ARTICLE IN PRESS
JID: EOR [m5G;July 20, 2021;17:47]
European Journal of Operational Research xxx (xxxx) xxx
Contents lists available at ScienceDirect
European Journal of Operational Research
journal homepage: www.elsevier.com/locate/ejor

Interfaces with Other Disciplines

Democratic versus elite governance for project selection decisions in executive committees

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ARTICLE INFO

Article history:
Received 5 February 2020
Accepted 16 June 2021
Available online xxx

Keywords:
Game theory
Decision processes
Project management,

ABSTRACT

Executive committees make critical decisions regarding project selection in different ways. In a committee operating under a democratic governance structure, all members have the right to vote, but the majority of voters ultimately decide which projects to undertake. Alternatively, in a committee operating under an elite governance structure, the decision is made only by a restricted number of voters. Therefore, in an elite governance, there are decision makers or “elite” members, and non-decision makers or “common” members. In this article, we study how committee members under either a democratic or elite governance structure interact and communicate information to each other, and ultimately make a decision about a project with uncertain revenues. We find that the efficient committee governance structure, i.e., the one that maximizes the expected surplus of the committee, can be determined by focusing on one specific communication between elite and common committee members. Further, we establish a sufficient condition on the revenues distribution for each governance structure to be efficient. Finally, when this sufficient condition on the revenues distribution does not hold, we find that governance efficiency depends on the probability of the decision makers to learn the true value of the revenues being sufficiently high or the one of the non-decision makers being sufficiently low or both these two conditions.

1. Introduction

In most organizations, critical decisions about project selection are often made by a committee rather than a single decision maker. Within the committee, the allocation of decision authority determines the committee governance structure. In a *democratic* governance, each member has the right to vote and each vote counts toward the final decision. In an *elite* governance, only a few members have the authority to make project selection decisions.

A renowned example of these two types of governance structures in action can be found in the case of cooperatives, which are horizontal alliances among firms with the same business focus. By nature, these organizations are a participatory and *democratic* form of business that guarantees equal voting rights to all members. In fact, the founding principle of cooperatives is the “one member, one vote” rule, where each member can *communicate* his perspective and voice his opinion, and the *decision authority* is allocated equally among the members. Despite the founding principle, the actual practice is regularly that the decision authority regarding cooperatives' investments and projects is allocated to a restricted number of members. This governance is especially prevalent in emerging markets, such as those seen in China. For instance, the Mashan Guzhai ecological farming cooperatives, active in the Guangxi province of China, is governed by only a few of 300 plus members. The cooperatives leader, Rongyan, and a handful of other farmers, are the ones that make decisions about the types of “green products” to produce, the ecological farming practices to adopt, and the sustainable technologies to develop (Song, Qi, Zhang, & Vernooy, 2014). Another cooperative example is provided by the Zhejiang province in southeast China, where farming cooperatives comply with the “one member, one vote” rule, but only on the paper. In reality, a recent survey of 37 cooperatives in the area revealed that decisions about projects were made by, on average, only 3.5% of the members (Liang, Hendrikse, Huang, & Xu, 2015).

There are many other examples of democratic and elite governance structures in executive committees. For instance, Oraiopoulos & Kavadias (2019) reported the example of pharmaceutical organizations' senior executives, who democratically

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https://doi.org/10.1016/j.ejor.2021.06.038
0377-2217/

decided whether a compound has achieved satisfactory proof of concept to progress to more advanced and expensive clinical trials. On the contrary, in law firms or other service organizations, there is often a distinction between junior and senior partners. Only senior partners can make strategic decisions about the firms' future projects or investments (Barney, 1999). Also publicly listed, investor owned enterprises can be viewed as being characterized by committee decision making regarding certain investments. The shareholders, i.e., members in the annual shareholders meeting, are heterogeneous. If all shareholders are relatively small, then the governance structure is characterized by the democratic governance in our paper. If there are shareholders having substantial blocks of votes (Bolton & Von Thadden, 1998), such as Warren Buffet in various enterprises, then the governance structure is characterized by the elite governance in our terminology.

In this article, we study why committees may adopt different governance structures when selecting which projects to pursue. More specifically, we address the following questions: Under what conditions should project decisions be made by only a subset of the committee members? Alternatively, when should decisions be democratically made? How does communication among committee members affect the final decision about a project?

To answer these questions, we model a committee as a group of two member types, common and elite. Common members outnumber elite members. The committee objective is to decide whether to implement a project whose revenues are stochastic in nature. In a democratic structure, every member communicates an assessment of the project and the final project decision is made by the majority of the members. In an elite committee, only elite members make project selection decisions. The two member types in the committee are heterogeneous among two dimensions: the opportunity cost (which is higher for elite than for common), and the likelihood to learn the true value of the project revenues. This likelihood of learning will be hereupon referred to as the probability of learning. In addition to the heterogeneity among committee members, we also model communication between common and elite members, wherein we prove that at equilibrium each member type sends a coarse message, i.e., either a favorable or an unfavorable message to the other member type, before the decision about the project is made. Finally, in an extension we also show how heterogeneity in the opportunity cost among common members affects our results.

We adopt the concept of *efficiency* to evaluate which governance structure makes the best decision regarding the project. A governance structure is efficient when it maximizes the expected surplus for all the committee members. Put differently, an efficient structure is one that minimizes judgement errors that decision makers may make, i.e., a "bad" project gets accepted or a "good" project gets rejected. Using an analogy from the classical theory of statistical inference, we label a governance structure as efficient when it minimizes the impact of type I and type II errors on the committee overall profits. In particular, we demonstrate that, due to different opportunity costs, common, i.e., the decision maker in a democratic structure, is more likely than elite to commit a type II error. On the contrary, elite, i.e., the decision maker in an elite structure, is more likely than common to commit a type I error. The decision makers' ability to avoid errors that would cause substantial losses to the committee determines the efficiency of the democratic versus the elite governance structure.

We derive four main findings. First, the equilibrium messages are coarse. If a member learns the true value of a project, then it is not in the best interest of this member to communicate this value. The payoff maximizing choice of message consists of communicating only whether a project is favorable or unfavorable, i.e. communication is coarse in equilibrium. Second, we establish that the governance structure efficiency can be determined by focusing on a specific message exchange between member types, wherein common is favorable and elite is unfavorable to project implementation. This result simplifies the analysis substantially, in that it makes structure efficiency solely dependent on the ability of common to accept a profitable project and of elite to reject an unprofitable one. Third, we explicitly demonstrate that the distribution of revenues does impact the governance structure efficiency. In particular, a sufficiently high probability that revenues are higher than the weighted average opportunity cost determines the efficiency of a democratic structure. Likewise, a sufficiently high probability that revenues are lower than the weighted average opportunity cost determines the efficiency of an elite structure. Fourth, when the conditions above do not hold, we demonstrate that the governance structure efficiency depends on the probability of learning the value of the project revenues, which reflects the members' expertise and business management skills. In particular, we demonstrate that for extreme markets, where the expected revenues are either very high (nascent markets) or very low (mature markets), and for intermediate values of the average opportunity costs, the efficiency of the governance structure depends on the decision makers' probability of learning. Specifically, the democratic structure will be efficient in nascent markets if common has sufficiently high probability of learning, whereas the elite structure is efficient in mature markets if elite has high probability of learning. In markets that are not extreme, i.e., mixed markets, however, the governance structures' efficiency depends not only on the decision makers' probability of learning but also on the gap in this probability between decision makers and non-decision makers. As a result, the elite (democratic) structure is efficient in a mixed market if the gap in probability of learning between elite (common) and common (elite) is sufficiently high.

Collectively, our work establishes that the committee governance structure efficiency is determined by an interesting mix of heterogeneity in cost, distribution of revenues, and members' probability of learning future revenues.

Finally, our results are consistent with our main example of cooperatives in China. In particular, our work establishes that the Chinese cooperatives may have an elite governance because, depending on the market, (i) elite members have a high probability of learning, (ii) common members have a low probability of learning, or both these two conditions, coupled with a sufficiently wide gap between the two member types' probabilities of learning. According to recent literature, the conditions about probability of learning are consistent with our results for Chinese cooperatives, where there is a notable gap between the education and managerial skills of elite and common members (Liang et al., 2015). In fact, it is well-known that elite members have an advanced education and high knowledge of different areas of management, and generally have high opportunity costs, whereas common members are individuals with little education and very limited knowledge of business management concepts, and generally have low opportunity costs. This scenario especially holds true for agricultural cooperatives. Due to this and perhaps other types of heterogeneity among the cooperatives members, elite governance structures have emerged in Chinese cooperatives.

The remainder of this paper is organized as follows. In Section 2, we survey the related literature. In Section 3, we formulate our model and explain how communication takes place between the two committee member types and how decisions are made under each governance structure. Section 4 derives the equilibrium decisions, whereas Section 5 establishes the conditions of efficiency for each governance. In Section 6 we show the robustness of our results when common members are heterogeneous with respect to the opportunity cost. Finally, in Section 7 we formulate concluding comments and describe possible extensions to our work.

2. Literature review

In the new product development (NPD) literature, since the work by Cooper (2009) there has been growing interest in studying the stage-gate process to manage new projects. This process involves stages separated by gates where executives decide whether or not to move on to the next project stage. Since different people in the organizational hierarchy are responsible for the stages and the gates, there is an issue of both adverse selection and moral hazard associated with the go/no-go decision at the intervening gate. Manso (2011) and Hutchison-Krupat & Kavadias (2016) studied problems of incentives for innovation while considering the problem of adverse selection that is typically encountered at the early stages of a stage-gate. Mihm (2010) incorporated adverse selection into his analysis, but did not consider the development effort and resources that must be invested in the late stages of a project. Xiao & Xu (2012) and Chao, Lichtendahl, & Grushka-Cockayne (2014) include both adverse selection and moral hazard in a multi-stage model that involves the possibility of contract revision. In our work, we consider the information asymmetry between different committee members, but also allow members to communicate before the go/no-go decision is made. This communication can update the information both member types possess, and thus affect the go/no-go decision process.

Other NPD studies have looked at the effect of group diversity on projects implementation decisions. Kavadias & Sommer (2009) demonstrated that for cross-functional problems, the brainstorming group exploited the competence diversity of its participants, and ultimately attained better solutions than a group of individuals working independently. Girotra, Terwiesch, & Ulrich (2010) further examined the impact of team structures on the generation of ideas. The authors found that groups organized in a *hybrid* structure, in which individuals first worked independently and then worked together, were able to generate more and better ideas, and to better discern the quality of the generated ideas. Tang, Liao, Xu, Streimikiene, & Zheng (2020) considered large-scale group decision making problems, where the goal was to reach a certain level of consensus before a decision could be made. A comprehensive review of the research in idea generation and selection, and its implications for the management of technology, was provided by Kornish & Hutchison-Krupat (2017). All these articles did not consider how the heterogeneity of the group members might impact the decision to either undertake or not undertake a project. Consequently, the distinguishing focus of our work is whether a risky project should be accepted or rejected by the members of the committee.

Another stream of literature, both in economics and organizational design, has more specifically studied the problem of accepting good projects and rejecting bad ones. One of the first studies in this context was proposed by Sah & Stiglitz (1986). The authors investigated how individual evaluations of a project were aggregated into an organizational decision. Various aggregation rules were considered. One aggregation rule was to require unanimous approval by all project evaluators, i.e. every evaluator has a veto power. Such an organizational design is referred to as a *hierarchy*. For instance, the United Nations security council has this organizational design. The other organizational form was referred to as a *polyarchy*. Every evaluator in a polyarchy had the power to approve and implement a project. A prime example of a polyarchy is a market economy where every entrepreneur is allowed to start a project. The desirability of an organizational design depends on its ability to prevent errors in the decision making, that is, the error of rejecting a good project (i.e., a type I error), and the error of accepting a bad project (i.e., a type II error). Sah & Stiglitz (1986) determined that a polyarchy had a higher probability than a hierarchy of accepting a project, regardless of whether this project was deemed good or bad.

In a more recent work, Christensen & Knudsen (2010) extended the decision structures considered by Sah & Stiglitz (1986) to include all possible hierarchy and polyarchy organizations. The authors showed how organizational designers could identify the structure that most effectively reduced type I and/or type II errors (given any number of available decision makers). Csaszar & Eggers (2013) studied four information aggregation structures commonly used by organizations to evaluate opportunities: individual decision making, delegation to experts, majority voting, and averaging of opinions. They found that delegation was the most effective structure when there was a diversity of expertise, when accurate delegation was possible, and when there was a good fit between the firm knowledge and the knowledge required by the environment. Otherwise, depending on the knowledge breadth of the firm, majority voting or averaging of opinions could be the most effective structure. Leitner, Rausch, & Behrens (2017) investigated the case of a hierarchical organization with distributed investment decision-making power where the autonomously made investment decisions were coordinated.

Our model differs from the settings found in this second stream of literature in three ways: First, we consider heterogeneity between the decision makers, which implies that an accepted (rejected) project may be a good (bad) decision for one decision maker, while it is a type II error (type I error) for the other member type. As a consequence, we consider a conflict of interest between the decision makers that may result in an inefficient decision making process. Second, the implementation decision in an organizational design is assigned to a specific member in our model, whereas it depended solely on the number of votes in the previous literature. Third, we explicitly consider communication between the members of an organization, which may affect the members' knowledge of project profitability. All these characteristics are absent in previous literature and are crucial for analyzing committees efficiency in projects management.

Finally, our work is close to the research article by Oraiopoulos & Kavadias (2019), who studied the performance of go/no-go decisions within executive committees. We study the same type of decisions, but our ultimate objective is to compare democratic and elite governance structures with respect to decision making efficiency. In fact, Oraiopoulos & Kavadias (2019) considered only a democratic governance structure, whereas our work considers both a democratic and elite governance structure to understand how decision authority should be allocated in projects management within committees. Further, another distinguishing difference between our work and Oraiopoulos & Kavadias (2019) is that we model communication between member types. Specifically, we show that at equilibrium this communication materializes with the exchange of a favorable or unfavorable message from one member type to the other. Based on this communication, then, all members may update their information about the uncertain project revenues and cast their vote about project implementation.

3. Model

Let $i \in \{c, e\}$ denote the type of members in a committee, where "c" stands for common and "e" stands for elite. There is a total of $n \geq 3$ members of which E are elite members, $1 \leq E < \frac{n}{2}$. The committee's objective is to implement a project, whose cost is normalized to zero, whereas its revenue, θ, is stochastic with a CDF, $F(\theta)$, which is common knowledge. The two types of committee members are characterized by their *minimum acceptable return*, k_i, which can be interpreted as the member type i's opportunity cost of implementing the project. The opportunity cost is lower for common than for elite members, so that $k_c < k_e$.

The process of deciding whether the committee should invest in the project consists of the three following phases:

1. **Phase I: Initial information.** In this phase, all the committee members hold the same prior belief about the potential revenues of the project. The project is considered "good" by member type i if and only if its expected profit is positive, i.e., $E[\theta] > k_i$. It is considered "bad" otherwise.
2. **Phase II: Posterior information**. The initial information of the committee members is affected in two ways:
   (a) **Learning.** Each committee member may privately learn more about the stochastic revenues of the project by acquiring additional information about the project potential. This information can be related to how the market will respond to the project, the technical challenges that will arise in implementing it, the resources that will need to be allocated, etc. We assume there is perfect communication among type i members, that is, it is sufficient that one type i member learns the true value of θ that all the members of the same type will learn θ as well. As a consequence, we define q_i as the probability that at least one type i member learns the true value of revenues θ.[1]
   (b) **Communication**. Each member type may also acknowledge the expertise of the other type's members, understanding that they may hold valuable information. We model this exchange of information or *communication* between member types by assuming that the two member types simultaneously exchange a message m_i.

   Summarizing, in phase II, the committee members may learn more about the value of θ, and thus *update* their initial information, accounting for both the additional information that members of the same type can collect through learning, and the preferences held and exchanged through messages by the members of the other type in the committee.
3. **Phase III: Implementation decision.** Depending on the governance structure in the committee, each member votes whether to approve ("A") or reject ("R") the project.

We consider two governance structures for the committee. The first is named "democratic", and represents a majority decision rule where the project is implemented as long as it receives a favorable vote by the majority of the committee members.[2] The second is named "elite", and represents a decision rule where the project is implemented if and only if it receives a favorable vote by the elite members.[3]

The solution concept is perfect Bayesian equilibrium. Therefore, we specify the payoff maximizing choice of messages and the members' implementation decision as well as beliefs which are consistent with Bayes' rule. Once the equilibrium decision about project is derived, we compare the two governance structures of the committee in terms of *efficiency*. A governance structure is said to be "efficient" if it maximizes the expected surplus of all the committee members. Sources of inefficiency for the committee are the judgement errors that decision makers may make – a "bad" project that gets accepted or a "good" project that gets rejected. Using an analogy from the classical theory of statistical inference, we can say that a governance structure is efficient when it minimizes the negative impact of type I and type II errors on profits.

Finally, the last element of our model is related to the type of market under which project decisions are made. In particular, we classify markets with respect to the a priori expected revenues that can be attained through project implementation.

Definition 1. The market for the committee projects is said to be

1. *Mature* if $E[\theta] \le k_c$,
2. *Mixed* if $k_c < E[\theta] \le k_e$, and
3. *Nascent* if $E[\theta] > k_e$.

Henceforth, we will use the subscripts *Ma*, *Mi*, and *Na* to refer to the mature, mixed, and nascent market, respectively.

4. Equilibrium analysis

To determine the equilibrium implementation decision on the project, it is sufficient to analyze the decisions of the "pivotal" members, that is, the members whose vote is decisive to determine whether a project is accepted or refused, under each governance structure. In the baseline model, we only have two member types, i.e., common with opportunity cost k_c, and elite with opportunity cost k_e. In this case, the pivotal members are any common member under a democratic governance and any elite member under an elite governance. In Section 6, we extend the baseline model and analyze the case when there are three members' types, and show that the results derived here are qualitatively robust.[4]

Next, we consider Phase II, which requires to determine the nature of the equilibrium messages exchanged by the two committee member types. In fact, after the individual learning of each member type, our model posits that the committee members communicate their preferences by exchanging a simultaneous message. How does this message look like? Clearly, the gap between the k_i's, $i \in \{c, e\}$, creates a conflict of interests, in that a project that is profitable to one member type may be unprofitable to the other one. It is well known from the literature that conflicting interests render communication strategic. One party might decide not to truthfully reveal her information about θ because doing so is not in her best interest (Crawford & Sobel, 1982). In the following result, we derive the equilibrium messages during the communication and the corresponding beliefs that these messages induce.

Proposition 1. *The members types' equilibrium messages, exchanged during the communication in Phase II, are either "Y" or "N", which denote either a positive or a negative assessment of the project, respectively. The equilibrium belief of a member type i upon receiving "Y" ("N") is that the expected revenue (or, in case of learning, its realization) of the project is not lower (higher) than the opportunity cost of the member type who sent the message.*

Proposition 1 derives insights about the nature of the messages exchanged during the communication among members' types. Specifically, it states that even though one member type learned the true value of θ, he would not reveal it but rather send a coarse message of the kind Y or N. In other words, the member type

[1] Notice that the fact that a member type may learn the true value of θ introduces the possibility of *asymmetric information*. Specifically, it can happen that one member type learns θ and holds this information private, whereas the other member type does not learn θ and therefore proceeds on his original information, $F(\theta)$.

[2] Since common members represent the majority of the committee members and have the same opportunity cost, under a democratic governance structure common members are the ones who make the final decision. In Section 6 we introduce heterogeneity among common members in terms of their opportunity cost. As a consequence, we will see that common members may vote differently for a project.

[3] Our model applies also to other settings. One can think of a number of different types of projects where the elite members have actually lower opportunity costs than the common members. For instance, due to economies of scale and scope, bigger farmers might find it easier to implement certain changes that would be nearly infeasible for smaller farmers. Our results carry over to this setting by relabeling the members and the governance structures.

[4] The most general case would be that each committee member has a different opportunity cost. In this case, the result of the *Median Voter Theorem* (Black, 1948) would apply, asserting that the median member is pivotal under a majority rule-based decision making. We leave the general case for future research.

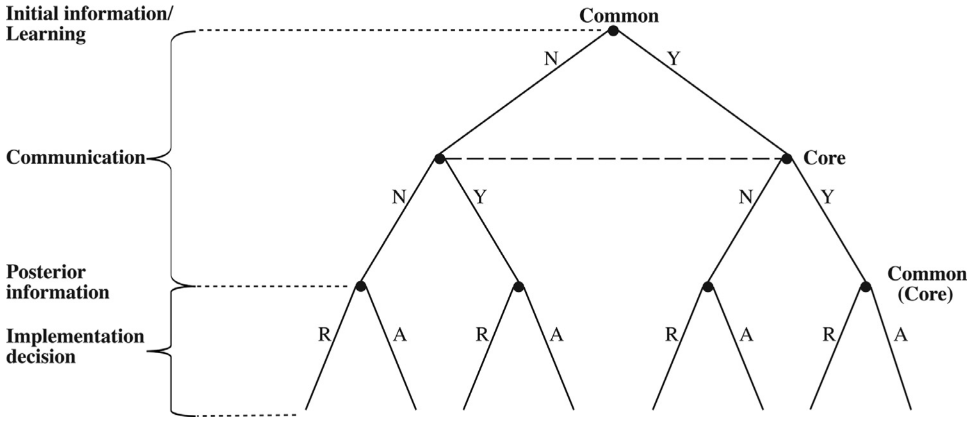

Fig. 1. Extensive form of the decision making process within the committee. Under a democratic (elite) governance structure, common (elite) either approves (A) or rejects (R) the project after simultaneously exchanging a Y or N message with elite (common).

would communicate whether the project is profitable or unprofitable to him, but would not give any other detail to the other members' type. The explanation of why the messages are coarse is as follows. Suppose that common learns θ and knows that $k_c \leq \theta < k_e$. If common reveals her information truthfully, then elite will not be in favor of the project. Therefore, under either governance common has a (weak) preference to claim $\theta \geq k_e$. The elite member, however, is aware of this strategic behavior and does not believe common. Indeed, elite interprets any message claiming $\theta \geq k_e$ as an indication that θ is at least as large as k_c. Therefore, common induces the same belief by communicating that she is in favor of the project without further details, i.e., by sending a message Y. Next, note that if common learns that $\theta < k_c$, then he does not have an incentive to conceal the true information as neither member types would like the project to be implemented. In this case, communicating N induces the same action as revealing the true value of θ. This shows that the equilibrium messages of common will be either Y or N. A symmetric argument would apply to the elite members who will also communicate with common members by sending either a Y or an N message.

Having established the nature of the messages exchanged by the two members types, Fig. 1 depicts the extensive form of the decision making process within the committee. In the next two sections, we solve the game represented in Fig. 1 and investigate the conditions under which a project would be accepted under each governance structure.

4.1. Democratic committee governance

Under a democratic governance, common is pivotal and therefore has the decision authority. Given their information about θ, common and elite member types exchange a message of either Y or N. It is clear that if both messages are positive (negative), i.e., YY (NN), there will not be any Bayesian update of the members types information, and thus, the project will be approved (rejected). Further, in case common learns the true value of θ by himself, the decision about the project will be taken independently of the message exchanged by elite. In this case, in fact, common will not use the message by elite to update his information; hence, common will approve the project if and only if $\theta > k_c$. The other cases where the messages are not symmetric or common does not learn θ are more complicated and deserve further discussion. The next result considers these cases and formalizes the conditions under which the project is approved by the democratic governance.

Proposition 2. *Under a democratic governance structure, the project is approved in the following cases:*

1. *if common learns θ, i.e., with probability q_c, when $\theta > k_c$;*
2. *if common does not learn θ, i.e., with probability $1 - q_c$, when one of the following conditions holds: (i) elite sends a Y message, (ii) elite sends an N message, the market is mixed, and $q_e E[\theta|\theta < k_e] + (1 - q_e)E[\theta] > k_c$, ($iii$) elite sends an N message, the market is nascent, and $E[\theta|\theta < k_e] > k_c$.*

As previously mentioned, under a democratic governance, common is the one who decides about project implementation. Clearly, if common learns the true revenues, and finds out that the project is profitable to him (i.e., $\theta > k_c$), the project will be approved (condition 1). The interesting case, however, is when common remains with his priors about the project profitability, which occurs with probability $1 - q_c$. Condition 2(i) states that common will follow the favorable message of elite when he has not learned θ. This result is intuitive as elite incurs a higher opportunity cost than common for the project; hence, elite's positive message signals the project must be profitable (either in expected or certain terms) to common as well. On the contrary, conditions 2(ii) and 2(iii) highlight the conflict of interest between the two members' types, wherein elite tries to dissuade common to reject the project by sending an N message, whereas common knows that this N message is untrustworthy.

In particular, when the market is mixed, the N message by elite does not reveal whether elite learned θ. In this case, then, common has to consider that with probability q_e elite learned θ, and thus the N message means $\theta < k_e$, whereas with probability $1 - q_e$ elite did not learn θ, and thus the N message is uninformative. In a mixed market, then, common will implement the project under condition 2(ii). When, instead, the market is nascent the N message by elite means elite learned θ and $\theta < k_e$. In this case, common will implement the project only under condition 2(iii).

4.2. Elite committee governance

Under an elite governance, elite has the decision authority about the project. As previously discussed for the democratic governance, also here the interesting cases are those where the messages exchanged are asymmetric and elite did not learn θ. The next proposition analyzes these cases and establishes when the project is implemented under an elite governance.

Proposition 3. *Under an elite governance structure, the project is approved in the following cases:*

1. *if elite learns θ, i.e., with probability q_e, when $\theta > k_e$;*
2. *if elite does not learn θ, i.e., with probability $1 - q_e$, when common sends a Y message and one of the following conditions holds: (i) the market is mature and $E[\theta|\theta > k_c] > k_e$, ($ii$)*

the market is either mixed or nascent and $q_c E[\theta|\theta > k_c] + (1 - q_c)E[\theta] > k_e$.

Under an elite committee governance, elite is the member type who has decision authority about project implementation. When elite learns θ (i.e., with probability q_e), the project is approved as long as $\theta > k_e$. This is a stricter condition than the one found for a democratic governance, as θ must be larger than a higher opportunity cost in this instance ($k_e > k_c$). When elite does not learn θ, an N message by common will always indicate that the project should be rejected. However, a Y message by common cannot be fully trusted by elite, as a profitable project to common may be unprofitable to elite. The decision depends on the market and the Bayesian information update by elite. In particular, if the market is mature (i.e., $E[\theta] \le k_c$), a Y message from common means that the latter learned θ, leading elite to assume $\theta > k_c$. If the market is either mixed or nascent (i.e., $E[\theta > k_c]$), a Y message from common does not prove learning by him. Thus, elite will have to consider the odds that common has learned θ as shown in condition 2(ii).

The previous analysis demonstrates that, when θ is known, the pivotal member will always accept (reject) the project as long as it is profitable (unprofitable) to him. However, a "good" project for the pivotal member may actually be "bad" for the whole committee. In a similar vein, a project that is "bad" for the pivotal member might be actually good for the committee. When θ is uncertain, the pivotal member can also make a decision that is not efficient for the committee as a whole. That is, the pivotal member might reject a project that is actually "good" for the committee, or accept a project that is actually "bad". Drawing from the theory of statistical inference, we can say that the pivotal members or decision makers can commit both type I (i.e., rejecting a "good" project) and type II (i.e., accepting a "bad" project) errors when there is uncertainty about θ.

In the next section, the determination of type I and type II errors will be crucial for evaluating the efficiency of a committee governance structure. In fact, the efficient governance can be derived as the one that minimizes the impact of type I and II errors on the profitability of the committee. In each case, we will answer the following questions: 1) Is the project, accepted by the pivotal member, expected to be profitable to the whole committee? 2) Is the rejected project expected to be unprofitable to the whole committee?

5. Efficient governance structure

Given the equilibrium decisions about the project, we now derive the efficient governance structure, that is, the structure that maximizes the committee expected surplus. This expected surplus is determined by the initial information about revenues as given by the distribution $F(\theta)$, the subsequent exchange of messages that may update the initial information, and the learning of each member type. Clearly, it is relevant to evaluate the efficiency of a governance structure only if the decision made under one governance is different from the one that is made under the other governance. Only in this case, in fact, it makes sense to compare the impact of a type I error made by one member type versus a type II error made by the other member type. The next result simplifies the efficiency analysis substantially by establishing that there is only one type of message exchange to consider.

Lemma 1. *To derive the efficient governance structure for the committee it is sufficient to consider the case where the messages exchanged are YN, i.e., common sends Y and elite sends N.*

Lemma 1 substantially simplifies the analysis of efficiency. The rationale behind this result is that all the possible message exchanges, except YN, lead to the same project implementation decision (accept or reject), regardless of the governance structure. As a consequence, these exchanges are irrelevant for comparing governance structures in terms of efficiency. The intuition for this result is as follows.

It is apparent that symmetric messages lead to the same implementation decision, no matter the governance structure. In particular, YY will result in project acceptance, whereas NN will result in project rejection. It is less intuitive, however, why NY also leads to the same implementation decision by either governance structure. To understand this result one should observe that the NY message exchange can never occur when both member types either learned or did not learn θ. In fact, either of these cases would imply that $k_c > k_e$, which contradicts one of the main assumptions of the model. As a consequence, the only possible case is that just one of the two member types learned θ. There are two cases. First, assume elite learned θ. In this case, the Y message by elite reveals to common that $\theta > k_e$, and thus the project will be accepted by either governance. Second, assume common learned θ. In this case, the N message by common reveals to elite that $\theta < k_c$, and thus the project will be rejected by either governance. In sum, all the possible message exchanges except for YN lead to the same implementation decision under either governance structure. Consequently, it is only relevant to consider the message YN to determine the efficient governance structure.

Lemma 1 implies that the implementation decision following YN determines which governance structure is efficient. Note, however, that YN can emerge only if the opportunity costs of common and elite differ. If $k_e = k_c$, then there is no possibility that a project is good for common and bad for elite. Therefore, absent cost heterogeneity, the member types would make a unanimous decision about project implementation, and both governance structures would be efficient. However, as the cost heterogeneity increases, it is more likely that θ falls in the interval $[k_c, k_e]$ and both members learn it. In this case the common member would implement the project, whereas the elite member would reject it. As a result, when k_c and k_e diverge, exactly one of the governance structures can be efficient: either the democratic one, which would implement the project, or the elite one, which would not implement it.

Lemma 2. *There always exist a unique efficient governance structure when* $k_c \neq k_e$.

We define $\Delta = k_e - k_c$ as the measure of heterogeneity. Our discussion so far shows that as long as $\Delta \neq 0$, there is always a unique efficient governance structure.

Next, note that the message YN might emerge when only one of the member types learns θ. For example, consider the elite committee in a mature or mixed market. If common learns that $\theta \ge k_c$, then she will send Y. The elite member, who did not learn, updates her belief and knows that the expected return of the project is $E(\theta \mid \theta \ge k_c)$. As a result, elite implements the project if and only if $E(\theta \mid \theta \ge k_c) \ge k_e$. If the heterogeneity is not too large, i.e., k_e and k_c are not too distant, then condition $E(\theta \mid \theta \ge k_c) \ge k_e$ holds true. There is, however, a level of heterogeneity such that $E(\theta \mid \theta \ge k_c) < k_e$. In other words, if Δ is large enough, then elite does not implement the project following YN. A symmetric argument also applies to the democratic committee in a nascent market. If Δ is large enough, then the common implements the project when she does not learn and the message is YN. It requires that $E(\theta \mid \theta < k_e) \ge k_c$.

Summarizing, we can say that the difference between the total surplus generated in the two governance structures increases with heterogeneity Δ. This increase results from the fact that as Δ grows, it becomes more likely that θ falls between k_c and k_e. In addition, there is a threshold for Δ in each market such that YN results in different implementation decisions in the democratic versus elite governance when Δ is equal or larger than that threshold. The following assumption ensures that YN leads to a different implementation decision in each governance structure.

Assumption 1. In all market types, heterogeneity Δ is large enough such that $E(\theta \mid \theta < k_e) \geq k_c$ and $E(\theta \mid \theta \geq k_c) < k_e$.

Assumption 1 guarantees that YN always results in implementing the project in the democratic governance and aborting it in the elite committee.

The next result derives the committee expected surplus for each of the three markets under consideration: mature, mixed, and nascent.

Proposition 4. *Let* $E_L = E[\theta|\theta \leq k_e]$, $E_M = E[\theta|k_c < \theta \leq k_e]$, $E_H = E[\theta|\theta > k_c]$. *Further, let* $\bar{k}$ *denote the weighted average opportunity cost, i.e.,* $\bar{k} = \frac{(n-E)k_c + Ek_e}{n}$. *When member types exchange the message YN, the committee expected surplus,* E_S^j *for market* j, $j \in \{Ma, Mi, Na\}$ *is given by:*

$$E_S^j = \frac{1}{A^j}\begin{cases} q_c q_e[F(k_e) - F(k_c)]\left[E_M - \bar{k}\right] + q_c(1-q_e)[1-F(k_c)]\left[E_H - \bar{k}\right], & j = Ma \\ q_c q_e[F(k_e) - F(k_c)]\left[E_M - \bar{k}\right] + (1-q_c)(1-q_e)\left[E[\theta] - \bar{k}\right] + \\ (1-q_c)q_e F(k_e)\left[E_L - \bar{k}\right] + q_c(1-q_e)[1-F(k_c)]\left[E_H - \bar{k}\right], & j = Mi \\ q_c q_e[F(k_e) - F(k_c)]\left[E_M - \bar{k}\right] + q_e(1-q_c)F(k_e)\left[E_L - \bar{k}\right], & j = Na \end{cases}, \quad (1)$$

where A^j *is detailed in the Appendix. The elite (democratic) governance structure is uniquely efficient in market* j *if and only if* $E_S^j < 0$ *(*$E_S^j > 0$*).*

The details for deriving the committee expected surplus E_S^j are reported in the Appendix. Here, we develop some intuition about the terms that appear in (1). In particular, it may be observed that the three expected values of θ, E_L, E_M, and E_H, are conditional on information that can be derived from the message exchange YN. For instance, E_L occurs when elite has learned θ and his N message reveals that $\theta \leq k_e$. To illustrate, in a nascent market, since $E[\theta] > k_e$, elite's N message reveals to common that elite knows θ, and thus $\theta \leq k_e$. A similar reasoning can be made for E_H, which may occur in a mature market. In this case (i.e., $E[\theta] \leq k_c$), common's Y message reveals to elite that common knows θ and $\theta > k_c$. In a mixed market, it is possible that only one member type learns θ, both learn θ, or none learns θ. For instance, if both types learn θ (i.e., with probability $q_e q_c$), common's Y message means $\theta > k_c$, whereas elite's N message means $\theta < k_e$. This explains the term $q_e q_c E_M$ in the expression of E_S^{Mi}. Likewise, if neither member type learns θ, the YN message exchange will be completely uninformative, which explains the term $(1-q_e)(1-q_c)E[\theta]$ in E_S^{Mi}.

The fact that we are focusing on the YN message exchange means that a priori common would like to accept (by sending Y) the project, whereas elite would like to reject (by sending N) it. The efficient structure emerges when the decision maker makes the right decision for the whole committee. More specifically, the condition $E_S^j < 0$ means that it is better to reject the project in market j. Thus, the elite structure would be efficient in this case, as it would avoid an expected loss for the committee, whereas the democratic structure would welcome such a loss. The opposite condition, $E_S^j > 0$, indicates that it is better to accept the project. Thus, the democratic structure would now be efficient, as it would attain an expected positive gain for the committee, while an elite committee would have passed on the project.

Although the results in Proposition 4 are general and can be used to compare the two governance structures with respect to efficiency, they lack managerial insight. In other words, we still need to understand what factors drive efficiency. In particular, the following questions still remain open:

1. What is the impact of the distribution of θ on efficiency?
2. What about the probability of learning θ?

Table 1
Sufficient condition for the efficiency of democratic and elite governance structure for each market.

Market	Democratic Structure	Elite Structure
Mature	$E_M > \bar{k}$	$E_H < \bar{k}$
Mixed	$E_L > \bar{k}$	$E_H < \bar{k}$
Nascent	$E_L > \bar{k}$	$E_M < \bar{k}$

The next set of results provides the answers to these questions. First, we will address the question about the impact of the distribution of θ on the governance structure efficiency. Remember, when there is a YN message exchange between common and elite, an elite governance will be efficient if it rejects a project whose expected surplus is negative, whereas a democratic governance will be efficient if it accepts a project whose expected surplus is positive (as per Proposition 4). Of course, this expected surplus depends on the distribution of θ. Therefore, the next proposition establishes sufficient conditions on the distribution of θ for governance structure efficiency.

Proposition 5. *A sufficient condition for the efficiency of each governance structure is reported in Table 1.*

Recall from Proposition 4 that a democratic (elite) structure is efficient in market j, $j \in \{Ma, Mi, Na\}$ if and only if $E_S^j > 0$ ($E_S^j < 0$). In essence, Proposition 5 states that if the (conditional) expected value of θ is higher (lower) than the weighted average opportunity cost, $\bar{k} = \frac{(n-E)k_c + Ek_e}{n}$, then a democratic (elite) structure is efficient. The conditions reported in Table 1 can be easily understood for a specific market. For instance, when considering a mature market, we derived in Proposition 4 that $E_S^{Ma} = \frac{q_c}{A^{Ma}}\left\{q_e[F(k_e) - F(k_c)]\left[E_M - \bar{k}\right] + (1 - q_e)[1 - F(k_c)]\left[E_H - \bar{k}\right]\right\}$. Clearly, q_c does not determine the sign of E_S^{Ma}. Further, it is readily verified that $E_H > E_M$ (see proof of Proposition 4 in the Appendix); hence, the expression in brackets (which represents an expected profit) is minimized when $q_e = 1$. Therefore, in a democratic structure, it is sufficient to have $E_M > \bar{k}$ to obtain $E_S^{Ma} > 0$. A similar but reversed reasoning can be applied to the elite committee, where it is sufficient that $E_H < \bar{k}$ to have $E_S^{Ma} < 0$. Finally, the sufficient conditions for a democratic or elite structure efficiency can be similarly derived in other markets.

Regarding the second open question, we study the effect of the member's probability of learning θ on structure efficiency. Intuitively, one would expect that a governance structure is efficient when the decision makers under that structure have a high probability of learning the true value of revenues θ. In other words, high information, expertise and knowledge of common members should make the democratic structure efficient, whereas if the elite members possessed the same skills, this should make the elite structure efficient. The next result shows that this intuition holds, but only under specific conditions – the effect of the probability of learning on governance structure efficiency is much more complex than expected.

Proposition 6. *The effect of learning probability on governance structure efficiency is given as follows:*

1. *When* $E_M < \bar{k} < E_H$, *the elite governance structure is efficient in a mature market if and only if* $q_e > q_e^* = \frac{[1-F(k_c)][E_H - \bar{k}]}{[1-F(k_c)][E_H - \bar{k}] - [F(k_e) - F(k_c)][E_M - \bar{k}]}$;
2. *When* $E_L < \bar{k} < E_H$, *the elite governance structure is efficient in a mixed market if and only if either* $q_e > q_e^*(q_c)$, *where*

$\frac{\partial q_e^*(q_c)}{\partial q_c} \geq 0$, or $q_c < q_c^*(q_e)$, where $\frac{\partial q_c^*(q_e)}{\partial q_e} \geq 0$ (the expressions of $q_e^*(q_c)$ and $q_c^*(q_e)$ are reported in the Appendix);

3. *When $E_L < \bar{k} < E_M$, the democratic governance structure is efficient in a nascent market if and only if $q_c > q_c^* = \frac{F(k_e)[E_L-\bar{k}]}{[F(k_e)-F(k_c)][E_M-\bar{k}]-F(k_e)][E_L-\bar{k}]}$.*

A first observation from Proposition 6 is that the learning probability does affect the governance structure efficiency, but only when the weighted average opportunity cost, $\bar{k}$, is neither too high nor too low. This is consistent with the sufficient conditions reported in Table 1.

We know from Proposition 4 that an elite (democratic) governance structure is efficient in market j when $E_S^j < 0$ ($E_S^j > 0$). Since we are focusing on a YN message exchange (where common communicates Y and elite communicates N), the elite structure efficiency is driven by the ability of elite to reject a bad project, whereas the democratic structure efficiency is determined by the ability of common to accept a good project. Clearly, in a mature market, where projects are expected to be unprofitable to the committee, the elite structure is more likely to be efficient as opposed to the democratic structure. However, as condition 1 of Proposition 6 states, for intermediate values of the average opportunity costs, the efficiency of the elite structure is determined by the probability of learning of the pivotal members. That is, the elite structure is efficient if and only if elite members have sufficiently high probability of learning, i.e., $q_e > q_e^*$. On the contrary, in a nascent market, where projects are expected to be profitable to the committee, the democratic structure is more likely to be efficient than the elite structure. In fact, and according to condition 3 of Proposition 6, the democratic structure is efficient in a nascent market if and only if the common members have sufficiently high probability of learning, i.e., $q_c > q_c^*$. Together, these two conditions establish that in extreme market conditions (i.e., either mature or nascent market), and for intermediate values of the weighted average opportunity cost, the governance structure efficiency is determined by the probability of learning of the decision makers (or pivotal members) being sufficiently high.

More complex are the conditions for structure efficiency in mixed markets. In these markets, it is still true that the structure efficiency depends on the decision makers' probability of learning being sufficiently high. However, it also depends on the gap between the probabilities of learning of decision makers and non-decision makers. In fact, looking at condition 2 of Proposition 6, in mixed markets and for intermediate values of the average opportunity costs, the elite governance structure is efficient if and only if the elite members' probability of learning is sufficiently high. However, this condition is more easily satisfied as the common members' probability of learning becomes lower.

These results are consistent with the governance structures that we observe in cooperatives in China. In fact, if we assume that China is a nascent market, our work establishes that cooperatives with elite governance structures are efficient when common members have sufficiently low probability of learning. If instead China is a mixed market, then the efficiency of the elite governance will be driven by the gap in learning probability between common and elite members. According to recent literature on Chinese cooperatives, these conditions hold true in either market. Indeed, elite governance structures for Chinese cooperatives are characterized by a marked difference between the two member types: Elite members have high education and managerial skills, whereas common members sometimes lack even the most basic education (Liang et al., 2015). This gap between member types' probabilities of learning is one reason (and certainly not the only one) why elite governance structures have emerged in Chinese cooperatives.

6. Extension: The case of three Members' types

In this section, we relax the assumption that there are only two member types, as identified by the two different opportunity costs, and show how the results of the paper carry over when an additional member type is introduced. Specifically, we analyze the case where the members of the committee may have three possible opportunity costs, k_l, k_m, and k_h, with $k_l < k_m < k_h$, and refer to these as *low*, *medium* and *high* type, respectively. Let also n_l, n_m, and n_h denote the numbers of members of low, medium, and high type, where clearly the sum of these numbers equals the total number of the committee's members, n. Further, it is reasonable to assume that there are only a few members with the highest opportunity cost, so that $n_h < \frac{n}{2}$. Under these settings, we consider the democratic governance structure, where the decision is made according to the majority of votes, and the elite governance structure, where the decision is made by the high type members.

As we pointed out in the analysis of the baseline model, it is crucial to identify the pivotal member under each governance. For the elite governance, the pivotal member is any of the high type members. For the democratic governance, instead, the pivotal member can belong to either the low or the medium type, depending on the value of n_l. In particular, if $n_l > \frac{n}{2}$ then the pivotal member will be of low type, otherwise he will be of medium type. In the following, we analyze the case of $n_l < \frac{n}{2}$ so that the pivotal member is of medium type. The analysis would be completely similar for the other case.

The difference between this setting and the baseline one is that the committee has a number of members (i.e., the low type members) who are non-pivotal in either committee governance structures and have a lower opportunity cost than the other two types of members. Similarly to the baseline model, we refer to q_i, $i \in \{l, m, h\}$ as the probability that at least one member of type i learned revenues θ. Further, the definition of mature, mixed and nascent market, provided by Definition 1, is now contingent on the opportunity cost of the pivotal committee members under either governance structure. Specifically, in this extension the market is said *mature* if $E[\theta] \leq k_m$, *mixed* if $k_m < E[\theta] \leq k_h$, and *nascent* if $E[\theta] > k_h$.

To facilitate the comparison between our baseline model and this extension, we consider that the elite type corresponds here to the high type, the common type to the medium type, whereas the low type has now been added. Thus, in this extension we have added a type of members with the lowest opportunity cost. Next, we discuss how the results previously derived change with this new setting.

6.1. Equilibrium analysis

We first want to highlight how the decision making under either governance is affected by the new setting. Let's first consider the democratic governance. Clearly, there is no change when the pivotal (i.e., medium type) member learns θ. In this case, the message of the pivotal member will drive the vote of the non-pivotal low type, and thus the project is approved as long as $\theta > k_m$. When the medium type does not learn θ, however, the decision on the project depends on both the messages from the high and the low types. In particular, it may be noticed that it is no longer sufficient that the high type sends a favorable message "Y" to drive the decision of the medium type. This would be true only when $E[\theta] < k_h$, i.e., the market is either mature or mixed. When, instead, the market is nascent, the project will be accepted only if the message by the low type is also favorable. On the other hand, when the message by the high type member is unfavorable, the project would be approved only if the low member sends Y, and an additional market-dependent condition is satisfied. For instance, if the market is nascent, the additional condition would be as follows:

$$q_l E(\theta \mid k_l \le \theta < k_h) + (1 - q_l) E(\theta \mid \theta < k_h) \ge k_m. \quad (2)$$

To understand condition (2), consider that the N message by the high type in a nascent market reveals that the high type learned θ and $\theta < k_h$. For the low type, if he learns, i.e., with probability q_l, then his Y message indicates that $\theta \ge k_l$. Otherwise, his Y message is uninformative, which explains condition (2). Similar reasoning can be carried out for the other markets. Under a democratic governance, then, the addition of a new type with the lowest opportunity cost requires not only the conditions specified in Proposition 2, but also a favorable message from the non-pivotal low type members.

Next, consider the elite governance structure. It is apparent that the results of our previous analysis, as reported in Proposition 3, would be still valid as long as both the low and medium types send a Y message to the high type. In fact, for mixed and nascent markets an N message from the low type would necessarily reveal to the decision-maker high type that the true value of θ is lower than k_h.

We can summarize the changes in Propositions 2 and 3 about project implementation decision under each governance as follows. Consider the initial committee consisting of only two member types: medium (or common) and high (or elite). If the decision-maker under each governance, i.e., the pivotal member, learns θ, then he will ignore the messages of the other members. Thus, the addition of the non-pivotal low type does not change the decision. If the pivotal member does not learn, however, the message of the added non-pivotal member will be crucial. If this message is N, then the project is not implemented in either type of governance structure (except when the composition of messages imply no learning from the non-pivotal member, such as NYN when $E(\theta) < k_l$). Otherwise, when this message is Y, then the project would be implemented but with stricter conditions than the case of two members' types. In general, we can say that the addition of the non-pivotal low type results in dropping some projects that otherwise would have been implemented and this effect is independent of the committee governance. Therefore, the results and insights of Proposition 2 and 3 carry over when there is a third member type.

6.2. Efficient governance structure

In the original setting, with only two types of members, we found in Lemma 1 that to determine the efficient structure it was sufficient to focus on the message exchange YN between the two member types, wherein Y was sent by common and N by elite. Following the same logic as in Lemma 1, when there are three members' types, the unique efficient governance structure can be determined only when focusing on the YN message between the two pivotal members, i.e., the medium and high types. As a consequence, including the message of the low type, there are two possible sequences of messages that we should consider: NYN and YYN. The first message sequence, NYN, leads to different decisions of the governance structures about project implementation only when $E[\theta] < k_l$. Only in this case, in fact, it follows that the low type did not learn θ, whereas the medium type did learn it. As a consequence, under a democratic governance, both low and medium types will vote in favor of the project, but under the elite governance the project can be rejected by the high type if $E[\theta|\theta > k_m] < k_h$. Regarding the sequence YYN, instead, the democratic and elite governance structures can make a different decision about project implementation for any market. For instance, when the market is nascent, i.e., $E[\theta] > k_h$, then the N by the high type reveals to the other members that the high type members learned that $\theta < k_h$. Under the elite structure, then, the project will be rejected. However, as long as $E[\theta|\theta < k_h] > k_m$ the pivotal medium type will accept the project under a democratic governance structure. It makes only sense, then, to study the efficiency of the governance structure when the sequences of messages is either NYN or YYN. In the following, we restrict our discussion to the latter sequence of messages, as the former is specific to the case of a very low expected value of the project revenues (i.e., $E[\theta] < k_h$).

Next, we show how Propositions 4 to 6 change as a result of adding the low type. Consider the expected surplus following the message YYN in a mature market. Note that the Y message from the medium type implies that $\theta \ge k_m$, whereas the Y message from the low type is uninformative in this case. Therefore, the expected surplus is the same found in Proposition 4 in a mature market. Consider now the nascent market. The message YYN implies that the high type has learned θ, and thus $\theta < k_h$. The expected surplus for the message sequence YYN is given by:

$$\frac{1}{A}\Big\{q_l q_m \frac{F(k_h) - F(k_m)}{F(k_h)} E(\theta \mid k_m \le \theta < k_h - \bar{k}) + (1 - q_m)(1 - q_l)$$
$$E(\theta \mid \theta < k_h - \bar{k}) + q_l(1 - q_m)\frac{F(k_h) - F(k_l)}{F(k_h)} E(\theta \mid k_l \le \theta < k_h - \bar{k})$$
$$+ q_m(1 - q_l)\frac{F(k_h) - F(k_m)}{F(k_h)} E(\theta \mid k_m \le \theta < k_h - \bar{k})\Big\}, \quad (3)$$

where A is the probability of occurrence of the message YYN,[5] and $\bar{k}$ is the weighted average of the opportunity costs. Comparing the expression in (3) with the expected surplus in Proposition 4 for the nascent market, i.e., $j = Na$, we observe that the addition of the low type increased the expected surplus. This result is expected as a Y message coming from a member with lower opportunity cost decreases the likelihood that the project be accepted when $\theta < k_l$. The same logic would apply to the mixed market, that is, the addition of a low type results in an increase of the total expected surplus.

Regarding Proposition 5, we show that the intuition behind this proposition carries over to the case of three members' types. To illustrate, consider the nascent market. For this market, Proposition 5 states that if the expected surplus is not lower than the weighted average of the opportunity costs, which we denoted by $\bar{k}$, then the democratic governance is efficient, otherwise the elite is efficient. Consider now the expression of the expected surplus for a nascent market in (3). Note that the smallest expected term in (3) is $E(\theta \mid \theta < k_h)$. Therefore, if $E(\theta \mid \theta < k_h) \ge \bar{k}$, then the expected surplus is guaranteed to be positive and thus the democratic governance is for sure efficient. On the contrary, the largest expectation in (3) is $E(\theta \mid k \le \theta < k_h)$. If $E(\theta \mid k_m \le \theta < k_h) < \bar{k}$, then the total expected surplus is guaranteed to be negative, and in this case the elite governance is efficient.

Finally, consider the results of Proposition 6. As we previously mentioned, the main insight from this proposition is two-fold. First, if the market is very favorable (unfavorable), then the governance structure that implements (does not implement) the project, i.e., the democratic (elite) governance, is efficient. Note that efficiency requires the total surplus to exceed the weighted average of opportunity costs, $\bar{k}$. The insight carries over in the mature market as adding the third member type does not change the expression of the expected surplus in (4). Consider the nascent market. Note that if the market is too favorable, then the term $E(\theta \mid \theta < k_h)$ in (3), that is, the smallest term, will be not lower than $\bar{k}$. As a consequence, the democratic committee that implements the project is efficient. If, on the other hand, the market is unfavorable, then the term $E[\theta \mid k_m \le \theta < k_h]$ will be lower than $\bar{k}$, and thus the elite committee, which does not implement the project, is efficient. The

[5] The expression of A is as follows: $A = q_l q_m \frac{F(k_h)-F(k_m)}{F(k_h)} + (1 - q_m)(1 - q_l) + q_l(1 - q_m)\frac{F(k_h)-F(k_l)}{F(k_h)} + q_m(1 - q_l)\frac{F(k_h)-F(k_m)}{F(k_h)}$.

second part of the insight of Proposition 4 implies that in order for a governance structure to be efficient, the decision rights should be allocated to member whose preference is more aligned with the market, given that the member is highly knowledgeable. We show that this part also carries over in this extension. Assume that the market is not favorable and not too unfavorable. That is,

$$\frac{F(k_h)-F(k_m)}{F(k_h)}E(\theta \mid \theta < k_h) < \bar{k} < E(\theta \mid k_m \leq \theta < k_h).$$

Note from (3) that if q_l and q_m are very small, i.e., $q_l \approx 0, q_m \approx 0$, then (3) becomes less than $\bar{k}$ as all terms but $\frac{F(k_h)-F(k_m)}{F(k_h)}E(\theta \mid \theta < k_h)$ diminish. If, on the other hand, $q_l \approx 1, q_m \approx 1$, we see that the expected surplus in (3) goes to $E(\theta \mid k_m \leq \theta < k_h)$ which is larger than $\bar{k}$. Again, when the market is not extreme, the democratic committee is more efficient than the elite committee only if those in favor of the project (low and medium type members) are highly likely to learn.

7. Concluding remarks

The ability to select appropriate projects is crucial for the successful development of any business. In this article, we have modeled and studied how members of a committee interact and communicate information to each other, and ultimately make a decision about project implementation. The motivation for our research derives primarily from the observation of governance structures in cooperatives, which have been recently documented in the literature. This phenomenon is particularly prominent in emerging economies, such as China. On the one hand, the Chinese Farmer Cooperative Law specifies that cooperatives are organizations collectively owned and democratically controlled by members. In fact, the basic voting rule within cooperatives is "one member, one vote", which allocates equal rights to all members in the cooperatives decision making process. On the other hand, the majority of Chinese cooperatives allocates voting and decision rights to only a limited subset of the total number of members. In practice, the majority of the members is deprived of the right to vote, even though they are usually allowed to participate in the project evaluation phase. As Liang et al. (2015) report, "real decision authority in a skewed cooperative lies with the management, rather than with the membership".

Motivated by the business example of cooperatives, in this article we have considered a committee formed by common and elite members under either a democratic or elite governance. The main question we addressed in this article is under what conditions we should prefer one governance structure over the other. To answer this question, we analyzed the internal structure of the committee. First, we considered that common and elite members may have different outside options, and thus a different opportunity cost for the project. Second, the two member types may acquire additional information about the project potential, and thus learn the related revenues. The probability of learning the value of future revenues is also different between the two member types. Third, for each governance structure we considered that the two member types communicate to each other their preferences about the project, which at equilibrium materialized into the exchange of either a favorable or an unfavorable message. Depending upon the committee governance structure, once this message is communicated, either common or elite members make the final project implementation decision.

Through our analysis, we determine the efficient governance structure for the committee, that is, the one that maximizes the expected surplus of the project. In particular, we show that the democratic structure is efficient when it accepts a project whose expected surplus is positive, whereas the elite structure is efficient when it rejects a project whose expected surplus is negative. As a consequence, the governance structure efficiency depends on the ability to avoid either a type I or type II error of judgement.

From a managerial point of view, we derive the following results: first, we show that if the distribution of the revenues is very left-skewed (right-skewed) then only the democratic (elite) governance can be efficient thanks to its role in accepting (rejecting) a good (bad) project. When the distribution of revenues is not extreme, instead, the efficiency of the governance structures also depends on the probability of learning of the member types. In particular, we show that for mature and nascent markets the efficiency of the elite governance depends on the probability of learning of the decision makers being sufficiently high. However, in the case of mixed markets, governance structure efficiency depends on the gap in probability of learning between the decision makers and the non-decision makers. The phenomenon of governance structures in China seems consistent with these findings, as a limited number of members there have much higher opportunity costs and learning potential than the majority of the cooperative members.

Starting from this work, there are several avenues of future research that can be considered. First, we showed that both type I and type II errors can be committed by the committee members, due to the different opportunity costs that generate a conflict of interest within the committee. Inefficiencies of this type, however, may occur in a one-shot game, but a different scenario could occur in a repeated game. As a consequence, further research could consider repeated games, and evaluate the efficiency of structures in deciding on a number of projects rather than on one single project. Second, there are several other aspects in the committee decision making process that can be included in the model. For instance, An, Cho, & Tang (2015) reported aspects of members' risk aversion, brand awareness, and process yield improvement that were relevant to the committee decision making process. As such, we hope our work will spark further innovative research in this area.

Appendix A

Table of Notation

Table 2
Main notation.

i	type of members, either common or elite, $i \in \{c, e\}$
n	number of members in the committee
E	number of elite members in the committee
k_i	opportunity cost of the project for member type i; $k_e > k_c$
θ	revenues of the project, distributed according to $F(\theta)$
q_i	probability that at least one member of type i learns the true value of θ

Proof of Proposition 1

Notice that if either elite or common has learned θ, then he will ignore the message of the other member type. In addition, when the message sender is the decision maker, he will be indifferent between sending any message as the receiver does not affect the implementation decision. The relevant case happens only when the sender does not have the decision rights, i.e., the elite under a democratic governance and common under an elite governance. Consider the case when elite learns that $k_c \leq \theta < k_e$ under a democratic governance. If elite truthfully reveals θ to common and the latter believes it, then common implements the project. This is not in the best interests of elite. Elite can do better by claiming θ is less than k_c whenever $k_c \leq \theta < k_e$. As a result, elite has incentive not to reveal θ truthfully when $\theta < k_e$. Knowing this, common does not believe elite whenever the latter claims that $\theta < k_c$ and interprets this message as an indication that $\theta < k_e$. As a result, any message of elite claiming $\theta < k_c$ induces the same belief in common, and thus elite is indifferent between sending N and any value of the revenues below k_e.

Next, if elite learns that $\theta \geq k_e$, then it is in the best interest of elite to reveal the true value as it leads to implementing the project by common under a democratic governance. Note that sending any message implying $\theta > k_e$ is equivalent to sending a Yes (Y). Finally, when elite does not learn θ, she relies on her prior and sends a message based on the expected value of θ. In case the expected value of θ is larger than k_e, she is indifferent between sending any message implying $\theta \geq k_e$ and sending a Yes (Y), as both induce the same belief in common. In case the expected value of theta is less than k_e, elite is indifferent between sending any message implying that $\theta < k_c$ and a No (N), as both induce the same belief in common. As a result, the equilibrium communication strategy of elite entails the following:

- Sending Y whenever she learns that $\theta \geq k_e$ or when she does not learn, and the expected value of θ is equal or more than k_c.
- Sending N whenever she learns that $\theta < k_e$ or when she does not learn and the expected value of θ is less than k_e.

The equilibrium belief of common entails believing that θ or its expected value is equal or larger than k_e when the message is Y and believing that θ or its expected value is less than k_e when the message is N.

A symmetric argument shows that, under an elite committee, common does not truthfully reveal θ when he learns that $\theta < k_e$ because if he does so and elite believes it, then elite would not implement the project when $k_c \leq \theta < k_e$. Thus, common is better off claiming $\theta > k_e$ when $k_c \leq \theta < k_e$. Given this fact, elite does not believe common when the latter claims $\theta > k_e$. Following the same line of argument as for the case of elite, the equilibrium communication strategy of common entails

- Sending Y whenever he learns that $\theta \geq k_c$ or when he does not learn and the expected value of θ is equal or more than k_c.
- Sending N whenever he learns that $\theta < k_c$ or when he does not learn and the expected value of theta is less than k_c.

The equilibrium belief of elite entails believing that θ or its expected value is equal or larger than k_c when the message is Y and believing that θ or its expected is less than k_c when the message is N.

Proof of Proposition 2

In a democratic structure, common makes the decision about implementing the project. It is clear, then, that when common learns the true value of θ, which occurs with probability q_c, he will accept the project if $\theta > k_c$. Condition 1 of the proposition follows from this reasoning. However, when common does not learn θ, he will observe the message from elite. Clearly, if elite sends a Y message it means that either $E[\theta] > k_e$ or $\theta > k_e$, which are both good enough for common to accept the project, as stated by condition $2(i)$. However, if elite sends an N message, common cannot necessarily infer whether elite has learned or not. That is, common does not always know whether $\theta > k_c$ or $E[\theta] > k_c$. When elite sends the N message, we focus on the message exchange YN to let the project have a chance to be accepted. For $E[\theta] \leq k_c$ there is never a message exchange YN without common learning θ. Therefore, in the mature markets the project will be never accepted as long as common is uncertain about θ. Consider next the mixed market, i.e., $k_c < E[\theta] \leq k_e$. The message exchange YN always occurs, unless elite learns θ and $\theta > k_e$. Common, then, can only evaluate the odds that elite has learned the true revenues. Thus, common will compute $q_e E[\theta|\theta < k_e] + (1 - q_e)E[\theta]$ and accept the project if this value is $> k_c$, which proves condition $2(ii)$. The last case is when the market is nascent, i.e., $E[\theta] > k_e$, where the N message by elite means $\theta < k_e$. In this case, common will evaluate $E[\theta|\theta < k_e]$ and accept the project if this expected value is $> k_c$. This proves condition $2(iii)$.

Proof of Proposition 3

In an elite structure, elite makes the decision about implementing the project. If elite learns θ, which occurs with probability q_e, he will accept the project as long as $\theta > k_e$. If instead elite does not learn θ, then the project will never be accepted if common sends N. In fact, the N message by common means that either $\theta < k_c$ or $E[\theta] < k_c$, which are both unprofitable conditions for elite. We focus, then, on the remaining cases where common sends a Y message and elite does not learn θ. There are two scenarios. First scenario is the one of mature markets, i.e., when $E[\theta] \leq k_c$. In this case, the Y message by common means that common learned θ and $\theta > k_c$. Elite then will accept the project if $E[\theta|\theta > k_c] > k_e$. Second scenario is the one of mixed or nascent markets, i.e., when $E[\theta] > k_c$. In this case, the Y message by common is not fully informative to elite, who has to evaluate the odds that common learned θ. In particular, with probability q_c common learned θ, and thus $\theta > k_c$, but with probability $1 - q_c$ common did not learn θ, and the Y message by common is completely uninformative. Elite then accepts the project if $q_c E[\theta|\theta > k_c] + (1 - q_c)E[\theta] > k_e$, that is, when condition $2(ii)$ is satisfied.

Proof of Lemma 1

The proof is already contained in the main text.

Proof of Lemma 2

The proof is straightforward and thus omitted.

Proof of Proposition 4

We need to derive the perfect Bayesian Nash equilibrium for each market j, $j \in \{Ma, Mi, Na\}$. We carry out a full analysis for the nascent market, i.e., $j = Na$, in which $E[\theta] > k_e$. The analysis for the other markets is similar. We denote by PL the event where common remains with his prior, whereas elite learns the value of θ. Focusing on the message exchange YN, there are only two possible learning outcomes: 1) LL and 2) PL. In fact, LP and PP are not possible because elite would not send an N message if he does not learn θ and $E[\theta] > k_e$. There are three cases, depending on the value of θ.

(i) $\theta < k_c$. In this case, only the PL learning is feasible, because when both member types learn that $\theta < k_c$ the only possible message exchange would be NN. Assuming common and elite exchange a YN message, elite learns θ and his N message means that $\theta < k_e$. Under a democratic governance, the expected profits of common and elite are given by: $E[\Pi_c] = E[\theta|\theta < k_c] - k_c$ and $E[\Pi_e] = E[\theta|\theta < k_c] - k_e$. Under an elite structure, instead, elite would reject the project and $E[\Pi_c] = E[\Pi_e] = 0$.

(ii) $k_c \leq \theta < k_e$. In this case, both LL and PL learning events are possible. For the LL, both common and elite learn θ and the expected profits of common and elite under a democratic structure are given by: $E[\Pi_c] = E[\theta|k_c \leq \theta < k_e] - k_c = E_M - k_c$, and $E[\Pi_e] = E_M - k_e$, respectively. Under an elite structure, instead, elite would reject the project and $E[\Pi_c] = E[\Pi_e] = 0$. For the PL case, the outcome is the same as the LL case.

(iii) $\theta \geq k_e$. In this case, neither LL nor PL learning events are possible. In fact, it can never happen that elite learns θ and sends an N message, as long as $\theta \geq k_e$.

Notice that the event LL occurs with probability $q_c q_e$, whereas PL with probability $(1 - q_c)q_e$. Also, the intervals of θ considered correspond to specific probabilities. For instance, case (i) where $\theta < k_c$ occurs with probability $F(k_c)$. As the expected surplus for the committee is given as the expected surplus under a democratic structure minus the one under an elite structure, and given that the latter surplus is zero, we have the following expression:

$$E_S^{Na} := \frac{1}{A^{Na}}\{F(k_c)(1-q_c)q_e\left(E_L-\bar{k}\right)+[F(k_e)-F(k_c)]\left[q_e q_c\left(E_M-\bar{k}\right)\right]\}, \qquad (4)$$

where $A^{Na} = F(k_c)(1-q_c)q_e + [F(k_e)-F(k_c)]q_e q_c$.

The same type of reasoning applies to the other markets.

It is straightforward to check that: $E_L < E_M < E_H$ and $E_L < E[\theta] < E_H$. To verify $E_H > E_M$, note that the total probability mass of E_M is spread on the interval $[k_c, k_e]$ whereas the probability mass of E_H is divided between the interval $[k_c, k_e]$ and an interval to the right of the former, $[k_e, \infty]$.

Proof of Proposition 5

As proved in Proposition 4, the following inequalities hold: $E_L < E_M < E_H$ and $E_L < E[\theta] < E_H$. For a mature market, if $E_M > \bar{k}$, it will follow that $E_H > \bar{k}$. Thus, $E_S^{Ma} = q_c q_e[F(k_e)-F(k_c)]\left[E_M-\bar{k}\right] + q_c(1-q_e)[1-F(k_c)]\left[E_H-\bar{k}\right]$ is the convex combination of two positive terms, which implies $E_S^{Ma} > 0$. Then, the condition $E_M > \bar{k}$ is sufficient for the democratic structure to be efficient. On the contrary, if $E_H < \bar{k}$, it will follow that $E_M < \bar{k}$. Thus, E_S^{Ma} would be the convex combination of two negative terms, which implies $E_S^{Ma} < 0$. As a consequence, the condition $E_H < \bar{k}$ is sufficient for the skewed structure to be efficient. A similar reasoning can be repeated for all the other markets.

Proof of Proposition 6

Recall that $\bar{k} = \frac{(n-E)k_c + Ek_e}{n}$. We have three markets to consider.

(i) Mature market. From Proposition 4, the expected surplus in a mature market is given by $E_S^{Ma} = q_c q_e[F(k_e)-F(k_c)]\left[E_M-\bar{k}\right] + q_c(1-q_e)[1-F(k_c)]\left[E_H-\bar{k}\right]$. Solving $E_S^{Ma} = 0$ for q_e, we obtain $q_e^* = \frac{[1-F(k_c)][E_H-\bar{k}]}{[F(k_e)-F(k_c)][E_M-\bar{k}]-[1-F(k_c)][E_H-\bar{k}]}$. Further, for $E_M < \bar{k} < E_H$, we obtain that $\frac{\partial E_S^{Ma}}{\partial q_e} = 2q_c\left\{[F(k_e)-F(k_c)]\left[E_M-\bar{k}\right]-[1-F(k_c)]\left[E_H-\bar{k}\right]\right\} < 0$, where the last inequality follows from the fact that $\frac{\partial E_S^{Ma}}{\partial q_e}$ is the sum of two negative terms. Then, it is proved that $E_S^{Ma} < 0$ if and only if $q_e > q_e^*$. As per proposition 4, $E_S^{Ma} < 0$ corresponds to the elite committee being efficient.

(ii) Nascent market. From Proposition 4, the expected surplus in a nascent market is given by $E_S^{Na} = q_c q_e[F(k_e)-F(k_c)]\left[E_M-\bar{k}\right] + q_e(1-q_c)F(k_e)\left[E_L-\bar{k}\right]$. Solving $E_S^{Na} = 0$ for q_c, we obtain $q_c^* = \frac{F(k_e)[E_L-\bar{k}]}{[F(k_e)-F(k_c)][E_M-\bar{k}]-F(k_e)][E_L-\bar{k}]}$. Further, for $E_L < \bar{k} < E_M$, we obtain that $\frac{\partial E_S^{Na}}{\partial q_c} = 2q_e\left\{[F(k_e)-F(k_c)]\left[E_M-\bar{k}\right]-F(k_e)\left[E_L-\bar{k}\right]\right\} > 0$, as it is the sum of two positive terms. Then, it is proved that $E_S^{Na} < 0$ if and only if $q_c < q_c^*$.

(iii) Mixed market. There are two cases to consider: the first for $E_L < \bar{k} < E_M$, and the second for $E_M < \bar{k} < E_H$. Each of these cases has two subcases, which are $E[\theta] < \bar{k}$ and $E[\theta] > \bar{k}$. We focus on the first case, $E_L < \bar{k} < E_M$, and the first subcase, $E[\theta] < \bar{k}$. The corresponding expected surplus in a mixed market, scaled for convenience by a factor of $\frac{1}{2}$, i.e., $\frac{E_S^{Mi}}{2}$, is depicted in Fig. A.2, where the dashed lines represent the cost terms, whereas the solid lines represent the revenue terms. The value of E_S^{Mi} is the difference between the weighted average of the revenues minus the weighted average of the opportunity costs of the two member types for each value of q_c and q_e.

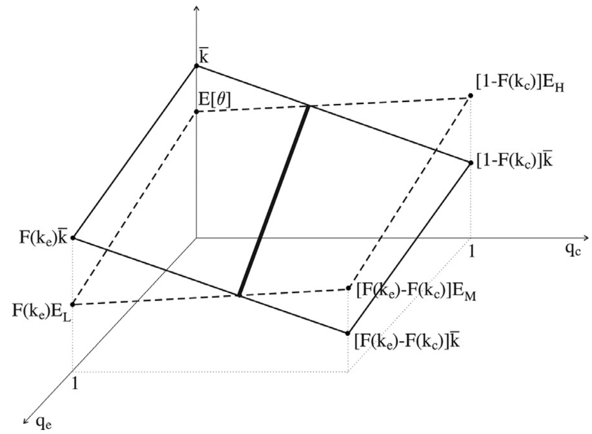

Fig. A2. Graphic representation of E_S^{Mi}.The dashed lines represent the cost terms, whereas the solid lines represent the revenue terms of E_S^{Mi}. The thick solid line represents $q_c^*(q_e)$.

Define $q_e^*(q_c)$ the value of q_e and q_c such that $E_S^{Mi} = 0$. From Proposition 4, it is verified that by solving $E_S^{Mi} = 0$ for q_c yields $q_e^*(q_c) = \frac{q_c[1-F(k_c)](E_H-\bar{k})+(1-q_c)(E[\theta]-\bar{k})}{q_c\{[1-F(k_c)](E_H-\bar{k})-[F(k_e)-F(k_c)](E_M-\bar{k})\}+(1-q_c)\{(E[\theta]-\bar{k})-F(k_e)(E_L-\bar{k})\}}$, whereas solving the same equation for q_e yields $q_c^*(q_e) = \frac{q_e F(k_e)(E_L-\bar{k})+(1-q_e)(E[\theta]-\bar{k})}{q_e\{F(k_e)(E_L-\bar{k})-[F(k_e)-F(k_c)](E_M-\bar{k})\}+(1-q_e)\{(E[\theta]-\bar{k})-[1-F(k_c)](E_H-\bar{k})\}}$. It is readily verified that $E_S^{Mi} > 0 \iff q_e > q_e^*(q_c)$ or $q_c < q_c^*(q_e)$.

Graphically, in this case where $E[\theta] < \bar{k}$ and $E[\theta] > \bar{k}$ it follows that $E_S^{Mi} = 0$ when the two planes represented in Fig. A.2 intersect. The smooth nature of the two planes entails that either $\frac{\partial q_c^*(q_e)}{q_e} \geq 0$ or $\frac{\partial q_c^*(q_e)}{q_e} \leq 0$. We show that the first of the two inequalities holds in this case. For $q_e = 0$ the two planes intersect at the value $q_c^*(q_e = 0) = \frac{\bar{k}-E[\theta]}{\bar{k}-E[\theta]+[1-F(k_c)](E_H-\bar{k})}$. Likewise, for $q_e = 1$, the two planes intersect at $q_c^*(q_e = 1) = \frac{F(k_e)(\bar{k}-E_L)}{F(k_e)(\bar{k}-E_L)+[F(k_e)-F(k_c)](E_M-\bar{k})}$. A positive slope entails that $q_c^*(q_e = 0) < q_c^*(q_e = 1)$, which implies

$$\frac{\bar{k}-E[\theta]}{\bar{k}-E[\theta]+[1-F(k_c)](E_H-\bar{k})} \leq \frac{F(k_e)(\bar{k}-E_L)}{F(k_e)(\bar{k}-E_L)+[F(k_e)-F(k_c)](E_M-\bar{k})} \iff$$

$$\frac{[1-F(k_c)](E_H-\bar{k})}{\bar{k}-E[\theta]} \geq \frac{[F(k_e)-F(k_c)](E_M-\bar{k})}{F(k_e)(\bar{k}-E_L)} \iff$$

$$\frac{E_H-\bar{k}}{E_M-\bar{k}} \times \frac{\bar{k}-E_L}{\bar{k}-E[\theta]} \geq \frac{F(k_e)-F(k_c)}{F(k_e)[1-F(k_c)]}.$$

The last inequality is verified as the left-hand side is the product of two terms which are both > 1, whereas the right-hand side is a term < 1. Thus, it is verified that $\frac{\partial q_c^*(q_e)}{\partial q_e} \geq 0$.

The other subcase, i.e., when $E[\theta] > \bar{k}$, can be proved in a very similar way. The only difference is that in Fig. A.2 we will have that for $q_e = q_c = 0$, the point $E[\theta]$ will be above and not below $\bar{k}$. Then, the two points of intersection will be obtained for $(q_c = 0; 0 < q_e < 1)$ and for $(0 < q_c < 1; q_e = 1)$. With a similar procedure as above, we will have to verify that q_c^* at the first intersection point is not greater than q_c^* at the second intersection point.

For the second case, i.e., $E_M < \bar{k} < E_H$, following a similar procedure as for the first case it can be proved that $E_S^{Mi} < 0 \iff q_e < q_e^*(q_c)$, where $\frac{\partial q_e^*(q_c)}{\partial q_c} \geq 0$.

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