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Risk Aversion, Managerial Reputation, and Debt–Equity Conflict

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Abstract: When a firm finances a new project by issuing debt, it has an incentive to invest in excessively high-risk projects because shareholders enjoy all the benefits in case the project is successful but have limited liability when it fails. Anticipating such behavior, creditors may require a higher interest rate or may even refuse to provide capital. This debt–equity conflict is alleviated by the fact that most investment decisions are made by risk-averse managers who are not as well diversified as shareholders. This paper investigates the debt–equity conflict in firms in which the managers have an unobservable degree of risk averseness. Since managerial risk averseness is a desirable quality, such asymmetric information makes managers undertake actions that increase the market's perception of them as being highly risk-averse. Consequently, such reputation building leads to a lower number of excessively high-risk projects being undertaken. This paper compares the entrepreneurial economy, in which managers are the sole owners of the firms, with the corporate economy, in which managers are hired by shareholders. Using the overlapping generations model, this paper shows that managerial reputation building can partially resolve the debt–equity conflict and improve efficiency in both economies; however, such improvement is larger in the entrepreneurial economy.

Keywords: debt–equity conflict; managerial reputation; risk attitude

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1. Introduction

When a firm borrows money to finance its operations, the actions that maximize the equity value do not necessarily maximize the firm value. Indeed, while the creditors share the downside risk and may lose money in case of bankruptcy, the shareholders enjoy all the upside potential of successful risky investments. As a result, firms may be inclined to invest in high-risk projects even when safer and more profitable projects are available. Anticipating such future investment misallocation, the lenders require an additional risk premium that results in a higher cost of debt (Darrough and Stoughton [1]).

To reduce the cost of debt, shareholders seek to commit to undertaking less risky projects. While bond covenants and bank monitoring are important tools in preventing shareholders from investing in excessively risky projects (Smith and Warner [2]; Lou and Otto [3]; Mansi, Qi, and Wald [4]), the debt–equity conflict can also be alleviated by hiring risk-averse managers (Lewellen [5]) or by offering the manager a contract that will incentivize them to invest in the safer project (John and John [6]; Brander and Poitevin [7]). The problem with the latter approach, however, is that such an incentive contract can be renegotiated after the debt is issued.

Given the heterogeneity of individual risk attitudes (Santos-Pinto et al. [8]), the existence of the debt–equity conflict makes risk-averse managers more valuable since firms managed by managers with higher perceived risk averseness will be able to borrow at lower interest rates. Furthermore, since the risk attitude of an individual cannot be easily observed and can only be inferred from their past behavior, younger managers may be inclined to build a reputation of being risk-averse and may choose to invest in safer projects even when they are risk-tolerant.

The goal of this paper is to investigate how the manager's desire to build a reputation of being risk-averse amplifies the positive effect of managerial risk averseness on the firm's ability to borrow funds. In this paper, we develop an overlapping generations model that demonstrates why it may be optimal for new managers to implement safe projects regardless of their own risk attitude and, by doing so, build their reputation as being risk-averse. Many signaling models (Fairchild [9]; Dodonova and Khoroshilov [10]) concentrate on separating equilibria where agents undertake costly actions to signal their good type in order to build a reputation. In our model, however, agents need to choose costly actions to hide their bad type to achieve a pooling equilibrium and avoid gaining a bad reputation.

The contribution of this paper is twofold. First, we show that when managerial risk averseness is viewed as a positive characteristic that reduces the cost of debt, risk-neutral managers will hide their risk tolerance and, at the same time, will behave similarly to risk-averse managers and implement safe projects. Second, we analyze the strength of such reputation-building incentives for risk-neutral managers in owner-operated firms and in publicly owned firms with hired managers. By comparing a case of separation of ownership and control with the case of owner-managed firms, we show that in the case of owner-managed firms, the desire to build reputation is a more powerful tool in reducing the debt–equity conflict and, consequently, improving efficiency. In particular, we show that such reputation building allows alleviating the moral hazard problem in the capital market in owner-operated firms when the manager is risk-neutral; however, it cannot completely resolve the debt–equity conflict in publicly owned firms with hired managers.

The model developed in this paper is a stylized model and it is not aimed to describe the existing debt–equity conflict in its entirety. For example, when looking at managerial risk averseness, we consider only two extreme types—namely, risk-neutral and infinitely risk-averse managers—and assume that the proportion of such managers in the population does not change over time. Similarly, we assume that the investment project can have only two equally likely outcomes: success with a fixed monetary return or a failure where all investment is lost. These assumptions are made in order to simplify the analysis; however, the qualitative results of the paper would be applicable for a more general setup with less extreme assumptions.

Our paper is related to Hirshleifer and Thakor [11], who developed a model in which the manager's reputation building distorts the firm's investment policies in favor of relatively safe projects. While in their model, the managers are differentiated by their "natural ability" that allows them to make better investment decisions, in our model, we assume that all managers are equally skilled.

Most of the existing relevant theoretical research is concentrated on the managerial desire to build their reputation as managers with above-average abilities (Fee and Hadlock [12]; Hirshleifer [13]), and the connection between managerial risk aversion, compensation contract, and project and effort choice (Hirshleifer and Suh [14]). The area most closely related to our paper includes the studies of the relationship between career concern and risk taking. Such studies are limited to the managers' reputation building models where managers want to signal their high ability and can lead to either avoiding risk when the manager is not aware of their own ability (Holmstroom [15]) or taking an excessive risk when they know their ability (Chen and Sheng [16]). Our paper is aimed to fill a narrow gap in existing theoretical research: given that managerial risk averseness leads to lower cost of debt, this paper investigates how the managers' desire to build their reputation of being risk-averse affects the firm's ability to avoid the adverse selection problem and be able to borrow funds to invest in a low-risk, high-return project. In this paper, only one specific aspect of the complex corporate governance problem is explored; to this end, an example is developed in which managerial risk aversion may be valuable for the firm, and it is amplified by the managers' desire to build their reputation of being risk-averse even if they are highly risk-tolerant.

The rest of the paper is organized as follows: Section 2 sets up the model of entrepreneurial and corporate economies. It considers a reputation-building overlapping

generations model in the presence of the moral hazard problem between creditors and firms that are run by managers with different degrees of risk averseness. The entrepreneurial economy model is a standard debt–equity conflict model in which the manager behaves in the best interests of the shareholders or simply owns 100% of the firm. The corporate economy model assumes that managers are hired by the shareholders to manage the firm, and they are paid based on the incentive contracts that can be renegotiated at any time, as long as both the shareholders and the manager are willing to do so. In Section 3, we solve for the equilibrium and show that it is always easier to mitigate the debt–equity problem in the entrepreneurial economy. In Section 4, we conclude. All proofs are presented in Appendix A.

2. The Model

2.1. Technology and Information

Consider an economy that consists of firms and competitive lenders (creditors). The firms are run by managers who live for two periods. We assume that population is not growing; thus, at each point in time, there is an equal number of "new" and "old" managers on the market. Each period the firm has access to two projects: "safe" and "risky". Both projects require a USD 1 investment that the firm must raise by issuing one-period debt. The safe project is profitable and generates a cash flow $S > 1$ at the end of the period. The risky project has a zero expected return and results in a cash flow of either USD 2 or USD 0 with equal probabilities. Creditors are risk-neutral, while managers can be either risk-neutral, with probability λ, or infinitely risk-averse (i.e., with expected utility function approximately equal to the minimum value of possible outcomes), with probability $(1-\lambda)$. The managers' expected utility is normalized to zero. The manager's type, their choice of the project, and the realized project's cash flow are not observable to the outsiders, but the bankruptcy event (i.e., a situation when the realized cash flow is not sufficient to cover the debt obligations) is observable. Therefore, all managers can be classified into three categories: "new" managers, "old good" managers (i.e., old managers whose previous firm did not declare bankruptcy), and "old bad" managers (i.e., old managers whose previous firm declared bankruptcy). At the end of each period, the firm pays out all the current period cash flow, current old managers leave the labor market, current new managers move into the next period and become old managers, and a set of new managers enters the market. In case the current cash flow is not sufficient to cover the debt obligations, the firm declares bankruptcy, is liquidated, and a new firm is created next period. In particular, we assume that creditors cannot extend their claims beyond the current period cash flow. The intertemporal discount factor for all utility functions is one and the creditors' required expected rate of return is 0%. In what follows, we assume that

$$\frac{2}{2-\lambda} < S < 1.5, \tag{1}$$

which immediately implies that $\lambda < 2/3$. Condition (1) is a technical condition that states that the return should be large enough so that lenders are willing to lend money even if all risk-neutral managers chose to invest in a risky project and, at the same time, is small enough for the debt–equity conflict to exist. Indeed, if lenders expect all risk-neutral managers to invest in risky projects and all risk-averse managers to invest in safe ones, they will demand a gross stated return (or face value of USD 1 debt) F that allows them to break even, i.e., that satisfies $0.5\lambda\min\{2,F\} + (1-\lambda)\min\{S,F\} = 1$. Assuming that investment in safe projects remains profitable, i.e., $F < S$, the above break-even condition becomes $F = \frac{2}{2-\lambda}$. Therefore, the left-hand side of condition (1) guarantees that, when the creditors expect λ managers to invest in risky projects, safe projects can still be financed. The right-hand side of (1) guarantees that, in the case the firm is run by a risk-neutral owner without reputation concerns, the owner would prefer to invest in a risky project that generates USD 2, with a 50% probability instead of a safe project that generates USD

S regardless of the face value of debt, i.e., there is a moral hazard problem between the creditors and the firm.

2.2. Entrepreneurial Economy Model

In the model of an entrepreneurial economy, we assume that all firms are owned by their managers ("entrepreneurs"). This is a classical debt–equity moral hazard problem that can be potentially mitigated by new managers' desire to build their reputation as risk-averse managers in order to lower their cost of debt during the second period of their lives.

2.3. Corporate Economy Model

In a corporate economy, in addition to managers and creditors, there are risk-neutral shareholders who own the production function (that consists of a safe and a risky project). To run the firm, shareholders must hire a manager and offer them a compensation contract. However, such a compensation contract can be renegotiated after creditors provide funds if both the shareholders and the manager are willing to do so. We assume that all contracts are valid for one period only and, while the initial contract is observable to outsiders, the renegotiated contract is known only to the firm and the manager. The latter assumption is required to prevent the manager's risk tolerance to be revealed by the choice of the contract. Shareholders cannot implement the project without the manager, and managers do not have access to the production function and cannot start their own firms.

An initial offer of a profit-based contract reveals to the creditors that the manager is risk-neutral and, therefore, results in a face value of debt $F = 2$ and zero shareholders' profit. As a result, the original contract must be a fixed wage contract, which can be renegotiated after the funds are borrowed. Since the managers are either infinitely risk-averse or risk-neutral, the optimal contract offered at the renegotiation stage should be a linear contract in which the manager receives the entire firm's profit minus a fixed fee. We also assume that during the renegotiation stage, the firm has all the bargaining powers and offers the manager an alternative contract that they can either accept or reject and keep the original fixed wage contract. For such a contract to be accepted, the manager's expected utility from the new contract must be equal to the fixed compensation they were offered by the original contract.

In each period, the sequence of events is as follows:

- The firm offers the manager a one-period, fixed-wage compensation contract w_{fix}. Such wage can depend on the manager's observed characteristics (new, old good, or old bad), and it must be feasible in the sense that the firm's cash flow from the safe project should be sufficient to cover the wage and the face value of debt;
- Creditors lend USD 1 to the firm with a face value of debt F that can depend on the manager's observed characteristics;
- The firm offers the manager to renegotiate their fixed-wage contract for a new contract in which the manager receives all the claims to the firm's residual cash flow after repaying the debt and a fixed fee to the current shareholders, i.e., a contract $w_{inc} = \max\{0, I - F - c\}$, where I is the project's cash flow, F is the face value of debt, and $c \geq 0$ is a constant. Such renegotiation consists of the firm making the manager a take-it-or-leave-it offer;
- The manager either accepts the new incentive contract or keeps the original fixed wage contract;
- The manager chooses the project to implement;
- The project's cash flow is realized and paid out;
- It is observed whether the firm went into bankruptcy (i.e., whether the project's cash flow was insufficient to cover the debt obligations);
- Current old managers leave the labor market, current new managers proceed to the next period, and a set of new managers enter the labor market.

To model the labor market, we assume that there is an equal number of new and old managers and that the total number of managers is slightly larger than the total number of firms so that some managers are not employed and receive their reservation utility of zero. At the same time, the difference between the number of firms and the number of managers is small so that only the least desirable class of managers face a risk of unemployment while there is excess demand for other managers.

3. Equilibrium Analysis and Results

In what follows, we investigate a steady-state equilibrium and assume that risk-averse managers always chose safe projects even when their compensation does not depend on the project's outcome. It is worth noting that, in both economies, old risk-neutral managers will always choose risky projects: In the entrepreneurial economy, it follows directly from condition (1), while in the corporate economy, condition (1) makes it beneficial for the shareholders to offer risk-neutral old manager a profit-based renegotiated contract. As a result, we concentrate on the effect of reputation concern on the behavior of risk-neutral new managers and whether such concern makes them choose safe projects. Depending on the relationship between the proportion of risk-neutral managers λ and the profitability of the safe project S, three types of equilibria can exist: pooling equilibria (when all risk-neutral new managers choose safe projects), separating equilibria (when risk-neutral new managers choose risky projects), and a mixed-strategy equilibria (when only a portion of risk-neutral new managers chose risky projects). Pooling equilibrium completely resolves the debt–equity conflict for new managers, mixed-strategy equilibrium partially resolves it, and separating equilibrium does not provide any improvement relative to the case of no reputation concern.

To simplify notations, we denote $F_t(\alpha)$ to be the face value of debt for new and old good managers, where $t \in \{1,2\}$ is the indicator variable for new $(t = 1)$ and old good $(t = 2)$ managers and α is a proportion of new risk-neutral managers who choose risky projects. We also denote $U_t^j(\alpha, p)$ to be the expected utility of a risk-neutral manager in their life period $t \in \{1,2\}$ given that, at the time they were a new manager, they choose project $p \in \{safe, risky\}$; α is the portion of new risk-neutral managers that choose the risky project, and $j \in \{ent, corp\}$ is the indicator variable for entrepreneurial $(j = ent)$ and corporate $(j = corp)$ economies.

Using Bayes' rule, the portion of risk-neutral managers among old good managers is equal to $\frac{\lambda(2-\alpha)}{2-\alpha\lambda}$. Denoting the equilibrium face values of debt for the firm run by new managers and by old good managers as $F_1(\alpha)$ and $F_2(\alpha)$, we can find

$$\begin{cases} F_1(\alpha) = \frac{2}{2-\alpha\lambda} \\ F_2(\alpha) = \frac{2(2-\alpha\lambda)}{4-\alpha\lambda-2\lambda} \end{cases} \tag{2}$$

Since a prior bankruptcy reveals the risk-neutral type of old bad managers, the face value of debt for the firms run by such managers is always equal to USD 2.

The model of an entrepreneurial economy represents a standard example of a moral hazard problem in the financial market. Since the cost of debt positively depends on the probability that a risky project will be chosen, it may be costly for new risk-neutral managers to implement risky projects since a failure will reveal their type and makes it impossible to borrow funds in the future at a rate that allows profitable investment. As a result, some risk-neutral managers may decide to implement safe projects to build their reputation. The following proposition describes all possible equilibria in the entrepreneurial economy.

Proposition 1. *Equilibrium in the entrepreneurial economy*

Let $S_1 = \frac{5-2\lambda}{2(2-\lambda)}$ *and* $S_2 = \frac{10-10\lambda+2\lambda^2}{(2-\lambda)(4-3\lambda)} > S_1$. *In this case:*

- *If* $S > S_2$, *then there is a unique pooling equilibrium in which all new managers chose safe projects;*

- *If $S < S_1$, then there is a unique separating equilibrium in which all new risk-neutral managers chose risky projects;*
- *If $S_1 < S < S_2$, then there are three equilibria: pooling, separating, and a mixed-strategy equilibrium in which $\alpha \in (0,1)$ is the share of new risk-neutral managers choosing risky projects. Furthermore, the mixed-strategy equilibrium is unstable in the sense that, given an equilibrium α^*, for any $\alpha > \alpha^*$, new risk-neutral managers will prefer to invest in risky projects, while for any $\alpha < \alpha^*$, new risk-neutral managers will prefer to invest in safe projects.*

The intuition behind Proposition 1 is straightforward. When the benefit of the safe project is high enough, it becomes less profitable for risk-neutral managers to choose the risky project and, therefore, easier to sustain a reputation-building pooling equilibrium. Although for $S \in (S_1, S_2)$, there are several equilibria, we assume that the most efficient stable pooling equilibrium is realized. Using simple algebra, one can show that there are values S for which both condition (1) and condition $S > S_1$ are satisfied, i.e., it is possible to completely resolve the debt–equity conflict in firms owned and operated by new managers in the entrepreneurial economy. One of the implications of Proposition 1 is that new managers are more likely to invest in a safer project, and it is consistent with predictions of Hirshleifer and Thakor [11], Scharfstein and Stein [17], and Zwiebel [18].

Proposition 2. *Equilibrium in the corporate economy*

There is no pooling equilibrium in the corporate economy, i.e., it is never optimal for all new managers to invest in safe projects. Furthermore, for any parameters of S and λ for which there is a mixed-strategy equilibrium in the corporate economy, in which $0 < \alpha < 1$ portion of risk-neutral new managers invest in risky projects, there is a pooling equilibrium in the entrepreneurial economy in which all new managers invest in safe projects.

Proposition 2 states that it is always easier to resolve debt–equity conflict and achieve higher efficiency in owner-operated markets than it is in markets where managers are hired by the shareholders, but compensation contracts can be renegotiated after the debt is issued. The driving force behind the non-existence of the pooling equilibrium in the corporate economy is a combination of assumptions about the labor market and the contract renegotiation process. Given the excess supply of managers and the shareholders' bargaining power during contract renegotiation, the manager does not receive the full benefits of their reputation, which makes a reputation-building pooling equilibrium unsustainable.

4. Conclusions

When a firm is financed by both debt and equity, shareholders may find it profitable to invest in risky projects even when safer and more profitable projects are available. Anticipating such investment misallocation, the debtholders may require a higher stated return on newly issued debt, thus making the shareholders bear the costs of this moral hazard problem. One of the ways shareholders can reduce these costs is by delegating investment decision making to risk-averse managers.

Using the overlapping generations model, in this paper, it was shown that the debt–equity conflict can be partially resolved by managers' desire to build their reputation as highly risk-averse managers. Two types of economies were considered: an entrepreneurial economy, where all firms are managed by their owners, and a corporate economy, where shareholders hire managers to manage the firms. The paper shows that the desire to build reputation is stronger in the entrepreneurial economy, and it can help to completely resolve the moral-hazard problem for firms managed (and owned) by reputation-concerned managers. In the case of the corporate economy, a small excess supply in the managerial labor market does not allow managers to enjoy all the benefits of their reputation building. As a result, while it is possible to partially resolve the debt–equity conflict in the corporate economy, the same set of parameters allows the full resolution of this conflict in the entrepreneurial economy.

Two seemingly controversial conclusions can be drawn from the results of the model. First, on average, the model predicts that young managers are more likely to choose safer projects than old managers. Second, it predicts that owner-managed firms are more likely to be able to raise funds by issuing debt.

Indeed, while the theoretical prediction of the effect of CEOs' age on their risk-taking behavior is mixed, most empirical evidence (see, e.g., Serfing [19]; Li, Low, and Makhija [20]; Martino, Rigolini, and D'Onza [21]) document that younger managers are more likely to undertake riskier projects. It is important to note that this paper was not aimed to analyze the debt–equity and principal–agent conflicts in all their complexities. There are many reasons why younger managers may be willing to accept more risk, such as tournament-style, life-long compensation structure, or people's general tendency to become more risk-averse with age (Rolison et al. [22]). What is revealed in this study is that the debt–equity conflict induces young managers' desire to build their reputation of being risk-averse, which, in turn, reduces the observed negative dependency between the managers' age and their risk-taking behavior.

The model's prediction that owner-managed firms are more likely to be able to raise funds by issuing debt may seem counterintuitive. Indeed, while widely held large corporations are able to sustain a high debt-to-equity ratio, small private companies are usually restricted to high-interest bank loans. However, such discrepancy is mostly due to the company size, and therefore, business diversification in owner-managed firms is more likely to be smaller Thus, one needs to be careful in applying the prediction of this model of the effect of managerial ownership on the firm's ability to raise debt and control for the size and stand-alone risk of the firm's operations.

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Appendix A

Proof of Equation (2). From the Bayes rule, the conditional probability that the old manager is risk-neutral given that his firm did not declare bankruptcy in the previous period is $\frac{0.5(1-\alpha)\lambda}{0.5(1-\alpha)\lambda+(1-\lambda)} = \frac{\lambda(2-\alpha)}{2-\alpha\lambda}$. The break-even conditions for the creditors can be written as

$$(0.5\lambda\alpha + (1-\lambda\alpha))F_1(\alpha) = 1 \tag{A1}$$

$$\left(0.5\frac{\lambda(2-\alpha)}{2-\alpha\lambda} + \left(1 - \frac{\lambda(2-\alpha)}{2-\alpha\lambda}\right)\right)F_2(\alpha) = 1 \tag{A2}$$

Solving (A1) and (A2) for $F_1(\alpha)$ and $F_2(\alpha)$ results in (2). □

Proof of Proposition 1. In the entrepreneurial economy,

$$U_1^{ent}(\alpha, safe) + U_2^{ent}(\alpha, safe) = S - F_1(\alpha) + \frac{1}{2}(2 - F_2(\alpha)) \tag{A3}$$

$$U_1^{ent}(\alpha, risky) + U_1^{ent}(\alpha, risky) = \frac{1}{2}(2 - F_1(\alpha)) + \frac{1}{4}(2 - F_2(\alpha)) \tag{A4}$$

For pooling equilibrium to exist, new risk-neutral managers should prefer to invest in safe projects when $\alpha = 0$. Using the above expressions, such condition can be written as

$$S \geq 1 + \frac{1}{2}F_1(0) - \frac{1}{4}(2 - F_2(0)) \tag{A5}$$

Using (2), the latter can be rewritten as

$$S \geq S_1 \equiv \frac{5 - 2\lambda}{2(2 - \lambda)} \tag{A6}$$

For a separating equilibrium to exist, new risk-neutral managers should prefer to invest in risky projects when $\alpha = 1$, i.e., it must be true that

$$S \leq 1 + \frac{1}{2}F_1(1) - \frac{1}{4}(2 - F_2(1)) \tag{A7}$$

Using (2), the latter can be rewritten as

$$S \leq S_2 \equiv \frac{10 - 10\lambda + 2\lambda^2}{(2 - \lambda)(4 - 3\lambda)} \tag{A8}$$

The fact that $S_1 < S_2$ follows from direct comparison.

In a mixed-strategy equilibrium, new risk-neutral managers should be indifferent between choosing safe or risky projects. Define

$$\begin{aligned} &G^{ent}(S, \alpha) \\ &\quad \equiv U_1^{ent}(\alpha, safe) + U_2^{ent}(\alpha, safe) - U_1^{ent}(\alpha, risky) - U_2^{ent}(\alpha, risky) \\ &\quad = \tfrac{1}{4}(4S - 2 - 2F_1(\alpha) - F_2(\alpha)) \end{aligned} \tag{A9}$$

to be the difference in total life-long (over two periods) expected utility for new risk-neutral managers when they choose safe and risky projects in the first period. Since old bad managers have zero expected utility, (A9) can be rewritten as

$$G^{ent}(S, \alpha) = \frac{1}{4}(4S - 2 - 2F_1(\alpha) - F_2(\alpha)) \tag{A10}$$

Using (2), $G^{ent}(S, \alpha)$ can be written as

$$G^{ent}(S, \alpha) = S - 1 - \frac{2 - \alpha\lambda^2}{(2 - \alpha\lambda)(4 - 2\lambda - \alpha\lambda)} \tag{A11}$$

Since both $\frac{2-\alpha\lambda^2}{(2-\alpha\lambda)}$ and $\frac{1}{(4-2\lambda-\alpha\lambda)}$ increase with α, it follows that $\frac{\partial G^{ent}(S,\alpha)}{\partial \alpha} < 0$. At the same time, $\frac{\partial G^{ent}(S,\alpha)}{\partial S} = 1 > 0$. Furthermore, since conditions (A5) and (A7) are satisfied with equality when $S = S_1$ and $S = S_2$ respectively, it follows that $G^{ent}(S_1, 0) = G^{ent}(S_2, 1) = 0$. Thus, for $S < S_1$ and $\alpha \in [0, 1]$ we must have $G^{ent}(S_1, \alpha) < 0$, i.e., there is no mixed-strategy equilibrium. Similarly, if $S > S_2$ and $\alpha \in [0, 1]$, then $G^{ent}(S_2, \alpha) > 0$, i.e., there is no mixed-strategy equilibrium. If $S_1 < S < S_2$, then $G^{ent}(S, 0) > 0$ while $G^{ent}(S, 1) < 0$, i.e., both pooling and separating equilibria exist. In addition, since $\frac{\partial G^{ent}(S,\alpha)}{\partial \alpha} < 0$, it follows that there is a unique α that satisfies $0 < \alpha < 1$ such that $G^{ent}(S, \alpha) = 0$, i.e., there is also a mixed-strategy equilibrium. Since $\frac{\partial G^{ent}(S,\alpha)}{\partial \alpha} < 0$, such equilibrium is unstable. □

Proof of Proposition 2. To prove that there is no pooling equilibrium in the corporate economy, assume, by contradiction, that such equilibrium exists. Since there are no old bad managers in equilibrium, either some of the new or some of the old managers (or both) will be unemployed.

In the case in which some old managers are unemployed, the competition in the labor market will drive the original fixed-wage of these managers $w_{2,fix}$ to zero. Since, during the renegotiation process, shareholders make the manager take-it-or-leave-it offer, the incentive contract that shareholders will offer to the old managers $w_{2,inc}$ will satisfy $E(w_{2,inc}) = w_{2,fix} = 0$, i.e., reputation has no value for the managers. Therefore, when new managers are offered the original fixed-wage $w_{1,fix}$ and, during the renegotiation process, are offered an incentive contract $w_{1,inc} = \max\{0, CF - F - c\}$, such incentive contract must satisfy $E(w_{1,inc}) \geq w_{1,fix}$ to incentivize risk-neutral managers to accept it and choose the risky project, i.e., it must be true that $\frac{1}{2}(2 - F_1(0) - c) \geq w_{1,fix}$. Setting the highest possible $c = 2 - F_1(0) - 2w_{1,fix}$, shareholders will receive the expected profit $\frac{c}{2} = 1 - w_{1,fix} - \frac{F_1(0)}{2}$. At the same time, their profit under the fixed-wage contract is $S - w_{1,fix} - 1 < 1 - w_{1,fix} - \frac{F_1(0)}{2}$, where the inequality follows from the fact that $F_1(0) = 1$ and condition (1). Therefore, shareholders will find it profitable to offer an incentive contract to new managers and risk-neutral new managers will be willing to accept such a contract and choose the risky project, which contradicts the assumption of pooling equilibrium.

In the case in which some new managers are unemployed, the competition in the labor market will drive their original fixed-wage $w_{1,fix}$ to zero. The case in which the original, fixed wage for old good managers $w_{2,fix}$ is zero is identical to the case when there is unemployment among old good managers, and it was considered above. Thus, we can assume that $w_{2,fix} > 0$. Since, during the renegotiation process, shareholders make the managers take-it-or-leave-it offer, all old good managers will end up with the same expected wage $w_{2,fix}$, regardless of whether they accept or reject the renegotiated contract. Therefore, the expected profit of the firms that hire old good managers is $\frac{\lambda}{2}(2 - F_2(0)) + (1 - \lambda)(S - F_2(0)) - w_{2,fix} = (1 - \lambda)(S - 1) - w_{2,fix}$, while the profit of the firms that hire new managers is $S - F_1(0) = S - 1$. Given the unemployment among new managers, the firms must weakly prefer hiring old managers, i.e., it must be the case that $(1 - \lambda)(S - 1) - w_{2,fix} \geq S - 1$, which leads to $w_{2,fix} \leq -\lambda(S - 1) < 0$. The latter contradicts the assumption that the manager's reservation utility is zero. Hence, there is no pooling equilibrium.

In a potential mixed-strategy equilibrium in which α portion of new risk-neutral managers invest in risky projects, consider the difference in total life-long expected utility for new risk-neutral managers between choosing safe and risky projects in the first period

$$\begin{aligned} &G^{corp}(S, \alpha) \\ &\quad \equiv U_1^{corp}(\alpha, safe) + U_2^{corp}(\alpha, safe) - U_1^{corp}(\alpha, risky) - U_2^{corp}(\alpha, risky) \end{aligned} \tag{A12}$$

Since in a mixed-strategy equilibrium, old managers must be old bad managers who are not able to generate a positive profit for shareholders, there is excess demand for new managers and old good managers, which will drive their original fixed wage contract to the maximum possible expected profit that is attainable when the manager is risk-averse, i.e., $w_{1,fix} = S - F_1(\alpha)$ and $w_{2,fix} = S - F_2(\alpha)$. Since, during the contract renegotiation, shareholders make a take-it-or-leave-it offer to the manager, the expected utility of old good managers are not affected by contract renegotiations, and, therefore, $U_2^{corp}(\alpha, safe) = S - F_2(\alpha)$ and $U_2^{corp}(\alpha, risky) = \frac{1}{2}(S - F_2(\alpha))$. During the first period, the manager gains $U_1^{corp}(\alpha, safe) = S - F_1(\alpha)$ from choosing the safe project. However, since shareholders receive zero profit when the manager chooses the safe project, they are willing to offer the entire firm's profit to the new manager to incentivize them to select a risky project. Therefore, $U_1^{corp}(\alpha, risky) = \frac{1}{2}(1 - F_1(\alpha))$. As a result, (A12) can be rewritten as

$$G^{corp}(S, \alpha) = \frac{1}{2}(3S - 2 - F_1(\alpha) - F_2(\alpha)) \tag{A13}$$

Using (A10), it follows that, $4G^{ent}(S, \alpha) - 2G^{corp}(S, \alpha) = S - F_1(\alpha) > 0$. Therefore, when α^* corresponds to a mixed-strategy equilibrium in the corporate economy, i.e., if

$G^{corp}(S, \alpha^*) = 0$, then $G^{ent}(S, \alpha^*) > 0$, i.e., new risk-neutral managers in the entrepreneurial economy prefer to invest in safe projects. From Proposition 1, it is possible only if $S > S_1$, i.e., only if there is a pooling equilibrium in the entrepreneurial economy. □

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