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Managerial vision bias and cooperative governance

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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 being the efficient governance structure.

Keywords: vision bias, cooperatives, governance

JEL classification: D21, L23, Q13

> There is thus ample reason to think that any particular organizational structure will bias policy-making toward some outcomes and away from others.
> (Hammond and Thomas, 1989: 158)

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 shapes 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 decision makers must be

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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 article, 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 investor owned firms (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).[1] 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. In 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 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

1 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.

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 (Feng, 2011; Nilsson, Svendsen and Svendsen, 2012). 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 and Hendrikse, 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. Because of 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 (van Oijen and Hendrikse, 2002). 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 2. Section 3 presents the model. Section 4 derives the equilibrium

payoffs of the different governance structures. Section 5 identifies the efficient governance structure featured by the CEO identity and vision bias. Section 6 provides some discussion on our results. Conclusions and future research directions are formulated in the final section.

2. Literature

The management of a marketing cooperative is faced with more complex and difficult tasks than its counterparts in IOFs (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, 2001a). The vertical ties between the members and the cooperative firm consist of both a transaction element and an ownership element (Feng and Hendrikse, 2012). In 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 article, 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 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 the 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 article 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. In 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. In 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 (Cook, 1994; Henehan and Anderson, 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.[2] 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 the 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. In 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 (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.

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 1a presents the decision-making process of a cooperative.[3] 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

2 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.

3 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.

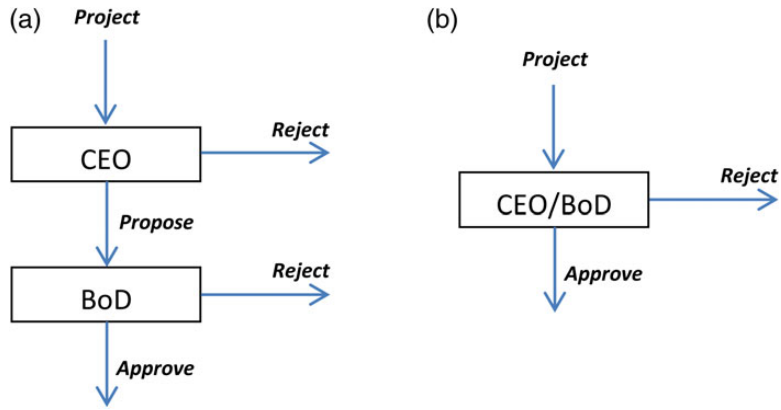

Fig. 1. (a) Decision process of a cooperative. (b) Decision process of an IOF.

decision of approval or rejection based on whether their perceived payoff is also positive.[4] 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 payoff but may have different managerial visions. Burress, Livingston and Cook (2011) reports that less than 1 per cent 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 1b presents the decision process of the 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: $f(\omega) = (1/(\sigma\sqrt{2\pi}))e^{-(1/2)(\omega/\sigma)^2}$, $\omega \in (-\infty, +\infty)$, and σ is the standard deviation of ω.[5]

4 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.

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

Table 1. Three governance structures

	COOP1	COOP2	IOF
CEO	Member	Professional	Professional
BoD	Member	Member	

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 $j = \mathrm{U}, \mathrm{D}$. When a member CEO sees an upstream (downstream) project opportunity, he perceives the payoff of the project to be $\omega' = \omega + B_{\mathrm{U}}^m\ (\omega - B_{\mathrm{D}}^m)$, 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 $\omega' = \omega - B_{\mathrm{U}}^p\ (\omega + B_{\mathrm{D}}^p)$, 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 $\omega' + B_{\mathrm{U}}^m\ (\omega' - B_{\mathrm{D}}^m)$.

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 1. Both COOP1 and COOP2 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.

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.

4.1. Equilibrium decisions

4.1.1. IOF

Figure 2 presents the extensive form of the game when an IOF is chosen in the first stage.

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 $\omega' = \omega - B_{\mathrm{U}}^{p}$. The professional CEO's negative bias towards upstream projects implies that only those upstream projects with a payoff $\omega > B_{\mathrm{U}}^{p}$ will be implemented. The professional CEO thus commits type I errors by rejecting the good projects with a positive payoff $\omega \in (0,\ B_{\mathrm{U}}^{p}]$. When a downstream project is generated, the perceived project payoff of the professional CEO is $\omega' = \omega + B_{\mathrm{D}}^{p}$. The positive bias of the professional CEO will make her implement the downstream projects with a payoff $\omega > -B_{\mathrm{D}}^{p}$, which include some bad projects. The professional CEO commits type II errors by accepting the bad projects with a negative payoff $\omega \in (-B_{\mathrm{D}}^{p},\ 0]$.

4.1.2. Cooperative

In a cooperative, any project is subject to double screening. Figure 3 presents the extensive form of the game when a cooperative is chosen in the first stage.

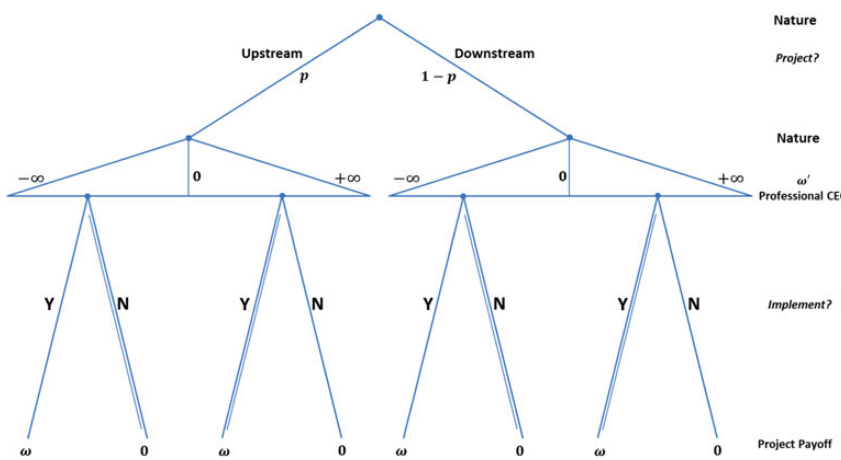

Fig. 2. Choices in the extensive form of the game with the IOF.

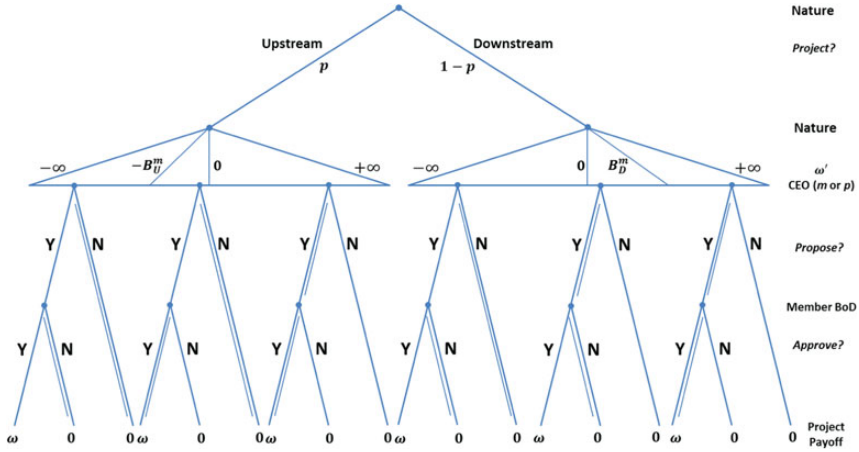

Fig. 3. Choices in the extensive form of the game with a cooperative.

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 $\omega' = \omega + B_{\mathrm{U}}^{m}$. He will propose the project to the BoD if $\omega' > 0$, i.e. $\omega > -B_{\mathrm{U}}^{m}$. Because of 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 $\omega' + B_{\mathrm{U}}^{m} > 0$. 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 $\omega' = \omega - B_{\mathrm{D}}^{m}$. Only the downstream projects with a payoff $\omega > B_{\mathrm{D}}^{m}$ 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 $\omega' - B_{\mathrm{D}}^{m}$. The downstream project will be approved by the BoD if $\omega' > B_{\mathrm{D}}^{m}$. Because $\omega' = \omega - B_{\mathrm{D}}^{m}$, only the downstream projects with a payoff $\omega > 2B_{\mathrm{D}}^{m}$ will be implemented. In other words, only those 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 $\omega > B_{\mathrm{U}}^{p}$ and the downstream projects with a payoff $\omega > -B_{\mathrm{D}}^{p}$ 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 $\omega' - B_{\mathrm{D}}^{m}$ due to the negative bias. The project will be implemented if $\omega' > B_{\mathrm{D}}^{m}$. Because $\omega' = \omega + B_{\mathrm{D}}^{p}$, the downstream projects with a payoff $\omega > B_{\mathrm{D}}^{m} - B_{\mathrm{D}}^{p}$ 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 $B_{\mathrm{D}}^{m} > B_{\mathrm{D}}^{p}$, 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.

4.2. Equilibrium payoffs

4.2.1. 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 $(B_{\mathrm{U}}^{p}, +\infty)$ and $(-B_{\mathrm{D}}^{p}, +\infty)$, respectively. The expected payoff of the IOF is

$$\begin{aligned}\pi_{\mathrm{IOF}} &= p\int_{B_{\mathrm{U}}^{p}}^{+\infty} \omega f(\omega)\mathrm{d}\omega + (1-p)\int_{-B_{\mathrm{D}}^{p}}^{+\infty} \omega f(\omega)\mathrm{d}\omega \\ &= \frac{1}{\sigma\sqrt{2\pi}}\left[pe^{-\frac{1}{2}\left(\frac{B_{\mathrm{U}}^{p}}{\sigma}\right)^{2}} + (1-p)e^{-\frac{1}{2}\left(\frac{B_{\mathrm{D}}^{p}}{\sigma}\right)^{2}} \right].\end{aligned}$$

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 outcomes 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 $B_U^p < B_D^p$.

4.2.2. 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

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

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 $B_U^m > 2B_D^m$.

4.2.3. COOP2

The payoff range of the implemented upstream projects is $(B_U^p, +\infty)$. 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 $(B_D^m - B_D^p, +\infty)$. 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 $B_{\mathrm{D}}^{p} > B_{\mathrm{D}}^{m}$, some bad downstream projects will be implemented (type II errors). The expected payoff of COOP2 is

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

The relationship between π_2 and p is straightforward. If $B_{\mathrm{U}}^{p} = |B_{\mathrm{D}}^{m} - B_{\mathrm{D}}^{p}|$, the expected payoff of COOP2 is invariant with p. If $B_{\mathrm{U}}^{p} > |B_{\mathrm{D}}^{m} - B_{\mathrm{D}}^{p}|$, 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 $B_{\mathrm{U}}^{p} < |B_{\mathrm{D}}^{m} - B_{\mathrm{D}}^{p}|$.

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

$$\pi_{\mathrm{FB}} = \int_{0}^{+\infty} \omega f(\omega)\mathrm{d}\omega = \int_{0}^{+\infty} \frac{\omega}{\sigma\sqrt{2\pi}} e^{-\frac{1}{2}\left(\frac{\omega}{\sigma}\right)^2} = \frac{1}{\sigma\sqrt{2\pi}}.$$

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

Table 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	$pe^{-(1/2)(B_{\mathrm{U}}^{m}/\sigma)^2} + (1-p)e^{-(1/2)(2B_{\mathrm{D}}^{m}/\sigma)^2}$	$e^{-(1/2)(2B_{\mathrm{D}}^{m}/\sigma)^2}$	$e^{-(1/2)(B_{\mathrm{U}}^{m}/\sigma)^2}$
COOP2	$pe^{-(1/2)(B_{\mathrm{U}}^{p}/\sigma)^2} + (1-p)e^{-(1/2)((B_{\mathrm{D}}^{m}-B_{\mathrm{D}}^{p})/\sigma)^2}$	$e^{-(1/2)((B_{\mathrm{D}}^{m}-B_{\mathrm{D}}^{p})/\sigma)^2}$	$e^{-(1/2)(B_{\mathrm{U}}^{p}/\sigma)^2}$
IOF	$pe^{-(1/2)(B_{\mathrm{U}}^{p}/\sigma)^2} + (1-p)e^{-(1/2)(B_{\mathrm{D}}^{p}/\sigma)^2}$	$e^{-(1/2)(B_{\mathrm{D}}^{p}/\sigma)^2}$	$e^{-(1/2)(B_{\mathrm{U}}^{p}/\sigma)^2}$

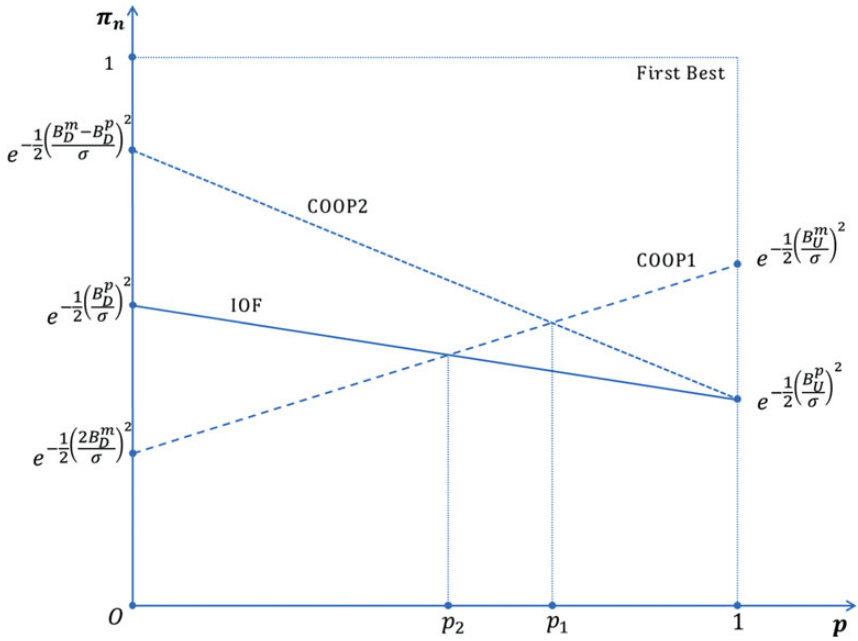

Fig. 4. The normalised payoff.

realise the first-best payoff if the positive bias of the professional CEO (B_{D}^p) and the negative bias of the BoD ($-B_{\mathrm{D}}^m$) towards downstream projects cancel each other exactly ($B_{\mathrm{D}}^p - B_{\mathrm{D}}^m = 0$). 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.* $B_{\mathrm{D}}^p \neq B_{\mathrm{D}}^m$, *no governance structure is first-best efficient.*

The normalised expected project payoffs of the three governance structures are depicted in Figure 4. The first-best payoff is represented by the horizontal line with the normalised payoff of 1.

From Figure 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.[6] 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.[7] COOP2 is thus the efficient governance structure. The values of p_1 and p_2 are endogenously determined by

6 $p_1 = [e^{-(1/2)(B_{\mathrm{D}}^p/\sigma)^2} - e^{-(1/2)(B_{\mathrm{D}}^m - B_{\mathrm{D}}^p/\sigma)^2}]/[e^{-(1/2)(B_{\mathrm{D}}^p/\sigma)^2} - e^{-(1/2)(B_{\mathrm{U}}^m/\sigma)^2} + e^{-(1/2)(B_{\mathrm{D}}^p/\sigma)^2} - e^{-(1/2)(B_{\mathrm{D}}^m - B_{\mathrm{D}}^p/\sigma)^2}]$.
7 $p_2 = [e^{-(1/2)(2B_{\mathrm{D}}^m/\sigma)^2} - e^{-(1/2)(B_{\mathrm{D}}^p/\sigma)^2}]/[e^{-(1/2)(B_{\mathrm{U}}^p/\sigma)^2} - e^{-(1/2)(B_{\mathrm{U}}^m/\sigma)^2} + e^{-(1/2)(2B_{\mathrm{D}}^m)/\sigma^2} - e^{-(1/2)(B_{\mathrm{D}}^p/\sigma)^2}]$.

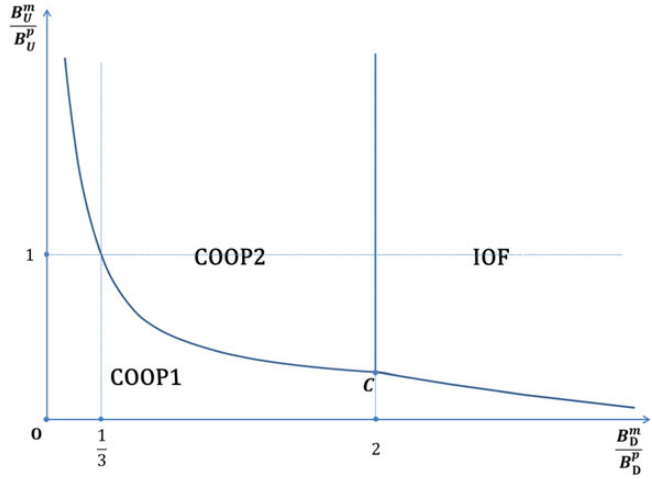

Fig. 5. The efficient governance structure.

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. $B_{\mathrm{U}}^m/B_{\mathrm{U}}^p = 1$. p_1 will approach 0 when $2B_{\mathrm{D}}^m$ is equal to $|B_{\mathrm{D}}^m - B_{\mathrm{D}}^p|$, i.e. $B_{\mathrm{D}}^m/B_{\mathrm{D}}^p = 1/3$. Similarly, p_2 will approach 0 when $2B_{\mathrm{D}}^m$ is equal to B_{D}^p, i.e. $B_{\mathrm{D}}^m/B_{\mathrm{D}}^p = 1/2$. In addition, $p_1 \geq (\leq) p_2$ holds when $B_{\mathrm{D}}^m \leq (\geq)\ 2B_{\mathrm{D}}^p$, i.e. $B_{\mathrm{D}}^m/B_{\mathrm{D}}^p \leq (\geq)\ 2$. Therefore, given a certain value of p, we can identify the ranges of $B_{\mathrm{U}}^m/B_{\mathrm{U}}^p$ and $B_{\mathrm{D}}^m/B_{\mathrm{D}}^p$ in which a governance structure is efficient.

Figure 5 summarises the main results regarding the efficient governance structure. The detailed analysis and propositions are presented in Appendix A. $B_{\mathrm{U}}^m/B_{\mathrm{U}}^p$ on the vertical axis represents the ratio of the upstream vision biases of the member and professional executive, while $B_{\mathrm{D}}^m/B_{\mathrm{D}}^p$ 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 $B_{\mathrm{D}}^m/B_{\mathrm{D}}^p < (>)2$. The curve approaches the vertical (horizontal) axis when $B_{\mathrm{U}}^m/B_{\mathrm{U}}^p (B_{\mathrm{D}}^m/B_{\mathrm{D}}^p)$ increases. At point C, the three governance structures are equally efficient.

Several important implications can be drawn from Figure 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 $B_{\mathrm{D}}^m/B_{\mathrm{D}}^p < 2$, the efficient governance structure will change from COOP1 to COOP2 if $B_{\mathrm{U}}^m/B_{\mathrm{U}}^p$, $B_{\mathrm{D}}^m/B_{\mathrm{D}}^p$, 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 B_U^m/B_U^p increases, COOP1's upstream payoff losses will increase in comparison with that of COOP2. When $B_U^m/B_U^p > 1$, 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. In 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 B_D^m/B_D^p increases, the downstream project payoff of COOP1 will drop more quickly compared with COOP2. When $B_D^m/B_D^p > 1/3$, 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 B_U^m/B_U^p, 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 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 $B_D^m/B_D^p \leq 1$, 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 $1 < B_D^m/B_D^p < 2$, 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 $B_D^m/B_D^p < 2$, COOP2 makes better downstream decisions and dominates the IOF. When $B_D^m/B_D^p > 2$, 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 $B_D^m/B_D^p > 2$. Therefore, in the area above the curve, when $B_D^m/B_D^p > 2$, 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 B_D^m/B_D^p. The intuition is that COOP1's downstream performance will decrease compared with COOP2 and the IOF when 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, 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 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 $B_U^m/B_U^p = 1$. This means that, when the available projects are mainly upstream projects, whether COOP1 can be dominant depends mostly on the value of B_U^m/B_U^p. The relative strength of executives' vision biases towards downstream projects, i.e. B_D^m/B_D^p, has little impact on efficiency. Conversely, if p is smaller, the curve will become steeper. The increase of B_D^m/B_D^p has a larger payoff loss effect for COOP1 when the percentage of downstream projects becomes higher. When the value of p is decreasing to 0, the curve will converge to the vertical line $B_D^m/B_D^p = 1/3$. 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.* $B_U^m < B_U^p (B_D^m < (B_D^p/3))$ *when the proportion of upstream projects in the pool of available projects increases to 1 (decreases to 0).*

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. $2B_{\mathrm{D}}^{m} > B_{\mathrm{U}}^{m}$. The performance of COOP1 will thus increase in p. In addition, as Figure 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 $B_{\mathrm{D}}^{m}/B_{\mathrm{D}}^{p} > 1/2$. 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 $B_{\mathrm{U}}^{m}/B_{\mathrm{U}}^{p} < 1$, its competitive advantage will diminish as p decreases. As shown in Figure A3, the efficient range of COOP1 will converge to $B_{\mathrm{D}}^{m}/B_{\mathrm{D}}^{p} < 1/2$ 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, 2001b), 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 Appendix A states that if the cooperative BoD's vision bias towards downstream projects is less than twice those of the professional CEO's vision bias, i.e. $B_{\mathrm{D}}^{m}/B_{\mathrm{D}}^{p} < 2$, 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 $B_{\mathrm{D}}^{m}/B_{\mathrm{D}}^{p} > 2$, 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; Lang, 2002; USDA, 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 to them why the cooperative should increase the investment of the value-added products in that area. These member education programmes 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 $B_{\mathrm{D}}^{m}/B_{\mathrm{D}}^{p}$. 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). The separation of formal and real authority will give cooperative management more freedom to operate (Hendrikse, 2005). 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 fact that the managers' preferred goals are reflected in the organisational decisions and practices, which make cooperatives more and more akin to IOFs (Hind, 1997, 1999).

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 article 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 article 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 testing. 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 article. 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.

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Appendix A

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.

A.1. The comparison of the IOF and COOP2

In Figure 4, the payoff lines of the IOF and COOP2 both emanate from $e^{-(1/2)(B_U^p/\sigma)^2}$ 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 obvious that, when $|B_D^m - B_D^p| < B_D^p$, i.e. $B_D^m/B_D^p < 2$, 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 fewer 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 $|B_D^m - B_D^p| > B_D^p$. Figure A1 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).*

A.2. Comparison of COOP1 and COOP2

The comparison between COOP1 and COOP2 becomes complex because their decision qualities regarding upstream and downstream projects can both be

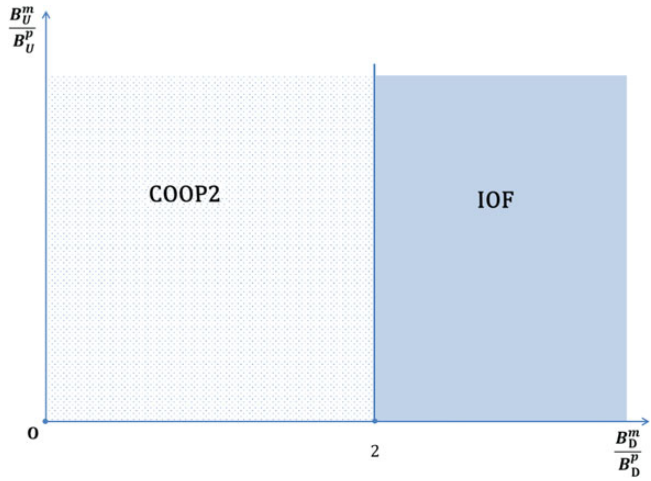

Fig. A1. Efficiency of the IOF versus COOP2.

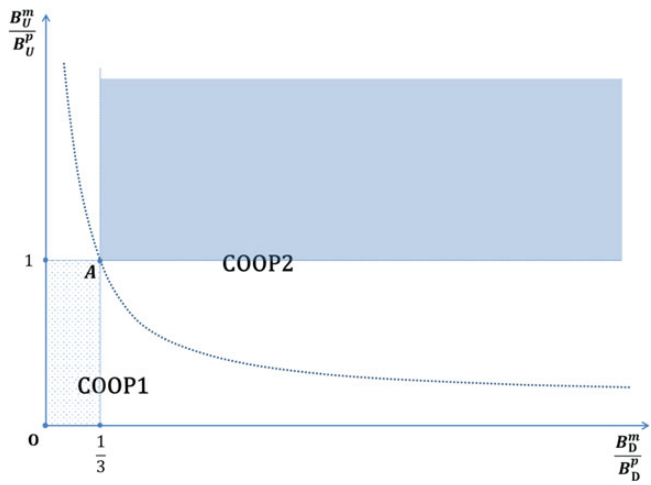

Fig. A2. Efficiency of COOP1 versus COOP2.

different. There are four possibilities. First, when $2B_{\mathrm{D}}^m < |B_{\mathrm{D}}^m - B_{\mathrm{D}}^p|$ and $B_{\mathrm{U}}^p < B_{\mathrm{U}}^m$, the payoff of COOP1 will be always higher than the payoff of COOP2. COOP1 thus dominates COOP2 for every value of p. Second, when $2B_{\mathrm{D}}^m > |B_{\mathrm{D}}^m - B_{\mathrm{D}}^p|$ and $B_{\mathrm{U}}^p > B_{\mathrm{U}}^m$, COOP2 will dominate COOP1 for every value of p. In these two situations, the payoff lines of COOP1 and COOP2 in Figure 4 have no intersection and one governance structure makes better decisions regarding both upstream and downstream projects. The ranges of $B_{\mathrm{U}}^m/B_{\mathrm{U}}^p$ and $B_{\mathrm{D}}^m/B_{\mathrm{D}}^p$ in which COOP1 or COOP2 will dominate the other for every value of p are highlighted by the shaded areas in Figure A2.

Third, when $2B_D^m > |B_D^m - B_D^p|$ 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 B_U^m/B_U^p and B_D^m/B_D^p are within the down-right unshaded area ($B_D^m/B_D^p > 1/3$ and $B_U^m/B_U^p < 1$) in Figure A2. Finally, when $2B_D^m < |B_D^m - B_D^p|$ 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 B_U^m/B_U^p and B_D^m/B_D^p are within the top-left unshaded area ($B_D^m/B_D^p < 1/3$ and $B_U^m/B_U^p > 1$) in Figure A2. In these unshaded areas, given a certain value of p, the dotted curve approximates the combinations of B_U^m/B_U^p and 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 (1/3, 1), at which the payoff lines of COOP1 and COOP2 in Figure 4 perfectly coincide and they are therefore the same for every value of p. The dotted curve decreases in B_D^m/B_D^p. The intuition is that, COOP1's downstream performance will decrease compared with COOP2 when 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 on the dotted curve. Therefore, 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 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 B_U^m/B_U^p. The relative strength of executives' vision biases towards downstream projects, i.e. 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 $B_U^m/B_U^p = 1$. Conversely, if p is smaller, the dotted curve will become steeper. The increase of 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 $B_D^m/B_D^p = 1/3$.

A.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 4 have no intersection and one governance structure makes better decisions regarding both upstream and downstream projects. The ranges of B_U^m/B_U^p and B_D^m/B_D^p in which

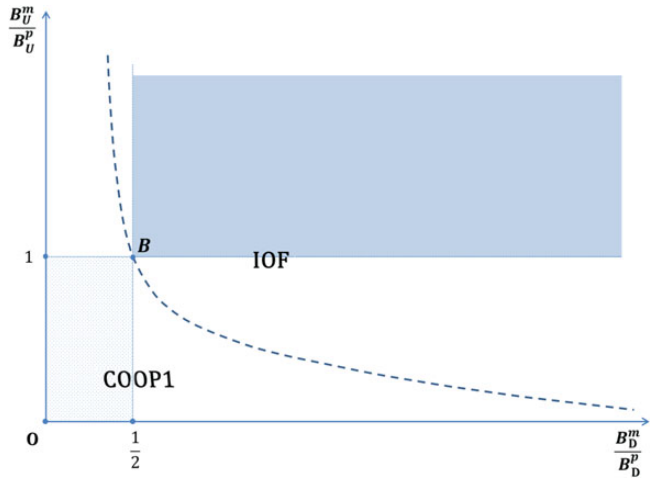

Fig. A3. Efficiency of the IOF versus COOP2.

COOP1 or the IOF will dominate the other for every value of p are highlighted by the shaded areas in Figure A3.

Third, when $2B_{\mathrm{D}}^m > B_{\mathrm{D}}^p$ and $B_{\mathrm{U}}^m < B_{\mathrm{U}}^p$, the IOF makes better decisions regarding downstream projects whereas COOP1 makes better decisions regarding upstream projects. The ranges of $B_{\mathrm{U}}^m/B_{\mathrm{U}}^p$ and $B_{\mathrm{D}}^m/B_{\mathrm{D}}^p$ are within the down-right unshaded area ($B_{\mathrm{D}}^m/B_{\mathrm{D}}^p > 1/2$ and $B_{\mathrm{U}}^m/B_{\mathrm{U}}^p < 1$) in Figure A3. Finally, when $2B_{\mathrm{D}}^m < B_{\mathrm{D}}^p$ and $B_{\mathrm{U}}^m > B_{\mathrm{U}}^p$, the IOF makes better decisions regarding upstream projects whereas COOP1 makes better decisions regarding downstream projects. The ranges of $B_{\mathrm{U}}^m/B_{\mathrm{U}}^p$ and $B_{\mathrm{D}}^m/B_{\mathrm{D}}^p$ are within the top-left unshaded area ($B_{\mathrm{D}}^m/B_{\mathrm{D}}^p < 1/2$ and $B_{\mathrm{U}}^m/B_{\mathrm{U}}^p > 1$) in Figure A3. In these unshaded areas, given a certain value of p, the dashed curve approximates the combinations of $B_{\mathrm{U}}^m/B_{\mathrm{U}}^p$ and $B_{\mathrm{D}}^m/B_{\mathrm{D}}^p$ 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 $B\,(1/2,\ 1)$, at which the payoff lines of COOP1 and the IOF in Figure 4 perfectly coincide and they are therefore the same for every value of p. Similar to the dotted curve in Figure A2, the dashed curve in Figure A3 decreases in $B_{\mathrm{D}}^m/B_{\mathrm{D}}^p$ and will converge to the horizontal line $B_{\mathrm{U}}^m/B_{\mathrm{U}}^p = 1$ 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 $B_{\mathrm{D}}^m/B_{\mathrm{D}}^p = 1/2$.

A.4. Efficient governance structure

By synthesising Figures A1–A3, Figure A4 presents the ranges of $B_{\mathrm{U}}^m/B_{\mathrm{U}}^p$ and $B_{\mathrm{D}}^m/B_{\mathrm{D}}^p$ in which a governance structure is efficient. Figure 5 is based on Figure A4, where the curve is equal to the dotted curve when $B_{\mathrm{D}}^m/B_{\mathrm{D}}^p \leq 2$, and equal to the dashed curve when $B_{\mathrm{D}}^m/B_{\mathrm{D}}^p \geq 2$.

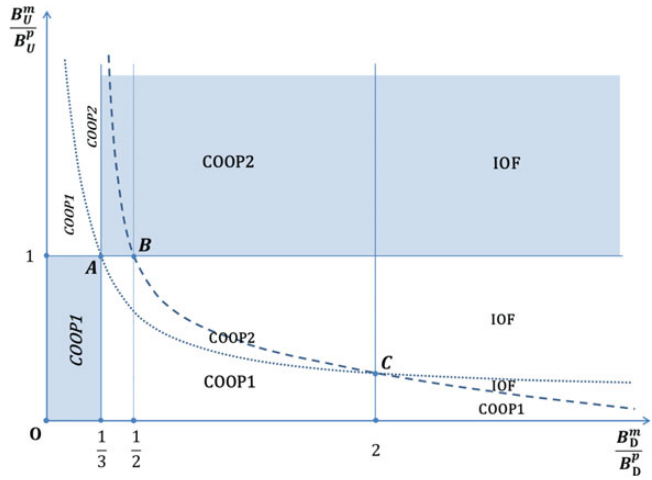

Fig. A4. Comparison of three governance structures.

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. In contrast, COOP1 has a member CEO with a positive vision bias towards upstream projects, which causes type II errors. Therefore, $B_{\mathrm{U}}^m/B_{\mathrm{U}}^p > 1$ 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 $B_{\mathrm{U}}^m/B_{\mathrm{U}}^p < 1$, COOP1 has better performance regarding upstream projects.

The decision outcome of the different governance structures regarding downstream projects depends on $B_{\mathrm{D}}^m/B_{\mathrm{D}}^p$. First, Proposition 3 states that the IOF will make better downstream decisions than COOP2 when $B_{\mathrm{D}}^m/B_{\mathrm{D}}^p > 2$. 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 $1/3 < B_{\mathrm{D}}^m/B_{\mathrm{D}}^p < 2$, 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 $B_{\mathrm{D}}^m/B_{\mathrm{D}}^p < 1/3$, 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* $B_U^m/B_U^p > 1$ and $B_D^m/B_D^p > 2$, *the IOF is uniquely efficient; when* $B_U^m/B_U^p > 1$ and $1/3 < B_D^m/B_D^p < 2$, *COOP2 is uniquely efficient; when* $B_U^m/B_U^p < 1$ and $B_D^m/B_D^p < 1/3$, *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 B_U^m/B_U^p and 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 $B_D^m/B_D^p < (>)\ 2$, the dotted (dashed) will be lower than the dashed (dotted) in the corresponding area because a relatively smaller B_U^m/B_U^p is required for COOP1 to be equally efficient as COOP2 (IOF). When $B_D^m/B_D^p = 2$, 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 $B_D^m/B_D^p < (>)\ 2$. Therefore, the curve in Figure 5 is a combination of the dotted curve when $B_D^m/B_D^p \leq 2$ and dashed curve when $B_D^m/B_D^p \geq 2$.