industries. This prediction is not in line with low cooperative market shares in the sugar sector, which is more complex than dairy. However, the differences in complexity measures are minimal, so the role of complexity in explaining differences between cooperative market shares in the dairy and sugar sectors is negligible.

Lastly, agricultural sectors differ with respect to capital intensity. To illustrate, we compute the share of raw product, supplied by farmers, i.e. either sugar beet or milk, in cooperative's total operating expenses. For instance, consider the largest sugar and dairy cooperatives in the Netherlands. According to the most recent available financial statements of the sugar cooperative, the share of sugar beets costs in cooperative's total operating expenses is 12%. The share of milk costs in the dairy cooperative's total operating expenses is 30%. This suggests that sugar production entails higher levels of capital intensity than dairy production. Furthermore, the initial capital investments required to establish a sugar processing plant are generally higher relative to a milk processing plant. Then, low market shares of cooperatives in the EU sugar sector do not support the claim by Caves and Peterson (1986) that cooperatives may have an advantage in capital-intensive industries.

4.5.1 Embeddedness, Institutional Environment, and Governance

Table 4.8 reports the correlation coefficients measuring the association between sugar cooperative market shares and variables measuring embeddedness, institutional environment, and governance. In contrast with the dairy sector, almost none of the

variables are statistically significant in explaining sugar cooperatives market shares. This is illustrated by the absence of statistically significant pairwise correlation coefficients in the first column of Table 4.8. The only exception is religious heterogeneity with a positive and statistically significant effect size of 0.61 (p-value 0.0115). However, this result is driven entirely by the highest measure of religious heterogeneity in the Netherlands, which also has the highest sugar cooperative market share. The sugar market of the Netherlands is discussed in more detail in the resource allocation level analysis in the subsection 4.4.2.1.

4.5.2 Resource Allocation

Since 1968 the European sugar market is regulated through the Common Organization of the Sugar Market (COSM). The two main mechanisms of regulation are production quotas and a minimum sugar price. Two recent important regulations in the European sugar market are highlighted. First, the European sugar market has changed dramatically after a reform of 2006. The goal of the reform was to reduce European sugar prices to bring them more in line with those on the world market, to create a smaller and more competitive industry, to provide access for the least developed countries and to comply with the rules of the World Trade Organization (WTO). As a result, EU sugar production has been reduced from 19 million to 13 million tons (a reduction of 31.6%). Of around 304 thousand sugar beet growers, 167 thousand stopped production (a reduction of 55%); of the 189 European sugar factories, 80 have been closed (a reduction of 42%) and five EU countries have stopped sugar manufacturing entirely (European Association of Sugar Producers, 2016). The EU changed from being a net exporter to a net importer of sugar. The European Commission, the European Parliament and the European Court of Auditors have concluded that the EU has achieved the objectives of the reform for the sugar market. Second, the quota system in the EU ended as of 30 September 2017. This will probably change the functioning of the sugar industry in the EU. More specifically, the sugar production quotas and the minimum purchase price of sugar beet will be eliminated. It implies that each country and each sugar company in the EU can produce and market an unlimited amount of sugar. This is expected to lead to more fluctuations in the price of sugar and of sugar beets.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1 Sugar coop market share	1.00															
2 Trust	-0.14	1.00														
3 Ethnic heterogeneity	-0.15	-0.16	1.00													
4 Linguistic heterogeneity	0.38	-0.07	**0.78***	1.00												
5 Religious heterogeneity	**0.61***	-0.19	0.16	0.25	1.00											
6 Property rights	0.21	**0.42***	-0.10	0.19	0.10	1.00										
7 Judicial effectiveness	0.07	0.33	-0.18	-0.04	-0.09	**0.81***	1.00									
8 Voting rule	0.35	0.36	-0.01	0.25	0.27	**0.47***	0.36	1.00								
9 Cooperative tax	0.17	-0.06	-0.18	-0.06	-0.17	-0.01	0.21	0.04	1.00							
10 Min capital	-0.23	-0.15	0.35	0.19	-0.29	-0.13	-0.02	-0.27	**0.39***	1.00						
11 Min members	-0.19	-0.13	-0.14	-0.38	**-0.41***	-0.35	-0.10	-0.31	-0.03	0.28	1.00					
12 Communist regime	-0.22	-0.15	0.42	0.14	0.30	**-0.53***	**-0.55***	**-0.42***	**-0.44***	-0.17	0.02	1.00				
13 Fascist regime	0.07	-0.08	-0.07	-0.11	-0.14	-0.11	-0.17	0.11	-0.02	0.01	0.08	-0.27	1.00			
14 Sugar self-sufficiency	-0.03	0.51	-0.16	-0.11	-0.25	0.20	0.02	-0.26	0.38	0.04	-0.07	0.01	-0.49	1.00		
15 Management score	0.42	0.21	0.29	0.95	0.55	0.45	0.35	0.75	0.06	-0.53	-0.47	-0.28	-0.38	0.03	1.00	
16 Product diversification	-0.16	0.87	0.47	0.47	0.56	-0.75	-0.66	0.83	-0.59	-0.21	-0.47	-	0.59	-0.53	-1.00	1.00

Table 4.8. Correlation matrix, variables measuring sugar cooperative market shares and variables measuring embeddedness, institutional environment, governance, and resource allocation

In 2016, 61 companies represented the EU sugar market across 20 EU member states (Austria, Belgium, Bulgaria, Croatia, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Italy, Lithuania, the Netherlands, Poland, Romania, Slovakia, Spain, Sweden and the United Kingdom). Table 4.9 reports the change in the number of companies in the EU sugar market between 2005 and 2016. It indicates that the number of companies decreased by 13, which is composed of 24 companies ceased to exist and 11 new ones were formed in Romania and Croatia.

	2006	2016	Reduction of
Number of companies	74	61	17%
Number of factories	189	109	42%
Number of growers	304,890	137,354	55%

Table 4.9. Changes in the EU 28 Sugar Market (European Association of Sugar Producers, 2016)

4.5.2.1 Sugar Market in the Netherlands

Consider the case of the sugar market in the Netherlands. In 1899 the first cooperative sugar factory Sas van Gent was formed. In 1919, IOF sugar-processing enterprise CSM (Central Sugar Company) was established. By 1966 there were twelve sugar factories in the Netherlands, and six of them merged into one cooperative Suiker Unie. Between 1966 and 2006 the share of sugar beets processed by the cooperative Suiker Unie was roughly the same – around 60%. This is due to the fact that in the Netherlands, the Ministry of Agriculture divided the sugar quantity quota according to a fixed allocation between Suiker Unie and CSM. In 1966 Suiker Unie was renamed to Cosun, and in 2007 Cosun acquired CSM, because IOF CSM decided to divest its sugar activities. Hence, since 2007 100% of the sugar beets in the Netherlands are processed by one cooperative company. By-products of the sugar beet processing at Cosun are sugar beet pulp for animal feed, betacal (lime fertilizer for agricultural purposes), molasses for the fermentation industry and animal feed, and green gas (an energy source for the sugar factory) (Cosun, 2017).

The Dutch Competition Authority approved the merger between Cosun and CSM because it was assessed that this merger will not result in a dominant position in the European market that could restrict competition (The Netherlands Competition Authority, 2007). The IOF CSM historically diversified in activities other than sugar processing, mainly biobased activities. In 1982 it acquired full control of Chemie Combinatie Amsterdam, or CCA, a producer of fermentative (natural) lactic acid and lactic acid derivatives. It also acquired various other branded food and confectionery manufacturers in Europe and the US. Since 2012, CSM is solely a biobased products company and is titled Corbion (Corbion, 2017). The cooperative Royal Cosun

developed a quite different product portfolio. A crucial input continues to be sugar beet, due to the single origin constraint (Cook, 1997; Deng, 2015). The sugar market in the Netherlands consists nowadays of one enterprise – Royal Cosun Cooperative.

To sum up, the historical development of the Dutch sugar market in combination with the European sugar reform of 2006 resulted in the current cooperative market share in the Dutch sugar market of 100% (prior to 2006, 60%). This case is interesting because it illustrates the change from co-existence of two organizational forms in one market (forward integration, i.e. a cooperative, and long-term contracts, i.e. an IOF) to a fully forward integrated market.

4.6 Conclusion and further research

In this paper we empirically investigate the determinants of cooperative market shares in the agricultural sectors in the European Union. First, we find statistically important differences across sectors and countries. There are large and statistically significant differences in cooperative market shares between the dairy and all other sectors. Next to that, when considering all sectors, market shares of cooperatives are significantly lower in Eastern Europe relative to all other EU regions. These results indicate that the variety of cooperative market shares observed across sectors and countries in the EU is not a result of a random assignment, but partly constitutes a statistical regularity.

Second, when focusing on the dairy sector, we observe the presence of substantial differences in the organization of the dairy production across EU countries, where cooperatives dominate in the North-West of Europe, and are less prominent in the South-East. Based on the four levels framework of social analysis by Williamson (2000), we find that the dairy cooperative market shares are higher in countries with high levels of trust and low levels of heterogeneity (embeddedness level), with strong contracting institutions (institutional environment level), and with high milk self-sufficiency scores (resource allocation level). We do not find an association between dairy cooperative market shares and cross-country variations in cooperative laws and measures of value added by the downstream activities (as measured by the management practices and product differentiation).

One puzzling result of our analysis is that higher dairy cooperative market shares are observed in countries with strong contracting institutions. It is not in line with the prediction of the transaction cost theory that vertical integration is preferred in settings where it is hard to write long-term contracts, i.e. where contracting institutions are weak. Hence, we can conclude that in the European dairy sector, cooperatives do not serve as a response to poorly functioning institutions. Besides, this result also implies that the determinants of cooperative market shares may not correspond to the determinants of vertical integration, due to conceptual differences between a

cooperative and vertical integration. This result may also reflect the influence of a third variable, which influences both the quality of institutions and cooperative market shares, and thus drives this positive correlation. For instance, more advanced countries may have better quality of institutions and at the same time provide a necessary "enabling" environment for cooperatives. Variables such as trust, the quality of institutions, economic development, and the presence of cooperative enterprises are interlinked, and may even reinforce each other.

Third, in contrast with the dairy sector, none of the variables measuring country-level differences across the four levels of social analysis appear to be statistically important for explaining sugar cooperative market shares. With the example of the sugar market in the Netherlands, we highlight another determinant of the sugar cooperative market share. We show that it was the combination of policy changes and the product differentiation strategy of the competitor IOF, which resulted in the current cooperative market share (100%) in the Netherlands. Therefore, relative to the dairy market, which exhibits a clear pattern, cooperative market shares in the EU sugar market support the Atalay et al. (2014) view that vertical integration can be viewed as a by-product of product portfolio development. It posits that the degree of vertical integration may not be a consequence of systematic make-or-buy decisions, but a consequence of firms' efficient transfers of intangible inputs. In fact, the main reason for cooperative Royal Cosun to acquire the East German IOF sugar processing company in Anklam is its "organization capabilities", namely cooperative's expertise in sugar production and marketing.

We propose several directions for further research. First, the study of cooperative market shares would benefit from the systematic data collection on farmer cooperatives in the EU. For example, the cooperative market shares, used in the paper, were estimated by country experts during the "Support for Farmers Cooperatives" project. On the one hand, such a measure benefited from expert knowledge, but on the other hand, it lacked cross-country estimation consistency.

Second, once the abovementioned data weakness is resolved, the analysis of the determinants of cooperative market shares could benefit from a more dynamic approach. According to Hansmann (1999), "the market share of cooperatives in economic activity has grown throughout the 20th century". To illustrate, the share of milk, handled by cooperatives in the United States, increased from 40% in 1936 to 81% in 2012 (USDA, 2012). Such approach will clarify the patterns of path dependency in growing cooperative market shares.

Appendix 4.1. Cooperative market shares

"Support for Farmers Cooperatives" (Bijman et al., 2012) differentiates between sectors and countries in the European Union and reports a total of 126 cooperative market shares estimates across 27 EU member states and 8 sectors. Market share is calculated as a percentage of farm produce handled by cooperatives.

	Dairy	Sugar	Fruit & Vegetables	Pig meat	Cereals	Wine	Olives	Sheep meat
Austria	95	0	50		70	15		
Belgium	66	1.6	83	25	4.7			0
Bulgaria								
Cyprus						10		
Czech Republic	66		35	25		8		20
Denmark	94	0	50	86				0
Estonia	35		4	1	10			0
Finland	97		40	81	49			
France	55	62	35	94	74	38		0
Germany	65	0	40	20	50	33		
Greece		0	35	0		15		0
Hungary	31	30	18	25	12	9		20
Ireland	99	0		0	0			0
Italy	42	20	50		27	52		
Latvia	33		12		38			6
Lithuania	25			0				0
Luxemburg								
Malta	91		20	100		70	0	
Netherlands	90	100	95	0	55			0
Poland	72	0	11		7			0
Portugal	70		25	0	0	42	30	0
Romania		0		0	1	1		1
Slovakia	25	0	10	11	16	0		0
Slovenia	80		70		42			
Spain	40	28	50	25	35	70	70	25
Sweden	100	0	70	51				55
UK		0	35					

Table 4.10. Cooperative market shares. An empty cell indicates the absence of a sector in a country (Bijman et al., 2012)

Appendix 4.2. Sector effects

Hypothesis A1: Market shares of cooperatives in the EU dairy (fruit and vegetables, olives, pig meat, cereals, wine, sugar, sheep meat) sector are statistically different from other sectors.

	Cohen's d (Confidence Interval) Mean comparison with						
EU Sector	F&V	Olives	Pig meat	Cereals	Wine	Sugar	Sheep meat
Dairy	**0.98*** (0.34,1.62)	1.15 (-0.11,2.40)	**1.12*** (0.43,1.79)	**1.41*** (0.68, 2.11)	**1.43*** (0.65,2.20)	**1.82*** (1.03,2.53)	**2.20*** (1.71,3.46)
F&V		0.25 (-0.96,1.46)	0.32 (-0.31,0.93)	0.44 (-0.20,1.09)	0.48 (-0.22,1.18)	**0.94*** (0.25,1,62)	**1.55*** (0.81,2.28)
Olives			0.08 (-1.14,1.31)	0.17 (-1.06,1.39)	0.20 (-1.06,1.46)	0.62 (-0.64,1.86)	**1.41*** (0.08, 2.71)
Pig meat				0.04 (-0.62,0.70)	0.07 (-0.64,0.78)	0.46 (-0.22,1.14)	**0.82*** (0.12,1.50)
Cereals					0.04 (-0.68,0.76)	0.51 (-0.18,1.20)	**1.04*** (0.32,1.76)
Wine						0.47 (-0.27,1.21)	**1.04*** (0.26,1.80)
Sugar							0.34 (-0.34,0.99)

Table 4.11. Sector differences in cooperative market shares in the EU (* - significant at 95% confidence level)

Standardized differences in means suggest that cooperative market shares in the dairy sector are significantly higher relative to all other sectors except for olives. A standardized difference in means above 0.8 is considered large. Therefore all statistically significant effect sizes, which range between 0.98 and 2.20, suggest quantitatively large difference between the dairy sector and six other sectors. Additionally, cooperative market shares in the sheep meat sector are significantly lower relative to all other sectors except for sugar. Hence, the hypothesis of zero difference between the dairy and other sectors (with exception of olives), and between sheep meat and other sectors (with exception of sugar) is rejected at the 95% confidence level. It is illustrated in Table 4.11 by the positive confidence intervals, which do not include zero. Lastly, there also appear to be large (Cohen's d of 0.94) and statistically significant (confidence interval between 0.25 and 1.62) differences in the cooperative market shares in the fruit and vegetable and sugar sectors.

Dependent Variable – Cooperative Market Shares

Variable	Sector Effect
Dairy	51.32*** (6.66)
Sugar	2.70 (0.32)
F&V	25.29*** (3.25)
Pig meat	18.49** (2.33)
Cereals	17.30** (2.11)
Wine	18.94** (2.08)
Olives	13.98 (0.90)
26 country controls (statistically significant are):	
Finland	35.14* (1.72)
Netherlands	33.98* (1.78)
Constant	3.49 (0.20)
R^2 = .59	
F = 4.47***	

*p<0.10, **p < .05, ***p<.01, t-statistic in parentheses

Table 4.12. Ordinary Least Squares regression model estimating sector effects on cooperative market shares (n = 126)

Results from the Cohen's d sector analysis are confirmed with the OLS regression analysis in Table 4.12. Relative to the sheep meat sector, cooperative market shares are significantly higher in the dairy, fruit and vegetables, pig meat, cereals, and wine sectors. Regression coefficients also suggest quantitatively large effects (between 17% and 51% increase in cooperative market shares). Interestingly, among the 26 country controls, Finland and Netherlands appear to have significantly higher (by around 30%) cooperative market shares relative to other countries.

Appendix 4.3. EU region effects

Hypothesis A2: Market shares of cooperatives across EU agricultural sectors are statistically different in Scandinavian (Western, Southern, Eastern) countries relative to other countries.

	Cohen's d (Confidence Interval) Mean comparison with		
	West	South	East
EU region			
Scandinavia	0.44 (-0.17,1.06)	0.61 (-0.22,1.25)	**1.73*** (1.03,2.41)
West		0.09 (-0.38,0.55)	**0.87*** (0.40,1.33)
South			**0.92*** (0.44,1.40)

Table 4.13. Regional differences in cooperative market shares in EU 8 agricultural sectors (* - significant at 95% confidence level)

Regional differences in cooperative market shares across all sectors are evident from Table 4.13. It suggests that there are large and statistically significant differences in the cooperative market shares in the Eastern EU countries relative to the Scandinavian, Western, and Southern countries.

Dependent Variable – Cooperative Market Shares

Variable	Region Effect
Scandinavia	37.83*** (5.12)
West	24.16*** (4.46)
South	19.49*** (3.42)
7 sector controls (statistically significant are):	
Dairy	54.44*** (7.04)
F&V	28.13 *** (3.62)
Pig meat	18.97** (2.37)
Cereals	19.63** (2.41)
Wine	19.45** (2.20)
Constant	-6.10 (-0.98)
R^2 = .48	
F = 10.63***	

*p<0.10, **p < .05, ***p<.01, t-statistic in parentheses

Table 4.14. Ordinary Least Squares regression model estimating regional effects on cooperative market shares (n = 126)

Similarly, results from the Cohen's d regional analysis are confirmed with the OLS regression analysis in Table 4.14. Regression coefficients suggest large positive (between 19% and 37% increase in cooperative market shares) statistically significant effects of Scandinavian, Western, and Southern regions on cooperative market shares relative to the Eastern European countries.

Appendix 4.4: EU region effects, dairy sector

EU region	Mean Cooperative Market Share	Std. Dev.	Cohen's d (Confidence Interval) Mean comparison with **East**	Mean comparison with **South**	Mean comparison with **West**
Scandinavia	97	3	3.29**(1.16,5.33)	1.73*(0.15,2.86)	1.19(-0.36,2.66)
West	78,3	18,5	1.95**(0.52,3.11)	0.67(-0.6,1.83)	
South	64,6	22,8	1.13*(0.02,2.07)		
East	41	19,6			
Total	65,3	26,7			

Table 4.15. Regional differences in cooperative market shares in the dairy sector in the EU. (** (*) - significant at the 95% (90%) confidence level)

The first column of Table 4.15 summarizes the mean cooperative market shares in the dairy sector per European region. The last three columns of Table 3 report standardized differences in means of cooperative dairy market shares between regions. The two largest effect sizes indicate statistically significant (at the 95% confidence level) differences between Scandinavian and Eastern countries (Cohen's d of 3.29) and between Western and Eastern countries (Cohen's d of 1.95). The difference between Scandinavian and Southern countries is of the lower magnitude (Cohen's d of 1.73) and is significant at the 90% confidence level. Lastly, there are also statistically significant differences (at the 90% confidence level) between Southern and Eastern countries (Cohen's d of 1.13).

Appendix 4.5: Embeddedness variables, descriptive statistics across EU regions

Region	Mean Generalized Trust	Std. Dev.
Scandinavia	7,53	0,71
West	5,87	0,59
East	5,71	0,70
South	5,68	0,71
Total	5,95	0,85

Table 4.16. Generalized trust across EU regions

	Mean Religious Heterogeneity	Std. Dev.	Mean Linguistic Heterogeneity	Std. Dev.	Mean Ethnic Heterogeneity	Std. Dev.
Scandinavia	0,24	0,01	0,15	0,05	0,09	0,04
South	0,27	0,13	0,18	0,16	0,16	0,13
West	0,42	0,25	0.28	0,24	0,23	0,20
East	0,47	0,16	0.28	0,18	0,33	0,15
Total	0,38	0,20	0,24	0,19	0,23	0,17

Table 4.17. Heterogeneity across EU regions

Appendix 4.6: Institutional environment variables, descriptive statistics across EU regions

	Property Rights Mean	Std. Dev.	Judicial Effectiveness Mean	Std. Dev.
Scandinavia	88,63	1,95	77,80	8,06
West	86,25	3,39	77,69	7,67
South	69,96	8,16	59,00	5,46
East	68,31	7,30	56.22	13.31
Total	76,31	10,77	65,70	13,66

Table 4.18. Quality of institutions across EU regions (Economic Freedom Index, 2017)

	Mean Liberal Voting Rules	Std. Dev.	Mean Favorable tax	Std. Dev.	Mean Min Member Requirement	Std. Dev.	Mean Min Capital Required	Std. Dev.
Scandinavia	1,33	0,58	0,67	0,58	1,33	1,53	0,00	0,00
West	1,14	0,90	0,87	0,35	2,62	3,29	2318,75	6558,41
South	0,67	0,82	1,00	1,00	4,14	3,08	2500,00	4183,30
East	0,29	0,49	0,33	0,71	3,11	2,42	794,55	1159,62
Total	0,78	0,80	0,70	0,72	3,04	2,79	1565,42	4107,69

Table 4.19. Legal aspects of cooperative law across EU regions

Appendix 4.7: Governance level, quality of management

County	Overall Management	Monitoring	Target	Incentives	Coop dairy market share
Sweden	3.18	3.54	3.22	2.86	100%
Germany	3.18	3.40	3.24	2.95	65%
France	3.00	3.28	2.98	2.78	55%
Italy	2.99	2.98	2.80	2.73	42%
UK	2.98	3.16	2.93	2.88	-
Poland	2.88	2.88	2.93	2.85	72%
Ireland	2.84	2.95	2.76	2.81	99%
Portugal	2.79	3.07	2.72	2.61	70%

Table 4.20. Management practices in EU countries (Bloom and Van Reenen, 2010)

Appendix 4.8: Data

Country	Dairy coop market share	Sugar coop market share	Trust	Ethnic heterog eneity	Linguis tic heterog eneity	Religio us heterog eneity	Prope rty rights	Jud. effectiv eness	Coop tax	Libe ral votin g rules
Austria	95	0	5.9	0.11	0.15	0.41	86	81.8	1	1
Belgium	66	1.6	5.7	0.56	0.54	0.21	83.3	69.3	1	0
Bulgaria			4.2	0.40	0.30	0.60	62.5	38.9	0	0
Cyprus			4.5	0.09	0.40	0.40	75.4	60.7	1	0
Czech Republic	66		5.3	0.32	0.32	0.66	70.3	55.9	0	1
Denmark	94	0	8.3	0.08	0.10	0.23	86.7	68.5	1	1
Estonia	35		5.8	0.51	0.49	0.50	82.6	82.8	0	0
Finland	97		7.4	0.13	0.14	0.25	90.6	82.7	0	1
France	55	62	5.0	0.10	0.12	0.40	85	72.7	1	
Germany	65	60	5.5	0.17	0.16	0.66	82.9	79.5	1	1
Greece		0	5.3	0.16	0.03	0.15	52.5	56.1	2	1
Hungary	31	30	5.3	0.15	0.03	0.52	60.1	51.8	1	0
Ireland	99	0	6.4	0.12	0.03	0.16	85.8	78.3	0	0
Italy	42	20	5.7	0.11	0.11	0.30	74.6	55.4	0	1
Latvia	33		6.5	0.59	0.58	0.56	72.6	59.7	2	
Lithuania	25		6.1	0.32	0.32	0.41	73	62.4	0	1
Luxemburg			5.5	0.53	0.64	0.09	85.8	77	1	2
Malta	91		6.2	0.04	0.09	0.12	67.7	62.9	2	0
Netherlands	90	100	6.9	0.11	0.51	0.72	87.4	69.9	1	2
Poland	72	0	6.0	0.12	0.05	0.17	60.8	58	0	0
Portugal	70		5.3	0.05	0.02	0.14	73.3	68.9	2	0
Romania		0	6.4	0.31	0.17	0.24	63.9	58.5	0	0
Slovakia	25	0	5.8	0.25	0.26	0.57	69	38	0	
Slovenia	80		6.5	0.22	0.22	0.29	75	55.1	0	
Spain	40	28	6.3	0.42	0.41	0.45	71.2	53.9	0	2
Sweden	100	0	6.9	0.06	0.20	0.23	88.6	82.2	1	2
UK		0	6.1	0.12	0.05	0.69	93.8	93	1	2

Continued

Country	Min capital requirement	Min member requirement	Comm. regime	Fascist regime	Management Score	Milk self-sufficiency	Sugar self-sufficiency	Product Differentiation Dairy	Product Differentiation Sugar
Austria	0	0	0	0		134.7	104	-0.24	
Belgium	18550	3	0	0		120.2	139.1	0.00	0.14
Bulgaria	0	0	1	0			0		
Cyprus	0	0	0	0			0		
Czech Republic	0	3	1	0		115.9	148.5	-0.79	
Denmark	0	0	0	0		247.4	368.3	0.74	
Estonia	2556	5	1	0			0	0.53	
Finland	0	1	0	0		106.9	54.05	1.75	
France	0	7	0	0	3	136.8	195.5	0.32	-0.24
Germany	0	3	0	0	3.18	132.5	124.7	0.20	
Greece	10000	10	0	0		34.1	32.31		
Hungary	0	0	1	0		89.5	242		
Ireland	0	8	0	0	2.84	154.2	0	0.71	
Italy	0	3	0	1	2.99	67.3	25.7	0.29	0.00
Latvia	2845	0	1	0			0	-0.20	
Lithuania	0	5	1	0		161.9	146.8	0.09	
Luxemburg	0	0	0	0			0		
Malta		5	0	0			0	0.00	
Netherlands	0	0	0	0		165.6	118.2	-0.68	
Poland	0	5	1	0	2.88	125.9	113.7	-0.16	
Portugal	5000	5	0	1	2.79	84.1	0.88	-0.44	
Romania	500	5	1	0		70.3	24.63		
Slovakia	1250	5	1	0		92	104.1	-0.33	
Slovenia	0	3	1	0			0	0.00	
Spain	0	3	0	1		67.5	44.23	-0.63	1.89
Sweden	0	3	0	0	3.18		107.6	0.00	
UK	0	0	0	0	2.98	83.6	52.09		

Table 4.21. Data Matrix

Variable	Explanation	Source
Dairy (sugar) cooperative market share	The percentage of the value of farm produce (milk or sugar) handled by cooperatives in a country. It is a combined market shares of all cooperatives in the sector compared to the cumulative market share of all IOFs in the same sector, both measured at farm-gate transaction.	Support for farmers' cooperatives: Final report *(Bijman et al., 2012).*
Trust	Generalized trust measure, which captures the extent to which "most people can be trusted" in a country.	World Values Survey, 2017
Ethnic / linguistic / religious heterogeneity	The measure reflects the probability that two randomly selected individuals from a population belonged to different ethnic / linguistic/ religious groups. It is calculated as one minus the Herfindahl index of group shares. A higher fractionalization measure implies a higher degree of heterogeneity.	Fractionalization dataset (Alesina et al., 2003)
Property rights	"The extent to which a country's legal framework allows individuals to freely accumulate private property, secured by clear laws that are enforced effectively by the government". The score consists of five equally weighted sub-factors: physical property rights, intellectual property rights, strength of investor protection, risk of expropriation, and quality of land administration. A higher score indicates a more effective legal protection of property in a country.	Index of Economic Freedom (Heritage Foundation, 2017)
Judicial effectiveness	"The degree of efficient and fair judicial systems, which ensure that laws are fully respected, with appropriate legal actions taken against violations". The score consists of six equally weighted	

	sub-factors: public trust in politicians, irregular payments and bribes, transparency of government policymaking, absence of corruption, perceptions of corruption, and governmental and civil service transparency. A higher score indicates better judicial effectiveness in a country.	
Favorable cooperative tax	A score of 2 is assigned to countries, where cooperatives are exempt from the corporate income tax. A score of 1 is assigned to countries, where cooperatives have the same corporate income regime as IOFs, however several facilities are provided for the deduction of patron dividends paid to the members related to the economic transactions between the cooperative and its members. Zero score is assigned to countries which do not have special tax facilities for cooperatives or have tax facilities that have no impact on the promotion or success of cooperatives.	"Support for farmers cooperatives: Legal aspects" (van der Sangen, 2012)
Liberal voting rules	A score of 2 is assigned to countries where the adjudication of voting rights is liberal and can be attributed to members according to their volume of economic transactions with the cooperative. A score of 1 is assigned to countries that allow cooperatives to depart from the principle of "one member - one vote", but only to a limited degree. Zero score is assigned to countries that do not allow to depart from the "one member – one vote rule".	
Minimum capital requirement	Legal requirement regarding the minimum member capital upon the formation of a cooperative.	

Minimum member requirement	Legal requirement regarding the minimum number of members upon the formation of a cooperative.	
Communist regime	A score of 1 is assigned to a country, which was under the communist regime after World War II, zero score otherwise.	Historical facts
Fascist regime	A score of 1 is assigned to a country, which was under the fascist regime for more than 20 years, zero score otherwise.	
Management Score	Management practices are measured based on three areas: (i) "monitoring - how well do companies monitor what goes on inside their firms, and use this for continuous improvement; (ii) targets - do companies set the right targets, track the right outcomes and take appropriate action if the two are inconsistent; (iii) incentives - are companies promoting and rewarding employees based on performance, and trying to hire and keep their best employees? A higher score indicates better managerial practices in a country.	World Management Survey (Bloom and Van Reenen, 2010)
Milk self-sufficiency	The percentage of a country's milk self-sufficiency is calculated as $\frac{C}{C+I-E}$, where C is the country's total milk deliveries, I is the milk equivalent imports, and E is the milk equivalent exports. A percentage above (below) one hundred percent indicates that a country is (not) milk self-sufficient.	CLAL (clal.it , 2010)
Sugar self-sufficiency	The percentage of a country's sugar self-sufficiency is calculated as $\frac{C}{C+I-E}$, where C is the country's total raw sugar equivalent production, I is the raw sugar equivalent imports, and E is the raw	Authors' calculations (FAO statistics, 2010)

	sugar equivalent exports. A percentage above (below) one hundred percent indicates that a country is (not) sugar self-sufficient.	
Product Differentiation Dairy / Sugar	The degree of product diversification of cooperatives relative to IOFs in a country. It is calculated as a difference in means between the total diversification degree, as measured by the number of 4-digid industry codes, of cooperatives and IOFs in a country. A positive (negative) score indicates that cooperatives are more (less) diversified than IOFs in this country.	Authors' calculations (Bureau van Dijk)

Table 4.22. Descriptions of variables

5. General Conclusion

Chapter 1 of this thesis highlights the empirical prevalence of cooperatives. Besides being a prominent worldwide phenomenon, a cooperative form is interesting from a theoretical perspective because of its distinctive allocation of ownership. As opposed to a privately owned agricultural firm, an agricultural cooperative is owned by a society of farmer-members. Hence, farmers are the residual claimants in a cooperative. This feature has two implications. First, for all unforeseen contingencies, not specified in contracts, the decision rights are allocated to farmers, i.e. farmers hold the formal authority in a cooperative. So, a cooperative is member-controlled. Second, as owners, farmers are also the residual claimants of the income of a cooperative, i.e. a cooperative is member-benefitted. Another defining characteristic of an agricultural cooperative is the fact that farmers are not only owners, but also users of a cooperative enterprise, i.e. they deliver their farm products to a downstream firm. Therefore, there are two types of relations between the farmers and a downstream enterprise – an ownership, but also a transaction relationship.

Chapter 2 of this thesis provides a game-theoretic explanation for the observed variety of patterns of emergence of cooperatives. First, by considering two farmers and an outsider, and just one exogenous parameter – member heterogeneity, predictions are formulated regarding the bottom-up and top-down emergence of cooperatives. When the value of the outsider is low and member heterogeneity is limited, a cooperative emerges efficiently bottom-up by the initiation of all members. When heterogeneity increases, a coordination problem arises, and only one member takes a lead. We refer to such member as a coop champion. The game changes to a prisoner's dilemma when heterogeneity is high, and therefore no cooperative emerges in the equilibrium. We consider a role of a third party in addressing these inefficiencies. The distinction is made between two types of outsiders: a selfish outsider, such as the "dragonheads" in China, and a benevolent outsider, such as NGOs. As the value of the outsider increases, a top-down cooperative with a selfish outsider becomes uniquely efficient when the value of the outsider is in the intermediate high range and heterogeneity of members is low. Hence, in some instances a top-down cooperative with a selfish outsider may be desired. This range therefore provides a justification for the existence of the so-called dragonheads, i.e. the elites who initiate the formation of cooperatives in the local areas in China (Lin and Huang 2007). A top-down cooperative with a benevolent outsider becomes uniquely efficient when the value of the outsider is in the intermediate low range and heterogeneity of members is high. So, a benevolent type is more efficient at

resolving the farmers' hold-up problem than a selfish type when heterogeneity of farmers is high, but the value of the outsider is limited.

The efficient allocation of decision rights regarding the profit distribution in cooperatives is delineated in Chapter 3, from a relational contracting perspective. The decision about the retained earnings percentage in a cooperative is crucial because it is an important source of internal finance. Unlike an investor-owned firm, a cooperative cannot obtain external finance by issuing new equity. This would violate the member-ownership requirement. A non-cooperative game between the upstream (farmers) and the downstream (management) parties is formulated, where the right to decide on the retained earnings percentage is allocated either to the farmers, or delegated to the management. In the equilibrium of the one-period game, an inefficiency arises in a member-controlled cooperative. There exists a range of parameters, such that cooperative members propose a retained earnings percentage which is too low, which consequently results in the downstream underinvestment. A hold-up problem arises, because the downstream party is unwilling to make downstream investment, as she is not able to secure a sufficiently high share of the total surplus in the ex-post bargaining. The model adds a novel perspective on the profit distribution decision in a cooperative by (i) formulating an infinitely repeated version of the stage game; and (ii) by delineating the stability conditions for the relational contract between the members and the management. If the long-run repeated nature of interaction in a cooperative is taken into account, the efficiency of a member-controlled cooperative improves for some range of the parameters. In particular, the results of the infinitely repeated game show that in some instances, the membership is able to credibly commit to a higher retained earnings percentage and the management is able to credibly commit to downstream investment. However, the results also indicate that when the cost of downstream investment is very high and the outside opportunities of the management are limited, the relational contract does not resolve the hold-up problem in a member-controlled cooperative.

Chapter 4 investigates empirically the market shares of agricultural cooperatives in the European Union. It starts with an observation that cooperative market shares are higher in the North-West of Europe relative to the South-East, and in the dairy sector relative to all other sectors. While referring to the framework of four levels of social analysis by Williamson (2000), a number of theoretical predictions regarding the degree of forward vertical integration are formulated. Namely the distinction is made among the embeddedness, the institutional environment, governance, and resource allocation levels. The effect sizes (correlation coefficients and differences in means) are calculated by using the data from the dairy and sugar sectors in the European Union. The results indicate that dairy cooperative market shares are higher in countries with high levels of trust, low levels of heterogeneity, strong

contracting institutions, and in countries which are more milk self-sufficient. In contrast, almost none of the variables measuring the four levels of social analysis are statistically important in explaining the differences in cooperative market shares in the sugar sector. The EU sugar market policy changes and the product differentiation strategies of the investor owned competitor(s) are discussed as alternative explanations for cooperative market shares in the EU sugar sector.

This thesis focused on agricultural cooperatives. More generally, the findings of this thesis contribute to the understanding of the emergence, governance, and market shares of collectively owned organizations. In an even broader context, cooperatives are part of the "social economy". The objective of a social enterprise is to serve member interests, and hence it ensures societal impact, which goes beyond the profit-maximizing motive of an investor-owned firm. Given conceptual similarities of member-owned enterprises, our results are also relevant outside the agricultural sector. We highlight three potential applications. First, cooperatives in other industries, such as renewable energy, are also subject to the involvement of the outsiders (selfish or benevolent types). For example, given the EU level sustainability goals, by 2020 14% of the total energy production in the Netherlands must come from renewable sources. Consequently, the Dutch government is concerned with promoting sustainable energy sources such as wind energy cooperatives. Our results regarding the efficient governance of cooperative emergence in Chapter 2 (top-down vs. bottom-up) can be applied to the emergence of collective action in such industries. Second, as illustrated by Chapter 3, the delegation of authority to professional management improves the efficiency in a cooperative. However, our results indicate that an efficient outcome may also emerge in a member-controlled enterprise under certain conditions in a repeated setting (when a relational contract between the membership and the management is stable). This result highlights the importance of informal agreements between the owners and the managers in the member-owned enterprises, regardless of the industry. Lastly, we hypothesize that the variables, which are the determinants of cooperative market shares in agriculture, are also relevant for the market shares of collective enterprises in other industries.

Summary

This thesis focuses on agricultural cooperatives, i.e. on the enterprises collectively owned by farmer-members. Chapter 1 discusses the distinguishing features of this governance form. First, the owners of a cooperative are also users, because farmers deliver their farm products to the cooperative enterprise. Second, the allocation of ownership implies also that residual income and decision rights are allocated to the farmers in a cooperative.

The first question addressed in this thesis is why there are so many types of emergence of cooperatives. Chapter 2 proposes an answer to this question by modeling cooperative emergence as a non-cooperative game between the farmers and the outsider. The main exogenous parameter in the model is member-heterogeneity. The main contribution of this chapter is the conceptualization of the bottom-up and top-down emergence patterns of cooperatives and evaluating the types of emergence from the efficiency perspective. The main results suggest that bottom-up emergence with the initiative of all farmers is efficient when heterogeneity and the value of the outsider are low. As heterogeneity of members increases, two types of problems arise among farmers: (i) first, a coordination problem, and as a consequence emergence with an initiative of one farmer only, and (ii) second, a hold-up problem, and as a consequence no emergence. A top-down cooperative with a selfish (benevolent) outsider is uniquely efficient when the value of the outsider is in the intermediate high (low) range and heterogeneity is low (high).

Next, this thesis investigates the determinants of the retained earnings percentage in a cooperative, from a relational contracting perspective. Chapter 3 formulates a non-cooperative game between the upstream (farmers) and the downstream (management) parties, where the right to decide on the retained earnings percentage is either allocated to the farmers, or delegated to the management. The main contribution of this chapter is twofold. First, it adds novel insight regarding the profit distribution decision in a cooperative by incorporating the relational contracting perspective. When the long-run repeated nature of interaction in a cooperative is taken into account, our results suggest that there exists a range of retained earnings percentages, such that a relational contract between the members and the management is feasible and stable, and therefore a member-controlled cooperative is efficient. Second, it formulates conclusions regarding the efficient allocation of decision rights in a cooperative.

Lastly, Chapter 4 investigates empirically the market shares of agricultural cooperatives in the European Union. It starts with an observation that cooperative market shares are higher in the North-West of Europe relative to the South-East, and in the dairy sector relative to all other sectors. A number of theoretical predictions regarding the degree of forward vertical integration are formulated and tested by using

the data from the dairy and sugar sectors in the European Union. The results indicate that dairy cooperative market shares are higher in countries with high levels of trust, low levels of heterogeneity, strong contracting institutions, and in countries which are more milk self-sufficient. In contrast, these variables are not statistically important in explaining differences in cooperative market shares in the sugar sector. Sugar cooperative market share is instead the result of the combination of EU policy changes and the product differentiation strategy of the investor owned competitor(s).

Samenvatting (in Dutch)

Dit proefschrift richt zich op landbouwcoöperaties, dus op de ondernemingen die gezamenlijk eigendom zijn van boerenleden. Hoofdstuk 1 bespreekt de onderscheidende kenmerken van deze ondernemingsvorm. Ten eerste zijn de eigenaren van coöperatie ook gebruikers, omdat boeren hun boerderijproducten aan de coöperative leveren. Ten tweede betekent de eigendomsstructuur dat ook het resterende inkomen en de beslissingsrechten worden toegewezen aan de boeren in een coöperatie.

De eerste vraag in dit proefschrift is waarom er zoveel soorten coöperaties ontstaan. Hoofdstuk 2 biedt een antwoord op deze vraag door de coöperatieve opkomst te modelleren als een niet-coöperatief spel tussen de boeren onderling een buitenstaander. De belangrijkste exogene parameter in het model is lidheterogeniteit. De belangrijkste bijdrage van dit hoofdstuk is de conceptualisering van de bottom-up en top-down verschijningpatronen van coöperaties en het evalueren van hun types vanuit het oogpunt van efficiëntie. De resultaten tonen aan dat de bottom-up verschijning met het initiatief van alle boeren efficiënt is wanneer de heterogeniteit en de waarde van de buitenstaander laag zijn. Naarmate heterogeniteit van leden toeneemt, ontstaan er twee soorten problemen bij boeren: (i) ten eerste, een coördinatieprobleem, en als gevolg daarvan verschijning van een initiatief van één boer alleen, en (ii) ten tweede, een hold-up probleem, en als een gevolg ontstaat er geen coöperatie. Een top-down coöperatie met een egoïstische (welwillende) buitenstaander is alleen efficiënt wanneer de waarde van de buitenstaander in het tussenliggende hoge (lage) bereik ligt en de heterogeniteit laag (hoog) is.

Vervolgens onderzoekt dit proefschrift de determinanten van het ingehouden winstpercentage in coöperaties, vanuit een herhaalde interacties perspectief. Hoofdstuk 3 formuleert een niet-coöperatief spel tussen de upstream (boeren) en de downstream (management) partijen, waar het besluitvormingsrecht over de ingehouden winst wordt toegewezen aan de boeren, of wordt gedelegeerd aan het management. De belangrijkste bijdrage van dit hoofdstuk is tweeledig. Ten eerste voegt het nieuw inzicht toe met betrekking tot de winstverdelingsbeslissing in een coöperatie vanuit het relationele contracteringsperspectief. Wanneer rekening wordt gehouden met de lange termijn interactie in een coöperatie, geven de resultaten aan dat er een aantal gereserveerde winstpercentages bestaat, zodanig dat een relationeel contract tussen de leden en het management haalbaar en stabiel is, en daarom een lid gecontroleerde coöperatie alsnog efficiënt is. Ten tweede formuleert het conclusies met betrekking tot de efficiënte toewijzing van besluitvormingsrechten in een coöperatie.

Tenslotte onderzoekt hoofdstuk 4 empirisch de marktaandelen van landbouwcoöperaties in de Europese Unie. Het begint met de constatering dat coöperatieve marktaandelen hoger zijn in het noordwesten van Europa in vergelijking met het zuidoosten en in de zuivelsector in vergelijking met alle andere sectoren. Een aantal theoretische voorspellingen met betrekking tot de mate van verticale integratie worden geformuleerd en getest door gebruik te maken van de gegevens van de zuivel- en suikersectoren in de Europese Unie. De resultaten geven aan dat het marktaandeel van zuivelcoöperaties hoger is in landen met een hoog niveau van vertrouwen, lage

heterogeniteit, sterke instituties en in landen die meer melk zelfvoorzienend zijn. Deze variabelen zijn statistisch niet van belang voor het verklaren van verschillen in coöperatieve marktaandelen in de suikersector. Het suikercoöperatieve marktaandeel is het resultaat van de combinatie van EU-beleidswijzigingen en de productdifferentiatiestrategie van concurrenten die een andere ondernemingsvorm hebben.

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About the author

Anna Petruchenya was born in Krasnoyarsk, Russia. She studied Economics and Business Administration at American University in Bulgaria and University of Maine in the USA, and received her Bachelor of Arts degree in 2011. In 2012 she received Erasmus Mundus full scholarship for two Master of Science degrees under a common theme "Economic Development and Growth". She received her first degree from Warwick University in the UK in 2012 and her second degree from Lund University in Sweden in 2013. In 2013, she joined the Department of Organization and Personnel Management of Rotterdam School of Management, Erasmus University, as a PhD candidate. Her research is in the field of organizational economics and applied game theory. Anna presented her research at several international conferences including Conference of the Society for Institutional and Organizational Economics (SIOE), European Association of Agricultural Economists (EAAE) Congress, Economics and Management of Networks Conference (EMNet), and International Cooperative Alliance Conference (ICA). Her research is under review in economics and agricultural journals.

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English (CPE Exam, grade A)	2014
Scientific Integrity	2014
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Executive Compensation and other Managerial Incentives	2015
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Presentations at Conferences

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- 19th Annual Conference, Harvard University, MA, USA. June 2015

European Association of Agricultural Economists (EAAE):

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International Cooperative Alliance Research Conference in Almeria, Spain (ICA); May 2016

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Teaching

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Cooperatives received significant attention in recent years as an alternative to investor-owned corporations. The objective of a cooperative to advance the interests of its member-owners is appealing from a societal perspective, particularly when comparing it with a profit-maximizing objective of an investor-owned firm. This thesis focuses on agricultural cooperatives, i.e. on the enterprises collectively owned by farmer-members. It advances the knowledge about a cooperative enterprise in three ways: (i) by conceptualizing and evaluating different patterns of emergence of cooperatives; (ii) by delineating an efficient allocation of decision rights regarding the profit distribution in cooperatives, from a relational contracting perspective; (iii) and by investigating the determinants of cooperative market shares in the EU. Chapter 1 discusses the distinguishing features of this governance form. First, the owners of a cooperative are also users, because farmers deliver their farm products to the cooperative enterprise. Second, the allocation of ownership implies that residual income and decision rights are allocated to the farmers in a cooperative. Chapter 2 models cooperative emergence as a non-cooperative game between two farmers and an outsider. Chapter 3 formulates a non-cooperative game between the upstream party (farmers) and the downstream party (cooperative management) regarding the distribution of profits of the cooperative enterprise. Chapter 4 provides an empirical analysis of cooperative market shares in the European Union. Lastly, Chapter 5 concludes and addresses how the results can be extended beyond agricultural cooperatives.

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