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Social Capital and Diversification of Cooperatives

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Sociaal kapitaal en diversificatie van coöperaties

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To My Family

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1. Introduction

Cooperatives play an important role in the world economy. According to the International Co-operative Alliance website (ICA, 2014), 'the United Nations estimated in 1994 that the livelihood of nearly 3 billion people, or half of the world's population, was made secure by cooperative enterprises'. Nowadays, cooperative enterprises worldwide provide 250 million jobs and the largest 300 cooperatives generate a turnover of more than 2.2 trillion USD in 2014 (ICA, 2014). Cooperatives are also an important governance structure in the agricultural sector. For instance, as of 2007, cooperatives occupy 95% of the dairy market in New Zealand (ICA, 2014). 'The average market share of all agricultural marketing cooperatives in the EU is 40%' (Bijman et al., 2012:29). In Japan, 91% of farmers are registered as cooperative members in 2007 (ICA, 2014), and in China, more than 25% of agricultural households have joined cooperatives by the end of 2013 (MoA, 2014). Cooperatives will continue to contribute in the economic and social development of many countries.

The research in this dissertation focuses on marketing cooperatives.[1] According to Feng and Hendrikse (2012:242), 'a cooperative is an enterprise collectively owned by many independent farmers as input suppliers in a production chain'. The main activities of marketing cooperatives include 'bargain for better prices, handle, process or manufacture, and sell farm products' (Ortmann and King, 2007:43). Marketing cooperatives advance the interests of members by bringing the following benefits: economies of size, elimination of double marginalisation, profits from processing, assurance of product outlet, gains from vertical and horizontal coordination, risk reduction, countervailing power, competitive yardstick effect and auxiliary services for members, etc. (e.g. Cotterill, 1987; Shaffer, 1987; Cook, 1995; van Dijk, 1997). Agricultural marketing cooperatives are thus important for farmer members as well as for the socio-economic development of the agricultural sector.

In the past two decades, agribusiness underwent significant changes. On the one hand, the great concentration of the agrifood distribution sector, rise of demand on processed products, increasing concern for product quality, and changing consumer preferences for products, etc. all placed new market opportunities and challenges on cooperatives (e.g. Bijman, 2010; Hendrikse, 2011; Liang, 2013). On the other hand, the advancement in information technology, financial instruments, and biological science largely changed the agricultural production practices on the farm. Members nowadays

[1] It should be noted that the development of cooperative forms of business 'varies between countries and between sectors of the economy' (Karantininis, 2007:19). The focus of this dissertation is the development of cooperatives in developed countries.

become more heterogeneous and have different interests than before (e.g. Hakelius, 1999; Karantininis and Zago, 2001; Hendrikse, 2011). Confronted with these changes in the external and internal environment, cooperatives have no choice but to 'balance the interests of producer-members with their ability to compete in a dynamic market' (USDA, 2002:21). Since the efficient governance structure has to match the situation facing the enterprise (Feng, 2011), how cooperatives can adapt to the changing situations and maintain as efficient governance structure is the core question of the current research.

The governance structure of traditional cooperatives is usually highly collective. The ownership rights are allocated to all farmer members, who have two roles: as patrons of the cooperative by providing input and as collective claimants of the residual rights over the cooperative (Feng, 2011). In recent decades, people observe that many marketing cooperatives shift to more individualistic governance structures by adopting non-traditional allocations of decision and income rights (Nilsson, 1998; Hendrikse and Veerman, 2001a and 2001b; Chaddad and Cook, 2004; Hendrikse, 2011; Bijman, Hendrikse and van Oijen, 2013). To answer the question of whether cooperatives can still be efficient, cooperative scholars examine the cooperative governance structure and its adaptation to new situations across a large number of research themes (Hendrikse and Feng, 2013:503). Among these themes, two of them have not been extensively addressed in the previous research, namely, social capital and product diversification of cooperatives. This dissertation is devoted to these two themes.

The first research theme, social capital of cooperatives, is related to cooperatives' intrinsic characteristics. Cooperatives have a 'double nature' (Draheim, 1955; in Valentinov, 2004:5). Every cooperative represents simultaneously a social group, and a joint enterprise owned and operated by the same group of members (Valentinov, 2004). Much of the previous research attention regarding the efficiency of cooperatives has been given to the formal institutions of cooperative governance structure, while the social attributes of cooperatives and their value are largely ignored. The theoretical analysis of social capital of cooperatives lags behind empirical approaches. Furthermore, there has been no attempt to investigate the interaction between social capital and governance structure of cooperatives. Thus, the research regarding cooperative social capital in this dissertation aims to provide a theoretical analysis of social capital in cooperatives. We seek to understand better how social capital exists within cooperative organisations and how it affects the cooperative business. After examining the content and value of social capital in cooperatives, we formally analyse the interaction between social capital and governance structure and highlight the importance of the balance between the social and economic attributes of cooperatives.

There are several ways to position this dissertation in the literature of social capital. First, despite growing research interest in social capital of cooperatives, previous research usually focuses on specific facets or components of social capital and uses various constructs to measure it. This dissertation is among the first to provide an integrated analysis of social capital in cooperatives by covering all its dimensions. Second, since a cooperative is simultaneously a firm and a community, one cannot study it meaningfully as one or the other in isolation. Nonetheless, to our knowledge, theoretical modelling of social capital in cooperatives is still missing in the literature. In addition, while social capital has been proven to be important for cooperatives, the way it generates value for cooperatives and the factors that determine its level are not well understood. In this dissertation, we develop several formal models to address the different dimensions of social capital and their interaction with governance structure. The results provide novel insights into the complex characteristics of cooperatives and have implications for the organisational design of agricultural marketing cooperatives.

The second research theme of this dissertation is product diversification of cooperatives. Although the research interest of product diversification can be traced back to more than half a century ago (Penrose, 1959), the studies about product diversification strategies of cooperatives are still sparsely covered by literature (van Oijen and Hendrikse, 2002). Given the differences in governance structure, cooperatives may behave differently than IOFs do in product diversification.[2] In addition, as product diversification is one of the potential strategies of cooperatives to respond to changing market situations, there is a need to forward our understanding of this topic. In this dissertation, we mainly investigate the relationship between governance structure and product diversification strategies. Several characteristics of cooperative governance structure, such as the single origin constraint, double screening in decision making, vertical integration, etc., may influence cooperatives' product diversification. We attempt to capture the consequences of these features by using agent-based simulations. In addition, as empirical evidence shows that many cooperatives have adopted innovative governance structure models in the past decades (e.g. Chaddad and Cook, 2004; Bijman, Hendrikse and van Oijen, 2013), it is worth

[2] When cooperatives are compared with investor owned firms (IOFs), the topology we use to define different institution forms is based on their ownership structures: cooperatives are owned by suppliers of input while IOFs are owned by investors of capital (Hansmann, 1996). The analysis will be focused on the consequences of the principal differences between these two ownership structures, such as the different allocations of control and decision rights. Although there are various types of IOFs such as publicly listed firms and private IOFs, the differences between them are not the focus of the analysis in this dissertation.

investigating empirically whether these governance structure changes of cooperatives have led to a change in their diversification behaviours.

The research on diversification of cooperatives in this dissertation contributes to the scientific knowledge in various ways. First, agent-based simulations are used to compare cooperatives with IOFs regarding their product portfolio evolution and composition. The single origin constraint of cooperatives can be captured in an agent-based model by assigning an infinite lifetime to the first product of a cooperative while assigning a limited lifetime to the first product of an IOF. In addition, various other aspects of governance structure and the competition between the cooperative and IOF can be explicitly analysed in the agent-based model. Through simulations, we are able to observe how organisational decisions are made in different governance structures and analyse the outcomes that emerge at the aggregated level. From the methodological perspective, the current study introduces a novel approach in the research of cooperative governance structure. Second, we test the proposition that there is a relationship between firms' governance structure and diversification strategies by using a dataset of Dutch cooperatives and publicly listed firms. Specifically, we aim at explaining the impacts of the unique characteristics of cooperative governance structure on cooperatives' choices regarding product portfolio composition. We also investigate the restructuring of cooperative governance structure and discuss how the innovative cooperative models can influence cooperatives' diversification strategies. Finally, the results of the research will provide information about the trend in diversification strategies based on firms' governance structures. Importantly, this study helps cooperative practitioners understand the impacts of various cooperative organisational characteristics on the choices of potential product diversification strategies.

The remainder of this dissertation is structured into two parts, each covering one research theme outlined above. Part A of the dissertation is devoted to the research on social capital of cooperatives. It consists of five articles (Chapters 2 – 6) and one conclusion chapter (Chapter 7). We begin with a literature review of cooperative social capital in Chapter 2. In this review, we analyse the structural, cognitive, and relational dimension of social capital in the organisational context of cooperatives. From the perspective of the enterprise as a system of attributes, these social capital dimensions are viewed as the social attributes of cooperatives, which must be aligned with cooperatives' economic attributes. In addition, we integrate diverse ideas and empirical facts that pertain to cooperative social capital with the cooperative lifecycle theory.

Chapter 3 addresses the relationship between income rights structures and product quality of cooperatives in a standard economic model. It serves as a benchmark for the analysis in Chapter 4, in which relational social capital is formally modelled in the provision of product quality. Chapters 4 – 6 model the relational, structural, and cognitive dimension of cooperative social capital, respectively. Specifically, Chapter 4 focuses on the influence of relational social capital on the income rights structure. It shows that it is efficient for the cooperative to adopt a collective income rights structure when its social capital level is high. However, when the social capital level decreases, the cooperative should implement more individualistic income rights structures with strong economic incentives in order to maintain efficient. Chapter 5 investigates the influence of the income rights structure on structural social capital. We model members' social interactions and the dynamics of members' social ties under different pooling policies. The results show that the collective income rights structure featured by complete pooling is beneficial for cooperative social capital because it creates a large externality in members' production activities. However, when the social context of the cooperative is no longer conducive to social interactions, the complete pooling policy will become inefficient. The cooperative should adopt the no-pooling policy. Chapter 6 explores the potential efficient combinations of cognitive social capital and decision rights structure in different market settings. We show that the common vision of the CEO and Board of Directors (BoD) and the double screening process in project decisions make the cooperative attractive when upstream projects are dominant. However, in environments with a relatively high percentage of downstream projects, the cooperative should hire a professional CEO who holds a vision different from the BoD. In Chapter 7, we conclude and discuss the results of Part A. We pose that the combination of high social capital levels and collective governance structure represents one coherent attribute system that has been adopted by many traditional cooperatives. Alternatively, low social capital levels and individualistic governance structure form another coherent system, which is commonly found in IOFs. These systems of attributes with different attribute values are interpreted as alternative equilibrium outcomes of the interaction between social capital and governance structure. The social context of the cooperative community determines to a large extent the equilibrium that the cooperative will choose. Chapter 7 also outlines avenues for future research on cooperative social capital.

Part B of the dissertation investigates product diversification of cooperatives. It consists of two articles (Chapters 8 and 9) and one conclusion chapter (Chapter 10). In Chapter 8, we develop an agent-based model to compare the product diversification of cooperatives and IOFs. The simulation results show that the single origin constraint of a cooperative is responsible for pulling all its products together in one cluster centred

on the original product, resulting in the lower diversification level and larger output of the cooperative. In addition, we capture the competition between a cooperative and an IOF in the simulation of a mixed duopoly market. We show that although the cooperative and IOF have very different product portfolio composition, the total surplus of the cooperative is close to the total profit of the IOF. Chapter 9 empirically tests the influence of governance structure on product diversification behaviour by comparing the product diversification levels of Dutch cooperatives and publicly listed companies in 2001 and 2012.[3] The results show that cooperatives are less diversified than publicly listed companies in 2001, whereas in 2012, the product diversification levels of these two types of companies are statistically comparable. We conclude that, with flexibility in governance structure, cooperatives and other types of enterprises may actually behave indifferently in terms of product diversification. Chapter 10 summarises the findings in Part B and outlines future research possibilities.[4]

[3] Because of the lack of agricultural marketing cooperatives in the database, this empirical study includes cooperatives from other industrial sectors.

[4] The comments and suggestions by Jos Bijman and Jerker Nilsson on Chapter 2, and the comments and suggestions by Aswin van Oijen on Chapter 9 are greatly appreciated. Any remaining errors are the author's.

Part A:
Social Capital of Cooperatives

2. Cooperative Social Capital – Towards a Lifecycle Perspective[5]

Abstract

This chapter provides an integrated analysis of the structural, relational, and cognitive dimension of internal social capital in cooperatives. We integrate the social capital concept with cooperative lifecycle theory and describe the change of cooperative social capital along the lifecycle. We propose that cooperatives in different stages of the lifecycle are featured with different levels of social capital. Cooperatives are supposed to enjoy a high level of social capital in the early stages of the lifecycle. However, the level of social capital in cooperatives exhibits a trend of declining along the development of the organisation. The decrease of social capital will lead to an imbalance of the social and economic attributes of cooperatives. The cooperative's governance structure must change accordingly. We argue that it is important for cooperatives to maintain and develop the social capital strategically over time. Otherwise, the comparative advantage of the cooperative business form may disappear.

Keywords: Social Capital, Cooperatives, Lifecycle

2.1 Introduction

Cooperative researchers have investigated how cooperatives are distinct from other organisational forms in a broad range of themes (Hendrikse and Feng, 2013). To address these topics, various theoretical perspectives are applied, including agency theory (Cook, 1995; Hueth and Marcoul, 2009), transaction costs theory (Bonus, 1986; Hendrikse and Veerman, 2001a), property rights theory (Fulton, 1995; Hendrikse and Veerman, 2001b), team theory (Hendrikse, 1998), and bounded cognition theory (Feng, 2011), etc. One common shortcoming of these theoretical approaches is that they largely ignore the embeddedness of the cooperative's and members' economic activities in the social context of cooperative community. The explanatory relevance of the social relationships among cooperative members is not taken into consideration.

It is commonly argued that social capital is a valuable asset based on inter-personal social relationships (e.g. Coleman, 1990; Adler and Kwon, 2002). Cooperatives are

[5] A version of this chapter was published in the proceeding of the EAAE (European Association of Agricultural Economists) 2014 Congress, Ljubljana, Slovenia (http://ageconsearch.umn.edu/handle/182922).

regarded as 'social capital-based organizations' (Valentinov, 2004:15) or as 'dual organizations' (Nilsson and Hendrikse, 2011:339). Therefore, social capital is potentially important in addressing the difference between cooperatives and investor owned firms (IOFs) because 'the existence of this social foundation of cooperation, giving rise to its expressly democratic and people-oriented character, was the basis for differentiating between the cooperative and "capitalistic" organization' (Valentinov, 2004:5). In addition, social capital has been recognised as a main comparative advantage of the cooperative form (Røkholt, 1999; Spear, 2000).

Social capital at the organisational level can be categorised as internal and external social capital (Adler and Kwon, 2002; Leana and Pil, 2006).[6] Internal social capital describes the aggregate form and value of social relationships among organisational members (e.g. Coleman 1990; Putnam, 1993), whereas external social capital describes the social linkages between the organisation and other external actors (e.g. Burt, 1992; Uzzi, 1996). In this dissertation, we focus on the internal social capital of cooperatives. In other words, we treat a cooperative as a community and look at the structure and content of relationships among its members, which facilitate the pursuit of collective goals of the cooperative (Adler and Kwon, 2002). For the sake of simplicity, the term 'social capital' hereafter refers to the internal social capital and our discussion is geared to marketing cooperatives.

In the cooperative literature, many issues related to the notion of social capital, including ideology, culture, value, trust, identity, norms, loyalty and commitment, have been studied by scholars (e.g. Fulton and Adamowicz, 1993; Hansen, Morrow and Batista, 2002; Valentinov, 2004; James and Sykuta, 2006; Bhuyan, 2007; Nilsson, Svendsen and Svendsen, 2012). In examining these studies, it seems to us that an integrated analysis of social capital of cooperatives is missing. Therefore, the primary motivation for this chapter is to conduct a literature review and develop a theoretical connection between social capital and cooperative organisations.

Accordingly, we strive to achieve three objectives in this chapter. The first objective is to identify the content of social capital of cooperatives and the benefits resulting from it. To achieve this objective, we adopt Nahapiet and Ghoshal's (1998) three dimensions of social capital: structural, cognitive, and relational. From the perspective of a system of attributes (Milgrom and Roberts, 1990), these social capital dimensions

[6] Social scientists have categorised the forms of social capital in other ways, such as bonding and bridging (e.g. Adler and Kwon, 2002; Carolis and Saparito, 2006), or intra- and inter-organisational (e.g. Arregle, Hitt, Sirmon, and Very, 2007). These characterisations of social capital are similar to the internal and external view adopted in the current study. See Payne et al. (2011) for a typology of social capital.

constitute the social attributes of the cooperative, which must be aligned with the cooperative's economic attributes. We delineate each social capital dimension and discuss how they may generate comparative advantages for cooperatives. Second, this chapter integrates diverse ideas and empirical facts that pertain to cooperative social capital with cooperative lifecycle theory. Although social capital is an asset of traditional cooperatives, the level of social capital in a cooperative is by no means static. The development and expansion of the cooperative will change the environment where social capital develops and sustains. Some researchers attribute the failure of some large cooperatives to the decline of social capital in the organisation (Nilsson, Svendsen and Svendsen, 2012). Based on Cook's (1995) cooperative lifecycle model, we describe the change of social capital along the cooperative lifecycle and its potential impacts on cooperatives' business performance. Our fundamental argument is that the social capital level in a cooperative may decrease along the cooperative lifecycle. The decrease of social capital level leads to an imbalance of the social and economic attributes of the cooperative. When this happens, the cooperative's governance structure may become inefficient and need to be changed. Third and finally, we argue that it is important that cooperative leaders strategically maintain and develop social capital over time. Otherwise, the comparative advantage of cooperatives over IOFs may disappear. We discuss the implications for the management practice in cooperatives. Specifically, we offer some suggestions to sustain and recreate social capital in large and modern cooperatives.

This chapter is organised as follows. In Section 2.2, we develop an integrated analysis of cooperative social capital. Section 2.3 contours the evolution of cooperative social capital along the lifecycle with illustrative empirical evidence. In Section 2.4, we discuss the practical implications of social capital for the management of cooperatives. The last section encompasses conclusions and presents some implications for future research on cooperative social capital.

2.2 Social Capital and Cooperatives

There is a growing interest and research regarding social capital of cooperatives. Many cooperative scholars have emphasised the importance of social capital and tried to link it with the development and performance of cooperatives. However, owing to the multi-dimensionality of the social capital concept, the previous research usually focuses on specific facets or components of social capital and uses various constructs to measure it. Therefore, it is important and necessary to clarify the dimensions of social capital in cooperatives and identify the benefits resulting from each dimension.

According to Nahapiet and Ghoshal (1998), social capital is composed of three distinct dimensions: structural, cognitive and relational. The measurement of social capital can be operationalised according to these dimensions (e.g. Tsai and Ghoshal, 1998; Leana and Pil, 2006; Wu, 2008). In the following subsections, each dimension will be examined in the organisational setting of cooperatives. In addition, we characterise a cooperative by its social and economic attributes.[7] These social capital dimensions are conceptualised as the social attributes, whereas the governance structure of the cooperative represents its economic attributes. The social and economic attributes must be aligned in order to obtain organisational coherence. Our analysis aims at laying the ground of explaining how social capital will change along the lifecycle and why cooperative decision makers should try to maintain it during the development of cooperatives.

Structural Dimension

The structural dimension of social capital reflects the overall pattern of social connections between the members of an organisation, and the most important facets in this dimension include the network ties, network configuration and appropriability (Nahapiet and Ghoshal, 1998).

Network ties describe the social connections between people in an organisation. They are regarded as a fundamental aspect of social capital because 'an actor's network of social ties creates opportunities for social capital transactions' (Adler and Kwon, 2002:24; Inkpen and Tsang, 2005:152). A cooperative is by design an organisation with plenty of social ties among its members. It is formed by a group of farmers voluntarily to achieve their collective goals and interests. The members of a cooperative are not anonymous financiers but real persons who run their own agricultural enterprises (Nilsson, Svendsen and Svendsen, 2012). The collective ownership of the member group towards the downstream processor and the local nature of the cooperative entail that the members are likely to know each other and have social relationships (Cropp and Ingalsbe, 1989; Nilsson, Svendsen and Svendsen, 2012). Therefore, there exists a social network among the members of a cooperative.

The configuration of a social network determines the pattern of linkages among network members, such as the network hierarchy and relationships density, etc. (Nahapiet and Ghoshal, 1998). The social network in a cooperative is a combination of horizontal and vertical social ties. The horizontal ties represent the social relationships and interactions between members in the cooperative society. The vertical ties are the

[7] Cooperatives have been analysed in other attribute systems; see Hendrikse and Veerman (1997), Bijman (2002), and Feng (2011).

social connections between the members and the cooperative processor and management. In cooperatives, the Board of Directors is elected from the membership, and historically, the CEO of a traditional cooperative is also a member.[8] There is thus personal acquaintance between the members and cooperative leaders. Furthermore, as the members transact frequently with the cooperative processor (Hendrikse and Feng, 2013), they meet with management in a personal way regularly. Close social relationships between them are expected to develop.

According to Bolino et al. (2002:510), 'network appropriability relates to the ease with which different types of relationships can be transferred within a network'. It measures the extent to which a relationship developed in one context can be (re)used in other contexts (Nahapiet and Ghoshal, 1998; Pearson, Carr and Shaw, 2008). Every cooperative represents simultaneously a social group and a joint enterprise (Valentinov, 2004). As the joint enterprise is owned and operated by the same group of members, the pre-existing social relationships established between members in the community are thus transferred into the joint enterprise and its business. The members' economic activities in the cooperative are highly embedded in their social network.

In short, a cooperative is not only a business firm but also a society with a dense inter-personal social network. The structural social capital of a cooperative can be measured by the strength of social ties, by the density of social network, and by the frequency of social interactions among the members. Gargiulo and Benassi (2000:184) summarise the previous research on social networks and conclude that 'networks can help actors to coordinate critical task interdependencies and to overcome the dilemmas of cooperation and collective action'. Therefore, because a social network creates a platform for information sharing and exchange (Gulati, 1995; Walker et al., 1997; Sparrowe et al., 2001), a high level of structural social capital is advantageous for both members and cooperatives. For individual members, strong ties with similar producers may lead to spill-over effects that result in an increase in efficiency and productivity (Levin and Reiss, 1998). For the cooperative firm, the close social connections between members and managers may create a superior vertical information flow that significantly supports the collective activities (Hendrikse and Feng, 2013).

Cognitive Dimension

The cognitive dimension is the 'shared representations, interpretations and systems of meaning among parties, which reflects the members' collective understanding of the

[8] Nowadays, many cooperatives, especially in China, still use one of the members as a CEO, rather than hire an outsider. Conversely, in Western countries, especially in the US, most cooperatives employ outside CEOs. In Spain and Brazil, the situation is more mixed (Liang and Hendrikse, 2013).

organisation's culture, shared vision and purpose, common language and codes, etc.' (Nahapiet and Ghoshal, 1998:244).

The cooperative culture, vision, and purpose are largely carried by the ideology and values of traditional cooperatives, which provide a good starting point for the members to develop mutual understanding. When farmers take collective actions to found a cooperative, they are supposed to agree on what their cooperative should do, and how to do it. They also acknowledge the proper way of acting in such a community. The cooperative principles such as the Rochdale principles contain a clearly discernible element of ideology describing these issues (Nilsson, Svendsen and Svendsen, 2012). In general, the cognitive foundation of cooperative values, norms and beliefs in traditional cooperatives is to emphasise service to members over profit, to subordinate individual goals to the good of the whole, and to value equality, etc. (Hogeland, 2004). For example, in Sweden, the old farmers 'view the cooperative memberships as a way of showing solidarity with peers, economic aspects being of secondary importance' (Hakelius, 1999:31).

A cooperative will also develop a set of common language or codes among the members. The geographical and production proximity entails that the members will have similar production and marketing problems and thus less disagreement (Hendrikse and Feng, 2013). In addition, the frequent social interactions within the membership network and the repeated transactions between the members and the processor will also support the development of the system of shared meanings in the cooperative (Tsai and Ghoshal, 1998; Wu, 2008).

The cognitive social capital of a cooperative can be measured by the extent to which the members share congruent vision and goals. A high level of cognitive social capital benefits cooperatives in several ways. First, it supports the collective actions of members. People with shared vision are more willing to enter into cooperation (Tsai and Ghoshal, 1998). In addition, Leana and Pil (2006) argue that the shared goals in a community can mitigate the free-riding problems and reduce the use of formal control mechanisms. Second, the cognitive social capital promotes successful coordination by facilitating effective communication and common perceptions among members. Inkpen and Tsang (2005:157) claim that, 'when a shared vision is present in the network, members have similar perceptions as to how they should interact with one another'. A shared vision provides members with the ability to communicate more effectively and avoid possible misunderstanding in communications (Tsai and Ghoshal, 1998). In cooperatives, better communication increases the level of mutual understanding among members and helps them anticipate the actions of other members

(Hendrikse and Feng, 2013). This will lead to the cooperative's successful coordination of business activities and adaptation to changing situations.

Relational Dimension

According to Nahapiet and Ghoshal (1998:244), the relational dimension of social capital is composed of 'trust, shared norms, perceived obligations, and a sense of mutual identification'.

Trust is the key facet of the relational dimension of social capital (Nahapiet and Ghoshal, 1998). Bolino et al., (2002: 511) summarise the prior research (e.g. Putnam, 1993; Tsai and Ghoshal, 1998) and conclude that 'trust facilitates social and resource exchange, increases communication, and enhances cooperation between individuals'. When individuals trust each other, they are more likely to cooperate and participate in the collective actions (Gulati, 1995). The value of trust has been widely studied in the cooperative literature. Researchers claim that cooperatives have greater organisational trust than IOFs do, which exist both among the members and between the members and processor (Shaffer, 1987; Balbach, 1998; Shapira, 1999; Sykuta and Cook, 2001; James and Sykuta, 2005, 2006). The trust in the cooperative makes the members willingly identify themselves to the cooperative (Borgen, 2001), be loyal to the cooperative (James and Sykuta, 2006), and actively participate in the cooperative governance (James and Sykuta, 2005; Österberg and Nilsson, 2009; Barraud-Didier et al., 2012). The members' trust towards their cooperative also makes them willing to accept the control of the cooperative (Søgaard, 1994) and leads to more efficient contracts between the members and processor (Balbach, 1998). Ollila, Nilsson and von Brömssen (2011:1) claim that 'mutual trust between the membership and their cooperative has through history enabled both members and cooperatives to survive financially difficult times'.

A norm represents 'a degree of consensus in the social system' about the proper way to behave (Nahapiet and Ghoshal, 1998:255). According to Coleman (1990:243), a norm exists 'when the socially defined right to control an action is held not by the actor but by others'. As a society with a dense social network and common ideology, a cooperative is supposed to develop social norms emphasising cooperation, reciprocity, and loyalty. In cooperatives, members are willing to accept a high degree of social control via these norms (Nilsson, Svendsen and Svendsen, 2012). Social control can curb free-riding problems by making opportunistic behaviours more costly due to the threat of social sanctions and reputational effects (Granovetter, 1985; Gulati et al., 2000). Therefore, the need for formal control can be reduced (Adler and Kwon, 2002).

According to Nahapiet and Ghoshal (1998:255), 'obligations represent a commitment or duty to undertake some activity in the future'. Members' obligations towards the

collective actions are crucial for cooperatives because their survival and success rely on the patronage and member commitment (Fulton and Adamowicz, 1993). When members have a strong sense of obligation towards one another and towards their cooperative, they will commit themselves by actively patronising the cooperative processor, providing risk capital, and participating in cooperative governance (Österberg and Nilsson, 2009).

Finally, identification is defined as 'the process whereby individuals see themselves as one with another person or a group of people' (Nahapiet and Ghoshal, 1998:256). It is members' sense of belonging to the cooperative. Group identity is beneficial for information exchange and cooperation (Nahapiet and Ghoshal, 1998). It can also become a social motivation (Akerlof and Kranton, 2005). In cooperatives, members' sense of identity can be induced by their common goals and a long history of social interactions. Gray and Kraenzle (1998) underline the strong identification of members with their cooperative. Members' identification with the cooperative is also a significant trust-making mechanism (Borgen, 2001) and a source of members' commitment (Jussila et al., 2012).

The relational social capital can be measured by the amount of trust members place on each other and on management, by the strength of social norms in the community, and by the level of loyalty of members towards their cooperative. In general, the relational social capital serves as the key resource for creating cooperatives' comparative advantage over IOFs. Successful cooperatives are characterised by possessing a large stock of these relational social capital components, which facilitate the collaborative behaviours and collective actions of members. On the other hand, there is rich evidence showing that the future for cooperative business barely exists if there is no sufficient relational social capital, such as trust, commitment and loyalty, to support collective actions of farmers (e.g. Nilsson and Hendrikse, 2011).

Relation between Different Dimensions

As Nahapiet and Ghoshal (1998) point out, although we can discuss the dimensions of cooperative social capital separately for analytical reasons, they are closely interrelated. We suggest that the three dimensions are complementary in nature, with each dimension reinforcing the creation of the other dimensions.

First, the structural dimension serves as an important resource for the creation of the other two dimensions (Tsai and Ghoshal, 1998). Previous studies have suggested that social ties and interactions promote trust between individuals (Gulati, 1995; Granovetter, 1985; Arregle et al., 2007). Norms are more firmly held and easier to enforce in a denser social network (Granovetter, 2005). In addition, the organisation members' social ties and interactions support the formation of shared vision (Tsai and

Ghoshal, 1998) and altruisms (Dur and Sol, 2010). It is easy for members to share common values and understanding of roles if they closely connected (Podolny and Baron, 1997). The closure of a social network also facilitates the development of high levels of relational and cognitive social capital (Nahapiet and Ghoshal, 1998).

Second, Tsai and Ghoshal (1998:466) propose that 'the common values and a shared vision, the major manifestations of the cognitive dimension of social capital, encourage the development of trusting relationships'. Pearson, Carr and Shaw (2008) also argue that the cognitive dimension serves as an antecedent to the relational dimension. They suggest that 'a shared vision will lead to collective trust and norms for fulfilment of the common purpose' (p.958). In addition, the cognitive social capital also supports the development of structural dimension because people who share the same mental model, language and value are more likely to interact with one another and exchange information regularly (Mohammed and Dumville, 2001; Leana and Pil, 2006).

Third, the relational dimension of social capital reinforces the creation of the other dimensions. As Nahapiet and Ghoshal (1998:251) argue, 'trust creates anticipation of value through social interactions with others and thus motivates actors to deepen relations and pursue interactions'. In addition, 'trusting relations allow for the transmission of more information as well as richer and potentially more valuable information' (Leana and Pil, 2006:354).

Cooperative as a Coherent System

Due to the 'double nature' of cooperatives (Draheim, 1955; in Valentinov, 2004:5), we can perceive a cooperative as a system composing both social and economic attributes. The structural, cognitive, and relational social capital constitute the social attributes while the economic attributes are represented by the governance structure characterised by the income and decision rights allocation (Hansmann, 1996). Income rights specify 'the rights to receive the benefits and the obligations to pay the costs associated with the use of an asset, thereby creating the incentive system faced by the decision makers', and decision rights concern all rights and rules regarding 'the deployment and use of assets', and specify who directs the enterprise's activities (Hendrikse, 2011:1693). To reach organisational efficiency, the values of a company's social and economic attributes must be coherent (Milgrom and Roberts, 1990).

Figure 2.1 provides a graphical comparison of a traditional cooperative and an IOF with respect to the values of their social and economic attributes. The social attributes consist of the structural, cognitive, and relational social capital. The economic attributes are the governance structure. There are two possible values for each attribute, i.e. strong – weak, common – diverse, high – low, and collective – individualistic.

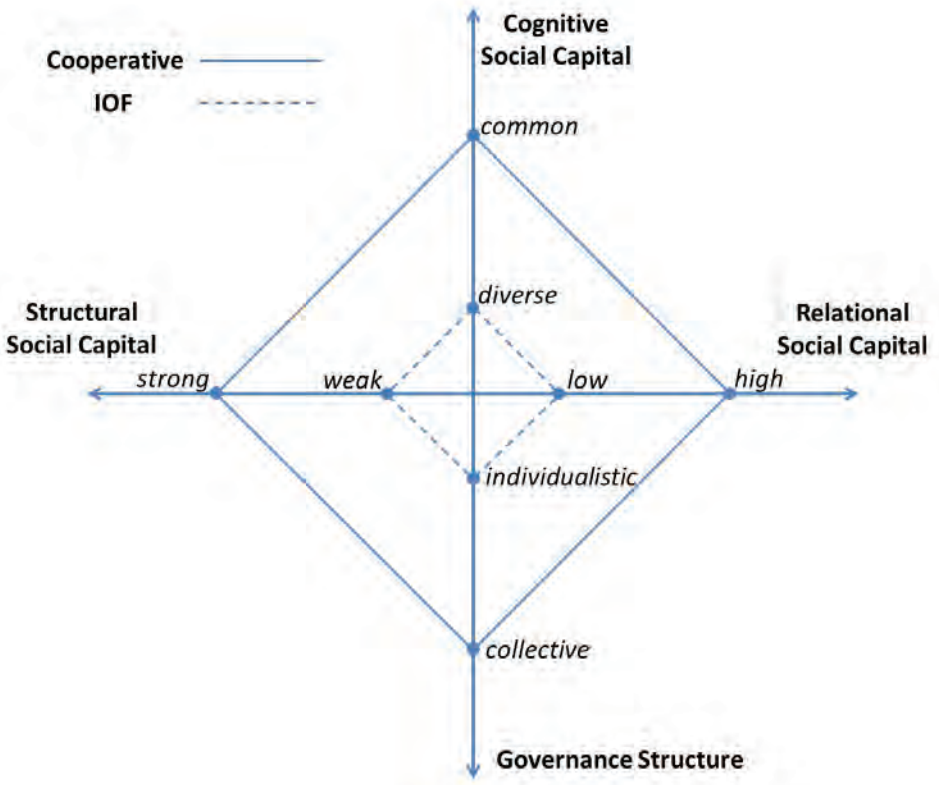

Figure 2.1: Attributes of a cooperative and an IOF

We argue that the cooperative and the IOF are both efficient because their social and economic attributes are coherent. The cooperative (represented by the solid rectangular) is characterised by a high level of social capital featured by the strong social ties, common vision, and high trust within the membership. Although depicted as separate attributes, they are mutually-reinforcing and complementary to each other. The governance structure of the cooperative is featured by the collective income and decision rights allocation. A unique feature of cooperatives' income rights structure is that members hold the residual claims collectively and receive benefits proportional to their patronage (Dunn, 1988). Pooling is a prominent element in the income rights structure of traditional cooperatives. It entails that 'revenues and costs are to a certain extent allocated independent of quantity and/or quality' (Hendrikse and Feng, 2013:509). The members thus receive collective instead of individualistic incentives for their patronage. Regarding decision rights, members usually have equal voting power and make decisions collectively based on the one-member-one-vote principle (Hansmann, 1996). With the collective governance structure, traditional cooperatives

are supposed to face with organisational inefficiency due to the opportunistic behaviours and high collective decision-making costs. However, the presence of a high level of social capital complements the collective governance structure by controlling and coordinating the members' activities via social mechanisms.

The IOF (represented by the dashed rectangular) has a different set of social and economic attribute values featured by a low social capital level in combination with an individualistic governance structure. An IOF is owned by investors and the primary goal of the IOF is to give its investors the highest investment return. The farmers are only the suppliers of the IOF and the relationship between the farmers and the IOF is seen as solely seller-buyer. The farmers, as individual suppliers, are not supposed to socialise with each other so frequently as how the cooperative members will do. Therefore, there is a low social capital level among the farmers, and between the farmers and the IOF. However, when the farmers deliver their produce to the IOF, they receive an individual instead of pooled price. The economic incentives are individualised. The investors of the IOF are the holders of decision rights, although these rights are usually delegated to the CEO, who 'often has substantial control over setting, ratifying and implementing company policy' (Hendrikse and Feng, 2013:507). In the IOF, economic incentives instead of social mechanisms play the dominant role of controlling and coordinating economic activities. Individualistic governance structure is thus coherent with the low social capital level.

The analysis of system of attributes provides insights into organisational dynamics. Changing the value of a particular attribute in the system without changing the values of other attributes may lead to a serious loss in the organisational efficiency (Milgrom and Roberts, 1990). For the cooperative, if one or some values of its social attributes change, the cooperative may become inefficient if the collective income or decision rights allocation in the governance structure remain the same. To avoid organisational inefficiency and failure, a new combination of attribute values must be forged. These dynamics will be discussed in the next section from the perspective of the cooperative lifecycle.

2.3 Social Capital along the Lifecycle of Cooperatives

Social capital is closely bound with the development and strategy of the organisation (Nahapiet and Ghoshal, 1998). In this section, the evolution of social capital in a cooperative is contoured along the cooperative lifecycle.[9] We aim to highlight the

[9] The discussion in this section is mainly based on the development history of cooperatives in Western Europe and North America. The development of cooperatives in Central and

dynamics of social capital in cooperatives. Moreover, we explain the formation, growth, decline, and change of cooperative organisations from the lens of social capital and the coherence between social capital and governance structure.

Cook (1995:1155) suggests a five-stage lifecycle model for cooperatives: '(1) economic justification and establishment, (2) survival of infant stage, (3) growth and consolidation, whereby problems of so-called vaguely defined property rights appear, (4) struggle against the vaguely defined property rights problems, (5) exiting, restructuring (including choosing a hybrid model and involving outside co-owners), or shifting (choosing an individualised cooperative model, including tradable delivery rights)'. We propose that cooperatives in different stages of the lifecycle are featured with different levels of social capital. Cooperatives are supposed to possess a large stock of social capital in the early stages of the lifecycle, which forms a coherent system with the traditional cooperative governance structure. However, the level of social capital in cooperatives exhibits a declining trend along the development of the organisation (Nilsson, Svendsen and Svendsen, 2012). The values of the three social attributes indicated in Figure 2.1 gradually change from dense to loose, from common to diverse, and from high to low as the cooperative develops. We examine the ways in which certain organisational changes in cooperatives affect each social capital dimension. In the last stages of the lifecycle, a low social capital level in the cooperative is no longer aligned with the economic attributes featured by the collective governance structure. The imbalance of social capital and governance structure explains the cooperative's common property problems and loss of competiveness. We present some cases showing how cooperatives respond to the imbalance of social and economic attributes.

Economic Justification and Establishment

While economic justifications, such as correction of market failures (Cook, 1995), competitive yardstick effect (Cotterill, 1987), economies of scale (LeVay, 1983), etc., provide farmers various motives to form a cooperative, a high level of social capital among the potential members initialises their collective actions. Regarding the structural dimension, because most cooperatives start on a small scale, members are usually well acquainted with each other and there are strong social ties among them (Nilsson, Svendsen and Svendsen, 2012). The pre-existing social ties provide information on potential members' trustworthiness and reliability. Meanwhile, in a relatively small and close social network, the presence of frequent interactions, common interests, and similar backgrounds promotes the development of a shared

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Eastern Europe and developing countries may follow a different trajectory (Chloupkova, 2002; Nilsson and Hendrikse, 2011; Liang, 2013).

vision in the community. Communication is effective in the social network and clear objectives of the cooperative can be developed. The social ties and common vision thus provide a condition for developing an initial coalition of potential members and the formation of a stable membership. The cooperative's formation also needs a high level of relational social capital. When the members pool their resources to form their cooperative, they create mutual dependence on each other. They must be confident that no one will shirk their commitments as business partners. Therefore, trust among the farmers is crucial before they decide to invest time and money in the cooperative.

Nilsson, Svendsen and Svendsen (2012:190) view social capital as 'the point of departure' in the governance of cooperatives. Feng, Nilsson, Ollila and Karantininis (2011:1) also claim that member loyalty and commitment are *sine qua non* for the success and adaptation of cooperative enterprises. To the contrary, if there is not sufficient social capital in the community, especially the mutual trust between individual farmers, cooperatives will not be founded because no collective actions can be initiated and sustained. The empirical study of cooperative membership in Macedonia demonstrates that a low level of trust between the farmers prevents them from taking any initiative in cooperative formation, although they have a need for cooperatives to correct market failures (Nilsson and Hendrikse, 2011). In Eastern Europe, farmers have been reluctant to join cooperatives due to their distrust of collective arrangements stemming from their experiences under communist regimes (Chloupkova, Svendsen and Svendsen, 2003). In fact, even after cooperatives, like those in Russia, have been established in a top-down way by governmental administration, these cooperatives have meagre survival chances if there is only an extremely low level of trust within the membership (Nilsson and Hendrikse, 2011).

Therefore, a high level of social capital can be regarded as the necessary condition for the formation of cooperatives. During the establishment stage, the level of social capital in a cooperative is very high and it exists as a result of interpersonal relationships developed from the informal social interactions among farmers. The trust among members and between members and management is high. Members are very loyal to their cooperatives and maintain a high level of commitment.

Survival of Infant Stage

In the second stage of the lifecycle, the economic survival and growth of cooperatives as business firms rely on cooperative social capital. In general, social capital supports the cooperative business through promoting cooperation, reducing opportunisms, mitigating free-riding and agency problems, and improving coordination and operating efficiency, etc. (e.g. James and Sykuta, 2006; Bhuyan, 2007; Nilsson, Svendsen and Svendsen, 2012).

The structural dimension of social capital is manifested as the social ties and interactions in the cooperative community. Horizontally, it supports the dispersion of production technology and knowledge among the members (Peterson and Anderson, 1996). Vertically, when the cooperative processor needs information on members' products and production methods in order to schedule its processing and marketing activities, the structural social capital generates superior information exchange and coordination between the members and processor (Hueth and Marcoul, 2009; Hendrikse and Feng, 2013).

By facilitating common language and meanings, the cognitive social capital supports the collective actions of the members by improving communication efficiency. In addition, when there are mutual understanding and common goals among the members, a consensus in decision-making is easy to achieve. The costs associated with collective decision-making in the cooperative are thus low.

Relational social capital strongly benefits cooperatives by serving as social mechanisms supporting both coordination and control. According to Borgen (2001), coordination and control in cooperatives cannot be fully accomplished by means of prices or authority. Successful cooperatives are characterised by their capacity to overcome this gap with the strength of relational social capital, featured by a high level of trust and strong social norms. As the trust between members makes them believe that nobody will shirk their duties, the cooperative is able to reduce the time and costs spent on expensive controlling measures such as formal contracts, information gathering, monitoring, and surveillance. In addition, the trust of members in their cooperative is a determining factor of members' commitment to the cooperative (James and Sykuta, 2006). According to Fulton (1999: 423), members' commitment is 'the preference of cooperative members to patronize a cooperative even when the cooperative's price or service is not as good as that provided by an IOF'. Committed members are willing to invest in the cooperative and participate in cooperative governance (Österberg and Nilsson, 2009). Furthermore, they are more supportive to the organisational changes of their cooperative (Trechter et al., 2002). Social norms in the cooperative mitigate the opportunistic behaviours and generate certain routines in transactions and collective actions. The costs of formal control and coordination are further saved. As such, the informal mechanisms steered by the relational social capital play a crucial role in cooperative governance by reducing transaction costs (Chloupkova, Svendsen and Svendsen, 2003; Volentinov, 2004).

Chloupkova, Svendsen and Svendsen's (2003:243-244) case study of the Danish cooperative dairy movement highlights the value of a high social capital level. From 1882, an increasing number of Danish peasants committed themselves to deliver all

their milk to their own cooperatives. The cooperatives were formed by circles of energetic entrepreneurs in the local rural communities and 'valuable social capital was created bottom-up' (p.243). The cooperative dairies became very successful and the quality of the butter was increased. It became possible to standardise output and thus demand higher prices. The social control mechanism guaranteed that none of the members would cheat and the milk was delivered in good condition. In general, as a high level of social capital reduces the tendencies to free ride and default for individual advantage (Paldam and Svendsen, 2000), it guaranteed the milk quality under complete pooling while no strict formal control was provided at such an early stage of the Danish dairy cooperatives. Recent evidence from Kenya also shows that the observed differences in the performance of producer cooperatives can be explained by the differences in the organisations' social capital levels (Wambugu, Okello and Nyikal, 2009).

Growth and Consolidation

In stage three of the lifecycle, successful cooperatives become large and complex by expanding horizontally and vertically. Cooperatives tend to adopt market-oriented strategies in order to respond to the increasing competition and changing market situations (Bijman, 2010). While facilitating the growth and competitiveness of cooperatives, the social capital level in cooperatives may decline gradually and become quite low in large and complex cooperatives (Nilsson, Svendsen and Svendsen, 2012). The comparison between small and large grain marketing cooperatives in Sweden shows that the larger the cooperative, the lower the social capital level, which is expressed in members' involvement, trust, satisfaction, and loyalty (Feng and Nilsson, 2012). Nilsson, Kihlén, and Norell (2009) also conclude that the reason for poor member satisfaction, involvement, and trust is that the cooperative in question is very large and complex. Therefore, cooperatives' growth may lay the seeds of their failure because all social capital dimensions are affected by cooperatives' expansion.

First, the structural social capital decreases. The expansion of the cooperative will create a large and heterogeneous membership (Nilsson, Svendsen and Svendsen, 2012). It becomes infeasible for members to maintain social connections with most people in a large society. As a consequence, the social ties between members become weaker, the cohesiveness of member community disappears, the distance between members and management increases, and communication problems emerge (Nilsson, Kihlén and Norell, 2009; Österberg and Nilsson, 2009). The technological developments such as electronic transactions, which have increasingly replaced face-to-face transactions, may also hamper the development and maintenance of intimate connections between members and the cooperative (Byrne and McCarthy, 2005). When the cooperative

becomes large, it needs to hire professional executives, who are not from the membership (Feng, 2011). Information asymmetry between the members and the professional management may increase (Nilsson and Hendrikse, 2011). In addition, as the cooperative develops, members have decreasing involvement the cooperatives' decision making and management becomes increasingly autonomous (Bager, 1996; Hart, 1997; Bhuyan, 2007; Bijman, Hendrikse and van Oijen, 2013). The social ties between the members and cooperative leaders also disappear in large cooperatives.

Second, the large and heterogeneous membership has detrimental effects on the cognitive social capital. According to Hogeland (2006), the culture of traditionally organised cooperatives vanishes gradually as the cooperative expands. The social interactions in cooperatives, which serve as the mechanism to develop and maintain shared beliefs and values, become less frequent when the cooperative membership is large. The pronounced heterogeneity in membership, such as size, geographical location, knowledge, interests, even nationality, makes it difficult for members to develop common values and organisational language. Moreover, cooperative ideology plays a less prominent role in cooperatives nowadays. According to Fulton (1995), changes in society's values are likely to make cooperation more difficult. Profitability becomes the priority of the members. Farmers today, especially the young generation of farmers, are more pragmatic about their cooperatives and members' decisions are based mainly on economic terms (Hakelius, 1999; Karantininis and Zago, 2001).

Finally, following the decline of the structural and cognitive social capital, the relational social capital decreases. Horizontally, with less interaction in the membership, the traditional conditions for personal trust building are no longer in place (Granovetter, 1985). At the same time, 'the larger the group, the lower is its ability to crystallize and enforce norms, including those against free-riding behaviours' (Granovetter, 2005:34). Bijman and Verhees (2011) also find that members' commitment decreases in the geographical size of cooperatives. Vertically, the stricter hierarchical control mechanisms demanded by the vertical coordination may lead to a negative attitude and commitment of the members towards their cooperatives (Hogeland, 2006). The lack of communication between the members and cooperative leaders will lead to low trust of members in management. The shrinking members' control in large cooperatives makes the members care less about the governance of their cooperative and increase the agency costs. As the cooperative becomes large, it acts more like IOFs, and becomes more corporate-oriented (Hind, 1997, 1999; Nilsson and Ollila, 2009). The identification of members with the cooperative weakens (Borgen, 2001). 'Members consider their relationship with the cooperative purely in business terms' (Ollila, Nilsson and Hess, 2013:4), and the behavioural constraints that social mechanisms can place on members are much weaker.

The decrease of social capital in a cooperative in its expansion stage can be attributed to the change in factors that shape the evolution of social capital, namely, time, interaction, interdependence and closure (Nahapiet and Ghoshal, 1998). In general, the expansion of a cooperative over time may change all or most of these factors by modifying the social structure of cooperative community, decreasing the possibility of interactions among members, lowering the interdependency between members, and weakening the identity of membership. Consequently, the trust, common vision, loyalty and other elements of social capital disappear in the minds of the members.

Struggle Against the Vaguely Defined Property Rights Problems

In stage four of the lifecycle, cooperatives are confronted by the 'conflicts over residual claims and decision control', represented by the vaguely defined property rights problems such as free rider, horizon, portfolio, control, and influence problem (Cook, 1995:1156). The common property rights in cooperatives are based on a high degree of collectivism. When there is insufficient social capital to support the collectivism in the governance structure, the common property rights structure is no longer appropriate. The vaguely defined property rights problems surface and become acute (Nilsson, Svendsen and Svendsen, 2012). Essentially, these problems are rooted in the imbalance of the social and economic attributes of cooperatives. In other words, the governance structure featured by collective income and decision rights allocation is no longer coherent with the decreasing social capital level.

Therefore, the vaguely defined property rights problems are typically interrelated with the low level of social capital in cooperatives. Borgen (2004) states that the adversarial consequences of the common property rights are expected to appear in the form of weak membership commitment. The combination of traditional equitable policies and a low level of social capital may cause free-riding problems and the adverse selection of efficient members (Hendrikse, 2011; Pennerstorfer and Weiss, 2013). In addition, the decrease of social capital level forms a vicious cycle with the vaguely defined property rights problems. For example, if members don't have trust in their cooperative's long-run perspective, they will have a strong desire for low retained earnings and a short redemption period, reflected as the horizon problem. On the other hand, the members who become dissatisfied with the common property rights will continuously lose their loyalty towards their cooperative. As such, a low level of social capital aggravates the vaguely defined property rights problems, and in turn, these problems further erode cooperative social capital.

Nilsson, Svendsen and Svendsen (2012:187) posit that 'the drain of social capital in cooperatives is reflected in a lessening of members' involvement for mutual benefits, less collaboration, and decrease in trust in their cooperatives' leaders, as well as in

each other'. With a low level of social capital, members forgo cooperative values and care mainly about individual economic benefits. Furthermore, members lose their loyalty to their cooperative; they are unwilling to sacrifice any short-term loss for a long-term gain; they tend to be free riders and are unwilling to provide equity; they do not trust management anymore and provide adequate commitment to control management; and the collaboration in cooperatives becomes cumbersome and efficiency is lost, to name a few. As the low social capital level jeopardises the foundation of cooperative governance structure, the cooperative loses its competiveness gradually and faces the risk of being abandoned by its members. At the end of stage four, some cooperatives recognise the imbalance of the social and economic attributes of cooperatives and consider options for change, which leads to stage five of the lifecycle.

Exit, Restructuring, or Shifting

In attempting to solve the vaguely defined property rights problems, cooperatives seem to choose among three different strategies (Cook, 1995). Some choose the exit strategies of liquidation or conversion to an IOF structure. Others stay with the cooperative form but decide to restructure or shift the governance structure.

One governance structure restructuring strategy cooperatives can adopt is to change their collective income rights structure into more individualistic forms, e.g. replacing complete pooling with partial or no pooling, introducing individualised and tradable ownership, differentiated member treatment, etc. (Chaddad and Cook, 2004; Hendrikse, 2011). These solutions can be seen as a strategic move of cooperatives to align their economic attributes with the new status of the social attributes. The Greenery is an example of cooperative development and restructuring during stage three to stage five of the cooperative lifecycle. Specifically, The Greenery chose to convert its income rights structure from a collective to an individualistic form (Hendrikse, 2011).

The Greenery is a leading fruit and vegetable company in Europe. As the outcome of a merger of nine Dutch regional fruit and vegetable auction cooperatives, the new cooperative has been struggling in implementing its new strategy and in finding the most appropriate organisation (Bijman, 2002; Hendrikse, 2011). Besides the large size, The Greenery's membership heterogeneity increased due to the fact that 'consumers' demand on more variety and higher quality has induced some growers to innovate' (Hendrikse, 2011:1699). In the first few years after the merger, some large growers left the cooperative because of 'cross-subsidization of small growers' (Bijman and Hendrikse, 2003:102). Meanwhile, some innovative producers also left because the equality principle of pooling limits the payoff they could receive for their innovation

efforts (Hendrikse, 2011). Explained from the social capital perspective, The Greenery, as a large and complex cooperative, has difficulty in maintaining social capital in the organisation. As Bijman (2002:105) points out, the organisational changes after the merger resulted in dissatisfaction among growers and part of the dissatisfaction was caused by 'a lack of communication between The Greenery and members'. Members' loyalty and commitment is no longer in place to serve as their social motivation to stay with and deliver to the cooperative. Driven mainly by economic benefits, the members who are not compensated for their higher product quality or larger volume would simply leave the cooperative to trade with IOFs or form a new cooperative. This process was finally countered by the introduction of member benefit programmes in The Greenery, which 'increased the number and extent of quality attributes covered by specific clauses in the incentive contracts' (Hendrikse, 2011:1699). It entails that members realise the payoff for higher product quality by receiving a quality-specific price. With the member benefit programmes, the cooperatives adopted strong and individualistic quality incentives. The Greenery case illustrates the necessity of adjusting the income rights structure according to the cooperative's social attributes. In a large and complex cooperative with heterogeneous membership, when social capital seems to have played a limited role in members' decision making, adopting individualistic income rights allocation is necessary.

Instead of changing the income rights structure, cooperatives can also choose to maintain or recover social capital during the development of the organisation. Although it may become increasingly difficult as the membership base expands and becomes more heterogeneous (Valentinov, 2004), it can still be very successful. However, as social capital takes a long time to build, it thus requires management's continuous efforts and great endeavour (Putnam, 1993).

Uzea and Fulton (2009) provide empirical evidence of the Co-operative Retailing System (CRS) in Canada, where the identity management has successfully been used, together with economic mechanisms, to manage opportunisms in a large cooperative, such as shirking on quality maintenance of the cooperative brand name, patronising outside and overexpansion. CRS is a network of about 264 retail co-operatives and their wholesaler, Federated Co-operatives Limited (FCL). The strategy of FCL to maintain social capital mainly consists of 'identity management' (p.12), which includes establishing CRS identity, fostering retails' identification with the system and establishing succession planning. Empirical study has shown that the strong identification is a significant trust-making mechanism in cooperative organisations (Borgen, 2001). CRS successfully removed individualistic norms, created cooperative norms, enhanced common and mutual understanding, shared knowledge and promoted loyalty. By inducing the members to identify with the network, members have the

desire to 'act in compliance with one's own identity' (p.5). With all these measures to maintain the cognitive and relational social capital, the robust cooperation among members is promoted. In combination with identity management, the economic mechanisms of CRS such as the patronage refund system and the marketing programme are also introduced to deter opportunisms by the retails. For example, the patronage refund system, which distributes part of the net savings to members in proportion to their patronage, 'provides retails strong incentive to operate in the system' (p.22). The well-designed social and economic mechanisms brought great success to CRS. It is worth noticing that the social capital in CRS, represented by retails' identification with the system, is reinforced by the success of the CRS. The success of CRS demonstrates that it is possible to achieve cooperative success by strategically building cooperative social capital in combination with economic mechanisms. The CRS case shows that both recovering the social capital level and introducing individualistic incentive structures will help support cooperative performance. Importantly, individualistic incentives complement the maintenance of social capital. Therefore, it entails that a high social capital level and an individualistic governance structure can form a coherent system of attributes.

2.4 Management Implications

In this section, we focus on the implications of the study of social capital for the management practice in cooperatives and discuss how cooperatives can maintain and create social capital.

Agricultural cooperatives have been faced with the challenges of new market conditions. To respond to the intensified competition and differentiated demands of the market, many cooperatives choose to expand horizontally or/and vertically (van der Krogt, et al., 2007). As a consequence, cooperatives become large in size and complex in organisational structure. Meanwhile, cooperatives start to adopt the competitive strategies and control mechanisms similar to those used usually by the IOFs (Bijman and Wollni, 2008). Cooperatives nowadays are becoming more and more akin to IOFs, and gradually, 'members consider their relationship with the cooperative purely in business terms' (Ollila, Nilsson and Hess, 2013:4). However, all these strategies of a cooperative aiming for economic success are at the cost of its social capital, which happens to be the cooperative's comparative advantage over IOFs. According to Nilsson, Svendsen and Svendsen (2012:194):

> 'If a cooperative is not aware of its comparative advantage in terms of social capital, and therefore does not protect it, it risks losing this form of capital in the process of developing into a large-scale enterprise. Consequently, profits

> from economies of scale and scope may be outweighed by loss of social capital mirrored in less trust among members and between members and leaders, alienation and passivity among members, low involvement, weak democratic governance, private good provision rather than collective good provision, widespread free riding, low satisfaction, and loss of solidarity.'

Cooperatives largely rely on members' collective actions. Our discussion of cooperative social capital along the lifecycle suggests that social capital can be regarded as a key success factor of cooperatives. Therefore, when cooperatives respond to changing market conditions and modify their structures from the traditional to innovative forms, they must develop means to maintain or even increase social capital (Ollila, Nilsson and Hess, 2013). The primary mechanisms by which social capital can be maintained and increased reside in each social capital dimension. First, as the structural dimension serves as the basic resource for the creation of social capital, the most obvious way for a cooperative to build social capital is to foster the social relationships among its members (Leana and van Buren, 1999). Cooperatives should invest in maintaining the membership network by promoting social interactions between members. This can be done by creating social events and gatherings of members, developing an appropriate communication policy, organising workshops and training seminars, and so on. In addition, cooperatives should put efforts into keeping the membership stable. According to Inkpen and Tsang (2005), 'a highly unstable network may limit the opportunities for the creation of social capital, because when an actor leaves the network, ties disappear'.

Second, the cognitive dimension can be developed through the effective communication of cooperatives' shared goals and values. Cooperatives should provide education about the nature and benefits of cooperation to members to reinforce the cooperative ideology (Byrne and McCarthy, 2005). Cooperatives can also establish shared vision by selecting and rewarding members who value working collectively (Leana and van Buren, 1999). As frequent interactions evoke the development of shared language and understanding among group members, the suggested investment in the structural dimension will also benefit the growth of cognitive social capital.

Finally, drawing on the discussion in Section 2.2, the relational dimension is highly dependent on the development of the first two dimensions. Consistent with this idea, the cooperative's investment in the structural and cognitive dimension will ultimately lead to the development of its relational social capital. For example, frequent communication between the members and management will enhance the trust and loyalty of members towards the cooperative (Barraud-Didier et al., 2012). Trechter et al., (2002) also show that cooperative communication strategies have the potential to

increase members' commitment. In addition, cooperatives should develop measures to encourage members to participate in cooperative governance. Previous study suggests that members' access to information and their feeling of control over the cooperative strengthen their trust and commitment (e.g. Fulton, 1999; Birchall and Simmons, 2004; Byrne and McCarthy, 2005; Österberg and Nilsson, 2009). Finally, the case of CRS described in the previous section provides an illustrative example of recovery of social capital through strengthening cooperative identity.

Furthermore, cooperatives should pay attention to the complex relationship between social capital and governance structure. In the last stages of the lifecycle, many cooperatives confront the vaguely defined property rights problems by introducing individualistic income rights structure and transferable and appreciable equity shares. This change of cooperative governance structure provides members with more economic motivation for patronage commitment and equity contribution. However, the consequence of this motivation on cooperative social capital is still unclear. One possibility is that the new governance structure with strong and individualistic economic incentives will lead to economic success of the cooperative and social capital is in turn reinforced by the economic success. This phenomenon can be found in the CRS case described above. Cechin et al. (2013a) also find that stricter hierarchical control mechanisms actually have a positive effect on members' commitment. In this situation, the individualistic governance structure and a high social capital level form a new coherent system of attributes. Another possibility is that strong and individualistic economic incentives in combination with formal control mechanisms will crowd out the intrinsic motivation of members and suppress trust (Malhotra and Murnighan, 2002; Bowles and Polania-Reyes, 2012). It decreases the cooperative's social capital level. Ultimately, the cooperative is featured by an individualistic governance structure and a low social capital level in the system of attributes, which is similar to IOFs. Therefore, a better understanding of both possibilities is crucial for cooperative leaders when they consider the change in governance structure.

2.5 Conclusion and Further Research

In this chapter, we seek to understand how social capital exists within cooperatives and how social capital affects the cooperative business. We adopt Nahapiet and Ghoshal's (1998) conceptualisation of social capital, and provide an integrated analysis of the structural, cognitive and relational dimensions of social capital in cooperatives. Specifically, we complement the previous research on cooperative social

capital by delineating the links between the three dimensions of social capital and the governance structure of cooperatives.

The second focus of this chapter is to study the social capital in cooperatives from the perspective of the cooperative lifecycle (Cook, 1995). During the early stages of the lifecycle, the social capital level in cooperatives is high. It serves as the basis for the formation, survival, and success of cooperatives. The high level of social capital in cooperatives deters free-riding behaviour and promotes stable cooperation among members. However, social capital in cooperatives will decline as the cooperatives become large in size and complex in structure. Cooperatives' market-oriented strategies and approaches of horizontal and vertical expansion may bring economic success, but in the meantime, the loss of social capital may outweigh the economic gain. When the low level of social capital upsets the balance between social and economic attributes, the cooperative may lose its efficiency. Cooperatives in this stage of the lifecycle shall adopt strategies that can rebalance the social and economic attributes, either by restoring cooperative social capital or by changing income rights structure.

In order to sustain organisational social capital, Leana and van Buren (1999) argue that it is important for the organisation and its members to understand the benefits and value of social capital. Therefore, cooperative leaders shall be aware of the differences between cooperatives and IOFs and pay special attention to the social attributes of their organisations. Moreover, management shall elicit efforts of members in maintaining social capital in their cooperatives. We offer some suggestions on the sustaining and recreation of social capital in large and modern cooperatives. These measures cover the different dimensions of social capital. In addition, as the relationship between social capital and governance structure is still equivocal, cooperatives should take the potential costs of social capital into consideration when any decision of cooperative restructuring is made.

Given the significant importance of cooperative social capital, further research on this topic is warranted. We would like to suggest some avenues for further theoretical and empirical work. Researchers can further explore the dimensions of social capital to identify the means by which these dimensions affect each other and affect other important organisational outcomes. Furthermore, each social capital dimension consists of several facets. The nature of how each facet relates to the other facets of the same dimension and the facets of other dimensions is not precisely formalised. It requires further investigation. The outcome of this type of research will provide practical implications for cooperative decision makers who want to maintain and

recreate cooperative social capital effectively and, in turn, sustain cooperatives' comparative advantage.

Second, we analyse the internal social capital of cooperatives on the organisational level in this chapter, however, the external/bridging social capital held by specific individuals may affect the behaviour of the individuals and the performance of organisations as well (Burt, 1992). External social capital is often operationalised in research as the social connections held by top managers (Leana and Pil, 2006). The research on Chinese cooperatives shows that, the CEO and core members play an important role in their cooperative due to their rich external contacts and social resources (Liang, 2013). This type of social capital is beyond the scope of the present chapter and deserves more investigation.

Finally, we focus only on the positive side of social capital so far. However, social capital may also have a 'dark side' (Nooteboom, 2007:35). The cohesiveness of cooperative society may be harmful for the cooperative development in some respects. For example, Leana and van Buren (1999) point out the maintenance costs associated with social capital. In addition, excessive social capital may also result in an overly closed network, limiting access to external resources, and impeding actors' ability to adapt to changing task environments (Uzzi, 1997; Gargiulo and Benassi, 1999). The trade-off between the positive and negative impacts of the social capital needs to be further evaluated.

3. Uncertainties and Governance Structure in Incentives Provision for Product Quality[10]

Abstract

This chapter compares product quality provisions of cooperatives and investor owned firms (IOFs) by highlighting the impacts of two types of uncertainty on agricultural production and marketing, and farmers' risk aversion. In a principal-agent model, we show that the linear contract can shift the risk of market uncertainty from farmers to processors, and pooling can share the risk of production uncertainty among cooperative members. Complete pooling makes the cooperative in a disadvantageous position in the competition with the IOF in a quality-differentiated market due to the loss of free-riding dominating the gain of risk sharing. Product quality of cooperatives decreases when the membership size increases. Cooperatives can overcome this disadvantage by partial pooling. Product quality of cooperatives will be equivalent to that of IOFs when an optimal income rights structure with partial pooling is adopted.

Keywords: Quality, Cooperative, Investor Owned Firm, Pooling

3.1 Introduction

In the organisational economics literature, cooperatives are commonly considered less efficient in terms of delivering high-quality products to market. Saitone and Sexton (2009:1224) list a number of disadvantages of cooperatives in the provision of product quality, including: '(i) revenue pooling, which in quality-differentiated markets is generally regarded as disadvantageous due to the potential for adverse selection; (ii) patronage-based financing, which leads to the horizon problem and underinvestment in long-term strategies that can enhance objective or perceived product quality; (iii) providing a "home" for member production, which is problematic both with respect to product quality and the potential to glut niche markets; (iv) difficulties in terminating "marginal" members; and (v) limitations on procuring product from nonmember sources.' These considerations have led to the pessimistic prospect of cooperatives' future regarding their ability to compete and survive in the modern agricultural markets (Fulton, 1995; Cook, 1995).

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However, nowadays there are many large cooperatives active in the market, competing with investor owned firms (IOFs) for market share by delivering products with superior quality. For example, in the Brazilian broiler industry, Cechin et al. (2013b) find that suppliers delivering to a cooperative are performing better in terms of quality than suppliers delivering to an IOF are. Another empirical observation raising doubts about the prospects for cooperatives is that in many sectors, they coexist with IOFs. Mérel et al. (2009) posit that several particular characteristics of cooperatives, such as the preference of consumers for cooperative products, better communication, insurance function of pooling, etc., have the potential to counterbalance the disadvantages of cooperatives in the provision of product quality. Other cooperative researchers consider the components of social capital in cooperatives, such as identification and trust, as cooperatives' comparative advantage in the competition with IOFs (Uzea and Fulton, 2009; Feng et al., 2011; Nilsson et al., 2012).

This chapter formulates a principal-agent model regarding the provision of product quality by different governance structures, including self-processing, cooperative and IOF. The impacts on product quality of three aspects are highlighted: farmers' risk-aversion, uncertainties, and (partial) pooling. First, although farmers are usually regarded as risk-averse (Staatz, 1987), this characteristic is not explicitly captured in most of the conceptual models analysing the decision-making of cooperative members. Second, agricultural production and marketing are subject to different types of risk, including biological, price, and institutional (Bogetoft and Olesen, 2004). We highlight two types of risk in agribusiness: the risk of market uncertainty and production uncertainty (Knoeber and Thurman, 1995). Third, a pooling policy is often adopted by cooperatives (Hendrikse, 2011). We show that a cooperative with a complete pooling policy will have lower product quality than an IOF. The growth of the cooperative membership will hamper the cooperative's provision of product quality. Cooperative researchers have pointed out that large cooperatives have to adopt a strong incentive structure by paying a quality-specific price to the members with high product quality (Hendrikse, 2011). We investigate how a large cooperative can maintain an high product quality level by designing an optimal income rights structure with partial pooling, which is effective because it provides on the one hand insurance to risk-averse farmers and on the other hand incentives for high-quality products. In this chapter, because we address the relationship between income rights structures and product quality in a standard economic model, the impact of social capital on the provision of product quality is not included. Chapter 4 extends the current model and formally analyses the relational dimension of cooperative social capital.

The remainder of this chapter is organised as follows. In Section 3.2, we formulate the model. Section 3.3 compares the quality provision of different governance structures.

In Section 3.4, we investigate the design of a cooperative's income rights structure, and determine the optimal income right structure for large cooperatives. Section 3.5 discusses the findings and the last section concludes.

3.2 Model

This section develops a non-cooperative game with a group of upstream farmers and a downstream processor. Assume that there are N identical farmers in a region producing a certain raw commodity that needs to be processed before reaching the final market. The farmers each produce only one unit of the raw produce and individually make decisions regarding the quality of their produce. The cost related to the product quality provision of farmer i, where $i = 1,2,\dots,N$, is $C(q_i) = \frac{1}{2}cq_i^2$.

The quality provision cost coefficient c is identical for all farmers and is treated as a constant. Without loss of generality, the production costs of the raw produce, and the processing costs and valued-added of the final product are sunk and will not enter into the analysis (Mérel et al., 2009). We also assume that one unit of the raw produce will be processed into one unit of the final product. We refer to the difference in the quality as in the realm of vertical product differentiation (Mérel et al., 2009). The quality of the raw produce determines the quality of the final product, and the processing itself cannot change the product quality.

The farmers are risk-averse, their von Neumann-Morgenstern utility function of an uncertain economic payoff π_i $(i = 1,2,\dots,N)$ is $U_i = -\exp(-r\pi_i)$. Parameter r, which is assumed identical for all farmers, is the farmers' coefficient of absolute risk aversion, i.e. the higher r is, the more risk averse the farmers are.

We highlight two types of risk in our model. The first type of risk is from the market uncertainty. Because we want to investigate the provision of product quality, in the current model we only try to capture the uncertainty in the market's preference of product quality. Assuming that the market is competitive and quality-differentiated, the final product's unit price in the market increases linearly with the product quality, nevertheless, with a certain level of uncertainty:

$$P_m = (P_0 + \epsilon_1)q.$$

q (> 0) denotes the quality of the final product sold, which is determined by the quality of the raw produce, and the coefficient $P_0(> 0)$ denotes the marginal market price with respect to the product quality. P_0 can also be understood as the market's aggregate 'taste parameter' in the model of Mussa and Rosen (1978:301). The utility that the market derives from consuming one unit of the product with the quality of q is

$P_0 q$, and it pays the equivalent price $P_0 q$ to the product seller. The market prefers higher ranked quality by paying a higher price as $P_0 > 0$. However, the preference or taste of the market is uncertain. Therefore, there is a normally distributed random noise term ϵ_1 in the marginal market price, with mean zero and variance ρ_1^2.

The second type of risk is from the uncertainty in agricultural production per se. Assuming that farmer i's planned quality for his production is q_i. However, his realised product quality after harvest is $q_i + \epsilon_{2i}$, where ϵ_{2i} is a normally distributed random noise term, with mean zero and variance ρ_{2i}^2, representing the uncertainty in his production. We assume that production uncertainty is common for all farmers, i.e. $\epsilon_{2i} = \epsilon_2, \rho_{2i}^2 = \rho_2^2$. The variances ρ_1^2 and ρ_2^2 represent the objective risk of the market and production, respectively.

Three governance structures regarding the processing of a farmer's produce will be considered: self-processing, cooperative and IOF. In the following, we will analyse how the risk of market and production uncertainty affects the farmers' utility when they trade with different processors, and the consequence on the provision of product quality.

Self-processing

Consider the situation where a farmer processes the raw produce into the final product by himself, and then sells the final product in the market directly. In self-processing, a farmer, also as the processor, sells the product in the market and will receive price P_m from the market according to his product quality q_i. There is indeed no contract between the farmer and processor. Farmer i's economic payoff is

$$\pi_i = (P_0 + \epsilon_1)(q_i + \epsilon_2) - \frac{1}{2} c q_i^2.$$

The farmer's utility function is

$$U_i = -\exp\left\{-r\left[(P_0 + \epsilon_1)(q_i + \epsilon_2) - \frac{1}{2} c q_i^2\right]\right\}.$$

The farmer's certainty equivalent payoff is

$$CE_i = P_0 q_i - \frac{1}{2} c q_i^2 - \frac{1}{2} k_1 q_i^2 - \frac{1}{2} k_2 P_0^2 + CE(\epsilon_1 \epsilon_2),$$

where $k_1 = r\rho_1^2, k_2 = r\rho_2^2$ denote the farmer's subjective risk towards the market and production uncertainty, respectively. Each term of subjective risk is the corresponding objective risk scaled by the farmer's degree of aversion (see Bolton and Dewatripont, 2005, Chapter 4). The term $\frac{1}{2} k_1 q_i^2$ and $\frac{1}{2} k_2 P_0^2$ are risk premiums, which are the

disutility of risk. $CE(\epsilon_1\epsilon_2)$ is the risk premium of the joint contribution of the market and production uncertainty. It is negative and decreases when the market and production uncertainty increases.

The farmers can also sell the raw produce to an enterprise processor. The enterprise processor has one of the two governance structures: an open-membership cooperative or an IOF. We model the transactions between the enterprise processor and the farmers in a principal-agent framework (Holmström, 1979). The processor acts as a principal, and the farmers are agents who are rewarded by the outcome of their efforts invested in the product quality. The efforts per se are not observable, but the quality q of the delivered raw produce from the farmers to the processor is contractible. The processor offers the farmers a linear contract stating the payment formula as

$$P = \alpha + \beta q.$$

P is the unit price of the raw produce that the processor will pay for. α (≥ 0) is the base (guarantee) price and β (≥ 0) is the incentive regarding the product quality or the quality premium. An important function of the linear contract between the principal and agent is to 'balance the costs of risk bearing against the incentive gains' (Milgrom and Roberts, 1992:207). This form of contract is commonly used in agribusiness, whether the processor is an IOF or a cooperative (Gow et al., 2000; Cechin et al., 2013b).

Cooperative

Confronted with the market and production uncertainty, the individual farmers, who used to process individually and trade directly in the market, may have incentive to form a marketing cooperative with an open-membership policy. The members of the cooperative jointly own the processor, but the farmers remain independent regarding their quality decisions. We assume that the cooperative adopts the traditional principle of complete pooling policy. This assumption will be relaxed later. The marketing contract between the cooperative and the members has the payment formula as follows:

$$P_c = \alpha_c + \beta_c Q_c$$

$$Q_c = \frac{1}{n}\sum_{i}^{n}(q_i + \epsilon_{2i}).$$

The price consists of a fixed base price α_c and a quality-incentive β_c. In complete pooling, the cooperative enacts a single pool for all products with various qualities, and the members share equitably on a per-unit basis in the revenue stream that has been created (Saitone and Sexton, 2009). This equality principle distributes the net revenue to members based on the delivered volume, regardless the quality of the

product. Therefore, in the payment formula of the marketing contract, the quality incentive is related to the pooled or aggregate quality Q_c instead of the individual product quality q_i, since the cooperative will also receive revenues from the market based on Q_c. A member i's economic payoff is

$$\pi_i = \alpha_c + \beta_c Q_c - \frac{1}{2} c q_i^2.$$

And the member's utility function is

$$U_i = -\exp\{-r[\alpha_c + \frac{\beta_c}{n} \sum_i^n (q_i + \epsilon_{2i}) - \frac{1}{2} c q_i^2]\}.$$

Different from the utility function of the self-processing farmers who trade directly in the market, the subjective risk towards market uncertainty k_1 is not in the member's utility function. This is because the members are not selling their products to the final market directly. Instead, they sell to the market via the cooperative they own and they are insulated from the market uncertainty ϵ_1 and risk σ_1^2. Their projected income is then decided by the payment formula P_c. A member's certainty equivalent payoff is

$$CE_i = \alpha_c + \frac{\beta_c (q_i + Q_{-i})}{n} - \frac{1}{2} c q_i^2 - \frac{1}{2} k_2 \frac{\beta_c^2}{n}.$$

Notice that Q_{-i} is the sum of the quality decisions of the other members besides member i and $\sum_i^n \epsilon_{2i}$ has a normal distribution with variance $n\sigma_2^2$. We can see that complete pooling reduces the member's risk premium term $\frac{1}{2} k_2 \frac{\beta_c^2}{n}$ related to the production uncertainty by a factor of $\frac{1}{n}$. It captures the risk sharing function of pooling.

IOF

An IOF procures the raw produce of the farmers and sells the processed products in the same final market. The contract the IOF offers to the farmers is

$$P_f = \alpha_f + \beta_f q_i.$$

Similarly, the price consists of a fixed base price α_f and an individualised quality-incentive β_f, and with this contract, the farmers are not faced with the market uncertainty ϵ_1 and risk σ_1^2 directly. Differently, the quality incentive is now based on the individual instead of pooled product quality. The economic payoff of a farmer i, who trades with the IOF, is

$$\pi_i = \alpha_f + \beta_f q_i - \frac{1}{2} c q_i^2.$$

His utility function is

$$U_i = -\exp\left\{-r\left[\alpha_f + \beta_f(q_i + \epsilon_{2i}) - \frac{1}{2}cq_i^2\right]\right\}.$$

And, his certainty equivalent payoff is

$$CE_i = \alpha_f + \beta_f q_i - \frac{1}{2}cq_i^2 - \frac{1}{2}k_2\beta_f^2.$$

Different from the certainty equivalent payoff of the cooperative members, in farmer i's certainty equivalent payoff, both the quality incentive and risk premium of the production uncertainty are individualised. Table 3.1 lists the players' decisions in three different governance structures.

Table 3.1: Decisions of the farmers and the processor

	Self-processing	**IOF**	**Cooperative**
Processor	-	α_f, β_f	α_c, β_c
Farmer i $(i = 1, 2, \dots, N)$	q_i	q_i	q_i

Assume that the farmers' coefficient of absolute risk aversion, quality provision cost coefficient, production uncertainty, and the market's preference and uncertainty are common knowledge. The product quality is perfectly measurable. The timing of the two-stage game is as follows: (i) the principal (processor) chooses the α and β of the payment formula; (ii) the agents (farmers) choose the product quality to maximise their certainty equivalent payoff. This game will be solved by backward induction.

3.3 Equilibrium

In this section, we derive the equilibrium product quality in different governance structures and compare the farmers' certainty equivalent payoff.

Self-processing

The self-processing farmer's decision regarding product quality is obtained by the FOC (first-order condition) of his certainty equivalent payoff:

$$\frac{\partial CE_i}{\partial q_i} = P_0 - k_1 q_i - cq_i = 0$$

$$q_i^* = \frac{P_0}{c + k_1}.$$

The result entails that if the farmer trades directly in the market, the quality of the product is determined by his subjective risk towards the market uncertainty k_1. The

product quality will be reduced if the farmer's subjective risk towards the market uncertainty is high. The production uncertainty doesn't play a role in the quality decision because it is intrinsic and the farmer cannot change the disutility from the production uncertainty by choosing his product quality. However, it determines whether the farmer will participate in the market. The farmer's certainty equivalent payoff is

$$CE_i^* = \frac{P_0^2}{2}\left(\frac{1}{c + k_1} - k_2\right) + CE(\epsilon_1\epsilon_2).$$

Assuming that the farmer's reservation certainty equivalent payoff is zero, when k_1 and k_2 is so large that $CE_i^* < 0$, the farmer is not willing to participate in the market.

Cooperative

The cooperative members make their decisions individually. Member i's decision on his product quality is obtained by the FOC of his certainty equivalent payoff:

$$\frac{\partial CE_i}{\partial q_i} = \frac{\beta_c}{n} - cq_i = 0$$

$$q_i^* = \frac{\beta_c}{nc}.$$

While the subjective risk towards market uncertainty k_1 doesn't play a role in members' decisions now, the cooperative's membership size n and quality incentive β_c jointly determine the member's decision regarding product quality. As the cooperative becomes large in terms of n, while the policy of complete pooling attenuates the production risk of individual members by risk sharing, it also causes an offsetting impact – the members will free ride on other members' efforts in product quality improvement. The members have little incentive to supply high-quality product, since each member's share is relatively insensitive to his effort level in a large organisation. When any individual effort will not be directly rewarded, it gives rise to free riding. Because all members are identical, the cooperative's aggregate product quality is

$$Q_c^* = \frac{\beta_c}{nc} + \frac{1}{n}\sum_i^n \epsilon_{2i}.$$

For the members, the risk of market uncertainty is now placed on the cooperative processor. In fact, this risk cannot be completely shifted from the members to the processor because the members are also the decision makers and residual claimants of the processor. They are actually the same people. Therefore, farmer cooperatives are

usually regarded as risk averse in decision-making (Vitaliano, 1983; Staatz, 1987). However, the risk sharing is still possible between the members and processor because 'the equity in the cooperative can be used as a buffer to absorb temporary fluctuations in profits' (Bogetoft and Olesen, 2004:193). In the current model, we assume that the cooperative can execute this buffering function and treat the cooperative processor as risk-neutral regarding the decision of the payment formula. Assuming that the processing costs and valued-added of the cooperative processor is sunk, the processor retains no earnings and its objective is to maximise the joint certainty equivalent payoff of the processor and members, which is

$$\pi_c = E\left[nP_0Q_c^* - \frac{n}{2}cq_i^{*2} - \frac{n}{2}k_2\frac{\beta_c^2}{n}\right] = n\left(\frac{P_0\beta_c}{cn} - \frac{1}{2}\frac{\beta_c^2}{cn^2} - \frac{1}{2}k_2\frac{\beta_c^2}{n}\right).$$

Following the FOC regarding β_c ($0 \le \beta_c \le P_0$):

$$\frac{\partial \pi_c}{\partial \beta_c} = \frac{P_0}{cn} - \frac{\beta_c}{cn^2} - \frac{k_2\beta_c}{n} = 0$$

$$\beta_c^* = \frac{P_0}{\frac{1}{n} + ck_2}.$$

It entails that the cooperative's quality incentive payment β_c^* should increase with membership size but decrease with the members' subjective risk towards production uncertainty. The cooperative's expected aggregate product quality is

$$Q_c = E\left[\frac{\beta_c^*}{nc} + \frac{1}{n}\sum_i^n \epsilon_{2i}\right] = \frac{P_0}{c(k_2nc+1)}.$$

The member's certainty equivalent payoff is

$$CE_i^* = \frac{P_0^2}{2c(k_2nc+1)}.$$

The result shows that, in comparison with self-processing farmers, the members of the cooperative with a complete pooling policy can always obtain a positive certainty equivalent payoff because the cooperative processor bears the risk of market uncertainty for its members. However, due to the increasing free-riding problem, the cooperative's aggregate product quality and members' certainty equivalent payoff decreases when its membership size increases.

IOF

The farmer trading with the IOF makes the decision of product quality based on the FOC of his certainty equivalent payoff:

$$\frac{\partial CE_i}{\partial q_i} = \beta_f - cq_i = 0$$

$$q_i^* = \frac{\beta_f}{c}.$$

Owned by investors who can hold diversified portfolios, the IOF is modelled as risk-neutral. Assuming that the processing costs and valued-added of the IOF processor is sunk, it will maximise its total economic payoff subject to the farmers' participation constraint. The farmer's reservation certainty equivalent payoff R is assumed equal to the certainty equivalent payoff of the cooperative members:

$$R = \frac{P_0^2}{2c(k_2nc + 1)}.$$

The participation constraint of the farmers to deliver his raw produce to the IOF is

$$CE_i^* = \alpha_f + \beta_f q_i^* - \frac{1}{2}cq_i^{*2} - \frac{1}{2}k_2\beta_f^2 \geq R.$$

The IOF will simply pay the lowest possible fixed payment so that the farmers are willing to deliver:

$$\alpha_f^* = R - \frac{\beta_f^2}{2c} + \frac{1}{2}k_2\beta_f^2.$$

The total expected payoff of the IOF is

$$\pi_f = E\left[nP_0q_i^* - n\left(\alpha_f^* + \beta_f q_i\right)\right] = n\left(\frac{P_0\beta_f}{c} - \frac{1}{2}k_2\beta_f^2 - \frac{\beta_f^2}{2c} - R\right).$$

The IOF maximises its payoff by choosing β_f $(0 \leq \beta_f \leq P_0)$:

$$\frac{\partial \pi_f}{\partial \beta_f} = n\left(\frac{P_0}{c} - k_2\beta_f - \frac{\beta_f}{c}\right) = 0$$

$$\beta_f^* = \frac{P_0}{1 + ck_2}.$$

Given the contract offered by the IOF, the farmer's decision on the product quality can be obtained. As all farmers are identical, and assuming that there are m farmers supplying the IOF, the expected aggregate product quality of the IOF is

$$Q_f = E\left[\frac{\beta_f^*}{c} + \frac{1}{m}\sum_i^m \epsilon_{2i}\right] = \frac{P_0}{c(1 + ck_2)}.$$

From the equation above, we see that the farmers' subjective risk towards production uncertainty k_2 determines the IOF's product quality. The farmers' certainty equivalent payoff is equal to his reservation certainty equivalent payoff and the IOF keeps the remaining part of the payoff of each unit of the product. The IOF exists because by offering the contracts to the non-member farmers, it also insures them from the market uncertainty and elicits supplies.

Comparison

Table 3.2 presents the comparison of the product quality, farmers' certainty equivalent (CE) payoff and the processor's payoff per unit of product in different governance structures.

Table 3.2: Product quality and CE payoff in the three governance structures

	Self-processing	**IOF**	**Cooperative**
Product Quality	$\frac{P_0}{c+k_1}$	$\frac{P_0}{c(1+ck_2)}$	$\frac{P_0}{c(1+nck_2)}$
Farmers' CE Payoff	$\frac{P_0^2}{2}(\frac{1}{c+k_1}-k_2)+CE(\epsilon_1\epsilon_2)$	$\frac{P_0^2}{2c(1+nck_2)}$	$\frac{P_0^2}{2c(1+nck_2)}$
Processor's Payoff	*n.a.*	$\frac{P_0^2}{2c(1+ck_2)}$ $-\frac{P_0^2}{2c(1+nck_2)}$	*0*

When the farmers process individually and trade directly in the market, the product quality is merely decided by their subjective risk towards the market uncertainty. However, when the farmers' subjective risk towards the market and production uncertainty is too large to produce a non-negative certainty equivalent payoff, they will not participate in the market. By contrast, when the farmers trade with a (enterprise) processor, the risk of market uncertainty is shifted from the farmers to the processor through the contract. This result is supported by empirical findings (Knoeber and Thurman, 1995; Franken, Pennings and Garcia, 2009), and it may justify the trend that, fewer and fewer products are traded on open markets and production contracts are becoming more common (Bogetoft and Olesen, 2004). However, the farmers still face the risk of production uncertainty. The product quality will thus be determined by the contract offered by the processor, which balances the production risk bearing and incentive provision.

The cooperative has an advantage over self-processing, since the risk-averse farmers can always earn a positive certainty equivalent payoff as members of the cooperative in an uncertain market. This provides a justification for the formation of agricultural cooperatives. However, the complete pooling policy is problematic. Although the

complete pooling policy can bring the benefits of risk sharing that supports the quality provision of the cooperative, it goes at the detriment of its members' incentive in quality improvement. With the complete pooling policy, when a new member joins the cooperative, the loss from the free-riding dominates the benefit of risk sharing. In addition, the cooperative is not able to provide sufficient incentives for the provision of product quality. As a consequence, the cooperative's product quality will continuously decrease as its membership size increases.

Instead of using the quality incentive based on pooled quality, the IOF processor offers the farmers quality incentive based on individual product quality. Without pooling, the individualised incentive will expose the farmers to more production uncertainty. However, the IOF processor can design an optimal contract which reaches a trade-off between providing incentives and minimising the cost of risk. Therefore, the IOF processor is able to elicit farmers to deliver products with higher quality. We can formulate the first proposition as follows:

Proposition 1: The product quality of the cooperative with a complete pooling policy is always lower than that of the IOF.

Figure 3.1 provides a graphical illustration that compares the product quality of the IOF and the cooperative.

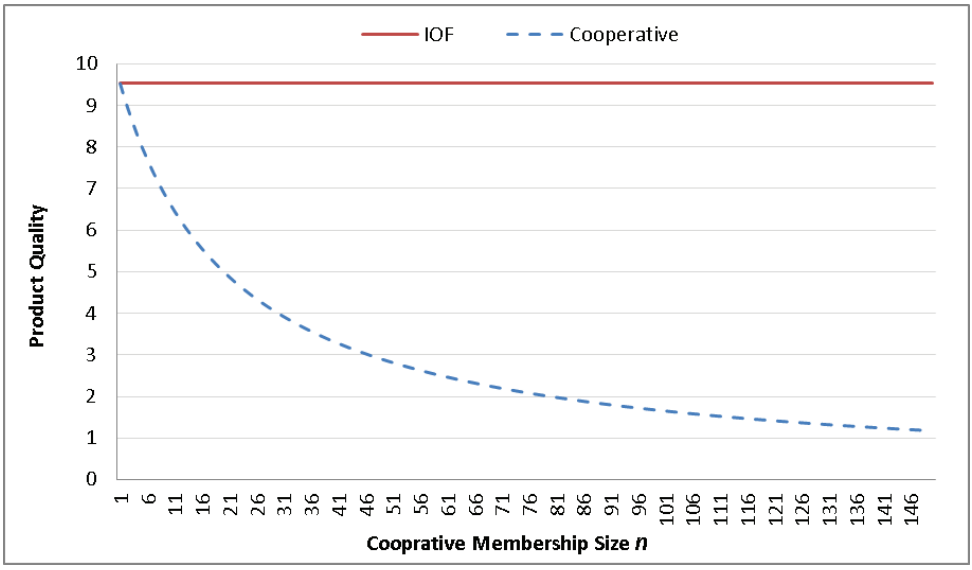

Figure 3.1: Product quality

How will the farmers choose the processor? As discussed previously, if self-processing and trading directly in the market brings no positive certainty equivalent

payoff to the farmers due to the large uncertainties, i.e. $\frac{P_0^2}{2}\left(\frac{1}{c+k_1}-k_2\right)+CE(\epsilon_1\epsilon_2)\leq 0$, no farmers will participate in the market alone. They either form a cooperative or trade with the IOF. Assuming that both a cooperative and an IOF exist, they attract the supplies from the farmers in the same region. Figure 3.2 illustrates the competition between the cooperative and the IOF over raw produce supplies.

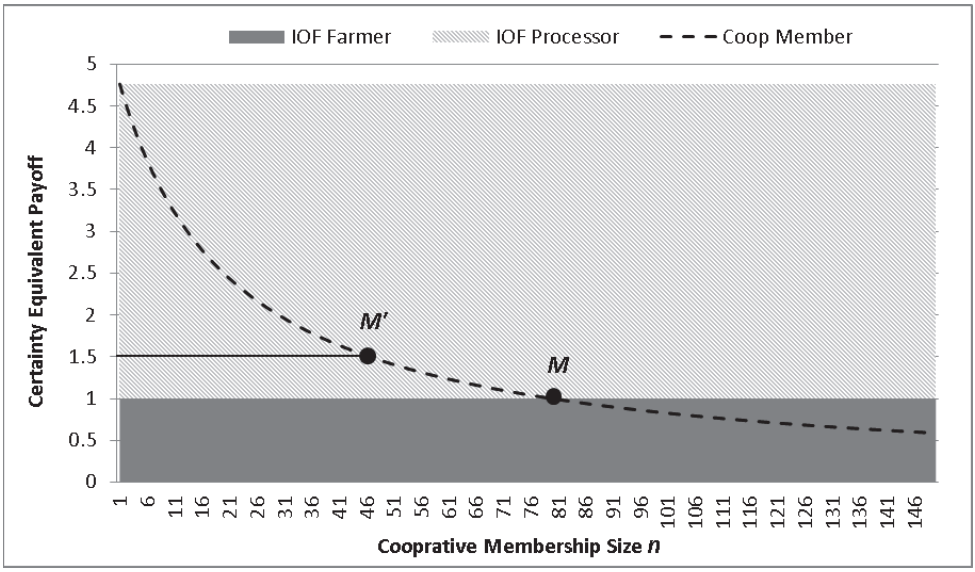

Figure 3.2: Certainty equivalent payoff

When the cooperative's membership size is M, each member's certainty equivalent payoff is equal to 1. The IOF processor designs the contract subject to the farmers' participation constraint, which will be equal to 1. The cooperative's membership size will no longer grow because each member's certainty equivalent payoff will be less than 1 if more farmers join the cooperative, and as a consequence, some members will leave and turn to the IOF. However, if the IOF processor wants to attract more suppliers, it can simply modify the contract it offers to the suppliers by increasing the base payment α_f. As such, the certainty equivalent payoff of the farmers who supply the IOF will be higher than the cooperative members' certainty equivalent payoff. For example, if the certainty equivalent payoff of the farmers who supply the IOF is increased from 1 to 1.5, some cooperative members will then leave the cooperative and trade with the IOF. The cooperative membership size will decrease. With fewer members, the cooperative's product quality and members' certainty equivalent payoff will increase because the free-riding problem is relatively eased. When the membership size decreases to M', cooperative members' certainty equivalent payoff is

again equal to the certainty equivalent payoff received by the farmers trading with the IOF, and the members will stay in the cooperative. The membership size of the cooperative is determined by the certainty equivalent payoff that the IOF offers to its suppliers. Generally, the cooperative with a complete pooling policy is in a disadvantageous position in the competition with the IOF. The IOF can not only elicit supply with better quality, but also attract supplies from the cooperative's members by increasing payment. The total certainty equivalent payoff (sum of farmer and processor) of each unit of product generated by the IOF is larger than that by the cooperative, i.e. $\frac{\mathrm{P}_0^2}{2\mathrm{c}(1+\mathrm{ck}_2)} > \frac{\mathrm{P}_0^2}{2\mathrm{c}(1+\mathrm{nck}_2)}$. The IOF is thus more efficient than the cooperative.

Another situation we have to consider is when self-processing and trading directly in the market can bring a positive certainty equivalent payoff to the farmers, i.e. $\frac{P_0^2}{2}\left(\frac{1}{c+k_1} - k_2\right) + CE(\epsilon_1\epsilon_2) > 0$. The curve in Figure 3.3 approximates the situations where the certainty equivalent payoff of self-processing is equal to zero. The area below the curve thus represents the range of k_1 and k_2, within which the self-processing farmers can obtain a certain level of positive certainty equivalent payoff. This positive certainty equivalent payoff also serves as the reservation payoff of all farmers. According to Figure 3.2, the certainty equivalent payoff of the cooperative members will continuously decrease when the membership size increases. When the certainty equivalent payoff of the cooperative members is equivalent to the certainty equivalent payoff of the self-processing farmers, the farmers are indifferent between self-processing and becoming members of the cooperative. The cooperative's membership size will thus no longer grow. The membership size of the cooperative is determined by the certainty equivalent payoff of the self-processing. When k_1 and k_2 increase, the certainty equivalent payoff of the self-processing will decrease, so will reservation payoff of all farmers. The membership size of the cooperative will also increase. If there exists also an IOF in the region, the IOF will design the contract subject to the reservation payoff as well and take it as the farmers' participation constraint. As such, the farmers will be indifferent in self-processing or supplying to the cooperative or the IOF. Given that $k_1 > 0, k_2 > 0$ and $CE(\epsilon_1\epsilon_2) < 0$, through simple derivation we can obtain the result that the total certainty equivalent payoff of each unit of product generated by the IOF is larger than that by self-processing, i.e. $\frac{P_0^2}{2c(1+ck_2)} > \frac{P_0^2}{2}\left(\frac{1}{c+k_1} - k_2\right) + CE(\epsilon_1\epsilon_2)$. The IOF is also more efficient than self-processing.

We can compare the product quality of different processors according to the value of k_1 and k_2. According to the values of k_1 and k_2, the rank of product quality of three

different governance structures is illustrated Figure 3.3. First, the IOF's product quality is always higher than that of the cooperative (Proposition 1). Second, when the certainty equivalent payoff of self-processing is positive and $k_2 < \frac{k_1}{c^2}$, the IOF's product quality is higher than that of the self-processing products, i.e. $\frac{P_0}{c(1+ck_2)} > \frac{P_0}{c+k_1}$. Third, when the certainty equivalent payoff of self-processing is positive and $k_2 < \frac{k_1}{nc^2}$, the cooperative's product quality is higher than that of the self-processing product, i.e. $\frac{P_0}{c(1+nck_2)} > \frac{P_0}{c+k_1}$. Finally, when self-processing and trading directly in the market brings no positive certainty equivalent payoff to the farmers (k_1 and k_2 are in the area above the curve), there will be no self-processing. Denote the product quality of self-processing, cooperative and IOF as Q_m, Q_c and Q_f, respectively.

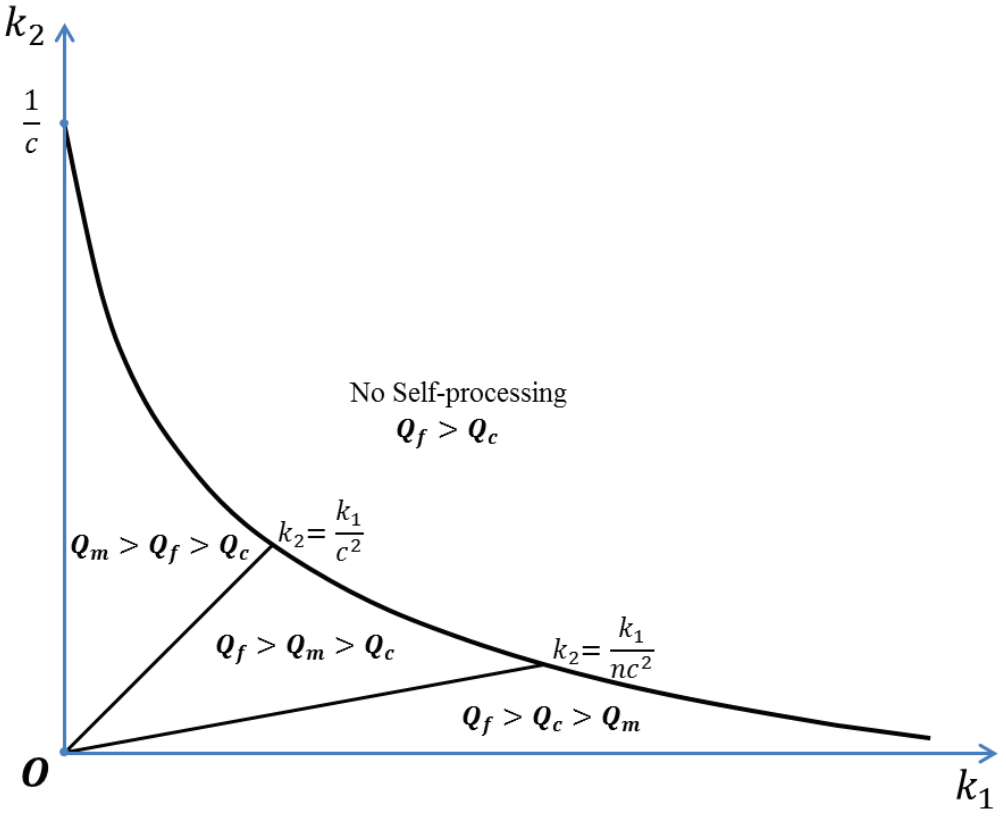

Figure 3.3: Uncertainties, governance structures and product quality

3.4 Partial Pooling

In this section, we investigate how a cooperative can design an optimal income rights structure by adjusting its pooling policy, in order to achieve high product quality when the membership size is large. We extend the model of the cooperative processor in Section 3.2 by adding the decision regarding a pooling ratio $\sigma\ (0 \le \sigma \le 1)$, in addition to the decisions of the fixed payment $\alpha_c (\ge 0)$ and quality incentive $\beta_c\ (0 \le \beta_c \le P_0)$. The payment that a member will receive is modified to

$$P_i = \alpha_c + \beta_c \sigma Q_c + \beta_c (1-\sigma) q_i.$$

The pooling ratio σ measures to what extent the quality incentive will be paid according to the pooled quality Q_c, whereas $1-\sigma$ denotes the portion of a member's production that receives a quality-specific price (Saitone and Sexton, 2009). Member i's economic payoff is

$$\pi_i = \alpha_c + \beta_c \sigma Q_c + \beta_c (1-\sigma) q_i - \frac{1}{2} c q_i^2.$$

The member' utility function is

$$U_i = -\exp\left\{-r\left[\alpha_c + \frac{\beta_c \sigma}{n}\sum_i^n (q_i + \epsilon_{2i}) + \beta_c (1-\sigma)(q_i + \epsilon_{2i}) - \frac{1}{2} c q_i^2\right]\right\}.$$

The member' certainty equivalent payoff is

$$CE_i = \alpha_c + \frac{\beta_c \sigma}{n}\sum_i^n q_i + \beta_c (1-\sigma) q_i - \frac{1}{2} c q_i^2 - \frac{1}{2} k_2 \beta_c^2 \left[\frac{\sigma^2}{n} + (1-\sigma)^2\right].$$

The member's decision on quality is obtained by:

$$\frac{\partial CE_i}{\partial q_i} = \frac{\beta_c \sigma}{n} + \beta_c (1-\sigma) - c q_i = 0$$

$$q_i^* = \frac{\beta_c \sigma}{nc} + \frac{\beta_c (1-\sigma)}{c} = \frac{\beta_c}{c}\left(\frac{\sigma}{n} + 1 - \sigma\right)$$

The cooperative's aggregate quality is then

$$Q_c^* = \frac{\beta_c}{c}\left(\frac{\sigma}{n} + 1 - \sigma\right) + \frac{1}{n}\sum_i^n \epsilon_{2i}.$$

Similarly, the cooperative processor retains no earnings and maximises the joint certainty equivalent payoff of the processor and members, which is:

$$\pi_c = E\left\{nP_0Q_c^* - \frac{n}{2}cq_i^{*2} - \frac{n}{2}k_2\beta_c^2\left[\frac{\sigma^2}{n} + (1-\sigma)^2\right]\right\}$$
$$= n\left\{\frac{P_0\beta_c}{c}\left(\frac{\sigma}{n} + 1 - \sigma\right) - \frac{\beta_c^2}{2c}\left(\frac{\sigma}{n} + 1 - \sigma\right)^2 - \frac{1}{2}k_2\beta_c^2\left[\frac{\sigma^2}{n} + (1-\sigma)^2\right]\right\}.$$

The cooperative maximises π_c by choosing β_c ($0 \le \beta_c \le P_0$) and σ ($0 \le \sigma \le 1$):

$$\frac{\partial \pi_c}{\partial \sigma} = n\left[\frac{P_0\beta_c}{c}\left(\frac{1}{n} - 1\right)\right] - \frac{n\beta_c^2}{c}\left(\frac{\sigma}{n} + 1 - \sigma\right)\left(\frac{1}{n} - 1\right) - nk_2\beta_c^2\left[\frac{\sigma}{n} - (1-\sigma)\right] = 0$$

$$\sigma^* = \frac{\left(\frac{P_0}{c} - \frac{\beta_c}{c}\right)\left(\frac{1}{n} - 1\right) + k_2\beta_c}{\frac{\beta_c}{c}\left(\frac{1}{n} - 1\right)^2 + k_2\beta_c\left(\frac{1}{n} + 1\right)}.$$

When n is large, $\frac{1}{n} \approx 0$:

$$\sigma^* \approx \frac{ck_2\beta_c + \beta_c - P_0}{ck_2\beta_c + \beta_c} = 1 - \frac{1}{(1+ck_2)\frac{\beta_c}{P_0}}.$$

Because $0 \le \beta_c \le P_0$, the pooling ratio the cooperative can choose is

$$0 \le \sigma^* \le \frac{ck_2}{1+ck_2}$$

And:

$$\frac{\partial \pi_c}{\partial \beta_c} = \frac{nP_0}{c}\left(\frac{\sigma}{n} + 1 - \sigma\right) - \frac{n\beta_c}{c}\left(\frac{\sigma}{n} + 1 - \sigma\right)^2 - nk_2\beta_c\left[\frac{\sigma^2}{n} + (1-\sigma)^2\right] = 0$$

$$\beta_c^* = \frac{\frac{P_0}{c}\left(\frac{\sigma}{n} + 1 - \sigma\right)}{\frac{1}{c}\left(\frac{\sigma}{n} + 1 - \sigma\right)^2 + k_2\left[\frac{\sigma^2}{n} + (1-\sigma)^2\right]} \approx \frac{P_0}{(1+ck_2)(1-\sigma)}$$

$$\frac{\beta_c^*}{P_0} = \frac{1}{(1+ck_2)(1-\sigma)}.$$

Because $0 \le \sigma^* \le \frac{ck_2}{1+ck_2}$:

$$\frac{1}{1+ck_2} \le \frac{\beta_c^*}{P_0} \le 1$$

In sum, we obtain the optimal decision of the cooperative:

$$\frac{\beta_c^*}{P_0}(1-\sigma^*) = \frac{1}{(1+ck_2)}.$$

Denote $\gamma^* = \frac{\beta_c^*}{P_0}, (0 \le \gamma \le 1)$, as the ratio between the quality incentive of the cooperative and the marginal market price with respect to the product quality in the market. It measures the relative strength of the cooperative's quality incentive. In sum, the optimal income rights structure S^* of the cooperative can be written as

$$S^* = \gamma^*(1-\sigma^*) = \frac{1}{1+ck_2}, \qquad \frac{1}{1+ck_2} \le \gamma^* \le 1 \; and \; 0 \le \sigma^* \le \frac{ck_2}{1+ck_2}.$$

With the optimal income rights structure, the expected aggregate quality of the cooperative is

$$Q_c = E\left[\frac{\beta_c^*\sigma^*}{nc} + \frac{\beta_c^*(1-\sigma^*)}{c} + \frac{1}{n}\sum_i^n \epsilon_{2i}\right] \approx \frac{P_0}{c(1+ck_2)}.$$

Because the cooperative operates with a zero-profit constraint, the base price can be obtained by:

$$P_0 Q_c^* - [\alpha + \beta_c^*\sigma^* Q_c^* + \beta_c^*(1-\sigma^*)q_i^*] = 0.$$

$$\alpha_c^* = q_i^*(P_0 - \beta_c^*).$$

Figure 3.4 illustrates the optimal income rights structure the cooperative can choose. Given a certain level of members' subjective risk towards the production uncertainty k_2 and quality provision cost coefficient c, the solid part of the curve represents the efficient frontier of the optimal income rights structure.

Several important implications regarding the optimal income rights structure can be drawn. First, a high pooling ratio is associated with high relative quality incentive strength γ. While the high pooling ratio reduces the disutility of the risk premium term $\frac{1}{2}k_2\beta_c^2\left[\frac{\sigma^2}{n} + (1-\sigma)^2\right]$ in the members' certainty equivalent payoff, it also reduces the members' incentive to improve product quality and boosts free-riding. Hence, a high quality incentive is needed to maintain the product quality provisions from the members when the pooling ratio is high. On the other hand, when the pooling ratio is low, the relative quality incentive strength γ must decrease as well. When the pooling ratio is low, its risk-sharing function will decrease whereas the quality incentive will become effective due to less free-riding. The low pooling ratio individualises not only the risk of production uncertainty but also the rewards of product quality. Therefore, with a low pooling ratio, the cooperative only needs relative low incentive strength to

support the product quality but a high base price to decrease the members' disutility from the risk of production uncertainty.

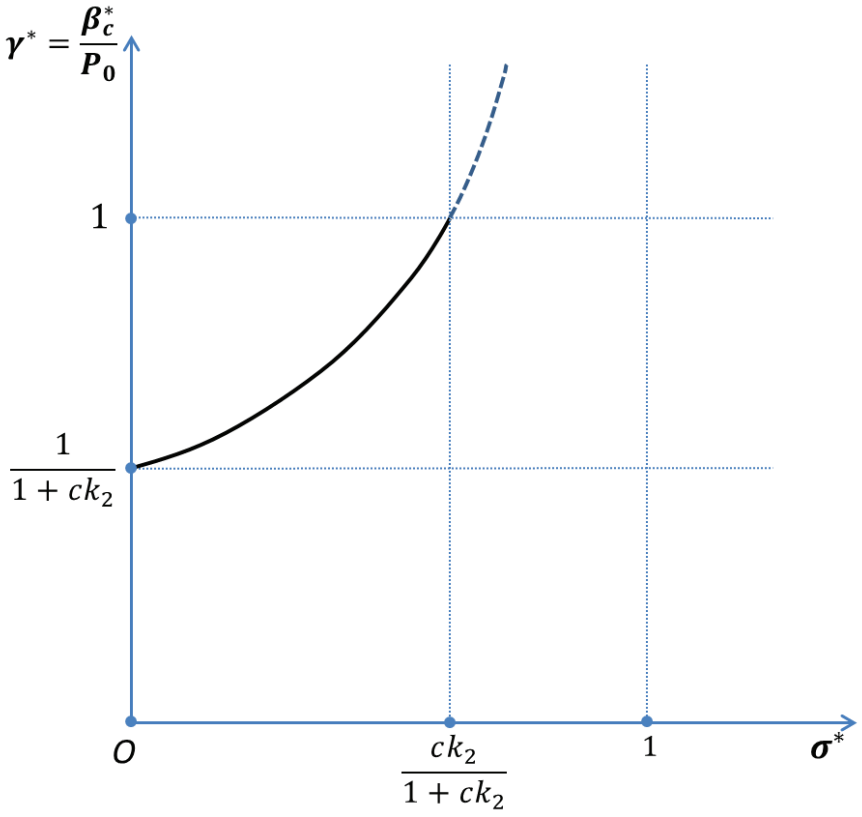

Figure 3.4: The optimal income rights structure of cooperatives

Second, the complete pooling policy, i.e. $\sigma = 1$, should by no means be adopted by the cooperative. Instead, the highest pooling ratio that the cooperative can enact is $\sigma_{max} = \frac{ck_2}{1+ck_2}$. When the cooperative chooses σ_{max}, the base price α_c will be zero and the quality incentive β_c will be b in the corresponding optimal payment formula. It entails that the members will receive no base price and the cooperative's quality incentive will be equal to the quality marginal price of the market. The relative quality incentive strength γ is then equal to 1. In other words, with pooling ratio σ_{max}, the cooperative does not need to pay a base payment to members to bear their risk of production uncertainty. The pooling arrangement itself has already minimised the cost of risk by risk-sharing. If the cooperative's pooling ratio is set higher than σ_{max}, the cooperative has to use a relative quality incentive strength $\gamma > 1$, i.e. $\beta_c > P_0$, to

maintain the product quality level. The reason is that a pooling ratio higher than σ_{max} further reduces the members' incentive in quality improvement. To sustain the product quality, a more powerful incentive must be provided. However, as the cooperative operates on a zero-profit condition, choosing $\beta_c > P_0$ entails that $\alpha_c < 0$, i.e. the cooperative charges the members a base fee for each unit of produce they deliver. This is impractical and it also proves that the traditional principle of complete pooling, which we have modelled in Section 3.2, is inefficient. Therefore, there is an upper bound on the pooling ratio that the cooperative can adopt. Beyond that, the cooperative will be not able to maintain its product quality with the increase of membership size. The dashed part of the curve in Figure 3.3 represents the inapplicable income rights structure. Another implication of the upper bound on the pooling ratio is that σ_{max} will decrease when the farmers' subjective risk towards production uncertainty k_2 and quality provision cost coefficient c decrease. It entails that, while agricultural modernisation nowadays attenuates the production uncertainty and quality provision cost, the upper bound on the pooling ratio is continuously lowered.

Third, the cooperative can adopt the no-pooling policy i.e. $\sigma = 0$, which means that the quality incentive will be fully individualised. This is the same arrangement as in the contract of the IOF. Under this circumstance, a lowest quality incentive $\beta_c = \frac{P_0}{1+ck_2}$ must be chosen; otherwise, the members will encounter a large disutility brought by the risk premium $\frac{1}{2}k_2\beta_c^2$, which is also fully individualised under the no-pooling policy. As the low quality incentive β_c is accompanied with a high base payment α_c, when there is no pooling to share the members' risk of production uncertainty, the highest base payment is provided to the members for bearing the risk.

In sum, the optimal income rights structure S^*, which consists of the decisions of the pooling ratio and relative quality incentive strength, provides the cooperative with optimal alignments between pooling, incentive and risk bearing, thereby supporting the quality provision of the cooperative. The cooperative's decision regarding the pooling ratio is flexible as it can choose from a range of pooling ratios. However, the cooperative may prefer a specific pooling ratio, which is able to bring the organisation additional benefits. We leave this topic for further research.

The second proposition is formulated as follows:

Proposition 2: The range of the efficient equilibrium pooling ratio of the cooperative is $\left[\mathbf{0}, \frac{ck_2}{1+ck_2}\right]$.

Table 3.3 compares the product quality, farmers' certainty equivalent payoff and the processor's payoff per unit of product in different governance structures when the cooperative adopts the optimal income rights structure with partial pooling.

Table 3.3: Product quality and CE payoff under the optimal income rights structure

	Self-processing	**IOF**	**Cooperative**
Product Quality	$\frac{P_0}{c+k_1}$	$\frac{P_0}{c(ck_2+1)}$	$\frac{P_0}{c(ck_2+1)}$
Farmers' CE Payoff	$\frac{P_0^2}{2}(\frac{1}{c+k_1}-k_2)+CE(\epsilon_1\epsilon_2)$	$\frac{P_0^2}{2c(ck_2+1)}$	$\frac{P_0^2}{2c(ck_2+1)}$
Processor's Payoff	*n.a.*	*0*	*0*

With the optimal income rights structure, the cooperative's product quality can reach the same level as that of the IOF. Importantly, as the certainty equivalent payoff the members receive increases, so does the farmers' reservation payoff. As the IOF processor is competing with the cooperative for the supplies of raw produce from the farmers in the same region, it has to increase the certainty equivalent payoff of its suppliers to the level as high as the farmers' reservation payoff. Therefore, the competition pushes the IOF processor's profit to zero and makes the farmers indifferent to supplying the cooperative and the IOF. Because $\frac{P_0^2}{2c(1+ck_2)} > \frac{P_0^2}{2}(\frac{1}{c+k_1}-k_2)+CE(\epsilon_1\epsilon_2)$, i.e. the certainty equivalent payoff of the farmers trading with an enterprise processor is strictly larger than that of self-processing farmers, no farmer will choose self-processing. The governance structure of the cooperative and the IOF are both efficient, while self-processing is inefficient. Our third proposition can be formulated as follows:

Proposition 3: The product quality of the cooperative with an optimal income rights structure will be equivalent to that of the IOF.

3.5 Discussion

We have highlighted two different types of risks in our model and investigated their impacts on the quality decisions of risk-averse farmers. Specifically, our results imply that the market uncertainty and production uncertainty both will deter the provision of product quality. If the payoff regarding the product quality is uncertain, the risk-averse farmers will be reluctant to invest efforts in quality improvement. We show that an important attribute of the production or marketing contract is to shift the risk of market uncertainty from the farmers to the processor. Via the contract, the farmers' participation can be secured. Since the farmers still face the risk of production

uncertainty, another function of the contract is to balance the production risk bearing and incentive, in order to elicit optimal product quality from the farmers. The processor thus optimises the contract according to its objective by choosing the payment formula. It is proved that the cooperative processor with a complete pooling policy is disadvantageous in the competition with the IOF processor. The latter can elicit the optimal quality provisions from the farmers by offering an efficient contract with individualised quality incentives. By contrast, the product quality of the cooperative with the complete pooling policy will be lower than that of the IOF, and will decrease when the cooperative becomes large in terms of membership size. Therefore, the cooperative must change its income rights structure and adopt a partial pooling policy.

When investigating the optimal income rights structure of the cooperative, we relax its traditional principle of complete pooling and the cooperative can choose a pooling ratio. This adds an additional dimension in the cooperative's approach of aligning risk-sharing and incentives of the members. One important benefit of pooling is to share the risk of production uncertainty among members. When the risk is shared by more members, the disutility of risk is smaller for each member and the members are more willing to invest efforts in quality improvement. However, the pooling also has a negative impact on the quality provision because it will reduce the member's incentive and cause free-riding when the members make quality decisions. Under the circumstance of pooling, the more members the cooperative has, the weaker the incentive. Therefore, the cooperative must find the applicable pooling ratio, with which the pros and cons of the pooling policy can be balanced by the linear contract $P = \alpha + \beta q$. Based on this rationale, we derive the optimal income rights structure for the cooperative, under which the cooperative can maintain a high product quality even when the membership size is growing and large. The configuration of the optimal income rights structure is flexible. In order to reach the optimal product quality, the cooperative need not necessarily imitate the IOF by abandoning pooling and adopting a fully individualised quality incentive. Instead, the cooperative can choose from a range of pooling ratios. When a high pooling ratio is chosen, the risk of production uncertainty is well shared, and the cooperative can choose a contract with a stronger quality incentive. When the a low pooling ratio is chosen, the incentive as well as the risk is more individualised, the cooperative thus must choose a contract with a large base payment and a weak quality incentive, which better bears the members' production risk. As such, the cooperative has more flexibility in its payment arrangements. Importantly, we emphasize that when the members have subjective risk towards production uncertainty, the pooling ratio must be lower than an upper bound. With a pooling ratio higher than this upper bound, the pros and cons of pooling can no

longer be balanced by a contract, and the cooperative's product quality will therefore decrease as the cooperative grows.

Table 3.4 summarises the effects of the institutional arrangements of different governance structures on the provision of product quality.

Table 3.4: Effects on quality provisions in the three governance structures

	Self-processing	**IOF**	**Cooperative**	
			Complete Pooling	**Optimal Structure**
Shifting Market Risk	No	Yes	Yes	Yes
Pooling of Production Risk	No	No	Yes	Yes
Free-riding	No	No	Yes	Yes
Bearing Production Risk by α	No	Yes	Yes	Yes
Providing Sufficient Quality Incentive by β	No	Yes	No	Yes

Our model also provides an explanation for the coexistence of IOFs and cooperatives in agricultural markets. We argue that by abandoning the complete pooling policy and adopting an optimal income rights structure, cooperatives can overcome their disadvantageous position in the competition with IOFs. Theoretically, the product quality of the IOF and the cooperative with an optimal income rights structure can both reach the same optimal level. However, in reality, the competition between the IOF and cooperative is much more dynamic. First, they may have different and non-precise judgements on the farmers' absolute risk aversion, quality provision cost coefficient, and the level of production uncertainty, which can lead to their different decisions regarding the payment formula. Second, the quality incentive of the cooperative is normally projected by the members as a certain promise, because the members own and control the processor, they can decide and enforce the incentive collectively. By contrast, when trading with the IOF, the farmers may have additional subjective risk towards the IOF's quality measurement and payment (Balbach, 1998; Gow et al., 2000). This may distort the farmers' decisions in product quality. Third, the cooperative processor may be, to some extent, risk averse instead of risk neutral. They may thus adopt a more conservative policy regarding the quality provision. All these factors may play a role in the quality competition between cooperatives and IOFs. In addition, different processors are also competing in the quality dimension by other means. For example, they may provide the farmers with farming supplies and technical support in order to decrease the farmers' subjective risk towards production uncertainty k_2, or help the farmers to decrease the quality provision cost coefficient c. With such measures, they are able to increase product quality further.

3.6 Conclusion and Further Research

For a risk-averse decision maker, an uncertain payoff is considered less valuable than a certain payoff with the same expected value (Bolton and Dewatripont, 2005). Confronted with the risk of market and product uncertainty, the risk-averse farmers' efforts of product quality provisions will be deterred, especially, when they trade directly in the market individually. By forming a cooperative, the risk-averse farmers can obtain benefits because the cooperative processor insures them from the risk of market uncertainty. Pooling also reduces the risk of product uncertainty. However, with a complete pooling policy, the members are rewarded for their product quality according to the pooled quality of the cooperative. The farmers can also trade with the IOF, which rewards the farmers' product quality on an individualised basis. In a principal-agent framework with the processor as risk-neutral principal and the farmers as risk-averse agents, we compare the quality provision of a cooperative and an IOF. It is shown that the traditional principle of complete pooling policy makes the cooperative in a disadvantageous position in the competition with the IOF in a quality-differentiated market. The reason is that, with the complete pooling policy, when a new member joins the cooperative, the loss from the free-riding dominates the benefit of risk sharing. As a consequence, the cooperative's product quality will continuously decrease as its membership size increases. By contrast, the IOF processor can design an optimal contract that reaches a trade-off between providing incentives and minimising the cost of risk. Therefore, the IOF processor elicits higher quality from the farmers.

However, the cooperative can overcome this disadvantage by relaxing the traditional principle of complete pooling to partial pooling. We find that given the members' subjective risk towards product uncertainty k_2, the complete pooling policy should be by no means adopted by the cooperative. Instead, there is an upper bound on the pooling ratio that the cooperative can adopt. We prove that by designing an optimal income rights structure for the organisation, the cooperative can maintain an optimal product quality level, which is equivalent to the product quality level of the IOF. The configuration of the optimal income rights structure is flexible. The cooperative can choose from a range of pooling ratios, from no pooling to the upper bound pooling ratio. When a high pooling ratio is chosen, the risk of production is well shared, and the cooperative can choose a contract with a stronger quality incentive β. When a low pooling ratio is chosen, the incentive as well as the risk is more individualised, the cooperative thus must choose a contract with a large base payment α, which bears the members' production risk, and a weak quality incentive β. As such, the cooperative

also has more feasibility in payment arrangements. However, why the cooperative may choose a specific pooling ratio within the range needs to be further investigated.

In general, our model contributes to comparing the product quality provisions of cooperatives and IOFs by capturing the uncertainties in agribusiness and the farmers' characteristics of risk aversion. We argue that cooperatives are able to compete with IOFs in a quality-differentiated market if an optimal income rights structure is adopted. This may provide an explanation for the coexistence of cooperatives and IOFs in many agricultural sectors.

There are various possibilities for further research by relaxing some assumptions of our model. One assumption is that the farmers are identical, with respect to both the absolute risk aversion level and quality provision efficiency. Hence, the adverse selection effect of heterogeneous farmers is not addressed in our model. Second, we don't distinguish between the common and idiosyncratic production uncertainty, and simply model the contract based on the absolute quality evaluation. However, the contract rewarding farmers based on the relative product quality is also commonly used in agricultural production, which shifts the common part of the production uncertainty to the processor. Third, as mentioned in Section 3.3, the cooperative processor may be risk-averse as well. However, the level of absolute risk aversion of the cooperative as a whole may be less than that of each individual member. In addition, the IOF may behave opportunistically ex-post regarding quality measurement and payment. This entails an additional risk for the farmers who trade with the IOF. Finally, the final product market is assumed to be perfectly competitive in our model. However, in many agricultural sectors, the markets are oligopolistic. Different market settings may change the behaviours of the processors regarding contract optimisation. In sum, we argue that there are several additional factors that may potentially influence the quality provision of cooperatives and their competition with IOFs.

4. Social Capital and Incentives in the Provision of Product Quality by Cooperatives[11]

Abstract

This chapter highlights the interaction between social capital, pooling and quality premiums and their influence on cooperative members' decisions regarding product quality. A necessary condition for adopting the cooperative equitable principle of complete pooling is that there exists a high level of social capital in the cooperative. When the level of social capital is high, the social motivation in the cooperative can guarantee high product quality while economic incentives are weak. When the level of social capital declines, an income rights structure with stronger quality incentives must be adopted by the cooperative to maintain product quality. The cooperative is uniquely efficient when the farmers are very risk averse and product quality is highly uncertain. When the level of social capital in cooperatives is higher than a threshold, which is decreasing in members' subjective risk towards production uncertainty, cooperatives are able to achieve higher product quality than IOFs.

Keywords: Quality, Social Capital, Cooperatives, Income Rights Structure

'Cooperation is jointly determined by social factors and incentive alignment.'

(Williamson, 1985:6)

4.1 Introduction

Cooperatives are often associated with low-quality products. The decentralised decision-making mechanism (Pennerstorfer and Weiss, 2013) and various traditional

[11] A version of this chapter was published in the proceedings of the following conferences: the Economics and Management of Networks Conference (EMNet), 2013, Agadir, Morocco (https://emnet.univie.ac.at/uploads/media/Deng_Hendrikse_2_.pdf); the 140th EAAE (European Association of Agricultural Economists) Seminar, Perugia, 2014, Italy; the EAAE 2014 Congress, Ljubljana, Slovenia (https://www.conftool.pro/eaae2014/); and the Workshop on Producers' Organizations in Agricultural Markets, 2014, Toulouse, France. This chapter has been accepted for presentation at the Conference of the International Society for New Institutional Economics (ISNIE), 2015, Harvard University, Massachusetts, US.

cooperative business practices seem not to be conducive to meeting consumers' need for quality (e.g. Saitone and Sexton 2009; Merél, Saitone and Sexton, 2009; Fulton and Sanderson, 2002). Specifically, 'the practice of pooling in cooperatives is commonly believed to place cooperatives at a competitive disadvantage in quality-differentiated markets' (Liang, 2013:66).

In a pooling arrangement, 'revenues and costs are to a certain extent allocated independent of quantity and/or quality' (Hendrikse and Feng, 2013:509). Under the assumption of self-interest or opportunism, due to the free-riding behaviours of individual members, collectively optimal quality outcomes will not arise under pooling. Low product quality of cooperatives is thus essentially a problem of collective motivation. To solve this problem, cooperatives need to adopt an income rights structure with a well-designed pooling policy and quality premiums to promote the quality provisions of members (Deng and Hendrikse, 2013), and keep high-quality farmers (Hendrikse, 2011). There is evidence showing that the cooperatives delivering high quality products are characterised by paying quality premiums to members. For example, Balbach (1998) reports that after the extractable sugar contracts were introduced by cooperative processors to provide additional incentives to reduce impurities, the average sugar losses to molasses fell by 36%, while actual sugar production per ton of beets rose by 12%, representing significant increases in quality and value.

However, there is also considerable evidence showing that the informal aspects of cooperative organisations such as social norms and reputation effects among members are no less important than the formal institutional settings of cooperatives (e.g. Nilsson and Hendrikse, 2011). Actually, social capital can enable cooperatives to produce high-quality products even with the practice of complete pooling. Chloupkova, Svendsen and Svendsen's (2003:243-244) case study of the Danish dairy cooperative movement records that, starting from 1882, an increasing number of Danish farmers started to deliver all their milk to their own cooperatives. The cooperatives were formed by circles of energetic entrepreneurs in the local rural communities and 'valuable social capital was created bottom-up' (p.243). The cooperative dairies became very successful and the quality of the butter was increased. Milk was delivered in good condition because the social control mechanism guaranteed that none of the members would cheat. It is worth noticing that the milk quality was secured under complete pooling while no quality measurement and incentive were provided in such an early stage of Danish dairy cooperatives: 'a single horse-drawn carriage collected the milk from every farm' (p.244). This study shows that social mechanisms have been effective in influencing the product quality by eliminating the free-riding problem in the provision of product quality. In addition, cooperatives nowadays are

also able to achieve higher product quality than IOFs under similar quality incentive structures. Cechin et al. (2013b) point out that some important differences regarding relationship characteristics between the farmers and processors could account for the higher quality performance of Brazilian broiler cooperatives. Ruben and Heras (2012) also find that the productive and economic performance of Ethiopian coffee cooperatives is enhanced by intra-community bonding social capital. Therefore, it is desirable to include the role of social capital in the study of the provision of product quality by cooperatives.

According to Granovetter (2005:43), 'a firm cannot be viewed simply as a formal organization, but must also be understood as having the essential elements of any social community'. Granovetter's argument is particularly true of agricultural cooperatives, which are jointly owned and controlled by a society of farmers. According to Valentinov (2004:5), 'every cooperative represents simultaneously an association of persons in the sense of sociology and social psychology, i.e. social group, and a joint enterprise, owned and operated by the same members of this group'. Cooperatives are therefore with 'double nature' (Valentinov, 2004:5) or regarded as 'dual organization' (Nilsson and Hendrikse, 2011:339).

Social capital has been defined in a number of ways. Payne et al. (2011) categorise social capital by distinguishing the external (bridging) and internal (bonding) aspects and the individual and collective aspects of social capital. The issues typically related to the notion of internal social capital in cooperatives include ideology, culture, value, trust, identity, norms, etc. (e.g. Valentinov, 2004; Feng, Nilsson, Ollila and Karantininis, 2011; Nilsson, Svendsen and Svendsen, 2012). Member loyalty and commitment are often expressed as important indicators of social capital in cooperatives (Feng, Nilsson, Ollila and Karantininis, 2011). Previous research on cooperative's social capital has referred to the different facets of internal social capital and they can be clustered into three dimensions: structural, cognitive, and relational (Nahapiet and Ghoshal, 1998). The structural dimension reflects 'the patterns and strength of ties between the members of a group' (p.244). The cognitive dimension is the 'shared representations, interpretations and systems of meaning among parties, which reflects the members' collective understanding of the organisation's culture, shared vision and purpose, common language and codes, etc.' (p.244). The relational dimension refers to 'those assets created and leveraged through relationships, including trust and trustworthiness, norms and sanctions, obligations and expectations, and identity and identification' (p.244). In essence, the relational dimension serves as the key resource that can create comparative advantages for cooperatives by facilitating members' collective actions. In this chapter, our analysis of social capital in cooperatives will focus on the collective-internal perspective and the function of its

relational dimension in mitigating free-riding problems in cooperatives. As such, social capital in this study is conceptualised as 'the ability of a group of agents linked by horizontal social relations to discipline individual behaviour' (Putnam, 1993; in Spagnolo, 1999:3).

The importance of social capital for cooperatives has been well recognised. However, to our knowledge, a theoretical analysis of social capital in cooperatives is still missing. Moreover, prior studies on cooperatives' income rights structure generally do not consider the interplay between economic incentives and social capital. This chapter fills the gap by presenting a model regarding the interaction between cooperative's social capital and economic incentives and its influence on product quality. Prior models on social capital have explicitly highlighted the value of social motivation generated by the relational dimension of social capital. These models emerge from the standard economic models by introducing a social (dis)utility term into the utility function of agents. This social utility term can be specified in different ways but all serve as a non-pecuniary source of agents' motivation. The modelling approach in this chapter is mainly adapted from Casadesus-Masanell (2004), Akerlof and Kranton (2005) and Uzea and Fulton (2009). According to Casadesus-Masanell (2004), an effort-averse agent will observe three significant bases for trust, i.e. norms, ethical standards, and altruism, which create intrinsic motivation and result in larger total surplus. Akerlof and Kranton (2005) develop a model of identity and work incentives. Their principal-agent model incorporates the notion of identity, where employees may have identities that lead them to behave more or less in concert with the goal of their organisations. The analysis shows that with such an identity, workers are willing to put in high effort rather than low effort with limited wage dispersion. Similarly, Uzea and Fulton (2009) develop a model to demonstrate how the core firm in a strategic network can use identity to deter opportunism by network members. Their main argument is that when members identify strongly with their network, they lose utility if they deviate from the network norm.

In this chapter, our model highlights not only the value of social capital in a cooperative, but also the necessity of changing the cooperative income rights structure when the level of social capital changes. In our model, social capital generates social motivation for the members to abide by the product quality standard of the cooperative. The members will lose utility if their actions deviate from the standard. We demonstrate how the social motivation, based on cooperative's social capital, and the economic motivation, based on the pooling policy and quality premiums formulated in the contract between members and processor, jointly influence members' decisions regarding product quality. The results show that when the level of social capital is high, the social motivation in the cooperative can support high product quality under a

collective income rights structure with low quality incentive intensity, and complete pooling can be efficient; as social capital declines, the social motivation alone is incapable of supporting the cooperative's quality performance, and an income rights structure must with stronger economic incentives must be adopted. Additionally, the value of social capital in a cooperative is highlighted by comparing the cooperative with an IOF in terms of their product quality and payoff. Social capital makes the cooperative uniquely efficient when the farmers are very risk averse and the product quality is highly uncertain. We show that when the social capital level in the cooperative is higher than a threshold, which is decreasing in members' subjective risk towards production uncertainty, the product quality of the cooperative will be higher than that of the IOF.

This chapter proceeds as follows. In Section 4.2, we specify the game between the processor and farmers. Section 4.3 determines the equilibrium. Section 4.4 compares the product quality and payoff of processors in different governance structures. In Section 4.5, we discuss the results and present some empirical implications. The last section presents conclusions and suggestions for future research.

4.2 Model

This section presents a non-cooperative game regarding product quality. The decision-making parties, the choices, the payoffs, the information structure and the sequence of the decisions will be specified.

There are two parties: a group of n upstream farmers and a downstream processor. The farmers are identical and produce a raw commodity that needs to be processed before reaching the final market. Each farmer produces one unit and supplies it to the processor. Each farmer decides individually regarding the quality of his or her product. The product quality decision of farmer i is q_i, where $i = 1,2,\dots,n$, and the cost associated with the quality provision is

$$C(q_i) = \frac{1}{2} c q_i^2.$$

The quality provision cost coefficient c is identical for all farmers and is treated as a constant. Without loss of generality, the production costs of the raw produce are sunk and will not enter into the analysis (Saitone and Sexton, 2009). We assume that one unit of the raw product will be processed into one unit of the final product.

We model the transactions between the processor and the farmers in a principal-agent framework (Holmström, 1979). The processor acts as a risk-neutral principal, and the farmers are risk-averse agents who are rewarded by the outcome of their efforts

invested in the product quality. The efforts per se are not observable, but the quality of the delivered raw produce from the farmers to the processor is observable and verifiable. The processor offers the farmers a linear contract

$$P = \alpha + \beta q.$$

P is the unit price of the raw product that the processor will pay for. α (≥ 0) is the base (guarantee) price and β (≥ 0) is the quality premium. An important function of the linear contract between the principal and agent is to 'balance the costs of risk bearing against the incentive gains' (Milgrom and Roberts, 1992:207). This form of contract is commonly used in agribusiness, whether the processor is an IOF or a cooperative (Gow et al., 2000; Levy and Vukina, 2002; Dubois and Vukina, 2004; USDA, 2004; Cechin et al., 2013b). The farmers are risk-averse, and their von Neumann-Morgenstern utility function of an uncertain payoff π_i ($i = 1,2, \dots, n$) is

$$U_i = -\exp(-r\pi_i).$$

Parameter r, which is assumed identical for all farmers, is the farmers' coefficient of absolute risk aversion, i.e. the higher r is, the more risk averse the farmers are. The payoff uncertainty results from the risks in agribusiness. Agricultural production and marketing are subject to different types of risks, including biological risk, price risk and institutional risk (Bogetoft and Olesen, 2004). We focus on the risk of quality uncertainty in agricultural production. The realised product quality after harvest is $q_i + \epsilon_i$, where ϵ_i is a normally distributed random noise term, with mean zero and variance ρ_i^2, representing the uncertainty in the production. We assume that the uncertainty regarding product quality is identical for all farmers, i.e. $\epsilon_i = \epsilon, \rho_i^2 = \rho^2$. The variance ρ^2 represents the objective risk of production.

The processor further processes the raw product supplied by the famers and sells the final product in the market, which is assumed to be competitive. The market differentiates product quality and the processor receives a unit price P_m from the market based on the average product quality Q (Pennerstorfer and Weiss, 2013):

$$P_m = P_0 Q$$

$$Q = \frac{1}{n}\sum_{i}^{n}(q_i + \epsilon).$$

$P_0 (> 0)$ measures the market's marginal preference for quality and can be understood as the aggregated 'taste parameter' of the market (Mussa and Rosen, 1978:301). We refer to the difference in the quality as in the realm of vertical product differentiation (Mérel et al., 2009). The quality of the raw product determines the quality of the final

product, and the processing itself cannot change the product quality. The processor's aggregate product quality Q is thus the average quality of the raw product of all farmers.

We compare two governance structures: a marketing cooperative and an investor owned firm (IOF). The difference between these governance structures is threefold. First, the cooperative, which is collectively owned by a society of farmers, is assumed to possess a certain amount of social capital within the organisation. By contrast, the social capital, either between the farmers and the IOF processor or among the farmers, is assumed low and ignorable as compared with that in the cooperative. In other words, the farmers delivering raw produce to the IOF are unsocialised and the relationship between the farmers and the IOF is seen as solely seller-buyer. Second, the cooperative may apply a pooling policy in its income rights structure while the IOF pays each farmer an individualised price for the supply of the raw product. Third, a cooperative is characterised by the zero-profit feature, i.e. revenues of the processor are returned to its members, while the IOF maximises the processor's profit. In the following, the farmers' certainty equivalent payoff will be determined for each governance structure.

Cooperative

Pooling is a general practice used by traditional cooperatives (LeVay, 1983; Staatz, 1987). It has a beneficial insurance function for risk-adverse farmers (Hendrikse and Feng, 2013). The cooperative can decide on a pooling policy by choosing the pooling ratio σ, where $0 \leq \sigma \leq 1$ (Saitone and Sexton, 2009). σ denotes the portion of each member's product that is assigned to a common pool. It determines the pooled payment received by a member and is contingent on the pooled quality Q_c. $1-\sigma$ denotes the portion of product that receives a member-specific payment based on q_i. When $\sigma = 1$, the cooperative applies the complete pooling policy, whereas when $\sigma = 0$, the cooperative applies the no-pooling policy. Partial pooling is characterised by $0 < \sigma < 1$. The cooperative processor retains no profit and maximises the joint economic certainty equivalent payoff of the processor and members by choosing the base price α_c, quality premium β_c, and the pooling ratio σ. A cooperative member therefore receives

$$P_c = \alpha_c + \beta_c[\sigma Q_c + (1-\sigma)(q_i + \epsilon)]$$

$$Q_c = \frac{1}{n}\sum_{i}^{n}(q_i + \epsilon).$$

We suppose that social capital generates a social mechanism making a cooperative member internalise the ethical standard in the organisation and will lose utility if his action deviates from this standard (Casadesus-Masanell, 2004). Although this is indeed an extreme simplification of the concept and functionality of social capital, we show that the model is suitable for highlighting the basic function of social capital in terms of affecting members' behaviour. In our model, the cooperative's ethical standard is set as a product quality standard Q_s, which is the product quality desired by the cooperative. The cooperative's social capital level, denoted as $\Delta\ (\geq 0)$, measures the pressure felt by the members to abide by the quality standard. Intuitively, social capital in the cooperative results in intrinsic motivation because the further away the product quality is from the standard, the larger the social loss the member will suffer. This loss in members' utility can be guilt or the loss of reputation from other members (Gulati et al., 2000), as a kind of social penalty

$$U_{Loss} = -\frac{1}{2}\Delta(q_i - Q_s)^2.$$

A member's overall payoff therefore consists of not only an economic but also a social part:

$$\pi_i(q_i) = \alpha_c + \beta_c[\sigma Q_c + (1-\sigma)(q_i + \epsilon)] - \frac{1}{2}cq_i^2 - \frac{1}{2}\Delta(q_i - Q_s)^2.$$

The member's certainty equivalent payoff is

$$CE_i = \alpha_c + \beta_c\left[\frac{\sigma}{n}\sum_i^n q_i + (1-\sigma)q_i\right] - \frac{1}{2}cq_i^2 - \frac{1}{2}k\beta_c^2\left[\frac{\sigma^2}{n} + (1-\sigma)^2\right] - \frac{1}{2}\Delta(q_i - Q_s)^2.$$

$k \equiv r\rho^2$ denotes the member's subjective risk towards the product quality uncertainty. The subjective risk is the corresponding objective risk scaled by the farmer's degree of risk aversion (see Bolton and Dewatripont, 2005: Chap. 4). The term $\frac{1}{2}k\beta_c^2\left[\frac{\sigma^2}{n} + (1-\sigma)^2\right]$ is the risk premium, which is the disutility of risk.

IOF

When the processor is an IOF, it pays for individual product quality of each farmer. The IOF will maximise its total profit subject to the farmers' participation constraints by deciding on the linear contract

$$P_f = \alpha_f + \beta_f q_i.$$

It is assumed that social capital plays no role in the transactions between the farmers and the IOF, i.e. the social (dis)utility does not enter into the farmers' certainty equivalent payoff. The payoff of a farmer i is

$$\pi_i = \alpha_f + \beta_f(q_i + \epsilon) - \frac{1}{2}cq_i^2.$$

Both the quality premium and risk premium in farmer i's certainty equivalent payoff are individualised. The certainty equivalent payoff of a farmer trading with the IOF processor is therefore

$$CE_i = \alpha_f + \beta_f q_i - \frac{1}{2}cq_i^2 - \frac{1}{2}k\beta_f^2.$$

We assume that the farmers' coefficient of absolute risk aversion, quality provision cost coefficient, quality uncertainty in production, and the market's preference for quality are common knowledge. The product quality can be perfectly measured. The cooperative's social capital level is also known and treated as exogenous. The game consists of three stages. The efficient governance structure (cooperative or IOF) is determined in the first stage. The linear contract (and pooling ratio of the cooperative) is decided by the processor in the second stage. In the third stage, the farmers decide their product quality. The game will be solved by backward induction.

4.3 Equilibrium Quality Incentive

In this section, we derive the equilibrium linear contract (and the equilibrium pooling ratio of the cooperative) in the two governance structures.

Cooperative

Member i's decision of product quality in the third stage of the game is obtained via the FOC (first-order condition) of his certainty equivalent payoff:

$$q_i^* = \frac{\beta_c\left(\frac{\sigma}{n} + 1 - \sigma\right) + \Delta Q_s}{c + \Delta}.$$

Because CE_i is concave, the member will choose a product quality between the selfish option and the quality standard. As all members are identical, the average product quality of the cooperative is

$$Q_c^* = \frac{\beta_c\left(\frac{\sigma}{n} + 1 - \sigma\right) + \Delta Q_s}{c + \Delta} + \frac{1}{n}\sum_i^n \epsilon.$$

We assume that the cooperative's product quality standard is the product quality that generates the first-best cooperative economic payoff:

$$Q_s = \frac{P_0}{c}.$$

The pooling ratio σ and the quality premium β_c are determined in the second stage of the game. Assume that the processing costs and value-added of the cooperative processor are sunk. The joint certainty equivalent payoff of the processor and members is

$$\pi_c = E\left\{nP_0Q_c^* - \frac{n}{2}cq_i^{*2} - \frac{n}{2}k\beta_c^2\left[\frac{\sigma^2}{n} + (1-\sigma)^2\right]\right\}.$$

The cooperative maximises π_c by choosing σ $(0 \le \sigma \le 1)$ and β_c $(0 \le \beta_c \le P_0)$[12]. The FOC of σ leads to

$$\sigma^* = \frac{\frac{c(P_0-\beta_c)}{(c+\Delta)^2}\left(\frac{1}{n}-1\right) + k\beta_c}{\frac{c\beta_c}{(c+\Delta)^2}\left(\frac{1}{n}-1\right)^2 + k\beta_c\left(\frac{1}{n}+1\right)}.$$

When n is large, $\frac{1}{n} \approx 0$ and

$$\sigma^* \approx 1 - \frac{P_0}{\left[1 + ck(1+\frac{\Delta}{c})^2\right]\beta_c}.$$

Because $0 \le \beta_c \le P_0$, the pooling ratio the cooperative can choose is

$$0 \le \sigma^* \le \frac{ck\left(1+\frac{\Delta}{c}\right)^2}{1 + ck\left(1+\frac{\Delta}{c}\right)^2}.$$

And the FOC of β_c leads to

$$\frac{\beta_c^*}{P_0} \approx \frac{1}{\left[1 + ck(1+\frac{\Delta}{c})^2\right](1-\sigma)}.$$

Because $0 \le \sigma^* \le \frac{ck(1+\frac{\Delta}{c})^2}{1+ck(1+\frac{\Delta}{c})^2}$, we have

[12] The quality premium will not be larger than the market's marginal preference for quality because the cooperative has a zero-profit feature.

$$\frac{1}{1+ck(1+\frac{\Delta}{c})^2} \leq \frac{\beta_c^*}{P_0} \leq 1.$$

Combining the solution of σ^* and β_c^*, we denote the optimal income rights structure of the cooperative as

$$S^* \equiv \frac{\beta_c^*}{P_0}(1-\sigma^*) = \frac{1}{1+ck(1+\frac{\Delta}{c})^2}.$$

Because the cooperative operates with a zero-profit constraint, the base price can be obtained by

$$\alpha_c^* = q_i^*(P_0 - \beta_c^*).$$

$\frac{\beta_c^*}{P_0}$ is the ratio between the quality premium of the linear contract and the marginal market price with respect to product quality. It measures the absolute strength of the cooperative's quality premium provided by the linear contract. $1-\sigma^*$ denotes the portion of a member's product that receives a price according to the member's individual product quality. It measures the extent to which the quality premium is individualised and the strength of the connection between the quality premium and quality provision effort of each member. Therefore, S^* essentially measures the overall quality incentive intensity of the cooperative's income rights structure.

The optimal income rights structure is determined by the social capital level Δ in the cooperative and members' subjective risk towards quality uncertainty k. When the cooperative has a very high level of social capital, S^* approaches zero. It entails that the cooperative can adopt the income rights structures with very low quality incentive intensity or even without economic incentive at all if the social capital level is very high. At the same time, the cooperative is able to produce high product quality given that every member's quality decision will be close to the quality standard: $lim_{\Delta\to\infty} q_i^* = Q_s$. A high level of social capital thus plays a role of substituting economic incentives for product quality. This function is manifested through the potential utility loss the members will suffer if their quality decisions deviate from the quality standard. However, as the cooperative's social capital level Δ declines, the cooperative should increase S^*. It entails that when social motivation fades away, the cooperative should compensate for the loss by increasing the incentive intensity in its income rights structure. This increase can be achieved either by increasing the quality premium β_c^* or by decreasing the pooling ratio σ^*. The relationship between S^* and Δ is stated in Proposition 1 and depicted in Figure 4.1.

Proposition 1: When the cooperative's social capital level declines, the quality incentive by the cooperative will be stronger.

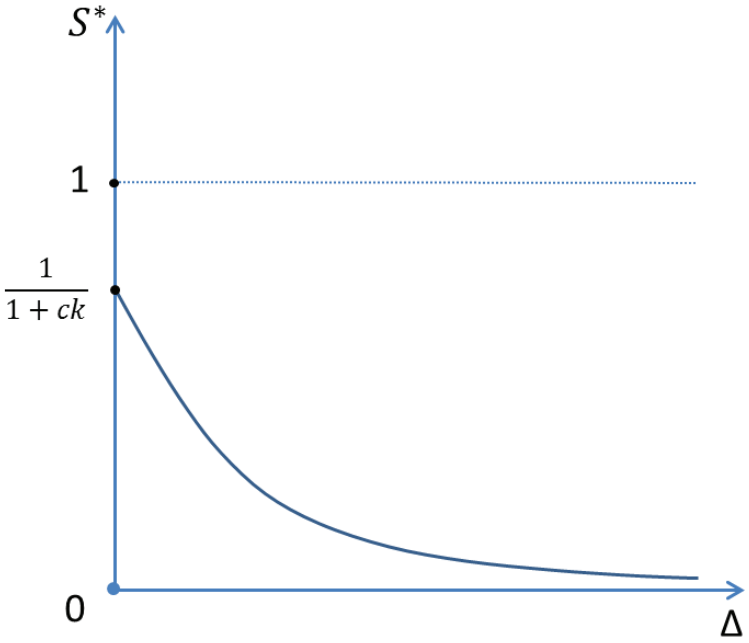

Figure 4.1: The relationship between social capital and quality incentive intensity

Proposition 2 formulates the comparative statics result regarding the members' subjective risk towards quality uncertainty. Given any level of social capital, a higher level of subjective risk k requires the cooperative to adopt the income rights structures with lower quality incentive intensity. This is because a strong quality incentive results in substantial risk bearing of the members and generates large disutility. The cooperative thus should choose a high pooling ratio, which shares more risks among members, or a large base payment, which makes the processor bear more risk. This is in line with the results of the classic principal-agent framework (Holmström, 1979).

Proposition 2: When members' subjective risk towards quality uncertainty increases, the cooperative chooses lower quality incentive intensity, given the level of social capital.

The choice of β_c^* and σ^* in S^* is pairwise because the cooperative is faced with a trade-off between providing a quality premium and sharing production risk. Figure 4.2 illustrates the values of β_c^* and σ^* in the optimal income rights structure of the cooperative. S_0 represents the value β_c^* and σ^* when there is no social capital in the

cooperative, while S_1 represents the case when the level of social capital Δ is higher than zero. S_0 serves as a benchmark in highlighting the effect of social capital. In both cases, we assume that the members' subjective risk is equal to k.

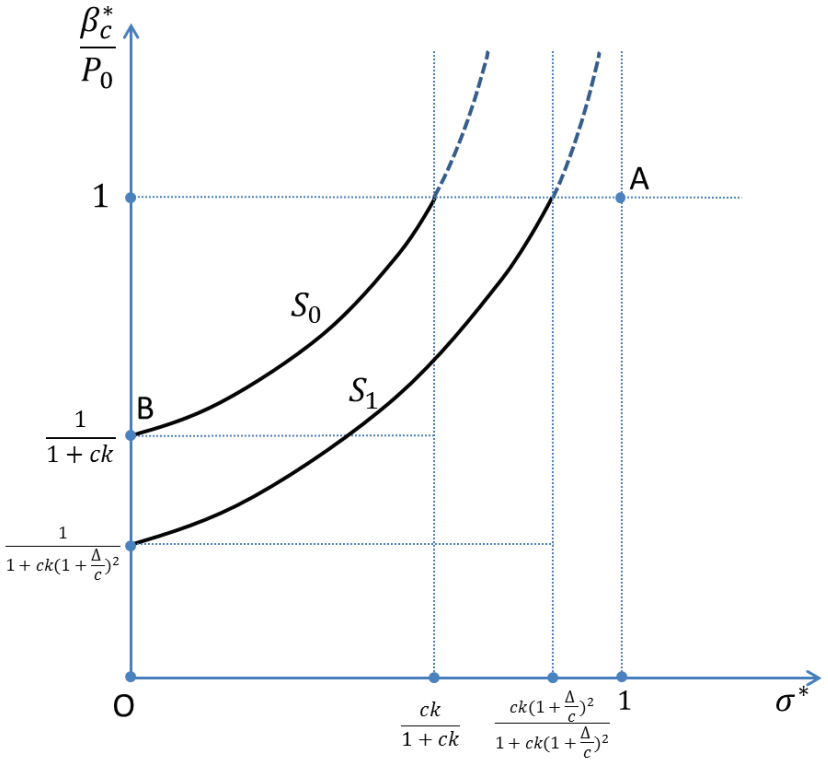

Figure 4.2: Trade-off between pooling ratio and quality premium in the quality incentive intensity

In the case that the cooperative has no social capital, i.e. $\Delta = 0$, the optimal income rights structure S^* converges to $S^* = \frac{1}{1+ck}$. The solid part of the curve S_0 is the efficient frontier of the optimal income rights structures and the dashed part represents the unfeasible choices (Deng and Hendrikse, 2013). In the trade-off between β_c^* and σ^*, while a high pooling ratio reduces the risk premium term $\frac{1}{2}k\beta_c^2\left[\frac{\sigma^2}{n} + (1-\sigma)^2\right]$ in the members' certainty equivalent payoff via sharing more risk, it also reduces the members' incentive to improve product quality and boosts free-riding. Hence, the cooperative needs a large quality premium β_c^* in the linear contract to maintain the product quality provisions from the members when the pooling ratio is high. On the other hand, when the pooling ratio is low, the quality premium must decrease. When the pooling ratio is low, its risk-sharing function will decrease whereas the quality

premium will become more effective because of less free-riding. The low pooling ratio individualises not only the risk of production uncertainty but also the rewards for product quality. Therefore, with a low pooling ratio, the cooperative needs a relatively low incentive premium to support product quality but a high base price to decrease the members' disutility from the risk of production uncertainty. When $\Delta = 0$, the highest pooling ratio that the cooperative can enact is $\frac{ck}{1+ck}$, whereby the cooperative will pay no base price to the members and the quality premium of the linear contract will be at the highest level, i.e. $\beta_c^* = P_0$. If the cooperative chooses the no-pooling policy, i.e. $\sigma^* = 0$, the lowest quality premium $\beta_c^* = \frac{P_0}{1+ck}$ must be chosen and the highest base payment must be paid in order to reduce the members' utility loss due to quality uncertainty. The range of the efficient pooling ratio is $\left[0, \frac{ck}{1+ck}\right]$, and the range of the efficient quality premium is $\left[\frac{P_0}{1+ck}, P_0\right]$. A pooling ratio larger than $\frac{ck}{1+ck}$ is unfeasible because, under such circumstances, the cooperative has to use $\beta_c^* > P_0$ to maintain the product quality level. However, as the cooperative operates on a zero-profit condition, choosing $\beta_c^* > P_0$ entails that $\alpha_c^* < 0$. This means that the cooperative charges the members a base fee for each unit of produce they deliver. Therefore, the values of β_c^* and σ^* on the dashed part of the curve should not be chosen by the cooperative.

Now we consider the situation when a certain level of social capital exists in the cooperative, i.e. $\Delta > 0$. With social capital, the frontier of the efficient income rights structures expands from S_0 to S_1. The highest efficient pooling ratio is correspondingly increased from $\frac{ck}{1+ck}$ to $\frac{ck(1+\frac{\Delta}{c})^2}{1+ck(1+\frac{\Delta}{c})^2}$, and the lowest quality premium is decreased from $\frac{P_0}{1+ck}$ to $\frac{P_0}{1+ck(1+\frac{\Delta}{c})^2}$. These changes show the value of social capital as it gives the cooperative more flexibility in the income rights structure choice. Other conditions the same, the cooperative can choose a higher level of pooling or a lower quality premium. This makes it possible to boost risk sharing among the members or have the cooperative processor bear more risk. Social capital therefore reduces the members' utility loss due to quality uncertainty in production and increases the joint certainty equivalent payoff of the cooperative. The social capital in a cooperative is thus valuable in response to the quality risk in agribusiness. Proposition 3 formulates the relationship between the level of social capital and the flexibility in designing the optimal income rights structure of the cooperative.

Proposition 3: The frontier of efficient income rights structure expands when the level of social capital increases, i.e. $\boldsymbol{\sigma^* \in \left[0, \frac{ck(1+\frac{\Delta}{c})^2}{1+ck(1+\frac{\Delta}{c})^2}\right]}$ ***and*** $\boldsymbol{\frac{\beta_c^*}{P_0} \in \left[\frac{1}{1+ck(1+\frac{\Delta}{c})^2}, 1\right]}$.

When the social capital level is very high, i.e. $\Delta \to \infty$, curve S^*will further expand and its end points will approach Point A and Point O in Figure 4.2. On Point A, the income rights structure consists of $\alpha_c = 0, \beta_c = P_0, \sigma = 1$. It entails that the cooperative is able to adopt the equitable principle of complete pooling when a very high level of social capital exists in the organisation. Complete pooling distributes the net revenue to members completely based on delivered volume, regardless the quality of the product. The members share the revenue equally and there is no need to pay a base payment. Or, the cooperative can simply adopt another type of equitable principle by paying each member a fixed price for their deliveries and the pooling is unnecessary, i.e. $\alpha_c = P_0 Q_s, \beta_c = 0, \sigma = 0$ (Point O). In both situations, the high level of social capital in the cooperative prevents the members from free-riding. Their decisions on product quality will be consistent or very close to the quality standard Q_s set by the cooperative.

The existence of a high level of social capital thus explains why some cooperatives are able to maintain high product quality while maintaining an equitable principle such as complete pooling. Under these circumstances, the members act in their collective interests even when they have the chance to behave opportunistically. A high level of social capital creates a large certainty equivalent payoff for the members because the risk premium is minimised under equitable principles. In addition, as the intensive quality control and supervision is avoided, a high level of social capital in the cooperative also saves on monitoring and measurement costs. This result is stated in the next corollary.

Corollary: A necessary condition for cooperative equitable principles of complete pooling is that there exists a very high level of social capital in the cooperative.

IOF

Given the linear contract offered by the IOF processor, farmer i makes the decision of product quality by maximising his certainty equivalent payoff. According to the FOC of CE_i:

$$\frac{\partial CE_i}{\partial q_i} = \beta_f - cq_i = 0$$

$$q_i^* = \frac{\beta_f}{c}.$$

Assuming that the processing costs and valued-added of the IOF processor are sunk, the IOF will maximise its profit subject to the farmers' participation constraint as a reservation certainty equivalent payoff R. The participation constraint of the farmers to deliver his raw produce to the IOF is

$$CE_i^* = \alpha_f + \beta_f q_i^* - \frac{1}{2} c q_i^{*2} - \frac{1}{2} k \beta_f^2 \geq R.$$

The IOF will simply pay the lowest possible base payment so that the farmers are willing to deliver:

$$\alpha_f^* = R - \frac{\beta_f^2}{2c} + \frac{1}{2} k \beta_f^2.$$

The total expected profit of the IOF is

$$\pi_f = E\left[nP_0 q_i^* - n\left(\alpha_f^* + \beta_f q_i\right)\right] = n\left(\frac{P_0 \beta_f}{c} - \frac{1}{2} k \beta_f^2 - \frac{\beta_f^2}{2c} - R\right).$$

The IOF maximises its profit by choosing β_f $(0 \leq \beta_f \leq P_0)$:

$$\frac{\partial \pi_f}{\partial \beta_f} = n\left(\frac{P_0}{c} - k\beta_f - \frac{\beta_f}{c}\right) = 0$$

$$S^* = \frac{\beta_f^*}{P_0} = \frac{1}{1 + ck}.$$

The optimal linear contract the IOF shall offer can be represented by Point B in Figure 4.2.

4.4 Governance Structure Choice

We now compare the cooperative with the IOF in terms of the equilibrium product quality and certainty equivalent payoff. With the optimal income rights structures, the cooperative's expected aggregate product quality is

$$Q_c = E[Q_c^*] = Q_s \left[1 - \frac{ck\left(1 + \frac{\Delta}{c}\right)}{1 + ck\left(1 + \frac{\Delta}{c}\right)^2}\right].$$

Each member's certainty equivalent payoff is

$$CE_i^* = \frac{P_0^2}{2c}\left[1 - \frac{ck}{1 + ck\left(1 + \frac{\Delta}{c}\right)^2}\right].$$

The cooperative retains no earnings: $\pi_c = 0$. The joint certainty equivalent payoff of the farmers and the processor for each unit of product is

$$\pi_c^J = CE_i^* + \pi_c = \frac{P_0^2}{2c}\left[1 - \frac{ck}{1 + ck(1 + \frac{\Delta}{c})^2}\right].$$

As for the IOF, given the equilibrium linear contract offered by it, the expected average product quality of the IOF is

$$Q_f = E\left(\frac{\beta_f^*}{c} + \frac{1}{n}\sum_i^n \epsilon\right) = Q_s\left(1 - \frac{ck}{1 + ck}\right).$$

Each farmer's certainty equivalent payoff is equal to the reservation payoff and the IOF keeps the remaining part of the payoff for each unit of the product:

$$CE_i^* = R$$

$$\pi_f = \frac{P_0^2}{2c}\left(1 - \frac{ck}{1 + ck}\right) - R.$$

The joint certainty equivalent payoff of the farmers and the processor for each unit of product is

$$\pi_f^J = CE_i^* + \pi_f = \frac{P_0^2}{2c}\left(1 - \frac{ck}{1 + ck}\right).$$

Table 4.1 summarises the product quality, the farmer's certainty equivalent (CE) payoff, the processor's payoff and the joint payoff per unit of product in each governance structure.

Table 4.1: Product quality and CE payoff per unit of product

	Cooperative	**IOF**
Product Quality	$Q_s\left[1 - \frac{ck(1 + \frac{\Delta}{c})}{1 + ck(1 + \frac{\Delta}{c})^2}\right]$	$Q_s\left(1 - \frac{ck}{1 + ck}\right)$
Farmers' CE Payoff	$\frac{P_0^2}{2c}\left[1 - \frac{ck}{1 + ck(1 + \frac{\Delta}{c})^2}\right]$	R
Processor's Payoff	0	$\frac{P_0^2}{2c}\left(1 - \frac{ck}{1 + ck}\right) - R$
Joint Payoff	$\frac{P_0^2}{2c}\left[1 - \frac{ck}{1 + ck(1 + \frac{\Delta}{c})^2}\right]$	$\frac{P_0^2}{2c}\left(1 - \frac{ck}{1 + ck}\right)$

The comparison of the product quality of the cooperative and IOF is illustrated in Figure 4.3. Figure 4.3a compares the product quality of the cooperative and IOF when $0 < k < \frac{1}{c}$ and Δ varies. First, if there is no social capital in the cooperative, i.e. $\Delta = 0$, or if the social capital is equal to a threshold level $\Delta^{\circ} = \frac{1}{k} - c$, the cooperative and IOF will have the same product quality. Second, the sufficient condition for the cooperative to have higher product quality than the IOF is $\Delta > \Delta^{\circ}$, which is obtained by solving the inequality of $Q_c > Q_f$. Especially, when $k \geq \frac{1}{c}$, the threshold level $\Delta^{\circ} \leq 0$, the existence of any level of social capital in the cooperative, i.e. $\forall \Delta > 0$, will lead the cooperative to have higher product quality. This situation is highlighted in Figure 4.3b. Third, the sufficient condition for the IOF to have higher product quality than the cooperative is obtained by solving the inequality of $Q_c < Q_f$ and it is $0 < \Delta < \Delta^{\circ}$. The results are summarised in the following proposition:

Proposition 4: The cooperative and IOF will have the same product quality when $\Delta = 0$ ***or*** $\Delta = \frac{1}{k} - c$***. The cooperative will supply lower quality than the IOF if and only if*** $\Delta \in \left(0, \frac{1}{k} - c\right)$.

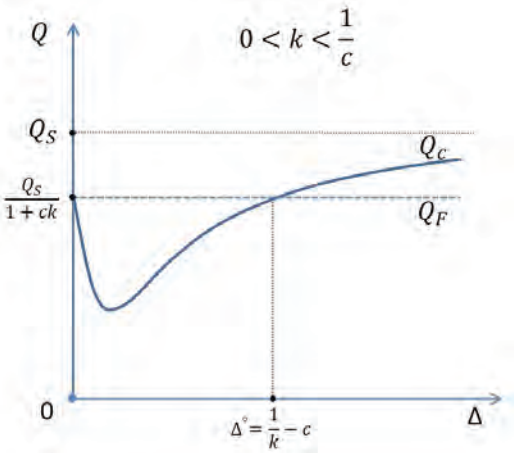

Figure 4.3a: Quality comparison $0 < k < \frac{1}{c}$

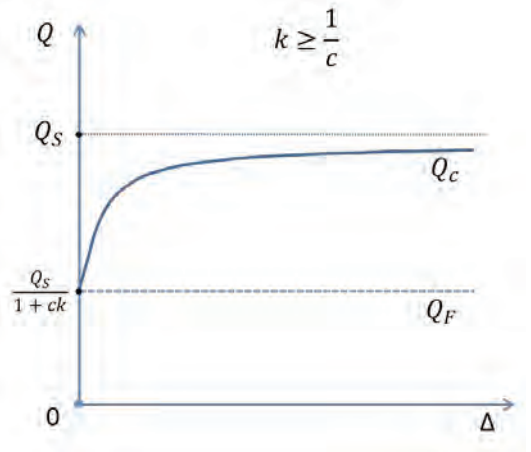

Figure 4.3b: Quality comparison $k \geq \frac{1}{c}$

The comparison of product quality yields the following insights. First, the cooperative maximises the members' certainty equivalent payoff by reaching an optimal trade-off between incentivising the product quality and reducing the disutility of risk. Higher quality incentive intensity will increase product quality but at the same time decrease the members' certainty equivalent payoff because the members are exposed to more risk. When $\Delta = 0$, there is no social motivation in the cooperative and the two

governance structures have the same quality incentive intensity ($\frac{1}{1+ck}$) under the optimal income rights structure. The cooperative and IOF thus will have the same product quality ($\frac{Q_s}{1+ck}$). However, the cooperative has more flexibility than the IOF in determining the payment structure by choosing different pairs of β_c^* and σ^* on the solid part of the curve S_0. To the contrary, the IOF can only choose Point B (Deng and Hendrikse, 2013).

Second, when $\Delta > 0$, the cooperative is able to choose weaker quality incentives than the IOF does because the social capital in the cooperative serves as a social motivation substituting economic incentives for the members' quality provisions. There is a difference of quality incentive intensity between the cooperative and IOF: $S_c^* - S_f^* = -\frac{\Delta k\left(2+\frac{\Delta}{c}\right)}{\left[1+ck\left(1+\frac{\Delta}{c}\right)^2\right](1+ck)} < 0$. When $\Delta = \Delta^\circ$, the quality loss due to the weaker economic incentive in the cooperative is exactly offset by the social motivation geared by social capital, the cooperative and IOF thus have the same product quality. When $\Delta > \Delta^\circ$ ($0 < \Delta < \Delta^\circ$), the quality improvement due to the social motivation exceeds (undergoes) the quality loss due to the weaker economic incentive, the cooperative thus has the higher (lower) product quality than the IOF.

Third, the threshold social capital level $\Delta^\circ = \frac{1}{k} - c$ is determined by the members' subjective risk towards quality uncertainty. In essence, it reflects the relative effectiveness of economic incentive and social motivation in different contexts. The solid curve in Figure 4.4 provides a graphical illustration of Δ°. The area above curve Δ° and the horizontal axis represents the range of social capital, with which the cooperative will have higher product quality. The area surrounded by curve Δ°, the horizontal and the vertical axis represents the situations where the IOF will have higher product quality. When k is large, the economic incentive is less effective in eliciting quality provisions because the highly risk-averse farmers will be reluctant to invest efforts in quality improvement as the payoff is treated as highly uncertain. Therefore, a low level of social capital in the cooperative is sufficient to generate social motivation that compensates the weaker economic quality incentive. Δ° will then be low. To the contrary, when k is low, the economic quality incentive becomes more effective. A high level of social capital is needed to supplement the weaker economic incentive and support the product quality and Δ° will be high. Cooperatives therefore do not always benefit from social capital in product quality provisions. Only when the social capital within the organisation is higher than the threshold level Δ°, can the cooperative produce higher product quality than the IOF. As the product quality of cooperatives depends on both social capital and members' subjective risk

towards quality uncertainty, comparison of the product quality of the cooperative and IOF provides a potential explanation to the fact that cooperatives and IOFs coexist in most agricultural markets, some of which 'have lower quality products provided by cooperatives, whereas other markets have high quality products provided by cooperatives' (Liang, 2013:65). As Δ° is decreasing in k, the advantage of the cooperative's social capital for product quality provisions is more prominent when the subjective risk of the farmers is high. This result is formulated in Proposition 5:

Proposition 5: In the agribusiness with high (low) quality uncertainty in production, high-quality products are mainly produced by cooperatives (IOFs).

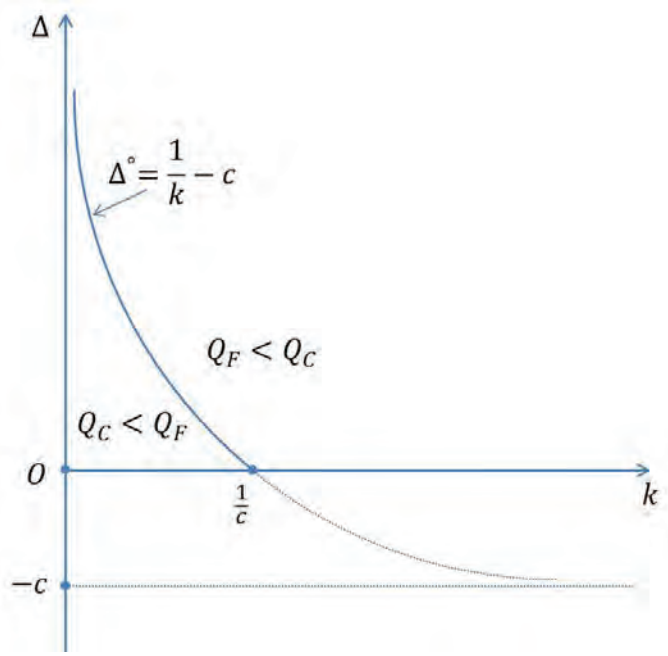

Figure 4.4: Product quality, social capital and subjective risk

Straightforward comparison of the joint certainty equivalent payoff shows that when an optimal income rights structure is chosen by the cooperative, the joint certainty equivalent payoff of the cooperative will always be higher than that of the IOF if the cooperative's social capital level is higher than zero. The existence of social capital in the cooperative replaces economic incentives and helps reduce disutility from the risk of production uncertainty when the farmers are risk averse. Therefore, with social capital, the cooperative is always more efficient than the IOF. Proposition 6 states the result:

Proposition 6: The cooperative is uniquely efficient when $\Delta > 0$.

4.5 Discussion

In this section, we discuss the results of our model and link the propositions with the empirical observations in previous cooperative studies. While there are no direct tests of our theory, there is some related evidence that is worth mentioning. First, we review the relationship between social capital and the practices and success of cooperatives. Second, we discuss the change in social capital when cooperatives develop and the consequences of this change in cooperatives' performance and income rights structure. Finally, we highlight the need for maintaining and recovering social capital in cooperatives and discuss how to achieve it.

Social Capital and Cooperative Success

Cooperative social capital has long been recognised as a main comparative advantage of the cooperative form (Røkholt, 1999; Spear, 2000; Hogeland, 2006). According to Borgen (2001), control and coordination in cooperatives cannot be fully accomplished by means of prices or authority. Successful cooperatives are characterised by their capacity to overcome this gap with social capital. With the informal control and coordination geared by social capital, monitoring and transaction costs can be saved (Chloupkova, Svendsen and Svendsen, 2003; Volentinov, 2004), and the problem of coordination and aligning preferences can be alleviated (Castiglione, van Deth and Wolleb, 2008). The model in this chapter highlights the informal control function of cooperatives' social capital and captures its values in three aspects.

First, as a substitute for formal control, social capital mitigates the free-riding problem and generates social motivation for members' quality provisions. Proposition 3 and its Corollary show that the equitable principles adopted by most traditional cooperatives, especially those in the early stage of the lifecycle, is based on the high level of social capital they possess. As cooperatives usually start on a small scale, members are usually well acquainted and there is strong social relationships among them (Nilsson, Svendsen and Svendsen, 2012). The trust among members makes them believe that no one will shirk their duties. Social sanctions and reputational effects in the cooperative community make opportunistic behaviour costly. Members are loyal to their cooperatives and have high commitments.

With a high level of social capital, traditional cooperatives enjoy the benefits of complete pooling by sharing production risk among members to the largest extent and achieving economy of scale. At the same time, high product quality can still be sustained because a high level of social capital diminishes the tendencies to free-ride and default for individual advantage (Paldam and Svendsen, 2000). As demonstrated by the Danish dairy cooperatives case, farmer cooperatives were historically superior

in the production of large and homogeneous volumes of high-quality agricultural products. Social capital provides a foundation for their success. By contrast, if there is insufficient social capital, complete pooling becomes inefficient and should not be adopted by cooperatives. Actually, if there is only weak social capital within the membership, the members tend to be ignorant and free-riding behaviour will prevail. Empirical evidence from Macedonia, Russia and Eastern Europe shows that if there exists insufficient social capital between potential members, especially the mutual trust between individual farmers, cooperatives will not be founded or be successful because no collective actions can be enabled and sustained (Nilsson and Hendrikse, 2011). Social capital is thus regarded as the 'point of departure' in the governance of traditional cooperatives (Nilsson, Svendsen and Svendsen, 2012:190) and the '*sine qua non*' for the success and adaptation of cooperative enterprises (Feng, Nilsson, Ollila and Karantininis, 2011:1). Social capital provides a social explanation to the common practice of complete pooling in traditional cooperatives, which appears difficult to explain when being analysed purely on the grounds of economic incentives.

Second, Proposition 2, 4 and 5 indicate that social capital is especially valuable when economic incentives are less effective for product quality provisions. As stated in Proposition 2, when farmers' subjective risk towards quality uncertainty is high, the risk attitude of farmers imposes large constraints on the applicability of economic incentives. The processor has to adopt a limited strength of economic incentive under these circumstances, and high product quality is difficult to obtain. Social capital gives cooperatives an additional degree of freedom to incentivise their members and make cooperatives capable of achieving high product quality. This argument can be generalised to other situations where economic incentives fail. In our model, farmers' subjective risk is the scale of their absolute risk aversion level and the objective quality risk in production. The objective quality risk is assumed to be adhered to the nature of agricultural production per se. However, there are also other sources of uncertainty in the agribusiness value chain that will contribute to the quality risk. When this uncertainty exists, economic incentives will also become ineffective and give rise to the role of social capital. For example, the uncertainty in grading and testing mechanisms will cause a systematic underinvestment of farmers in farm-level quality control when a price-grade type incentive structure is applied (Hennessy, 1996). The case of the US sugar beet industry also shows that, when trading with an IOF, the farmers may face additional uncertainty towards the IOF's quality measurement and payment (Balbach, 1998). This uncertainty in the agribusiness value chain makes farmers less willing to invest in improving product quality. In both situations, the social motivation geared by social capital may help cooperatives overcome the

impediment of economic incentives and support high product quality. Nevertheless, this prediction is subjected to more empirical tests.

Third, as stated in Proposition 6, social capital can generate a higher certainty equivalent payoff for cooperative members. Agricultural production is usually uncertain and farmers are generally risk averse. Although linear contracts are designed to optimally trade off risk bearing against quality incentives, the risk premium the farmers bear will increase with the quality incentive intensity. As social capital provides social motivation for quality improvement, it plays a role of reducing the use of economic incentives or even completely substituting them in the case that the social capital level is very high. This is beneficial for cooperative members because weaker quality incentives imply a larger pooling ratio or a larger base payment in the linear contract, which expose the members to less risk from quality uncertainty and make the processor bear more risk. The loss of certainty equivalent payoffs due to risk premium is reduced by social capital, which justifies the advantage of the cooperative business form.

Cooperative Growth, Social Capital, and Failure

Nowadays, cooperatives tend to adopt market-oriented strategies in order to respond to increasing competitive pressure and changing market situation. While facilitating their growth, cooperatives often expand horizontally by merging with others and/or vertically by moving forward in the value chain (van der Krogt, et al., 2007). However, the social capital level in cooperatives is supposed to decline as they become large and complex cooperatives (Nilsson, Svendsen and Svendsen, 2012). The reasons are multifaceted. First, horizontal expansions tend to create a large and heterogeneous membership (Nilsson, Svendsen and Svendsen, 2012), which is detrimental to cooperative social capital. According to Hogeland (2006), the culture in traditional cooperatives will be changed as the cooperative expands. When cooperatives become large and complex, the social interactions between members, which serve as the mechanism to develop and maintain shared beliefs, values and vision, become less frequent. Without sufficient social interactions, the conditions for building personal trust are no longer in place either (Granovetter, 1985). In addition, according to Granovetter (2005:34), 'the larger the group, the lower is its ability to crystallize and enforce norms, including those against free-riding'. Second, vertical integration strategies drive cooperatives enter into value-added business which is far away from members' on-farm activities. Cooperatives' business becomes so complex that members have difficulty in understanding it (Nilsson and Hendrikse, 2011). At the same time, as more decision power is allocated to professional managers, members have limited influence on the cooperatives' decision making (Bager, 1996, Hart, 1997;

Bhuyan, 2007, Bijman, Hendrikse and van Oijen, 2013). The shrinking members' control in large cooperatives not only changes the governance of cooperatives, but also makes them act more like IOFs and more corporate-oriented (Hind, 1997, 1999; Hendrikse, 2005), thereby weakening identification of members with the cooperative (Borgen, 2001). Third, ideology plays a less prominent role in cooperatives nowadays. According to Fulton (1995), changes in society's values are likely to make cooperation more difficult. Farmers today are more pragmatic about their cooperatives and members' decisions are based mainly on economic terms (Karantininis and Zago, 2001). The behavioural constraints that social capital can set on members are much weaker.

Low social capital in the organisation has been used to explain the failure of large and complex cooperatives in the past decades. Nilsson, Svendsen and Svendsen (2012:187) summarise that the drain of social capital is reflected in 'less involvement for mutual benefits, less collaboration and members' decreasing trust in their cooperatives' leaders, as well as in each other'. With a low level of social capital, members forgo cooperative value and care mainly about individual economic benefits; members lose their loyalty to their cooperative; members are not willing to sacrifice any short-term loss for long-term gain; members tend to be free riders and they are unwilling to provide equity to cooperatives; members do not trust managers and make inadequate commitment to control the management; collaboration in cooperatives becomes cumbersome and efficiency is lost, to name a few.

Regarding product quality provisions, low social capital in large and complex cooperatives will lead to weak social motivation. Weak social motivation and an income rights structure with weak economic incentives is a misalignment in the incentive system. Members will have insufficient motivation to deliver high quality products and it leads to low product quality of cooperatives. According to Proposition 1, when the cooperative's social capital level declines, the cooperative must provide stronger economic incentives for product quality provisions. To do this, the cooperative can change the income rights structure either by increasing the quality premium in the linear contract or by decreasing the pooling ratio. Proposition 3 specifies the highest efficient pooling ratio a cooperative can enact. As the social capital level in the cooperative declines, the highest efficient pooling ratio will also decrease. It entails that the income rights structure needs to become more individualised. In addition, when the cooperative's social capital level declines, the necessary condition for the complete pooling policy does not hold anymore. With severe free-riding problems, the complete pooling policy becomes very inefficient and should be abandoned.

The change of income rights structure of The Greenery provides an example of conversion from collective to more individualised forms of income rights structure. The Greenery is the outcome of a merger of nine Dutch regional fruit and vegetable auction cooperatives. Besides the large size, The Greenery's membership heterogeneity increased (Hendrikse, 2011). In the first few years after the merger, some large growers left the cooperative because of 'cross-subsidization of small growers' (Bijman and Hendrikse, 2003:102). Meanwhile, some innovative producers left because the equality principle of pooling limits the payoff they could receive for their innovation efforts (Hendrikse, 2011). Explained from the social capital perspective, as a large and complex cooperative, The Greenery has very limited social capital in the organisation. Members' patronage commitment is no longer associated with social motivation but with economic incentives. The Greenery later introduced the member benefit programmes, which increased the number and extent of quality attributes covered by specific clauses in the incentive contracts. Members receive the payoff for higher product quality in terms of a quality-specific price (Hendrikse, 2011). With the member benefit programmes, the cooperative increased the economic incentive density for product quality. After that, innovative producers did not leave The Greenery anymore and some even came back to the cooperative (Hendrikse, 2011). The Greenery case shows the necessity of adjusting the income rights structure according to the level of cooperative social capital. As a large and complex cooperative with heterogeneous membership, The Greenery has to introduce strong economic incentives, as its social capital seems to have played no role in providing motivation for quality provisions.

Maintain and Recover Cooperative Social Capital

Although we argue that changing the income rights structure is necessary when cooperative's social capital level declines, it is also important to emphasise that cooperatives should never forgo the potential value of social capital in bringing comparative advantages to cooperatives. Besides providing social motivation and bringing larger welfare to members, social capital can generate other benefits for cooperatives and members. For instance, social capital also helps cooperatives obtain financial resources and stability. Since cooperatives generally have to obtain additional equity from their members (Hansmann, 1996), members who trust their cooperative are more willing to invest in the cooperative. In addition, the cooperative ideology of members makes them more willing to accept a large amount of unallocated equity capital (Fahlbeck, 2007).

Maintaining social capital during the development of the cooperative may become increasingly difficult as the membership base expands and becomes more

heterogeneous (Valentinov, 2004). Nevertheless, it can still be very successful. Social capital in organisations mainly relies on the factors that shape the evolution of the social relationship between members, namely, time, interaction, interdependence, and closure (Nahapiet and Ghoshal, 1998). Horizontal and vertical expansion of a cooperative may change all or most of these factors by modifying the social network structure of cooperatives, decreasing the possibility of interactions among members, lowering the interdependency between members, and weakening the identity of membership. In other words, the growth of cooperatives goes at the expense of social capital (Nilsson, Svendsen and Svendsen, 2012). If cooperative members and managers can identify the detrimental trends of declining social capital and initiate proper membership strategies to counter it, social capital in cooperatives can be maintained.

Uzea and Fulton (2009) provide empirical evidence of the Co-operative Retailing System (CRS) in Canada, where identity management has successfully been applied, together with economic mechanisms, to manage opportunisms in the network, such as shirking on quality maintenance of the brand name, patronising outside and overexpansion. CRS is a network of about 264 retail cooperatives and their wholesaler, Federated Co-operatives Limited (FCL). The strategy of FCL to maintain social capital mainly consists of 'identity management' (p.16), which includes establishing CRS identity, fostering retails' identification with the system and establishing succession planning. Empirical study has shown that strong identification is a significant trust-making mechanism in cooperative organisations (Borgen, 2001). CRS successfully removed individualistic norms, created cooperative norms, enhanced common and mutual understanding, shared knowledge and promoted loyalty. By inducing the members to identify with the network, members have the desire to 'act in compliance with one's own identity' (p.5). The robust cooperation among members is promoted. In combination with the identity management, the economic mechanisms of CRS such as the patronage refund system and the marketing programme are also introduced to deter opportunisms by the retails. For example, the patronage refund system, which distributes part of the net savings to members in proportion to their patronage, 'providing retails strong incentive to operate in the system' (p.23). The well-designed combination of social and economic mechanisms brought great success to CRS. It is worth noting that the social capital in CRS, represented by retails' identification with the system, is reinforced by the success of the CRS, 'providing the retails with even stronger incentives to co-operate in patronising their wholesaler' (p.32). The success of CRS demonstrates cooperative success achieved by strategically building cooperative's social capital in combination with proper economic incentives.

4.6 Conclusion and Further Research

A model is formulated to study the value of social capital in cooperatives and the importance of the balance between social capital and the income rights structure of cooperatives. It highlights the value of social capital in the provision of product quality by cooperatives. Social capital generates social motivation for members to abide by the product quality standard of the cooperative. With social capital, the cooperative is able to adopt low-powered economic incentives for product quality, and expose members to less quality uncertainty. The existence of a very high level of social capital supports the equitable principle of complete pooling in traditional cooperatives. With social capital, cooperatives are more attractive than IOFs because they can generate a larger joint certainty equivalent payoff for farmers. However, social capital may change with the development of cooperatives. The increasing prevalence of a market-oriented perspective has led marketing cooperatives to assign increasing importance to expansion strategies (van der Krogt, et al., 2007). Cooperatives tend to lose social capital when they expand horizontally and vertically. We argue that when social capital in cooperatives is incapable of supporting product quality by providing sufficient social motivation, the change in cooperatives' income rights structure becomes necessary. When the cooperative's social capital level declines, stronger quality incentives will be introduced by the cooperative.

Social capital provides social motivation for cooperative members in the provision of product quality; however, it will not always lead cooperatives to have higher product quality than IOFs. Whether cooperatives have higher product quality depends on the social capital level and the subjective risk aversion level of farmers. When farmers have a high subjective risk towards quality uncertainty, the economic quality incentive becomes less effective in eliciting their quality efforts. The social motivation geared by the social capital becomes more advantageous. As an IOF is less able to elicit high quality supplies from the farmers by using economic incentives, a low level of social capital in the cooperative is already sufficient to make the cooperative supply higher product quality than the IOF through the mechanism of social motivation. To the contrary, when the farmers have a low subjective risk toward quality uncertainty, the economic quality incentive will become more effective, and a high level of social capital will be needed to supplement the weaker economic incentive in the cooperative. Therefore, social capital is supposed to make cooperatives more competitive in the agribusinesses with higher quality uncertainty in production.

In this chapter, our notion of social capital is much more basic and elementary than those discussed in the voluminous literature on social capital. However, the value of our model lies in its explanatory power of the functional aspects of relational social

capital, the behaviour mechanism behind it, and what social capital can accomplish for a cooperative. This chapter offers a rigorous theoretical explanation of the value of cooperative social capital and indicates various possibilities for further research. First, the members' social motivation to act according to the cooperative's standard is treated as exogenous and is determined by the social capital level of the cooperative in the model. There is the possibility that pooling policies may influence social capital as well, i.e. the two-way interaction between the economic incentives and social motivation. Partial pooling represents a higher intensity of individualised quality incentives for members than complete pooling. It may, positively or negatively, affect the members' social preference of contributing to the wellbeing of the cooperative. In other words, the decrease of the pooling ratio can have the 'crowding-in' or 'crowding-out' effect on the cooperative's social capital, which provides intrinsic motivation for members' quality provisions (Bowles and Polania-Reyes, 2012:368). The next step is therefore to model the interaction between the cooperative income rights structure and social capital by making the latter as an endogenous attribute of the cooperative. Second, the members' cost parameter of product quality and their risk aversion level are assumed identical. We do not investigate the adverse selection problem caused by the decreasing social capital in this chapter (Hendrikse, 2011). Further modelling is called for to address heterogeneous members' decisions. Third, a longitudinal study of the evolution of social capital in a single large cooperative along its lifecycle is lacking. Such studies are helpful to provide cooperative practitioners and researchers with a better understanding of the balance of the cooperative's social and economic attributes.

5. The Impact of Pooling on Structural Social Capital and Product Quality in Cooperatives

Abstract

Decisions by members in cooperatives are driven by economic as well as social concerns. They value the income resulting from the (quality of) products delivered to the cooperative as well as the interactions with other members and the concern for their wellbeing. We investigate in a game theoretic model the consequences of members' social interactions on their product quality decisions. It is shown that the amount of the members' social interactions depends upon, and increases with, the cooperative's pooling ratio. We show that the complete pooling is not only economically efficient but also socially advantageous when it can stimulate frequent social interactions among members. However, when the social context of the cooperative is no longer conducive to social interactions, the complete pooling policy will become sub-optimal. The cooperative should abandon the pooling policy. In particular, the model offers an alternative explanation for several of the commonly observed phenomena relating to the pooling policy of cooperatives.

Keywords: Social Capital, Social Interaction, Cooperatives, Pooling Policy

'Most behaviour is closely embedded in networks of interpersonal relations.'

(Granovetter, 1985:504)

5.1 Introduction

Voluntarily formed by a group of producers to achieve their collective economic goals and interests, every cooperative represents an association of persons in the sociological and social-psychological sense (Valentinov, 2004). A cooperative is therefore a joint enterprise collectively owned by a social group. The members are not anonymous financiers but real persons who run their own agricultural enterprises (Nilsson, Svendsen and Svendsen, 2012). The local nature of cooperative membership entails that the members are likely to know each other and have social relationships (Cropp and Ingalsbe, 1989; Hendrikse and Feng, 2013). Therefore, there exists a social network among the members of a cooperative.

Sociologists have forcefully argued that the embeddedness of economic activities in networks of social ties has a profound impact on the economic performance of organisations (e.g. Coleman, 1984; Granovetter, 1985; Turner, 1999). Nowadays, this is also reflected in economic models of social networks (e.g. Goyal, 2007). It seems therefore appropriate to model the social connections among members in cooperatives. In this chapter, we investigate the social ties between members in cooperatives, which can be characterised as the structural dimension of social capital. According to Nahapiet and Ghoshal, (1998), structural social capital reflects the overall pattern of social connections between the members in the organisation. A high level of structural social capital featured by the existence of strong social ties among members is beneficial for cooperatives in various aspects. It not only facilitates the exchange of information between the members but also supports the formation of the cognitive and relational dimension of social capital, such as shared vision, trust, and norms in the cooperative (e.g. Granovetter, 1985; Gulati, 1995; Tsai and Ghoshal, 1998). Furthermore, social ties in a cooperative community carry personal attachments between the members. According to van Dijk and van Winden (1997:325), a social tie between two individuals consists of their 'sentiments' about each other, which are defined as 'the extent to which one person cares about the other's welfare and derives satisfaction from it'. Social ties thus give rise to altruism between members. Similar to the altruism between colleagues in a workplace or in a team (Rotemberg, 2006), the altruism between cooperative members may promote reciprocal behaviours. That is, an altruistic member will care about the fellow members' wellbeing, and then adapts his or her future actions accordingly. Therefore, in addition to other benefits, social ties between cooperative members may serve as a source of social motivation for their production activities and have potential impacts on cooperative's economic performance.

Social ties between people are not always constant. Instead, 'they depend on the history of interaction between the individuals' (van Dijk and van Winden, 1997:324). In cooperatives, members are socially connected to each other and the altruism between them is rooted in the social ties. Following Dur and Sol's (2010:295) work on the formation of social ties, we assume that a member's altruistic feelings towards others depend on the 'attention' the member has received. The formation and strength of the altruism in a cooperative thus depend on the amount of the members' social interactions. By adopting Coleman's (1988) approach of incorporating agents' purposive actions in social contexts, we argue that cooperative members' social interactions are driven by the net utility they can derive. Two aspects are likely to play an important role in members' decisions regarding social interactions. First, the income rights structure of the cooperative may influence the members' willingness to

interact because it determines the externality of their economic payoff on their social interactions. The members will interact more if the externality is larger because the economic benefits of social interactions are better internalised. Second, the social utility and costs of social interactions will be considered by the members. It is natural to expect that the members will interact less if social interactions are more costly or bring less social utility.

According to Singh (2012:107), 'there are two main classes of social interaction models in economics, one that uses non-cooperative game theory to study the strategic interaction among agents, and another that uses empirical models to determine the existence of social interaction effects reflecting the role of nonmarket influences on individual decision-making'. In this chapter, our approach belongs to the first class. Specifically, we present a game theoretic model to capture the members' social interactions and product quality decisions under different pooling policies. We obtain two main results. First, the model shows that the income rights structure of cooperatives influences the social interactions of members and social ties in the cooperative. The amount of the members' social interactions and the strength of social ties depend upon, and increase with, the cooperative's pooling ratio. In addition, the increase of the marginal cost of social interaction activities will deter the formation of social ties. Second, the social ties have a positive impact on the members' production activities, economic payoff, and total utility. With strong social ties, the cooperative can approach the first-best level of product quality and joint economic payoff under the complete pooling policy. When considering the members' total utility instead of merely their economic payoff, the complete pooling policy is economically and socially desirable if strong social ties can be formed in the cooperative. However, when complete pooling cannot facilitate sufficient social interactions between the members due to increasing social interaction costs, the cooperative should abandon the complete pooling policy and adopt the no-pooling policy.

This chapter proceeds as follows. In Sections 5.2 and 5.3, we present the model and derive the equilibrium. In Section 5.4, we provide the comparative statics analysis. In Section 5.5, we discuss the empirical implications and the final section concludes.

5.2 Model

We study a cooperative with two identical members.[13] In this model, we consider the members' production activities as well as social interaction activities. Members decide

[13] This setting can be extended to a cooperative with n (>2) members in order to analyse richer network structures.

on their social interaction activities simultaneously in the first stage of the game, while production activities are determined in the second stage. The equilibrium social interaction activities and product quality decisions are determined by backward induction.

Each member produces one unit of raw product and supplies it to the cooperative. The cooperative sells the product in a functioning market and pays the members. We focus on the members' production activities regarding their quality provisions. The members decide the product quality q_i $(\geq 0;\ i = 1\ or\ 2)$ individually, which is assumed to be fully contractible. The cooperative's aggregate product quality Q_C is the average quality of the raw product of both members

$$Q_C = \frac{1}{2}(q_1 + q_2).$$

The cooperative's income rights structure is represented by its pooling policy. It is captured by the pooling ratio σ $(0 \leq \sigma \leq 1)$, which denotes the portion of each member's product that is assigned to a common pool (Saitone and Sexton, 2009). It determines the pooled payment received by a member and is contingent on the pooled quality Q_c. $1 - \sigma$ denotes the portion of product that receives a member-specific payment based on q_i. When $\sigma = 1$, the cooperative applies the complete pooling policy, whereas the cooperative applies no pooling when $\sigma = 0$. Partial pooling is characterised by $0 < \sigma < 1$. The cooperative's pooling ratio is known and treated as exogenous. Assume that $P_0(> 0)$ is the marginal price of product quality, which can be understood as the aggregated 'taste parameter' of the market (Mussa and Rosen, 1978:301), and c is the cost coefficient of the quality provision, the economic payoff of a member's production activity is

$$\pi_i = \sigma P_0 Q_C + (1 - \sigma) P_0 q_i - \frac{1}{2} c q_i^2\ , i = 1\ or\ 2.$$

The members' social interaction activity s_i $(\geq 0;\ i = 1\ or\ 2)$ is modelled as the social interactions initiated by member i. According to Dur and Sol (2010:294), social interactions can be modelled as an exchange of 'attention' between agents. A member initiates social interactions by giving social attention to the other member. It can be the 'kind gestures' the member gives to the other (p.294), e.g. an invitation for coffee or a conversation about family issues. The members' social interaction activities s_i are not contractible but costly in terms of time, money, and efforts. The cost is assumed to be ds_i, where $d(> 0)$ is the marginal cost coefficient of social interaction activities.

Social interactions generate two types of benefits (van Dijk and van Winden, 1997; Dur and Sol, 2010). First, it brings direct social utility to the receiver. For example,

when member 1 initiates social interactions, member 1's social interaction activities will bring member 2 a direct social utility of ks_2 $(k > 0)$ because people enjoy being treated kindly by others. Second, social interactions lead to altruistic feelings among the members. That is, when member 1 initiates social interactions, his social interaction activities will lead to member 2's feeling of altruism towards him. When member 2 is altruistic towards member 1, member 2 cares about member 1's economic payoff in addition to member 2's own economic payoff. Sheldon (1971) claims that this effect is increasing in the time and effort invested in a relationship. Likewise, the more frequently agents interact, the more cooperative behaviours will emerge and sustain (Duffy and Ochs, 2009). We thus assume that the strength of the altruistic feeling member 2 will develop towards member 1 is proportional to the social interactions member 2 receives from member 1. An altruism utility term $s_1\pi_1$ is incorporated in member 2's utility function. s_1 thus measures the strength of the developed social ties from member 2 to member 1. It is assumed that the members appreciate social interactions similarly. Social interactions thus have the same altruism-creating effect on both members. These features are presented in the members' utility functions

$$U_1 = \pi_1 - ds_1 + ks_2 + s_2\pi_2$$

$$U_2 = \pi_2 - ds_2 + ks_1 + s_1\pi_1.$$

We assume that the members' quality provision cost coefficient, social interaction activity cost coefficient, and the market's preference for product quality are common knowledge.

5.3 Equilibrium

In the second stage of the game, member 1's product quality is determined by the FOC (first-order condition) of his utility function:

$$\frac{\partial U_1}{\partial q_1} = \frac{\partial \pi_1}{\partial q_1} + s_2\frac{\partial \pi_2}{\partial q_1} = \frac{\sigma P_0}{2} + (1-\sigma)P_0 - cq_1 + s_2\frac{\sigma P_0}{2} = 0.$$

$$q_1^* = \frac{P_0}{c}\left[1 - \frac{\sigma}{2}(1-s_2)\right].$$

Similarly, member 2's quality decision is $q_2^* = \frac{P_0}{c}\left[1 - \frac{\sigma}{2}(1-s_1)\right]$.

The cooperative's equilibrium product quality is

$$Q_C^* = \frac{P_0}{c}\left[1 - \frac{\sigma}{4}(2-s_1-s_2)\right].$$

Substitute q_i^* and Q_C^* in π_i:

$$\pi_1^* = \frac{\sigma P_0^2}{c}\left[1-\frac{\sigma}{4}(2-s_1-s_2)\right]+\frac{(1-\sigma)P_0^2}{c}\left[1-\frac{\sigma}{2}(1-s_2)\right]-\frac{P_0^2}{2c}\left[1-\frac{\sigma}{2}(1-s_2)\right]^2$$

$$\pi_2^* = \frac{\sigma P_0^2}{c}\left[1-\frac{\sigma}{4}(2-s_1-s_2)\right]+\frac{(1-\sigma)P_0^2}{c}\left[1-\frac{\sigma}{2}(1-s_1)\right]-\frac{P_0^2}{2c}\left[1-\frac{\sigma}{2}(1-s_1)\right]^2.$$

In the first stage of the game, the social interaction activity of each member is determined by:

$$\frac{\partial U_1}{\partial s_1}=\frac{\partial \pi_1^*}{\partial s_1}-d+s_2\frac{\partial \pi_2^*}{\partial s_1}=\frac{\sigma^2P_0^2}{4c}-d-\frac{\sigma^2P_0^2}{4c}s_1s_2=0$$

$$\frac{\partial U_2}{\partial s_2}=\frac{\partial \pi_2^*}{\partial s_2}-d+s_1\frac{\partial \pi_1^*}{\partial s_2}=\frac{\sigma^2P_0^2}{4c}-d-\frac{\sigma^2P_0^2}{4c}s_1s_2=0.$$

We obtain $s_1s_2=1-\frac{4cd}{\sigma^2P_0^2}$. The symmetric solution of the members' equilibrium social interaction activity is

$$s_i^*=s^*=\sqrt{1-\frac{4cd}{\sigma^2P_0^2}}.$$

Social interactions will occur and social ties will be formed when $\sigma > \frac{2\sqrt{cd}}{P_0}$.

Substitute s_i^* in Q_C^*:

$$Q_C^*=\begin{cases}\frac{P_0}{c}\left[1-\frac{\sigma}{2}\left(1-\sqrt{1-\frac{4cd}{\sigma^2P_0^2}}\right)\right], & \sigma > \frac{2\sqrt{cd}}{P_0}\\ \frac{P_0}{c}\left(1-\frac{\sigma}{2}\right), & \sigma \le \frac{2\sqrt{cd}}{P_0}.\end{cases}$$

We denote $\pi_C=\pi_1+\pi_2$ as the joint economic payoff of the cooperative. It is equal to

$$\pi_C^*=\begin{cases}\frac{P_0^2}{c}\left[1-\frac{\sigma^2}{4}\left(1-\sqrt{1-\frac{4cd}{\sigma^2P_0^2}}\right)^2\right], & \sigma > \frac{2\sqrt{cd}}{P_0}\\ \frac{P_0^2}{c}\left(1-\frac{\sigma^2}{4}\right), & \sigma \le \frac{2\sqrt{cd}}{P_0}.\end{cases}$$

The members' total utility in equilibrium is

$$U_C^*=U_1^*+U_2^*=\pi_C^*+[\pi_C^*+2(k-d)]s_i^*.$$

5.4 Comparative Statics Analysis

In this section, we provide a comparative statics analysis of the equilibrium outcome. We first analyse the influence of the cooperative's pooling policy on the members' social interactions. Next, we study how the pooling ratio and social ties jointly determine the cooperative's product quality and economic payoff. Finally, we consider the members' total utility in the justification of the cooperative's pooling policy. This analysis permits us to formulate propositions regarding the members' behaviour and the optimal pooling practices of cooperatives.

Social Interactions and Social Ties

Figure 5.1 presents a graphical illustration of the members' social interactions as a function of the pooling ratio.

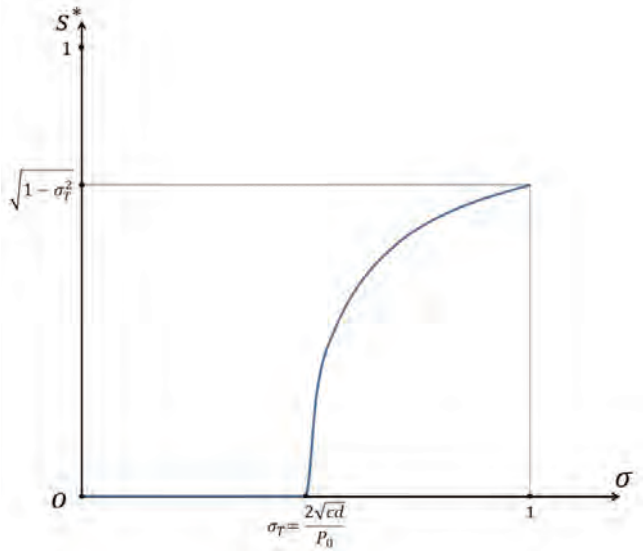

Figure 5.1: Members' social interactions

Members' social interactions are highly dependent on the cooperative's pooling policy. First, there exists a threshold pooling ratio $\sigma_T = \frac{2\sqrt{cd}}{P_0}$. Only when $\sigma > \sigma_T$ will the members undertake social interaction activities. Otherwise, no social interactions will take place and no social ties will be formed. Second, if social interactions occur, then they are increasing in the pooling ratio. s^* can be rewritten as $\sqrt{1-\frac{\sigma_T^2}{\sigma^2}}$ when $\sigma > \sigma_T$. When the cooperative enacts the complete pooling policy ($\sigma = 1$), the members will undertake the maximum amount of social interactions: $s^*_{max} = \sqrt{1-\sigma_T^2}$, and develop the strongest social ties and the highest level of altruism towards each other. The

following proposition summarises the relationship between the pooling ratio and social interaction:

Proposition 1: Cooperative members will undertake social interactions only when $\boldsymbol{\sigma > \frac{2\sqrt{cd}}{P_0}}$ ***and it is increasing in the pooling ratio.***

Pooling creates an externality in cooperative members' production activities, which means that 'the actions of one party result in benefits or costs for another party' (Feng, 2011:7). In our model, if a member increases (decreases) his product quality, the other member will benefit (suffer) through the pooling. A larger pooling ratio entails a larger externality because one member's quality decision will have more impact on the other's economic payoff and vice versa. An altruistic member's utility depends positively on the economic payoff of the other member. He will partly internalise the effect of his production activity on the other member, therefore adjusting his product quality decision in the desired direction in response to the receipt of social interactions. As such, the members will attempt to make others feel altruistic towards them by investing in social interactions. The larger the pooling ratio, the more willing are the members to invest in social relationships with their fellow members because the benefits from social interactions are more internalised. The cooperative's income rights structure influences the members' social interactions via the economic incentives it offers. Since the social ties between the members are based on their social interactions, the income rights structure thus has an influence on the cooperative's structural social capital.

Different pooling ratios reflect different levels of collectivism in the cooperative's income rights structure. The presence of a pooling ratio threshold σ_T entails that if the income rights structure of the cooperative is too individualistic, it will not be able to stimulate social interactions between the members. σ_T is determined by three parameters: the members' quality provision cost coefficient c, social interaction activity cost coefficient d, and the market's preference for product quality P_0. The members will undertake social interaction activities if doing so will increase their equilibrium utility U_i^*. The benefit of social interactions is determined by the economic payoff of quality provisions and the extent of externality, whereas the cost is determined by the cost coefficient d. If c and P are constant, the economic payoff of a certain level of quality provision is fixed. A larger d will require a larger pooling ratio in order to increase the externality. σ_T will thus be proportional to d. Conversely, if d is fixed, the decrease of c and increase of P both will raise the payoff of quality provisions. The benefits of social interactions under the same level of externality are larger. A smaller pooling ratio is thus sufficient to stimulate social interactions. Either

a smaller c or a larger P_0 (or both) will decrease σ_T, making social interactions more attractive.

The pooling ratio threshold σ_T also determines the amount of the social interactions and the strength of the social ties. Given a certain pooling ratio σ ($> \sigma_T$), the larger the σ_T, the smaller the s^*. Likewise, the maximum amount of social interactions s^*_{max} depends on σ_T. When σ_T is close to 0, s^*_{max} approaches 1. The members will develop the strongest ties between each other. However, when σ_T increases, s^*_{max} will decline, and the s^* curve will converge towards the point $\sigma = 1$ on the horizontal axis of Figure 5.1. In other words, the social interactions and social ties between the members diminish when σ_T increases. Especially, when $\sigma_T \geq 1$, i.e., $\frac{P_0^2}{4cd} \geq 1$, there will be no social interactions and no social ties between the members even under the complete pooling policy. σ_T is increasing in c and d but decreasing in P. As we focus specifically on the social interactions of members, we derive the range of d in that the social interactions will not occur, and social ties cannot be formed.

Proposition 2: Cooperative members will undertake no social interactions under any pooling policy if $\boldsymbol{d \geq \frac{P_0^2}{4c}}$***.***

Figure 5.2 depicts the range of d and c, in which social interactions can occur.

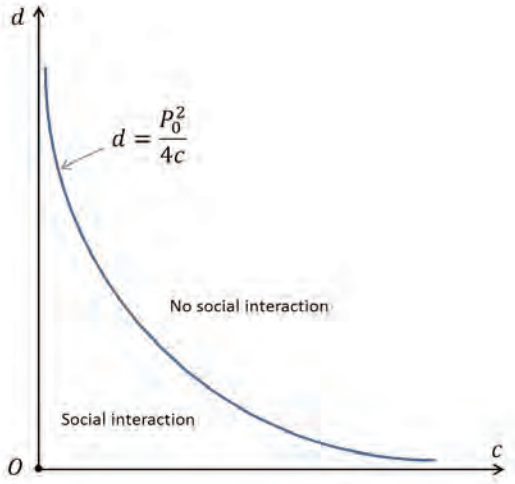

Figure 5.2: Parameter range of social interactions

Because σ_T is increasing in d, the formation of social ties will become more difficult or even impossible when d increases. The intuition is that, besides the income rights structure, the formation of social ties in the cooperative fundamentally depends on the social context of the cooperative community since it determines the marginal cost of

the members' social interaction activity. The following aspects may lead to an increase of d. First, d is positively associated with the distance between the members. For instance, if the members are living in a close neighbourhood or attend the same church regularly, they can interact with each other easily. By contrast, if the members live far apart or don't know each other, it will be much more costly to initiate social interactions. Second, d increases with the heterogeneity of members. If the members are very different in terms of background, interest, production scale, product portfolio, and so on, there is less proximity to enable smooth social interactions. Third, d may also depend on the opportunity costs of time. Social interactions are time consuming. If the members perceive that the time they spend on social interactions could have generated higher payoffs by investing it in other activities, this translates into a larger cost of social interaction activities.

Cooperative Product Quality and Economic Payoff

Because the cooperative can neither contract on the members' social interaction activities nor measure the costs and social utility of social interactions, its attention is confined to the product quality Q_C and joint economic payoff of the members' production activities: $\pi_C = \pi_1 + \pi_2$. They are important for the cooperative because, as a business firm, the cooperative competes with the other types of firms in the market and aims to achieve the highest possible economic payoff.

For the purpose of comparison, it is useful to derive the equilibrium results of the standard economic model, in which the social interactions and the related effects are ignored. The equilibrium product quality and joint economic payoff of the standard economic model are $\frac{P_0}{c}(1-\frac{\sigma}{2})$ and $\frac{P_0^2}{c}\left(1-\frac{\sigma^2}{4}\right)$. Furthermore, we can derive the first-best product quality. The FOC of π_C leads to $Q_{FB} = \frac{P_0}{c}$, and therefore the first-best joint economic payoff $\pi_{FB} = \frac{P_0^2}{c}$. A direct comparison of the first-best results and the equilibrium results of the standard economic model indicates that the pooling policy reduces the cooperative's efficiency by decreasing product quality.

The equilibrium product quality Q_C^* and joint economic payoff π_C^* can be normalised by using Q_{FB} and π_{FB}, respectively. Figures 5.3 and 5.4 present the normalised equilibrium results $Q_C^{*\prime}$ and $\pi_C^{*\prime}$. The first-best product quality and joint economic payoff are represented by the horizontal lines equal to 1 in each figure. The dotted curves represent the normalised equilibrium results of the standard economic model. Because the cooperative's joint economic payoff relies on the cooperative product quality, its change along σ has a similar pattern to that of the cooperative product quality. Figures 5.3 and 5.4 are thus similar in form except for the scales of the y-axis.

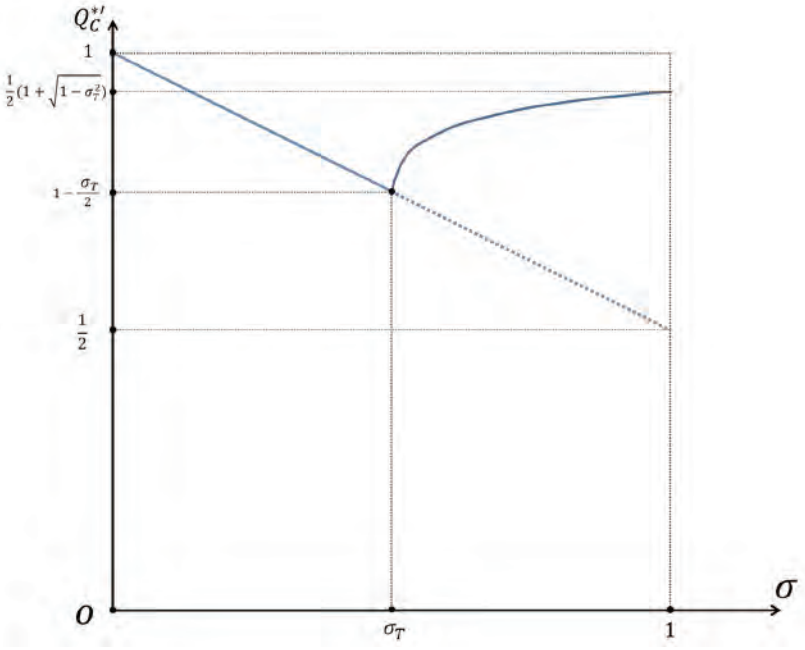

Figure 5.3: Cooperative's product quality

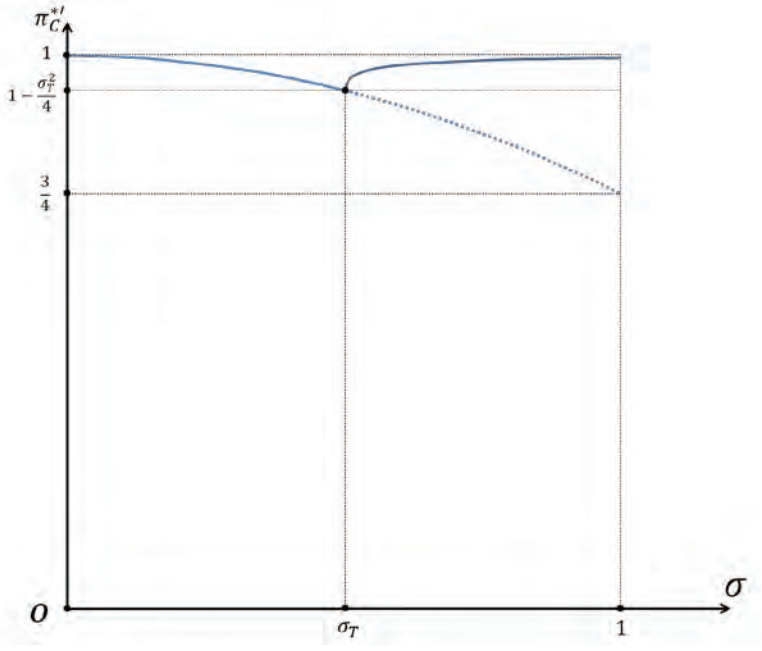

Figure 5.4: Cooperative's joint economic payoff

Several implications regarding the cooperative's choice of pooling policy can be drawn. First, when the cooperative adopts the no-pooling policy, the first-best product quality and joint economic payoff can be realised. In such a circumstance, each member is paid individually according to his or her own product quality. There will be no free-riding in the product quality provisions, but in the meantime, there will be no social interactions between the members. By contrast, when the cooperative applies a pooling policy, the cooperative's equilibrium product quality and joint economic payoff are determined by the joint effect of economic and social motivation. The former is directly decided by the pooling ratio whereas the latter is geared by social ties between the members.

Second, the cooperative's equilibrium product quality and joint economic payoff will fall below the first-best levels when there is pooling. Pooling facilitates the members' free-riding behaviours in their product quality provisions. The larger the pooling ratio, the more severe the free-riding problem. As Figures 5.3 and 5.4 show, the cooperative's equilibrium product quality and joint economic payoff will decrease continuously in σ when $\sigma \leq \sigma_T$, where no social interactions take place and the equilibrium results are the same as what the standard economic model predicts. When $\sigma \leq \sigma_T$, there is only economic motivation for the members, which is weaker than under the no-pooling policy. Therefore, the cooperative should not choose a pooling ratio $\sigma \in (0, \sigma_T]$. Instead, it should adopt the no-pooling policy. In other words, if a pooling policy only leads to free-riding and does not stimulate social interactions, it should not be enacted.

Third, when $\sigma > \sigma_T$, pooling will elicit social interactions between the members. With social interactions, the members develop social ties and altruism starts to play a role in their decision making regarding product quality. With social motivation based on altruism, the cooperative's equilibrium product quality and joint economic payoff will be above the standard economic equilibrium outcomes and increase in σ when $\sigma \in (\sigma_T, 1]$. The pooling policy is indispensable for social motivation because the externality of production activities is dependent on the pooling ratio. Although a larger pooling ratio leads to more free-riding, it also stimulates more social interactions and facilitates the development of stronger social ties. They will reach their maximum levels when $\sigma = 1$. Therefore, if the cooperative decides to enact a pooling policy, complete pooling is the best choice.

Finally, when the cooperative chooses the complete pooling policy, the equilibrium product quality and joint economic payoff rely on the maximum amount of social interactions it can elicit. When $\sigma = 1$, we rewrite $Q_C^{*\prime} = 1 - \frac{1}{2}(1 - s_{max}^*)$ and $\pi_C^{*\prime} = 1 - \frac{1}{4}(1 - s_{max}^*)^2$, where $s_{max}^* = \sqrt{1 - \sigma_T^2}$. As we have discussed above, σ_T is

ultimately decided by d. When d is very low, σ_T approaches 0, and $Q_C^{*\prime}$ and $\pi_C^{*\prime}$ will be close to the first-best levels. The reason is that, when σ_T decreases to 0, the members' social interactions under complete pooling s_{max}^* will increase to 1. Member 1's utility U_1 will be almost equal to $\pi_1 + \pi_2 + k$. It entails that member 1 puts the same weight on the economic payoff of member 2 as on his own economic payoff. Member 1 will not free ride and the same reasoning applies to member 2. Therefore, the economic incentives under an egalitarian distribution such as the complete pooling policy are perfectly efficient when the 'complete social consciousness' is obtained in the agricultural cooperative (Sen, 1966:369). When σ_T increases with d, $Q_C^{*\prime}$ and $\pi_C^{*\prime}$ will decline. When d is larger, the members' social interactions will become less because they are more costly. As a consequence, the social ties become weaker and less altruism is developed. The members care less about the other's economic payoff and become more willing to free ride on product quality provisions. When d increases to $\frac{P_0^2}{4c}$, σ_T will be close to 1. The members' social interactions disappear, and $Q_C^{*\prime}$ and $\pi_C^{*\prime}$ converge on the equilibrium results of the standard economic model. In this situation, it is better for the cooperative to choose no pooling.

We summarise the analysis of Figure 5.3 and 5.4 in the following proposition regarding the choice of cooperative pooling policy:

Proposition 3: If the cooperative decides to enact pooling, it should choose the complete pooling policy, which facilitates the strongest social ties between the members. With complete pooling, the cooperative can approach the first-best product quality and joint economic payoff when the marginal cost of social interactions is very low. However, if pooling cannot stimulate (sufficient) social interactions due to the large marginal cost of social interactions, the cooperative should choose the no-pooling policy.

Total Utility

According to LeVay (1983:3), 'cooperatives are known to appeal to people not merely as a means of running a business but also as an instrument of social amelioration'. Therefore, the social utility resulting from social interactions and social ties should not be ignored when we evaluate the cooperative's pooling policy. The members' total equilibrium utility is $U_C^* = U_1^* + U_2^* = \pi_C^* + [\pi_C^* + 2(k - d)]s_i^*$. The first term of U_C^* is the economic payoff of production activities and the second term is the social utility originated from the members' social interactions and social ties. The social utility includes the members' satisfaction derived from other members' economic payoff and the net benefits of social interactions. In Figure 5.5, the members' total utility is represented by the dashed curve. When $\sigma \leq \sigma_T$, there are no social interactions in the

cooperative, the utility curve is the same as the economic payoff curve. When $\sigma > \sigma_T$, the total utility curve starts to increase and will dominate the first-best economic payoff due to the additional social utility.

Figure 5.5 indicates that the cooperative's pooling policy, especially the complete pooling policy, can be better justified when the members' social utility is taken into account. If the members have strong social ties, i.e. s^* being close to 1, the members' total utility U_C approaches $2(\pi_{FB} + k)$, which is higher than the first-best economic payoff π_{FB}. The members enjoy the social interactions and develop strong social ties between each other. In turn, the altruisms make them better off when seeing other members achieving high economic payoffs, and drive them to invest optimal efforts in the quality provisions. As such, the pooling policy can lead to the members' total utility being much higher than the first-best economic payoff under the no-pooling policy. In particular, in the presence of social interactions, the members receive the highest total utility under the complete pooling policy.

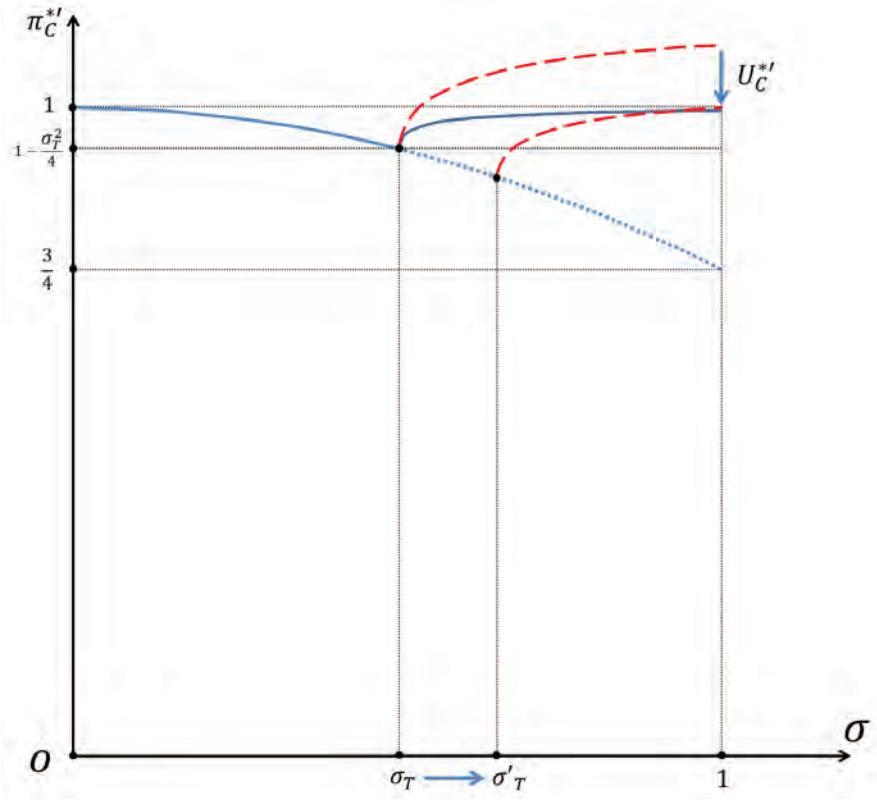

Figure 5.5: Members' total utility

When σ_T increases with a larger d, the members' total utility will decrease consequently. The reason is twofold. On the one hand, less social interactions result in weaker social ties and less altruism. The cooperative's economic payoff drops due to increasing free-riding in product quality provisions. On the other hand, the social utility drops as well, because the members appreciate others' economic payoffs less and receive lower net social benefits due to the lower social attention from others and higher costs of social interaction activities. Under the complete pooling policy, when σ_T increases to 1, the $U_C^{*\prime}$ curve converges to the standard economic payoff. As shown in Figure 5.5, when σ_T is larger than a certain value ${\sigma'}_T$ (< 1), the members' total utility will fall below the first-best economic payoff.[14] This makes the complete pooling policy sub-optimal even when we consider its social effect. In such a situation, the best strategy of the cooperative is to abandon the complete pooling policy and adopt no pooling. In so doing, the members receive individualised economic quality incentives and there will be no free-riding. The members can obtain the first-best economic payoff but there will be no social interactions between them. They receive no social utility any more. We summarise this insight in Proposition 4.

Proposition 4: The complete (no) pooling policy maximises total utility when $\sigma_T < (\geq) {\sigma'}_T$.

5.5 Discussion

Our model incorporates several important stylised facts of a traditional cooperative's development along its lifecycle. In particular, the model explains some of the commonly observed phenomena regarding the pooling policy of cooperatives.

In a pooling arrangement, 'revenues and costs are to a certain extent allocated independent of quantity and/or quality' (Hendrikse and Feng, 2013:509). Under the assumption of self-interest or opportunism, due to the free-riding behaviours of individual members, collectively optimal quality outcomes will not arise under pooling. The pooling policy is regarded as detrimental to product quality and economic performance of cooperatives (Saitone and Sexton, 2009; Liang, 2013). However, when the marginal cost of social interactions is low, the pooling policy, especially complete pooling, is actually desirable instead of sub-optimal due to its prominent social effect. Cooperative members may be motivated by more than economic benefits. Our model shows that, the pooling policy can stimulate social interactions among members and thus support the formation of social ties in the

[14] ${\sigma'}_T$ can be obtained by solving the equation: $U_C^{*\prime} = 1$. However, it is not possible to derive an analytical expression of the solution.

cooperative. When cooperative members are socially connected, they develop altruistic feelings towards each other. The members will be reluctant to free ride on the efforts of others when they are altruistic. The social interactions among the members generate not only social utility but also social motivation for members' production activities. The cooperative can be efficient under the complete pooling policy and the members can obtain a high total utility.

The benefits of the pooling policy largely depend on the social context of the cooperative community. The complete pooling policy is common in the early stage of a cooperative's development. According to Nilsson, Svendsen and Svendsen (2012:189), 'practically all cooperatives started on a small scale'. Members are usually well acquainted and there are strong social ties among them. In a small community, the members can easily undertake frequent social interactions between each other, which foster the altruism within the membership. Meanwhile, the complete pooling policy creates a large positive externality in the members' production activities. With the social motivation based on altruism, the members will not free ride. As such, the cooperative is efficient under the complete pooling policy. The members not only enjoy the economic payoffs comparable to the first-best level but also derive large social utility. Therefore, when the cooperative is in the early stage of the lifecycle, given the very low social interaction costs in the cooperative community, it is always beneficial to apply the complete pooling policy. This result offers an additional justification for the complete pooling policy of traditional cooperatives other than the explanation of economies of scale (Staatz, 1987) and production risk sharing (Deng and Hendrikse, 2013).

The complete pooling policy will become inefficient when it cannot elicit sufficient social interactions among the members. This may occur when the social context of the cooperative community changes, for example, when the cooperative expands and the membership becomes large and heterogeneous. In some large cooperatives, the members are no longer from the same village or community. Instead, they are from different regions or even from different countries (Bijman, 2010). As the members are becoming anonymous, it is more difficult and costly for them to interact with each other. As a consequence, they feel alienated to each other and the social ties in the cooperative become weaker (Nilsson, Kihlén and Norell, 2009; Österberg and Nilsson, 2009). The industrialisation of agribusiness also contributes to diminishing social ties in cooperatives. The members of some cooperatives have become large and modern farming enterprises instead of small farming households from decades ago. These farming enterprises are managed professionally and have large scales of production. They focus on the production activities and rarely interact with each other. As there is no space for members to develop social ties and altruistic feelings towards each other,

the complete pooling policy will lead to severe free-riding problems and low economic performance. The cooperative's best choice is thus to adopt the no-pooling policy. When members receive the individualistic economic payoff regarding their production activities, they tend to judge their cooperatives on the basis of economic efficiency more than its traditional social utility. In this sense, it can explain why cooperatives nowadays are losing their social attributes and becoming similar to conventional firms.

5.6 Conclusion and Further Research

Because a cooperative is simultaneously a firm and a community, one cannot study the cooperative without considering its social context. To our knowledge, the theoretical explanation of the effects of the social ties among members in cooperatives is still missing in the literature. In addition, while such social ties have been claimed to be important for cooperatives, the way that they are formed and the factors that determine their strength are less well understood. In this chapter, social ties between members are viewed as the manifestation of the structural social capital of the cooperative. We develop a game theoretic model to analyse the dynamics and value of the social ties in a cooperative.

One main result is that the cooperative's income rights structure has important impacts on the members' social interactions and in turn the formation of social ties. Another factor, which powerfully affects the formation of social ties, is the marginal cost of the members' social interactions. While the cooperative's pooling policy results in an externality regarding the members' production activities, the marginal cost of social interactions determines the amount of social interactions that will occur. Large pooling ratios and a low marginal cost of social interactions will boost the formation of strong social ties. We also show that the social ties are beneficial for the cooperative because altruism among the members carried by the social ties has a positive impact on the cooperative's economic performance and members' utility. Therefore, the complete pooling policy is not only economically efficient but also socially advantageous when the marginal cost of social interactions is low. However, when the social context of the cooperative does not allow for low-cost social interactions, the complete pooling policy will become sub-optimal. The cooperative should abandon the complete pooling policy and adopt the no-pooling policy. The results correspond with the common feature of a cooperative's development along its lifecycle regarding the pooling policy choice.

Several topics for future research may be pursued. First, the cooperative product quality in our model is the average of the members' product quality. There is no complementarity between the members' productive efforts. In addition, we did not

capture the complementarity between the social interaction activities and production activities, which may exist because social interactions lead to the exchange of information and experience (Peterson and Anderson, 1996). As such, although our model allows us to show the prominent altruistic effect of social ties, it will be worth investigating the above-mentioned complementary effects as well. Second, the marginal costs of the social interactions have been modelled as an exogenous variable in the current study. This assumption is reasonable because the change in the social structure in cooperatives has been largely driven by the trend of increasing competition and industrialisation in agribusiness (e.g. Bijman, 2010). However, the marginal cost of social interactions might be endogenously affected by the members' social interactions. After cooperative members have developed social ties, social interactions may become less costly since they have known each other better. Third, some cooperatives have started to organise social events to create opportunities for members to interact with each other. These events can be understood as the measures the cooperatives undertake to decrease the costs of social interactions. Members may develop social ties through these organised social events more easily. The effect of these social events in cooperatives is an interesting topic for further empirical research.

6. Managerial Vision Bias and Cooperative Governance[15]

Abstract

What causes firms to behave the way they do when they face different investment opportunities? We argue that both people and processes are behind the decision-making of project implementation. Member and professional CEOs of cooperatives differ regarding their managerial vision towards upstream and downstream projects. Cooperatives with member CEOs are upstream focused and it is reflected by the cascading effect of negative vision bias towards downstream projects. When downstream activities become more important, cooperatives need to replace the member CEOs with professional CEOs. However, a cooperative with a professional CEO may still be in a disadvantageous position if the member-dominated Board of Directors' negative bias towards downstream projects is too strong, which may result in an investor owned firm (IOF) being the efficient governance structure.

Keywords: Vision Bias, Cooperatives, Governance

'There is thus ample reason to think that any particular organisational structure will bias policy-making toward some outcomes and away from others.'

(Hammond and Thomas, 1989:158)

6.1 Introduction

What causes firms to behave the way they do when they face different investment opportunities? We argue that both processes and people are behind the decision-making of project implementation. First, the income and decision rights allocation of a governance structure shape the impact of decision-makers' discretion in the decision-making process (Hansmann, 1996). Second, as strategies are closely linked to the upper echelons of governance (Hambrick and Mason, 1984), human factors of

[15] A version of this chapter was published in the proceedings of the EAAE 2014 Congress, Ljubljana, Slovenia (https://www.conftool.pro/eaae2014/); the Workshop on Producers' Organizations in Agricultural Markets, 2014, Toulouse, France. This chapter has been accepted for publication by the Journal of European Review of Agricultural Economics.

decision makers must be taken into consideration when we study decision-making in organisations. In the cooperative literature, each of these factors has attained much attention, but they are not analysed within the same model. In this chapter, we incorporate the decision-making characteristics of different governance structures and decision makers' identity into one model. We compare cooperatives managed by different types of CEOs, and identify the circumstances under which professional CEOs will be efficient and create cooperatives' competitive advantages over IOFs.

Decision-making processes and decision makers are important in cooperatives. A prominent feature of traditional cooperatives' decision rights allocation is member dominance (Hendrikse and Feng, 2013). [16] The General Assembly (GA) of cooperatives has more extensive decision-making power than the annual shareholders meeting of IOFs do (Hendrikse, 1998). In addition, according to Feng (2011:21), 'the cooperative board of directors, democratically chosen by and from the membership, was the main body governing the activities and investments of the cooperative firm'. Because CEOs of cooperatives have almost no influence on the board composition (Cook and Burress, 2013), the BoD enjoys the independence to 'question management decisions and reject its recommendations' (USDA, 2002:11). Burress, Livingston and Cook's (2012) survey shows that cooperative boards are intensively involved in the development and evaluation of cooperatives' strategic decisions. By contrast, in an IOF, 'the CEO often has a large, if not dominant voice, in selecting the Board of Directors' (USDA, 2002:11). As an organisation can be perceived as a collection of decision-making bodies, a traditional cooperative is characterised by two independent decision-making bodies regarding project decisions: the CEO (of the cooperative firm) and the BoD (representing the members). While the CEO of the cooperative decides whether to submit an investment project proposal to the BoD, the BoD has the power to veto the proposal. Conversely, an IOF consists of only one decision-making body dominated by the CEO (Hendrikse, 1998:204).

Another feature of cooperatives is the identity of the BoD and CEO, which refers to the BoD's and CEO's group affiliation based on their career background (Liang and Hendrikse, 2013). The identity of cooperative BoD is determined by the ownership

[16] The term 'traditional cooperative' refers to the cooperatives in which the board of the cooperative holds the real decision-making power. Conversely, if the decision-making power has shifted from the board to the managers, the cooperative is not regarded as a traditional cooperative anymore. Bijman, Hendrikse and van Oijen (2013) describe the traditional mode of cooperative governance and the other two non-traditional modes in the Netherlands. Chaddad and Iliopoulos (2013:12) categorise agricultural cooperatives into three broad types of governance models along a 'member control' continuum – traditional model, extended traditional model, and managerial and corporate model.

nature of cooperatives. The BoD of cooperatives is dominated by farmer members (Hendrikse, 1998; Cornforth, 2004; Burress, Livingston and Cook, 2011). Although this board composition secures members' trust in the BoD (Hendrikse and Veerman, 1997), it may make cooperatives less efficient than IOFs because the member directors may lack the necessary skills and knowledge needed on the board (Staatz, 1987; Lang, 2002; USDA, 2002; Bond, 2009). Cooperatives have responded by hiring outside directors with specific expertise, while securing member dominance. Similar concerns also apply to member CEOs of cooperatives. Although member CEOs are somehow advantageous for cooperatives in that they are closely connected to the member community and are often professional in agricultural production management, they may lack the knowledge of market and other managerial skills compared with professional CEOs. These worries about the competence in the governance of cooperatives were already pointed out by LeVay (1983:20; see also Vitaliano, 1983) more than 30 years ago based on the '… presumption that most farmers cannot see any further than the farm gate and that directors of agricultural co-operatives, unless the executive or outside expertise are co-opted onto the board, are production, rather than market, orientated'. More recently, USDA (2002) calls for highly professional leadership for cooperatives and Bijman et al. (2012) highlight the relevance of outside directors and board training.

The CEO of a cooperative, as the head of the management team, can be either a farmer member of the cooperative or a professional manager employed from outside. Historically, cooperatives usually start on a small scale and one of the members assumes the role of CEO (Nilsson, Svendsen and Svendsen, 2012; Feng, 2011). However, the CEO identity may change along the cooperative's lifecycle. As the cooperative develops and grows, it will need full-time professional executives because the experience and competence of most members are insufficient for the cooperative management (Feng, 2011). Nowadays, more and more cooperatives recruit CEOs and the rest of the management team from the labour market (Nilsson, Svendsen and Svendsen, 2012; Bijman, Hendrikse and van Oijen, 2013; Chaddad and Iliopoulos, 2013; Bijman, Hanisch and van der Sangen, 2014). The CEO identity also varies across cooperatives in different countries due to different legislation, culture and development stages of cooperatives. For instances, many cooperatives in China have a member as CEO, while in Western countries, especially in the USA, most cooperatives employ outside CEOs (Liang and Hendrikse, 2013).

The market conditions in the agrifood business have been changing quickly over the past decades (e.g. Bijman, 2002, 2010; Hendrikse, 2011; Liang, 2013). According to Bijman (2002:8), 'the most fundamental one is the shift from production-orientation to market-orientation in the strategy of producers'. It entails that downstream activities

become more and more important in agribusiness. These downstream activities include the vertical expansion into value-added business, exploitation of market opportunities, creation of superior customer value, and so on. Cooperatives have been criticised as being too focused on bulk production and too slow in responding to the market and competitors (Nilsson, 2001). With the changes in market conditions, a common concern is whether the cooperative is still an efficient governance structure. Due to the production orientation and upstream focus, traditional cooperatives may be disadvantageous in competition with IOFs when downstream projects are more important. In addition, cooperative scholars have argued that the traditional decision-making mechanism in cooperatives are more arduous and time-consuming, leading to a competitive disadvantage (Henehan and Anderson, 1994) and lost opportunities (Hendrikse and van Oijen, 2010). In order to become market-oriented, many cooperatives have gone through restructuring by replacing member CEOs with professional CEOs and allocating more decision power to CEOs (Bijman, Hendrikse and van Oijen, 2013).

These observations raise the question when professional CEOs are beneficial for cooperatives? We address this question in a project rectification and selection model by considering decision maker's managerial vision. Decision makers of a firm are confronted with many business ideas and opportunities and need to make decisions regarding project implementation. Decision makers with different identities are featured by different managerial visions. We suppose that a decision maker is 'consistently biased towards certain types of projects and against others' (Rotemberg and Saloner, 2000:695). The positive (negative) vision bias entails that the decision maker favours (dislikes) the project and makes the decision maker's judgement of the project payoff differs from the true value positively (negatively). Translated into the context of agricultural marketing cooperatives, a member CEO and a professional CEO may have different managerial visions towards upstream and downstream projects. We are interested in how the vision biases of different CEOs may influence the cooperative's behaviour and performance, under what circumstances a member or professional CEO is beneficial for the cooperative, and when cooperatives outperform IOFs?

Our results show that managerial vision leads to inefficiency in project implementation because it results in the decision errors of abandoning sometimes good projects and implementing sometimes bad projects. Moreover, managerial vision and governance structure of the firm jointly shape the decision outcome and organisational performance. The upstream focus of traditional cooperatives is reflected by the cascaded negative vision bias towards downstream projects forged by the double screening feature of cooperative decision-making. When downstream activities

become more important, cooperatives need to replace member CEOs with professional CEOs. While a professional CEO proposes more downstream projects to the BoD than a member CEO does, the member-dominated BoD's negative vision bias and the double screening feature of cooperative decision-making can reduce the errors of implementing bad downstream projects. Hiring a professional CEO thus generates the cooperative's advantage in competing with an IOF in downstream activities. However, a cooperative with a professional CEO may still be less attractive than an IOF if the cooperative's BoD has a strong negative bias towards downstream projects. Therefore, it is necessary for the cooperative to include outside directors on the board not only to bring specific expertise but also to ease the negative vision bias.

We begin by reviewing the previous research on related topics in more detail in Section 6.2. Section 6.3 presents the model. Section 6.4 derives the equilibrium payoffs of the different governance structures. Section 6.5 identifies the efficient governance structure featured by the CEO identity and vision bias. Section 6.6 provides some discussion on our results. Conclusions and future research directions are formulated in the final section.

6.2 Literature

The management of a marketing cooperative is faced with more complex and difficult tasks than its counterparts in IOFs are (Cook, 1994; Royer, 1999). According to Feng and Hendrikse (2012:242), 'a cooperative is an enterprise collectively owned by many independent farmers as input suppliers', who have formal authority regarding investment decisions at the downstream processing stage of the cooperative (Hendrikse and Veerman, 2001b). The vertical ties between the members and the cooperative firm consist of both a transaction element and an ownership element (Feng and Hendrikse, 2012). By contrast, an IOF is a firm owned by outside investors and the input suppliers have merely a transactional relationship with it. Therefore, while the management of an IOF mainly focuses on maximising the investment return for its investors, the management of a marketing cooperative has to consider members' two sets of concerns, bringing the downstream processor to value and in the meantime serving upstream member interests regarding their own farms (Feng and Hendrikse, 2012; Liang, 2013). This challenge in cooperative management has two implications for decision-making in cooperatives regarding the rectification and selection of projects.

First, members formally participate in the decision-making process of the cooperative. Because more extensive decision-making power is retained by cooperative members via the GA and BoD, the investment decisions in cooperatives are thus subject to

double screening (Hendrikse, 1998). A cooperative is more conservative than an IOF in terms of project selection because each investment proposal requires approval of the society of members as well as the CEO of the cooperative (Hu, 2007). However, double screening makes cooperatives more efficient in environments with a relatively high percentage of poor projects or relatively high costs of adopting poor projects (Hendrikse, 1998; Hu, 2007).

Second, CEOs of cooperatives face the challenge of balancing upstream and downstream activities. Since cooperative members have both 'owner concerns' and 'user concerns', they have expectations in both upstream and downstream activities (Feng and Hendrikse, 2012:242). Previous studies suggest that CEOs' decisions regarding upstream and downstream activities are subject to the incentives they receive and their cognitive ability. From an incentive perspective, Feng and Hendrikse (2012) address the decisions of a cooperative CEO regarding upstream and downstream activities in a multi-task principal-agent model. Their results show that not having a public listing prevents the cooperative CEO from focusing too much on downstream activities. In addition, cooperatives are uniquely efficient when the interdependency between upstream and downstream activities is complementary and above a certain level. From a bounded cognition perspective, Feng (2011) examines the influence of governance structure on decision makers' performance in identifying upstream and downstream states. In an upstream (downstream) state, the environment requires upstream (downstream) projects to be implemented. The decision makers with bounded cognition accept or reject proposals of projects based on the expected benefit (loss) due to identifying the state correctly (wrongly). The governance structure shapes the decision makers' ability of identifying various states and determines their decision-making errors under different circumstances. The results show that a cooperative is uniquely efficient when upstream states are more likely to occur. In addition, because the cooperative processor is more conservative in the project selection, cooperatives are efficient when the costs of selecting the wrong state are relatively high.

The direct relationship between CEO identity and cooperatives' decision-making regarding upstream and downstream activities has been largely neglected in the cooperative literature. One recent contribution is Liang and Hendrikse (2013). They examine the efficient CEO identity of cooperatives from an incentive alignment perspective. In their model, the main difference between a member CEO and an outside CEO is that 'a member CEO not only devotes attention to member interests and cooperative enterprise value, but also dedicates efforts to his or her own farm'(p.26). CEOs with different identities thus respond differently to the incentives they are faced with. They show that cooperative CEO's identity has an impact on the

choice of upstream and downstream activities, and 'whether a member or outside CEO is more efficient depends on the marginal productivities of upstream and downstream value-adding tasks as well as the size of the substitution effect between them' (p.35).

In this chapter, we argue that decision makers' identity may impact their decisions regarding upstream and downstream activities through the managerial vision they have. A few theoretical studies have discussed how managerial vision influences the selection of projects and the consequences. Rotemberg and Saloner (2000) present a formal model, in which vision is conceptualised as a bias of the CEO that makes him in favour of certain projects. By changing the likelihood of which projects get implemented, the vision of the CEO affects the incentives of employees face in terms of generating project proposals. Another study of managerial vision in the organisational economics literature is by Van den Steen (2005). He defines managerial vision as 'a strong belief by the manager about the future and about the right course of action for the firm' (p.257). In his model, manager and employee vision is transformed into their belief about the likelihood of the state of the world. The model shows that a CEO or a firm with strong managerial beliefs attracts people with similar beliefs, causing an alignment of beliefs within the firm that has important implications for the firm's behaviour and performance. On the empirical side, researchers find that executives with different identities may differ in their visions about what is right strategy and confirm that these vision differences have material consequences. For instance, Barker and Mueller (2002) find that firms managed by CEOs with career experience in marketing/sales or R&D/engineering generally spend more on R&D than firms led by CEOs without this background.

This chapter builds on Rotemberg and Saloner's (2000) conceptualisation of managerial vision and Hendrikse's (1998) model of double screening decision-making in cooperatives. We follow Rotemberg and Saloner (2000) and suggest that a member CEO and a professional CEO will have different managerial visions, which bias them towards certain types of projects and against others. As a producer, the member CEO's experiences and dispositions create a potential positive vision bias favouring upstream projects, which are the tasks organised by the cooperative for members' farming production activities, such as service to support on-farm production, improvement of farming technology, member collaboration, and so on. Similarly, a cooperative board dominated by members may also favour upstream projects. By contrast, a professional CEO hired from the labour market is not a producer but has superior information about product markets, which may result in his or her preference for investment projects with a high downstream value. The professional CEO thus has a positive vision bias favouring downstream projects, which are focused on the value-added tasks at the downstream processing stage, including the activities of improving processing

efficiency, marketing campaigns, new product development, etc. These vision biases of different CEOs can affect the decisions of the cooperative regarding the selection of upstream and downstream projects and in turn affect the efficiency of the cooperative.

We differ from Rotemberg and Saloner (2000) and Hendrikse (1998) as follows. First, Rotemberg and Saloner (2000) study the role of CEO vision in ameliorating the incentive problems in organisations. In their model, CEO vision affects which projects are implemented and therefore the incentives of employees to innovate. By contrast, our model is a decision theoretic model based on team theory (Marschak and Radner, 1972), in which decision makers pursue the same objective but may have different judgements when seeing the same business opportunity. In our model, essentially, different visions cause different judgements instead of different incentives. Second, Hendrikse (1998) captures the advantage of cooperative governance structure by accepting less poor projects when there are more poor projects or when the costs of adopting poor projects are high. The double screening process in the current model differs in four ways. First, we make a distinction between upstream and downstream projects, whereas Hendrikse (1998) does not make this distinction. Second, we assume that a decision maker observes the payoff of a project, whereas Hendrikse (1998) assumes that the payoff of a project is not observable. Third, the two decision-making bodies screen a candidate project independently (Hendrikse, 1998:206). In our model, we capture the sequential project screening, i.e. the BoD's decision regarding a project is based on the project proposal generated by the CEO. This is a common practice in cooperatives (Henehan and Anderson, 1994; Cook, 1994). Therefore, we assume that the CEO's vision bias will be incorporated in the project proposal he or she summits to the BoD. This will have an impact on the BoD's judgements.[17] Fourth, in our model, decision-making bodies sequentially evaluate a candidate project by considering the perceived project payoff. The vision bias makes their perceived project payoffs deviate from the true values. The double screening thus has an effect of aggregating the deviations in the perceived project payoffs of the two decision-making bodies. The decision outcome depends on the particular sequence of the decision-making process. In fact, the double screening in our model determines the payoff range of the projects that will be implemented. By contrast, the project screening in Hendrikse (1998) is based on the probability of correctly recognising good and bad projects. The outcome of the double screening is thus the multiplication of the probability of the correct

[17] Because the decision maker's judgement regarding a project is not about the probability of whether the project is good or bad, there is no Bayesian updating in the current model. We assume that the BoD is unaware of the vision bias of the CEO and there is therefore no inference from the decision made by the CEO. Sah and Stiglitz (1988) address architecture choice and Bayesian updating.

(incorrect) judgements of the two decision-making bodies. Therefore, the effect of the double screening highlighted in each model is different. In our model, we highlight the combined effect of the characteristics of governance structure and the identity of decision makers when firms face different types of investment opportunities.

6.3 Model

A three-stage game theoretic model is formulated to address the efficiency of three governance structures: a cooperative with a member CEO, a cooperative with a professional (outside) CEO, and an IOF. These three governance structures are distinguished in the first stage of the game. Second, Nature chooses the type of the project, either upstream or downstream with a random payoff. Finally, the decision-making bodies decide regarding the acceptance of the project in the third stage of the game. This game is solved for its sub-game perfect Nash equilibrium by the method of backward induction.

A cooperative consists of two decision-making bodies and it aggregates the decisions into a project implementation decision of the organisation only when both decision-making bodies accept the project (Hendrikse, 1998). Figure 6.1a presents the decision-making process of a cooperative.[18] The cooperative has a certain amount of capital at its disposal, which is to be invested in the projects for the development of the cooperative. The cooperative CEO first screens the candidate projects and then proposes the one with a positive perceived payoff to the cooperative's BoD. The BoD, as the representative of the members, evaluates the project proposal submitted by the CEO and makes the decision of approval or rejection based on whether their perceived payoff is also positive.[19] If the proposal is approved, the project is implemented and its payoff is realised. If the proposal is rejected, no payoff will be generated. The cooperative CEO and BoD pursue the same objective of maximising expected project

[18] The figure is adapted from Hendrikse (1998:208). Our main point is that the number of decision-making bodies and the identity of decision makers may have an effect on the behaviour and performance of organisations. The actual cooperatives in a specific country, in a specific sector, and in a specific period may differ from our stylised specification but we think our framework is sufficiently general and flexible to tailor it to a specific setting.

[19] According to Fama and Jensen (1983), decision rights can be separated into decision management (the initiation and implementation of decisions) and decision control (the ratification and monitoring of decisions). For modern firms, including cooperatives and IOFs, this separation of decision rights is common. It is observed in cooperatives that CEOs propose investment projects to BoDs (Henehan and Anderson, 1994; Cook, 1994). Usually, a cooperative will have regular board meetings and one or two general assembly meetings per year to discuss and approve the proposals prepared by the CEO. We thus focus on the situation that the CEO first reviews the investment opportunities.

payoff but may have different managerial visions. Burress, Livingston and Cook (2011) reports that less than 1% of cooperatives in their sample have more than one outside director. We therefore assume that the member-dominated cooperative BoD favours upstream projects. The cooperative can choose a member CEO, who favours upstream projects too, or a professional CEO from outside, who favours downstream projects. In contrast to the cooperative, an IOF consists of only one decision-making body (Hendrikse, 1998). The IOF has a dominated professional CEO who favours downstream projects. Figure 6.1b presents the decision process of the IOF.

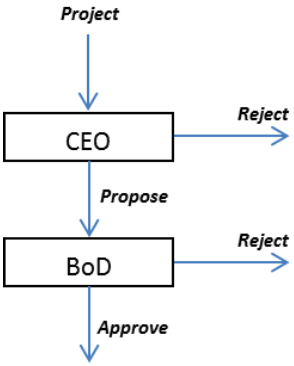

Figure 6.1a:
Decision process of a cooperative

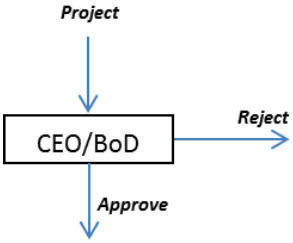

Figure 6.1b:
Decision process of an IOF

Each time Nature generates one project. The composition of the portfolio of projects is characterised by p, which is defined as the proportion or percentage of upstream projects in the portfolio of available projects. The complementary probability $1-p$ defines the portion of downstream projects. p is therefore an important measure of the agribusiness environment. The larger (smaller) the p, the more important are the upstream (downstream) activities. The payoff of the project, either upstream or downstream, is a random variable ω decided by Nature. The project payoff has a normal distribution with the density function: $f(\omega) = \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{1}{2}\left(\frac{\omega}{\sigma}\right)^2}, \omega \in (-\infty, +\infty)$, and σ is the standard deviation of ω.[20]

The decision-making bodies can correctly identify the type of projects (upstream or downstream), but their judgements of the project payoff is distorted by their vision bias. We capture the vision bias by supposing that a decision maker's judgement of the project payoff differs from the true value by $B_j^i (\geq 0)$, where $i = m, p$ and $j = U, D$. When a member CEO sees an upstream (downstream) project opportunity, he

[20] The assumption of a normal distribution of project payoffs is an accepted approximation of investment returns (Markowitz, 1952; Brealey, Myers and Allen, 2006).

perceives the payoff of the project to be $\omega' = \omega + B_U^m\ (\omega - B_D^m)$, i.e. the member CEO is biased in favour of the upstream project (against the downstream project). Conversely, when a professional CEO sees an upstream (downstream) project, she perceives the payoff of the project to be $\omega' = \omega - B_U^p\ (\omega + B_D^p)$, i.e. the professional CEO dislikes the upstream project (favours the downstream project). When the CEO's perceived project payoff $\omega' > 0$, the CEO believes the project is a good one and submits a project proposal to the BoD for approval. The estimated project payoff reported in the proposal is ω'. We regard the BoD as one decision-making body. Therefore, its vision should be the aggregation of all board members' vision. As the member-dominated BoD has the same bias as the member CEO, when the BoD reviews an upstream (downstream) project proposal with a reported payoff of ω', its decision regarding the project will be based on $\omega' + B_U^m\ (\omega' - B_D^m)$.

We assume that the CEO and BoD are unaware of the vision bias, both their own and the other decision-making body's. This assumption is central for the results because a decision maker will be able to make objective judgements if he knows how he is biased. In addition, if he knows the other decision-making body's vision bias, he can adjust his decision by considering that bias. For instance, if the BoD knows the magnitude of the CEO's bias and its own bias towards a project when they review the proposal, they can simply subtract the bias from the proposal and calculate the objective payoff. If this is the case, the perceived project payoff will be equal to the true value and there will be no decision errors. In addition, because the BoD obtains the information of a project opportunity only from the project proposal submitted by the CEO, the BoD is not able to identify the CEO's bias incorporated in the proposal.

The characteristics of the three governance structures are summarised in Table 6.1. COOP1 and COOP2 both have two decision-making bodies. The BoDs of COOP1 and COOP2 are member-dominated. COOP1 has a member CEO, whereas COOP2 has a professional CEO. The IOF has only one decision-making body controlled by a professional CEO.

Table 6.1: Three governance structures

	COOP1	**COOP2**	**IOF**
CEO	Member	Professional	Professional
BoD	Member	Member	

6.4 Equilibrium

In this section, the equilibrium outcomes are determined. We start with the equilibrium decisions in each governance structure and then present the equilibrium payoffs.

Equilibrium Decisions

IOF

Figure 6.2 presents the extensive form of the game when an IOF is chosen in the first stage.

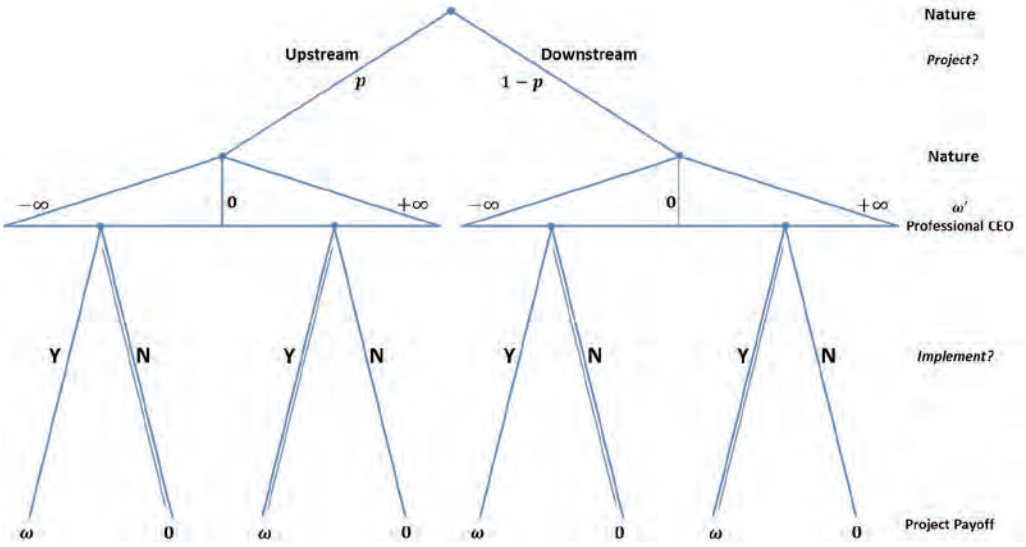

Figure 6.2: Choices in the extensive form of the game with the IOF

Because the IOF has only one decision-making body, it will implement the project if the professional CEO perceives the project payoff to be positive, i.e. $\omega' > 0$ .When an upstream project is generated, the project has a payoff of ω, but the CEO perceives the payoff of the project to be $\omega' = \omega - B_U^p$. The professional CEO's negative bias towards upstream projects implies that only those upstream projects with a payoff $\omega > B_U^p$ will be implemented. The professional CEO thus commits type I errors by rejecting the good projects with a positive payoff $\omega \in (0, B_U^p]$. When a downstream project is generated, the perceived project payoff of the professional CEO is $\omega' = \omega + B_D^p$. The positive bias of the professional CEO will make her implement the downstream projects with a payoff $\omega > -B_D^p$, which include some bad projects. The professional CEO commits type II errors by accepting the bad projects with a negative payoff $\omega \in (-B_D^p, 0]$.

Cooperative

In a cooperative, any project is subject to double screening. Figure 6.3 presents the extensive form of the game when a cooperative is chosen in the first stage.

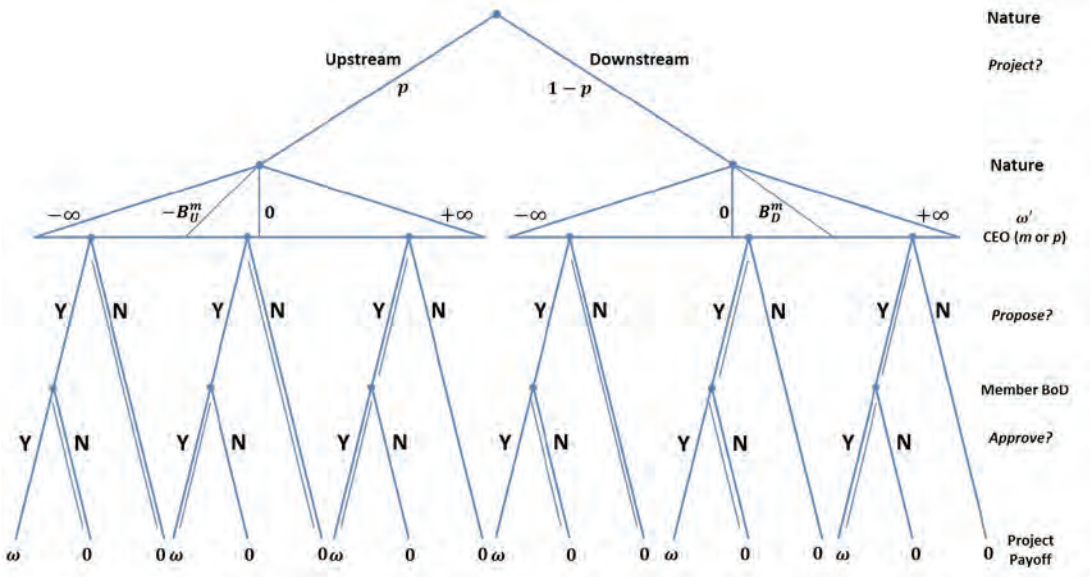

Figure 6.3: Choices in the extensive form of the game with a cooperative

COOP1 and COOP2 differ by having the different types of CEO (m or p) in the first decision-making body. In COOP1, when an upstream project is generated by Nature, the member CEO observes the project opportunity. His perceived project payoff is $\omega' = \omega + B_U^m$. He will propose the project to the BoD if $\omega' > 0$, i.e. $\omega > -B_U^m$. Due to the member CEO's positive bias towards upstream projects, some bad projects will be proposed. The member CEO thus commits type II errors by proposing the upstream projects with a negative payoff. When the CEO proposes a project to the BoD, he reports his perceived project payoff ω' in the proposal. Because the BoD is also subject to vision biases, when it reviews the upstream project proposal with a reported payoff of ω', its perceived project payoff is $\omega' + B_U^m > 0$. Therefore, the member-dominated BoD will always approve the proposed upstream projects given its same positive bias towards upstream projects as what the CEO has. When a downstream project is generated, the member CEO's perceived project payoff is $\omega' = \omega - B_D^m$. Only the downstream projects with a payoff $\omega > B_D^m$ will be proposed to the BoD. The member CEO thus commits type I errors by abandoning the downstream projects with a positive payoff. When the BoD reviews the downstream project proposal, its perceived project payoff becomes $\omega' - B_D^m$. The downstream project will be approved by the BoD if $\omega' > B_D^m$. Because $\omega' = \omega - B_D^m$, only the downstream projects with a payoff $\omega > 2B_D^m$ will be implemented. In other words, only the downstream projects with the payoff exceeding the cascaded negative bias of the member CEO and BoD will be implemented by COOP1.

Because COOP2 has a professional CEO, the results of its project screening in the first decision-making body are the same as the outcome of the project decisions of the IOF. The upstream projects with a payoff $\omega > B_U^p$ and the downstream projects with a payoff $\omega > -B_D^p$ will be proposed to the BoD. Similar to the BoD of COOP1, the BoD of COOP2 will always approve the proposed upstream projects due to its positive bias in the evaluation of upstream project proposals. However, when the BoD reviews the downstream project proposal with a reported payoff of ω', its perceived project payoff becomes $\omega' - B_D^m$ due to the negative bias. The project will be implemented if $\omega' > B_D^m$. Because $\omega' = \omega + B_D^p$, those downstream projects with a payoff $\omega > B_D^m - B_D^p$ will be implemented by COOP2. It entails that whether the proposed downstream project will be implemented is determined by the relative strength of the positive bias of the professional CEO and the negative bias of the member-dominated BoD.

A direct comparison of COOP1 and COOP2 indicates that the effect of the double screening in the project decisions differs with respect to the type of project. Regarding upstream projects, because the member-dominated BoD will always approve the proposed upstream projects, only the screening of the CEO plays a role in the selection of upstream projects. There is in fact only single screening in the project decisions regarding upstream projects. As such, COOP1 suffers upstream payoff losses due to type II errors made by the member CEO, whereas COOP2 suffers upstream payoff losses due to type I errors made by the professional CEO. Regarding downstream projects, while the double screening in COOP1 cascades the congruent negative vision bias of the CEO and BoD, it allows the opposite vision bias of the CEO and BoD to cancel each other out in COOP2. In other words, the CEO and BoD of COOP1 both commit type I errors, which cause relatively large payoff losses in COOP1. In COOP2, the CEO commits type II errors by proposing some bad projects but the BoD's negative bias offsets part of these errors and alleviates the downstream payoff losses. However, whether COOP2 will commit type I or type II errors and the size of the errors depend on the relative strength of the CEO's positive bias and the BoD's negative bias. If $B_D^m > B_D^p$, the BoD of COOP2 rejects not only the bad projects but also some good projects. COOP2 starts to suffer downstream payoff losses from type I errors.

Equilibrium Payoffs

IOF

The payoff of the IOF depends on B_U^p and B_D^p, both of which cause payoff losses by leading to wrong decisions. The mechanisms of decision errors are different. B_U^p leads

to type I errors of missing some good upstream projects, while B_D^p leads to type II errors of implementing some bad downstream projects. The payoff range of the implemented upstream and downstream projects is $\left(B_U^p, +\infty\right)$ and $\left(-B_D^p, +\infty\right)$, respectively. The expected payoff of the IOF is

$$\pi_{IOF} = p\int_{B_U^p}^{+\infty} \omega f(\omega)\, d\omega + (1-p)\int_{-B_D^p}^{+\infty} \omega f(\omega)\, d\omega = \frac{1}{\sigma\sqrt{2\pi}}\left[pe^{-\frac{1}{2}\left(\frac{B_U^p}{\sigma}\right)^2} + (1-p)e^{-\frac{1}{2}\left(\frac{B_D^p}{\sigma}\right)^2}\right].$$

B_U^p and B_D^p also determine the effect of the project composition p on π_{IOF}. If $B_U^p = B_D^p$, the expected payoff of the IOF is invariant with p because the IOF's decision outcome regarding upstream and downstream projects are the same. If $B_U^p > B_D^p$, the IOF makes relatively better decisions regarding downstream projects. The IOF's payoff will decrease in p. The IOF will become less attractive when upstream projects dominate in the portfolio of projects. The reverse holds when $B_U^p < B_D^p$.

COOP1

The payoff range of the implemented upstream projects is $(-B_U^m, +\infty)$. Due to the positive bias of the member CEO towards upstream projects, some bad upstream projects with a negative payoff $-B_U^m < \omega < 0$ will be proposed and implemented by the cooperative, leading to type II errors. Conversely, the cascaded negative bias of the CEO and BoD towards downstream projects leads to type I errors. The payoff range of the implemented downstream projects is $(2B_D^m, +\infty)$. Some good downstream projects with a positive payoff $0 < \omega < 2B_D^m$ will be abandoned. The expected payoff of COOP1 is

$$\pi_1 = p\int_{-B_U^m}^{+\infty} \omega f(\omega)\, d\omega + (1-p)\int_{2B_D^m}^{+\infty} \omega f(\omega)\, d\omega = \frac{1}{\sigma\sqrt{2\pi}}\left[pe^{-\frac{1}{2}\left(\frac{B_U^m}{\sigma}\right)^2} + (1-p)e^{-\frac{1}{2}\left(\frac{2B_D^m}{\sigma}\right)^2}\right].$$

How COOP1's payoff changes with p depends on the relative strength of B_U^m and B_D^m. If $B_U^m = 2B_D^m$, the expected payoff of COOP1 is invariant with p. When $B_U^m < 2B_D^m$, COOP1's payoff is increasing in p, as the percentage of upstream projects in the project portfolio become higher. The reverse holds when $B_U^m > 2B_D^m$.

COOP2

The payoff range of the implemented upstream projects is $\left(B_U^p, +\infty\right)$. The professional CEO's negative bias towards upstream projects determines that some good upstream projects with a positive payoff $0 < \omega < B_U^p$ will be missed, leading to type I errors. When faced with a downstream project, COOP2 will implement the project if $\omega > B_D^m - B_D^p$. The payoff range of the implemented downstream projects is

$\left(B_D^m - B_D^p, +\infty\right)$. The type of decision error depends on the relative strength of the biases of the CEO and BoD. If $B_D^m - B_D^p > 0$, i.e. $B_D^p < B_D^m$, the BoD's negative bias is larger than the CEO's positive bias, and some good downstream projects will be missed (type I errors). Conversely, if $B_D^p > B_D^m$, some bad downstream projects will be implemented (type II errors). The expected payoff of COOP2 is

$$\pi_2 = p\int_{B_U^p}^{+\infty} \omega f(\omega)\, d\omega + (1-p)\int_{B_D^m - B_D^p}^{+\infty} \omega f(\omega)\, d\omega = \frac{1}{\sigma\sqrt{2\pi}}\left[pe^{-\frac{1}{2}\left(\frac{B_U^p}{\sigma}\right)^2} + (1-p)e^{-\frac{1}{2}\left(\frac{B_D^m - B_D^p}{\sigma}\right)^2}\right].$$

The relationship between π_2 and p is straightforward. If $B_U^p = \left|B_D^m - B_D^p\right|$, the expected payoff of COOP2 is invariant with p. If $B_U^p > \left|B_D^m - B_D^p\right|$, COOP2's payoff will decrease in p. It entails that COOP2 will become less attractive when the percentage of upstream projects is higher. The reverse holds when $B_U^p < \left|B_D^m - B_D^p\right|$.

6.5 Efficient Governance Structure

According to Williamson (2000:601), 'an extant mode of organisation for which no superior feasible form of organisation can be described and implemented with expected net gains is presumed to be efficient'. As we compare three different governance structures in our model, the one with the highest expected payoff will be regarded as efficient. Before we compare the three different governance structures, it is useful to describe the first-best payoff, i.e. the expected payoff a firm can attain if all the good projects that bring a positive payoff are implemented:

$$\pi_{FB} = \int_0^{+\infty} \omega f(\omega) d\omega = \int_0^{+\infty} \frac{\omega}{\sigma\sqrt{2\pi}} e^{-\frac{1}{2}\left(\frac{\omega}{\sigma}\right)^2} = \frac{1}{\sigma\sqrt{2\pi}}.$$

The expected payoffs of the different governance structures can be normalised by $\pi_{FB} = \frac{1}{\sigma\sqrt{2\pi}}$. The normalised expected payoffs are listed in Table 6.2.

Table 6.2: The normalised expected payoffs of three governance structures

	$0 \le p \le 1$	when $p = 0$	when $p = 1$
First-best	1	1	1
COOP1	$pe^{-\frac{1}{2}\left(\frac{B_U^m}{\sigma}\right)^2} + (1-p)e^{-\frac{1}{2}\left(\frac{2B_D^m}{\sigma}\right)^2}$	$e^{-\frac{1}{2}\left(\frac{2B_D^m}{\sigma}\right)^2}$	$e^{-\frac{1}{2}\left(\frac{B_U^m}{\sigma}\right)^2}$
COOP2	$pe^{-\frac{1}{2}\left(\frac{B_U^p}{\sigma}\right)^2} + (1-p)e^{-\frac{1}{2}\left(\frac{B_D^m - B_D^p}{\sigma}\right)^2}$	$e^{-\frac{1}{2}\left(\frac{B_D^m - B_D^p}{\sigma}\right)^2}$	$e^{-\frac{1}{2}\left(\frac{B_U^p}{\sigma}\right)^2}$
IOF	$pe^{-\frac{1}{2}\left(\frac{B_U^p}{\sigma}\right)^2} + (1-p)e^{-\frac{1}{2}\left(\frac{B_D^p}{\sigma}\right)^2}$	$e^{-\frac{1}{2}\left(\frac{B_D^p}{\sigma}\right)^2}$	$e^{-\frac{1}{2}\left(\frac{B_U^p}{\sigma}\right)^2}$

It is immediately clear that neither the cooperatives nor the IOF can realise the first-best payoff if the CEO and BoD have vision biases, i.e. when $B_j^i > 0$, then $\pi < 1$. Nevertheless, there is one exception. That is, when $p = 0$, COOP2 can realise the first-best payoff if the positive bias of the professional CEO (B_D^p) and the negative bias of the BoD ($-B_D^m$) towards downstream projects cancel each other exactly ($B_D^p - B_D^m = 0$). We suggest that managerial vision bias in general leads to inefficient project investment, which is formulated in the first proposition.

Proposition 1: If the magnitudes of the vision bias of the professional CEO and member BoD towards downstream projects differ, i.e. $B_D^p \neq B_D^m$, no governance structure is first-best efficient.

The normalised expected project payoffs of the three governance structures are depicted in Figure 6.4. The first-best payoff is represented by the horizontal line with the normalised payoff of 1.

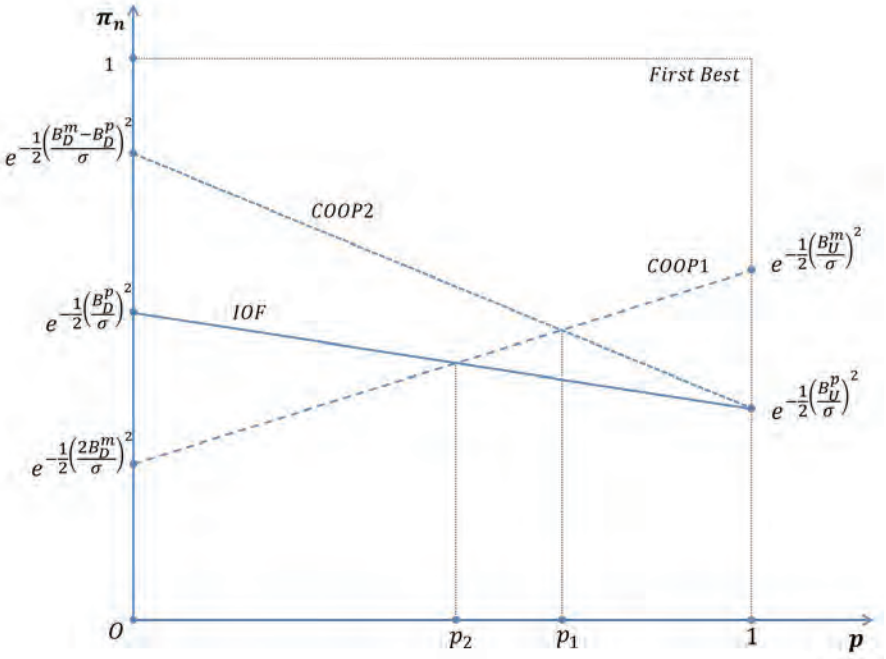

Figure 6.4: The normalised payoff

From Figure 6.4, it follows that the efficient governance structure is jointly determined by the managerial vision biases and the project composition p. For instance, when $p = p_1$, COOP1 and COOP2 are both efficient and have a higher payoff than the

IOF.[21] When $p > (<) p_1$, COOP1 (COOP2) becomes the efficient governance structure. When $p = p_2$, the IOF and COOP1 have the same payoff but it is lower than that of COOP2.[22] COOP2 is thus the efficient governance structure. The values of p_1 and p_2 are endogenously determined by the relative strength of decision makers' vision biases. p_1 and p_2 will approach 1 when B_U^m is equal to B_U^p, i.e. $\frac{B_U^m}{B_U^p} = 1$. p_1 will approach 0 when $2B_D^m$ is equal to $\left|B_D^m - B_D^p\right|$, i.e. $\frac{B_D^m}{B_D^p} = \frac{1}{3}$. Similarly, p_2 will approach 0 when $2B_D^m$ is equal to B_D^p, i.e. $\frac{B_D^m}{B_D^p} = \frac{1}{2}$. In addition, $p_1 \geq (\leq) p_2$ holds when $B_D^m \leq (\geq)\ 2B_D^p$, i.e. $\frac{B_D^m}{B_D^p} \leq (\geq)\ 2$. Therefore, given a certain value of p, we can identify the ranges of $\frac{B_U^m}{B_U^p}$ and $\frac{B_D^m}{B_D^p}$ in which a governance structure is efficient.

Figure 6.5 summarises the main results regarding the efficient governance structure. The detailed analysis and propositions are presented in the appendix of this chapter. $\frac{B_U^m}{B_U^p}$ on the vertical axis represents the ratio of the upstream vision biases of the member and professional executive, while $\frac{B_D^m}{B_D^p}$ on the horizontal axis represents the ratio of the downstream vision biases of the member and professional executive. The quadrant is divided into three areas by a curve with a kink at point C and an upward vertical line starting from point C. The efficient governance structure in each area is highlighted. COOP2 and the IOF are equally efficient under any value of p on the vertical line, while the curve represents the situations when COOP1 and COOP2 (IOF) are equally efficient given a certain value of p and $\frac{B_D^m}{B_D^p} < (>) 2$. The curve approaches the vertical (horizontal) axis when $\frac{B_U^m}{B_U^p}$ ($\frac{B_D^m}{B_D^p}$) increases. At point C, the three governance structures are equally efficient.

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[21] $p_1 = \dfrac{e^{-\frac{1}{2}\left(\frac{B_D^p}{\sigma}\right)^2} - e^{-\frac{1}{2}\left(\frac{B_D^m - B_D^p}{\sigma}\right)^2}}{e^{-\frac{1}{2}\left(\frac{B_U^p}{\sigma}\right)^2} - e^{-\frac{1}{2}\left(\frac{B_U^m}{\sigma}\right)^2} + e^{-\frac{1}{2}\left(\frac{B_D^p}{\sigma}\right)^2} - e^{-\frac{1}{2}\left(\frac{B_D^m - B_D^p}{\sigma}\right)^2}}$

[22] $p_2 = \dfrac{e^{-\frac{1}{2}\left(\frac{2B_D^m}{\sigma}\right)^2} - e^{-\frac{1}{2}\left(\frac{B_D^p}{\sigma}\right)^2}}{e^{-\frac{1}{2}\left(\frac{B_U^p}{\sigma}\right)^2} - e^{-\frac{1}{2}\left(\frac{B_U^m}{\sigma}\right)^2} + e^{-\frac{1}{2}\left(\frac{2B_D^m}{\sigma}\right)^2} - e^{-\frac{1}{2}\left(\frac{B_D^p}{\sigma}\right)^2}}$

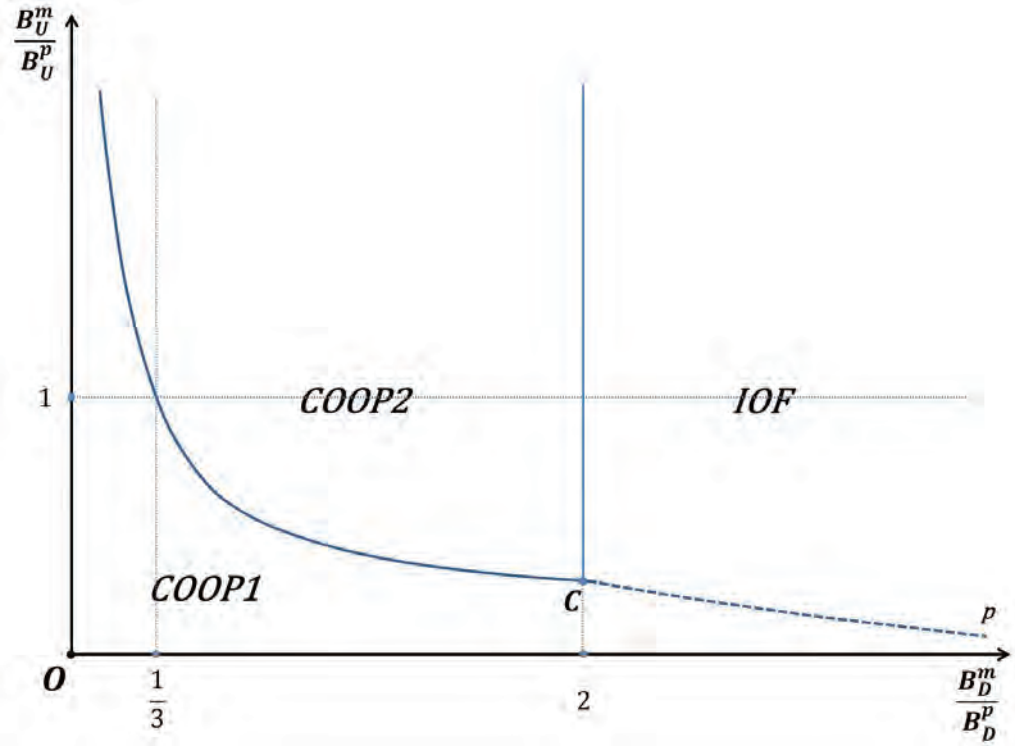

Figure 6.5: The efficient governance structure

Several important implications can be drawn from Figure 6.5. First, COOP1 is efficient in the area below the curve. It entails that COOP1 is more attractive when member executives have relatively smaller vision biases. Given $\frac{B_D^m}{B_D^p} < 2$, the efficient governance structure will change from COOP1 to COOP2 if $\frac{B_U^m}{B_U^p}$, $\frac{B_D^m}{B_D^p}$, or both increase. The switch of the efficient governance structure between COOP1 and COOP2 highlights the effect of different CEOs in cooperatives. Regarding upstream projects, different CEOs lead to the different types and sizes of upstream decision errors. Because the BoDs of COOP1 and COOP2 have no impact on the screening of upstream projects, the upstream decision outcome of COOP1 and COOP2 are solely determined by the vision biases of their CEOs. COOP1 commits type II errors due to the member CEO's positive bias, whereas COOP2 commits type I errors due to the professional CEO's negative bias. Therefore, when $\frac{B_U^m}{B_U^p}$ increases, COOP1's upstream payoff losses will increase in comparison with that of COOP2. When $\frac{B_U^m}{B_U^p} > 1$, COOP2 makes better upstream decisions than COOP1 because of the smaller upstream vision

bias of the professional CEO. Regarding downstream projects, the CEO type determines the amount and quality of the projects that will be proposed to the BoD. In COOP1, due to the negative bias of the member CEO, the bad projects and some good downstream projects are filtered out. By contrast, due to the positive bias, the professional CEO in COOP2 will propose more downstream projects to the BoD, which include some bad projects. The BoD in COOP2 will reject some of the downstream proposals. While the double screening in COOP1 cascades the congruent negative vision bias of the CEO and BoD, it allows the opposite vision bias of the CEO and BoD to cancel each other out in COOP2. Therefore, when $\frac{B_D^m}{B_D^p}$ increases, the downstream project payoff of COOP1 will drop more quickly compared with COOP2. When $\frac{B_D^m}{B_D^p} > \frac{1}{3}$, the opposite downstream vision biases of the member BoD and professional CEO results in a smaller aggregate vision bias in COOP2. COOP2 thus makes better downstream decisions than COOP1. Therefore, the increase of $\frac{B_U^m}{B_U^p}$, $\frac{B_D^m}{B_D^p}$, or both, will decrease the efficiency of COOP1 in comparison with COOP2.

Second, in the area above the curve, the efficient governance structure will change from COOP2 to the IOF when $\frac{B_D^m}{B_D^p}$ increases above 2. The IOF and COOP2 both have a professional CEO. The only difference between these two governance structures is that COOP2 has an additional screening bureau featured by the member-dominated BoD. The switch of the efficient governance structure between COOP2 and the IOF thus highlights the value of (abandoning) the second screening bureau. Regarding upstream projects, COOP2 and the IOF have the same decision outcome. The professional CEO of the IOF and COOP2 both commit type I errors of missing some good upstream projects. Because the BoD of COOP2 will always approve upstream project proposals submitted by its CEO, the second screening bureau in COOP2 has no actual impact on the decision outcome of upstream projects. In fact, the decision outcome of COOP2 and the IOF regarding downstream projects will determine their relative efficiency. When $\frac{B_D^m}{B_D^p} \leq 1$, the negative vision bias of the BoD of COOP2 towards downstream projects rejects some bad projects. COOP2 commits thus less type II errors than the IOF. When $1 < \frac{B_D^m}{B_D^p} < 2$, the BoD of COOP2 rejects also good projects and commits type I errors. However, the aggregate vision bias of COOP2 is still smaller than that of the IOF. The downstream payoff losses of COOP2 due to type I errors are smaller than that of the IOF due to type II errors. Therefore, when $\frac{B_D^m}{B_D^p} < 2$, COOP2 makes better downstream decisions and dominates the IOF. When $\frac{B_D^m}{B_D^p} > 2$, the aggregate vision

bias of COOP2 becomes larger than that of the IOF. COOP2 rejects too many good downstream projects and suffers larger downstream payoff losses than the IOF does. The IOF becomes more attractive when $\frac{B_D^m}{B_D^p} > 2$. Therefore, in the area above the curve, when $\frac{B_D^m}{B_D^p} > 2$, the efficient governance structure is the IOF. In general, the second screening bureau in COOP2 influences COOP2's decision outcomes by changing its equilibrium project selection towards downstream projects. When the relative strength of the vision biases of the BoD and CEO of COOP2 is in a proper range, it results in a smaller aggregate downstream vision bias than that of the IOF. However, when the BoD's vision bias is too strong compared with that of the CEO, COOP2 becomes less attractive than the IOF.

Third, the project composition p determines the steepness of the curve and then the shapes of the areas in which a governance structure is efficient. The curve decreases in $\frac{B_D^m}{B_D^p}$. The intuition is that, COOP1's downstream performance will decrease compared with COOP2 and the IOF when $\frac{B_D^m}{B_D^p}$ becomes larger. COOP1 must make better upstream decisions to compensate for the increasing downstream payoff losses in order to remain equally efficient as COOP2 and the IOF. Therefore, $\frac{B_U^m}{B_U^p}$ must become smaller. The curve declines slowly if p is large. The reason is that, when there are more upstream projects, the payoff loss effect of the increase of $\frac{B_D^m}{B_D^p}$ is smaller for COOP1. Especially, when the value of p is close to 1, the curve will converge to the horizontal line $\frac{B_U^m}{B_U^p} = 1$. This means that, This means that, when the available projects are mainly upstream projects, whether COOP1 can be dominant depends mostly on the value of $\frac{B_U^m}{B_U^p}$. The relative strength of executives' vision biases towards downstream projects, i.e. $\frac{B_D^m}{B_D^p}$, has little impact on efficiency. Conversely, if p is smaller, the curve will become steeper. The increase of $\frac{B_D^m}{B_D^p}$ has a larger payoff loss effect for COOP1 when the percentage of downstream projects become higher. When the value of p is decreasing to 0, the curve will converge to the vertical line $\frac{B_D^m}{B_D^p} = \frac{1}{3}$. The efficient area of COOP1 is mainly determined by the relative strength of executives' vision biases towards downstream projects. We summarise these observations in the following hypothesis:

Proposition 2: COOP1 is efficient for almost all cases where the upstream (downstream) bias of the member CEO is smaller than the upstream (one third of the downstream) bias of the professional CEO, i.e. $B_U^m < B_U^p$ ($B_D^m < \frac{B_D^p}{3}$) ***when the proportion of upstream projects in the pool of available projects increases to 1 (decreases to 0).***

6.6 Discussion

Our model offers insights into the impact of CEO identity on the behaviour and performance of cooperatives. The cooperative with a member CEO is featured by the cascaded negative vision bias towards downstream projects, which makes the cooperative upstream focused. Therefore, when the portfolio of projects contains mainly upstream projects, i.e. the industry is featured with production-oriented activities, cooperatives with member CEOs are more attractive. However, when the portfolio of projects contains mainly downstream projects, i.e. the industry demands market-oriented activities, cooperatives with member CEOs will become less attractive than IOFs. Cooperatives thus need to replace the member CEOs with professional CEOs. Specifically, in a cooperative with a professional CEO, the opposite vision biases of the CEO and BoD in combination with the double screening decision-making process may generate an advantage for the cooperative by reducing type II errors in downstream activities. This keeps the cooperative as a viable business form in the competition with IOFs. However, a cooperative with a professional CEO will still be less efficient than IOFs if the BoD negative bias towards downstream projects is too strong. To solve this problem, the cooperative can ease the BoD's negative bias by including outside directors on the board.

The comparison of the governance structures shows that the efficiency of a governance structure is determined by the joint effect of the vision biases and the decision-making process. While vision biases lead to decision makers' project selection errors, the decision-making process determines how these errors are aggregated. Under some circumstances, one governance structure is uniquely efficient for every value of p, whereas under other circumstances, one governance structure's efficient range depends on the agribusiness environment where a certain type of project is prominent. While acknowledging the impossibility of distinguishing among all scenarios, we interpret some commonly observed evidence in cooperative research by using the results derived from the model.

First, traditional cooperatives are featured by a powerful BoD dominated by farmer members. It is reasonable to assume that the magnitude of the cascaded bias towards

downstream projects in COOP1 is larger than that of a single bias towards upstream projects, i.e. $2B_D^m > B_U^m$. The performance of COOP1 will thus increase in p. In addition, as Figure 6.5 indicates, when there are more upstream projects, the negative effect of the relatively large B_D^m is weaker. COOP1 is efficient in a larger range of parameter values when competing with the IOF. Therefore, COOP1, which represents typical traditional cooperatives in the early stage of their development, is an attractive governance structure in environments with a relatively high percentage of upstream projects in the project portfolio.

Second, traditional cooperatives may be disadvantageous in competition with IOFs when downstream activities become more important. It is quite possible that the cascaded negative bias towards downstream projects in COOP1 is larger than the single positive bias towards downstream projects in the IOF. The competition between the IOF and COOP1 is thus in the area of $\frac{B_D^m}{B_D^p} > \frac{1}{2}$. In this area, although the IOF implements some bad downstream projects, COOP1 will suffer more losses because the cascaded negative vision bias makes it miss more good downstream opportunities. Even COOP1 can make better upstream decisions than the IOF by having $\frac{B_U^m}{B_U^p} < 1$, its competitive advantage will diminish as p decreases. As shown by Figure 6.8 in Appendix 6.1, the efficient range of COOP1 will converge to $\frac{B_D^m}{B_D^p} < \frac{1}{2}$ when p decreases. When p is small, COOP1 can outperform the IOF only if the member CEO and BoD both have very small negative biases towards downstream projects. This target is very difficult to achieve given the dominance of farmer members in the BoD. The IOF is thus more likely to be efficient when p is small. Our model highlights the challenge of cooperatives in changing market conditions, which has been widely addressed in the previous studies but from different theoretical perspectives, such as incomplete contract theory (Hendrikse and Veerman, 2001a), investment theory (Russo and Sabbatini, 2005), agency theory (Feng, 2011), and cognition theory (Feng, 2011).

Third, the cooperative has the choice of replacing the member CEO with a professional CEO. Different from the member CEO, the professional CEO in COOP2 has vision biases opposite to those of the BoD. When faced with downstream projects, the opposite vision biases of the CEO and BoD can lead to an advantage. The reason is that, while a professional CEO proposes more downstream projects than a member CEO does, the double screening process of the cooperative featured by the member-dominated BoD's negative vision bias will reduce type II errors. The COOP2 is thus able to capture more downstream opportunities and values. Proposition 3 in the appendix states that, if the cooperative BoD's vision bias towards downstream projects

is smaller than two times of the professional CEO's vision bias, i.e. $\frac{B_D^m}{B_D^p} < 2$, COOP2 will always dominate the IOF. Therefore, it may be optimal for a cooperative to hire a professional CEO while keeping the board dominated by members. However, the cooperative BoD's vision bias towards the downstream project should not be too strong. If $\frac{B_D^m}{B_D^p} > 2$, the efficiency of COOP2 will become always lower than the IOF because too many good downstream projects are rejected. In addition, the efficiency difference between COOP2 and the IOF will widen when p decreases. Therefore, COOP2 is only attractive when the BoD's vision bias is limited. One potential strategy is to modify the composition of the BoD by including some outside directors with different managerial visions. As such, while other cooperative scholars call for outside directors to bring the necessary expertise to the cooperative's boardroom (Cook, 1994; USDA, 2002; Lang, 2002), we argue that outside directors might have an additional function to moderate the BoD's vision bias. In addition, we also observe that most cooperatives in Europe and North America are providing member education. For instance, Friesland Campina spent one year in conveying the message to members about the market potential of lactose and explaining them why the cooperative should increase the investment of the value-added products in that area. These member education programs help members understand and enter the businesses they are unfamiliar with. They help alleviate members' negative bias towards downstream projects and reduce the value of $\frac{B_D^m}{B_D^p}$. In general, these choice possibilities in the decision rights structure create substantial flexibility for cooperatives to adapt to the new agribusiness environment and justify the competence of them in changing market situations.

Finally, the double screening of cooperatives has a great strength as well as a great weakness. Although it can reduce type II errors in the downstream project implementation, it also decreases the decision-making efficiency of the cooperative. However, in order to become more responsive to the market, cooperatives may need to allocate more decision power to CEOs. One example is the introduction of the so-called corporation model in the Dutch cooperatives, in which the BoD acts as a supervisory body instead of a directing body (van Dijk, 1999; Bijman, Hendrikse and van Oijen, 2013). As such, the decision-making structure of COOP2 becomes similar to that in the IOF. This shift of control of cooperatives may lead to the dominance of the CEO's managerial vision in the cooperative. One serious consequence is that 'the aspirations of the managers, rather than those of the farmers, are realized' (Hind, 1999:536). This explains the facts that the managers' preferred goals are reflected in

the organisational decisions and practices, which make cooperative more and more akin to IOFs (Hind, 1997; 1999).

6.7 Conclusion

Our model captures the aspects of people and processes in the decision making of enterprises. First, we propose that executives with different identities view upstream and downstream projects differently. With respect to cooperatives, the member CEO and the member-dominated BoD are supposed to favour upstream projects and dislike downstream projects. The reverse holds for professional CEOs. Second, we capture members' involvement in the decision-making process of cooperatives by incorporating the double screening of investment project proposals in the model. Our analysis shows that managerial vision biases have a pronounced impact on the performance of project implementation. The executives' negative vision bias towards a certain type of project may cause the company to commit type I errors by forgoing some profitable business opportunities. On the other hand, the positive vision bias will cause the firm to conduct type II errors by implementing some bad projects. Therefore, the existence of managerial vision bias will lead to certain inefficiencies in project implementation. The comparison of the performance of three governance structures (a cooperative with a member CEO, a cooperative with a professional CEO, and an IOF) shows that the efficiency of a governance structure is determined by the governance structure's decision-making process and the relative strength of executives' vision biases. We identify for each governance structure the situations where it is efficient.

There are several ways to position this chapter in the literature. First, we extend the research regarding the decision rights structure of cooperatives. Cooperative members are regarded as conservative and they often favour a conservative investment strategy in order to stabilise member returns (Staatz, 1987; Henehan and Anderson, 1994). Peterson and Anderson (1996) also claim that only the most secure projects are considered as investment options by cooperative members. However, the changes in the agribusiness call for necessary and timely responses from cooperatives. In particular, extensive discussion has been devoted to whether cooperatives' traditional decision-making structure allows them to become more market-oriented (Bijman, Hendrikse and van Oijen, 2013). We highlight the double screening feature of cooperatives by considering decision-making bodies' managerial vision. Circumstances are identified under which a specific configuration of decision rights structure and decision makers will be advantageous for cooperatives. Second, cooperative scholars and practitioners have emphasised the need for professional CEOs and outside directors in cooperatives based on the demand of expertise (e.g.

USDA, 2002; Bijman et al., 2012). We depart from these traditional arguments and instead examine the influence of cooperative CEO identity on the efficiency of the cooperative from a novel angle. It enriches the literature on cooperative governance by investigating the implications of executives' managerial vision for cooperatives. Third, this chapter is related to the cognitive dimension of the social capital of cooperatives, which represent the 'shared representations, interpretations and systems of meaning among parties' (Nahapiet and Ghoshal, 1998:244). When a cooperative has a high level of cognitive social capital, it gives the decision makers a common perspective that enables them to perceive and interpret business opportunities in similar ways. The commonality in vision supports the collective decision-making. In addition, a member CEO who shares the same cooperative vision and values with the BoD is more committed to the cooperative than an outside CEO. However, the common vision of the CEO and BoD also indicate their common negative bias towards downstream projects. High levels of cognitive social capital in cooperatives can be transformed into the resistance to downstream activities even when they become important for the cooperative. It leads to the cognitive lock-in (Gargiulo and Benassi, 1999) and may impede the cooperative's ability to adapt to changing task environments (Uzzi, 1997). Under such circumstances, hiring a professional CEO who has a different vision from the BoD will be necessary to respond to the changing market conditions.

There are several possibilities for further research. First, the relevance of managerial vision of top executives and performance of cooperatives are worthwhile to be tested. It would be interesting to examine whether observed success and failure of cooperatives can be better explained by taking both the decision-making process and the identity of decision makers into account. For example, Bijman, Hendrikse and van Oijen (2013) present empirical results regarding the relationship between board model and performance of agricultural cooperatives. However, decision makers' identities are not incorporated in their research. Second, our model shows the strategic complementarity between the decision-making process and the identity of decision makers. Our suggestion is that cooperatives should choose a CEO tailored to the specific business environment. However, we did not address the cooperatives' decision-making process and other important issues of the decision rights structure such as the delegation of power. A third possibility is to introduce incentives and influence activities in the decision making process. The current model assumes that the CEO and BoD have no private benefits when they make their decisions. There is no conflict of interests between decision makers, i.e. all decision makers are assumed to maximise the same utility function. However, it is more likely that the decision makers are also motivated by their own interests rather than merely those of the organisation. Given the private benefits, the information the CEO reports when he

proposes a project to the BoD may consist of not only the vision bias but also the interest bias (Alonso, Dessein, and Matouschek, 2008). In addition, influence activities are important in cooperatives, and are highlighted in Zusman and Rausser (1994) and Iliopoulos and Hendrikse (2009). They are modelled as a principal-agent problem with hidden characteristics and signalling (e.g. Milgrom and Roberts, 1988). These incentive topics are quite different from the theoretic approach in this chapter. Ultimately, a more general model will have to incorporate various features of an incentive system. Under this setup, the cooperative needs to choose not only a suitable CEO but also an optimal incentive structure.

Appendix 6.1: Comparison of Governance Structures

In the following analysis, we first compare the payoffs of the governance structures in pairs. Next, we derive the efficient governance structure.

The comparison of the IOF and COOP2

In Figure 6.4, the payoff lines of the IOF and COOP2 both emanate from $e^{-\frac{1}{2}\left(\frac{B_U^p}{\sigma}\right)^2}$ at $p = 1$. It entails that they have the same decision outcome regarding upstream projects. In fact, the payoffs of COOP2 and IOF regarding downstream projects will determine their relative efficiency. It is immediate that, when $\left|B_D^m - B_D^p\right| < B_D^p$, i.e. $\frac{B_D^m}{B_D^p} < 2$, the aggregate vision bias of the CEO and BoD in COOP2 is smaller than the CEO's vision bias in the IOF. COOP2 makes better downstream decisions than the IOF by committing less decision errors regarding downstream projects. The payoff line of COOP2 is thus above that of the IOF and COOP2 dominates the IOF. The reverse holds when $\left|B_D^m - B_D^p\right| > B_D^p$. Figure 6.6 depicts the efficient areas of the IOF and COOP2 and this result is formulated

Proposition 3: When $B_D^m < (>)\ 2B_D^p$, COOP2 (IOF) dominates IOF (COOP2).

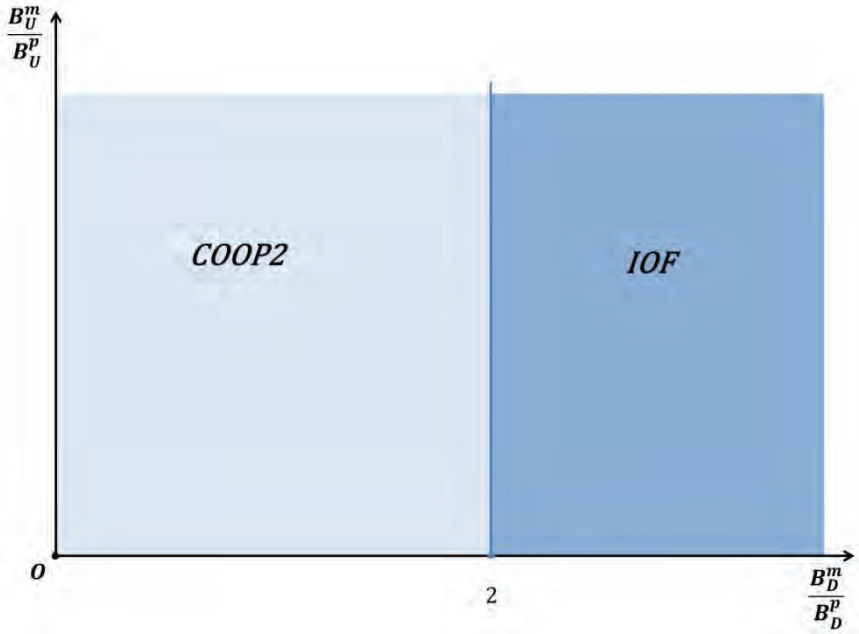

Figure 6.6: Efficiency of the IOF versus COOP2

Comparison of COOP1 and COOP2

The comparison between COOP1 and COOP2 becomes complex because their decision qualities regarding upstream and downstream projects can be both different. There are four possibilities. First, when $2B_D^m < \left|B_D^m - B_D^p\right|$ and $B_U^p < B_U^m$, the payoff of COOP1 will be always higher than the payoff of COOP2. COOP1 thus dominates COOP2 for every value of p. Second, when $2B_D^m > \left|B_D^m - B_D^p\right|$ and $B_U^p > B_U^m$, COOP2 will dominate COOP1 for every value of p. In these two situations, the payoff lines of COOP1 and COOP2 in Figure 6.4 have no intersection and one governance structure makes better decisions regarding both upstream and downstream projects. The ranges of $\frac{B_U^m}{B_U^p}$ and $\frac{B_D^m}{B_D^p}$ in which COOP1 or COOP2 will dominate the other for every value of p are highlighted by the shaded areas in Figure 6.7.

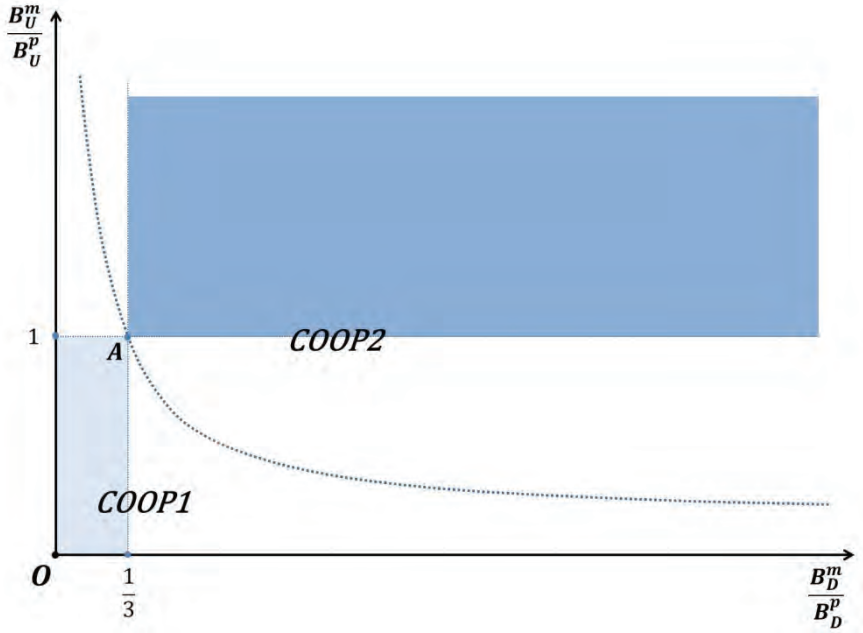

Figure 6.7: Efficiency of COOP1 versus COOP2

Third, when $2B_D^m > \left|B_D^m - B_D^p\right|$ and $B_U^m < B_U^p$, COOP2 makes better decisions regarding downstream projects whereas COOP1 makes better decisions regarding upstream projects. The ranges of $\frac{B_U^m}{B_U^p}$ and $\frac{B_D^m}{B_D^p}$ are within the down-right unshaded area ($\frac{B_D^m}{B_D^p} > \frac{1}{3}$ and $\frac{B_U^m}{B_U^p} < 1$) in Figure 6.7. Finally, when $2B_D^m < \left|B_D^m - B_D^p\right|$ and $B_U^m > B_U^p$, COOP2 makes better decisions regarding upstream projects whereas COOP1 makes

better decisions regarding downstream projects. The ranges of $\frac{B_U^m}{B_U^p}$ and $\frac{B_D^m}{B_D^p}$ are within the top-left unshaded area ($\frac{B_D^m}{B_D^p} < \frac{1}{3}$ and $\frac{B_U^m}{B_U^p} > 1$) in Figure 6.7. In these unshaded areas, given a certain value of p, the dotted curve approximates the combinations of $\frac{B_U^m}{B_U^p}$ and $\frac{B_D^m}{B_D^p}$ for which COOP1 and COOP2 are equally efficient. COOP1 (COOP2) has a higher payoff in the range below (above) the dotted curve. The dotted curve passes through point A $(\frac{1}{3}, 1)$, at which the payoff lines of COOP1 and COOP2 in Figure 6.4 perfectly coincide and they are therefore the same for every value of p. The dotted curve decreases in $\frac{B_D^m}{B_D^p}$. The intuition is that, COOP1's downstream performance will decrease compared with COOP2 when $\frac{B_D^m}{B_D^p}$ becomes larger. COOP1 must make better upstream decisions to compensate for the increasing downstream losses in order to maintain equal efficiency as COOP2. Therefore, $\frac{B_U^m}{B_U^p}$ must be smaller. The dotted curve declines slowly if p is large. The reason is that, when there are more upstream projects, the payoff loss effect of the increase of $\frac{B_D^m}{B_D^p}$ is smaller for COOP1. This means that, in environments with a relatively high percentage of upstream projects in the project portfolio, whether COOP1 can dominate COOP2 depends mainly on the value of $\frac{B_U^m}{B_U^p}$. The relative strength of executives' vision biases towards downstream projects, i.e. $\frac{B_D^m}{B_D^p}$, has less impact on efficiency. Especially, when the value of p is close to 1, the dotted curve will converge to the horizontal line $\frac{B_U^m}{B_U^p} = 1$. Conversely, if p is smaller, the dotted curve will become steeper. The increase of $\frac{B_D^m}{B_D^p}$ has a larger payoff loss effect for COOP1 when the percentage of downstream projects become higher. The efficient areas are mainly determined by the relative strength of executives' vision biases towards downstream projects. When the value of p is close to 0, the dotted curve will converge to the vertical line $\frac{B_D^m}{B_D^p} = \frac{1}{3}$.

Comparison of COOP1 and the IOF

The comparison between COOP1 and the IOF is similar to the comparison between COOP1 and COOP2. First, when $2B_D^m < B_D^p$ and $B_U^p < B_U^m$, the payoff of COOP1 will be always higher than the payoff of the IOF. COOP1 thus dominates the IOF for every value of p. Second, when $2B_D^m > B_D^p$ and $B_U^p > B_U^m$, the IOF will dominate COOP1

for every value of p. In these two situations, the payoff lines of COOP1 and the IOF in Figure 6.4 have no intersection and one governance structure makes better decisions regarding both upstream and downstream projects. The ranges of $\frac{B_U^m}{B_U^p}$ and $\frac{B_D^m}{B_D^p}$ in which COOP1 or the IOF will dominate the other for every value of p are highlighted by the shaded areas in Figure 6.8.

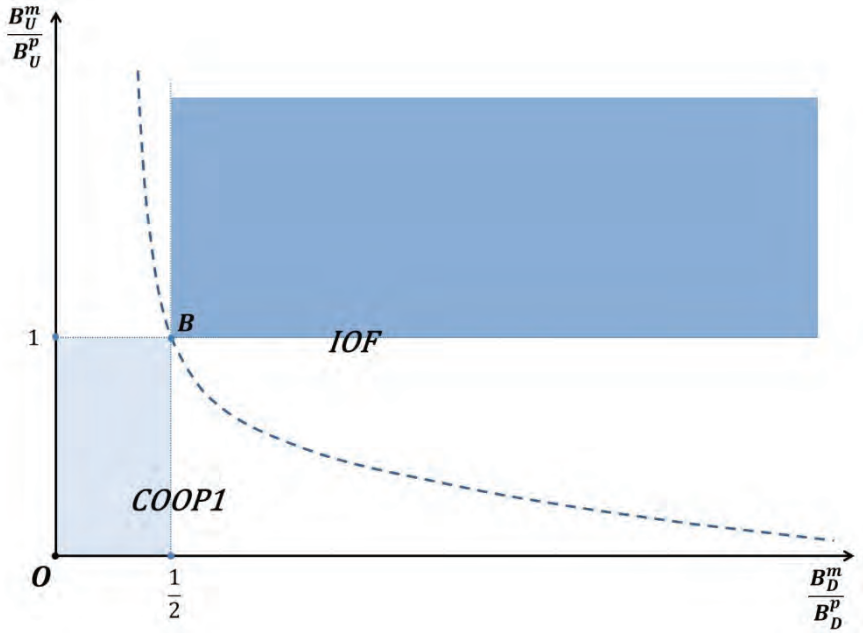

Figure 6.8: Efficiency of the IOF versus COOP2

Third, when $2B_D^m > B_D^p$ and $B_U^m < B_U^p$, the IOF makes better decisions regarding downstream projects whereas COOP1 makes better decisions regarding upstream projects. The ranges of $\frac{B_U^m}{B_U^p}$ and $\frac{B_D^m}{B_D^p}$ are within the down-right unshaded area ($\frac{B_D^m}{B_D^p} > \frac{1}{2}$ and $\frac{B_U^m}{B_U^p} < 1$) in Figure 6.8. Finally, when $2B_D^m < B_D^p$ and $B_U^m > B_U^p$, the IOF makes better decisions regarding upstream projects whereas COOP1 makes better decisions regarding downstream projects. The ranges of $\frac{B_U^m}{B_U^p}$ and $\frac{B_D^m}{B_D^p}$ are within the top-left unshaded area ($\frac{B_D^m}{B_D^p} < \frac{1}{2}$ and $\frac{B_U^m}{B_U^p} > 1$) in Figure 6.8. In these unshaded areas, given a certain value of p, the dashed curve approximates the combinations of $\frac{B_U^m}{B_U^p}$ and $\frac{B_D^m}{B_D^p}$ for which COOP1 and the IOF are equally efficient. COOP1 (the IOF) has higher payoff in the range below (above) the dashed curve. The dashed curve passes through

point $B\ (\frac{1}{2}, 1)$, at which the payoff lines of COOP1 and the IOF in Figure 6.4 perfectly coincide and they are therefore the same for every value of p. Similar to the dotted curve in Figure 6.7, the dashed curve in Figure 6.8 decreases in $\frac{B_D^m}{B_D^p}$ and will converge to the horizontal line $\frac{B_U^m}{B_U^p} = 1$ when the value of p is close to 1. When the value of p is close to 0, the dashed curve will converge to the vertical line $\frac{B_D^m}{B_D^p} = \frac{1}{2}$.

Efficient Governance Structure

By synthesising Figures 6.6 – 6.8, Figure 6.9 presents the ranges of $\frac{B_U^m}{B_U^p}$ and $\frac{B_D^m}{B_D^p}$ in which a governance structure is efficient. Figure 6.5 is based on Figure 6.9, where the curve is equal to the dotted curve when $\frac{B_D^m}{B_D^p} \leq 2$, and equal to the dashed curve when $\frac{B_D^m}{B_D^p} \geq 2$.

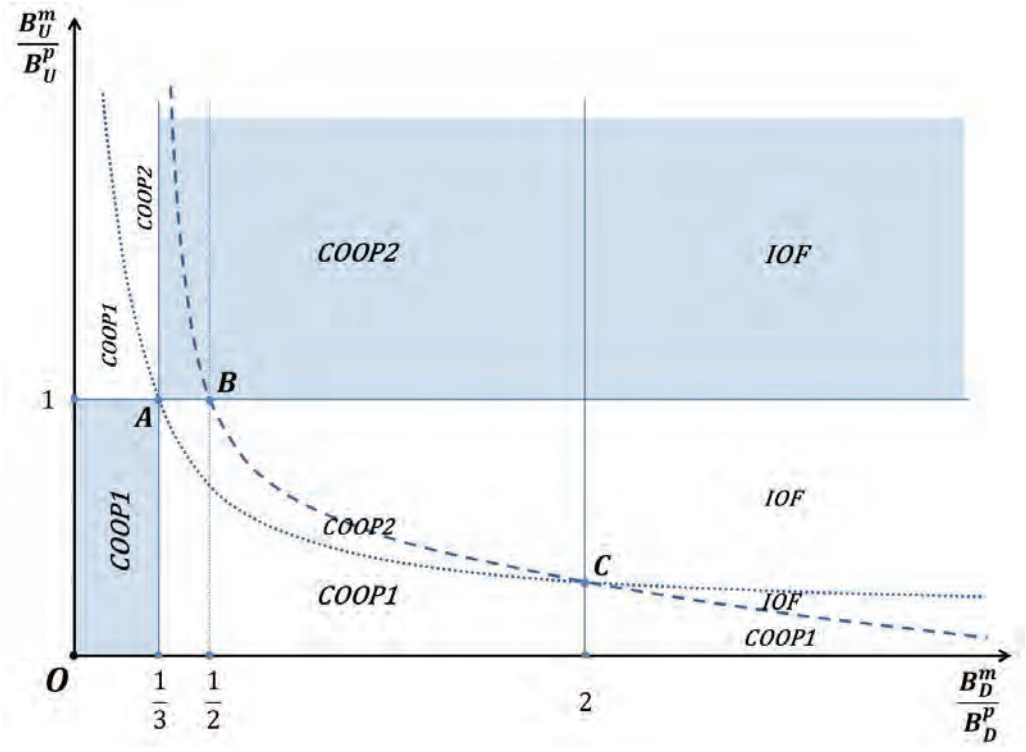

Figure 6.9: Comparison of three governance structures

In the shaded areas, one governance structure is uniquely efficient regardless of the composition of projects. In order to be efficient for every value of p, a governance structure must make better decisions than the others do in both upstream and downstream projects. The IOF and COOP2 both have a professional CEO. The professional CEO's negative vision bias causes type I errors in the decisions regarding upstream projects. By contrast, COOP1 has a member CEO with a positive vision bias towards upstream projects, which causes type II errors. Therefore, $\frac{B_U^m}{B_U^p} > 1$ must hold if the IOF and COOP2 outperform COOP1 in the upstream stage of production. It entails that the upstream payoff losses of type I errors in the IOF and COOP2 are lower than the payoff losses of type II errors in COOP1. Conversely, if $\frac{B_U^m}{B_U^p} < 1$, COOP1 has better performance regarding upstream projects.

The decision outcome of the different governance structures regarding downstream projects depends on $\frac{B_D^m}{B_D^p}$. First, proposition 3 states that the IOF will make better downstream decisions than COOP2 when $\frac{B_D^m}{B_D^p} > 2$. The reason is that, COOP2 rejects too many good downstream projects if the negative bias of the BoD towards downstream projects is too strong. The downstream payoff losses of COOP2 due to type I errors is larger than the payoff losses of the IOF due to type II errors. Second, when $\frac{1}{3} < \frac{B_D^m}{B_D^p} < 2$, COOP2 has the best performance in selecting downstream projects. In this range, the potential downstream payoff losses of COOP2, due to either type I or type II errors, are lower than that of the IOF and COOP1. Finally, when $\frac{B_D^m}{B_D^p} < \frac{1}{3}$, COOP1 will outperform the IOF and COOP2 regarding the decisions of downstream projects. The member CEO and BoD have a very small negative bias against downstream projects in comparison with the professional CEO's positive vision bias. COOP1 will not reject too many good downstream projects. The downstream payoff losses of type I errors in COOP1 are thus smaller than that of type II errors in the IOF. In COOP2, the relatively small downstream negative bias of the member BoD makes it unable to filter out the bad projects efficiently. The downstream payoff losses of type I errors in COOP1 are thus also smaller than that of type II errors in COOP2. The results are formulated in the following hypothesis:

Proposition 4: When $\frac{B_U^m}{B_U^p} > 1$ and $\frac{B_D^m}{B_D^p} > 2$, the IOF is uniquely efficient; when $\frac{B_U^m}{B_U^p} > 1$ and $\frac{1}{3} < \frac{B_D^m}{B_D^p} < 2$, COOP2 is uniquely efficient; when $\frac{B_U^m}{B_U^p} < 1$ and $\frac{B_D^m}{B_D^p} < \frac{1}{3}$, COOP1 is uniquely efficient.

In the unshaded areas, a certain governance structure performs better in selecting one type of project but is worse regarding the other type. Therefore, the efficient governance structure is dependent on the value of p. The three unshaded areas are divided by the dotted and dashed curve. Given a certain value of p, the dotted curve approximates the combinations of $\frac{B_U^m}{B_U^p}$ and $\frac{B_D^m}{B_D^p}$ for which COOP1 and COOP2 are equally efficient. COOP1 (COOP2) has a higher payoff in the range below (above) the dotted curve. Similarly, the dashed curve approximates the situations where the IOF and COOP1 are equally efficient. COOP1 (IOF) is better in the range below (above) the dashed curve. Because the payoff of COOP2 (IOF) is always higher than that of the IOF (COOP2) when $\frac{B_D^m}{B_D^p} < (>)\ 2$, the dotted (dashed) will be lower than the dashed (dotted) in the corresponding area because a relatively smaller $\frac{B_U^m}{B_U^p}$ is required for COOP1 to be equally efficient as COOP2 (IOF). When $\frac{B_D^m}{B_D^p} = 2$, the dotted curve and dashed curve will cross at point *C* because the IOF and COOP2 are the same in this situation. In addition, the efficient governance structure is chosen among COOP1 and COOP2 (IOF) in the unshaded areas when $\frac{B_D^m}{B_D^p} < (>)\ 2$. Therefore, the curve in Figure 6.5 is a combination of the dotted curve when $\frac{B_D^m}{B_D^p} \leq 2$ and dashed curve when $\frac{B_D^m}{B_D^p} \geq 2$.

7. Conclusion of Part A

In Part A of the dissertation, we conduct a series of theoretical analyses on social capital of cooperatives. The major research questions we try to answer include:

- What are the content and value of cooperative social capital?
- How cooperative social capital develops over time?
- How social capital and governance structure interact?

To address these questions, we start with a literature review of cooperative social capital based on Nahapiet and Ghoshal's (1998) conceptualisation of the social capital dimensions. In Chapter 2, we analyse the structural, cognitive, and relational dimension of social capital in the organisational context of cooperatives. From the perspective of a system of attributes, these social capital dimensions are viewed as the social attributes of cooperatives, which must be aligned with cooperatives' economic attributes. Because social capital is tightly bound with the development and strategy of the organisation (Nahapiet and Ghoshal, 1998), we also discuss the change in cooperative social capital from the perspective of the cooperative lifecycle. The central argument is that, when the social capital level in a cooperative decreases, the cooperative shall adopt strategies to rebalance its social and economic attributes, either by restoring social capital or by changing its governance structure. As each governance structure is characterised by its income and decision rights allocation (Hansmann, 1996), we first model the income rights structure of cooperatives and its interaction with cooperative social capital in Chapters 3, 4, and 5. In Chapter 6, we model the decision rights structure of cooperatives by considering the visions of the cooperative CEO and Board of Directors, which is related to the cognitive dimension of social capital.

The analyses in Chapters 3 – 6 can be summarised in Figure 7.1, which is identical to Figure 2.1 except for the additional double lines between the attributes. Each double line represents the relationship between the two attributes we have investigated. The arrows indicate the directions of identified influence of one attribute on another. Specifically, we model the influence of relational social capital on income rights structure (Chapters 3 and 4), the influence of income rights structure on structural social capital (Chapter 5), and the relationship between decision rights structure and cognitive social capital (Chapter 6). In the following paragraphs, we briefly outline the findings in each chapter and provide an integrated view of the relationship between cooperative social capital and governance structure. At the end of this chapter, we discuss limitations of our research and some possibilities for future research.

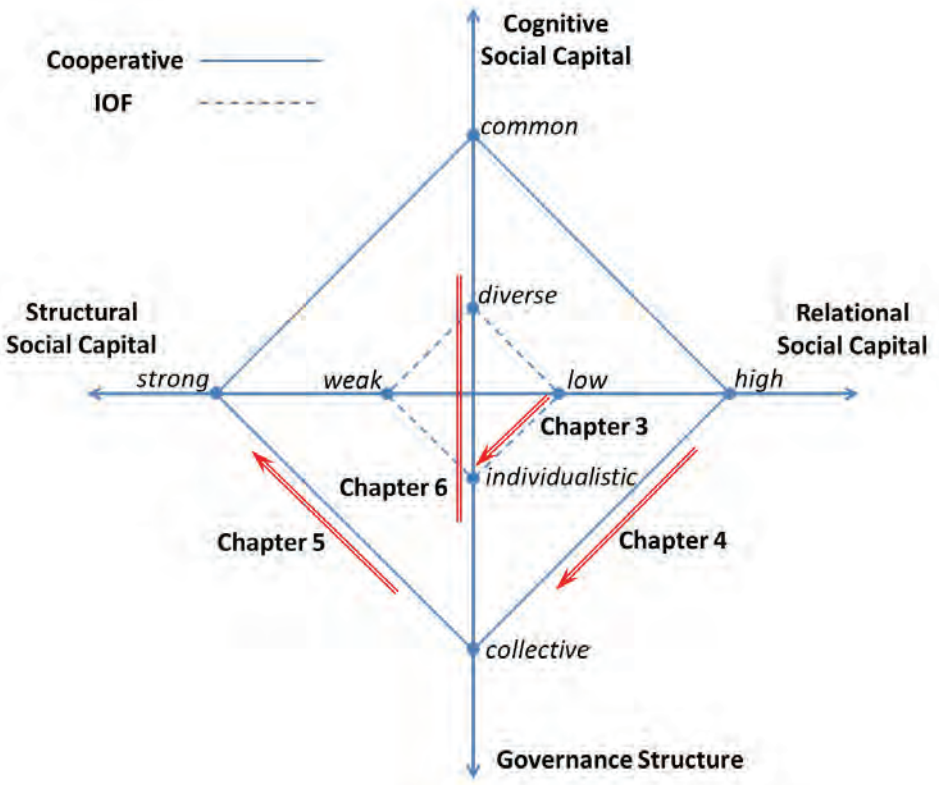

Figure 7.1: Investigated relationships between attributes

In Chapter 3, we develop a baseline model to address the relationship between the income rights structure and product quality provisions of cooperatives. We develop a standard economic model and incorporate no influence of social capital on members' decisions. In other words, Chapter 3 investigates the optimal income rights structure of cooperatives when social capital does not exist. It shows the coherent attribute system cooperatives can choose under such circumstances and compare it with that of IOFs. The result of Chapter 3 serves as a benchmark for the analyses in Chapter 4, in which social capital is explicitly modelled. The major conclusion of the standard economic model in Chapter 3 is that the traditional principle of complete pooling makes the cooperative in a disadvantageous position in the competition with the IOF in a quality-differentiated market. The complete pooling policy should by no means be adopted by cooperatives. Instead, there is an upper bound on the pooling ratio. We argue that by designing an optimal income rights structure featured by partial pooling, cooperatives can maintain an optimal product quality level, which is equivalent to the product quality level of the IOF.

Chapter 4 further investigates the cooperative's choice of pooling policy by taking the relational dimension of social capital into consideration. Specifically, we extend the economic model of Chapter 3 by incorporating a social term in the members' utility function. Social capital helps a member internalise the ethical standard in the cooperative. The member will lose utility if his or her product quality decision deviates from this standard. We aim to identify the optimal income rights structure of the cooperative when a certain level of social capital is present. The result shows that, with social capital, the cooperative can adopt an income rights structure with lower quality incentive intensity or even without economic incentive at all if the social capital level is very high. Other conditions the same, social capital enables the cooperative to choose a higher level of pooling. Social capital thus plays a role in substituting economic incentives to enhance product quality. Different from the results of the standard economic model in Chapter 3, we show in Chapter 4 that the cooperative can enact complete pooling when there is a very high level of social capital in the organisation. In the meantime, the cooperative is still able to produce high product quality because every member's product quality decision will be close to the quality standard. The model in Chapter 4 also shows that the cooperative should introduce stronger quality incentives in its income rights structure when the social capital level decreases. In principle, we treat cooperative social capital as an exogenous factor that determines the optimal income rights structure of the cooperative.

The interaction of social capital and income rights structure is supposed to be bidirectional. To investigate the reverse causality, we study the influence of the income rights structure on social capital in Chapter 5. Specifically, we construct a game theoretic model to capture members' social interactions and the dynamics of members' social ties under different pooling policies. The model suggests that the amount of the members' social interactions and the strength of social ties depend upon, and increase with, the cooperative's pooling ratio. The income rights structure of the cooperative determines the externality of members' economic payoff. The members will interact more and develop stronger social ties between each other when the income rights structure is more collective. Social ties can be characterised as the structural dimension of social capital, which are regarded as the basis of the other social capital dimensions. Chapter 5 in general captures the impact of the income rights structure on cooperative social capital.

In Chapter 6, we compare the efficiency of cooperatives when the cooperative CEO and Board of Directors (BoD) have congruent or divergent visions. When a cooperative has a member CEO, the CEO and BoD share the same vision towards upstream and downstream projects. They have a common perspective that enables

them to perceive business opportunities in a similar way. In addition, the double screening of the cooperative decision-making process reduces type II errors in project decisions. A high level of cognitive social capital thus makes the cooperative attractive in environments with a relatively high percentage of upstream projects. However, the common vision of the CEO and BoD also causes a large negative bias towards downstream projects. As such, a high level of cognitive social capital in the cooperative could be transformed into its focus on upstream projects and resistance to downstream activities. This is detrimental to the cooperative when downstream activities become important. In such circumstances, hiring a professional CEO with a different vision from the BoD will be necessary for the cooperative to respond to changing market conditions. We argue that, in a cooperative with a professional CEO, the opposite vision biases of the CEO and BoD in combination with the double screening decision-making process may generate an advantage for the cooperative. This keeps the cooperative as a viable business form in the competition with IOFs.

The results of Chapters 3 – 6 illustrate the coexistence of different coherent systems of attributes. High social capital levels and collective governance structure represent one coherent system that has been adopted by many traditional cooperatives. Alternatively, low social capital levels and an individualistic governance structure represent another system, which is commonly found in IOFs. The comparison of cooperatives and IOFs in our models shows that both systems can lead to efficient outcomes. In addition, by integrating the results of Chapters 4 and 5, the system of attributes with different attribute values can be interpreted as the alternative equilibrium outcome of the interaction between social capital and governance structure. Figure 7.2 provides a graphical illustration of the reaction functions and equilibrium outcomes. The horizontal axis is the income rights structure represented by the pooling ratio. The larger the pooling ratio, the more collective is the income rights structure. The vertical axis measures the social capital level. Reaction function 1 (the dashed curve) is adapted from Figure 4.1. It describes the choice of the pooling ratio based on the social capital level. It indicates that the pooling ratio is increasing in the social capital level. Reaction function 2 (the solid curve) represents the influence of the pooling ratio on social capital, which is based on Figure 5.1. It indicates that a larger pooling ratio is more effective in generating social capital.

The reaction functions in Figure 7.2 have three intersections, indicating three equilibria. The first equilibrium is at point O, where no social capital exists and there is no pooling, i.e. (Δ_O^*, σ_O^*). The second equilibrium is featured by a low pooling ratio and a low social capital level, i.e. (Δ_L^*, σ_L^*). These two equilibria are similar in that both of them represent the system featured by low social capital levels and individualistic governance structures. Particularly, the equilibrium (Δ_O^*, σ_O^*) can be seen as the choice

of most IOFs. By contrast, the third equilibrium with a high pooling ratio and a high social capital level, i.e. (Δ_H^*, σ_H^*), represents the combination of a collective governance structure and a high social capital level. Traditional cooperatives are usually featured by the equilibrium of (Δ_H^*, σ_H^*) with σ_H^* close or equal to 1. The multiple equilibria of the interaction between social capital and governance structure thus explain the different coherent systems of attributes selected by IOFs and traditional cooperatives[23].

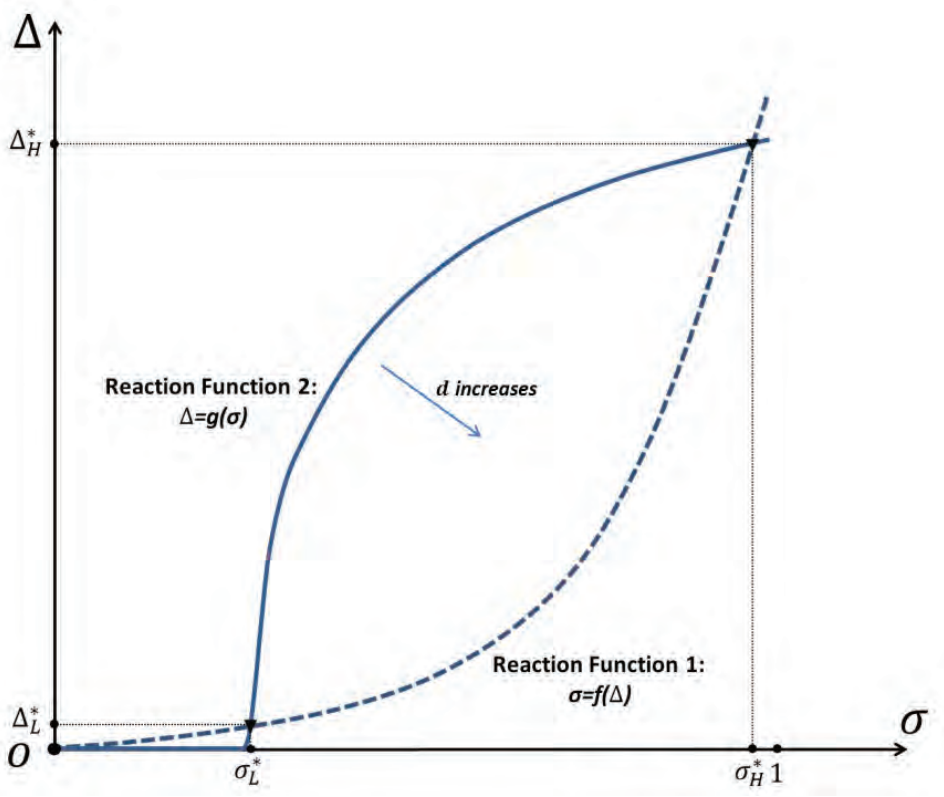

Figure 7.2: Equilibriums of social capital and income rights structure

Importantly, the equilibrium (Δ_H^*, σ_H^*) may shift when the social context of the cooperative changes over time. According to the comparative statics analysis in Chapter 5, the complete pooling will be less capable of stimulating the formation of social capital if the social interactions between cooperative members are too costly.

[23] Cooperatives can also choose the equilibrium (Δ_O^*, σ_O^*) or (Δ_L^*, σ_L^*), however, as we have argued, they may prefer the equilibrium (Δ_H^*, σ_H^*) due to benefits of risk-sharing (Chapters 2 – 4) and social utility (Chapter 5).

When d (the marginal cost of social interactions) increases, the curve of reaction function 2 will converge towards the point (1, 0) on the horizontal axis. Its intersections with reaction function 1 will change. Specifically, the equilibrium (Δ_H^*, σ_H^*) will move towards the south-west. As such, the new equilibrium for the cooperative will be featured by a medium level of social capital and a partial pooling policy. Moreover, when the curve of reaction function 2 is lower than the curve of reaction function 1, the only intersection of the two reaction functions will be point O. The cooperative will thus have the equilibrium (Δ_O^*, σ_O^*). In this case, the cooperative adopts the no-pooling policy and becomes similar to IOFs.

In general, Part A of the dissertation contributes to the literature by formally addressing all three dimensions of cooperative social capital and their relationship with the governance structure. We strive to construct an analytical framework of cooperative social capital and advance the understanding of the interaction between social capital and governance structure. On the one hand, the income rights structure of traditional cooperatives is highly collective. The pooling policy of cooperatives largely relies on the high social capital level. On the other hand, the collective income rights structure also supports the formation of social capital. We propose that cooperatives' social and economic attributes can be understood as the equilibrium outcome of the interaction between social capital and governance structure. The social context of the cooperative community affects the equilibrium that the cooperative will choose. In addition, we illustrate the performance implications of the decision rights structure and cognitive social capital of cooperatives.

Nevertheless, this study is subject to limitations and there remain many aspects that have not been thoroughly examined. First, as shown in Figure 7.1, while we have modelled three pairs of relationships between social and economic attributes, how the different dimensions of social capital influence each other is not formally analysed. In addition, our model in Chapter 6 does not capture the causality between the cognitive social capital and governance structure. More theoretical work is thus warranted for enhancing our understanding regarding these issues. Second, the interaction between social capital and governance structure is clearly an empirical question. Evidence in the cooperative literature does support our general framework, but the specific predictions remain to be tested. Thus, further empirical research is highly desirable.

Part B:
Diversification of Cooperatives

8. On the Evolution of Product Portfolio of Cooperatives versus IOFs: An Agent-Based Analysis of the Single Origin Constraint[24]

Abstract

Agent-based methodology is adopted to analyse the relationship between governance structure and product portfolio. One distinction between an investor owned firm (IOF) and a cooperative is the single origin constraint, which pulls all products of the cooperative together in one cluster centred on the original product. This effect decreases the probability of choosing new products and accounts for the lower diversification level of the cooperative. By contrast, the IOF's product portfolio develops in a centrifugal way. The double screening in decision making and the objective of maximising the joint surplus and serving members at cost do not change the impact of the single origin constraint. Although the cooperative and the IOF have very different portfolio compositions, the total surplus of the cooperative and the total profit of the IOF are close in the monopoly, as well as the duopoly market. However, the cooperative has a higher average surplus per product, while the IOF has a higher average profit per output unit.

Keywords: Single Origin Constraint, Diversification, Product Lifetime, Cooperatives, Agent-based Model.

8.1 Introduction

One of the fascinating aspects of enterprises is the evolution and composition of their product portfolios. Product portfolios evolve due to enterprises expanding current product lines, adding new products, divesting products, conducting mergers and acquisitions, and so on. An important feature of the evolution and composition of product portfolios is coherence. 'Firms are coherent to the extent that their constituent businesses are related to one another' and 'firms over time add activities that related to some aspect of existing activities (Teece et al., 1994:2-3). In other words, firms seem to choose to enter industries that are close to their existing line of business. However, coherent product portfolios may follow different paths of evolution. For example,

[24] This chapter is based on the previous working paper of Hendrikse and Smit (2007). The source code of the simulation models in this chapter is available online at: http://hdl.handle.net/1765/77449.

coherent product portfolios of different enterprises may develop in different directions, or the product portfolio may develop into clusters of related products. Therefore, the mechanism driving the evolution and composition of the product portfolio is a central issue to understand any firms' strategy.

Teece et al. (1994) also pose that explaining corporate coherence requires taking various corporate forms into consideration. This position is supported by empirical evidence indicating that there is a relationship between governance structure and diversification behaviour, but it seems to depend on the governance structures being compared. On the one hand, Kamshad (1994) does not find a statistically significant difference between the diversification policies of IOFs and labour managed firms. Lane, Cannella and Lubatkin (1998) conclude that corporate ownership structure does not affect its diversification strategy. On the other hand, there is evidence showing that publicly listed firms are more diversified than cooperatives (van Oijen and Hendrikse, 2002), and family firms diversify less both domestically and internationally than non-family firms (Gomez-Mejia et al., 2010). In addition, van der Krogt et al. (2007) find that dairy cooperatives and IOFs have quite different expansion strategies. In general, 'cooperatives prefer mergers, collaboration agreements, joint ventures, and licensing, while IOFs focus on take-over strategies – acquisitions and share holdings' (p.453). These observations demand further analysis of the influence of specific governance structures on the evolution and composition of product portfolios.

In this chapter, we investigate the product portfolio consequences of the governance structure of cooperatives versus IOFs. Hansmann (1996) states that governance structures are usually characterised by ownership of one group of stakeholders. The providers of input are the owners of a marketing cooperative, while the providers of capital own the IOF (Hansmann, 1996). Investors of the IOF want it to generate maximum value in downstream processing stage, but this is not the case in the cooperative. According to Hendrikse (2007:139), 'the formal ownership by the input suppliers over the downstream assets is the essential governance structure feature of a cooperative'. Therefore, cooperative members have both 'owner concerns' and 'user concerns' (Feng and Hendrikse, 2012:242). The cooperative is supposed to serve member interests and generate value in processing simultaneously (Liang, 2013). This ownership difference between cooperatives and IOFs is reflected in various aspects, like different worldviews or orientations of owners, different ways of financing the enterprise, different decision making processes, and so on. Therefore, the governance structure differences between cooperatives and IOFs may have a number of implications on the evolution and composition of product portfolio.

The most distinct aspect of a cooperative is the single origin constraint. Cook (1997:87) observes that '… cooperatives … are "single origin" in that their objective is to optimize the utilization of their member owners output, not to originate products in another area or country. Most cooperatives have ties to producers/members within a particular region, and they do not have the same freedom as IOFs have. Being single origin for a cooperative is rational because of the member owners' high degree of physical, site, dedicated assets and temporal asset specificity. This asset specificity comes in the form of investment, land, machinery, perishable output, and location whereby their value in the next best use is often significantly lower'. The single origin constraint entails that cooperatives will never divest products requiring the input of members. It may thus account for a number of properties of the diversification behaviours of cooperatives, like an input orientation, a tendency to avoid new businesses, less flexibility in their input procurement and product portfolio, active in fewer industries, and a higher ratio of unrelated to total diversification than corporations do due to spreading risks of the farm portfolio of activities (van Oijen and Hendrikse, 2002; Hendrikse and Feng, 2013).

In addition, the decision-making process of a cooperative differs from that of an IOF. A cooperative consists of a society of members and a downstream economic entity. The impact of the organisation and representation of the society of members in a cooperative may have an impact on the pace of decision making regarding diversification projects. As Hendrikse (1998:203) claims, the members of a cooperative have incentives to 'structure the internal organisation in such a way that they have confidence that their substantial (financial) stakes are protected and their interests are advanced'. In cooperatives, extensive decision-making power is allocated to the General Assembly and the Board of Directors which are 'democratically chosen by and from the membership' (Feng, 2011:21). Therefore, a cooperative is characterised by two independent decision-making units with each unit having veto power regarding investment proposals, whereas an IOF consists of only one decision-making unit (Hendrikse, 1998).

The third difference between a cooperative and an IOF is manifested in their product output decisions. The members of a cooperative want to keep the average member profitability high, while an IOF makes output decisions with the objective to maximise the profits of the processor (Tennbakk, 1995). Therefore, while an IOF determines its product output by maximising the profits of the downstream processor, a cooperative may maximise the summed profits of the upstream farms and downstream processor (Staatz, 1987), or maximise the product output by making the downstream processor serve the members at cost (LeVay, 1983).

We adopt agent-based methodology to address these governance structure differences between cooperatives and IOFs. Agent-based models have been increasingly used in studying economies, which are modelled as 'evolving systems of autonomous interacting agents' (Tesfatsion, 2003:263). In an agent-based model, the unit of analysis is represented as an agent that possesses some properties, a repertoire of actions, and ways of interacting with other agents and with its environment. The three main ingredients of an agent-based model are agent, state, and transition rule. Each agent is characterised by their states, while actions of agents are governed by transition rules (Hendrikse, Smit and de la Vieter, 2007).

The transition rule of agents' diversification decisions will be captured by incorporating the results from the diversification literature. Studies regarding diversification report many failures and there are many prescriptions for successful diversification (e.g. Gruca et al., 1997; Palepu, 1985; Rumelt, 1982), among which Lowes et al. (1994) formulate the so-called concentric diversification strategy as the main general prescription. It entails that the agents diversify only into activities related to current products, markets, or processes. The concentric diversification strategy thus reflects the concept of corporate coherence suggested by Teece et al. (1994). Specifically, when an agent diversifies, the transition rules in the model make the agent randomly selects a new product in the local neighbourhood of its current product portfolio in each period. The locality of an agent's decision rules regarding new products will therefore serve to capture the feature of concentric diversification, while the transition rules will drive the evolution of the product portfolio.

The single origin constraint is modelled by assigning different lifetimes to the first product of different governance structures. The first product of an IOF will be divested after a finite number of periods, while a cooperative will never divest its first product due to the single origin constraint. The lifetime of the first product of a cooperative is thus set to infinite and the lifetime of that of an IOF is set to a certain number periods. All other products have the same finite lifetime in both governance structures. Furthermore, we can also incorporate agents' decision-making process and product output decisions in the model's transition rules and simulate the product portfolio evolution of an IOF and a cooperative in a mixed duopoly market. As such, this agent-based model is able to address the following question: How does the evolution and composition of the product portfolio of an IOF and a cooperative differ? By comparing cooperatives with IOFs, this chapter provides an explanation for the impact of governance structure on product portfolio.

This chapter is organised as follows. Section 8.2 presents the basic model and formulates the results regarding the impact of the single origin constraint on the

evolution and composition of product portfolio. Section 8.3 extends the basic model by incorporating additional governance structure features. Section 8.4 extends the model to a mixed duopoly market setting. Section 8.5 concludes and formulates directions for future research.

8.2 Basic Model

We develop an agent-based model to investigate the dynamics of an agent's product portfolio in a competitive environment with rival agents. The features of different governance structures need to be incorporated as well. In this section, we start with a basic model with only one agent and focus merely on the single origin constraint. The behaviour of an individual agent that evolves its product portfolio in the basic model is useful for interpreting the simulations with more complex settings. In Sections 8.3 and 8.4, we extend the basic model by including additional governance structure features and the competition between an IOF and a cooperative in a duopoly market.

Agent-based Model

An agent-based model consists of three elements: the agent, the state of the agent, and the transition rule that governs the evolution of the agent's state. The agent in our model is either a cooperative or an IOF. The agent can add new products to its portfolio by diversification. Divestment is captured by removing a product and its associated output from the product portfolio when the product reaches its lifetime. The agent can also adjust the output of its products.

The state of an agent is defined as its product portfolio, which is represented as a two-dimensional grid. We call this grid of products 'Portfolio Matrix'. A product in the product portfolio is represented as a cell in the grid. The distance between cells represents the relatedness between products. The product distance is defined in the paragraph preceding Figure 8.2a in Appendix 8.2. Each product in the Portfolio Matrix is characterised by its output level and lifetime. A product's lifetime starts at the period when it is added to the portfolio. The first product of an agent is called 'Original Product'. The single origin constraint of cooperatives is modelled by assuming that the lifetime of the Original Product is infinite. By contrast, the Original Product of an IOF has a finite lifetime and will be divested when the lifetime is reached. Every other product has the same finite lifetime. Notice that a divested product can be chosen again by the agent after certain periods when it is in the neighbourhood of the products in the Product Portfolio. However, it doesn't necessarily mean that the agent produces the same product again. It can be that another product with the same relatedness to the Original Product is produced.

The transition rules produce a new state for the agent as a function of the agent's current state. The basic transition rule of an agent is the concentric diversification strategy, which entails that the agent will only diversify into new products related to its current product portfolio. In our model, agents diversify their product portfolio by picking one of the cells from the set consisting of the existing products and their Moore neighbourhoods (Hegselmann and Flache, 1998). The probability of a cell being selected in the next period is calculated based on the content of the current product portfolio and is stored in the 'Probability Matrix'. The transition rules reflecting other differences between cooperatives and IOFs are introduced in Section 8.3. Figure 8.0 provides an example of a Portfolio Matrix and a Probability Matrix of an agent at the start, period 1 and period 2.[25]

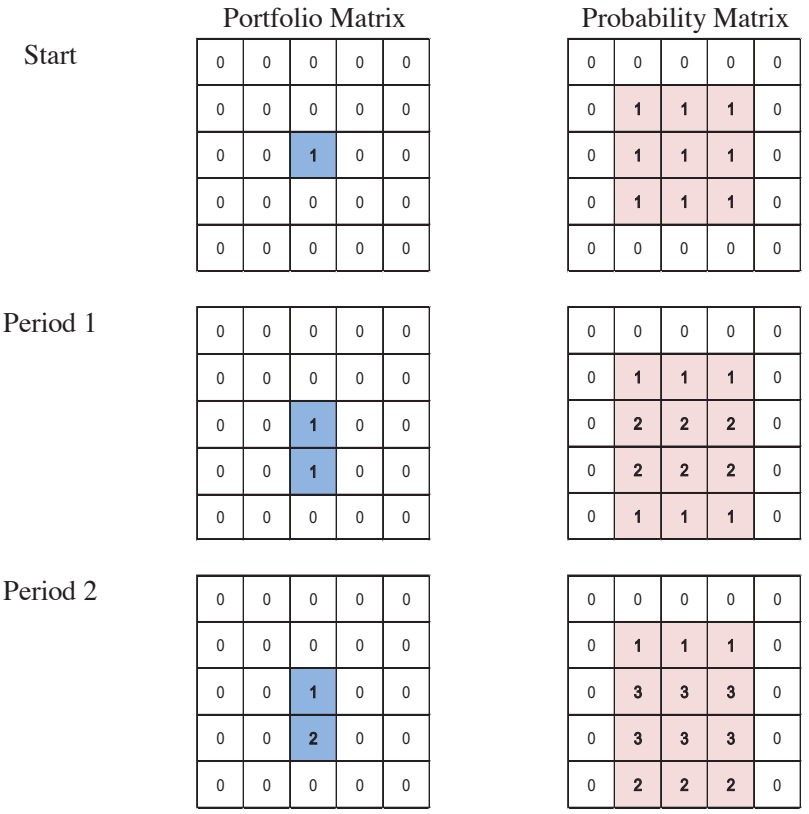

Figure 8.0: An example of the evolution of the product portfolio during 2 periods

[25] This example is adapted from the example in Hendrikse, Smit and de la Vieter (2007:427).

At the start, there is only one product (the Original Product) at the centre of the Portfolio Matrix with an initial output of 1 unit. The agent will start the evolution of its product portfolio from the Original Product. The Moore neighbourhood of the Original Product consists of all the product's neighbouring product cells. It consists of 9 cells, i.e. the cell of the Original Product and the 8 adjacent cells. Each product cell in the set consisting of the Moore neighbourhood and the Original Product has an equal probability of 1/9 of being chosen at the beginning of the next period. Suppose that the product south of the Original Product in the starting portfolio is chosen at the beginning of period 1. It entails that the agent is faced with a diversification project, and needs to make a decision. In the basic model, we assume that the agent will always accept diversification projects. After the agent adds the new product to its portfolio, the Probability Matrix at the end of period 1 changes so that the local neighbourhood now contains 12 products that have a chance to be chosen in next period. Six of these products are within the Moore neighbourhood of both products in the current portfolio. Therefore, their chances of being chosen are twice that of the other products.

Note that the existing products in the portfolio are also part of the local Moore neighbourhood and have a chance to be chosen in the next periods. If an existing product is chosen, the agent has to make a decision of changing the product's output according to the current market situation. The agent can also maintain its current output level. In the basic model, we assume that the agent will always increase the output of the existing products. Suppose that at the beginning of period 2, the same product is chosen again as in the first period. This product is already in the portfolio, thus the agent increases the output of the product by 1 unit. The bottom row in Figure 8.0 shows the portfolio and the weighed probability distribution at the end of period 2.

Simulation Settings of the Basic Model

Consider two simulation settings. The first (second) setting consists of an agent reflecting a cooperative (IOF). The initial output level of the Original Product is set to 1 for both agents. The lifetime of the Original Product of the cooperative is set to infinite, whereas the lifetime of the Original Product of the IOF is set to 40. The same lifetime of 40 will be assigned to all other products. The agents evolve the product portfolio independently. At the beginning of each period, the agent will choose randomly a product from the local Moore neighbourhood of its current product(s) according to the Probability Matrix. If the chosen cell is a new product, the new product will be assigned an initial output level of 1 unit. If the chosen cell is an existing product already in the agent's portfolio, the agent will increase the output level of the product by 1 unit. The agent will keep a product in the portfolio until its

lifetime is reached, and then the product and its output will be removed from the portfolio. We simulate the process of an agent's portfolio evolution in 500 periods. The results of 100 runs of simulation are averaged.

Simulation Results of the Basic Model

Appendix 8.1 presents the product portfolio evolution of an IOF and a cooperative in figures. The evolution of the product portfolio of an agent is described by several measures. We use the number of products, total output, and average output per product to record the agent's diversification and output decisions in general. To capture the relatedness of products in the evolving portfolio, two measures are defined: the average product distance and the average weighted product distance. The average product distance assigns the same weight to all products, while the average weighted product distance weights according to the output of the product.

Figure 8.1a illustrates the number of products in the agents' portfolio along the periods. After the simulation starts, both agents add new products to their portfolio. During the first 40 periods, the number of products increases quickly. However, from then on some products start to reach their lifetime. The number of products of both agents will fluctuate but further increase with a lower speed. For the IOF, the number of products in its portfolio will level off gradually. Given the same lifetime for every product, the speed of divesting products is related to how many products are in the portfolio. Therefore, when the speed of divesting products is equivalent to the speed of adding products to the portfolio, the number of products of the IOF will become stable. The change of the number of products of the cooperative shows a quite different pattern. In the course of time, the number of products of the cooperative will decrease continuously. The reason is that the output associated with the Original Product will never be removed due to single origin constraint, while all other products will be eliminated when they reach the lifetime. This will have an increasing effect on the probability of choosing the Original Product and the products close to it, and thus decreases the probability of choosing new products. This results in the decreasing number of products of the cooperative.

Figures 8.1b and 8.1c depict the total output and the average output per product. Their development is directly linked to the number of products. For the IOF, the total output and the average output per product will level off along the periods as well. This indicates that the IOF's product portfolio will reach a relative stable composition in the long term. The IOF will keep a certain number of products and maintain a constant output level. By contrast, because the probability of choosing new products is decreasing over time for the cooperative, it will focus on increasing the output of the

Original Product. Since the Original Product and its associated output will never be removed, the output of the cooperative will keep increasing.

The increasing average (weighted) product distance of the IOF depicted in Figures 8.1d and 8.1e indicate that the area covered by the IOF's portfolio widens over time. It entails that after the Original Product of the IOF has reached the lifetime and been divested, the IOF's portfolio gradually moves to those products that with a large distance to the Original Product. In other words, the IOF's product portfolio evolves into the products that are unrelated to the Original Product. To the contrary, the concentration effect of the single origin constraint will keep the product portfolio of the cooperative centred on the Original Product. The results of the basic model are formulated in Proposition 1:

Proposition 1: The single origin constraint pulls the products of the cooperative in one cluster centred on the Original Product, limits the diversification level of the cooperative, and increases the output of the Original Product continuously.

8.3 Extensions

This section extends the basic model by incorporating two additional governance structure features into the transition rules: the agents' project decision-making process and their output decisions. In addition, we introduce profits as the third characteristic of a product next to its output and lifetime, with which we are able to compare the performance of different agents.

Project Screening

The transition rule governing how an agent decides whether it will add a new product to its portfolio when faced with a diversification project is adapted from the project screening process in Hendrikse (1998). Instead of accepting all diversification projects, the agents will screen the possible diversification projects and decide to either accept or reject a project. Reflected in Figure 8.0, after the product south of the Original Product is chosen at the beginning of period 1, the agent has to decide whether to add this new product to its portfolio. If the project is accepted, the agent will add the chosen new product to its portfolio. Otherwise, the agent will reject the project and keep its portfolio unchanged. It is assumed that the pool of diversification projects consists of only two types of projects – good or bad. A good project means that diversification to this new product is successful and it will generate profits for the agent. By contrast, a bad project will bring losses or negative profits. In our simulation, the probability of good projects ($\alpha = 0.5$) and bad projects ($1 - \alpha = 0.5$) is equal.

An agent tries to distinguish between good and bad projects, and then accepts the good projects and rejects the bad ones. An agent's bounded capability of making right choices is modelled by the conditional acceptance probability of projects. According to Hendrikse (1998), we define $p(A|B)$ as the probability that a project is accepted, given that it is bad, and $p(A|G)$ as the probability that a project is accepted, given that it is good. Because there is some previous screening, the probability that a bad (B) project is judged to be good is smaller than the probability that a good (G) project is accepted: $p(A|B) < p(A|G)$ (Hendrikse, 1998).

Governance structures differ in the decision-making process. According to Hendrikse (1998), a cooperative consists of two decision-making units, and it aggregates the decisions of both units into an approval decision of the whole organisation only when both units accept the project. An IOF is defined as consisting of only one decision-making unit. Therefore, an IOF accepts a particular good (bad) project with probability $p(A|G)(p(A|B))$, whereas the probability of acceptance for a cooperative is $p(A|G)^2$ ($p(A|B)^2$). Errors of judgement happen in project screening: rejecting a good project is a type I error and accepting a bad project is a type II error. Because $p(A|G) > p(A|G)^2$ and $p(A|B) > p(A|B)^2$, an IOF accepts a larger percentage of projects, both good and bad. By contrast, a cooperative is supposed to accept fewer projects due to its double screening feature. Hence, an IOF has a relative advantage in accepting good projects, whereas a cooperative is better at rejecting bad projects. In other words, a cooperative (IOF) is more likely to commit type I (II) errors (Hendrikse, 1998). A cooperative and an IOF's conditional probabilities of accepting different projects are summarised in Table 8.1.

Table 8.1: Conditional probability of accepting projects

Project Type	**Probability of Accepting the Project**	
	IOF	**Cooperative**
Good Project	$\alpha p(A\|G)$	$\alpha p(A\|G)^2$
Bad Project	$(1-\alpha)p(A\|B)$	$(1-\alpha)p(A\|B)^2$

Output Decisions

In a monopoly market, the raw input for each product is produced by a large number of independent farms. There is only one agent in the region as a single processor, which is either a cooperative or an IOF. When the agent is a cooperative, it is assumed that all farms are members of the cooperative. Whereas when the agent is an IOF, the IOF is in a monopolistic position of taking the produce from the farms. The raw input an agent takes from the farms is labelled 'Raw Product'. The agent processes the 'Raw Product' and sells the 'Final Product' in the market. For simplicity, each unit of the Raw Product from the farms is assumed to yield one unit of the Final Product

(conversion rate of processing is equal to 1). As single seller of the Final Product in the monopoly market, the agent's ability to set the Final Product's price is limited only by the product's demand function, and the rising marginal costs of production. The production costs function consists of the processing costs of the processor and the price paid to the farms for collecting Raw Product.

Given the market demand function and production costs function, the agent can decide the optimal output level for each Final Product in its portfolio. The optimal output level in the simulation is also taken as the output constraint of the product. It means that the agent will not increase the product's output beyond this level. The optimal output of the product varies among different agents because they have different objectives. An IOF's objective is to maximise its profits of processing operations, whereas a cooperative's objective and optimising criteria can vary (LeVay, 1983; Soboh et al., 2009). Cooperatives choosing different objectives will have different market behaviours, which lead to different financial issues in consequence (LeVay, 1983). We simulate two different objectives of a cooperative in our model. The first objective (COOP1) is to maximise the members' total surplus (total profit of both cooperative processor and member farms) and the cooperative is assumed to have direct control over the Raw Product quantity members supply. A cooperative with this type of objective is assumed to behave as a centralised production entity, which produces an optimal output to maximise the joint surplus of the cooperative and farms. The second type of cooperative objective (COOP2) is to maximise the total output of products and serve the members at cost. The cooperative welcomes all eligible Raw Product from the members as long as no loss on its operation is incurred. With the second type of objective, the payment to member farms and the profit of the cooperative is expected to be lower due to overproduction.

The first product in an agent's portfolio is the Original Product. It means that the farms' initial farming activity at the start is to produce the raw input of the Original Product and supply it to the processor. When the processor adds a new product to its portfolio, it needs new Raw Product input from the farms. The relatedness of the new product to the Original Product is measured by its distance to the Original Product in the Portfolio Matrix. The new product's market demand function and the farms' aggregated cost function of producing the new Raw Product input depend on the relatedness of the new product to the Original Product. The larger the distance, the less the new product is related to the Original Product and the deeper the demand function. The definitions of the demand function and the derivation of the optimal output Q^* of a Final Product is provided in Appendix 8.2. The optimal output Q^* of the different processors is as follows:

$$Q^*_{IOF} = \frac{ab - B}{2(a + 2c) \times D}.$$

$$Q^*_{COOP1} = \frac{ab - B}{2(a + c) \times D}.$$

$$Q^*_{COOP2} = \frac{ab - B}{(a + 2c) \times D}.$$

$$D = (1 + 0.1)^{Distance}, \qquad Distance = 0, 1, 2, 3 \ldots$$

a and *b* are the parameters of the downward-sloping demand function of the Final Product; *B* is the marginal costs of processing the associated Raw Product; *c* is the parameter of the farms' aggregated cost function of producing the Raw Product. *D* is used to moderate the new product's demand function and cost function based on its distance to the Original Product. When the *Distance* = 0, *D* = 1, it represents the Original Product. For a specific Final Product, it can be shown that:

$$Q^*_{COOP2} > Q^*_{COOP1} > Q^*_{IOF}.$$

With a larger output constraint, the cooperative will produce more than an IOF does and is likely to 'overproduce' (Albaek and Schultz, 1998:397). This phenomenon can be explained by several features in the cooperative's governance structure design, i.e. the elimination of the 'double mark-up', the output policy driven by the average rather than the marginal member, and members' strong incentive to overproduce, etc. (Hendrikse and Feng, 2013:508).

Simulation Settings of the Monopoly Market

We first investigate the product portfolio evolution of different agents in a monopoly market. We use the same lifetime settings as in the basic model. The lifetime of the Original Product is set to infinite for the cooperative agent, which highlights the single origin constraint, whereas for the IOF agent a finite lifetime of 40 is assigned to the Original Product. A finite lifetime equal to 40 will be assigned for all other products.

At the beginning of each period, the agent will choose randomly a product from the local Moore neighbourhood of its current product(s) based on the Probability Matrix. If the chosen one is a new product, it can be a good project or a bad project. The agent must judge the project and decide whether to diversify through the screening process. The project screening process is configured under the following parameter setting: $p(A|G) = 0.6, p(A|B) = 0.2$ and $\alpha = 0.5$. If the agent decides not to diversify, the project is rejected and the product portfolio will remain unchanged in this period. If the agent accepts the project and the project is good, the new product will be assigned an initial output level. The new product will then start to generate profit for the agent

and be kept in the portfolio. To the contrary, if the project is bad, it will then generate a loss that is equal to negative profit of the initial output and the agent will divest the product in the next period immediately. If the chosen cell is an existing product already in the agent's portfolio, and its current output is still lower than the optimal output level defined by Q^*, the agent will then increase the output level of the product with a fixed growth rate.

The initial output level of the Original Product is set to 2. Given the numerical parameters ($a = 0.4;\ b = 20;\ c = 0.25; B = 0.8$), we can obtain the output constraints of the Original Product for different agents: $Q^*_{IOF} = 4;\ Q^*_{COOP1} = 5.5;\ Q^*_{COOP2} = 8$. The initial output level of a new product is decided by its distance to the Original Product and equal to $2/D$. The production constraint of the new product is: $Q^*_{IOF} = 4/D;\ Q^*_{COOP1} = 5.5/D;\ Q^*_{COOP2} = 8/D$. A fixed growth rate of 50% is chosen. The rationale is that the IOF, COOP1 and COOP2 will reach a product's output constraint after 2, 3 and 4 times the output increase, respectively. When a product's output level has reached its production constraint, the product will not be chosen again. The agent will keep a profit-generating product in the portfolio until its lifetime is reached, and then the product will be removed from the portfolio. We simulate the process of an agent's portfolio evolution over 500 periods. The results of 100 runs of simulation are averaged.

Results of the Monopoly Market Simulation

Appendix 8.3 presents and compares the simulation results of the product portfolio evolution and performance of different agents in a monopoly market. Particularly, we simulate two types of cooperatives with different objective functions: COOP1 is to maximise the farmer members' total surplus and COOP2 is to maximise the output of product and serve the members at cost.

Figures 8.3a – 8.3e capture the evolution of the agents' product portfolio in terms of number of products, output, and composition of products. Figure 8.3a illustrates the number of products in the agents' portfolio. After the simulation starts, both the cooperative and the IOF add new products to their portfolio by accepting diversification projects. Up until the 40th period, the number of products increases quickly but the increase of the IOF's number of products is faster. It entails that the IOF adds new products more quickly than the cooperative does. The speed of adding new products to the portfolio is determined mainly by the agent's project screening mechanism. With two independent decision-making units, the cooperative rejects more diversification projects; hence, it adds fewer new products along the periods. By contrast, the IOF agent is more willing to accept projects and thus becomes more diversified than the cooperative. After the 40th period, the number of products in the

agents' portfolios drops steeply because some products start to reach their lifetime. In the long term, the number of products in the IOF agent's portfolio fluctuates at around 9, while the number of products of the cooperative agent, both COOP1 and COOP2, fluctuates at around 6. This means that the cooperative is less diversified, keeping fewer products in the portfolio than the IOF does. Because COOP1 and COOP2 have the same screening process, their product numbers are close. Nevertheless, COOP1 has slightly more products than COOP2. This is because COOP1 has a smaller output constraint and its product will reach the constraint earlier. When a product has reached its output constraint, it will no longer be selected and more probability weight is given to the products not in the portfolio yet.

Figures 8.3b and 8.3c illustrate the agents' total product output and average output per product. After the simulation starts, both the cooperative and the IOF increase their total output quickly by adding new products to the portfolio and by increasing the output of the existing products. After the product divesture starts, the agents' total output drops. The total output of the cooperative levels off after some periods, whereas that of the IOF declines slowly along the whole periods. An agent's total output is related to the products number in its portfolio and the output of each product. From a long-term perspective, the IOF keeps about 9 products in its portfolio but the average output per product declines continuously over time. It confirms the results of the basic model that after the Original Product of the IOF has reached its lifetime and been divested, the IOF's product portfolio gradually evolves into product clusters that deviate from the Original Product. Because of this deviation, the IOF's portfolio consists of the products that have smaller market sizes and smaller output constraints. Therefore, the IOF has the lowest and a continuously declining average output per product and total output. By contrast, the Original Product of the cooperatives will remain in the portfolio forever due to the single origin constraint. The consequence is that the evolution of the product portfolio of the cooperative will be centred on the Original Product and the output constraints of individual products will vary in a relatively small range. In addition, the products similar to the Original Product are modelled to have large market demands. Therefore, the average output per product of the cooperative will be larger than that of the IOF. With the highest output constraints, it is natural that COOP2 has the largest output per product as well as total output.

Figures 8.3d and 8.3e present the change of the average product distance to the Original Product and the average weighted product distance. The cooperative's average (weighted) product distance stays stable after some periods. It confirms that the product portfolio of the cooperative remains concentrated around the Original Product. By contrast, the average (weighted) product distance of the IOF continues to increase when its portfolio evolves to the products that are far away from and less

related to the Original Product. In Figure 8.3d we can also see that the average product distance of COOP1 is slightly higher than that of COOP2. It entails that although both COOP1 and COOP2's portfolio are centred on the Original Product, COOP1's product portfolio is slightly more dispersed because COOP1 has more products than COOP2 does. It shows that a large output of the products will decrease the diversification level of the cooperative.

In the monopoly market, the single origin constraint still plays a dominant role in the development of a cooperative's portfolio. After the 40^{th} period, the limited product life time starts to have a divesture effect. For the cooperative, the product that reaches its lifetime first sits in the Moore neighbourhood of the Original Product. Although the cooperative will not continuously increase the output of the Original Product due to the output constraint, the Original Product maintains the large chance for the products around it to be chosen and thus generates a concentration effect. By contrast, the first divested product in the IOF's portfolio is the Original Product. The divesture of the Original Product entails that the probability weights regarding the selection of a new activity changes significantly since the centre of the probability distribution has been removed and the probability distribution becomes flat. It increases the likelihood that a new product, which is far away from the Original Product, is chosen. In consequence, the IOF's portfolio changes to product clusters that deviate from the Original Product. Following this deviation, the output of the IOF is declining over time because the products that have a large distance from the Original Product are defined to have lower production constraints. The results are formulated in Proposition 2:

Proposition 2: Compared with the IOF, the cooperative is less diversified and has a larger product output. The cooperative's product portfolio is centred on the Original Product, while the IOF diversifies into the product clusters that are not related to the Original Product.

The double screening in the decision making of cooperatives indicates more conservative project selection. In addition to the single origin constraint, the double screening also leads to the cooperatives being less diversified than the IOF. Table 8.2 shows the activity record of the different agents (the average of 100 runs of simulation). The cooperatives are good at abandoning bad projects, and seldom make type II errors (on average 8 times for COOP1 and 7 times for COOP2). By contrast, the IOF selected 34 bad projects. However, cooperatives have a higher tendency to commit type I errors. COOP1 and COOP2 rejected 117 and 114 good projects, much higher as compared to the 69 good projects rejected by the IOF. During 500 periods, COOP1, COOP2 and the IOF increase product output 136, 149 and 151 times respectively. COOP2 increased product output more often than COOP1 did due to its

larger output constraint. For the IOF, because it has more products in its portfolio, the frequency of the output increase is thus larger.

Table 8.2: Activity record of the monopolistic agents

Activities	COOP1	COOP2	IOF
Abandon bad project	175	167	141
Select bad project	8	7	34
Abandon good project	117	114	69
Select good project	63	63	105
Increase output	136	149	151

The simulation also generates indications for the performance of different processors in a monopoly market. Figure 8.3f illustrates the total surplus of the cooperative, the total profit of the IOF, and the profit of the farms that deliver the raw product to the IOF. The total surplus of COOP1 is higher than that of COOP2, and is close to the total profit of the IOF. It entails that COOP1, which has direct control over the product output, can generate a higher total surplus for the member farms than COOP2 does, which serves the member at cost. The latter type of cooperative suffers a loss of surplus due to overproduction. Meanwhile, although the IOF can earn a comparable level of profit as compared to the total surplus of the cooperative, the farms that deliver the raw product to the IOF can only obtain a very low level of profit. This indicates that the farms are exploited by the market power of the monopolistic IOF in the region. Both types of cooperatives can improve the wellbeing of the farms in the monopoly market, although the cooperative is less diversified.

Furthermore, as illustrated in Figure 8.3g, the average surplus of COOP1 or COOP2 per product is higher than the sum of the average profit per product of the IOF and the profit of the farms delivering the raw product to the IOF. This is due to the cooperative's advantage of being vertically integrated with farms. The vertical integration eliminates the double marginalisation and leads to a higher joint surplus of the cooperative processor and farms. In addition, Figure 8.3h shows that the average profit per output unit of the IOF is higher than that of the cooperative and continues to increase during the periods. As the IOF evolves to the products with a large distance from the Original Product, the IOF moves to the higher value-added products and receives a higher profit per output unit. Therefore, although the IOF has a smaller total output and average output per product, by having more products in its portfolio that enjoy a higher profit per output unit, it is still able to reach an equivalent level of total profit as compared to the total surplus of the cooperative. These results are formulated in the following proposition:

Proposition 3: In a monopoly market, the total surplus of the cooperative is close to the total profit of the IOF. However, the cooperative has a higher average surplus per product, while the IOF has a higher average profit per output unit.

8.4 Duopoly Market

In this section, we further extend the model of the product portfolio evolution to an environment with two agents – a cooperative and an IOF, which are competing in a mixed duopoly market. The simulation of a duopoly market addresses the impact of competition between different governance structures on product diversification.

Simulation Settings of the Duopoly Market

There are two different agents in the market. When the simulation starts, each agent has only the Original Product in its portfolio and both will evolve the product portfolio. However, an agent's portfolio evolution is now in a competitive environment and interacting with the other agent. If both agents are producing the same product, they are in competition and each has to choose the optimal output level for the product. This is captured by the Coutnot competition game. The single origin constraint of the cooperative will still be captured by setting the lifetime of the Original Product to infinite for the cooperative agent but finite for the IOF agent. All other products are assigned the same finite lifetime.

Like in the simulation of the monopoly market, an agent will choose a product in the local Moore neighbourhood of its product portfolio based on the weighted probability distribution at the beginning of each period. However, additional transition rules are required to govern an agent's interactions with the other agent in the duopoly market. In the monopoly market, when an agent chooses a product from its local neighbourhood, there are only two possibilities. If the product is already in the portfolio, the agent will simply increase its output level until the output reaches the output constraint; if the product is a new product, the agent will need to decide whether to diversify or not. In the duopoly market, because of the existence of a rival agent, two more possibilities exist and thus two new transition rules. The first possibility is that an agent chooses a product that is not in its own portfolio but in the rival agent's. In this case, we use the transition rule that the agent will enter into competition immediately because the product is proved to be good and adding it to the portfolio will generate profit. It is also assumed that the incumbent producer of the product cannot prevent the entry of the other agent. The second new possibility is that the chosen product is already in the portfolios of both agents. Then the agent will adjust its output based on the reaction function of the Coutnot competition game until

the output of that product reaches equilibrium. To be more precise, if an agent is producing a product alone, the output constraint of the product is decided in the same way as in the monopoly market. If an agent is competing with the rival agent in a product, the output level of the product is decided by the reaction function. In the duopoly market, if a product's output level has reached the output constraint or equilibrium, the product will not be chosen again in the next period. The status of the chosen product and an agent's activity is listed in Table 8.3.

Table 8.3: Status of the chosen product and the activities of agents

Status of the Chosen Product	**Activities**
New product (none of the agents is producing at the moment).	Decide whether to diversify or not based on the project screening process (*Project Screening*).
In own portfolio but not in rival agent's portfolio.	Increase output level until production constraint (*Increase Output*).
Not in own portfolio but in rival agent's portfolio.	Enter into competition and decide output level based on reaction function (*Join Competition*).
In both agents' portfolios.	Adjust output level based on the reaction function (*Adjust Output*).

The reaction functions are as follows and the derivation is provided in Appendix 8.4.

$$Q^*_{IOF} = \frac{ab - B - aDQ_{COOP}}{2(a + 2c) \times D}.$$

$$Q^*_{COOP1} = \frac{ab - B - aDQ_{IOF}}{2(a + c) \times D}.$$

$$Q^*_{COOP2} = \frac{ab - B - aDQ_{IOF}}{(a + 2c) \times D}.$$

$$D = (1 + 0.1)^{Distance}, Distance = 0,1,2,3 \ldots$$

Results of the Duopoly Market Simulation

Under the same parameters as in the monopoly market simulation, we simulate the process of portfolio evolution of an IOF and a cooperative, which are in competition for 500 periods. The results of 100 simulations runs are averaged.

The first simulation demonstrates the competition between the IOF and the cooperative that maximises the total surplus (COOP1). The results are in Appendix 8.5. In Figure 8.5a we can see that the number of products of the IOF is still larger than that of COOP1. However, the IOF and the cooperative have around 11 and 8 products in their portfolios in the duopoly market. The duopolistic agents' products numbers are larger than what they have when they are monopolists. The reason is that, when an agent selects a new product from its existing products' local neighbourhood, if is not

in its own portfolio but in the rival agent's, the agent will choose to join in competition without project screening because this product is profitable. This increases the chance of adding new products and increases the number of products in an agent's portfolio. It entails that the competition may boost product diversification if the agents use the strategy of following other agents to produce profitable products. However, in the duopoly market, the IOF is still more diversified than the cooperative because it is more willing to accept diversification projects.

Figures 8.5b and 8.5c illustrate that the cooperative has a higher level of total output and output per product than the IOF does. Due to the larger production constraints and the more aggressive behaviour of the cooperative, although the cooperative agent is less diversified and has fewer products in portfolio, the total output of the cooperative is larger than that of the IOF.

Figure 8.5d shows that the average product distance of the IOF is higher than that of the cooperative, and it levels off after some periods in the duopoly market. To the contrary, the average product distance of the IOF keeps increasing in the monopoly market (Figure 8.3d). This means that, when an IOF is competing with a cooperative, the competition prevents the IOF's portfolio from deviating from the Original Product continuously. This is because the products in competition are close to the Original Product as the portfolio of the cooperative concentrates around the Original Product due to the single origin constraint. This part of the IOF's portfolio continues to evolve as a products cluster, which is relatively close to the Original Product. Therefore, the average product distance of the IOF doesn't keep increasing. Therefore, the dispersion of the portfolio of the IOF in the duopoly market is lower than that in the monopoly market, due to the interaction between agents. However, Figure 8.3e shows that the average weighted product distance of the cooperative is higher than that of the IOF because of the cooperative's larger output per product.

The total surplus of the cooperative and the total profit of the IOF are close (Figure 8.5f). However, the farms that deliver the Raw Products to the IOF still earn a low level of profit. It is noticed that the total surplus of the cooperative is higher than the total profit of the IOF in the early periods of the simulation, e.g. before the 40^{th} period. This is because both processors' portfolio evolution starts from the Original Product, and their portfolios have much in overlap at the beginning of the simulation. It entails that they compete with more products at the start. The cooperative takes advantage of vertical integration into more products and obtains a higher surplus for every product in competition. Figure 8.5g illustrates that the average surplus per product of the cooperative is higher than the average profit per product of the IOF. With fewer products in the portfolio, the cooperative's source of surplus concentrates on fewer

products, whereas the IOF obtains its profit from more products. However, the average profit per output unit of the IOF is slightly higher (Figure 8.5h). It shows that the IOF still diversifies into the products with a larger distance to the Original Product and obtains a higher unit profit. Overall, similar to the situation in the monopoly market, the IOF has a smaller output per product and lower profit per product, but it enjoys a higher average profit per output unit. With a more diversified portfolio and a higher profit per output unit, the total profit of the IOF reaches a similar level as the total surplus of the cooperative along the periods.

Figure 8.5i compares the average market shares of the cooperative and the IOF. For those products in competition, the cooperative enjoys 60% of the market share and the IOF therefore only 40%. This confirms that the cooperative will produce more than the IOF in a mixed duopoly market (Tennbakk, 1995). Figure 8.5j shows that the number of products in competition reaches 8 at the beginning of the simulation. It means that the competition concentrates on the products around the Original Product at the start. After 40 periods, some products reach their lifetime and are divested. In consequence, the number of products in competition decreases and levels off. Approximately, the agents are competing in 5 products, and the output equilibrium is reached in about 3 products.

The second simulation of the duopoly market demonstrates the competition between the IOF and COOP2, a cooperative that maximises its output and breaks even. The simulation results are presented in Appendix 8.6. The agents' product numbers (Figure 8.6a) and average product distance (Figure 8.6d) are similar across the two duopoly market models, but the weighted average product distance (Figure 8.6e) of COOP2 is larger than that of COOP1 due to the larger product output of COOP2. In both duopoly market models, the total surplus of the cooperative and the total profit of the IOF are close. However, the cooperative enjoys a higher surplus per product due to the vertical integration, while the IOF obtains a higher level of profit per output unit.

The simulation of the competition between the IOF and COOP2 results also in some differences. First, the output of COOP2 is significantly larger (Figures 8.6b and 8.6c), and results in the lower total and per product surplus (Figures 8.6f and 8.6g). In addition, the average surplus per output unit of COOP2 is much lower than that of COOP1 due to the overproduction. The IOF's market share decreases to about 35% when in competition with COOP2. Second, the total profit and the average profit per product of the IOF also decrease when it competes with COOP2. This can be explained as follows. The portfolio of the cooperative is concentrated around the Original Product due to its single origin constraint and an overproducing cooperative like COOP2 will pool the large output of these products in the market because its

activity is only restricted by the at-cost condition. When the IOF is competing with the cooperative expanding its output aggressively, it is forced to decrease its output of the products and obtain certainly lower profit. This leads to destructive competition. By contrast, when the IOF is competing with the cooperative which maximises its total surplus (COOP1), the destructive competition is less serious because both agents are more interested in higher product prices. The results of the duopoly market simulation are summarised in the following proposition.

Proposition 4: In a mixed duopoly market, the total surplus of the cooperative is close to the total profit of the IOF. The cooperative is less diversified than the IOF. However, due to the competition effect, both the IOF and cooperative will have a higher diversification level than in the monopoly market. In addition, the dispersion of the IOF's product portfolio will be lower.

Table 8.4 records different agents' activities in the simulation of the duopoly market (the mean of 100 runs of simulations).

Table 8.4: Activity record of the duopolistic agents

	Duopoly Market 1		**Duopoly Market 2**	
Activities	**IOF**	**COOP1**	**IOF**	**COOP2**
Abandon bad project	136	162	138	159
Select bad project	35	7	34	6
Abandon good project	66	105	69	103
Select good project	103	60	102	59
Increase output	76	56	76	58
Join competition	33	50	34	51
Adjust output	50	59	48	63

Similarly, the cooperatives are good at abandoning the bad projects and they seldom make type II errors (7 times for COOP1 and 8 times for COOP2). By contrast, the IOF selected 35 and 34 bad projects. However, cooperatives have also a higher tendency to commit type I errors. COOP1 and COOP2 rejected 105 and 103 good projects, much higher as compared to the 66 and 69 good projects rejected by the IOF. During the 500 periods, COOP1 and COOP2 increase product output 56 and 58 times, respectively. During the same periods, the IOF increases product output more often (76 times) than the cooperatives due to the larger number of products in the IOF's portfolio. In general, the cooperatives are more inclined to enter the competition than the IOF is. When the cooperative selects a product in the IOF's portfolio but not in its own portfolio, it will enter the competition by starting to produce the product. Because the IOF has more products in its portfolio, the likelihood for the cooperative to join the competition is

thus higher. It entails that the cooperative acts more as a follower in the competition in the mixed duopoly market.

8.5 Conclusion

This chapter formulates a number of results regarding the impact of governance structure on the evolution of product portfolio coherence by using agent-based methodology. We simulate the product portfolio evolution of a cooperative and an IOF in three models: the basic model, the monopoly market model, and the duopoly market model.

The basic model focuses on the impact of the single origin constraint of cooperatives when agents adopt a concentric diversification strategy. Concentric diversification and portfolio coherence are made operational by making the agents diversify into new products in the Moore environment of the current product portfolio, while the single origin constraint is modelled by assigning an infinite lifetime only to the first product of the cooperative. The simulation results of the basic model show that the single origin constraint pulls the products of the cooperative in one cluster centred on the Original Product. This centralisation effect decreases the probability of choosing new products while increases the output of the Original Product continuously. Therefore, one important result is that the single origin constraint accounts for the lower diversification level of cooperatives. Without single origin constraint, the product portfolio of the IOF evolves in such a pattern that it consists of clusters of related products that deviate from the Original Product. In the long term, the IOF will be more diversified than the cooperative and keep a stable number of products in its portfolio. The output of the IOF is also relatively constant.

In the simulation of the monopoly market, two additional aspects of governance structure are addressed explicitly. First, the cooperative and the IOF have different decision-making processes in project screening. The cooperative is characterised by the double screening, whereas the project screening of the IOF consists of only one decision-making unit. Second, different governance structures lead to different objectives of firms, which have an impact on their output decisions. While an IOF determines its product output level by maximising the total profits of the downstream processor, a cooperative may maximise the summed profits of the upstream farms and downstream processor or maximise the product output by making the downstream processor serve the members at cost. The results show that, although the cooperative will not continuously increase the output of its Original Product due to the output constraint, its product portfolio still centres on the Original Product. By contrast, the IOF's product portfolio starts to develop in a centrifugal way after the Original

Product is eliminated. The distribution of product lifetime of products is proved to be the key factor in determining the coherence of the product portfolio of enterprises. Our model indicates that product portfolios evolve into clusters of related products only when all products have a finite lifetime. The centripetal effect on portfolio composition of one product with an infinite lifetime dominates the centrifugal effect of products with finite lifetime, regardless of the number of products with a finite lifetime.

Decision-making processes and objectives of firms have impacts on the evolution and composition of product portfolios. The cooperative's double screening process leads to its more conservative project selection. This is thus an additional reason that explains the cooperative's lower diversification level. The different objectives of the cooperative and the IOF are reflected in their different output decisions. The IOF has the lowest product output because it limits the product output to maximise the total profit of the processor. The cooperative that maximises its members' total surplus has a larger product output than the IOF does because the vertical integration eliminates the double-marginalisation problem. The cooperative that doesn't control the output and serves the members at cost further increases the output but the surplus is decreased in return.

In general, the cooperative's product portfolio is featured as less diversified, centred on the Original Product, with a larger output, a higher surplus per product, and a lower surplus per output unit. The IOF has more products in its portfolio, which deviates from the Original Product and has a smaller output, a lower profit per product, and a higher profit per output unit. However, although the cooperative and the IOF have very different portfolio compositions, the total surplus of the cooperative and the total profit of the IOF are close. The farms that deliver the Raw Products to the IOF obtain a much lower profit compared with the surplus received by the cooperative member farms. This result indicates the value of cooperatives for farms in terms of establishing countervailing power.

Competition between agents is modelled in the simulation of the mixed duopoly market. Competition entails that there is an interaction effect between the two agents, which modifies the diversification and divestment process. In the mixed duopoly market, the cooperative still has fewer products in its portfolio, and has a larger total and per product output than the IOF does. Similar to the results of the monopoly market, the cooperative has a higher surplus per product, whereas the IOF has a higher profit per output unit in the duopoly market. However, both the cooperative and IOF are more diversified in the duopoly market than in the monopoly market because of the interaction effect. A duopolistic agent will add a new product to its portfolio if the product is already in the rival's portfolio. Another impact is that the interaction

prevents the IOF's portfolio from deviating from the Original Product continuously by keeping some of the IOF's products close to the Original Product. Furthermore, it is indicated that the cooperative occupies a larger market share in the mixed duopoly market. The cooperative that serves the members at cost will further expand its market share in the competition with the IOF. The results also show that the total surplus of the cooperative and the total profit of the IOF are close when they are in competition, but both types of the cooperative can improve the member farms' wellbeing in the duopoly market.

Various avenues for future research are possible. First, the evolution and composition of product portfolios have been addressed, but this does not determine the direction of the growth activities. Modelling the portfolio problem and the horizon problem along the lines of this chapter may generate some directionality in the product portfolio. For example, focus on the Moore neighbourhood may account for the difference between related and unrelated diversification, while the lifetime parameter is a natural ingredient of the model for capturing the difference between short and long run projects. A recent study by Ang et al. (2014) shows the background of CEOs has an impact on their divestiture decisions.

Second, according to the resource-based view, resources of firms will shape their diversification pattern (Penrose, 1959). Compared with IOFs, cooperatives are supposed to be short of two types of resources. Cooperatives have less financial resources at their disposal for product diversification because their equity shares are not transferable and they are not able to raise capital from stock markets (Vitaliano, 1983; van Oijen and Hendrikse, 2002). As a consequence, cooperatives may have fewer means to diversify than IOFs. In addition, cooperatives may have insufficient human resources because member-dominated leaders may lack the skills and knowledge needed for diversification strategies (USDA, 2002). This results in the hypothesis that the frequency of product portfolio changes is lower for a cooperative than an IOF. We intend to investigate the implications of some of these observations in future research using agent-based methodology.

Appendix 8.1: Simulation Results of the Basic Model

This appendix presents various indicators of the evolution of the product portfolio of the IOF (dotted line) and the cooperative (solid line).

Figure 8.1: Simulation results of the basic model

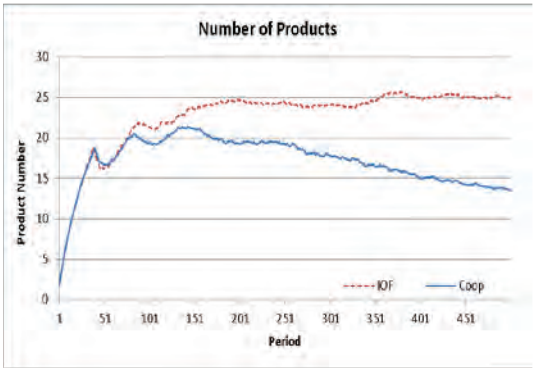

Figure 8.1a: Number of Products

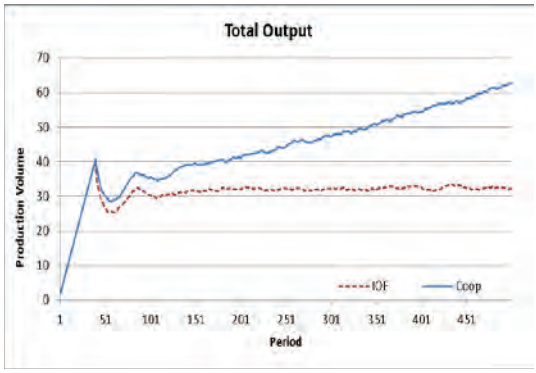

Figure 8.1b: Total Output

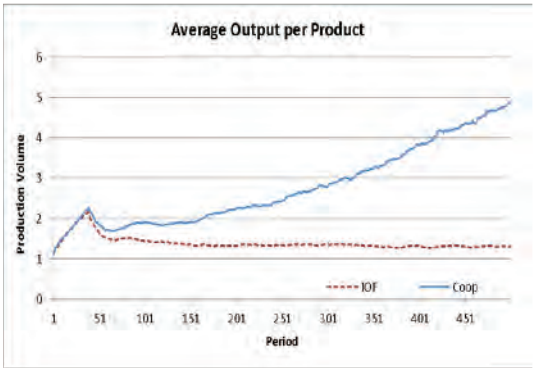

Figure 8.1c: Average Output per Product

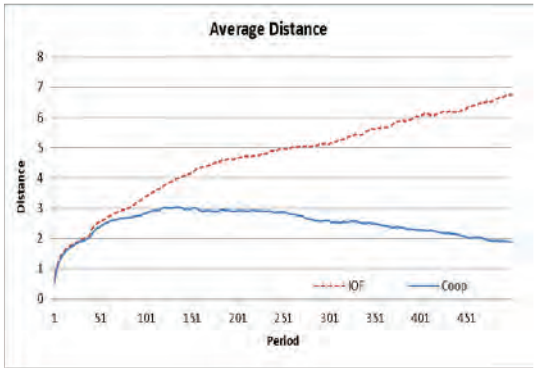

Figure 8.1d: Average Product Distance

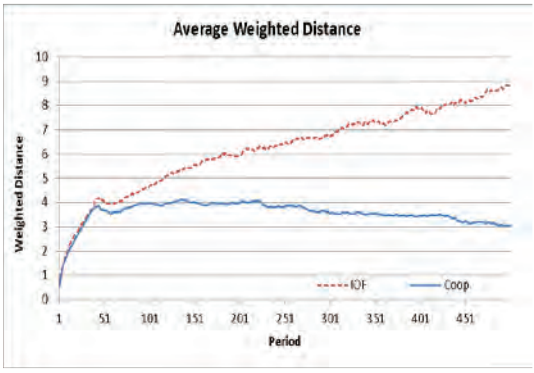

Figure 8.1e: Average Weighted Product Distance

Appendix 8.2: Optimal Output in the Monopoly Market

We first derive the optimal output Q^* for the Original Product. We assume that the Final Product's downward-sloping demand function is linear. Let p be the market price and the inverse market demand for the Original Product is:

$$p(Q) = -a(Q - b), a > 0, b > 0.$$

In the market under consideration, the Raw Product is produced by a large number of independent farms in the region. The aggregated cost function of the farms is increasing and convex, being a quadratic function of total output Q (Tennbakk, 1995; Albaek and Schultz, 1998):

$$C(Q) = cQ^2, c > 0.$$

All farms have to sell their Raw Product to the IOF, which is in a monopolistic position of taking the produce from farms. The IOF has to pay a price according to the aggregate marginal cost curve of farmers $C'(Q)$ to get the desired supply (Tennbakk, 1995; Royer and Matthey, 1999). In addition, in a long-term operation, the IOF processor has constant marginal costs B (> 0) for other input in production, thus the profit from the operation of the IOF processor and the profit of the farms are:

$$\pi_{IOF} = -aQ^2 + abQ - BQ - QC'(Q).$$

$$\pi_{Farms} = QC'(Q) - cQ^2 = cQ^2.$$

The IOF's objective is to maximise π_{IOF}. When the Original Product's marginal revenue is equal to the sum of the marginal processing costs and marginal costs of purchasing the Raw Product from the farms, π_{IOF} is maximised. From the first-order condition we obtain:

$$Q^*_{IOF} = \frac{ab - B}{2(a + 2c)}.$$

If the monopolistic processor in this region is a cooperative, we assume that all the farms are cooperative members and supply the Raw Product to the cooperative. The cooperative is assumed to have a direct control over the Raw Product quantity the members produce. The cooperative's objective is to maximise its members' total surplus (COOP1, denoted as S_{COOP}), which is the sum of the profits from the production of each member farms and the profit of the operation of processor, which are subsequently distributed back to the member farmers:

$$S_{COOP} = -aQ^2 + abQ - BQ - C(Q).$$

In this case, the cooperative is like a fully integrated firm, who integrates the production of its members and acts as monopolist in the Final Product market. The on-farm costs of members are internalised and the cooperative equalises marginal revenue to marginal costs. The integration of upstream and downstream firms bring an

advantage to the cooperative by eliminating the double-marginalisation problem (Spengler, 1950; Feng, 2011; Hendrikse and Feng, 2013).

The cooperative is assumed to have the same constant marginal costs B (> 0) for other input in production. By maximising the total surplus S we obtain:

$$Q^*_{COOP1} = \frac{ab - B}{2(a + c)}.$$

Another possible objective of cooperative is to maximise the output and serve the members at cost. We label it COOP2 and we obtain:

$$Q^*_{COOP2} = \frac{ab - B}{a + 2c}.$$

In the case of operating at cost, because the cooperative allows free entry to anyone with eligible produce (no input control), the cooperative welcomes all eligible Raw Product it is offered as long as no loss occurs in the operation (LeVay, 1983).

When a processor diversifies into a new product, and this product generates profits, the new product's demand curve and cost function are similar to those of the Original Product, but it is modified according to the new product's relatedness to the Original Product. The relatedness is measured by the new product's distance to the Original Product in the Portfolio Matrix. The distance is defined as the largest vertical or horizontal distance from the new product cell to the Original Product cell in the Portfolio Matrix. For example, Figure 8.2a illustrates the new product X, Y, and Z, which has a distance of 1, 1, and 2 to the Original Product, respectively:

0	0	0	0	0
0	0	0	0	0
0	0	Original	0	0
0	0	X	Y	0
0	0	0	0	Z

Figure 8.2a: The Original Product and new products

For a new product with a certain distance to the Original Product, the downward-sloping demand curve and aggregated cost function of its Raw Product are:

$$p(Q) = -a(DQ - b), a > 0, b > 0.$$

$$C(Q) = c(DQ)^2, c > 0.$$

$$D = (1 + 0.1)^{Distance}, \qquad Distance = 0,1,2,3 \ldots$$

D is used to moderate the new product's demand function and cost function based on its distance to the Original Product. When distance is equal to 0, $D = 1$, it represents the Original Product.

By maximising the objective functions, we obtain the general form of Q^*_{IOF}, Q^*_{COOP1} and Q^*_{COOP2} , i.e. the optimal outputs or production constraints of the product with a certain distance to the Original Product:

$$Q^*_{IOF} = \frac{ab - B}{2(a + 2c) \times D}.$$

$$Q^*_{COOP1} = \frac{ab - B}{2(a + c) \times D}.$$

$$Q^*_{COOP2} = \frac{ab - B}{(a + 2c) \times D}.$$

Figures 8.2b and 8.2c compare the demand curve and cooperative's surplus curve for the Original Product and a new product in Figure 8.2a with a distance of 2 (product Z).

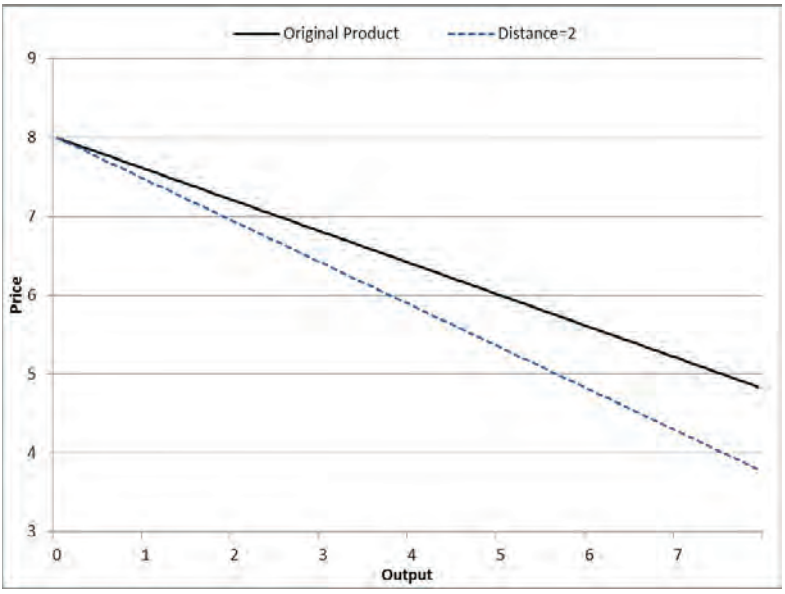

Figure 8.2b: Demand curve of the Original Product and the product with Distance=2

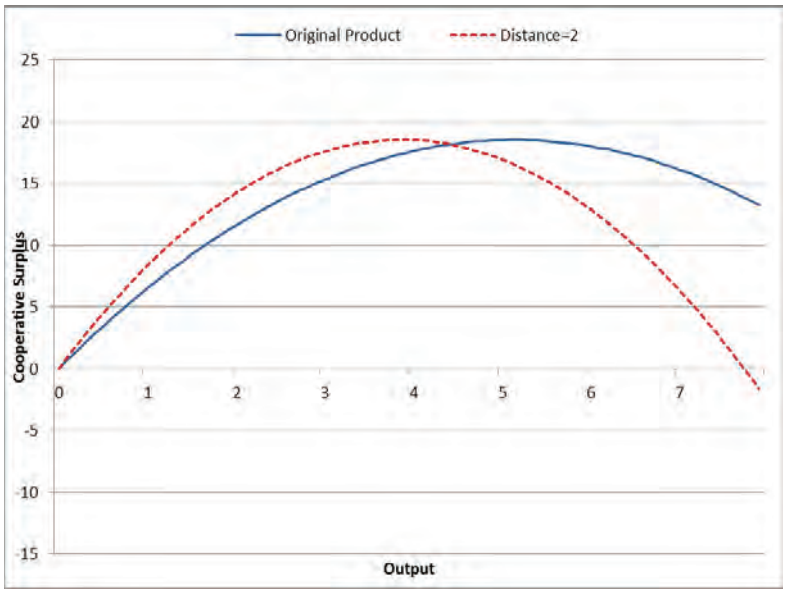

Figure 8.2c: Cooperative's surplus of the Original Product and the product with Distance=2

The rationale behind the distance of a new Final Product to the Original Product is that the larger the distance, the steeper the downward-slope of demand curve. It entails that the market size of the new product is smaller than the Original Product. However, the new product has a higher surplus (profit) per output unit than the Original Product does at its optimal output. In this sense, we view the Original Product as the product with basic quality features and model the diversification from the Original Product to a new product as an extension of business to higher value-added final products.

Appendix 8.3: Simulation Results of the Monopoly Market

This appendix presents various indicators of the evolution of the product portfolio of the IOF (dotted line) and the cooperative (solid line for COOP1 and dashed line for COOP2).

Figure 8.3: Simulation results of the monopoly market

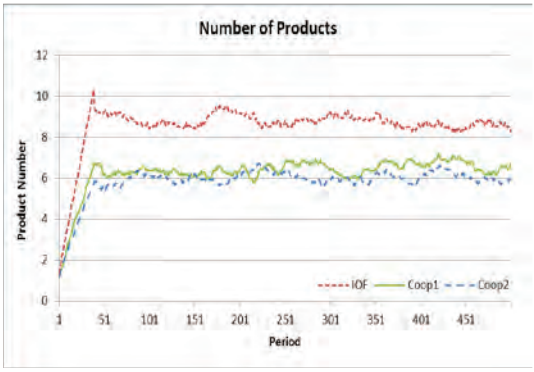

Figure 8.3a: Number of Products

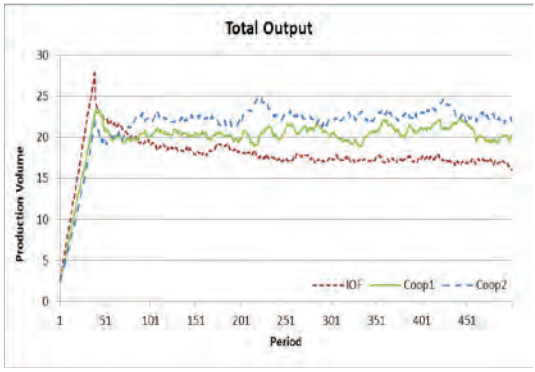

Figure 8.3b: Total Output

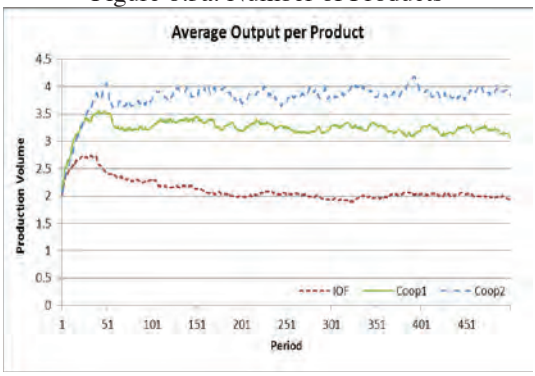

Figure 8.3c: Average Output per Product

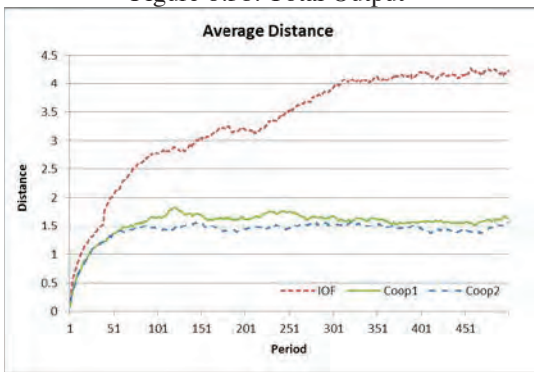

Figure 8.3d: Average Product Distance

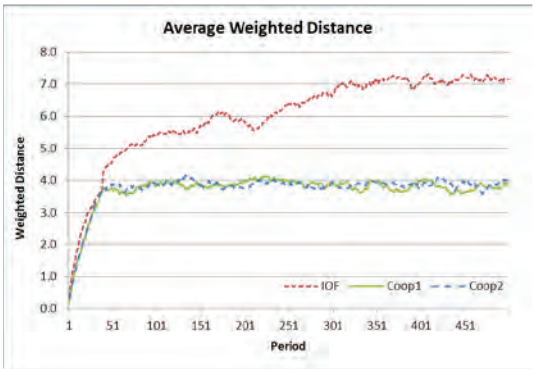

Figure 8.3e: Average Weighted Product Distance

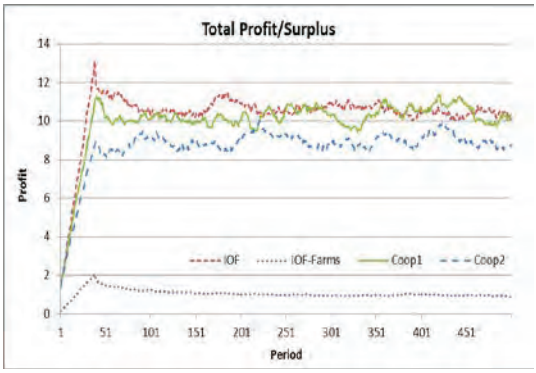

Figure 8.3f: Total Profit/Surplus

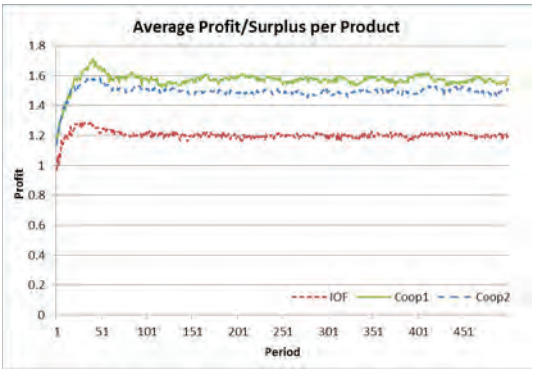

Figure 8.3g: Average Profit/Surplus per Product

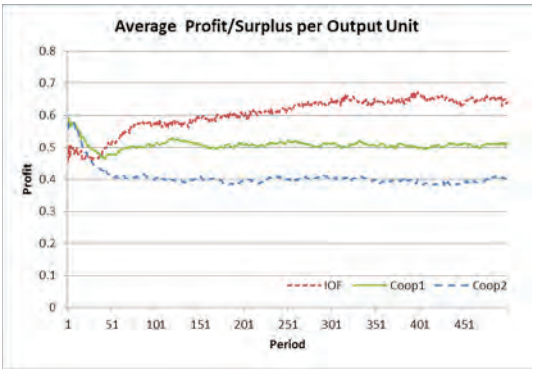

Figure 8.3h: Average Profit/Surplus per Output Unit

Appendix 8.4: Reaction Functions in the Duopoly Market

We first derive how agents decide the output of the Original Product when they are in competition. We adopt the same settings of Tennbakk (1995) for a mixed duopoly market, and assume that the farms are divided into two equal groups with the identical aggregated production costs function.

$$C(Q) = c(DQ)^2, c > 0.$$

The production of each farm group is exclusively distributed to the final market via one of the two processors – the IOF or the cooperative. The cooperative is modelled as a closed cooperative, which only takes the input from its member group. Therefore, the IOF is in a monopolistic position for those non-member farms. It is also assumed that the cooperative and IOF processor have the same constant marginal costs B (> 0) for other input in production. The inverse market demand of the Original Product is captured by:

$$p(Q) = -a(Q_1 + Q_2 - b), a > 0, b > 0.$$

For the IOF with an output level of Q_1, its profit is:

$$\pi_{IOF} = -(a + 2c)Q_1^2 + (ab - B - aQ_2)Q_1.$$

The reaction function of the IOF can be obtained:

$$Q_{IOF}^* = \frac{ab - B - aQ_2}{2(a + 2c)}$$

For the cooperative with an output level of Q_2, the total surplus is:

$$S_{COOP} = -(a + c)Q_2^2 + (ab - B - aQ_1)Q_2.$$

The reaction function of the cooperative can be derived by maximising the members' total surplus:

$$Q^*_{COOP1} = \frac{ab - B - aQ_1}{2(a+c)}.$$

If the cooperative is operating under the at-cost condition, the reaction function is:

$$Q^*_{COOP2} = \frac{ab - B - aQ_1}{a+2c}.$$

The equilibrium output of the Original Product is given by the intersection of the reaction functions as shown in Figure 8.4. The asymmetry in the reaction functions shows that the cooperative is a more aggressive agent by producing more than the IOF does.

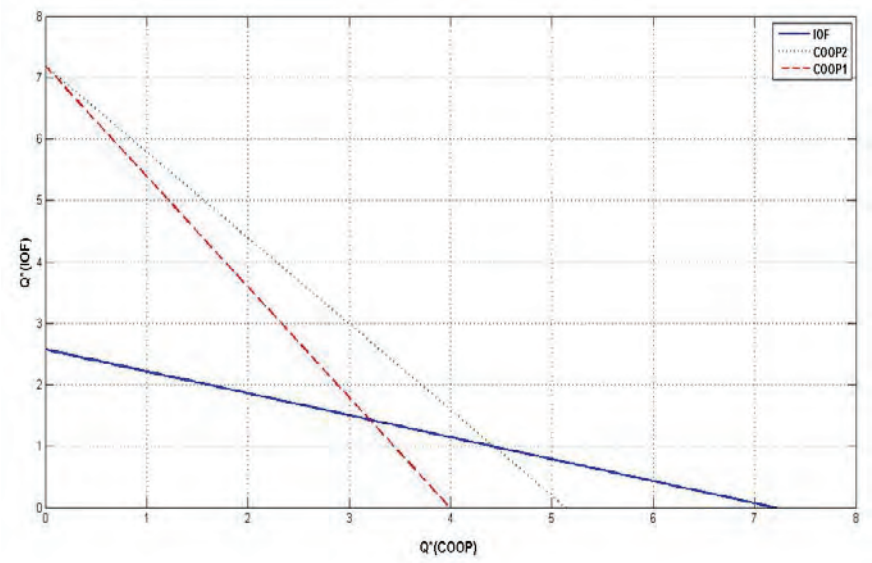

Figure 8.4: Reaction functions of the IOF and Cooperatives

Similar to the monopoly market, for a new product with a specific distance to the Original Product, the reaction functions are modified based on the product's distance to the Original Product:

$$Q^*_{IOF} = \frac{ab - B - aDQ_2}{2(a+2c) \times D}.$$

$$Q^*_{COOP1} = \frac{ab - B - aDQ_1}{2(a+c) \times D}.$$

$$Q^*_{COOP2} = \frac{ab - B - aDQ_1}{(a+2c) \times D}.$$

$$D = (1+0.1)^{Distance}, Distance = 1,2,3 \ldots$$

Appendix 8.5: Simulation Results of the Duopoly Market: IOF and COOP1

This appendix presents various indicators of the evolution of the product portfolio of the IOF (dotted line) and COOP1 (solid line).

Figure 8.5: Simulation results of the duopoly market: IOF and COOP1

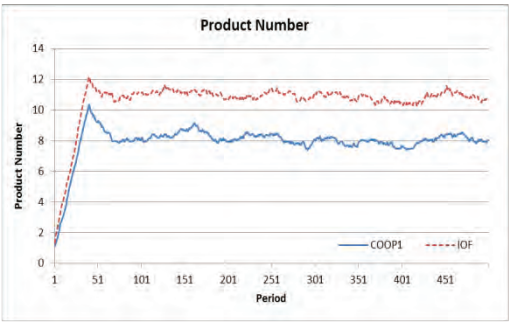

Figure 8.5a: Number of Products

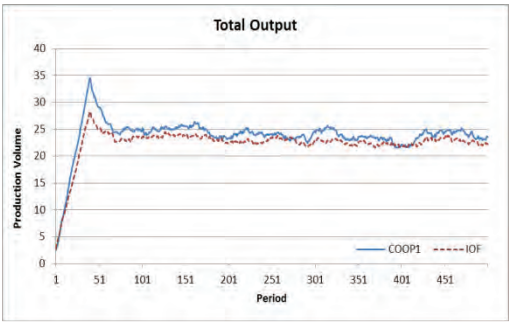

Figure 8.5b: Total Output

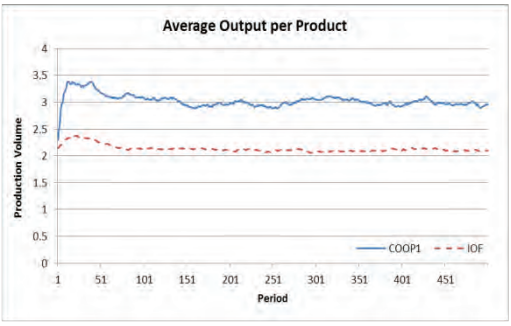

Figure 8.5c: Average Output per Product

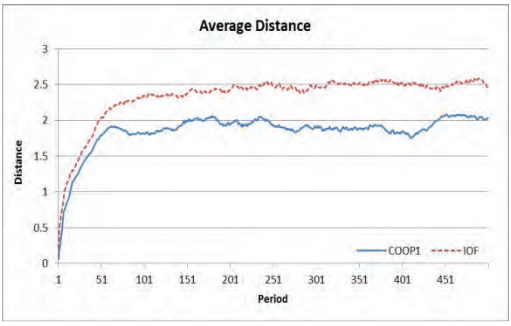

Figure 8.5d: Average Product Distance

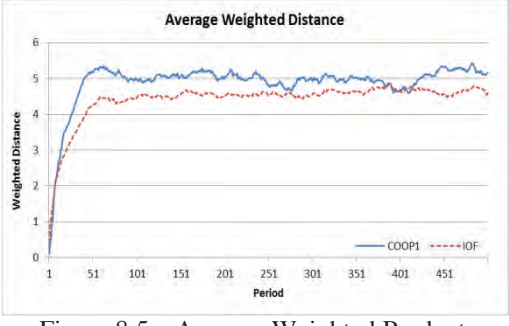

Figure 8.5e: Average Weighted Product Distance

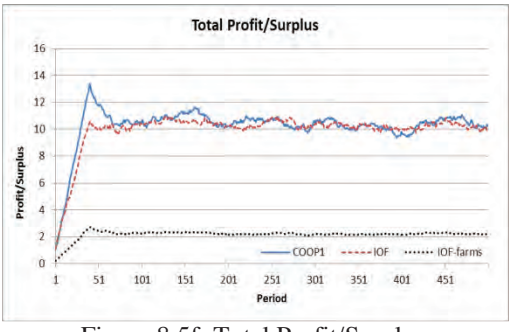

Figure 8.5f: Total Profit/Surplus

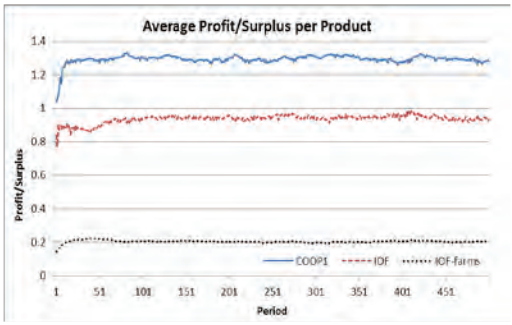

Figure 8.5g: Average Profit/Surplus per Product

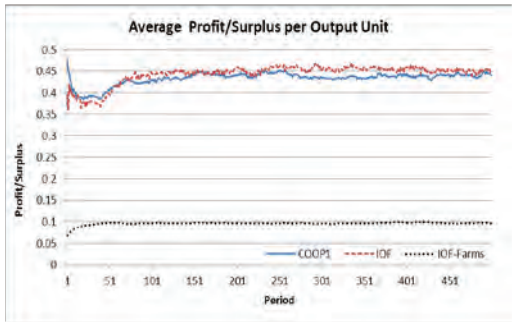

Figure 8.5h: Average Profit/Surplus per Output Unit

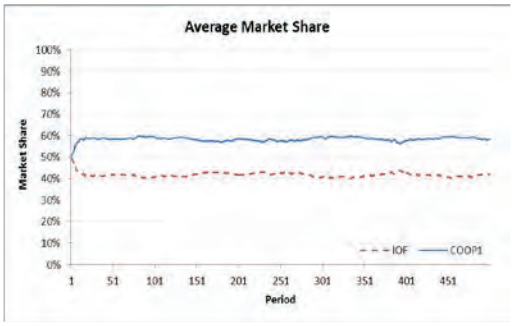

Figure 8.5i: Market Share

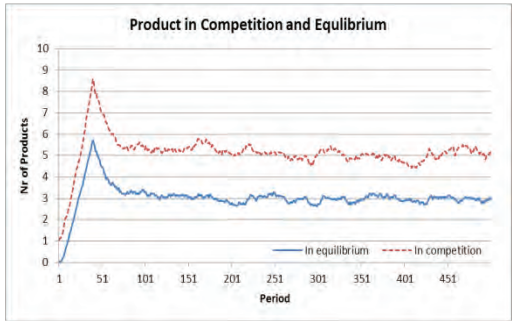

Figure 8.5j: Products in Competition and in Equilibrium

Appendix 8.6: Simulation Results of the Duopoly Market: IOF and COOP2

This appendix presents various indicators of the evolution of the product portfolio of the IOF (dotted line) and COOP2 (solid line).

Figure 8.6: Simulation results of the duopoly market: IOF and COOP2

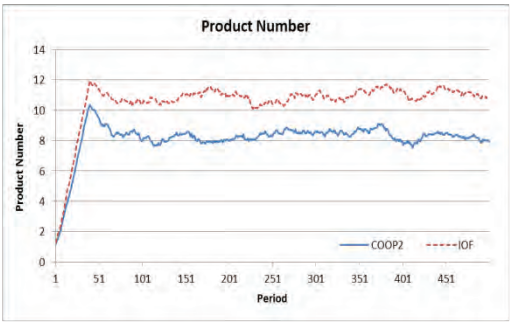

Figure 8.6a: Number of Products

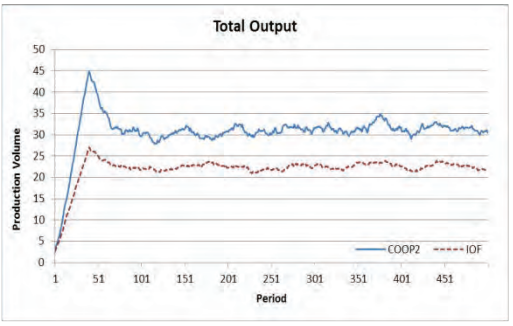

Figure 8.6b: Total Output

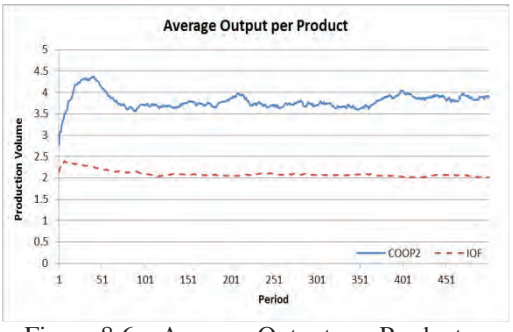

Figure 8.6c: Average Output per Product

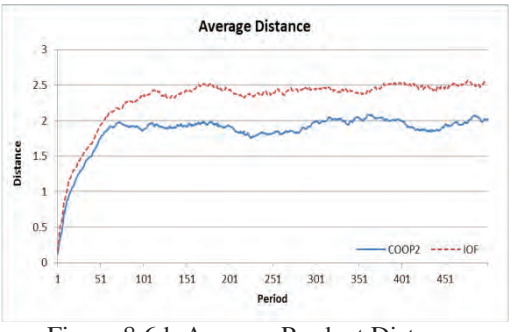

Figure 8.6d: Average Product Distance

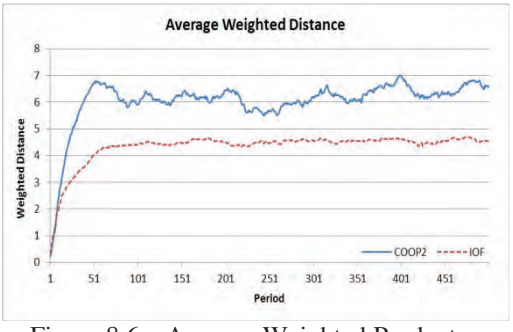

Figure 8.6e: Average Weighted Product Distance

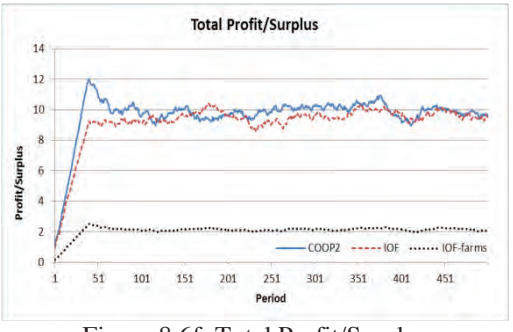

Figure 8.6f: Total Profit/Surplus

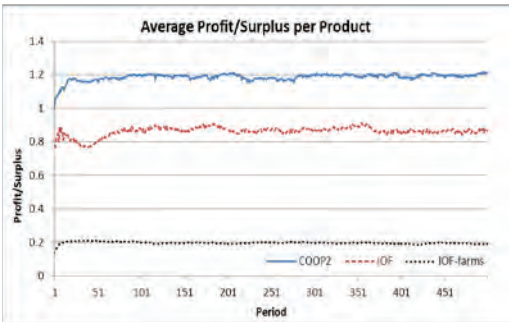

Figure 8.6g: Average Profit/Surplus per Product

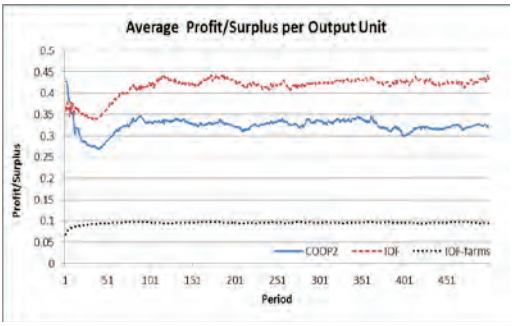

Figure 8.6h: Average Profit/Surplus per Output Unit

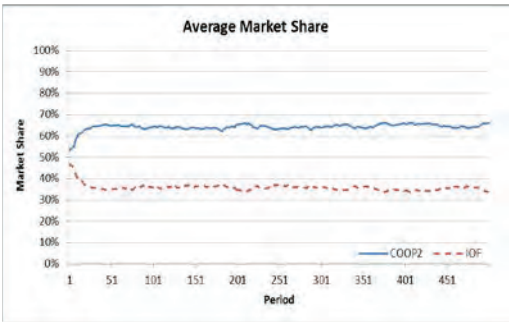

Figure 8.6i: Market Share

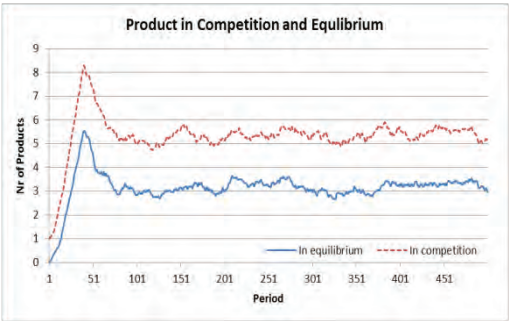

Figure 8.6j: Products in Competition and in Equilibrium

9. Product Diversification of Cooperatives and Corporations - Evidence from the Netherlands[26]

Abstract

This chapter investigates empirically the influence of governance structure on product diversification behaviour. We compare the product portfolio of Dutch cooperatives and publicly listed companies in 2001 and 2012. The results show that cooperatives are less diversified than publicly listed companies in 2001, whereas the diversification levels of these two governance structures is statistically comparable in 2012.

Keywords: Governance Structure, Product Diversification, Cooperative, Corporation

9.1 Introduction

Although the research interest of product diversification can be traced back to more than half a century ago (Penrose, 1959), the studies about product diversification strategies of cooperatives are still sparsely covered by literature (van Oijen and Hendrikse, 2002). However, the research into product diversification of cooperatives should not be neglected because cooperatives have been playing an important role in many economies (van Oijen and Hendrikse, 2002). For example, 'cooperatives in Europe represent 123 million members, 5.4 million employees and 160 thousand enterprises' (Cooperatives Europe, 2012). Globally, cooperatives provide 250 million jobs, and the largest 300 cooperatives alone generate a turnover of more than 2.2 trillion USD in 2014 (ICA, 2014). Given this important economic role of cooperatives worldwide, more insights into their product diversification strategies are warranted.

Many cooperative researchers have compared the organisational characteristics of cooperatives with those of corporations, and a common conclusion is that cooperatives are different from corporations in terms of governance structure (Staatz, 1987; Cook, 1995; van Bekkum and van Dijk, 1997; Hendrikse, 1998; Royer, 1999; Nilsson, 2001; Hendrikse and Veerman, 2001a). Traditional cooperatives, owned and controlled by their members, are formed to serve the interests of members rather than generate profits for investors (Liang, 2013). According to Commission of the European Communities, (2001:12), cooperatives have 'an orientation to provide benefits to

[26] A version of this chapter was published in the proceeding of the Economics and Management of Networks Conference (EMNet), 2013, Agadir, Morocco (https://emnet.univie.ac.at/upload/media/Deng_Hendrikse.pdf).

members and satisfy their needs, democratic goal setting and decision-making methods, special rules for dealing with capital and profit, and general interest objectives (in some cases)'. As previous research suggests that a company's ownership and organisational structure have effects on its product diversification (e.g. Belkaoui and Pavlik, 1992; Bethel and Lieberskind, 1993), these features in a cooperative governance structure may influence its product diversification strategies.

Empirical evidence supports that cooperatives with distinguishing governance structure features adopt different product diversification strategies than corporations do. Dunn, Ingalsbe and Armstrong (1979) point out that in general, farmer cooperatives tend to be less diversified than IOFs (investor owned firms). A few existing empirical studies on cooperatives seem to support this argument. Sporleder and Skinner (1977) investigate the diversification of regional marketing cooperatives over the period from 1960 through 1973 in the US. The results suggest that the portion of diversified regional marketing cooperatives is small (less than 10%) and there is no substantial trend towards product diversification. Chen, Babb and Schrader (1985) compare 32 large cooperatives and 35 large proprietary firms in 5 food industries in the US from 1975 to 1980. Their results suggest that cooperatives were less diversified than proprietary firms. Oustapassidis (1988) also finds that the overall diversification level of marketing agricultural cooperatives in Britain is uniformly low. And based on the comparison between cooperatives and IOFs in the Greek dairy industry, Oustapassidis and Notta (1997) conclude that cooperatives do not effectively apply diversification strategies in contrast to IOFs. Van Oijen and Hendrikse (2002) also find that Dutch cooperatives are less diversified than Dutch publicly listed firms.

The findings of previous empirical studies all indicate that cooperatives tend to be less diversified than corporations are. According to these studies, several characteristics of the traditional cooperative governance structure provide explanations for the lower level of product diversification of cooperatives. For example, cooperatives have less financial resources at their disposal for product diversification because their equity shares are not transferable and they are not able to raise capital from stock markets (Vitaliano, 1983; van Oijen and Hendrikse, 2002). In addition, traditional cooperatives used to be production-oriented. The members, who control the cooperatives collectively, may not be interested in investing in new activities. Instead, cooperatives tend to focus on the strategy of cost leadership and invest in enlarging their current operations (Nilsson, 2001).

However, due to the radical changes in agribusiness in recent decades, the traditional cooperative model has been questioned and substantial restructuring in the cooperative business sphere has taken place (Nilsson, 1998; Hendrikse and Veerman, 2001a). In

order to adapt to the changes in market conditions, cooperatives have to modify their strategies to become more market-oriented (Bijman, 2002). They need to extend their activities to value-added processing, be responsive to the market demand for innovative and differentiated products, and compete in international markets (e.g. Bijman, 2010; Hendrikse, 2011; Liang, 2013). Given the fact that the governance structure of traditional cooperatives is not suitable for these strategies, some cooperatives have transformed into other non-traditional organisational models, for example by introducing individual ownership by the members (Nilsson and Ohlsson, 2007) or by restructuring their organisational governance (Bijman, Hendrikse and van Oijen, 2013). Due to these changes in cooperatives' governance structure, some crucial aspects that make cooperatives different from corporations may no longer exist in many cooperatives. Nowadays, cooperatives may become similar to corporations in many respects including product diversification.

The purpose of this chapter is to investigate the difference between cooperatives and corporations regarding their levels of product diversification. This difference may be explained by the specific governance structure characteristics of cooperatives versus corporations. More specifically, we try to analyse the impacts that the characteristics of cooperative governance structure may have on cooperatives' strategies of product diversification. We also investigate whether cooperatives are becoming similar to corporations in terms of product diversification. The empirical basis of this chapter consists of the data from Dutch cooperatives and corporations regarding their product portfolio in 2001 and 2012. Hence, the dataset aims at revealing the difference between the product diversification levels of cooperatives and corporations and identifying the potential change in this difference over time.

This chapter is structured as follows. Section 9.2 focuses on the characteristics of the governance structure of traditional cooperatives and elaborates their effects on product diversification. In Section 9.3, we address the changes in cooperative governance structure and discuss the impacts of these changes on cooperatives' diversification strategies. In Section 9.4, we describe the empirical method and dataset, and we present the results in Section 9.5. Section 9.6 discusses the results and concludes.

9.2 Cooperative Governance Structure and Diversification

Each governance structure is characterised by its income and decision rights allocation (Hansmann, 1996), which is implemented through asset ownership and/or contracts (Baker, Gibbons and Murphy, 2008). A cooperative is characterised by Dunn (1988:85) as 'user-owned, user-controlled and user-benefited, i.e. a cooperative belongs to the people who use its services, the control of which rests with all members, and the gains

of which are distributed to the members in proportion to the use they made of its services'. It entails that the ownership rights of cooperatives reside with their members. The characteristics of the governance structure of traditional cooperatives, in terms of decision and income rights allocation, and their impacts on product diversification will be analysed in this section.

Decision Rights Allocation

Decision rights concern all rights and rules regarding 'the deployment and use of assets', and specify who directs the enterprise's activities (Hendrikse, 2011:1693). The allocation of decision rights in cooperatives is different from that in corporations in several respects, among which we highlight two features, i.e. the collective decision making and stricter internal control mechanism. They both may largely influence cooperatives' product diversification strategies.

First, according to Hendrikse and Feng (2013:307), 'the distinguishing feature of a cooperative is member dominance'. As a cooperative is commonly owned by its members, collective ownership requires collective decision making. In cooperatives, extensive decision-making power is allocated to the General Assembly and the Board of Directors which are 'democratically chosen by and from the membership' (Liang, 2013:21). More importantly, while the strategic decisions in corporations are mainly focused on the company's profitability and growth, the decision-making scope in cooperatives is wider, including both the questions of how to serve the member interests and how to generate maximum value at the cooperative enterprise (Feng, 2011). This creates a challenge for the collective decision making in cooperatives, especially when the heterogeneity of membership is large and members' interests are diverse (Hansmann, 1996). Therefore, the collective decision-making in cooperatives makes their decisions of diversification more time-consuming (Hendrikse and van Oijen, 2010). This may result in a competitive disadvantage of cooperatives (Henehan and Anderson, 1994) and lost opportunities (Hendrikse and van Oijen, 2010). The second consequence of the collective decision rights structure of cooperatives is that it may amplify risk aversion (Staatz, 1987). Cooperative members are regarded as conservative and they often favour a conservative investment strategy in order to stabilise member returns (Staatz, 1987; Henehan and Anderson, 1994). Peterson and Anderson (1996) also claim that only the most secure projects are considered as investment options by cooperative members. Conservativeness is an impediment for cooperatives to initiate new and risky business activities such as product diversification. Therefore, the decision making process in cooperatives is expected to lead to a low level of product diversification of cooperatives.

Second, while an enterprise's formal rights of control reside with it owners, the real authority is usually delegated to its management (Baker, Gibbons and Murphy, 1999). This is also the case for cooperatives. However, one difference between cooperatives and corporations is that more extensive decision-making power is retained by cooperative members than by the shareholders of corporations (Hendrikse and van Oijen, 2010). The CEOs of cooperatives are less powerful than their counterparts in corporations. Instead, the Board of Directors of cooperatives, who are representatives of the members, plays a more prominent and independent role than their counterparts in corporations do (Hendrikse and van Oijen, 2010). In a corporation, the CEO 'often has substantial control over setting, ratifying and implementing company policy' (Hendrikse and Feng, 2013:507), and 'often has a large, if not dominant voice, in selecting the Board of Directors' (USDA, 2002:11). By contrast, the Board of Directors of a cooperative is democratically elected by and from its membership and the CEO has almost no influence on the board composition (Cook and Burress, 2013). As Hendrikse (1998:203) claims, the members of a cooperative 'have an incentive to structure the internal organisation in such a way that they have confidence that their substantial (financial) stakes are protected and their interests are advanced', and the Board of Directors of cooperatives have the independence 'to question management decisions and reject its recommendations' (USDA, 2002:11). In addition, the involvement of members in cooperatives' business also helps to ease the agency problem (Hendrikse and Feng, 2013). Amihud and Lev (1981, 1999) proposed that managers in manager-controlled firms tend to apply diversification policies and on average, diversification decreases shareholders' value. However, members and directors of a cooperative have frequent contacts and communication with the cooperative enterprise because they are also users. This leads to more effective monitoring and constrains of the power of management. Thus, the internal control mechanism in cooperatives is stricter than in corporations and managers of cooperatives have fewer opportunities to pursue their own interests through diversification than managers of corporations do. The investment decisions in cooperatives are thus subject to double screening, which means that a cooperative consists of two decision-making bodies with each having veto power on potential diversification projects (Hendrikse, 1998). Since cooperatives will accept fewer investment projects, they are supposed to be less diversified than corporations.

In general, the characteristics of the decision rights allocation in traditional cooperatives seem to constrain product diversification. With stricter internal control, more conservative and risk adverse decision making, cooperatives are more reluctant to enter new businesses than corporations.

Income Rights Allocation

According to Hendrikse (2011:1693), income rights specify 'the rights to receive the benefits and the obligations to pay the costs associated with the use of an asset, thereby creating the incentive system faced by the decision makers'. Among the features of cooperatives' income rights structure, the dual relationship between members and cooperatives and non-tradable shares are supposed to have prominent effects on the product diversification of cooperatives.

First of all, while shareholders have only a singular relationship with corporations, members have a dual relationship with their cooperatives or a double-set of income rights (Bijman, Hendrikse and van Oijen, 2013). The vertical ties between the members and the processor consist of a transaction element and an ownership element (Feng and Hendrikse, 2012). From an investment perspective, cooperatives are generating patronage cash flows, asset cash flows, or both (Peterson, 1992). In traditional cooperatives, because dividends of equity shares are limited and have been subordinated to patronage cash flows (Bijman, Hendrikse and van Oijen, 2013), members are therefore more interested in optimising the volumes and prices of their transactions with the cooperatives (Hansmann, 1996). This leads to free-riding in equity contribution and underinvestment problems. Members have the tendency to invest less than optimal since their payoffs are based on their patronage instead of on their investment in the cooperatives. Another consequence of the dual relationship is that the cooperative become a 'home' for the output of members, which also limits the possibilities for cooperatives to diversify (Saitone and Sexton, 2009:1224). Because cooperatives are run for the needs of members who are the formal owners of the firm, cooperatives have less freedom than corporations in disciplining from markets for inputs (Hendrikse and van Oijen, 2010). This is also labelled as the 'single origin constraint' (Cook, 1997:87). Traditional cooperatives usually focus on processing higher volumes of members' outputs or inputs at better prices instead of diversifying product portfolio (Nilsson, 2001). Product diversification may lead to economies of scope. However, cooperative members' income rights focus on receiving patronage refunds, driving cooperative enterprises to pursue economies of scale instead of economies of scope. Therefore, diversification into new businesses is more probable for corporations, which aim to maximise the capital returns for their investors, than it is for cooperatives.

Second, another important feature of cooperatives' income rights structure is that the residual claim rights or shares of traditional cooperatives are not tradable without restriction because the majority of the shares have to stay with the membership (Chaddad and Cook, 2004). The first consequence of this feature is that the ownership of cooperatives is collective and restricted to patron members (Vitaliano, 1983). Cooperatives are not able to attract capital from external investors and raise capital

from capital markets by issuing stocks. Hence, cooperatives have to rely mainly on internal equity sources, i.e. by convincing members to invest new capital, by retaining earnings, or by extending membership (Hansmann, 1996; USDA, 2002). The second consequence of the non-transferability of cooperative shares is that it depresses members' incentive to invest in cooperatives, leading to the free-riding problem, portfolio problem, and horizon problem (Cook, 1995). In general, without external equity sources and being confined to the equity from members, who are commonly less able and willing to provide new equity, 'the most important challenge facing traditional cooperatives is accumulating equity capital' (USDA, 2002:23). Therefore, as members are reluctant to finance new initiatives, especially those unfamiliar and risky activities, and there is no external source for risk capital, we expect that traditional cooperatives are less diversified than corporations because of the lack of financial resources.

In summary, we discuss four characteristics of traditional cooperatives' governance structure, which may reduce their product diversification: (a) collective decision making; (b) stricter internal control; (c) dual relationship; and (d) non-tradable shares. These arguments lead to the following hypothesis:

Hypothesis 1: Cooperatives are less diversified than corporations are.

9.3 Flexibility of Cooperative Governance Structure

The traditional type of cooperative has been successful in general. Cooperatives compete with corporations in many sectors of most modern economies and occupy a significant part of market share, especially in the agricultural sector (Cook, 1995; Hendrikse, 1998). However, the conditions in the market and in society have been changing quickly over the past decades (Hendrikse and Veerman, 2001a). On the one hand, the great concentration of the agrifood distribution sector, rise of demand on processed products, increasing concern for product quality, and changing consumer preferences for products, etc. all placed new market opportunities and challenges on cooperatives (e.g. Bijman, 2010; Hendrikse, 2011; Liang, 2013). On the other hand, the need for differentiation, innovation and value-added in business has the tendency to increase member heterogeneity (Hendrikse, 2011). USDA (2002:3) states that, 'cooperatives now must adapt to a more diverse membership that requires different services, products, and structures'. The traditional cooperatives may have difficulties when facing these external and internal changes. Accordingly, they need to adapt new strategies and realign their organisational structures (Kyriakopoulos and van Bekkum, 1999; Hendrikse, 2011). Changes of ownership rights such as contractual production, merger and acquisition, demutualisation, etc. are potential solutions (Hendrikse and

Feng, 2013). However, the flexibility in cooperatives' income and decision rights allocation also creates a number of possibilities for cooperatives to adapt to the new circumstances, while maintaining the allocation of ownership rights with members (Liang, 2013; Hendrikse and Feng, 2013). In this section, we discuss the adaptation of the cooperative governance structure in terms of decision rights and income rights allocation, and their potential impacts on product diversification.

Adaptation of Decision Rights Allocation

The adaptation of decision rights allocation can be realised by changing the allocation of decision power between the various bodies within the cooperative (Hendrikse and Feng, 2013). In order to be more responsive to market competition and reduce the costs of collective decision-making, cooperatives have to move the decision power closer to the downstream and centralise it to a larger degree than what they used to be. To achieve this goal, cooperatives may professionalise the management, delegate formal authority regarding more aspects of the cooperative enterprise to management, and separate the society of members and the cooperative enterprise, etc. (Hendrikse and Feng, 2013). The adaptation in decision rights allocation may reduce the involvement of members on the cooperatives' decision making and make cooperatives' management increasingly autonomous (Bager, 1996; Harte, 1997; Bhuyan, 2007; Bijman, Hendrikse and van Oijen, 2013). Hendrikse (2005) observes that the change of cooperatives' character in its governance structure and public appearances place members in a less influential position in decision making. As a consequence, 'the aspirations of the managers, rather than those of the farmers, are realised' (Hind, 1999:536). Cooperatives driven by management will behave more like ordinary enterprises.

As cooperatives become more management driven, the management has more freedom to make diversification decisions. The change of cooperatives' internal organisational structure follows this adaptation progress regarding the allocation of decision rights. For example, the agency relationship between the board and the management is changing in Dutch cooperatives. Nowadays, most of the expertise and the real authority lie with the professional management, which increasingly makes more strategic and operational decisions, while 'pushing the board into a supervisory role' (Bijman, Hendrikse and van Oijen, 2013:204). Bijman et al. (2013) also observe that cooperatives with the traditional board model are least diversified, while those with the management board model are most diversified. This adaptation of decision rights allocation supports cooperatives' market-oriented strategies and makes the decisions for product diversification easier. Based on the empirical findings on cooperative performance, Sexton and Iskow (1993) concluded that cooperatives are generally not

less efficient than other types of firms. As such, we expect that the difference of product diversification between cooperatives and corporations nowadays is smaller than before.

Adaptation of Income Rights Allocation

Starting from the 1990s, many traditional cooperatives have taken steps to restructure their income rights structure by replacing the collective capital structure with a more individualised capital structure (Nilsson, 1998). To acquire external equity capital, some cooperatives have converted to the model with a 'capital-seeking entity' or the model of 'investor-share cooperatives' (Chaddad and Cook, 2004:352). Both of these new models of cooperatives attenuate the restriction of cooperative ownership rights only to members. In the model with a capital-seeking entity, a cooperative introduces a separate legal entity, which is wholly or partially owned by the cooperative, to acquire external equity. The investor-share cooperatives issue separate classes of equity shares for external non-member investors. Alternatively, in order to generate incentives for members to provide equity, some cooperatives convert to 'proportional investment cooperatives' or 'new generation cooperatives' (Chaddad and Cook, 2004:352). In proportional investment cooperatives, although the ownership of cooperatives is still not transferable, the distribution of net earnings of cooperatives is proportional to member shareholding rather than patronage. The new generation cooperatives model relaxes the non-transferability of cooperative shares and the shares are appreciable as well as transferable among the 'well-defined member-patron group' (p.355). These two models maintain the principle that the owners of cooperatives must be members, but the appreciation and transferability of cooperative shares enhance members' willingness to invest in their cooperatives. The traditional cooperatives that have restructured the income rights allocation to these new models are expected to become capable of raising sufficient equity for participating in value-added processing and product diversification.

Another consequence is that the restructuring of income rights makes the asset cash flow so important that not only will the external investors demand a high return on their investment but also the members' income relies on the return on investment. Various previous studies already indicate that the financial performance of cooperatives is generally as strong as that of IOFs (Parliament, Lerman and Fulton 1990; Lerman and Parliament, 1990; Harris and Fulton, 1996). In new generation cooperatives, members can realise additional benefits from their equity investment in cooperatives (USDA, 2002). This change reinforces the financial relationship between members and cooperatives. The demand of members for investment returns makes cooperatives more ready to adopt good diversification projects that will result in

profitability and growth. Meanwhile, cooperatives also restructure their income rights by spending considerable efforts in developing member benefit programmes to counter the process of adverse selection and attract innovative members (Hendrikse, 2011). Cooperatives are thus able to attract high-quality suppliers and diversify into high value-added products. For example, Friesland Campina, a leading Dutch dairy cooperative, has been moving from 50:50 high versus low value-added products, to 80:20 now, and plans to reach 90:10 in a few years (van de Horst, 2012).

In sum, when considering the adaptation of decision rights and income rights allocation in cooperatives in the past decades, it is reasonable to project a decreasing difference of product diversification levels between cooperatives and corporations over time. In other words, cooperatives and corporations shall become similar in terms of product diversification behaviour. We conclude this section with the second hypothesis:

Hypothesis 2: The difference in the level of product diversification between cooperatives and corporations disappears over time.

9.4 Method

In this section, we explain the samples and data collection, the measures, and the analyses we use to test the propositions.

Sample and Data Collection

The samples and the data are extracted from the REACH database published by Bureau Van Dijk.[27] The REACH database contains comprehensive information on companies in the Netherlands. The REACH database was merged into Orbis Database of Bureau Van Dijk in 2007, which covers the data of firms worldwide.

We first select all active Dutch cooperatives (national legal form: C) and publicly listed companies for the year 2012. The latter type of firms represents corporations. And then we look for these companies in the database in 2001. Consistent with the previous research on product diversification, we remove firms from the financial services industry (Standard Industrial Classification (SIC) 6000 to 6999) and regulated utilities industry (SIC 4000 to 4999) (Denis, Denis and Sarin, 1997; Goranova et al., 2007). The results are 429 cooperatives and 48 public listed companies (Sample 1). For each company, we extracted its SIC code information from the database. The data for the year 2012 is downloaded from Orbis edition December 2012, and the data for the year 2001 are part of the REACH database historical edition in December 2001.

[27] http://www.bvdinfo.com/

With this measure, we identify the companies that are present in both 2001 and 2012, i.e. the companies that operate continuously during the time period of 2001-2012. The purpose is to adjust for the impact of the entry of new single-segment companies (Basu, 2009) and to differentiate the genuine changes from sampling errors. From 2001 to 2012, the number of cooperatives increases from 1,249 to 3,678, the entry of such large amount of new cooperatives in the database may bias the analysis. We therefore only investigate the same group of companies.

Given the fact that other factors, such as firm size, leverage, etc., may also affect product diversification (Denis, Denis and Sarin, 1997), and in order to remove the inactive cooperatives with no business activities (for example, cooperatives founded by the owners of apartments jointly to exploit common facilities are not aimed at creating business and thus not useful for comparison) from Sample 1, we further select the cooperatives that have available financial data (operating revenue) from Sample 1. Because reporting financial information is not mandatory for cooperatives, there are only a few cooperatives (31 out of 1,249) in REACH database with financial information in 2000 (one year before the sampling time). As a consequence, there are only 11 cooperatives with financial data in both 2000 and 2011. This requirement seems to be too strict and results in a too small sample of cooperatives. However, more cooperatives report financial data in 2011 (486 out of 3,678). We therefore select the cooperatives which have available operating revenue data for 2011. By doing this, we secure that the cooperatives in our sample are active in business activities. It results in Sample 2, which consists of 114 companies (66 cooperatives and 48 publicly listed companies).

Measures

The governance structure is measured by a dummy variable, which has value zero for cooperatives and value one for corporations. The most accepted and popular measures of product diversification are based on discrete and continuous business count approaches (Varadarajan and Ramanujam, 1987). However, the continuous business count approaches such as Berry-Herfindahl and entropy diversification indices are inapplicable for our dataset because the required information of breakdown of sales is not available for most of the cooperatives in our sample. Therefore, we take the discrete business count approach, which does not require data on sales of products but still provides insights into the degree of diversification of a company. Specifically, we use the number of 4-digit industry codes to measure each company's absolute degree of overall product diversification (Kim, Hoskisson and Wan, 2004).

Companies in different industrial sectors may have different opportunities and motivations for diversification. With all samples, we control the industrial effect based

on the classification of the main 2-digit SIC code of a firm. We introduce an industry dummy to reflect the 8 industrial sectors (see Appendix 9.1). We control for company size and leverage of the firms in Sample 2 based on the availability of financial data. We used the natural log of average company assets and operating revenue for 2009, 2010 and 2011 to measure firm size. The solvency ratio is introduced into the model as a control of leverage. Similarly, the 3-year average value for 2009, 2010 and 2011 is taken to smooth the fluctuation.

Analysis

Because of the potential inconsistency in the coding system due to revisions of SIC (Martin and Sayrak, 2003), conducting a panel analysis by using the product diversification data for the year 2001 and 2012 in Sample 1 and 2 is problematic. This is similar to the problem in historical analysis of financial data, which suffers from changes of accounting policies and systems over time (Hind, 1997). We therefore focus our study on the basis of a multiple cross-sectional data analysis and aim at investigating the change of the difference of product diversification levels between cooperatives and corporations from 2001 to 2012. The difference of product diversification levels in each single year is not affected by the inconsistency of the coding system because both types of companies report their product portfolio under the same standard of the year under observation.

Thus, for both Sample 1 and 2 we first compare the product diversification level of cooperatives and corporations in different years, and then investigate whether the difference of product diversification level between these two types of companies changes between the year 2001 and 2012. After that, we adopt a Poisson Regression Model to investigate the relationship between company's governance structure (independent variable) and product diversification level (dependent variable). For Sample 2, we incorporate additional control variables in the Poisson Regression Model. Because the dependent variable (number of 4-digit code a firm has) is discrete in nature and dispersedly distributed, we decide to choose a Poisson Regression Model for count data, instead of the linear regression model (Verbeek, 2012).

9.5 Results

Descriptive statistics

Table 9.1 and 9.2 present the number and percentage of the diversified firms, and the distribution of firms in different industrial sectors. In both samples, the number of cooperatives is higher than that of publicly listed companies. The distribution of companies among industries is consistent between two samples. The companies in

sector A, which consists of agriculture, forestry and fishing, are all cooperatives. This is in line with the fact that cooperatives are playing a major role in the Dutch agricultural and food sector (Bijman and Hendrikse, 2003). However, the cooperatives in the agricultural sector accounts for only about 6% of the cooperatives in each sample. Cooperatives are also more active in sector F (wholesale trade) compared with corporations. By contrast, corporations are more dominant in sector B (mining) and sector D (manufacturing). No company changed the governance structure between 2001 and 2012. However, some companies changed their major business activities. In Sample 1, 9 cooperatives and 5 corporations have changed their major business activities in the period. And in Sample 2, 2 cooperatives have changed their major business activities. The number of companies in sector B (mining), C (construction), and G (retail) decreases but the number of firms in sector I (services) increases.

Some trends regarding product diversification can be identified by comparing the data across 2001 and 2012. First, we find a decrease in the percentage of the diversified publicly listed companies. The samples show that in 2001, around 69% of the corporations have more than one product or activity, i.e. they are diversified. This percentage drops to around 56% in 2012. This result is in line with empirical findings of the downward trend of corporate diversification (Martin and Sayrak, 2003). Second, the percentage of diversified cooperatives decreases from 60% to 54% in Sample 1 but increases from 55% to 62% in Sample 2. Since the direction of the trends in the two samples is mixed, we are not able to tell whether more cooperatives chose to diversify or not. However, the cooperatives in Sample 2, which report operating revenue data, are usually large cooperatives. Among this group of cooperatives, 5 chose to diversify in the last 10 years, which may mean that large cooperatives tend to diversify their product portfolios in the past 10 years.

Table 9.3 presents the descriptive statistics of the product diversification level, measured by the number of 4-digit SIC codes, of all the companies in the samples. We find that the mean and distribution of the number of 4-digit SIC codes are similar for different samples in the same year but different between 2001 and 2012 for the same sample. In 2001, the mean diversification levels of all companies are 2.37 and 2.57 for Sample 1 and 2. In 2012, both means drop by about 0.45 to 1.94 and 2.12, respectively. The second change across 2001 and 2012 is the increase of the percentage of firms that has only one 4-digit SIC code. This corresponds with the decrease of fraction of diversified firms. The distribution of product diversification level is not normally distributed, with more than 60% of the companies having only 1 or 2 SIC codes. However, the distribution is more concentrated in the range of 1 to 7 in 2012, whereas in 2001 it is much more dispersed.

Table 9.1: Distribution of firms in industry sectors in Sample 1

2001	Type of Firm	Sample Size	Diversified Firms	Distribution of Firms in Industrial Sectors							
				A	B	C	D	F	G	I	J
	Cooperative	429	259	27	0	13	27	170	29	162	1
			60%	*6%*	*0%*	*3%*	*6%*	*40%*	*7%*	*38%*	*0%*
	Corporation	48	33	0	2	4	17	5	7	13	0
			69%	*0%*	*4%*	*8%*	*35%*	*10%*	*15%*	*27%*	*0%*
	Combined	447	292	27	2	17	44	175	36	175	1
			61%	*6%*	*0%*	*4%*	*9%*	*37%*	*8%*	*37%*	*0%*
2012	**Type of Firm**	**Sample Size**	**Diversified Firms**	**Distribution of Firms in Industrial Sectors**							
				A	**B**	**C**	**D**	**F**	**G**	**I**	**J**
	Cooperative	429	233	26	0	9	33	170	26	165	0
			54%	*6%*	*0%*	*2%*	*8%*	*40%*	*6%*	*38%*	*0%*
	Corporation	48	27	0	1	4	18	4	4	17	0
			56%	*0%*	*2%*	*8%*	*38%*	*8%*	*8%*	*35%*	*0%*
	Combined	447	260	26	1	13	51	174	30	182	0
			55%	*5%*	*0%*	*3%*	*11%*	*36%*	*6%*	*38%*	*0%*

Percentages are in italics.

Table 9.2: Distribution of firms in industry sectors in Sample 2

2001	Type of Firm	Sample Size	Diversified Firms	Distribution of Firms in Industrial Sectors							
				A	B	C	D	F	G	I	J
	Cooperative	66	36	3	0	0	10	21	4	27	1
			55%	*5%*	*0%*	*0%*	*15%*	*32%*	*6%*	*41%*	*2%*
	Corporation	48	33	0	2	4	17	5	7	13	0
			69%	*0%*	*4%*	*8%*	*35%*	*10%*	*15%*	*27%*	*0%*
	Combined	114	69	3	2	4	27	26	11	40	1
			61%	*3%*	*2%*	*4%*	*24%*	*23%*	*10%*	*35%*	*1%*
2012	**Type of Firm**	**Sample Size**	**Diversified Firms**	**Distribution of Firms in Industrial Sectors**							
				A	**B**	**C**	**D**	**F**	**G**	**I**	**J**
	Cooperative	66	41	3	0	0	11	20	5	27	0
			62%	*5%*	*0%*	*0%*	*17%*	*30%*	*8%*	*41%*	*0%*
	Corporation	48	27	0	1	4	18	4	4	17	0
			56%	*0%*	*2%*	*8%*	*38%*	*8%*	*8%*	*35%*	*0%*
	Combined	114	68	3	1	4	29	24	9	44	0
			60%	*3%*	*1%*	*4%*	*25%*	*21%*	*8%*	*39%*	*0%*

Percentages are in italics.

Table 9.3: Descriptive statistics of product diversification level

Sample	Year	No. of 4-digit SIC Codes				Distribution of No. of 4-digit SIC Codes								
		Mean	Min	Max	Observations	1	2	3	4	5	6	7	8	More than 8
Sample 1	2001	2.3690	1	22	477	185	162	63	15	15	10	3	20	4
		(2.04727)				*38.8%*	*34%*	*13.2%*	*3.1%*	*3.1%*	*2.1%*	*0.6%*	*4.2%*	*0.8%*
	2012	1.9350	1	7	477	217	139	74	37	4	4	2		
		(1.11048)				*45.5%*	*29.1%*	*15.5%*	*7.8%*	*0.8%*	*0.8%*	*0.4%*		
Sample 2	2001	2.5702	1	22	114	45	29	17	8	7	2	2	3	1
		(2.50652)				*39.5%*	*25.4%*	*14.9%*	*7.0%*	*6.1%*	*1.8%*	*1.8%*	*2.6%*	*0.9%*
	2012	2.1228	1	7	114	46	31	21	13	0	2	1		
		(1.24190)				*40.4%*	*27.2%*	*18.4%*	*11.4%*	*0*	*1.8%*	*0.9%*		

Percentages are in italics; Standard deviations are in parentheses.

Table 9.4: Comparison of means of product diversification level

Sample	Year	Cooperatives No. of 4-digit SIC Codes		Corporations No. of 4-digit SIC Codes		Difference in Means Student t	Wilcoxon
		Sample Size	Mean	Sample Size	Mean	t statistic	Nonparametric
Sample 1	2001	429	2.2867	48	3.1042	-2.640**	-2.576**
			(1.8480)		(3.2762)		
	2012	429	1.9231	48	2.0417	-0.701	-0.390
			(1.0878)		(1.3040)		
Sample 2	2001	66	2.1818	48	3.1042	-1.964*	-2.231*
			(1.6715)		(3.2762)		
	2012	66	2.1818	48	2.0417	0.593	-0.868
			(1.2014)		(1.3040)		

Standard deviations are in parentheses.

**denotes significance at the 1% level.

*denotes significance at the 5% level

Diversification Level Difference

Table 9.4 compares the mean product diversification levels of cooperatives and corporations in different years. In addition to the t-test statistic, we report the Wilcoxon nonparametric statistic because the data are not normally distributed. The Wilcoxon test enables us to distinguish between the two types of companies in terms of their product diversification levels. We find a significant difference in the mean product diversification levels between two types of companies in 2001, and more importantly, this difference disappears in 2012. In both Sample 1 and 2, the mean product diversification level of cooperatives is significantly lower than that of corporations in 2001. This result suggests that cooperatives in the samples are less diversified than corporations in 2001 are. Hypothesis 1 is thus supported. However, the difference in mean product diversification levels becomes smaller in 2012, and in both samples, the mean product diversification levels of cooperatives and corporations are no longer significantly different in 2012. In other words, the levels of product diversification of cooperatives and publicly listed companies are statistically comparable in 2012. The result of the 2012 data indicates that cooperatives are similar to corporations in terms of product diversification level. The difference between cooperatives and corporations in product diversification level is much smaller than before. The second hypothesis is thus supported by the data of 2012.

Regression analysis

Our preliminary results based upon the Wilcoxon nonparametric test (Table 9.4) are reinforced by using regression analysis. We run an individual Poisson regression on the cross-sectional data for each year to determine the relationship between firms' governance structure and product diversification level. The results are presented in Table 9.5.

Table 9.5: Regression results of product diversification level

Dependent Variable: Number of 4-digit SIC Codes
Method: ML/QML - Poisson Count (Quadratic hill climbing)

	Sample 1		Sample 2		
Variable	**2001**	**2012**	**2001**	**2012**	**2012'**
Constant	0	0.5515	0	0.5184	-0.0125
	0	(9.5964)**	0	(3.9587)**	(-0.0369)
A. Agriculture	1.8689	-0.0563	1.8971	0.3287	0.2717
	(1.8636)*	(-0.4848)**	(1.8514)*	(0.8221)	(0.0677)
B. Mining	1.2819	0.6044	1.2171	0.8114	0.7518
	(1.2106)	(1.0250)	(1.1449)	(1.3564)	(1.2433)
C. Construction	1.0989	0.7082	0.9657	0.8914	0.8981
	(1.0884)	(4.3932)**	(0.9249)	(2.7991)**	(2.7163)**
D. Manufacturing	1.1803	0.2821	1.1292	0.6081	0.4906
	(1.1754)	(2.5000)**	(1.1187)	(3.5889)**	(2.6517)**
F. Transportation	0.7170	0.0806	0.7053	0.2898	0.3657
	(0.7160)	(0.2704)	(0.6987)	(1.5537)	(1.8857)*
G. Wholesale	0.5436	0.1988	0.4547	0.4251	0.3651
	(0.5393)	(1.4390)	(0.4423)	(1.7018)*	(1.4341)*
I. Service	0.5470		0.4712		
	(0.5461)		(0.4673)		
Asset (log)					0.0745
					(1.2566)
Solvency (%)					0.0055
					(1.6730)*
Structure	0.2222	-0.0563	0.2870	-0.2312	-0.3197
	(2.2210)**	(-0.4848)	(2.0898)**	(-1.5580)	(-1.8267)*
Observations	447	447	114	114	114
Log Likelihood	-802.57	-705.91	-211.26	-173.56	-171.95
R^2	0.325	0.126	0.208	0.208	0.247

z-statistics are in parentheses.
*denotes significance at the 10% level.
**denotes significance at the 5% level

The results for Sample 1 suggest that, while controlling for industry, the coefficient for governance structure (0 for cooperative and 1 for corporation) is positive and statistically significant at the 5% level in 2001 but negative and insignificant in 2012. We obtain similar results from the regression on Sample 2. It entails that, *ceteris paribus*, in 2001, corporations have more products or activities than cooperatives do. However, in 2012, corporations seem to have fewer products or activities than cooperatives but this coefficient is not statistically significant. In the regression on the 2012 data of Sample 2, we also try to add two additional variables – asset and solvency ratio, to control for firm size and leverage. The results show that, while controlling for industry, firm size and leverage, the coefficient for governance structure is negative, at the 10% significance level. Firm asset and solvency ratio both have positive impacts on product diversification but these impacts are not statistically significant.

In summary, the analysis of the data for Dutch cooperatives and corporations reveals that cooperatives were less diversified than corporations in 2001. However, when comparing these two types of different firms again in 2012, we find that the relation between the governance structure and product diversification level is not statistically significant. This supports our argument that the impact of governance structure difference between cooperatives and corporations on product diversification may be disappearing. We can no longer assert that cooperatives are less diversified than corporations are.

9.6 Discussion and Conclusion

Findings of research into product diversification based on corporations may not automatically apply to cooperatives because they have different governance structures (Hendrikse and van Oijen, 2010). However, does the governance structure really matter in product diversification? This chapter investigates the difference in product diversification levels between cooperatives and corporations. The results show that the product diversification level of Dutch cooperatives is lower than that of Dutch publicly listed companies in 2001. However, the difference in product diversification levels between these two types of companies is statistically insignificant in 2012.

The analysis and explanation of the (in)difference in product diversification level between cooperatives and publicly listed companies is based on the impacts of a company's governance structure on its product diversification strategy. In this chapter, we focus on the decision and income rights allocation, which distinguishes cooperatives and corporations. For several years, Dutch agricultural cooperatives have made substantial structural changes (Bärnheim, 1996; van Dijk, 1997; Zwanenberg,

1997). Like other types of companies, cooperatives must continually adapt to the changes in market conditions. As substantial changes have taken place in the cooperative business sphere over the past decades, Fulton (1995) questions whether cooperatives can adapt to the rapidly changing environment. In our opinion, the flexibility of cooperative's governance structure makes this adaptation possible. Through the adaptation in decision and income rights allocation, cooperatives are able to deal with the new circumstances efficiently and continue to coexist and compete with other types of firms. In addition, cooperatives may actually behave similarly to corporations in terms of product diversification.

The adaptation of cooperatives' decision rights structure is based on the flexibility regarding the allocation of power in cooperatives. Delegating more decision rights by members to management entails giving real authority away while keeping the formal control staying with the members (Aghion and Tirole, 1997). The separation of formal and real authority will give cooperative management more freedom to operate (Hendrikse, 2005). The principal-agent relationship in cooperatives is thus modified to make cooperatives more responsive to the market. As such, the governance structure of a cooperative may not matter at all in its investment behaviour (Hendrikse, 2007). Another adaptation of cooperatives' governance structure is with the allocation of income rights. Cooperatives can replace the collective capital structure with a more individualised capital structure (Nilsson, 1998). Through this adaptation, although cooperatives' ownership rights still reside with members, cooperatives become more capable of raising sufficient equity and may ease the financial constraint for product diversification. In sum, as many observations have signalled that cooperatives behave like ordinary enterprises, in this chapter we show that the product diversification levels of Dutch cooperatives and publicly listed companies are statistically indifferent in 2012. It is intriguing that Fakhfakh, Perotin and Gago (2012) establish a similar result regarding the productivity of worker cooperatives and capitalist firms in four manufacturing industries in France.

This study is subject to some limitations. Since we focus on the cooperatives and corporations in the Netherlands, it thus has the limitation of external validity. Due to different institutional environments, the characteristics of the cooperative governance structure can be different from country to country, even within Europe (Chaddad and Iliopoulos, 2013). Therefore, it is valuable to conduct more longitudinal studies based on the samples from other countries, in order to validate the change of the difference between cooperatives and corporations in the past decades. An additional limitation of the current study is that, due to the different SIC coding systems in 2002 and 2012 and lack of insights into corporations, we cannot be sure that the convergence between cooperatives and corporations in terms of diversification level is caused by changes in

cooperatives or by changes in corporations (or both). Further study should identify the trends in product diversification by using more consistent measures of product portfolio and using panel datasets. Finally, enterprises are grouped crudely into two types: cooperatives and IOFs. However, there is substantial variety in each group. For example, there are consumer cooperatives and marketing cooperatives, and there are private and publicly listed corporations. Future research may take these differences into account.

Appendix 9.1: 2-Digit SIC Code Detail Level

Sector	Product or Activity	Range of 2-Digit SIC Code
A	Agriculture, forestry, & fishing	01-09
B	Mining	10-14
C	Construction	15-17
D	Manufacturing	20-39
E	Transportation & pub. utilities	40-49
F	Wholesale trade	50-51
G	Retail trade	52-59
H	Finance, insurance, & real estate	60-67
I	Services	70-89
J	Public administration	91-97
K	Non-classifiable establishments	99

Source: Occupational Safety and Health Administration, United States Department of Labour.

10. Conclusion of Part B

In Part B of the dissertation, we conduct two studies regarding the product diversification of cooperatives. The major research questions we try to answer are:

- What are the potential impacts of governance structure on cooperatives' product diversification behaviour?
- Do cooperatives and IOFs differ in terms of product diversification strategy?

To investigate these research questions, two different methodologies are applied. In Chapter 8, we adopt an agent-based model to simulate the evolution of product portfolio of different types of companies under different market settings. To capture the impact of the cooperative governance structure on product diversification, we highlight three features of cooperatives in the simulations. The first feature we highlight is the single origin constraint of cooperatives (Cook, 1997). This means that the original product requiring the input of the members will never be divested by a cooperative. The single origin constraint is determined by the ownership nature of cooperatives. A cooperative is collectively owned by its members to advance their interests. The members are not only residual income claimants but also input suppliers of the cooperative processor. As such, while an IOF may move to the products with a higher return for its investors, a cooperative will never divest the activity of processing the produce of its members.

Second, the cooperative and the IOF are different in the decision-making process with respect to project selection. Because more extensive decision-making power is retained by cooperative members via the General Assembly and Board of Directors, a cooperative is characterised by the double screening process in project decisions (Hendrikse, 1998). A cooperative will accept less diversification projects than an IOF does because each investment proposal must be approved by both the society of members and the management of the cooperative. This has an impact on the pace of cooperatives' product portfolio evolution. Cooperatives are therefore more conservative in terms of diversification than IOFs are.

Third, different objectives of firms lead to different income rights allocations in governance structures, which in turn influence their output decisions and performance. While an IOF determines its product output level by maximising the total profits of the downstream processor, the cooperative may maximise the summed profits of the upstream farms and downstream processor (Staatz, 1987), or maximise the product output by making the downstream processor serve the members at cost (LeVay, 1983). This results in cooperatives being more aggressive producers than IOFs (Albaek and Schultz, 1998).

A prominent advantage of the agent-based methodology is that all the above described features in cooperatives' decision and income rights structure can be incorporated in one dynamic model of product portfolio evolution. Through simulation, we are able to observe how firms' decisions are made and analyse the outcomes that emerge at the aggregated level. We start with a basic model that focuses only on the impact of the single origin constraint of cooperatives. The single origin constraint is modelled by assigning an infinite lifetime only to the original product of a cooperative. The simulation results show that the single origin constraint pulls the products of the cooperative in one cluster centred on the original product. This centralisation effect decreases the probability of the cooperative to choose new products while increases the output of the original product continuously. Therefore, the single origin constraint leads to the lower diversification level and larger output of cooperatives. Without single origin constraint, the product portfolio of the IOF evolves in such a pattern that it consists of clusters of related products that deviate from the original product. In the long term, the IOF will be more diversified than the cooperative and keep a stable number of products in its portfolio. The output of the IOF is also relatively constant.

We extend the basic model by including additional governance structure features and simulate the product portfolio evolution of a cooperative and an IOF in two market settings. We first investigate the monopoly market, where the cooperative and the IOF evolve the product portfolio independently. Similar to the results of the basic model, the cooperative's product portfolio centres on the location of the original product, while the product portfolio of the IOF evolves in such a pattern that it consists of clusters of related products that deviate from the original product. The cooperative is less diversified than the IOF and has a larger product output. Specifically, the cooperative that maximises its members' total surplus has a larger product output than the IOF because the vertical integration of the member farms and the cooperative processor eliminates the double-marginalisation problem. The cooperative that serves the members at cost will further expand the production. In general, the cooperative's product portfolio is featured as less diversified, centred on the original product, with a larger output, a higher surplus per product, and a lower surplus per output unit. The IOF has more products in its portfolio, which are far away from the original product, with a smaller output, a lower profit per product, and a higher profit per output unit. The total surplus of the cooperative and the total profit of the IOF are close. However, the farms that deliver raw products to the IOF obtain a much lower profit compared with the surplus received by the cooperative member farms.

We capture the competition between different agents in the simulation of the mixed duopoly market. The results show that the cooperative still has fewer products in its portfolio and a higher total and per product output than the IOF does. Similar to the

results of the monopoly market, the cooperative has a higher surplus per product, whereas the IOF has a higher profit per output unit in the duopoly market. However, both the cooperative and the IOF are more diversified in the duopoly market than in the monopoly market. The reason is that, according to the transition rule, an agent will add the new product to its portfolio if the product is in the rival's portfolio. This behaviour increases the chance of adding new products and increases the number of products in both agents' portfolios. It entails that the competition may boost product diversification if the agents apply a following strategy. Another impact of the competition is that, by keeping a cluster of the IOF's products close to the original product, it prevents the IOF's portfolio from continuously deviating from the original product. Furthermore, it is shown that the cooperative occupies a larger market share in the mixed duopoly market. The cooperative that serves the members at cost will further expand its market share in the competition with the IOF. The results also show that the total surplus of the cooperative and the total profit of the IOF are close, but both types of the cooperative can improve the member farms' wellbeing in the duopoly market by avoidance of market power.

In order to test the results of the simulation model, in Chapter 9 we empirically compare cooperatives and IOFs in terms of their product diversification levels by using a dataset from the Netherlands. Our sample consists of a group of Dutch cooperatives and publicly listed firms. We compare their product diversification levels in two different years. The results show that the product diversification level of Dutch cooperatives is lower than that of Dutch publicly listed firms in 2001. However, the difference in the product diversification levels between these two types of companies is statistically insignificant in 2012. The previous difference in product diversification level between cooperatives and publicly listed firms may be explained by the specific governance structure characteristics of cooperatives versus corporations. We also argue that the disappearance of the difference can be attributed to the substantial structural changes of Dutch agricultural cooperatives. Through the adaptation in decision rights and income rights allocation, cooperatives may behave similarly to corporations in terms of product diversification. On the one hand, the adaptation of the decision rights allocation supports cooperatives' market-oriented strategies and makes the decisions for product diversification of easier; on the other hand, many traditional cooperatives have restructured their income rights into more individualised forms, which enable them to raise sufficient equity for participating in value-added processing and product diversification. In sum, due to the changes in cooperatives' governance structure, we argue that some crucial aspects that make cooperatives different from corporations may no longer exist in many cooperatives.

Summary

A marketing cooperative is an enterprise owned by a society of members. Each member has an ownership and a transaction relationship with the cooperative. The transaction relationship, i.e. products or services are being exchanged between the owners and the enterprise they own, is absent in an investor owned firm (IOF). This thesis addresses *social capital* and *diversification* of cooperatives in a comparative institutional approach with the IOF as benchmark.

Part A (Chapters 2 – 7) of this dissertation examines the nature of a marketing cooperative by considering both its economic and social attributes. The structural, cognitive, and relational social capital constitute the social attributes while the economic attributes are represented by the governance structure in terms of decision and income rights. A cooperative's social and economic attributes must be aligned in order to obtain organisational efficiency. We argue that, when the social capital level in a cooperative changes, the cooperative shall adopt strategies to rebalance its social and economic attributes, either by restoring social capital or by changing its governance structure. Chapter 2 analyses the different dimensions of social capital in the organisational context of cooperatives. Chapters 3, 4, and 5 model the income rights structure of cooperatives and its interaction with the relational and structural dimension of cooperative social capital. Chapter 6 models the decision rights structure of cooperatives by considering the visions of the cooperative CEO and Board of Directors, which is related to the cognitive dimension of cooperative social capital.

The major conclusions are as follows. First, a necessary condition for high product quality under cooperative equitable principles is the existence of a high level of social capital in the cooperative. However, an income rights structure with stronger quality incentives must be adopted by the cooperative to maintain product quality when the level of social capital declines. Second, the complete pooling policy is not only economically efficient but also socially advantageous when it can stimulate frequent social interactions among members. However, when the social context of the cooperative community is no longer conducive to social interactions, the complete pooling policy will become sub-optimal. The cooperative should abandon the pooling policy. Third, the combination of decision rights structure and cognitive social capital has significant performance implications. Cooperatives with member CEOs are upstream focused because of the cascading effect of negative vision biases towards downstream projects. When downstream activities become more important, cooperatives need to replace the member CEOs with professional CEOs. In sum, Part A constructs an analytical framework of cooperative social capital and advances the understanding of the interaction between social capital and governance structure. We

propose that cooperatives' social and economic attributes can be understood as the equilibrium outcome of the interaction between social capital and governance structure. The social context of the cooperative community affects the equilibrium that the cooperative will choose.

Part B (Chapters 8 – 10) of this dissertation attempts to gain a better understanding of cooperatives' product diversification strategies. Two methodologies are applied. In Chapter 8, agent-based simulations are adopted to analyse the relationship between governance structure and the evolution of product portfolio. The cooperative governance structure is featured by the single origin constraint, the double screening in decision making, and the objective of maximising upstream and downstream surplus jointly. The simulation results show that the cooperative's product portfolio centres on the location of the original product, while the product portfolio of the IOF evolves in such a pattern that it consists of clusters of related products that deviate from the original product. In addition, the cooperative is less diversified than the IOF but has a larger product output. Chapter 9 empirically investigates the influence of governance structure on product diversification behaviour by using a dataset from the Netherlands. The sample consists of a group of Dutch cooperatives and publicly listed firms. We compare the product diversification level of these two types of firms in 2001 and 2012. The results show that cooperatives are less diversified than publicly listed companies in 2001, whereas the product diversification levels of these two types of companies are statistically comparable in 2012. We conclude that, with the flexibility in governance structure, cooperatives may actually not behave differently from other types of enterprises in terms of product diversification.

Samenvatting (in Dutch)

Een coöperatie is een bedrijf dat eigendom is van een vereniging van leden. Het verschil met eigendom van investeerders is dat elke investeerder slechts een financieel belang in het bedrijf heeft, terwijl elk lid van een coöperatie een eigen bedrijf heeft dat naast een financiële relatie ook een transactierelatie heeft door middel van levering van inputs aan of afname van de productie van het coöperatieve bedrijf. Dit proefschrift is gewijd aan *sociaal kapitaal* en *diversificatie* in coöperaties in een vergelijkende institutionele benadering met de beursgenoteerde onderneming als vergelijkingsmaatstaf.

In deel A (hoofdstukken 2-7) van deze dissertatie wordt de aard van een coöperatie onderzocht door te kijken naar zowel haar economische als sociale attributen. Het relationele, structurele en cognitieve sociale kapitaal vormen de sociale attributen; de economische attributen worden vertegenwoordigd door de bestuurlijke structuur in termen van beslissings- en inkomensrechten. Om organisatorische efficiëntie te bereiken, moeten de sociale en economische attributen binnen een coöperatie op elkaar afgestemd zijn. Wij stellen dat de coöperatie een strategie moet hanteren om de balans tussen sociale en economische attributen weer in evenwicht te brengen wanneer de mate van sociaal kapitaal binnen een coöperatie wijzigt, hetzij door herstel van het sociale kapitaal hetzij door wijziging van de bestuurlijke organisatie.

In hoofdstuk 2 worden de verschillende dimensies van sociaal kapitaal in de organisatorische context van coöperaties geanalyseerd. Hoofdstukken 3, 4 en 5 modelleren de uitbetalingsstructuur van de coöperatie in relatie tot de relationele en structurele dimensies van het sociale kapitaal. Hoofdstuk 6 modelleert de visie van respectievelijk de CEO en het bestuur in de besluitvormingsstructuur van coöperaties, waarbij de visie betrekking heeft op de cognitieve dimensie van het sociale kapitaal van een coöperatie.

De belangrijkste conclusies zijn de volgende. Ten eerste: een noodzakelijke voorwaarde voor het gelijkheidsprincipe van coöperaties om producten van voldoende kwaliteit te leveren is een hoog niveau van sociaal kapitaal binnen de coöperatie. Echter, kwaliteit dient onderscheidend te worden beloond om de productkwaliteit te waarborgen en te behouden, wanneer het niveau van het sociale kapitaal afneemt. Ten tweede: het gelijkheidsbeleid is niet alleen economisch efficiënt, maar brengt ook sociale voordelen, mits het frequente sociale interacties tussen leden stimuleert. Echter, het gelijkheidsprincipe functioneert niet optimaal, als er binnen de sociale context van een coöperatie weinig of geen interactie plaatsvindt. In dat geval zal de coöperatie de pooling policy moeten laten vallen.

Ten derde: de wisselwerking tussen de besluitvormingsstructuur en het cognitieve sociale kapitaal heeft significante gevolgen voor de prestaties van een coöperatie. Coöperaties waarvan de CEO ook een lid is, zijn stroomopwaarts gericht vanwege het cascade-effect van vooringenomen negatieve visies op projecten stroomafwaarts. Wanneer stroomafwaartse activiteiten belangrijker worden, dient de coöperatie de uit de leden gekozen CEO's te vervangen door professionele CEO's.

Kortom, in deel A wordt een analytisch raamwerk geconstrueerd met betrekking tot het sociale kapitaal van een coöperatie en de interactie tussen sociaal kapitaal en bestuursstructuur verduidelijkt. Wij stellen dat sociale en economische attributen van een coöperatie kunnen worden begrepen als de uitkomst van de wisselwerking tussen sociaal kapitaal en bestuursstructuur. De sociale context van de coöperatieve gemeenschap bepaalt het evenwicht dat de coöperatie kiest.

In deel B (hoofdstukken 8-10) van deze dissertatie wordt getracht een beter begrip te verkrijgen van de productdiversificatiestrategieën van een coöperatie. Twee methoden zijn hiervoor toegepast. In hoofdstuk 8 worden agent-gebaseerde simulaties gebruikt om de relatie tussen de bestuursstructuur en de evolutie van het diversificatiebeleid te analyseren. De bestuurlijke organisatie van een coöperatie wordt gekenmerkt door de levering van inputs van de leden, de dubbele controle in het besluitvormingsproces en het doel om de winst van het coöperatieve bedrijf en de bedrijven van de leden beide te maximaliseren.

De resultaten van de simulatie laten zien dat het productportfolio van een coöperatie zich richt op de het originele product, terwijl een beursgenoteerde onderneming zich zodanig ontwikkelt dat het productportfolio bestaat uit clusters van verwante producten die afwijken van het originele product. Daarnaast geldt, dat een coöperatie weliswaar een minder divers productportfolio heeft dan de beursgenoteerde onderneming, maar wel een hogere productie oplevert.

In hoofdstuk 9 wordt empirisch onderzoek naar de invloed van de bestuursstructuur van de onderneming op het diversificatiebeleid gepresenteerd met behulp van Nederlandse gegevens. De steekproef bestaat uit een groep van Nederlandse coöperaties en beursgenoteerde bedrijven in 2001 en 2012. Wij maken een vergelijking tussen het niveau van productiediversificatie van deze twee soorten bedrijven in 2001 en 2012. De resultaten laten zien dat coöperaties in 2001 een minder divers productportfolio hadden dan beursgenoteerde bedrijven, terwijl de productdiversificatie op een statistisch gelijk niveau was in 2012. Wij concluderen dat coöperaties zich door hun flexibiliteit in interne bestuursstructuur met betrekking tot hun productdiversificatie in feite niet anders hoeven te gedragen dan andere soorten ondernemingen.

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Curriculum Vitae

Wendong Deng was born in Fujian, China. He studied Electrical Engineering in Shanghai Jiao Tong University and received his Bachelor of Science degree in 2002. He obtained his Master of Science degree in Microwave Engineering in 2004 at Technical University of Munich and his MBA in 2009 at Shanghai Jiao Tong University. In 2011, he joined the Department of Organisation and Personnel Management of Rotterdam School of Management, Erasmus University, as a PhD candidate. His research focuses on the internal and industrial organisation of enterprises. He is interested in the incentive structure, social capital, product diversification and managerial vision in different governance structures of organisations. Wendong presented his research at several international conferences including Economics and Management of Networks Conference (EMNet), European Association of Agricultural Economists (EAAE) Congress, and Conference of the International Society for New Institutional Economics (ISNIE). His research is currently under review in top management and economics journals.

Wendong brings extensive industry and China-specific career experience to his doctoral research. Before joining Rotterdam School of Management, he spent seven years in consulting, business development and sales/marketing roles in China and Germany. He has been working at Siemens Mobile and TÜV SÜD as project manager and business development manager. From 2006 to 2011, Wendong founded and managed a business consulting company in Shanghai, which helped European companies to enter China and Chinese companies to realise their strategies of overseas expansion.

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This thesis contributes to two research streams of the literature regarding marketing cooperatives, namely, social capital and product diversification. First, the thesis examines the nature of a marketing cooperative by considering both its economic and social attributes. Several formal models are formulated to address the interaction between cooperative governance structure and the different dimensions of cooperative social capital. The cooperative's social and economic attributes are viewed as the equilibrium outcome of this interaction, while the social context of the cooperative community affects the equilibrium that the cooperative will choose. Second, the governance structure of cooperatives has an impact on the product diversification. An agent-based simulation shows that the single origin constraint of a cooperative creates a centralization effect in its product portfolio evolution, resulting in a lower diversification level and a larger output of the cooperative. Empirical evidence from the Netherlands shows that cooperatives are less diversified than publicly listed firms in 2001. However, the diversification level of cooperatives is comparable to that of publicly listed firms in 2012. It is concluded that, by making a change in the governance model in response to changes in the competitive environment, cooperatives may actually behave not differently from other types of enterprises in terms of product diversification.

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